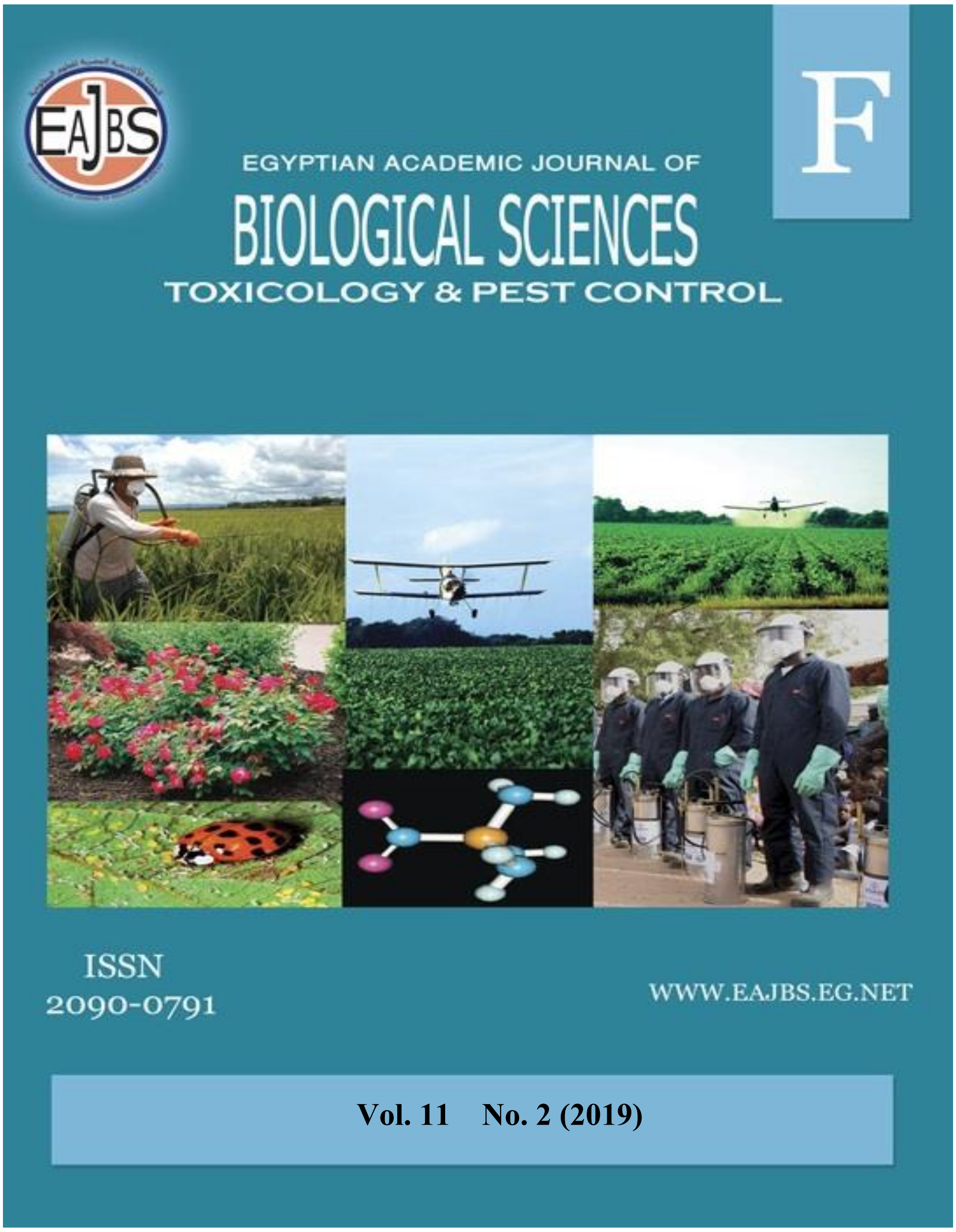

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Impact of Five Herbicides on the Peach Fruit Fly, *Bactrocera zonata* (Saunders)

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ABSTRACT

A study was carried out to evaluate the side effects of five herbicides against the peach fruit fly (P.F.F.) *Bactrocera zonata*, These were; Baron 48% SL, Paraquat Dichloride, Mambatm Max 480 SL Fluazilfop-p-butyl, and Glycine-isopropyl Ammonium, and the herbicides were applied to the soil of citrus orchards to weeds control, laboratory Results revealed that Mambatm max 480 SL and Paraquat Dichloride 48% SL formulations had the highest mean mortality percentages on *B. zonata* pupae which were 59.52% and 47.62 respectively. It can be concluded that it is visible to devise some herbicides regime (i.e.; Paraquat Dichloride and Mambatm max) that would be included in citrus agro-eco system to control of citrus pests.

INTRODUCTION

Peach fruit fly (PFF), *Bactrocera zonata* (Saunders) (Diptera: Tephritidae) is considered one of the most economically important pests for several kinds of fruits in temperate, tropical and subtropical countries (Younes, *et al.*, 2009). In Egypt, *B. zonata* became a serious pest since the last decade 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). Considerable research effort has addressed the potential impact of insecticides on Peach Fly, *B. zonata* (e.g., Croft & Brown, 1975, Kalushkov, 1982, Mizell & Schiffhauer, 1990, and Michaud 2002) For the management of peach flies, increasing applications of pesticides are facing resistance from environmental lists and the general public. Historically, since the beginning of the 20th century, bait and insecticide sprays have been used to control adult flies in aerial treatments (Moreno and Mangan, 2000), controlling pupal populations of fruit fly should be addressed in integrated crop management. Fruit flies pupate in soil underneath the fruit trees, where they are potentially vulnerable to natural enemies and the action of herbicides.

Degradation of pesticides, including herbicides, in the soil can be present at higher levels than the parent pesticide itself. In some instances, transformed products are more toxic. However, little attention has been given to the double potential toxicity of herbicides on weeds and insect-pest, despite the prevalence of their use on large acreages of fruit crops. Therefore, the aim of the current study was to investigate the side effects of five herbicides on *Bactrocera zonata pupae* as well, results will contribute to design an integrated pest management in the citrus agro ecosystem.

MATERIALS AND METHODS

Collection and Rearing of Test Insect:

Pupae of *B. zonata* were obtained from infested peach fruits, *Prunus persica* (L.), collected from Shandweel Research Station, Sohag, Egypt. The insect pest was reared by placing the fruits in glass jars containing soil, 3 cm deep under laboratory temperature of 28±2 °C and 70±5% RH. The soil was used to absorb the juice that may be dripped from the rotting peach fruits and protect larvae from drowning. Full-grown late third instar larvae that normally leave the fruits to pupate outside infested fruits inside the glass jars. The resulted pupae were collected every 24 hours for exposure to chemical treatments.

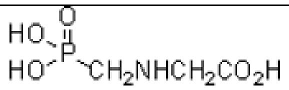
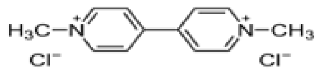
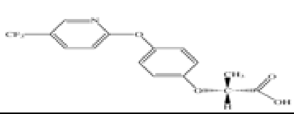
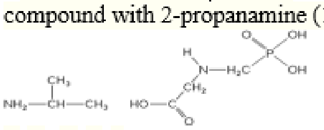
Laboratory Treatment:

Five formulated herbicides were used according to data presented in (Table 1), water was used as the control. Spray solutions were prepared according to the standard recommendations, including the dilutions using a 1 ml Hamilton micro-syringe. Ten ml of each concentration of herbicide solution were topically applied directly onto the soil. A layer of 3 cm deep of treated soil was placed in 100 ml backer and then ten newly formed pupae were placed on top of the treated soil and further covered with additional 3 cm deep layer of treated soil, to simulate the natural pupation conditions. Data obtained were corrected by Abbott’s formula (Abbott, 1925).

Statistical Analysis:

Data were statistically analyzed by Two-way analysis of variance (ANOVA) and means were compared by Duncan's Multiple Range Test at P < 0.05.

Table (1) Chemical structures and doses of the 5 pesticides used in the current work.

Commercial formulations	Active ingredient (a.i) (concentration)	Dose per feddan a.i	color code	**Chemical structure**	Mode of action
Baron 48% SL	Glyphosate isopropylammonium	2 L / fed	Green		**Non-Selective & Systemic**
Paraquat Dichloride	Paraquat (and mixtures)	2 L / fed	Toxic, environmental hazard	1,1'-Dimethyl-4,4'-bipyridinium dichloride; N,N'-Dimethyl-4,4'-bipyridinium dichloride; 	Non-selective contact herbicide.
Mambatm MAX 480 SL	Glyphosate IPA Salt (480 g a.e/l)	1.8 L/fed	Blue Dangerous for the environment	N-(phosphono methyl)glycine, Isopropyl- amine Salt $C_6H_{17}N_2O_5P$	
Fluazifop-p-butyl	Aryloxyphenoxypropionate.	1.5 L/fed	Toxicity to aquatic organisms .	(R)-2-[4-(5-trifluoromethyl-2-pyridyloxy)phenoxy]propionic acid [6] 	Inhibition of lipid formation.
Glycine-isopropyl ammonium	isopropylamine salt of glyphosate	2 L / fed	ranges from moderately toxic to practically non-toxic	*N*-(phosphonomethyl) glycine compound with 2-propanamine (1:1)  $C_6H_{17}N_2O_5P$	

RESULTS AND DISCUSSION

The effect of three concentrations of five formulations of herbicides on *B. zonata* pupae is shown in Table (2). The mean mortalities of the *B. zonata* pupae for different herbicides were significantly different, statistical analysis revealed that, Mambatm max 480 SL and Paraquat Dichloride 48% SL formulations had the highest mean mortality percentages, which were (59.52%) and (47.62%) for two formulations respectively, however, the lowest effect was recorded with Baron 48% SL treatment (8.14%) with insignificant differences but differed significantly with Glycine-isopropyl ammonium, Fluazifop-p-butyl 75% SG and Baron 48% SL, which were slightly toxic to peach fruit fly pupa with mortality percentages of 29.37%, 14.88% and 8.14%, respectively (LSD= 27.82, F=10.13 at p=0.00).

The level of damage increased with increase in dosage, full concentration was the most effective treatment resulting in 56.79% mortality, insignificantly differed with 50% of the field rate with 31.55% mortality and significantly differed with 25% of the field rate with 7.38% mortality.

Results showed that Mamba max 480 SL, caused 100% mortality at the highest concentration, followed by Paraquat Dichloride 48% SL, at the field concentration rate and 50% of the field concentration resulted in of 65.48% and 60.71% mortality respectively. Meanwhile, Mamba max 480 SL at the half of field rate and Glycine-isopropyl ammonium at the field and half field rate came in second place in terms of mortality with a percentage of 55.95, 42.26 and 29.77, respectively. The rest of the remaining formulations had a weak impact on the fruit fly pupae. Finally, Baron 48% SL at the 25 and 50% rates and Fluazifop-p-butyl 75% SG resulted in emergence rate more than the control treatment

Table 2: Effect of five herbicides on mortality percentages of *B. zonata* pupae as soil treatment.

Active ingredient (a.i)	Concentration			Mean	LSD	F	P.
	25 % field rate	50% field rate	the field rate				
Paraquat Dichloride 48% SL	16.67 ±2.16 D-H	60.71 ±0.82 A-C	65.48 ±1.25 AB	47.62 AB	27.82	10.13	0.00
Fluazifop-p-butyl 75% SG	**-5.36 ±2.16** GH	11.91 ±1.25 E-H	38.10 ±0.94 B-F	14.88 C			
Glycine-isopropyl ammonium	16.07 ±1.41 D-H	29.77 ±0.47 B-G	42.26 ±2.53 B-E	29.37 BC			
Mamba max 480 SL Glyphosate IPA Salt(480 g a.e/l)	22.62 ±1.63 C-H	55.95 ±2.36 B-D	100.0 ±1.89 A	59.52 A			
Baron 48% SL Glyphosate	**-13.10 ±0.94** H	-0.60 ±0.47 FGH	38.10 ±0.82 B-F	8.14 C			
Mean	7.38 B	31.55 AB	56.79 A				
LSD	32.04						
F	22.02						
P.	0.00						

DISCUSSION

Non-target effects of herbicides on soil pests have received substantial attention, little effort has been made to examine possible impacts of herbicides on *B. zonata*, despite the fact that herbicides are regularly and widely applied to Orchids. Direct contact of herbicides with pupae may reduce the protection provided by the waxy cuticle making them more prone to dehydration and block their spiracles, thus interfering with gas exchange (Affeld *et al.* 2003).

Results of the present study indicate that Paraquat Dichloride 48% SL and Mamba max 480 SL, present measurable hazards to the pupae of *B. zonata*, the used herbicides are nonselective herbicides which are likely to affect many species they come in contact with and the existence of highly toxic compound of glyphosate for humans and animals (Suntres, 2002). Many authors discussed the effect of Glyphosate-containing products to arthropods, Gagne *et al.* (1999) and highly toxic to laboratory animals (Conning *et al* 1969 and Bullivant 1966). These products have caused genetic damage in fruit flies, which, the frequency of lethal mutations was between 3 and 6 times higher in fruit flies that had been treated with glyphosate products (Cox. 1995). In the field, these products reduce 89% of herbivorous insects captured on herbicide-treated as compared to controls after one-year post-treatment (Santillo, *et al.* 1989). In contrast, Mead-Briggs (1991) found that, in semi-field, more realistic environmental exposure conditions in semi-field tests showed no effects on carabid beetles. Even when beetles were directly over-sprayed at the maximum use rate, no mortality was observed.

Finally, we must recognize that most herbicides have low direct toxicity to insects because of active ingredient has been selected to act on systems found only in plants. And the exposure conditions in the laboratory tests were totally artificial in that herbicides were applied onto sandy soil, in these conditions. the pupae were forced to remain in contact with the pesticide film for several days.

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ARABIC SUMMARY

تأثير خمس مبيدات للاعشاب (الحشائش) على عذارى ذبابة الخوخ

حسام الجبالي وابراهيم الشامي
قسم بحوث المكافحة الحيوية – معهد بحوث وقاية النباتات – مركز البحوث الزراعية

أجريت الدراسة لتقييم تـأثير خمسة مبيدات حشائش ضد ذبابة الخوخ *Bactrocera zonata* وهي: بارون 48%, باراكوات داي كلوريد, مامبا ماكس 480, فلوازيفوب و جلايسين-ايزوبروبايل امونيوم. وهي مبيدات مستخدمة لمقاومة الحشائش في بساتين الموالح. اظهرت النتائج المعملية ان مركبات المامباماكس والباراكوات دايكلوريد كانت الاعلي في متوسط نسب الموت لعذاري ذبابة الخوخ بمتوسط 59,52% و47,62% علي الترتيب. يمكن ان نخلص الي ان مبيدات المامباماكس والباراكوات دايكلوريد يمكن ان تقوم بالاضافة الي عملها الي مكافحة افات الموالح