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Comparative Toxicity of Certain Insecticides against Two Species of Fruit Flies

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ABSTRACT

The full grown larvae and pupae of 3-days old of both *Bactrocera zonata* and *Ceratitis capitata* were sandy-soil-treated under laboratory conditions with five different insecticides to determine their comparative toxicity. The toxicity of the used compounds differently varied against the 3rd larval instar of *B. zonata*, where Marisol 1.8% EC (abamectin) surpassed the other tested compounds at LC_{50} (5.343 µl/L), while Opal 5%EC (lufenuron) was the most effective insecticide against the 3rd larval instar of *C. capitata* showing the lowest value of LC_{50} of 11.299 µl/L. Respecting to the three-day old pupae of the two tested species, Marisol 1.8%EC was the most potent compound at LC_{50} (395.461 µl/L for *B. zonata* and 151.373 µl/L for *C. capitate*). The full grown larvae of *B. zonata* were the most susceptible to Heater 3%SC (lufenuron+emamectin benzoate) and Marisol 1.8%EC at both LC_{50} and LC_{90}, where those of *C. capitata* showed tolerance level to the two insecticides by 7.78, 14.16 and 6.02, 8.47 fold at LC_{50} and LC_{90}, respectively. But, pupae of *B. zonata* more tolerable than that of *C. capitate* to Glory 5%EC (lufenuron), Marisol 1.8%EC and Cymax 5%EC (lufenuron) at LC_{50} and LC_{90} by 5.54, 2.61, 1.87 and 8.29, 2.32, 3.28 fold, respectively.

Keywords: Insecticide, Fruit flies, *Bactrocera zonata*, *Ceratitis capitata*, Toxicity.

INTRODUCTION

Fruits and vegetables provide essential nutritional elements of the consumer body. Fruits are very much attractive for human being, they offer a variety of delicious tastes and many of them like guava, mangoes, peaches, papaya etc. have great visual appeals. Unfortunately, the fruit growing areas favor the activities of many insect pests. Among the insect pests of fruit and vegetable crops, fruit flies are of special importance (Jilani *et al*., 2006). Fruit flies (Diptera: Tephritidae) distributed all over the world and considered deleterious insect-pests of horticultural crops. There are nearly 5,000 described species of tephritid fruit flies, categorized in almost 500 genera, of which about 70 species are economically very important. The genera *Bactrocera* and *Ceratitis* have a world-wide reputation for its destructive impact on agriculture (Lysandrou, 2009). In Arab countries, fruit flies have become severe regional problems, with many fruit flies of economic importance. The most notable are the Mediterranean fruit fly, *C. capitita* (Wied.), peach fruit fly, *B. zonata* (Saund.), olive fruit fly, *B. oleae* (Gmelin) and others (Lysandrou, 2009). The peach fruit fly, *B. zonata* is recognized as one major insect pest attacking fruits and vegetables. This pest spread in many regions of the world (Drew, 1989). This tephirtid fly occurs in south east Asia, India, Mauritius, Pakistan, Reunion island, Serilanka, Thailand, Vietnam and Indonesia. In Middle East regions, it established and widespread in Egypt and also presented in Yemen, Iran, Saudi Arabia, United Arab Emirates and Oman. It has been recently reported in Palestine and Lebanon (FAO/IAEA, 2000) when not treated. The peach fruit fly can affect the entire yield of horticultural crops. The Mediterranean fruit fly or med-fly, *C. capitata* is a multivoltine and polyphagous insect-pest that limits the development and expansion of fruit agriculture in many localities in subtropical and temperate regions, since this insect has a high biotic potential and a wide range host. *C. capitata* is a dangerous agricultural pest in European-Mediterranean basin, South Africa, central and South America, South Western Australia, Hawaii and USA i.e., the medfly is a cosmopolitan pest that has a wide host range of over 250 species of fruit trees, nut and vegetable plants (McDonald, 1986). Generally, the Integrated Pest Management (IPM) programs for fruit flies rely mainly on insecticides as coverage or partial-bait spray, soil-drench treatments, male annihilation technique and poisoned mass trapping methods (Saul and & Seifert, 1990; Mohamed & El-Nasser, 1992; Stark *et al*., 1992; Mosallam, 1993; Purcell & Schroeder, 1996; Abdallahi *et al*. 2000; Stark & Vargas, 2009; Rizwanual Haq *et al*., 2012; Halawa *et al*., 2013 and Stark *et al*., 2014).

Thus, this work aimed to study toxicity and comparative potency of certain pesticides against two immature or developmental stages (the 3rd instar larvae and pupae of 3-day old) of the two species of fruit flies *B. zonata* and *C. capitata* in sand under laboratory conditions.

MATERIALS AND METHODS

1- Rearing Technique

Full grown larvae and pupae of *Bactrocera zonata* and *Ceratitis capitata* were obtained from strains continuously reared in the laboratory of Horticulture Insects Department, Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza under conditions of 25±3ºC and 60 ± 5% R.H. Adults of both *B. zonata* and *C. capitata* were reared in a wooden cage (40x40x40cm) which covered from all sides with metal screen, but the cage of *C. capitata* was covered from a side with muslin cloth for ovipositing, where eggs were collected in a metal pan (40x10x5cm). Adults of the two species were fed with sugar mixed with fortified protein hydrolysate at ratio of 3:1, respectively. Also, water was added in plastic bottles. The cage of *B. zonata* was supplied with false plastic fruits that had many fine pores (as oviposition receptacles). These plastic fruits are filled with 3cm water to receive and prevent drying of the eggs. Larvae of both species were reared on an artificial diet (500 ml tap water, 3.00gm sodium benzoate, 3.00gm citric acid, 84.50gm sugar, 84.50gm brewer's yeast and 330gm wheat bran). These ingredients were carefully mixed in a large plastic container. Then eggs were scattered on the surface of the diet which was placed in plastic trays of 20x10x8cm tightly covered with muslin clothes using rubber bands. After that, these trays were placed in a large plastic van with sand at the bottom to allow the jumping larvae to pupate. All pupae were separated by sieving from sand (Shehata *et al.,* 2006).

2- Pesticides Used

Three types of formulations of the Insect Growth Regulators (IGRs) lufenuron and a neonicotinoid compound of abamectin as well as a mixture of lufenuron and emamectin benzoate were comparatively evaluated as toxic agents against two immature stages (the full grown larvae and pupae of 3-day old) of both *B. zonata* and *C. capitata*. These used compounds were shown in the following table:

Trade name	Common name	Producer	Rate of use
Cymax 5% EC	lufenuron	Zhejiang Sega Science and Technology Co., Ltd, China	40ml/100L water for grapevine moth on grapes
Glory 5% EC	lufenuron	Medmac Company in Jordan	40ml/100L water for grapevine moth on grapes
Heater 3% SC	2% lufenuron + 1% emamectin benzoate	Zhejiang Sega Science and Technology Co., Ltd, China	40ml/100L water for grapevine moth on grapes
Marisol 1.8% EC	abamectin	Industerial Quimica KEY S.A., Spain	40ml/100L water for red mite on grapes
Opal 5% EC	lufenuron	Jiangsu Flag Chemical Industry Co., LTD. China	40ml/100L water for grapevine moth on grapes

3- Bioassay Tests

The efficacy of the tested toxicants was evaluated in sand against the full grown larvae and 3-day old pupae of both *B. zonata* and *C. capitata*. Sand was sieved and put in plastic cups (100gm/each). Twenty to thirty full grown larvae or 3-day old pupae were confined and buried into sand in each cup. A series of gradual concentrations in tap water of each compound for each stage of each species were used. Then, ten milliliters (required amount for saturation) of each concentration were added per each cup. Then, cups were covered with muslin clothes that tightly secured with rubber bands and left under the above mentioned laboratory conditions till adult emergence. For each concentration, three replicates were used. Control individuals were treated with water only for comparison and correcting mortalities.

4- Statistical Analysis

The observed mortality was corrected with Abbott's formula (Abbott, 1925) and plotted against concentrations as log/probit regression lines. LC_{50} and LC_{90} values as well as the slope of the toxicity lines were calculated using Ld-p Line® software. [http://embakr.tripod.com/ldpline/ldpline.htm]. Toxicity index was obtained by comparing the efficiency of different insecticides at LC_{50} and LC_{90} with that of the highly potent compound according to the equation of Sun (1950)

RESULTS

1- Toxicity Against the Full Grown Larvae

Toxicity against *B. zonata*

The obtained results compiled in Table (1) and Figure (1) show the toxicity of certain insecticides against the 3rd larval instar of *B. zonata* in sand under laboratory conditions. Marisol 1.8%EC surpassed the other tested compounds at both LC_{50} and LC_{90} (5.343 and 20.011 µl/L, respectively). The other tested pesticides arranged descendingly, according to LC_{50} values, as Heater 3%SC (17.261 µl/L), Opal 5%EC (196.998 µl/L), Glory 5%EC (368.719 µl/L) and Cymax 5%EC (443.796 µl/L). But, according to LC_{90}, the descending arrangement of toxicity was as follow, Heater 3%SC, Opal 5%EC, Cymax 5%EC and Glory 5%EC that recorded LC_{90} values of 91.046, 919.546, 2495.620 and 2790.899 µl/L, respectively. Respecting slope values of toxicity lines of the used compounds, Marisol 1.8% showed the steepest LC-p line (2.235). The toxicity lines of both Heater 3%SC and Cymax 5%EC were nearly paralleled recording slope values of 1.775 and 1.709, respectively. The toxicity line of Glory 5%EC was the flattest (1.458). Regarding toxicity index, Marisol 1.8% was the standard showing the most efficiency against the 3rd instar larvae of *B. zonata* at both LC_{50} and LC_{90}. Efficiency of the other tested compounds was 1.45, 30.95, 2.71 and 1.20% of the standard insecticide at LC_{50}, but it was 0.72, 21.98, 2.18 and 0.80% of Marisol 1.8%EC at LC_{90} for Glory 5%EC, Heater 3%SC, Opal 5%EC and Cymax 5%EC, consecutively.

Table 1. Toxicity of certain insecticides against the full grown larvae of *B. zonata* in sand.

Compound	LC_{50} (µl/L)	LC_{90} (µl/L)	Slope	Toxicity index at	
				LC_{50}	LC_{90}
Cymax 5%EC	443.796	2495.620	1.709±0.128	1.20	0.80
Glory 5%EC	368.719	2790.899	1.458±0.301	1.45	0.72
Heater 3%SC	17.261	91.046	1.775±0.276	30.95	21.98
Marisol1.8%EC	5.343	20.011	2.235±0.325	100	100
Opal 5%EC	196.999	919.546	1.916±0.152	2.71	2.18

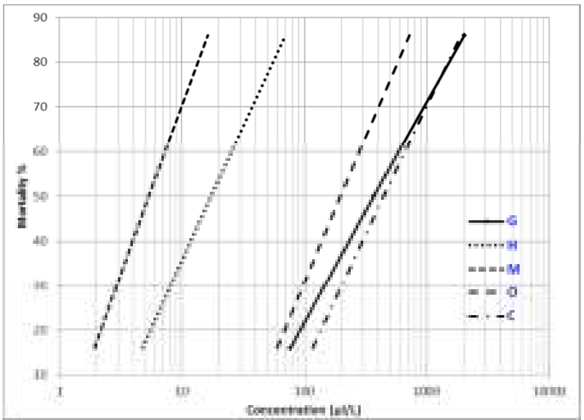

Figure 1. LC-p lines of certain insecticides against the full grown larvae of *B. zonata* in sand.

G= Glory 5%, H= Heater 3%, M= Marisol 1.8%, O= Opal 5%, C= Cymax 5%

Toxicity against *C. capitata*

As shown in Table (2) and Fig. (2), Opal 5%EC was the most effective insecticide on the 3rd larval instar of *C. capitata* showing the lowest value of LC_{50} of 11.299 µl/L followed by Cymax 5%EC, Glory 5%EC, Marisol 1.8%EC and Heater 3%SC which recorded LC_{50} values of 12.235, 17.455, 75.643 and 134.304 µl/L, respectively. On the other hand, with regard to LC_{90} values, Cymax 5%EC was much more the toxic followed descendingly by Opal 5%EC, Marisol 1.8%EC, Glory 5%EC and Heater 3%SC. The respective LC_{90} values were48.611, 142.566, 169.442, 226.498 and 548.548 µl/L. Respecting slope values, Marisol 1.8%EC showed the steepest toxicity line (3.660), but that of Opal 5%EC was the flattest one (1.164). The toxicity of the used insecticides (at LC_{50}) was 64.73, 8.41, 14.94 and 92.35% of the standard compound (Opal5%EC) for Glory 5%EC, Heater 3%SC, Marisol 1.8%EC and Cymax 5%EC, respectively. But, at LC_{90} Cymax 5%EC was the standard, where toxicity of the other tested compounds was 21.46, 8.86, 28.69 and 34.10% of the standard one for Glory 5%EC, Heater 3%SC, Marisol 1.8%EC and Opal 5%EC, successively.

Table 2. Toxicity of certain insecticides against the full grown larvae of *C. capitata* in sand.

Compound	LC_{50} (µl/L)	LC_{90} (µl/L)	Slope	Toxicity index at	
				LC_{50}	LC_{90}
Cymax 5%EC	12.235	48.611	2.139±0.362	92.35	100
Glory 5%EC	17.455	226.498	1.151±0.160	64.73	21.46
Heater 3%SC	134.304	548.548	2.097±0.400	8.41	8.86
Marisol 1.8%EC	75.643	169.442	3.659±0.534	14.94	28.69
Opal 5%EC	11.299	142.566	1.164±0.209	100	34.10

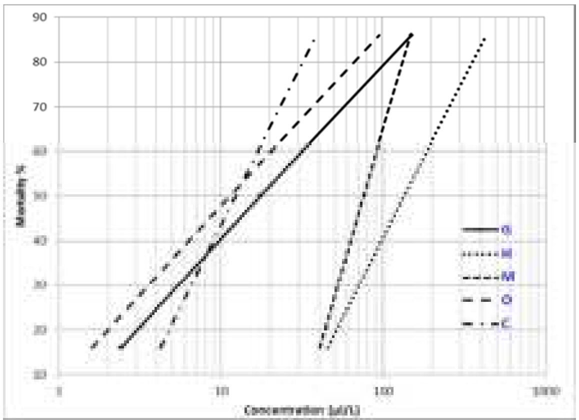

Figure 2. LC-p lines of certain insecticides against the full grown larvae of *C. capitata* in sand.
G= Glory 5%, H= Heater 3%, M= Marisol 1.8%, O= Opal 5%, C= Cymax 5%

2- Toxicity Against the 3-Day Old Pupae

Toxicity against *B. zonata*

Results compiled in Table (3) and Fig. (3) indicate the toxicity of the tested insecticides against *B. zonata* three-day old pupae in sand. The obtained results revealed that Marisol 1.8%EC was the most potent compound at both LC_{50} and LC_{90} (395.461 and 819.698 µl/L, respectively) surpassing the other used insecticides. Cymax 5%EC and Opal 5%EC alternated the second and third orders at LC_{50} and LC_{90}, respectively. The efficiency of both Glory 5%EC and Heater 3%SC was much more lower than that of the abovementioned three compounds recording high values of both LC_{50} and LC_{90} against the 3-day old pupae of *B. zonata* of 2706.538, 25754.403 and 7983.618, 185422.0 µl/L, successively. Slope values of toxicity lines of the five used compounds were 4.049, 2.728, 2.259, 1.768 and 1.495 for Marisol 1.8%EC, Glory 5%EC, Opal 5%EC Cymax 5%EC and Heater 3%SC, respectively. Marisol 1.8%EC had the steepest LC-p line, whereas Heater 3%SC had the flattest one. The efficiency of the used insecticides was differently varied, where Marisol 1.8%EC was the standard at both LC_{50} and LC_{90}. The potency of the other pesticides was 64.23, 58.51, 14.61 and 1.54% of the standard compound for Cymax 5%EC, Opal 5%EC, Glory 5%EC and Heater 3%SC, successively. The arrangement at LC_{90} was Opal 5%EC, Cymax 5%EC, Glory 5%EC and Heater 3%SC by 32.85, 25.07, 10.27 and 0.44% of Marisol 1.8%, respectively.

Table 3. Toxicity of certain insecticides against the 3-day old pupae of *B. zonata* in sand.

Compound	LC_{50} (µl/L)	LC_{90} (µl/L)	Slope	Toxicity index at	
				LC_{50}	LC_{90}
Cymax 5%EC	615.724	3269.127	1.768±0.163	64.23	25.07
Glory 5%EC	2706.538	7983.618	2.728±0.703	14.61	10.27
Heater 3%SC	25754.403	185422.0	1.495±0.291	1.54	0.44
Marisol1.8%EC	395.461	819.698	4.049±0.893	100	100
Opal 5%EC	675.893	2495.406	2.259±0.705	58.51	32.85

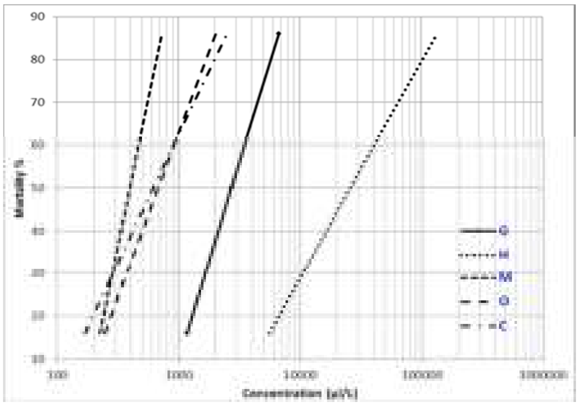

Figure 3. LC-p lines of certain insecticides against the 3-day old pupae of *B. zonata* in sand.
G= Glory 5%, H= Heater 3%, M= Marisol 1.8%, O= Opal 5%, C= Cymax 5%

Toxicity against *C. capitata*

As shown in Table (4) and Fig. (4), efficacy of the tested insecticides against the 3-day old pupae of *C. capitata* differently varied. Marisol1.8%EC was the most efficient showing the lowest values of both LC_{50} (151.373 µl/L) and LC_{90} (354.051 µl/L), whereas Heater 3%SC was the lowest potent recording the highest values of both LC_{50} and LC_{90} (30274.894 and 243203.0 µl/L, respectively). At LC_{50}, the other used insecticides descendingly arranged as Cymax 5%EC (329.399 µl/L), Glory 5%EC (488.851 µl/L) and Opal 5%EC (775.450 µl/L). But, at LC_{90} they were arranged as Glory 5% EC (962.476 µl/L), Cymax 5%EC (995.582 µl/L) and Opal 5%EC (1353.306 µl/L). Slope values of LC-p line of the used compounds descendingly were 1.416, 2.668, 3.473, 4.356 and 5.300 for Heater 3%SC (the flattest line), Cymax 5%EC, Marisol 1.8%EC, Glory 5%EC and Opal 5%EC (the steepest toxicity line). Considering Marisol 1.8%EC the standard compound, the efficacy of the others against 3-day old pupae of *C. capitata* differently varied, the toxicity of the tested compounds was more lower than the standard at both LC_{50} and LC_{90} by 30.97, 36.79; 0.50, 0.15; 19.52, 26.16 and 45.95, 35.56% of the Marisol 1.8%EC (the standard) for Glory 5%EC, Heater 3%SC, Opal 5%EC and Cymax 5%EC, respectively.

2- Comparative Toxicity Against Larvae

Data compiled in Table (5) comparatively show the effect of the used compounds against the third larval instar of both *B. zonata* and *C. capitata* which more differently varied at LC_{50} and LC_{90} values. The full grown larvae of *B. zonata* were the most susceptible to Heater 3%SC and Marisol 1.8%EC at both LC_{50} and LC_{90}, where those of *C. capitata* showed tolerance level to the two insecticides by 7.78, 14.16 and 6.02, 8.47 fold at LC_{50} and LC_{90}, respectively. On the other side, the 3[rd] larval instar of *B. zonata* were more susceptible than that of *C. capitata* which showed differently level of tolerance to Glory 5%EC, Opal 5%EC and Cymax 5%EC by 21.12, 17.43, 36.27 and 12.32, 6.45, 51.34 fold at LC_{50} and LC_{90}, respectively.

Table 4. Toxicity of certain insecticides against the 3-day old pupae of *C. capitata* in sand.

Compound	LC_{50} (µl/L)	LC_{90} (µl/L)	Slope	Toxicity index at	
				LC_{50}	LC_{90}
Cymax 5%EC	329.399	995.582	2.668±0.372	45.95	35.56
Glory 5%EC	488.851	962.476	4.356±0.471	30.97	36.79
Heater 3%SC	30274.894	243203.0	1.416±0.107	0.5	0.15
Marisol1.8%EC	151.373	354.051	3.473±0.219	100	100
Opal 5%EC	775.450	1353.306	5.300±0.437	19.52	26.16

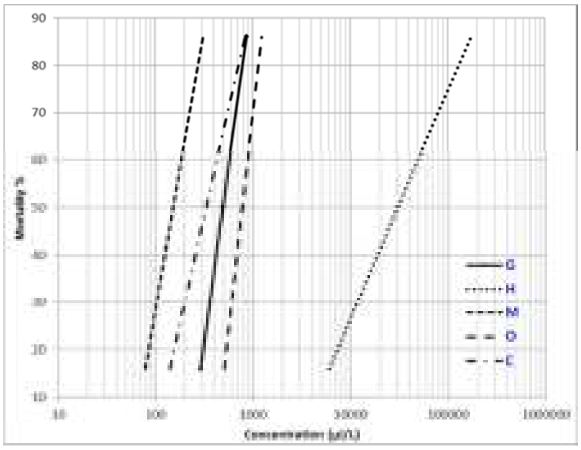

Figure 4. LC-p lines of certain insecticides against the 3-day old pupae of *C. capitata* in sand.
G= Glory 5%, H= Heater 3%, M= Marisol 1.8%, O= Opal 5%, C= Cymax 5%

Table 5. Comparative toxicity of certain insecticides against the full grown larvae of both *Bactrocera zonata* and *Ceratitis capitata* in sand under laboratory conditions.

Compound	LC_{50} (µl/L)		Fold		LC_{90} (µl/L)		Fold	
	B. zonata	*C. capitata*	*B. zonata*	*C. capitata*	*B. zonata*	*C. capitata*	*B. zonata*	*C. capitata*
Cymax 5%EC	443.796	12.235	36.27	1	2495.620	48.611	51.34	1
Glory 5%EC	368.719	17.455	21.12	1	2790.899	226.498	12.32	1
Heater 3%SC	17.261	134.304	1	7.78	91.046	548.548	1	6.02
Marisol 1.8%EC	5.343	75.643	1	14.16	20.011	169.442	1	8.47
Opal 5%EC	196.999	11.300	17.43	1	919.546	142.566	6.45	1

3- Comparative Toxicity Against Pupae

As shown in Table (6), the response of pupae of 3-day old of both *B. zonata* and *C. capitata* to Glory 5%EC, Heater 3%SC, Marisol 1.8%EC, Opal 5%EC and Cymax 5%EC slightly differed. Pupae of *B. zonata* more tolerable than that of *C. capitate* to Glory 5%EC, Marisol 1.8%EC and Cymax 5%EC at LC_{50} and LC_{90} by 5.54, 2.61, 1.87 and 8.29, 2.32, 3.28 fold, respectively. But, the reverse was true in case of Heater 3%SC where pupae of *C. capitata* was more tolerable than that of *B. zonata* by 1.18% and 1.31 fold at LC_{50} and LC_{90}, consecutively. In case of Opal 5%EC, the 3-day old pupae of *B. zonata* was more susceptible at LC_{50}, whereas at LC_{90} pupae of *C. capitata* showed high susceptibility. The tolerance level of *C. capitata* was 1.14 fold at LC_{50}, but it was 1.84 fold for *B. zonata* at LC_{90}. Generally, pupal stage of the two tested species (*B. zonata* and *C. capitata*) was much more tolerable to each used compounds than the larval stage.

Table 6. Comparative toxicity of certain insecticides against the three-day old pupae of both *Bactrocera zonata* and *Ceratitis capitata* in sand under laboratory conditions.

Compound	LC_{50} (µl/L)		Fold		LC_{90} (µl/L)		Fold	
	B. zonata	*C. capitata*	*B. zonata*	*C. capitata*	*B. zonata*	*C. capitata*	*B. zonata*	*C. capitata*
Cymax 5%EC	615.724	329.399	1.87	1	3269.127	995.582	3.28	1
Glory 5%EC	2706.538	488.851	5.54	1	7983.618	962.476	8.29	1
Heater 3%SC	25754.403	30274.894	1	1.18	185422.0	243203.0	1	1.31
Marisol 1.8%EC	395.461	151.373	2.61	1	819.698	354.051	2.32	1
Opal 5%EC	675.893	775.450	1	1.14	2495.406	1353.306	1.84	1

DISCUSSION AND CONCLUSION

Toxicity of the same compound differed according to the tested species and the examined stage of the same species. Saul and Seifert (1990) stated that the toxicity of methoprene to *Ceratitis capitata, Dacus dorsalis* [*Bactrocera dorsalis*] and *D. cucurbitae* [*B. cucurbitae*] was the highest in mature larvae and the newly formed pupae. Four insect growth regulators were tested by Mohamed and El-Nasser (1992) as dips for their toxicity and chemosterilant effects against prepupae and pupae of the tephritid *Ceratitis capitata*. BAY Sir-8514 [triflumuron] was the most toxic compound against prepupae and pupae, and had a sterilizing effect against both sexes when applied to the pupae. Prepupae were more sensitive than pupae to all the compounds, which included XRD 473 [hexafluron], IKI 7899 [chlorfluazuron] and Dowco 439 [chlorpyrifos-methyl]. Stark *et al*. (1992) determined effects of cyromazine and diazinon on eclosion, longevity and reproduction of *Ceratitis capitata, Bactrocera dorsalis* and *B. cucurbitae*. They found that formation of puparia not affected by cyromazine but affected by diazinon in a concentration-dependent manner at the concentrations tested. At LC_{50} values, *B. dorsalis* and *B. cucurbitae* were more susceptible to cyromazine than to diazinon; *C. capitata* was equally susceptible to both chemicals. Mosallam (1993) conducted laboratory tests to evaluate efficacy of certain pesticides belonging to different groups against some immature stages of the Mediterranean fruit fly using different methods of applications. The author reported that the toxicity of used pesticides differently varied against the tested immature stages according to type of pesticide and method of application as well as the tested stage (mature larvae and pupae of 3-day old). Purcell and Schroeder (1996) determined, in laboratory, the potency of the organo-silicone surfactant Silwet L-77 for 3 species of tephritids (*C. capitata, B. dorsalis* and *B. cucurbitae*). The biological activity of Silwet was compared to that of diazinon by exposing puparia of *C. capitata* to sand treated with each chemical within 1 h, 7 days, and 14 days after treatment. Silwet killed *C. capitata* and *B. dorsalis* at concentration within the range of field application rates. The response of *B. cucurbitae* was the most variable and very high concentrations were required to kill >90% of puparia. A 75% decrease in mortality of *C. capitata* puparia occurred 14 days after sand treatment with diazinon. In contrast, Silwet remained as toxic to *C. capitata* puparia at 14 days as on the 1st day of treatment. Abdallahi *et al*. (2000) conducted laboratory studies to determine the effect of 2 new pesticides viz. fipronil and pyriproxyfen on the fruitfly *C. capitata*. Larval development and percentage of adult eclosion were affected. Treatment of the medium for pupation with pyriproxyfen affected the larval development. Stark and Vargas (2009) evaluated, in Hawaii, toxicity of Platinum, Force, Admire, Regent, and Warrior after application to sand and soil as drenches for control of the Mediterranean fruit fly, *C. capitata* (Wiedemann); melon fly, *B. cucurbitae* (Coquillett); and oriental fruit fly, *B. dorsalis* (Hendel) and reported that susceptibility of each species differed. In sand, the order of toxicity at LC_{50} based on the 95% confidence limit overlap approach for *C. capitata* from most toxic to least toxic was diazinon > Force = Warrior > Admire = Platinum > Regent. The order of toxicity for *B. dorsalis* was diazinon > Platinum = Warrior = Force > Regent = Admire. The order of toxicity for *B. cucurbitae* was Warrior = diazinon > Force = Regent = Platinum = Admire. Rizwanual Haq *et al.* (2012) studied effects of lead acetate, in the concentrations of 0.125 mg., 0.25 mg., 0.5 mg, 1.0 mg and 2.0 mg on *B. dorsalis*, *B. zonata*, at 48 hours post-treatment. It was observed that under the effects of lead abnormalities and malformation were developed in the larvae of flies. Teratomorphic changes were observed as elongated wings, de-shaped wings, elongated and folded legs, changes in melanization of larvae, pupae and adults. Some other structural abnormalities of larvae and pupal shape were also observed. Also, toxicity of certain insecticides belonging to different chemical groups (Beticol, Biosad, Elsan, Lufox, Mani, Match and Radiant) against full grown larvae and pupae of *B. zonata* with different concentrations as contact poisons or in sandy soil treatments were assayed by Halawa *et al*. (2013) under laboratory conditions. Results showed that Radiant was the most contact toxicant on full grown larvae among the tested insecticides, followed by Elsan, Beticol, Lufox, Match, Biosad and Mani. The respective LC_{50} values were 4.60, 17.13, 18.65, 34.97, 108.24, 143.03 and 286.81µl/L. On 1-day old pupae, Elsan was the most potent compound followed by Match, Lufox, Beticol, Radiant, Mani and Biosad. But, in sandy soil treatment, Lufox was the most efficient against 1-day old pupae at (LC_{50} =156.02µl/L). Stark *et al.* (2014) evaluated the effectiveness of several insecticides as Diazinon replacements for control of three economically important fruit fly species, Mediterranean fruit fly, *C. capitata*, melon fly, *B. cucurbitae*, and oriental fruit fly, *B. dorsalis* using a semi-field approach. Pupae of fruit fly species that were ready to eclose within 24 h were exposed to organic soil treated with Radiant SC (Spinetoram), Force 3G and Force CS (Tefluthrin); Warrior II (Lambda-cyhalothrin); the biopesticides, Entrust and Entrust SC (Spinosad); GardStar 40% EC (Permethrin) or Diazinon AG 600. All alternative insecticides resulted in a significant reduction in adult emergence and were not significantly different from Diazinon. Insecticides that resulted in no adult emergence for *C. capitata* and *B. dorsalis* were Entrust SC, Warrior II, GardStar, and Force CS, and for *B. cucurbitae*, Entrust SC and Force CS. Also, late third instar larvae ready to pupate were exposed to organic soil treated with Force CS, Warrior II, Entrust SC, GardStar, or Diazinon AG 600. All alternative insecticides resulted in a significant reduction in adult emergence and were not significantly different from Diazinon. El-Rahman *et al.* (2017) tested the two compounds of phloxine B and menadione for toxicity to the peach fruit fly, *Bactrocera zonata* (Saunders) under both dark and sun light conditions and reported that both compounds had no significant toxic effect in dark and concentration-dependent toxicity when insect exposed to sunlight for 2 hrs. Phloxine B was approximately 1000 time more toxic to *B. zonata* than menadione with LC_{25} in water of 0.0007 g% and 0.854 g% (w/v), respectively. Adding menadione to phloxine resulted in significant antagonistic effects on insect mortality, which could be due to menadione alteration of the pH of the feeding media and/or menadione induction of the ROS-detoxifying enzymes, particularly peroxidase. It is concluded that phloxine B and menadione are incompatible and their mixture is not likely to pose any significant addition to their control potential against *B. zonata*. Gazit and Akiva (2017) evaluated the toxicity of malathion and spinosad to *B. zonata* and *C. capitata* as contact exposure (tactile) or feeding (insecticides mixed with bait). Results showed that doses of 1,000 and 2,000 ppm of malathion were highly toxic to *C. capitata* both upon contact and when eaten with bait, a dose of 10,000 ppm (1%) caused only 10 to 35% mortality of *B. zonata*. Khan and Muhammed Naveed (2017) evaluated the effectiveness of a bio-insecticide, emamectin benzoate with other conventionally used insecticides against *B. zonata*. Results revealed high toxicity of emamectin benzoate with LC_{50} value of 38.25 followed by trichlorfon, lambda-cyhalothrin and imidacloprid with LC_{50} values of 44.21, 58.98 and 187.81 ppm, after 24 h post-treatment, respectively. It is be conclude that the efficacy of a compound itself differs from one species to another. Also, the susceptibility of the different stages within the same species differs to the same compound.

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السمية المقارنة لبعض مبيدات الآفات ضد نوعين من ذباب ثمار الفاكهة

صفاء محمود حلاوة[1]، عزت فرج الخياط[1]، رشا عبد المقصود الحصرى[1]، مها محمد صبرى اسماعيل[2] وأحمد محمود زكى مسلم[2]

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لدراسة السمية المقارنة لخمس مبيدات مختلفة، تم معاملة العمر اليرقى الأخير وعذارى عمر 3-يوم لكل من ذبابة الخوخ وذبابة فاكهة البحر المتوسط فى التربة الرملية تحت ظروف المعمل. وقد اختلفت سمية المركبات المستخدمة ضد يرقات ذبابة الخوخ، حيث تفوق مركب مارسول 1.8% مسجلا أقل قيم LC_{50} (5.343 ميكرولتر/لتر). بينما كان مركب أوبال5% الأكثر فعالية ضد يرقات ذبابة فاكهة البحر المتوسط مسجلا أقل قيمة LC_{50} (11.299 ميكرولتر/لتر).. أما بالنسبة لعذارى عمر 3-يوم لكلا النوعين فقد كان مركب مارسول1.8% الأكثر تأثيرا عند LC_{50} (395.461 و ميكرولتر/لتر لذبابة الخوخ و 151.373 ميكرولتر/لتر لذبابة فاكهة البحر المتوسط). هذا وقد كانت يرقات ذبابة الخوخ الأكثر حساسية لمركبات هيتر3% و مارسول1.8% عند LC_{50} و LC_{90} فى حين أظهرت يرقات ذبابة فاكهة البحر المتوسط درجة تحمل لكلا المركبين بحوالى 7.78 ، 14.16 و 6.02 ، 8.47 مرات عند C_{50} و LC_{90} ، على الترتيب. بينما كانت عذارى ذبابة الخوخ أكثر تحملا لمركبات جلورى5% ، مارسول1.8% و سايمكس5% عند C_{50} و LC_{90}بحوالى 5.54 ، 2.61 ، 1.87 و 8.29 ،2.32 ، 3.28 مرات من مثيلتها لذبابة فاكهة البحر المتوسط، على التوالى.