EFFICIENCY OF SOME INSECTICIDES ON SUGAR BEET FLY, *PEGOMYIA MIXTA* (VILL.) IN THE FIELD

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Abstract

The objective of the present work was to compare the field efficiency of seven tested pesticides, Acarone 72% EC (Profenofos), Selecron 72% EC (Profenofos), Sumithion 50% EC (Fenitrothion), Diazonixy 60% EC (Diazinon), Chinook 35% SC (Imidacloprid), Vertimec 1.8% EC (Avermectin) and Actara 25% WG (Thiamethoxam), against larvae of the sugar beet fly, *Pegomyia mixta* on planting sugar beet in Sharkia Governorate during 2008/2009 and 2009/2010 sugar beet growing seasons. Data obtained revealed that Acarone (72% EC) gave the highest initial reduction in insect population (58.95%), followed by Diazonixy (56.68%). Selecron (72% EC) was the lowest effective (51.43%) in the first season, while in the second season, Acarone (72% EC), Selecron (72% EC) and Sumithion (50% EC) achieved excellent control against *P. mixta*. Reduction percentages were 90.37, 90.13 and 88.16% after one day of spraying (initial kill).

Acarone (72% EC) increased the percentage of sugar content comparing with the other treatments, whereas, there were no differences between Sumithion (50% EC) and Control. The highest purity percentage was obtained from Selecron (72% EC) and Sumithion (50% EC) treatments (90.76 % and 89.33 % respectively) in the first season, while in the second season, Acarone (72% EC) and Vertimec (1.8% EC) increased the percentage of sugar content comparing with the other treatments, (19.70 % and 19.40 %). While, Selecron (72% EC) and control decreased those percentages of sugar (16.10 % and 14.70%). Selecron (72% EC) and Actara (25% WG) were increased purity percentage (94.71 % and 92.84 % respectively).

Keywords: *Pegomyia mixta*, Pesticides, Profenofos, Fenitrothion, Diazinon, Imidacloprid, Avermectin, Thiamethoxam, Root yield and Sugar yield.

INTRODUCTION

Sugar beet *(Beta vulgaris* L.) is one of the most important sugar crops in the world (it produces annually about 40% of sugar production all over the world) (Anonymous, 2009). Sugar beet plants attract a considerable number of insect pests, among most important of them is the sugar beet fly, *Pegomyia mixta* (Diptera: Anthomyiidae). Abelentseva and Kreminskaya (1987) used Chlorophos and Phathalophos for controlling the beet leaf miner, *Pegomyia betae* on sugar beet.

Phathalophos (Phosmet 20% E C) at rate 2.5 - 5 Kg in 100-400 litres water was more effective than Chlorophos [Trichlorfon]. Shaheen (1989) used four insecticides (Basudin, Lannate, Sumithion and Reldan) on beet fly *Pegomyia mixta* (Vill). All of this pesticides significantly reduced the number of *Pegomyia mixta* (Vill)) on sugar beet plants. Basudin was very effective than others. Bassyouny and Bleih (1996) in Egypt mentioned that Nuvacron was the most effective insecticide followed by Febronil in controlling the beet leaf miner, *P. mixta.* The present work was carried out to evaluate certain conventional and non-conventional insecticides against *P. mixta* infesting sugar beet plants and their effect on Juice quality, root yield and sugar yield of sugar beet at Sharkia Governorate during two successive growing seasons.

MATERIALS AND METHODS

1- Experimental design:

The experiments were carried out at Kafr El-hamam village, Zagazig district, Sharkia governorate, during the two successive seasons, 2008/2009 and 2009/2010. The experimental area was divided into plots of 6x7 m ($42m^2$) each arranged in a randomized complete block design with four replicates for each treatment and the untreated control. The common sugar beet variety Baraca was cultivated of Mid. of November. The normal agriculture practice was followed. The insecticides were sprayed using motor sprayer (Kubota) to give good coverage of the tested plants. Sugar beet plants were sprayed at intervals samples of five plants were collected randomly from each plot (20 plants/ treatment) just before and hence forward at 1^{st}, 3^{rd}, 5^{th}, 7^{th}, 9^{th} and 11^{th} day from spraying. Samples were taken to laboratory for inspection.

Percentage of reduction (R %) were calculated according to the formula of **Henderson and Tilton (1955)** as follows:

$$\%\,R = 1-\left(\frac{\text{Insect No in check before spray}}{\text{Insect No in check after spray}} X \frac{\text{Insect No in treatment after spray}}{\text{Insect No in treatment before spray}}\right) X\ 100$$

2- Pesticides:

Four insecticides via Acarone 72% E.C, Selecron 72% E.C, Sumithion 50% E.C and Diazonixy 60% E.C were included in the first season. While, in the second season seven insecticides namely Acarone 72% E.C, Selecron 72% E.C, Sumithion 50% E.C, Diazonixy 60% E.C, Chinook 35% S.C, Vertimec 1.8% E.C and Actara 25% W.G were tested for control of sugar beet fly. The common name and rate of applications are used in table (1).

Table 1. The chemicals tested and their rates in this study were as follows.

No.	Trade name	Common name	Recommended application rate/100 L. of water
1	Acarone 72% E.C	Profenofos	375 cm^3
2	Selecron 72% E.C		375 cm^3
3	Sumithion 50% E.C	Fenitrothion	450 cm^3
4	Diazonixy 60% E.C	Diazinon	250 cm^3
5	Chinook 35% S.C	Imidacloprid	150 cm^3
6	Vertimec 1.8% E.C	avermectin	40 cm^3
7	Actara 25% W.G	Thiamethoxam	20 gm

3- Statistical analysis:

Statistical analysis were carried out to determine the differences between treatment and days after spraying by using one way analysis of variance (ANOVA) (Costat, 1990). Duncan's multiple range test (Duncan, 1955) was applied at 5% probability level.

4- Juice quality, root yield and sugar yield determinations:

For estimating the effect of the tested insecticides on sugar beet yield. Quantity and percentage of sugar at harvest, 20 plants were taken from each treatment and the leaves were cut-off. The roots were cleaned and weighted to calculate the root yield. Sugar extractable was determined at the Department of Pesticide, Faculty of Agriculture, Mansoura University. Juice quality and sugar yield were calculated as follow:

1. Total soluble solids (TSS %) which was determined using handle refractometer. according to Simon *et al.* (1980).
2. Sucrose percentage (%) was determined in fresh roots polarmetrically using lead acetate according to the methods of Le-Docte (1927).
3. Purity percentage was calculated according to the following formula: apparent purity % = sucrose% / TSS % X 100. According to Poschenok (1976).
4. Sugar yield (ton/fed) = root yield X sugar extractable %.

RESULTS AND DISCUSSION

1- Efficiency of tested pesticides against larvae of *Pegomyia mixta*:

In the first season results were tabulated in Table (2) and illustrated in Fig.(1) data showed that, the activity of the tested compounds was varied according to the chemical structure of the compound, where Acarone (72% EC) gave the highest initial reduction (58.95%), followed by Diazonixy (60% EC) (56.68%). Selecron (72% EC) was the lowest effective on the population of sugar beet fly. Results also indicated that after 3, 5, 7, 9, 11 days from spraying the reduction reached 100% except for Selecron (98.97%) after 3days of application.

As for the residual effect, Acarone, Sumithion and Diazonixy induced the best results, recording 100% reduction followed by Selecron (99.79%) in the first season.

Date in Table (3) and Fig.(1) indicated that Acarone, Selecron and Sumithion afforded excellent control against *P. mixta* reduction percentages were 90.37, 90.13 and 88.16% after one day of spraying (initial kill), respectively. Each of these insecticides in addition to Diazonixy, Vertimec and Chinook achieved 100% reduction from 7days till 9days after application. Acarone, Selecron, Diazonixy, and Sumithion gave the highest efficiency in reducing sugar beet fly population with a residual effect of 100% reduction, followed by Chinook (98.99%), Vertimec (98.48%) and Actara (97.13%) reduction, respectively in the second season.

These results are in agreement with data obtained by Bassyouny and Khalafalla (1996) reported that Carbosulfan was significantly effective than Profenofos against *Pegomyia mixta* Vill Boyd in both irrigated and non-irrigated sugar beet fields. Also, it appeared that irrigation did not significantly effect the toxicity of Carbosulfan to the considered insect. Shalaby (2001) in Egypt reported that reduction in blotches of *P. mixta* larvae were most reduced by Selecron and Marshall, Jojoba application in the third rank reducing the insect infestation by 26.53% in the first season and 33.80% in the second one. However, the poorest result was recorded for Foamier which reduced the number of *P. mixta* blotches by 7.27 and 21.44% in both seasons, respectively. Talha (2001) in Egypt evaluated some insecticides against different larval instars of *P. mixta* in sugar beet fields. The obtained results showed that Diazinoxy 60% E.C. and Diazol 60% E.C. had high activity against *P. mixta.*

Table 2. Efficiency of some pesticides against larvae of *Pegomyia mixta* in sugar beet leaves during 2008/2009 at Sharkia Governorate.

Treatment	%Reduction after spraying												Mean of residual effect	General mean of % reduction	L.S.D $_{0.05}$
	before application	Initial effect after one day		Residual effect											
				3		5		7		9		11			
	Mean	Mean	Reduction	Mean	Reduction	Mean	Reduction	Mean	Reduction	Mean	Reduction	Mean	Reduction			
Acarone	54.75A^{a} ±9.63	22.00B^{b} ±10.03	58.95	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	100	93.16	7.73**
Selecron	51.00A^{a} ±7.83	24.25B^{b} ±6.60	51.43	1.00B^{c} ±1.00	98.97	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	99.79	91.73	5.72**
Sumithion	58.75A^{a} ±9.17	27.5B^{b} ±5.68	52.18	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	100	91.68	6.00**
Diazonixy	47.75A^{a} ±8.77	20.25B^{b} ±6.99	56.68	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	0.00B^{c} ±0.00	100	100	92.78	6.23**
Control	47.5A^{a} ±4.50	46.5A^{a} ±3.87	___	43.25A^{ab} ±3.50	___	39.5A^{bc} ±3.87	___	36.25A^{cd} ±3.40	___	33.25A^{de} ±2.75	___	29.0A^{e} ±2.82	___	___	___	5.26**
L.S.D 0.05	12.35N.S	10.45**	___	2.48**	___	2.61**	___	2.29**	___	1.85**	___	1.91**	___	___	___	___

*Means followed the same capital letter in a column for different pesticides or small letter in row of each pesticides at different times are not significantly different at 5% level of Probability (Duncan's Multiple Rang Test).

Table 3. Efficiency of some pesticides against larvae of *Pegomyia mixta* in sugar beet leaves during 2009/2010 at Sharkia Governorate.

Treatment	%Reduction after spraying												Mean of residual effect	General mean of % reduction	L.S.D 0.05
	before application	Initial effect after one day		Residual effect											
				3		5		7		9		11			
	Mean	Mean	Reduction	Mean	Reduction	Mean	Reduction	Mean	Reduction	Mean	Reduction	Mean	Reduction			
Acarone	٣٣,٧٥A^{a} ±٥,٥٦	٣,٢٥B^{b} ±٢,٩٨	٩٠,٣٧	0.00C^{b} ±٠,٠٠	١٠٠	0.00B^{b} ±٠,٠٠	100	٠.00B^{b} ±٠,٠٠	100	٠,٠0B^{b} ±٠,٠٠	100	٠.00C^{b} ±٠,٠٠	100	100	98.39	3.51**
Selecron	٣٨,٠٠A^{a} ±٣,٥٥	٣,٧٥B^{b} ±٢,٧٥	٩٠,١٣	٠,٠0C^{c} ±٠,٠٠	١٠٠	0.00B^{c} ±٠,٠٠	100	٠.00B^{c} ±٠,٠٠	100	٠,٠0B^{c} ±٠,٠٠	100	٠.00C^{c} ±٠,٠٠	100	100	98.36	2.50**
Sumithion	٤٢,٢٥A^{a} ±٧,٨٤	٥.00B^{b} ±٥,٩٤	٨٨,١٦	٠.00C^{b} ±٠,٠٠	١٠٠	٠.00B^{b} ±٠,٠٠	100	٠,٠0B^{b} ±٠,٠٠	100	٠,٠0B^{b} ±٠,٠٠	100	٠.00C^{b} ±٠,٠٠	100	100	98.03	5.47**
Diazonixy	٣٧,٢٥A^{a} ±٤,٧٨	٤,٧٥B^{b} ±٢,٥	٨٧,٢٤	0.00C^{c} ±٠,٠٠	١٠٠	٠.00B^{c} ±٠,٠٠	100	٠.00B^{c} ±٠,٠٠	100	٠.00B^{c} ±٠,٠٠	100	٠.00C^{c} ±٠,٠٠	100	100	97.87	3.00**
Chinook	٤٢.00A^{a} ±٤,٢٤	٦.00B^{b} ±٣,٤٦	٨٥,٧١	١,٥0BC^{c} ±١,٧٣	٩٦,٦٣	٠.00B^{c} ±٠,٠٠	100	٠,٠0B^{c} ±٠,٠٠	100	٠.00B^{c} ±٠,٠٠	100	١,٠0BC^{c} ±0.81	98.34	98.99	96.78	3.22**
Vertimec	٣٥,٢٥A^{a} ±٦,٠٧	٤,٧٥B^{b} ±٣,٦٨	٨٦,٥٢	١,٢٥BC^{bc} ±١,٢٥	٩٦,٦٥	٠,٥0B^{bc} ±٠,٥٧	98.73	٠.00B^{c} ±٠,٠٠	100	٠.00B^{c} ±٠,٠٠	١٠٠	١,٥BC^{bc} ±1.00	97.03	98.48	96.43	4.06**
Actara	٤٠,٧٥A^{a} ±٨,٥٠	٦,٥٠B^{b} ±٤,٧٢	٨٤,٠٤	٣.00B^{b} ±٢,٤٤	٩٣,٠٥	٠,٧٥B^{b} ±٠,٩٥	98.35	٠,٥0B^{b} ±١,٠٠	٩٨,٩٨	٠,٢٥B^{b} ±0.50	99.55	٢,٥0B^{b} ±١,٢٩	95.72	97.13	94.95	5.68**
Control	٤١,٢٥A^{c} ±٢,٨٧	٤١,٢٥A^{c} ±٢,٨٧	ـــ	٤٣,٧٥A^{c} ±٣,٣٠	ـــ	٤٦,٢٥A^{bc} ±٣,٥٩	ـــ	٥٠.0A^{b} ±٤,٥٤	ـــ	٥٦,٢٥A^{a} ±٤,٨٥	ـــ	٥٩,٢٥A^{a} ±٢,٦٢	ـــ	ـــ	ـــ	5.32**
L.S.D 0.05	٨,٣٧N.S	٥,٥٢**	ـــ	٢,٣٩**	ـــ	1.94**	ـــ	2.40**	ـــ	2.52**	ـــ	1.65**	ـــ	ـــ	ـــ	ـــ

*Means followed the same capital letter in a column for different pesticides or small letter in row of each pesticides at different times are not significantly different at 5% level of probability (Duncan's Multiple Rang Test).

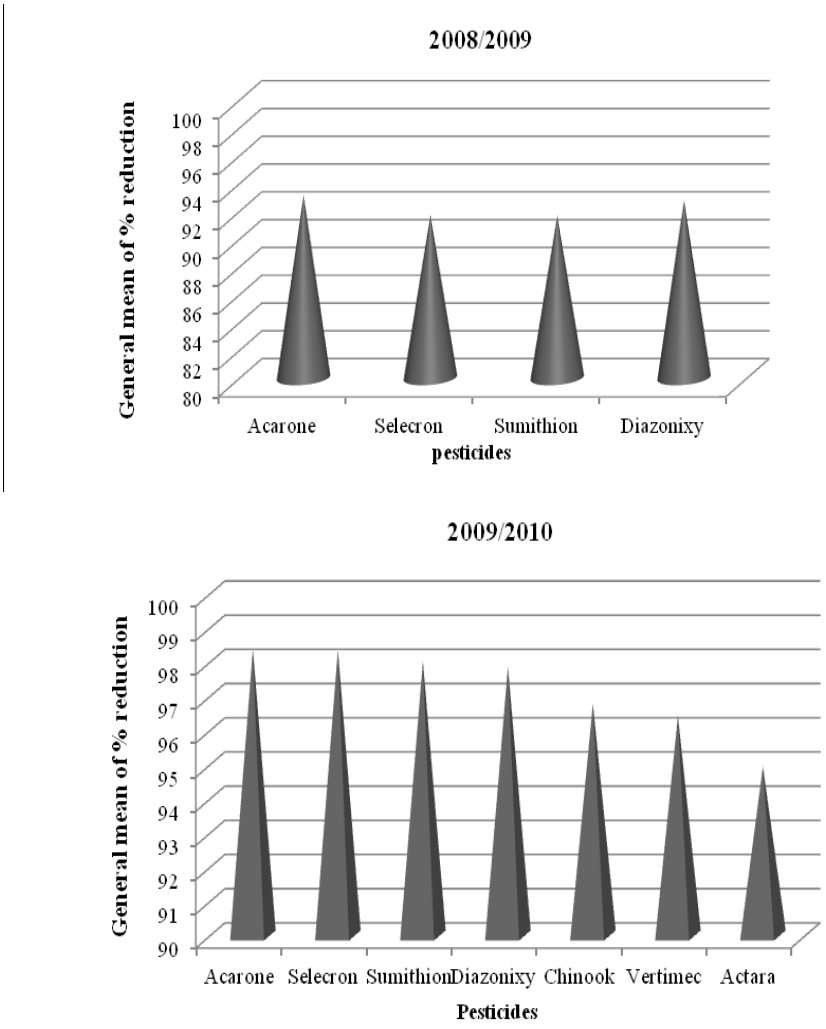

Fig. 1. General mean of reduction of beet fly, *Pegomyia mixta* in sugar beet leaves during 2008/2009 and 2009/2010 seasons.

2- Efficiency of insecticides on sugar content, root yield and sugar yield:

2.1. Season 2008/2009:-

Data in table (4) showed that Acarone increased the percentage of sugar content comparing with other treatments, whereas, there were no differences between Sumithion and Control, as well as total soluble solids (TSS %) as shown in fig. (2). The highest purity percentage was obtained from Selecron and Sumithion (90.76 % and 89.33 % respectively). On the other hand Diazonixy and control were the lowest one in juice purity percentage (87.03 % and 87.24 % respectively).

Data also indicated that Acarone and Diazonixy increased the sugar yield and roots yield (Ton / fed.) comparing with other treatments.

2.2. Season 2009/2010:-

Data in **table (4)** indicated that Acarone and Vertimec increased the percentage of sugar content comparing with other treatments (19.70 % and 19.40 % respectively). While, Selecron and control decreased those percentages of sugar (16.10 % and 14.70% respectively), as well as total soluble solids (TSS %) as shown in fig. (2). Selecron and Actara were increased purity percentage (94.71 % and 92.84 % respectively). On the other hand, Acarone and Vertimec were the lowest one in juice purity percentage (85.65 % and 88.18 % respectively).

Data also showed that Acarone and Vertimec increased the sugar yield and roots yield (Ton / fed.) comparing with other treatments.

Table 4. Efficiency of certain insecticides on Juice quality, Root yield and Sugar yield infested by *Pegomyia mixta* during 2008/2009 and 2009/2010 seasons.

Treatments	Season	Root weight (kg)/20plants	Sucrose (%)	TSS (%)	Purity (%)	Roots yield Ton/Fed	Sugar yield Ton/Fed
Acarone	2008/2009	29.27	17.13	20.00	85.٦5	40.978	7.02
	2009/2010	29.45	19.70	23.00	85.65	41.230	8.12
Selecron	2008/2009	23.00	14.75	16.25	90.76	32.200	4.75
	2009/2010	20.50	16.10	17.00	94.71	28.700	4.62
Sumithion	2008/2009	21.58	13.40	15.00	89.33	30.212	4.05
	2009/2010	23.35	17.03	18.75	90.83	32.690	5.56
Diazonixy	2008/2009	26.71	16.10	18.50	87.03	37.394	6.02
	2009/2010	25.80	19.10	21.50	88.84	36.120	6.89
Chinook	2009/2010	25.15	18.80	21.00	89.52	35.210	6.62
Vertimec	2009/2010	27.65	19.40	22.00	88.18	38.696	7.50
Actara	2009/2010	24.50	18.80	20.25	92.84	34.300	6.44
Control	2008/2009	20.90	12.65	١٤.٥٠	87.24	29.260	3.70
	2009/2010	19.15	14.70	14.70	100	26.810	3.94

TSS = Total soluble solids.

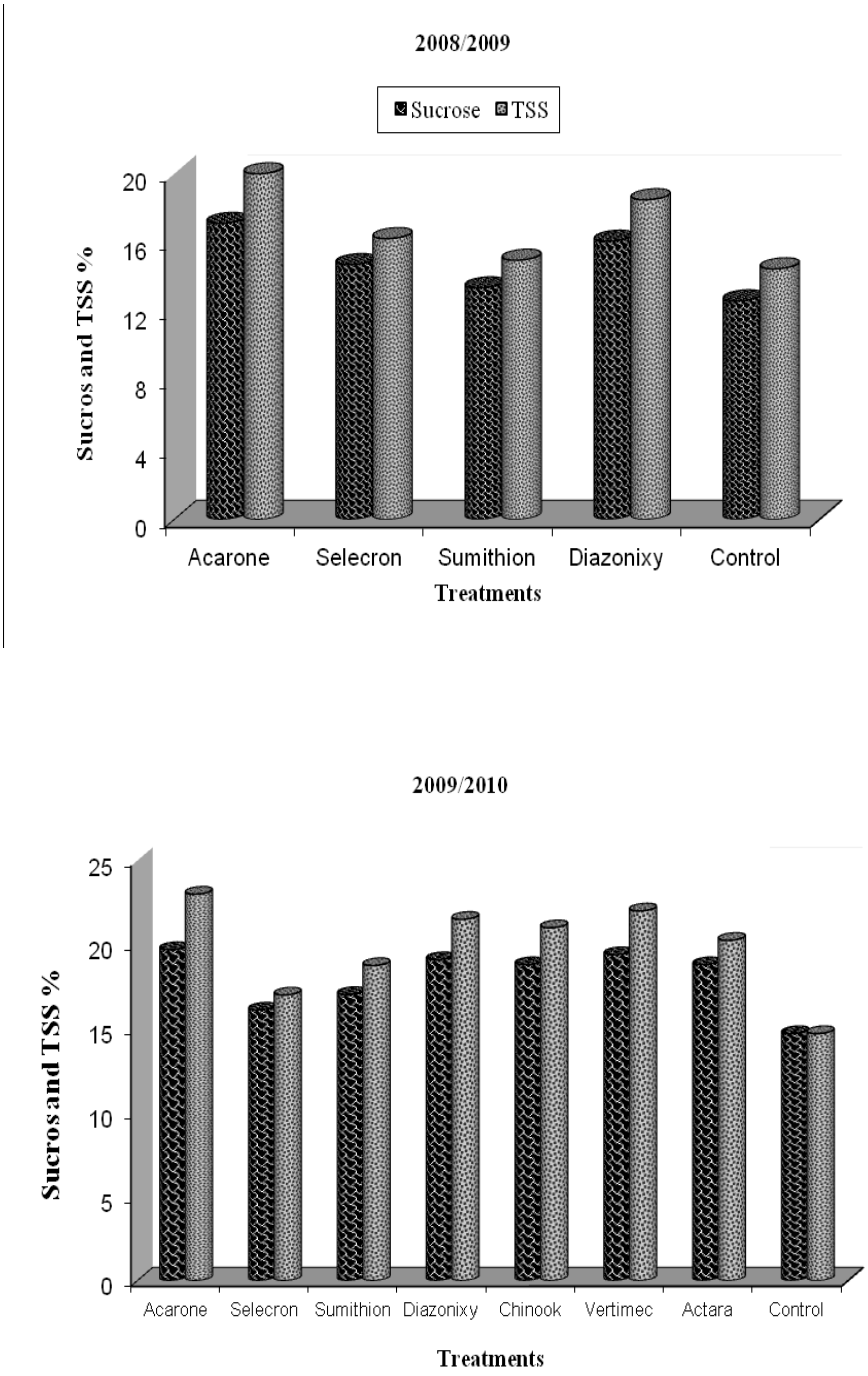

Fig. 2. Effect of the tested insecticides on percentage of sugar and total soluble solids during 2008/2009 and 2009/2010 seasons.

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كفاءة بعض المبيدات الحشرية على ذبابة بنجر السكر (*Pegomyia Mixta*) فى الحقل

على على عبدالهادى سعيد [١]، فؤاد عبدالله حسام الدين شاهين [١]، السيد على حسن شريف [٢] وحاتم عبد المنعم محمد فؤاد [٢]

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تم تقييم كفاءة سبعة مبيدات حشرية مختبرة هى الاكارون(برفينوفوس) ٧٢٪ EC ، السيليكرون(برفينوفوس) ٧٢٪ EC، السوميثيون (فينتروثيون) ٥٠٪ EC، الديازنوكسى (ديازنون) ٦٠٪ EC، الشينوك (اميداكلوبرايد) ٣٥٪ SC، الفيرتيمك (افرمكتين) ١,٨٪ EC والاكتارا (ثيميزوكسام) ٢٥٪ WG ضد يرقات ذبابة البنجر على نباتات بنجر السكر فى محافظة الشرقية خلال موسم ٢٠٠٨/٢٠٠٩ و ٢٠٠٩/٢٠١٠. أشارت البيانات فى الموسم الاول أن الاكارون أعطى أعلى نسبة قتل فورى (٥٨،٩٥٪) يليه الديازنوكسى (٥٦،٦٨٪). بينما فى الموسم الثانى اعطى كلا من الاكارون، السيليكرون والسوميثيون مكافحة ممتازة لحشرة ذبابة البنجر حيث اعطوا نسبة خفض ٩٠،٣٧ ؛ ٩٠،١٣ و٨٨،١٦٪على التوالى بعد يوم واحد من الرش (القتل الفورى). كذلك تمت دراسة تاثير هذة المبيدات على نسبة السكر والمواد الصلبة الذائبة حيث تبين فى الموسم الاول ان مركب الاكارون ادى الى زيادة نسبة السكر بالمقارنة مع باقى المركبات الأخرى بينما أدى كلا من السيليكرون والسوميثيون الى زيادة فى النسبة المئوية لنقاوة السكر (٩٠،٧٦؛ ٨٩،٣٣٪) على التوالى. بينما فى الموسم الثانى ادى كلا من الأكارون والفيرتيمك الى زيادة فى النسبة المئوية للسكر بالمقارنة مع باقى المعاملات (١٩،٧٠؛١٩،٤٠٪). أما السيليكرون والاكتارا أديا الى زيادة فى النسبة المئوية لنقاوة السكر (٩٤،٧١؛ ٩٢،٨٤٪) على التوالى.