EFFECTIVENESS OF CERTAIN PLANT EXTRACTS AGAINST INSECT PESTS AND PREDATORS IN SUGAR BEET FIELDS

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Abstract

The sugar-beet fields are inhabited by numerous insect pests and natural enemies. The plant extracts have shown marked insect control potential. Five of aqueous extracts were tested on sugar-beet insects and predators. It is preferable to use the coriander chamomile or chinaberry extracts, each alone, for controlling, the sugar-beet beetle *Cassida vittata* Vill., the sugar beet moth, *Scrobipalpa ocellatella* Boyed., the cotton leaf worm, *Spodoptera littoralis* Boisd. and beetfly, *Pegomia mixta*. The European corn borer, *Ostrinia nubilalis* Hub. was efficiently controlled by Greater Ammi extract. The Greater Ammi extract killed neumerous of the predators, specially, the rove beetle, *Paederus alfierii* Koch and Coccinellids followed by Christmas berry extract. On the other hand, Coriander and Chinaberry were the lowest potential against predators. Treatment with Selecron promoted the toxic effect against the insect pests but became more hazardous to the predators. Generally, Coriander, Chamomile and Chinaberry extracts were more effective in reducing the insect pest populations and less effective on the associated predators.

INTRODUCTION

Sugar beet crop is annually planted in Egypt in about 150,000 feddans, about 56% of this area is located at Kafr El-Sheikh Governorate (Egyptian Society of Sugar Technologist, December 2003).

The crop plants attract numerous insect pests and natural enemies which play a principal role in preventing further multiplication of these pests during the growing season (Bassyouni, 1987 and Shalaby, 2001).

Using traditional insecticides to control these insects can not be used owing to their dangerous problems. So, new safe materials should replace chemicals, particularly the Egyptian flora is a rich source of these new materials to be used as effective insecticides (Abo-Sholoa, 1990). The plant extracts have shown a marked insect control potential, in addition to its low cost, low mammalian toxicity, short-term

persistence in the environment, fewer negative effects on natural enemies of insects and can be made by very simple technology (Lowery and Isman, 1995). The previous facts have stimulated responsible researches to use plant extracts as a new tools in insect control program. Ropert (1977) found that an aqueous extract of Chestnut leaves (*Castanea sativa*) repelled and inhibited females of the beet moth, *Scrobipalpa ocellatella* Boyd. from oviposition and did not stimulate oogensis. The seed neem extracts (*Azadirachta indica*) have deterrent feeding and oviposition effect and impaired insect larval development (Marco *et al.,* 1996). Farrag (2000) found that apricot seed extracts were highly toxic to the cotton leaf worm, *Spodoptera littoralis*.

So, the objectives of this study is to throw light on the potential of some plant extracts against the sugar beet insects and, also, to evaluate its negative side effects on natural enemies of these insects.

MATERIALS AND METHODS

The experiment was conducted at Sakha Agric. Res. Sta. farm, during 2002/2003 season as a part of the sugar beet experiment programme to evaluate the potentiality of some plant extracts against the sugar beet insect pests and associated predators. The experimental area was prepared as recommended and divided into 24 plots (each measured 100 m^2) to represent eight treatments in three replicates. Raspoly sugar beet variety was planted on 15 Oct., and the recommended agricultural practices were followed during the growing season. The parts of the plants used for extraction Table 1 were crushed, soaked in water for 72 hr., squeezed, screened through muslin cloth and kept in refrigerator until application. The insecticide Selecron (Profenofos)72% EC. at 750 cc/feddan was used for comparison. Two types of treatments were applied: 1) full dose of extracts, and 2) full dose of selecron Table 1. The check was sprayed with water. When the populations of the sugar beet insects, Cassida vittata Vill., Pegomia mixta Vill., Scrobipalpa ocellatella Boyed. Spodoptera littoralis (Boisd.) and Ostrinia nubilalis (Hub.) reached its peaks in sugar beet area at fifth of April.

Table 1. Plant species used as insecticides against the insect pests attacking sugar beet plants 2002/2003.

Common name	Scientific name	Used parts	Conc. (kg/L)	Rate/fed. (kg)
Black nightshade	Solanum nigrum	All parts	1/7	30
Greater Ammi	Amimi visnaga	Seeds	1/15	15
Christmas berry	Schinus trebenthifolius	Leaves	1/7	30
Chamomile	*Artemisia cina* L.	Seeds	1/15	15
Coriander	Coriandrum sativum	Seeds	1/7	30
Chinaberry	Melia azedarach	Seeds	1/15	15

The tested compounds were sprayed using Knapsock sprayer. Five investigations were made, pre spraying by 24 hr. and after spraying by 24 & 72 hr. and 1 & 2 weeks for counting the considered insect pests and the main insect predators, *Paederus alferii, Chrysoperla carnea, Syrphus corollae, Coccinellids* and true spiders. Fifteen plants were examined for

every treatment and the obtained data were tabulated and the percentage of reduction were calculated according to Henderson and Tilton formula (1955). Statistical analysis as prepared by Duncan's Multiple range test (1955).

RESULTS AND DISCUSSION

A. Effectiveness of plant extracts on sugar beet insects the obtained data in Table 2 show the efficiency of plant extracts on sugar beet insects as follows:

1. Beet beetle, *Cassida vittata* Vill the population of *C. vittata* was variably decreased at the different treatments compared with check (83.3 insect/5 plants). Selecron was superior in reducing the insect population (21.0 insect/5 plants and 74% insect reduction), followed by: chamomile, coriander and chinaberry plant extracts which recorded not significant differences.The insect reduction differed from 36.7% with Greater-Ammi extract to 62.0% in case of chamomile extract.

2. Beet moth, *Scrobipalpa ocellatella* Boyd the results obtained in case of the beet beetle was similar to those of the beet moth. Using plant extracts decreased the population of insect larvae from 24.7 in check to value ranged between 11.4 and 4.2 larvae/5 plants. Percent reductions in insect population reached 53.9% in case of Greater Ammi and increased to 75.3 and 82.1% in case of Chinaberry and Chamomile extracts.

3. Cotton leaf work, *Spodoptera littoralis* (Boisd.) larval stage of *S. littoralis* was highly affected by Selecron (89.7% reduction), followed by extracts of coriander, chinaberry and chamomile (70.0, 68.2 and 62.8% reduction, respectively). The least affected was shown in Grater Ammi and Black-Nightshade extracts as shown in Table 2.

4. Beet fly, *Pegomia mixta* Vill the beet fly, *P. mixta* blotches were highest in check (untreated) treatment (10.8 blotches/5 plants). The application of plant extracts resulted in significant reductions in insect populations. The differences among treatments were significant. The highest effective plant extracts were chamomile (which induced 76.8 Rd) in fly population and both of Black-Nightshade & Chinaberry (each induced 62.9 reduction), however, Greater Ammi extract effect was the least one (49.1% reduction).

Table 2. The efficiency of some plant extract, in reducing insect population in sugar beet fields.

Treatment	Dose/ fed	Insect population/5 plants & % reduction										General average of		Rank of efficiency
		C. vittata		*S. ocellatella*		*S. littoralis*		*P. mixta*		*O. nubilalis*				
		Insect	% Red.	Larvae	% Red.	Larvae	% Red.	Blotch	% Red.	Larvae	% Red.	Insect pop.	% Red.	
Greater Ammi	15 kg	52.7 c	36.7	11.4 c	53.8	1.80	52.1	5.5 f	49.1	0.8 b	85.2	14.22	44.5	6
Black nightshade	30 kg	42.8 bc	48.6	8.8 ab	64.4	1.86	52.6	4.0 de	62.9	1.4 c	74.1	11.54	54.9	5
Christmas berry	30 kg	41.3 bc	50.4	8.7 bc	64.8	1.47	62.3	5.0 ef	53.7	1.3 c	75.9	11.32	55.8	4
Chamomile	15 kg	31.6 ab	62.0	4.2 ab	82.1	1.45 a	62.8	2.5 b	76.8	1.8 c	66.7	10.025	68.5	1
Coriander	30 kg	35.4 ab	57.5	8.0 bc	67.6	1.17 a	70.0	4.5 de	58.3	2.3 d	57.4	10.04	60.8	3
Chinaberry	15 kg	37.3abc	55.2	6.1 bc	75.3	1.24 a	68.2	4.0 cde	62.9	1.7 c	68.5	9.834	61.6	2
Selecrone	750 ml	21.0 a	74.8	1.1 a	95.6	0.4	89.7	0.8 a	92.6	0.02a	96.3	4.586	81.9	-
Check		83.3 c	-	24.7d	-	3.9	-	10.8 g	-	5.4 e	-	25.62	-	-

5. European corn borer, *O. nubilalis* (Hub.) population of larval stage of the insect borer recorded a significant reduction among different plant extracts. The more reduction was observed at Greater Ammi (85.2 rd) extract followed by Christmas berry (75.9%) and Black-Night shade (74.1%).

In conclusion, basing on the aforementioned results, it is preferable to use Chamomile, Chinaberry and Coriander extracts for controlling the considered insect populations except with the European corn borer which was more affected by using Greater Ammi.

B. Effectiveness of plant extracts on the prevailing predators from the data in Table 3 it can be observed that Greater Ammi extract killed numerous of *P.alferii* (76.2 %) and coccinellids (88.0 %) and recorded the highest general reduction (71.0 %) followed by Christmas berry (43.5 %) . On the other hand , Coriander extract was the lowest potential in killing predators (9.6 %) followed by chinaberry (30.6 %) . True spiders were least affected and more tolerant to the tested compounds .

From the data obtained in table 4 we can observe the Coriander extract was more effective in reducing the insect populations (60.8 %) and less effective on the predator populations (9.6 %). The same trend was followed by Chamomile and Chinaberry which resulted in 68.5 % and 61.6 % reduction of insect populations and recorded least injury levels on predator populations 33.9 and 30.6 % , respectively .

Despite the other extract compounds proved to be the most toxic against all insects , they were very harmful for natural enemies .

Based on the aforementioned results , it is preferable to use Coriander , Chamomile and Chinaberry extracts at the doses listed in Table 1 for controlling the considered insects infesting sugar beet .

This is supported by the finding of Lowery and Isman (1995) who stated that the plant extracts have shown marked insect control potential in addition to its low cost , short persistence , fewer negative effects on the natural enemies and can be made by very simple technology . Also, Robert (1977) , Soliman and Bleih (1995) and Farrag (2000) successfully used aqueous extracts of chestnut leaves , mixture of Coriander and Chinaberry and apricot seed for controlling the beet moth, *S. ocellatella.*

The cotton leaf worm, *S. littoralis* and rice stem borer, *Chilo Agamemnon* respectively.

Table 3 Negative side effect of some plant extracts on predators associated with sugar beet insects.

Treatment	Dose/ fed	Insect population/5 plants & % reduction										General average of		Rank of efficiency
		Paederus aflierii		*Chrysoperla carnea*		*Syrphus* spp..		Coccinellids		Spiders				
		Insect	% Red.	Larvae	% Red.	Insect	% Red.	Insect	% Red.	Spider	% Red.	Insect pop.	% Red.	
Greater Ammi	15 kg	4.0	76.2	4.2	67.2	1.7	39.3	4.1	88.0	11.4	45.7	5.08	71.0	2
Black nightshade	30 kg	11.8	29.7	5.0	60.9	2.3	17.9	20.3	40.6	18.8	10.5	11.64	33.6	5
Christmas berry	30 kg	7.3	56.5	2.6	79.7	0.8	71.4	21.4	37.4	17.4	17.1	9.9	43.5	3
Chamomile	15 kg	7.7	54.2	2.6	79.6	0.8	71.4	18.8	45.0	11.0	47.6	8.18	33.9	4
Coriander	30 kg	15.0	10.7	11.6	9.4	1.3	53.6	32.8	4.1	18.5	11.9	15.84	9.6	7
Chinaberry	15 kg	7.5	55.3	11.6	9.5	1.8	35.7	19.1	44.5	13.8	34.3	10.76	30.6	6
Selecrone	750 ml	0.8	95.2	1.3	89.8	0.3	89.3	4.4	87.1	5.8	72.4	2.52	85.6	1
Check		16.8	-	12.81	-	2.8	-	34.2	-	21.0	-	17.52	-	

Table 4. Comparison between the insect complex reduction and the predator complex reduction affected some plant extracts.

Plant species	Insect complex		Predators complex		Red. of insect/Red. of pred.	Preferment** (Rank)
	Reduction %	Rank*	Reduction %	Rank*		
Greater Ammi	44.5	13	71.0	3	0.62	6
Black Nightshade	54.9	12	33.6	12	1.63	4
Christmas berry	55.8	11	43.5	9	1.28	5
Chamomile	68.5	7	33.9	10	2.02	2
Coriander	60.8	9	9.6	13	6.33	1
Chinaberry	61.6	8	30.6	11	2..01	3
Selecron	81.9	1	85.6	1	0.95	1

* Based on toxicity of the extract

** Based on most toxic effect on insect pests and least toxic effect on predator [(Reduction of infect)/(Reduction of predators)]

Insect complex = *C. vittata, S. ocellatella, S. littoralis, P. mixta* and *O. nubilalis.*

Predator complex = P. alferii, Ch. carnea, Syrphus sp., Coccinellides and the spiders.

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تأثير بعض المستخلصات النباتية على آفات بنجر السكر الحشرية والمفترسات المصاحبة لها فى حقول بنجر السكر

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تحوى حقول بنجر السكر العديد من الآفات الحشرية والاعداء الحيوية وقد أصبحت المستخلصات النباتية وسيله واضحه وفعالة فى مكافحة هذه الآفات. وقد استهدف هذا البحث إختيار كفاءة خمسة من المستخلصات المائية النباتية ضد أهم أفات بنجر السكر الحشرية وكذلك تأثيرها على المفترسات المصاحبة لها.

وقد وجد أن هذه المستخلصات يمكن ترتيبها حسب أفضليتها فى التأثير على الآفات الحشرية فى حقول بنجر السكر كما يلى: الكسبره ، الشيح البلدى ، الزنزلخت وذلك عندما اختبرت ضد آفات بنجر السكر الحشرية وهى: خنفساء البنجر السلحفائية ، دودة ورق القطن ، ذبابة اوراق البنجر.

وقد أظهر المستخلص المائى لعنب الديب مكافحة قوية وفعاله لحشره ثاقبة الذرة الاوربية وهى حشره حديثة على المحصول فى مصر. وفيما يتعلق بتأثير هذه المستخلصات على المفترسات الموجودة فى حقول بنجر السكر. فقد خفض المستخلص المائى لعنب الديب من تعداد كثير من المفترسات وخاصة الحشره الرواغه ومجموعة أبو العيد ، ثم تبعه مستخلص الفلفل ذو الورق العريض.

وعلى الجانب الاخر أظهر كل من مستخلص الكسبره والزنزلخت اقل تأثير على مجاميع المفترسات.

والخلاصة أنه يمكن القول أن المستخلصات المائية لكل من الكسبره ،والشيح ثم الزنزلخت كانت اكثر تأثيرا فى خفض تعداد الآفات الحشرية وأقل ضررا على تعداد مجاميع المفترسات المصاحبه لهذه الآفات. مما يشجع على إمكانية جعلها وسيلة فعالة وآمنة فى خفض تعداد الآفات الحشرية لبنجر السكر وضعف تأثيرها على المفترسات المصاحبة لها.