

INSECTICIDAL EFFECTS OF TWO PLANT OILS ON *Earias insulana* (BOISD.) AND *Pectinophora* *gossypiella* (SAUND.) (IEPIDOPTERA)

Azab, A. M. A.; A. M. Rashad and Safaa H. Aly

Plant Protection Research Inst., Agric. Res. Center, Dokki-Giza, Egypt.

ABSTRACT

Laboratory bioassays on the effect of two plant oils, *i.e.*, cotton seed and safflower oils using different concentrations on *E. insulana* and *P. gossypiella* were investigated. Both oils caused insecticidal effects on the two insect pests. Data indicated a great reduction in population growth and weight of the larvae and adults than the control. Cotton seed oil was more effective on both insects than safflower oil. On the other hand, *P. gossypiella* was more sensitive than *E. insulana* for both oils. The two plant oils caused a reduction in the total soluble protein and fat contents in the treated insects. Both insects were more susceptible to cotton seed oil than safflower oil.

INTRODUCTION

The cotton bollworms; *Earias insulana* (Boisd.) and *Pectinophora gossypiella* (Saund.) are two of the most important pests causing great damage to a lot of agricultural economic crops as cotton, okra and others. The wide use of insecticidal application for controlling the two pests could generate some problems such as the pest resistance, toxic residues, pollution to the environment, destroying the natural enemies and producing new pests such as the sucking pests and the American bollworm. Therefore, it is necessary to develop safe, less expensive, and preferably locally available materials for pest control. Recently, renewed methods in the pest management potentially were evaluated, among of these the natural products were tested. These products are the compounds that have involved in plants for defense against phytophagous pests. The modern research now has the technology to exploit the toxic properties of some of the compounds including plant oils for controlling pests. In this field of study, Singh and Bhathal (1992) used soybean oil against *Spodoptera littoralis*. Singh and Singh (1989) used soybean oil against pulse beetle, *Callosobruchus chinensis*. Khaire *et al.* (1992) reported that sunflower, castor, mustard, safflower, palm, groundnut, sesame, neem, karanj and maize oils proved insecticidal effects against *Callosobruchus chinensis*.

MATERIALS AND METHODS

Insect rearing :

Earias insulana and *Pectinophora gossypiella* insects were reared in the laboratory on artificial diet of beans. Adults were kept in jars to lay eggs on paper pieces at 25°C. Eggs of 1 -day old and newly hatched larvae were exposed to the suspensions of the plant oils concentrations.

Methods :

Series concentrations of the two plant oils (30 %), 1.5, 3, 5 and 10 % were used for both cotton seed and safflower oils. Mortality was assessed and counted. Four replicates were used for each concentration.

Biological analysis :

Samples from both treatments started from 72 hours as well as the untreated ones were collected at random.

*** Determining the total soluble protein :**

The treated larvae were immersed and left in 96 % ethyl-alcohol for 24 hours, then removed and centrifuged. The supernatant was concentrated to 2 ml and then transferred to tightly closed bottle and kept in the refrigerator until use for determining the total soluble protein. Total protein content was determined according to the method of Lowry *et al.* (1951).

*** Determining the fat content :**

The rapid method of Bligh and Dyer (1959) was applied. Each sample as weighed and homogenized with a mixture of chloroform and methanol to produce a biphasic system, the chloroform layer contained the lipids. This layer was taken in clean dry beaker (weighed before) and chloroform was evaporated by air current. Thenafter, the remained fat residues and beaker were re-weighed and the lipid content was calculated.

RESULTS AND DISCUSSION

The present data indicate the insecticidal effects of two plant oils; cotton seed and safflower against *E. insulana* and *P. gossypiella*. These effects were also reported for *S. littoralis* by neem seed oil (Singh and Bhathal, 1992), for *Helicoverba armigera* by cotton seed oil (Manoharan and Uthamasamy, 1993), for *Cryptolestes pusillus* and *Rhyzopertha dominica* by cotton seed oil (Obeng-Ofori, 1995), and for *Callosobruchus chinensis* by safflower oil (Khaire *et al.*, 1992)

Insecticidal effects of two plant oils against *E. insulana* :

Data presented in Table (1) indicated that there were obvious insecticidal effects of both cotton seed oil and safflower oil against the treated *E. insulana* insects. These data clarified successful mortality in *E. insulana* tested. Mortality was increased with the increase of the concentrations. The compounds caused both toxic and growth inhibitory effects as well as reducing larval growth of the treated individuals which failed to produce pupae and adults. Also, the tested oils caused antifeedant effects. They inhibit the growth and reproduction and which hindered the fecundity of adult females. Moreover they decreased the reproductive period as well as longevity of the adults. As shown in Table (1), data indicated that the weight of larvae and pupae was less than of the control and most of the adults emergence were failed. The cotton seed oil was more effective than safflower oil to the treated individuals of *E. insulana*.

Table (1). Insecticidal efficiency of two plant oils against *Earlas insulana*.

Treat-ments	Conc. (%)	Larval mortality (%)	Larval weight (mg)	Pupal mortality (%)	Pupal weight (mg)	Adult mortality (%)
Cotton seed oil	5	89	0.0046	90	0.0561	100
		86	0.0055	90	0.0566	100
		89	0.0058	88	0.0441	100
		85	0.0061	86	0.0545	100
	3	88	0.0091	80	0.0588	100
		85	0.0029	77	0.0631	100
		83	0.00225	79	0.0588	100
		88	0.0074	80	0.0576	100
	1.5	55	0.0226	50	0.0801	90
		60	0.0235	48	0.0715	100
		55	0.0236	50	0.0580	95
		63	0.0355	49	0.0655	100
Safflower oil	5	83	0.0039	80	0.0520	100
		80	0.0081	78	0.0560	100
		80	0.0042	80	0.0471	100
		79	0.0085	79	0.0550	100
	3	67	0.0081	60	0.0545	97
		65	0.0153	57	0.0626	100
		67	0.0105	59	0.0603	96
		60	0.0155	59	0.0590	99
	1.5	61	0.0710	50	0.0707	93
		59	0.0210	47	0.0731	95
		55	0.0221	49	0.0695	90
		60	0.0329	50	0.0711	93
Control	-	0.0	0.0755 0.0874 0.0957 0.0895	0.0	0.0892 0.0985 0.0921 0.0857	0.0

Generally, there was positive correlation between the efficiency of the insecticidal concentrations of both tested oils and the larval and pupal mortality of *E. insulana* as well as the larval weight.

Insecticidal effects of two plant oils against *P. gossypiella* :

Data in Table (2) indicated insecticidal effects of both oils; cotton seed and safflower against the treated insect, *P. gossypiella*. These data indicated a successful reduction in *P. gossypiella* populations. Both oils were more toxic and produced better results at the higher dosages than the lower dosages. The oils caused toxic and growth inhibitory effects and reduced larval growth of treated insects and fail to become pupae and adults, and suppress population because the oils produced antifeedant effects with inhibiting the growth and reproduction and hindered the fecundity of adult females. Moreover they decreased the reproductive period as well as longevity of the adults. As shown in Table (2), data indicated that the weight of larvae and pupae was less than of the control and most of the adults emergence were

failed and dead. Data also proved that the cotton seed oil was more effective than safflower oil to the treated individuals of *P. gossypiella*.

Generally, there was positive correlation between the efficiency of the insecticidal concentrations of both tested oils and the larval and pupal mortality of *P. gossypiella* as well as the larval weight. Moreover, both oils were more effective on *P. gossypiella* than on *E. insulana*.

Table (2). Insecticidal efficiency of two plant oils against *Pectinophora gossypiella*.

Treatments	Conc. (%)	Larval mortality (%)	Larval weight (mg)	Pupal mortality (%)	Pupal weight (mg)	Adult mortality (%)
Cotton seed oil	5	98	0.0201	90	0.0393	100
		90	0.0129	89	0.0270	100
		95	0.0138	85	0.0200	100
		90	0.0222	90	0.303	100
	3	78	0.0139	80	0.0321	100
		85	0.0220	78	0.0250	100
		98	0.0211	77	0.0360	100
		87	0.0230	80	0.0398	100
	1.5	72	0.0260	80	0.0338	100
		80	0.0251	76	0.0261	100
		72	0.0223	80	0.0320	100
		79	0.0135	79	0.0271	100
Safflower oil	5	90	0.0221	100	0.0211	100
		88	0.0179	97	0.0271	100
		97	0.0239	100	0.0189	100
		98	0.0255	95	0.0252	100
	3	90	0.0289	90	0.0358	100
		93	0.0277	90	0.0206	100
		80	0.0195	88	0.0280	100
		80	0.0330	89	0.0255	100
	1.5	78	0.0232	80	0.0355	100
		72	0.0288	78	0.0338	100
		75	0.0266	80	0.0359	100
		69	0.0279	79	0.0266	100
Control	-	0.0	0.0357	0.0	0.0399	0.0
			0.0400		0.0450	
			0.0369		0.0389	
			0.0440		0.0485	

These data are in agreement with Rodriguez-Saona *et al.* (1998) who used avocado idioblast oil against *Spodoptera exigua* and proved toxic and growth inhibitory effects. Also, data are in agreement with Pacheco *et al.* (1995) who registered efficacy of soybean and castor oils in controlling *Callosobruchus maculatus* and *C. phaseoli* and proved that both oils inhibits population growth. The present data are in agreement with Khaire *et al.* (1992) who studied the efficacy of different vegetable oils, as sunflower, castor, mustard, safflower, palm, groundnut, sesame, neem, karanj and maize oils against *Callosobruchus chinensis*, and reported that these oils proved insecticidal effects against the treated insects.

Effect of the two plant oils, cotton seed and safflower oils on the total protein of the treated *E. insulana* insects :

Data summarized in Table (3) indicated that the cotton seed oil and safflower oil had effect on the total protein of *E. insulana*. The data revealed that both oils reduced the amount of the soluble protein in the treated individuals than the control. The mean of total protein in the treated insects with cotton seed oil was 0.554 protein (mg/gm body weight), and 0.746 mg/gm for safflower oil; whereas, the total soluble protein in control was 1.240 mg/gm body weight. The reduction percentage in the total protein was 55.323 % and 39.839 % for cotton seed oil and safflower oil, respectively as compared with control. In general, the cotton seed oil was more effective in reducing the total protein of *E. insulana* individuals than the safflower oil.

Table (3). Effect of two plant oils on the total protein of treated insects of *E. insulana*.

Treatments	Rep.	Amount of total soluble protein (mg/gm)	% Decrease
Cotton seed oil	1	0.499	58.382
	2	0.587	54.319
	3	0.576	53.398
	Mean	0.554	55.323
Safflower oil	1	0.538	55.129
	2	1.000	22.179
	3	0.701	43.285
	Mean	0.746	39.938
Control	1	1.199	-
	2	1.285	-
	3	1.236	-
	Mean	1.240	-

Effect of the two plant oils, cotton seed and safflower oils on the total protein of the treated *P. gossypiella* insects :

Data in Table (4) indicated that cotton seed and safflower oils had effect on the total protein of *P. gossypiella*. The data revealed that both oils reduced the amount of the soluble protein in the treated individuals than the control. The mean of total protein in the treated insects with cotton seed oil was 0.501 protein (mg/gm body weight), and 0.652 mg/gm for safflower oil; whereas, the total soluble protein in control was 1.20 mg/gm body weight. The reduction percentage in the total protein was 58.25 % and 45.667 % for cotton seed oil and safflower oil, respectively as compared with control.

Generally, data in Tables (3 & 4) proved that the cotton seed oil was more effective in reducing the total protein in the treated insects than the safflower oil. Also, *P. gossypiella* was more susceptible for both the two tested oils than *E. insulana*. These data, also, are in agreement with Srivastava and Krishna (1992), who used Eucalyptus oil against *Dysdercus koenigii*, and proved that the oil resulted a reduction in the total protein of the treated insects.

Table (4). Effect of two plant oils on the total protein of treated insects of *P. gossypiella*.

Treatments	Rep.	Amount of total soluble protein (mg/gm)	% Decrease
Cotton seed oil	1	0.493	57.863
	2	0.510	58.333
	3	0.500	58.541
	Mean	0.501	58.25
Safflower oil	1	0.598	48.889
	2	0.689	43.709
	3	0.668	44.610
	Mean	0.652	45.667
Control	1	1.170	-
	2	1.224	-
	3	1.206	-
	Mean	1.20	-

Effect of the two plant oils, cotton seed and safflower oils on the lipid content of the treated *E. insulana* insects :

Data in Table (5) indicated that the cotton seed oil and safflower oil had effect on the lipid contents of *E. insulana*. The data revealed that both oils reduced the amount of the lipid content in the treated individuals than the control. The mean of lipid content in the treated insects with cotton seed and safflower oils were 18.608 %, and 26.991 %, respectively. Whereas, the lipid content in control was 44.319 %. These data indicated that both oils affected the treated insects and decrease the lipid contents as effect on the metabolism in the treated insects.

Table (5). Effect of two plant oils on the lipid content of treated insects of *E. insulana*.

Treatments	Rep.	Sample weight (mg)	content	% Lipid content
Cotton seed oil	1	0.598	0.103	17.224
	2	0.699	0.151	21.602
	3	0.687	0.115	16.740
	Mean	0.661	0.123	18.608
Safflower oil	1	0.791	0.211	26.688
	2	0.683	0.189	27.701
	3	0.760	0.204	26.908
	Mean	0.7447	0.201	26.991
Control	1	1.243	0.546	43.926
	2	0.995	0.462	46.432
	3	1.221	0.524	42.916
	Mean	1.153	0.511	44.319

Effect of the two plant oils, cotton seed and safflower on the lipid content of the treated *P. gossypiella* insects :

Data in Table (6) indicated that the cotton seed and safflower oils had effect on the lipid contents of *P. gossypiella*. The data revealed that both oils reduced the amount of the lipid content in the treated individuals than the control. The mean of lipid contents in the treated insects with cotton seed and safflower oils were 8.571 %, and 16.654 %; whereas, the lipid content in control was 23.58 %. These data indicated that both oils affected the treated insects and decrease the lipid contents as effect on the metabolism in the treated insects.

Generally, data in Tables (5 & 6) proved that *P. gossypiella* was more susceptible for both the two tested oils than *E. insulana*; and cotton seed oil was more effective than safflower oil for the both insects, *E. insulana* and *P. gossypiella*. These data are in agreement with Srivastava and Krishna (1992), who used Eucalyptus oil against *Dysdercus koenigii*, and proved that the oil resulted a reduction in total lipids in the haemolymph and fat body in the treated insects.

Table (6). Effect of two plant oils on the lipid content of treated insects of *P. gossypiella*.

Treatments	Rep.	Sample weight (mg)	content	% Lipid content
Cotton seed oil	1	0.402	0.0311	77.36
	2	0.397	0.0250	6.297
	3	0.440	0.0501	11.386
	Mean	0.413	0.0354	8.571
Safflower oil	1	0.499	0.088	17.635
	2	0.630	0.101	16.032
	3	0.558	0.092	16.488
	Mean	0.562	0.0936	16.654
Control	1	0.94	0.205	21.809
	2	1.120	0.301	26.875
	3	1.04	0.220	21.154
	Mean	1.026	0.242	23.58

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تأثير إثنين من الزيوت النباتية كمبيدات حشرية على دودة اللوز الشوكية ودودة اللوز القرنفلية (حشرية الأجنحة)

عادل محمد حنفي عزب، أميره محمد رشاد و صفاء على
معهد بحوث وقاية النباتات، مركز البحوث الزراعية، الدقى - الجيزة.

تم إجراء تقييم معملي لإختبار تأثير إثنين من الزيوت النباتية (زيت بذرة القطن، زيت بذرة القرطم) كمبيدات حشرية على كل من دودة اللوز الشوكية ودودة اللوز القرنفلية وذلك باستخدام تركيزات مختلفة من كلا الزيتين. وجد أن كلا النوعين من الزيوت كان له تأثير كمبيد حشرى على الحشرتين. وقد أظهرت النتائج حدوث خفض كبير فى نمو المجموع الحشرى ووزن اليرقات والفراشات الكاملة عن مثيلتها فى المقارنة (بدون معاملة). وكان زيت بذرة القطن أكثر تأثيراً على كلا الحشرتين عن زيت بذرة القرطم. ومن جهة أخرى، كانت دودة اللوز القرنفلية أكثر حساسية لفعل نوعى الزيت عن دودة اللوز الشوكية. كما تسبب كلا الزيتين فى إحداث خفض فى كمية البيروتين السائل وكذلك المحتوى من الدهون فى الحشرات المعاملة. وقد وجد أن كلا الحشرتين كانتا أكثر حساسية لزيت بذرة القطن عن زيت بذرة القرطم.