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TIME OF SPRAYING SOME NATURAL OILS AS A LIMITING FACTOR FOR CONTROLLING COTTON BOLLWORM, *PECTINOPHORA GOSSYPIELLA* (SAUNDERS)

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Abstract

Laboratory studies were directed to clarify the efficacy of Solar oil E.C., CAPL-2 and Jojoba oil E.C. on newly hatched larvae of *P.gossypiella* susceptible and Cyanox-resistant strains. Results show that Solar and CAPL-2 gave the highest effect and that susceptible strain was more affected than the resistant one.

Moreover, field experiments were carried out during 1997 & 1998 cotton seasons on cotton at Sharkia governorate to evaluate the performance of some natural oils for controlling cotton bollworms, i.e. Solar oil E.C., CAPL-2, and plant oil Jojoba E.C. These oils were sprayed in biweekly schedule during two successive seasons. Two and three sprays were applied in 1997 and 1998, respectively. Results obtained show that the second and third spray gave the highest insecticidal efficiency, as it was applied during the appearance of a new generation. Solar oil gave the highest reduction in population followed by CAPL-2 and Jojoba oil E.C.

INTRODUCTION

The rising consumption of currently used insecticides in developing countries has led to a number of problems such as insect resistance, environmental pollution and the health hazards associated with pesticide residues. These facts have stimulated considerable interest to mineral and plant oils as alternatives to pesticides. Lukefahr & Griffin (1962), Noble (1969), mentioned that larvae began hatching about 8 a.m. and continued for 2-3 hour period. Newly hatched larvae entered fruiting forms within 30 minutes. Therefore, it could be expected that the proper time of controlling this pest is during egg stage and neonate. Mineral oils have efficient results against scale insects and mites (El-Sisi, 1981), aphids (El-Sisi and El-Hariry, 1989), eggs and newly hatched larvae of PBW in laboratory experiments (Hewady *et al.*, 1993) and also against cotton leafworm (Badr *et al.*, 1995). Therefore, the present study was conducted to investi-

gate the insecticidal activities of safe and cheap mineral and plant oils against pink bollworm larvae of susceptible and resistant strains in the laboratory and that infest cotton plants. Also, their role in addition to reduction the insect population and the proper time of spraying was also considered throughout the present investigation.

MATERIALS AND METHODS

1. Mineral oils: Two grades of petroleum oils: light medium (Solar) and medium (lubrication oils) produced by El-Aameria Co. for Petroleum Refining, Alex., prepared as emulsifiable concentrates by A.G. El-Sisi, Central Agricultural Pesticides Laboratory, Agric. Res. Center were obtained as:

1. Crude solar oil E.C., named as Solar E.C.

2. Lubrication oil E.C., named as CAPL-2 (CAPL = first letters of Central Agricultural Pesticides Laboratory).

2. Plant oils: Jojoba oil E.C.: It was produced by Egyptian Natural Oil Co., Egypt under the name ENCO-1 contains 96% Jojoba oil.

3. Evaluation of the tested material against pink bollworm

3.1 Laboratory evaluation against newly hatched larvae of susceptible and Cyanox - resistant strain:

3.1.1. Source of insects: The susceptible or laboratory strain has been maintained for several years in the laboratory, while Cyanox resistant strain was selected from a field strain for 42 generations (Rofail *et al.*, 1995). The resistance ratio for Cyanox was 37 fold.

3.1.2. Testing procedure: Serial aqueous concentrations of each oil formulation were prepared. Six concentrations were used for each oil. Each concentration was sprayed in Petri dishes (9 cm diameter) containing 4g of artificial diet previously described by Rashad and Ammar (1985), using hand atomizer. The Petri-dishes were left to dry and in each one 10 newly hatched larvae of pink bollworm were placed on the surface media. Three replicates were used for each concentration. The same procedure was done for the susceptible and Cyanox-resistant strain. Mortality percentages were determined after 48 hrs. The alive larvae were tranferred individually to untreated artificial diet poured into (7.5 x 2.0 cm) glass tubes. Therefore, treated and untreated

check larvae were incubated at 27±1°C and 80±5% R.H. Mortality was recorded after 7 and 14 days. LC_{50} and slope values of mortality errors were statistically calculated through a Proban Software computer program.

3.2. Field evaluation on cotton plants: Field experiments were conducted during 1997 and 1998 cotton growing season at El-Ibrahimyia district, Sharkia governorate to determine the efficiency of Solar, CAPL-2 (mineral oils) and Jojoba (plant oil) treatments against PBW, *P.gossypiella* infesting cotton plants. All tested formulated oils were sprayed two times in 1997 and three times in 1998 on cotton plants every 2 weeks at 2nd, 16th and 31st August, using a knapsack motor sprayer at ratio of 3 liter/feddan, each treatment was replicated 3 times, and each has an area of 350 m^2. Randomized samples of green cotton bolls (25 bolls for each sample) were collected just before the beginning of spray and after 7 & 14 days of each spray. The cotton bolls were examined and dissected to estimate infestation percentage of PBW of each treatment. Reduction percentage was calculated according to Hinderson and Tilton equation (1955).

RESULTS AND DISCUSSION

A. Laboratory Evaluation

Data in Table 1show the mortality percentage and slope of the newly hatched larvae of pink bollworm susceptible and Cyanox-resistant strain treated with Solar, CAPL-2 and Jojoba. It appears that Solar and CAPL-2 gave the highest effect. However, the susceptible strain was more affected than resistant one. The LC_{50}, after 7 days of application were 2790.2, 4864.87 and 4312.61 ppm for Solar, CAPL-2 and Jojoba, respectively in the susceptible strain. On the other hand, there were 9011.1, 12035.65 and 11455.94 ppm for the resistant strain.

Moreover, results show a residual effect after 14 days of application for Solar and CAPL-2. The LC_{50}s were 8058.07 and 11675.87 ppm, respectively in susceptible strain. For the resistant Cyanox strain, the LC_{50} were 4634.60 and 3981.55 ppm for CAPL-2 and Jojoba, respectively.

These results agree with the finding of Hewady *et al.* (1993) who reported that Solar showed the highest effect against eggs and newly hatched larvae of PBW and SPW.

Table 1. Insecticidal effect of the tested formulations against susceptible and resistant strains.

Treatment	2 days		7 days		14 days	
	LC_{50} (ppm)	Slope	LC_{50} (ppm)	Slope	LC_{50} (ppm)	Slope
Susceptible strain						
Solar	2823.66 1932.12-3725.91	2.026	2790.200 1944.52-3644.40	2.134	2790.200 1944.52-3644.40	2.134
CAPL-2	5697.285 4504.74-7167.35	2.477	4864.867 3661.63-6305.57	2.05	4634-606 3528.35-5934.93	2.193
Jojoba	9515.446 6442.32-16154.36	1.257	4312.614 3147.245-5655.936	1.938	3981.558 2781.963-5328.55	1.775
Cyanox-resistant strain						
Solar	13545.70 9776.40-19042.57	1.6013	9011.10 6457.55-12011.43	1.799	8058.07 6131.02-10234.30	2.309
CAPL-2	16330.807 11860.751-23639.426	1.5875	12035.659 8621.831-16688.971	1.641	11675.874 8408.28-16030.555	1.657
Jojoba	30296.22 23866.84-41588.35	2.540	11455.94 7818.30-16443.44	1.43	11455.94 7818.30-16443.44	1.43

B. Field Evaluation

Field experiments were carried out at El-Ibrahimyia, Sharkia governorate during two successive cotton seasons of 1997 and 1998, to evaluate the effect of Solar E.C., CAPL-2 E.C. and Jojoba oil against PBW, *P.gossypiella* infested green cotton bolls, Tables 2 & 3.

Results show that Solar E.C. gave highest effect followed by CAPL-2 E.C. and Jojoba at the second spray in 1997 and 2nd and 3rd spray in 1998. The respective values of reduction percentages were 33.5, 24.9 and -7.8 in 1997 season, while there were 47.7, 30.9 and 26.0 in 1998 season. These results are in agreement with laboratory experiments. On the other hand, 1st spray in 1997 cotton season with CAPL-2 show a remarkable reduction effect, it was 61%; meanwhile in 1998 cotton season, the three formulations did not show any remarkable effect compared with untreated check. Correlation between treatment and infestation clearly show that the second spray in 1998 was carried out at the beginning of a new generation of PBW larvae; therefore it gave high effect than the first one.

Finally, our results indicated that the best time to reduce this pest using the previous mentioned oils is determined by the beginning of new generation represented in eggs and newly hatched larvae.

Table 2. Effect of tested formulations on PBW infested green cotton bolls in 1997 cotton season.

Treatment	% Inf. before spray	Infestation and reduction percent at indicated days post treatment											
		First spray				Mean		Second spray				Mean	
		7 days		14 days				7 days		14 days			
		Inf.	Red.	Inf.	Red.	Inf.	Red.	Inf.	Red.	Inf.	Red.	Inf.	Red.
Solar E.C.	4.7	0.7	32.8	12.7	18.9	6.7	20.1	7.3	12.9	10.0	43.7	8.7	33.5
CAPL-2 E.C.	6.7	0.7	52.9	8.7	61.0	4.7	60.6	12.0	-0.4	16.0	36.8	14.0	24.9
Jojoba E.C.	4.0	0.7	21.11	6.7	49.8	3.7	48.1	10.0	-40.2	14.0	7.5	12.0	-7.98
Untreated	6.0	1.33	-	20.	-	10.7	-	10.7	-	22.7	-	16.7	-

Inf. : Infestation percent
Red. : Reduction percent

Table 3. Effect of tested formulations on PBW infested green cotton bolls in 1998 cotton season.

Treatment	% Inf. before spray	Infestation and reduction percent at indicated days post treatment																	
		First spray				Mean		Second spray				Mean		Third spray				Mean	
		7 days		14 days				7 days		14 days				7 days		14 days			
		Inf.	Red.	Inf.	Red.	Inf.	Red.	Inf.	Red.	Inf.	Red.	Inf.	Red.	Inf.	Red.	Inf.	Red.	Inf.	Red.
Solar E.C.	13.3	13.3	-10.0	12.0	-12.0	12.7	-11	8.0	50.0	10.7	46.5	9.4	47.7	9.3	41.8	20.0	20.9	14.7	28.9
CAPL-2 E.C.	10.7	9.3	3.7	9.3	-8.0	9.3	-1	10.7	16.9	9.3	42.2	10.0	30.9	9.3	27.7	18.7	8.1	14.0	15.9
Jojoba E.C.	10.7	10.7	-10.8	6.7	22.2	8.7	5	12.0	6.7	9.3	42.2	10.7	26.0	12.0	6.7	22.7	-11.5	17.4	-4.5
Untreated	13.3	12.0	-	10.7	-	11.4	-	16.0	-	20.0	-	18.0	-	16.0	-	25.3	-	20.7	-

Inf. : Infestation percent
Red. : Reduction percent

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توقيت رش بعض الزيوت الطبيعية كعامل محدد لمكافحة ديدان اللوز القرنفلية

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صممت التجارب المعملية لدراسة كفاءة الزيوت المعدنية : زيت السولار القابل للاستحلاب ، زيت كابل -٢ ، بالإضافة إلي الزيت النباتي جوجوبا القابل للاستحلاب علي الفقس الحديث للسلالتين الحساسة والمقاومة للسيانوكس (٣٧ مرة) لديدان اللوز القرنفلية.

أوضحت النتائج المتحصل عليها أن زيت السولار، كابل - ٢ أعطيا أعلي تأثير وأن السلالة الحساسة كانت أكثر تأثرا من السلالة المقاومة.

بالإضافة إلي ما سبق نفذت التجارب الحقلية أثناء موسمي ١٩٩٧ ، ١٩٩٨ علي محصول القطن في محافظة الشرقية لتقييم هذه المواد في خفض الإصابة بديدان اللوز القرنفلية والتي تم رشها مرتين وثلاث مرات في موسمي ١٩٩٧ و ١٩٩٨ علي التوالي، حيث كانت المدة بين الرشة والتالية لها أسبوعين في كلا الموسمين. أوضحت النتائج المتحصل عليها أن الرشة الثانية والثالثة أعطيتا أعلي كفاءة إبادية حيث تم تطبيقهما أثناء ظهور جيل جديد من ديدان اللوز القرنفلية. وأعطي زيت السولار أعلي خفض في الإصابة ببرقات دودة اللوز القرنفلية متبوعا بزيت كابل - ٢ ثم الجوجوبا القابل للاستحلاب.