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EFFICIENCY OF SOME BOTANICAL OIL FORMULATIONS AND A BIO-INSECTICIDE AGAINST PINK AND SPINY BOLLWORMS

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ABSTRACT

Laboratory experiments were carried out to study the efficiency of four oil formulations (azadirachtin) containing Nimbicidine EC 0.03% Azadirachtin, e-codaneem (0.3% Azadirachtin), Neem oil 0.0258% a commercial neem-based pesticide oils, Azadiracht (2.66-2.78%) crude oil extracted from seeds of *Melia azadirachtin* along with a bio-insecticide Emamectin benzoate (Radiacal 0.5 % EC produced by the soil microorganism, *Streptomyces avermitis* were investigated on PBW *Pectinophora gossypiella* (Saund) &SBW *Earias insulana* (Boisd.) through exposure of laboratory strain eggs .Results indicated that Nimbicidine oil proved to be the most effective in inhibiting egg hatching in both PBW & SBW where LC_{50} recorded (0.1077&0.2512 ppm, respectively) followed by e-codaneem , Azadiracht , Radical 0.5%, while Neem was the least effective (LC_{50} recorded 10.6787 &12.0088ppm, respectively). The author concluded that either Nimbicidine oil or e-codaneem oil could be an excellent fit into IPM/ICM programs of PBW and/or SBW eggs on cotton plants by the Ministry of Agriculture after successful field experiments.

Keywords: PBW; *Pectinophora gossypiella; SBW; Earias insulana;* plant extracts,bio-insecticide; ovicidal activity.

INTRODUCTION

The pink and spiny bollworms are considered the most destructive insect pests in Egypt that cause significant economic losses in both quantity and quality of cotton yield. During the last and resent years, control of bollworms by traditional insecticides was necessary to reduce population levels. Intensive use of insecticides resulted development of insecticide tolerance or resistance, environmental pollution, damage to beneficial organisms. For this reasons it is necessary to introduce other new insecticides that are effective, safer for human and ecosystem (Reddy and Manjunath 1999; Ravi *et al.*, 2008). Many authors are interested in the application of natural products as a factor to complement chemical control or as component of Pest Management which act as antifeedants, oviposition deterrents, larvicidal and insect growth regulators (Shalaby et *al.*,1997 ; Shalaby and Rashad ,2007and Vasantharaj David, 2008) as well as effective against plant pathogens (Harborne, 1988). Moreover, botanicals are preferred over other methods since they are easily available, biodegradable and least toxic to non -target organisms (Wink& Guo, 1995 and Ewete *et al.* 1996).

Noble (1969) reported that Incubation period of PBW eggs lasts 4-5days. Lukefahr &Griffin (1962), Khalifa (1967) and Noble (1969), mentioned that larvae of PBW began hatching about 8 a.m. and continued for 2-3 hour period. Newly hatched larvae entered fruiting forms within 30 minutes. On the

other hand, Matthews (1989) reported that SBW laid its eggs anywhere on cotton plants especially young shoots then the larvae move around the plant and damage several buds or bolls. Incubation period of SBW eggs lasts 3-4days. Therefore, it could be expected that the proper time of controlling these pests is during egg stage and neonate.

The goal of the present investigation is to study the ovicidal effect of four botanical oil formulations (Neem formulations) and a bio-insecticide produced by the soil microorganism *Streptomyces avermitis* on eggs of *P. gossypiella* and *E. insulana* under laboratory condition.

MATERIALS AND METHODS

The eggs of *P. gossypiella* (Saund.) and *Earias insulana* (Boisd.) used in this study obtained from laboratory strains established in the Bollworms Department, Plant Protection Research Institute, Dokki, Giza. These strains have been mass reared for several generations on semi artificial diet (Rashad and Ammar, 1985) under laboratory conditions without exposure to insecticides under constant laboratory conditions of 26±1° C and 75±5 % RH

Experimental Insecticides

Four botanical insecticides (exhibit multiple modes of action. It acts as an antifeedant, repellent, oviposition deterrent, insect growth regulator and sterilant) and a bio- insecticide Emamectin benzoate were used in the present study where it obtained from their respective manufacturers:

1- Nimbicidine EC 0.03% Azadirachtin, Osho, Chemical Industries LTD. Botanical and other terpinoids in the ratio as occur naturally in Neem.

2- e-codaneem (0.3% Azadirachtin) : Neem oil extract (biodegradable product 30.9% p/p) acts effectively against insects without creating resistances. Produced by Sustainable Agro Solutions (SAS), Spain.

3- Neem oil 0.0258% Azadirachtin (crude oil extracted from seeds of *Melia azadirachtin*).

4- Azadiracht 2.66-2.78% (crude oil extracted from seeds of *Melia azadirachtin* as described by Shalaby *et al.* 1997)

5- Emamectin benzoate 0.5% EC (Radical 0.5%), is a bio-insecticide produced by the soil microorganism, *Streptomyces* ***avermitilis***. Widely used in controlling lepidopterous pests on vegetables, brassicas and cotton, at up to 16 g/ha, purchased from Syngenta chemical company.

Treatment of Eggs:

To assess the ovicidal efficacy of the tested compounds, different concentrations were prepared ranged as shown in Tables (1&2).

The eggs of PBW &SBW used in the experiments were freshly laid eggs (1-day old) on paper discs and/or muslin cloth. The dipping technique was adopted, where paper discs and/or muslin cloth were dipped for 15 seconds in one of the prepared concentrations. The treated discs were left to dry naturally for approximately 15 minutes at room temperature and then kept

in glass tubes (3x10 cm) capped with cotton stoppers and incubated at 26± 1°C and 75± 5% RH. The control one was dipped in water and left to dry. Three replicates were maintained for each concentration with approximately 150 eggs/ concentration/treatment/species and also for the untreated check (control).Hatchability was recorded after two to four days for each treated eggs/treatment and corrected against those of the control by using Abbott's formula. Probit analysis was determined to calculate LC50& LC90 and slope values of the tested compounds (Finney, 1971), through software computer program. Number of eggs hatched in control and treatments were recorded and the percentage of ovicidal activity was calculated .Egg hatching inhibition was calculated as the percentage of unhatched eggs. The percentage of unhatched eggs in control experiments was adjusted with treatments by using Abbott's formula (Abbott, 1925). Control experiments with more than 20% egg mortality were discarded.

RESULTS AND DISCUSSION

The present investigation summarized in Tables 1 &2 and Fig.1&2 revealed that all the tested compounds exhibited ovicidal activity as non-traditional insecticides against PBW and SBW. Estimated LC50 against PBW revealed 0.1077, 3.5024, 10.6787, 4.2375 and 5.0547 ppm for Nimbicidine, e-codaneem, Neem oil, Azadiracht and Emamectin benzoate, respectively. In the other hand the respective estimated LC50 against SBW revealed 0.2512, 2.5123, 12.0088, 3.0970 and8.3112.Significant ovicidal activity was noticed in Nimmbecidine against both PBW & SBW (LC50 recorded 0.1077&0.2512 ppm, respectively. Neem exhibited the least LC50 value (10.6787&12.0088 ppm) for the two experimental species, respectively. The variance between the tested compounds could be explained by the differences in their physical properties. Enslee and Riddiford (1997) suggested that the failure of egg to hatch could be attributed to incomplete blastokinesis and abnormal breakage of extra embryonic membranes in the embryo. Schmutterer (1990) pointed out that egg hatchability was reduced by neem substances.

Table (1): Comparative toxicity of some pesticides formulations against fresh eggs of *P. gossypiella*.

Treatment	Conceentration rang(ppm)	LC_{50} (ppm)	LC_{90} (ppm)	Confidence limits for LC_{50}		Slope ± S.D.	Toxicity index %*	
				Lower	Upper		LC_{50}	LC_{90}
Nimmbecidine	0.0469-1.5	0.1077	0.7278	0.0960	0.1209	1.5427±0.0753	100	100
e-combecidine	0.4688-15.0	3.5024	66.1846	3.0103	4.0749	1.0028±0.0665	3.075	1.1
Neem	1.6125-51.0	10.6787	142.7256	9.2817	12.2858	1.1368±0.0707	1.009	0.51
Azadiracht 2.66-2.78%	0.8500-27.20	4.2375	67.0023	3.6563	4.9110	1.0676±0.0692	2.542	1.086
Radical 0.5%	0.3125-10.00	5.0547	59.3587	4.2056	6.0752	1.1965±0.0846	2.131	1.226

$$\text{Toxicity index (Sun, 1950)} = \frac{LC_{50} \text{ or } LC_{90} \text{ of the efficient compound}}{LC_{50} \text{ or } LC_{90} \text{ of other compound}} \times 100$$

Table (2): Comparative toxicity of some pesticides formulations against fresh eggs of *E. insulana*.

Treatment	Conceentration rang(ppm)	LC_{50} (ppm)	LC_{90} (ppm)	Confidence limits for LC_{50}		Slope ± S.D.	Toxicity index %	
Nimmbecidine	0.0469-1.5	0.2512	2.8221	0.2071	0.3048	1.2185±0.1068	100	100
e-combecidine	0.4688-15.0	2.5123	28.2207	2.0709	3.0477	1.2185±0.1068	9.999	10.0
Neem	1.6125-51.0	12.0088	95.6135	10.3089	13.9891	1.4206±0.0985	2.092	2.952
Azadiracht 2.66-2.78%	0.8500-27.20	3.0970	35.1715	3.0970	4.3041	1.3011±0.0965	8.111	91.124
Radical 0.5%	0.3125-10.00	8.3112	138.1972	5.9639	11.5824	1.0485±0.0977	3.022	2.042

$$\text{Toxicity index (Sun, 1950)} = \frac{LC_{50} \text{ or } LC_{90} \text{ of the efficient compound}}{LC_{50} \text{ or } LC_{90} \text{ of other compound}} \times 100$$

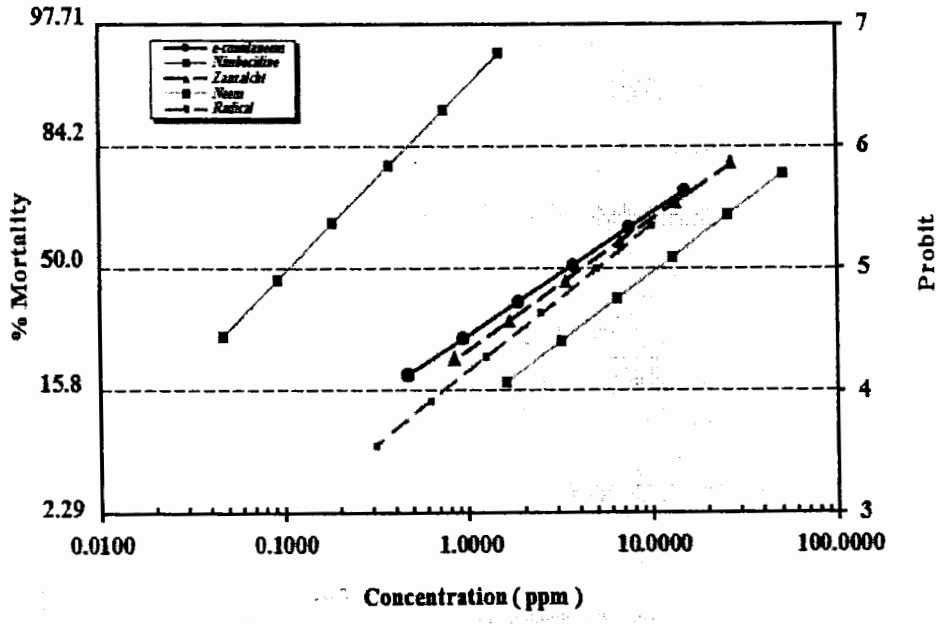

Fig. (1) : Ldp line of *Pectinophora gossypiella* (S.) laboratory strain fresh eggs responded to 4 Botanical oil formulations and Emamectin benzoate.

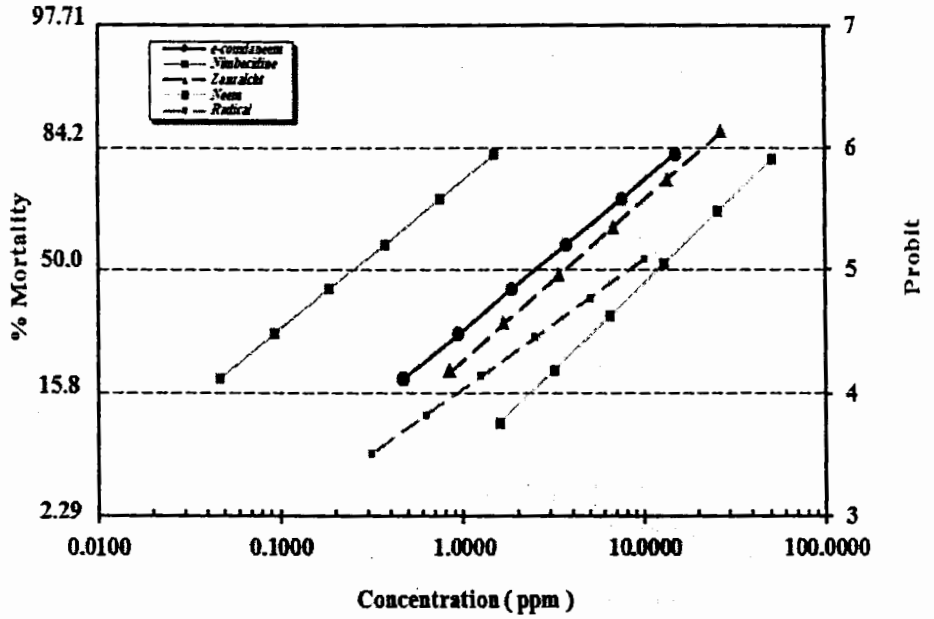

Fig. (2) : Ldp line of *Earias insulana* (Boisd.) laboratory strain fresh eggs responded to 4 Botanical oil formulations and Emamectin benzoate.

Generally, all the tested compounds are considered effective against PBW & SBW fresh eggs but either Nimbicidine oil or e-codaneem oil could be an excellent fit into IPM/ICM programs of PBW and/or SBW eggs on cotton plants by the Ministry of Agriculture after successful field experiments. More experimental efforts are needed to determine the larvicidal activity of the same compounds against newly hatched larvae of pink & spiny bollworms and their latent effects in biological aspects with biochemical studies.

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دراسة تأثير بعض المستخلصات والزيوت الطبيعية والمركبات الحيوية على بيض ديدان اللوز القرنفلية والشوكية

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فى اختبار تجريبى تحت الظروف المعملية لاربع مستحضرات طبيعية من الأزيراختين " نيمبسيدين ٣% ،ايكودانيم ٣% ، زيت نيم ٠,٠٢٥٨% ، مستخلص زيت بذرة الأزاديراخت (الزنزالخت) ٢,٦٦- ٢,٧٨ % بالإضافة لمستحضر راديكال ٠,٥% " لتقييم تأثيرها على بيض ديدان اللوز القرنفلية والشوكية أظهرت النتائج ان مستحضر زيت نيمبسيدين كان اكثر تأثيراً فى تثبيط الفقس لبيض كل من القرنفلية والشوكية وسجلت الجرعة النصفية المثبطة ٠،١٠٧٧ و ٠،٢٥١٢ جزء فى المليون على التوالى تبعها ايكودانيم، مستخلص زيت بذرة الأزاديراخت ، راديكال ، زيت نيم مسجلة جرعة نصفية مثبطة على التوالى ٢،٥١٢٣ و ٣،٠٩٧٠ و ٨،٣١١٢ و ١٢،٠٠٨٨ جزء فى المليون مما يشير بأهمية إدخال المستحضرات وخاصة مركبى نيمبسيدين ،ايكودانيم ضمن برامج المكافحة المتكاملة لديدان اللوز .