MANSOURA JOURNAL OF BIOLOGY
Official Journal of Faculty of Science, Mansoura University, Egypt
E-mail: scimag@mans.edu.eg ISSN: 2974-492X

Efficiency of some compounds for controlling the cotton leaf worm, *spodoptera littoralis* (boisd.)

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Received:4/2/2019
Accepted: 1/3/2019

Abstract: The study aims to evaluate the bioactivity of a plant extract, *Citrullus colocynthis* and commercial active ingredients from plant origin (thymol and camphor) comparing with Agron 10% on 2nd instar larvae of the cotton leaf worm, *Spodoptera littoralis* (Boisd). Also, LC_{50} of each treatment was established against 2nd instar larvae of *S. littoralis* and malformations were noticed specially for larvae treated with the tested plant extract and the plant active ingredients, the malformations include shrinkage in treated larval size, pale in colours and harding in larval body. The obtained results reveal that Agron 10% was more effective than other materials since it recorded (LC_{50} 0.705 ppm). However, camphor was the most effective material from plant origin for controlling 2nd instar larvae of cotton leafworm with LC_{50} 2257.16 ppm followed by Citrullus plant extract with LC_{50} 2325.72 ppm then thymol with LC_{50} 5523.28 ppm..

Key words: *Spodoptera littoralis*, camphor, thymol, *Citrullus colocynthis*, Agron 10%, biological effects.

1-introduction

Egyptian cotton leaf worm, *Spodoptera littoralis* (Boisd) (Lepidoptera: Noctuidae) is one of the key pests that cause great damage to cotton plants as well as other field and vegetables crops. The widespread and continuously increasing use of different types of nonselective pesticides in cotton fields in Egypt and elsewhere disturb the biological balance and cause insect resistance **[1]** and **[2]**

The pesticides caused many environmental problems. Thus, on the one hand, one needs to search the new highly selective and biodegradable to solve the problem of long term toxicity to mammals and, on the other hand, one must study the environmental friendly pesticides and develop techniques that can be used to maintain crop yields. Natural insecticides are one of alternatives to chemical insecticides, which is regarded as safer, cheaper and useful control agents **[3]**and **[4].**

Citrullus colocynthis (L.) Schrad. (Cucurbitaceae), commonly known as bitter apple or wild gourd. It is the fruit of cucurbitaceae plant *C. colocynthis*, distributing in desert and semiarid areas of Africa, the Mediterranean region and Western Asia **[5]**.

Camphor extract is a natural material derived from the camphor tree, *Eucalyptus comaldulensis* was used as a moth repellent **[6]**. It is a repellent to four species of stored-products beetles (*Sitophilus granaries, S. zeamais, Trilobium castaneum, Prostephanus truncatus*) **[7]** and it is a feeding deterrent for the tobacco budworm (*Heliothis virescens*) (Lepidoptera) and the boll weevil (*Anthonomus grandis*)**[8].[9]**, studied the effect of *E. globulus* leaves oil or camphor against the maturation of *Oestrus ovis* larvae . Camphor at concentrations 10000 ppm and 11000 ppm showed 100% mortality rate .On the other hand 27.5% of the developed pupae emerged to adults but only 36.8% of them were fertile . Camphor is safely used in Medical application.

Thymol extract in a natural compound extracted from Thymus vulgaris. Thymol has

repellent activity against stored product pests (Karamaouna et al., 2013).

Flufenoxuron (Agron10%) is an insecticide like white crystalline powder that follows benzoylurea group. It is insoluble in water, not flammable, and not an oxidizer **[10].**

The objective of this research was to assess the effect of some plant materials comparing with Agron10% against 1_{ry} 2^{nd} instar larvae of cotton leafworm, *S. littoralis*.

2-MATERIALS AND METHODS

2-1: Tested laboratory:

A laboratory strain of cotton leafworm, *S. littoralis* (Lepidoptera: Noctuidae) (maintained on above 30 generations) which was initiated from freshly collected egg-masses supplied from the divided of cotton leafworm of Plant Protection Research Institute (PPRI), Dokki, Egypt. Larval stages were reared on castor leaves, which were provided daily, in laboratory under constant conditions of 27±2^{o}C, photoperiod of 14 h light and 10 h dark and 65±5% R.H. The adults were kept separately and mated on the third day of emergence in clean jars adults were fed on 10% sugar solution, fresh green leaves of tafla, *Nerium oleander* (L.) were provided for egg laying.

2-2: Tested plants active ingredients:

In this study use some compounds for controlling cotton leafworm, *S. littoralis* the compounds are :

Citrullus colocynthis (as plant extract).

Camphor and thymol (as active ingredient) .

Agron 10% (as insecticide).

2-3: Preparation of plant samples and extraction of Citrullus plant:

To prepare the plant extract of fruits of Citrullus, plants were left to dry at room temperature for one month then they were grinded into fine powder. Powder of each plant was soaked in a mixture of petrolemether, acetone and ethanol solvents of equal proportion (1:1:1) in a flask for about one week.

Finally, the flask was shaked in a shaker and its contents was filtered. The solvents were evaporated under reduced pressure; the crude extracts was weighted and kept in deep freezer until use.

2-4: Preparation the stock solution of the tested material:

Convenient stock concentrations of each material (camphor, thymol, and the plant extract, Citrullus plant) were prepared on basis of the tested material weight and the volume of the distilled water (w/v) in the presence of tween 80(0.1%) as emulsifier. The stock concentrations were kept in glass stoppered bottles and stored under refrigeration. Four diluted concentrations for each material were used to draw the Ld-P Line .Three replicates were used for each concentration.

2-5: Preparation of IGR (Agron10%):

To prepare different concentrations of insecticide (0.1, 1 , 10 and 20 ppm) , distilled water was used for dilution.

Bioassays:

The second instar larvae were used to determine the toxicity action of all the tested compounds (camphor ,thymol, Citrullus and Agron10%) which used in the test of larval stage. 5 cm^2 of castor leaf discs were cut and dipped into the treatments for 20 seconds, then left for air dryness, 10 larvae for each replicate were released to each leaf disc placed. Four concentrations and three replicates were used to estimate each concentration-mortality line. The same number of leaf discs per treatment was dipped into distilled water as an untreated check. Before and after treatment, larvae were maintained under laboratory conditions (constant temperature 25 ±2 °C and 70± 5 % R.H. After 24 h of treatment the mortality was recorded and the data was corrected relatively to control mortality **[12].**

LC_{50} values were determined using probit analysis statistical method of **[13].**

3-results and discussion

Efficiency of the tested materials on 2nd instar larvae of cotton leaf worm, *Spodoptera littoralis* under laboratory conditions:

The data in Fig. (1a) indicated that, camphor was most effective material of plant origin with LC50 2247.16 ppm followed by Citrullus extract, and thymol with LC50 2325.72, and 5523.28 ppm, respectively, LC90 were

6561.45, 6423.34, 11325.87 ppm, respectively for camphor, Citrullus extract, and thymol. **[12]** proved that camphor extract has a significant effect on larval mortality of cotton leafworm and found the plant derivatives which are established from plant Citrullus colocynthis (L.) has shown 90% lethality toward *S.littoralis* third instar larvae.

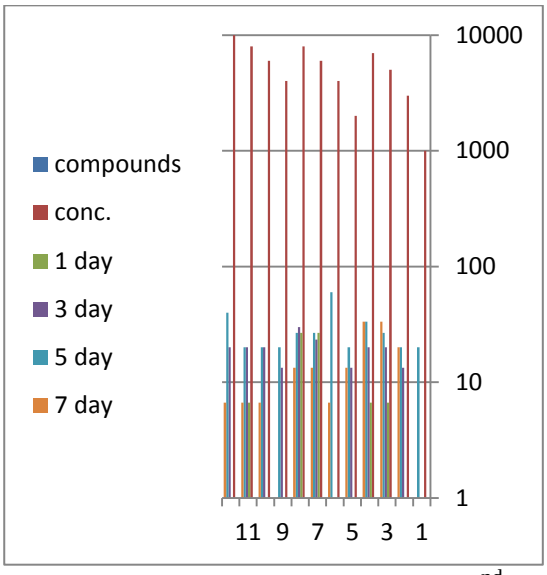

Fig. (1a): Corrected mortality % of 2nd instar larvae of the cotton leafworm, *Spodoptera littoralis* L. treated with plant extracts under laboratory conditions 27± 2ºC and 65±5% RH

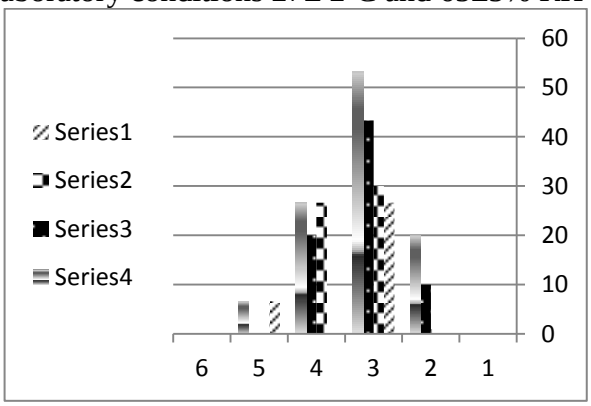

Fig. (1b): Corrected mortality % of 2nd instar larvae of the cotton leafworm, *Spodoptera littoralis* treated with Agron 10% under laboratory conditions 27± 2ºC and 65±5% RH.

The data in **Fig.(1b)** indicated that, Agron 10% (as insecticide) was the most effective compound to larvae of *S.littoralis* (Boisd) with LC_{50} 0.705 and LC_{90} 369.80 ppm.

So from **Fig.(1 a&b)**, Agron 10% was the most effective material but it's not save however camphor was the most effective material of plant origin, save and caused high mortality proportion on the 2nd instar larvae than Citrullus or thymol.

Fig (2a) demonstrated the efficiency of active ingredients (camphor and thymol) and Citrullus (plant extract) on 2nd instar larvae of *S.littoralis.* Results indicated that camphor was the most effective material to larvae of *S.littoralis* (Boisd) with LC_{50} 2247.16 ppm., and LC_{50} 2325.72, 5523.28 ppm., for Citrullus extract and thymol respectively.

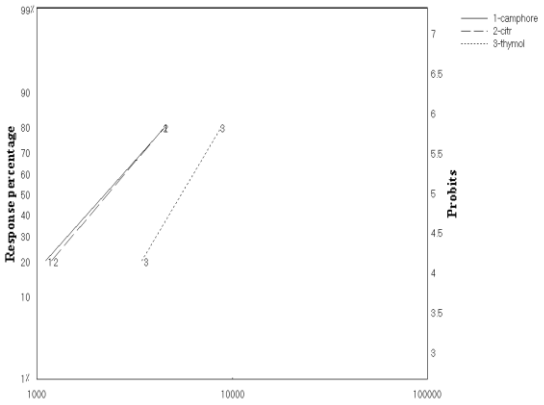

Fig. (2a): LC-P lines for some plant extracts against 2nd instar larvae of cotton leaf worm, *S. littoralis*.

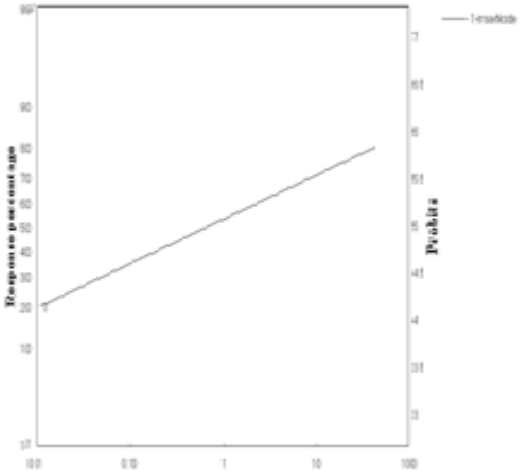

Fig.(2b):LC-P line for Agron 10% against 2nd instar larval of cotton leafworm, *S.littoralis*

Citrullus caused malformations in the treated larvae as shown in the following figures.

Data in **Fig (2b)** showed the effectiveness of Agron 10%on 2nd larval instar of *S. littoralis*.

Treatment of 2nd instar larvae of cotton leaf worm, *S. littoralis* with the insecticide, Agron 10% caused fast mortality without malformations. However, treatment with the extracts of plant origin and the plant extract,

Fig. (3): The 2nd larvae instar of *spodptera litoralis* without any treatment (control).

Fig. (4): Malformation caused to the 2nd larvae of *spodoptra littoralis* due to treatment with camphor.

Fig. (6): Malformation caused to the 2nd larvae of spodoptera littoralis

due to treatment with Citrullus.

The obtained results were in agreement with**[15), [16], [17] and [18]** who proved that the *S. littoralis* could be affected by plant extracts and their active ingredients.

Fig. (5): Malformation caused to the 2nd larvae of *spodoptera littoralis* due to treatment with thymol.

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