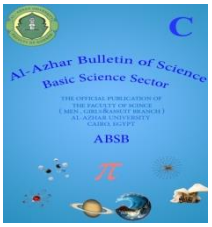
Al-Azhar Bulletin of Science, Sec. C, Vol. 32, No. 2, (December), 2021, pp. 9-15

http://doi.10.21608/absb.2021.89834.1129

Al-Azhar Bulletin of Science: Section C



TOWARD EFFICIENT AND SAFE CONTROL STRATEGY AGAINST COTTON LEAF WORM *SPODOPTERA LITTORALIS* (BOISD.) (LEPIDOPTERA: NOCTUIDAE) APPLYING ONION AND PEPPER EXTRACTS AND THEIR OILS.

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Received: 16 Aug 2021; Revised: 13 Sep 2021; Accepted: 24 Sep 2021; Published: 01 Dec 2021

ABSTRACT

Spodoptera littoralis (Boisduval) is a very destructive pest of a widely huge number of plants all over the world. It caused huge damage to several crops. Pesticides have dangerous effect on human health. Plant extracts and oil have been shown to act as potent acute or chronic insecticides and insect growth regulators. Different concentrations of onion extract, pepper extract and its essential oils were used against 2nd instar larvae beside Agron 10% under laboratory conditions. the treated larvae with onion, pepper extracts showed shrinkage in larvae size where onion oil, pepper oil caused obvious swelling. Onion extract showed the highest effect on 2nd instar larvae, comparing with the other extracts with LC_{50} =661.89 ppm and LC_{90} =8728.39 ppm.; while all treated larvae with Agron 10% died during the experiment without transfer to third instar and without any malformation.

Keywords: Cotton leaf worm; Plant extracts; Plant oil; Agron 10%.

1. INTRODUCTION

Spodoptera littoralis (Boisd.) larvae considered as a harmful plant-feeders which causing various spoliation for several field harvest beside cotton, like vegetables, ornamentals and orchard trees [1-4].

All pesticides cause damage to the ambience and are known or suspected to be toxic to living soul. Pesticide effect on living organism including human health, it can cause acute neurologic toxicity, cancer, fertility, and possibly immune and endocrine disfuncation. pesticides are effect on food, and it became a residue. The Residue levels reflects the amount of pesticide applied to a crop, the time that has passed since application, and the rate of pesticide dissolution and evaporation [5].

Natural insecticides are one of alternatives to chemical insecticides, which is regarded as safer, cheaper and useful control agents [6]. Many authors stated the toxicity of plant extracts in many workers [7-8]. Also, oils and active compounds extract from plants can be applied as control agent [9].

The paper aimed to exam the efficacy of onion and pepper leave extracts and their commercial oil on cotton leaf worm, *Spodoptera littoralis* and comparing these results with the effect of the insecticide, Agron 10%.

2. MATERIALS AND METHODS

2.1 Insect rearing:

Insects were obtained from a colony maintained during 10 generations (one year

approximately) in the Plant Protection Research Institute, Dokki, Egypt that had no history of pesticides. The larvae were reared in laboratories of Department of Zoology and Entomology, Faculty of Science, Cairo, Al-Azhar University, Egypt where they maintained on clean newly harvested castor bean leaves, *Ricinus communis* L., in a controlled environmental chamber at 25±2ºC and 65±5% R.H. and a photoperiod of 12:12 hrs. (L:D). as described by **[10].**

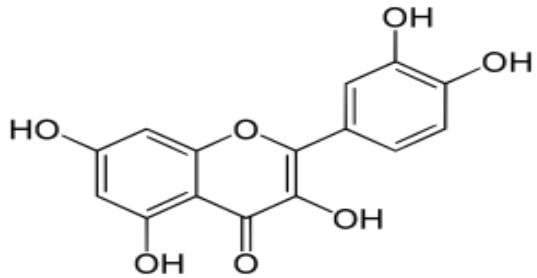
2.2 The plants and Extraction:

Onion (*Allium cepa* L.), and pepper (*Capsicum annuum* L.) leaves were used in this study. The fresh leaves of these plants were collected, cleaned and dried separately under room temperature. The extraction method of **[11],** was followed with some modification.

leaves of chosen plants are dry at room temperature for approximately 30 days, then they powder. Then they soaked in equal proportion (1:1:1) of mixture of hexane, acetone and ethanol solvents about one week. After Shaked the contents were filtered. Then, the solvents got vaporized by using reduced pressure and the crude extracts kept until use.

- Chemical structure of onion:

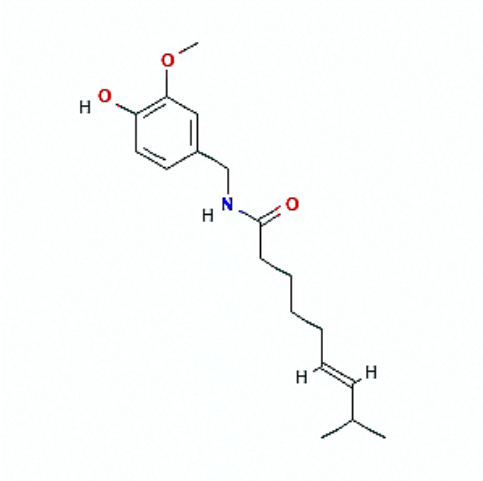
Leaves of onion (*Allium cepa* L.) were used as plant extract. The plant consists of many useful components, but the most active ingredient was quercetin which is one of Flavonoids. The chemical formula was $C_{15}H_{10}O_7$.



Quercetin chemical structure **[12].**

- Chemical structure of pepper:

Leaves of sweet pepper (*Capsicum annuum* Group) were used as plant extract. The plant consists of many useful components, but the most active ingredient was capsicum which is one of Flavonoids. The chemical formula was $C_{18}H_{27}NO_3$.



Capsicum structure [13]

- Tested essential oils:

Commercial onion oil and pepper oil were used in this experiment as concentrated essential oil. It bought from El Captain Company (CAP PHARM) for extracting natural oils, plants and cosmetics

- Tested insecticide:

This compound was flufenoxuron (Agron 10% DC) that is chitin synthesis inhibitor.

2.3 Preparing the Stock Solution of the Tested materials:

Adapted amount of stock concentrations of onion extract and sweet pepper extract were prepared on basis of the tested plant 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. Such stock solutions were prepared periodically. Four diluted concentrations for each plant extract were used to draw the LC-P Lines. Three replicates were used for each concentration.

With regard to Agron 10%, four diluted concentrations of the insecticide were prepared on basis of weight and the volume of the distilled water (w/v) to draw the LC-P lines.

Three replicates were used for each concentration.

2.4 Method of application on larvae of *S. littoralis*:

- Leaf dipping method:

The insecticidal effect of onion leaves extract, pepper leaves extract, onion oil, and pepper oil comparing with Agron 10% were tested on 2nd larval instar.

The leaf of Castor plant was cut and dipping into 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 concentrations used were 500, 1000, 5000 and 10000 ppm for onion leaves extract and pepper leaves extract. For the insecticide, the concentrations were 10, 20, 30 and 40 ppm. Commercial onion oil, and pepper oil were used without dilution. 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.). The percentage of mortality was recorded after one, three, five and seven days. The data were corrected relatively to control mortality **[14].** LC_{50} values were determined using probity analysis statistical method of [**15-16]** (to determine LC_{50} index).

Toxicity index for LC_{50} =

$$\frac{LC_{50} \text{ of the most effective compound}}{LC_{50} \text{ of the least effective compound}} \times 100$$

3. RESULTS

The results obtained during the present study explain that; onion extract is effective against of *S. littoralis* 2nd instar larvae than onion oil, and the total mortality of 2nd instar larvae due to treatment with commercial onion oil was 60% only and this is the same proportion of 1000 ppm of onion extract as shown at **Table (1).**

Pepper extract is effective against 2nd instar larvae of *S. litoralis* than pepper oil, the total mortality of 2nd instar larvae due to treatment with commercial pepper oil was 40% only and this is the same proportion of 1000 ppm of pepper extract.

Also, **Table (1) and Fig. (1):** indicated that, the mortality of 2nd instar larvae of *S. littoralis*, after treatment with 10 ppm of Agron 10%, was 3.33% after seven days of treatment with 20 ppm &40ppm of Agron 10%. Moreover, the mortality was 6.67%after five days of treatment with 10& 40 ppm. Also, the mortality was 20% after three days of treatment with 20 ppm and after three and five days of treatment with 30 ppm of Agron 10%. The total mortality was 46.67% after treatment with 10 ppm; 66.67% after treatment with 20 ppm; 73.33% after treatment with 30 ppm and 90% after treatment with 40 ppm of Agron 10%.

There was a significant change in size of treated larvae. Denaturation due to onion extract and oil showed shrinkage in the body of larvae when treated with various concentrations of onion extract and with onion oil, also. However, denaturation due to

Table (1): Mortality % of 2nd instar larvae of the cotton leaf worm, *Spodoptera littoralis* treated with plant extracts, plant essential oils and Agron10% under laboratory conditions.

Treatments	Conc. (ppm)	Mortality after treatments %				Total Mortality %
		One day	Three days	Five days	Seven days	
Pepper extract	500	3.33	3.33	10	13.33	30
	1000	-----	16.67	10	13.33	40
	5000	------	20	13.33	16.67	50
	10000	6.67	23.33	30	20	80
Onion extract	500	-----	20	3.33	20	43.33
	1000	3.33	20	13.33	23.33	60
	5000	10	30	33.33	10	83.33
	10000	13.33	33.33	33.33	16.67	96.66
Agron 10%	10	10	30	6.67	-------	46.67
	20	26.67	20	16.67	3.33	66.67
	30	33.33	20	20	------	73.33
	40	43.33	36.67	6.67	3.33	90
Pepper oil	------	------	10	20	10	40
Onion oil	-------	------	33.33	13.33	13.33	60

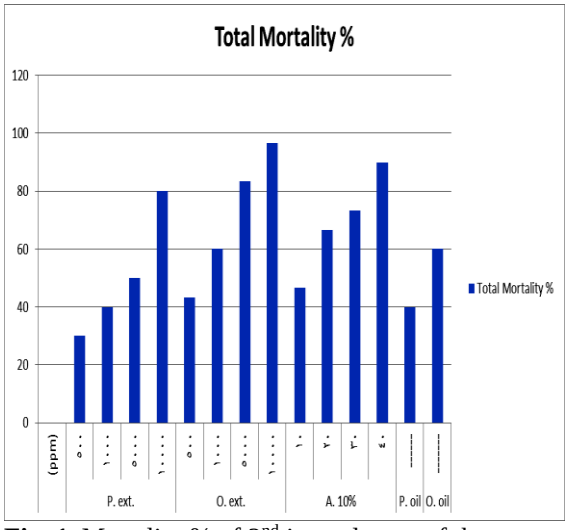


Fig. 1. Mortality % of 2nd instar larvae of the cotton leaf worm, *Spodoptera littoralis* treated with plant extracts, plant essential oils and Agron10%.

pepper extract and oil caused swelling in the larval body. Several oil extracts or isolated active compounds have been shown to act as potent acute or chronic insecticides. Also effect of some plant oil extracts on various insects and this study showed denaturation in treated larval bodies. These results were agreed with [17], who showed that all biological parameters (larval duration, pupal duration, emergency, fecundity, and hatchability) were also affected by the treatment [3-18] also agreed with our studies. While the insecticide, Agron 10% caused initial kill to the treated larvae without any change in its appearance. So, denaturation of treated larvae associated mainly with the larvae treated with natural materials was extract or oil.

Determination of the medium lethal concentration (LC_{50}) of some plant extracts against 2nd instar larvae of *Spodoptera littoralis*:

Results in Table (2) and Fig. (2) demonstrated that, the insecticide Agron 10% has the lowest LC_{50} & LC_{90} than the extracts of per and onion that recorded 11.64 & 52.60 ppm for Agron 10%. However, LC_{50} & LC_{90} for the onion extract were lower than pepper extract and recorded 661.89 & 8728.39 ppm, respectively for onion extract and 2223 & 66711 ppm, respectively for pepper extract.

The slope value had the highest value for Agron 10% that recorded 1.957 followed by onion extract that was 1.144 then pepper extract that was 0.868. The result reveled the toxicity index (Ti= 100) that was recorded 100% for Agron 10%, then 1.759% for onion extract and 0.524% for pepper extract.

The value of LC_{90} / LC_{50} confirmed the value of criterion that recorded 30, 13.19 and 4.52 for pepper extract, onion extract and Agron 10%, respectively. Thus, the highest slope value or lowest ratio LC_{90} / LC_{50} means the steepest toxicity line. So, the results

Table (2): Efficiency of some plant materials against 2nd instar larvae of the cotton leaf worm, *Spodoptera littoralis.*

Treatments	Conc.	Corrected mortality %	LC_{50}	LC_{90}	Slope± S.D.	Toxicity index LC_{50}	LC_{90}/ LC_{50}	R	P
Pepper extract	500	30	2223	66711	0.868± 0.13	0.524	30	0.915	0.007
	1000	40							
	5000	50							
	10000	80							
Onion extract	500	43.33	661.89	8728.39	1.144± 0.15	1.759	13.19	0.9779	0.8341
	1000	60							
	5000	83.33							
	10000	96.66							
Agron 10%	10	46.67	11.64	52.60	1.957±0.3	100	4.52	0.954	0.147
	20	66.67							
	30	73.33							
	40	90							

P: Probability, R: Regression, Response% in table (2) meaning toxicity only.

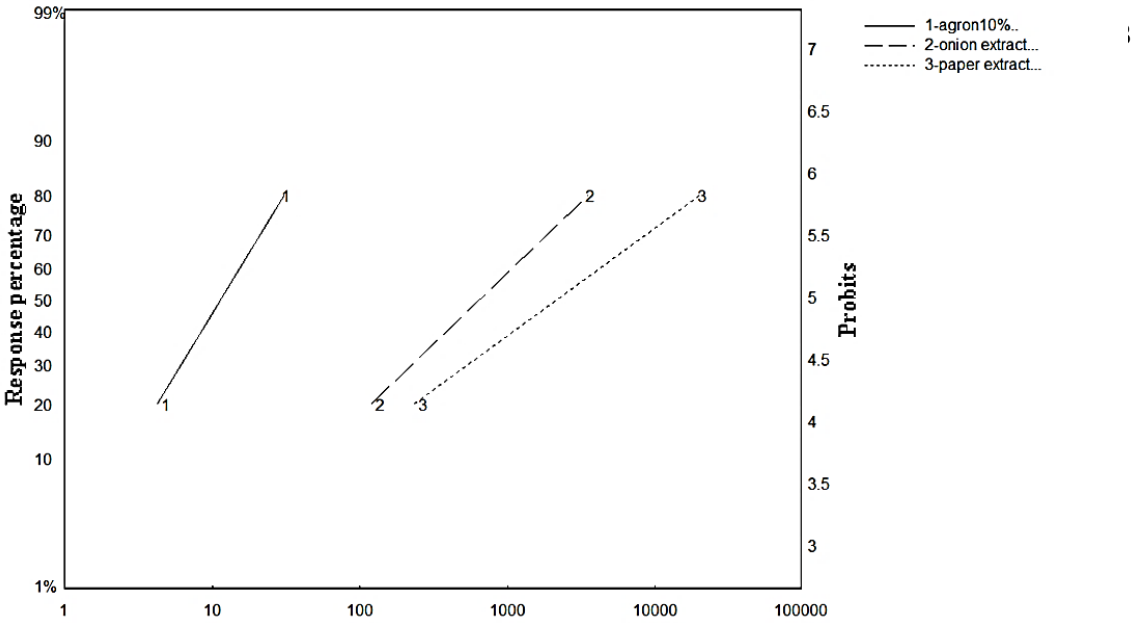


Fig. 2. LC-P lines for some materials against 2nd instar larvae of cotton leaf worm, *S. littoralis*

indicated that onion extract is the effective natural tested material than the pepper extract.

The obtained results agreed with [19] who estimated the insecticidal activity of white wild basil essential oil *Ocimum gratissimum L*, ethanolic and water extracts against *S. littoralis*. Acute toxicity experiments were carried out on larvae *S. littoralis* to determine the LC50 and LC90 values of the oil and polar extracts. Chronic toxicity was evaluated on *S. littoralis* feeding on tomato discs treated with essential oil and polar extracts. The essential oil was significantly more active on target insect than extracts, [20-21] agreed with the obtained results.

4. DISCUSSION

Many of natural oil extracts or isolated active compounds have been shown to work as powerful acute or chronic insecticides. Also, this study showed denaturation in treated larval bodies. And this agreement with **[3]** his results showed that all biological parameters (larval duration, pupal duration, % emergency, fecundity, and hatchability) were also affected by the treatment

Agron 10% caused initial kill to the treated larvae so, denaturation of treated larvae associated mainly with the larvae treated with natural materials whether was extract or oil. showed shrinkage in the body of larvae of cotton leafworm when treated with various concentrations of onion extract and with onion oil, also. And swelling in the body of larvae of cotton leafworm when treated with various concentrations of pepper extract and with pepper oil, also. The obtained results were in agree with [22] evaluated the toxicological effects of three IGR (chlorfluazuron, flufenoxuron and pyriproxifen) on the *S. littoralis* larvae. Chlorfluazuron proved to be the most toxic IGR followed by flufenoxuron in contrast the juvenile hormone mimic, pyriproxifen was the smallest toxic compound.

5. CONCLUSION

The results confirmed that onion leaves extract and onion oil extract are promising in control of *S. littoralis*. And this control can be used to decrease as possible the dangerous effect of consumption chemical pesticides at the future.

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نحو استراتيجية فعاله وامنه لمكافحة ديدان ورق القطن Spodoptera Littoralis باستخدام المستخلصات النباتية للبصل و الفلفل وزيوتهما.

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الملخص:

تعتبر دودة ورق القطن (*Spodoptera littoralis*) من الآفات المدمرة لعدد كبير من النباتات الزراعية في جميع انحاء العالم حيث انه تسبب اضرار جسيمه لعدد من المحاصيل ونظرا لان المبيدات الحشرية لها تأثير خطير علي صحة الانسان ، تهدف الدراسة الحالية لاستخدام المستخلصات النباتية والزيوت الطبيعية كمبيدات حشريه ومنظمات لنمو الحشرات . تم استخدام تركيزات مختلفة من مستخلص كل من نباتي البصل والفلفل وزيوتهم الطبيعية ضد العمر الثاني لليرقة كما تم استخدام مبيد الأجرون10%للمقارنه تحت الظروف المعملية . أظهرت النتائج انكماش حجم اليرقات المعاملة بنباتي البصل والفلفل وكان مستخلص البصل الأعلى تأثيرا علي اليرقات المعاملة حيث سجل (LC50=661.89ppm, LC90=8728.39ppm) في حين أن تسبب المبيد المستخدم (الأجرون 10%) في وفاة كل اليرقات المعاملة دون التحول للعمر الثالث ودون حدوث أي تشوه لليرقة .