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TOXICITY AND BIOACTIVITY OF FEEDING COTTON LEAF WORM, *Spodoptera littoralis* (Boisduval) (Lepidoptera: Noctuidae) LARVAE ON FRESH LEAVES OF SELECTED WEEDS

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ABSTRACT

This work aims to study the toxicity, biological effects and joint action of the insecticides with selected weeds against the 4th larvae instar of cotton leafworm. Results obtained indicated the obvious differences in their biological parameters when the larvae fed on untreaded fresh leaves of the tested weeds resulted in 100% larval mortality in 9 out of the 16 weed plants.

Larval duration was significantly prolonged in 4 out of 16 recording. The pupation percentage was significantly reduced in 7 treatments that survived after larval feeding and pupated. Pupal duration was significantly shortened in most weed treatments. Adult emergence percentage increased significantly in 1 weed plant while decreased significantly in 2 weeds. Feeding larvae on different weeds drastically inhibited egg production. Hatchability percentage of eggs resulted in different weed treatments was significantly reduced in 2 weeds.

Feeding on weed plants resulted in significant increase in sterility in 3 weeds. The synergism factor resulted from treated weed plants with insecticides indicated that some of weed plants have synergisted effect and the rest of them have antagonism effect after 48h. Data revealed slight to moderate potentiation in toxicity when fresh leaves of 11 weeds were treated with chlorpyrifos.

Antagonistic activity was exhibited when fresh leaves of 5 weeds were treated with esfenvalerate. Slight to moderate synergistic activity was achieved when the larvae were fed on thiodicarb-treated leaves of 9 weeds. Antagonistic was exhibited when leaves of only 3 weeds were treatd with thiodicarb.

Keywords: Biological effects, insecticides, synergism, antagonism.

INTRODUCTION

The Egyptian cotton leafworm, *Spodoptera littoralis* (Boisduval) (Lepidoptera: Noctuidae) is a key pest of cotton and other many crops in the Mediterranean area and Middle Eastern countries (Campion *et al.,* 1977; Gómez-Clemente and Del Rivero, 1951; Nasr *et al.,* 1984; Ahmad 1988; Domínguez 1993; Hatem 2006). The fact that the insect infests more than 112 host plants belonging to 44 families (Moussa *et al.,* 1960; Brown and Dewhurst, 1975; Hatem 2006) makes it a model of serious polyphagous pests. The control of this pest is focused to the searching of new insecticides with biological and ecological qualities.

The reproductive potential, behavior, fecundity, and fertility of the *Spodoptera frugiperda* (Smith) have been studied under a variety of both natural and controlled environmental conditions. These published reports indicate a wide variation in those parameters, which may be influenced by temperature, larval diet and the strain of *S. frugiperda* (Simmons and Lynch, 1990, Rogers and Marti, 1994; Gabriela and Eduardo, 2004). And for *S. exigua* (Allan 2001; Azidah and Sofian-azirun, 2006). The influence of weeds plant on the susceptibility of *S. littoralis* to insecticides. Santiago-Alvarez and Ortiz-Garcia (1992) Studied the influence of 5 host plants, castor bean, alfalfa, mulberry, cotton and potato, on the susceptibility of the cotton leaf worm, *S. littoralis* to a nuclear polyhedrosis virus (NPV). The resulted showed that the larvae were significantly less susceptible to the NPV when fed on castor bean than when fed on alfafa, mulberry, cotton or potato and were also significantly less susceptible when fed on alfafa than when fed on mulberry, cotton or potato. (Masarrat Haseeb, 2007) studied the influence of host plants on susceptibility of *Spodoptera litur* (Fabricius) to *Beauveria bassiana* (Balsamo), the result indicated that larvae reared on cabbage and castor a were significantly more susceptible to the infection of *B. bassiana* with 62% mortality compared to groundnut and cauliflower. Comparison of the LT50 values showed the larvae to be most susceptible when fed on cabbage followed by cauliflower.

A principle role in the naturally rejected plant defense strategies has been ascribed to secondary plant compounds (Whittaker and Feeny, 1971; Feeny, 1975), It was also suggested that some chemicals may have a multiplicity of defensive function within plant (Levin, 1976). Also, it has been shown in a number of instances that the choice of food is guided by the presence of secondary plant substances typical of the plant which is the insect's preferred or exclusive food. At the same time, a non-food plant is characterized not only by the absence of specific chemical attractants or feeding stimulants, but also by the presence of other secondary plant substances which acts as repellents (Brues 1946; Dethier 1954, Fraenkel 1959) or phagodeterrents (Meisner *et al.,* 1981) or as attractants and repellents (Dethier 1974).

However, these allelochemicals are considered a primary means of plant defense against phytophagous insects (Rhoades 1983). In cotton, the terpenoid allelochemical gossypol deters feeding activity and possesses antibiotic activity to a number of Lepidopterous species (Lukefahr and Honghtaling, 1969; Zur *et al*., 1980; Chan *et al*., 1983). Furthermore, Elliger *et al*. (1978) reported that in addition to gossypol, cotton possesses numerous other compounds that are toxic to insects. Surely natural products toxic to insects provide a continual inspiration to the agricultural chemists is their search for new products to control pests, improve yields, and environmental preservation.

Therefore, research efforts in the present study aimed to explore these principal approaches :

1- Toxicological and biological effects by feeding of *S. littoralis* larvae on several weeds.
2- Evaluation of indirect effects of feeding on several weed plants on larval susceptibility to selected insecticides.

MATERIALS AND METHODS

A. Materials:

Test insect:

The larvae used in the present study were obtained from laboratory colony continuously reared away of insecticidal contamination since 1990 in Sakha (North of Egypt) Agriculture Research Station, Egypt. Rearing of insects was conducted following the technique described by El- Defrawi *et al*. (1964). Larvae were fed on fresh castor bean *Ricinus communis* L., leaves until pupation. Moths were fed on 10% sugar solution offered in a piece of cotton tissue soaked in this solution. Each jar was provided with branches of tafla, *Nerium oleander,* as an oviposition site. The rearing room was kept at constant temperature of 25±2 ºC and relative humidity of 65±5 %, a photoperiod of 16:8 (L:D) h.

Plant materials used:

Sixteen plant species, belonging to twelve botanical families (Table 1), were investigated in the present study. These plants represent the naturally growing annual weeds, which were collected from the cultivated area in Faculty of Agriculture. These plants were chosen on the basis of preliminary experiments for consumption and utilization of different plant species by *S. littoralis* larvae, in addition to visual observations under field conditions. Only leaves of these plants were collected to use as food for larvae.

Table(1): Latin, common and family names of plant species used in the experiments.

Family	Latin name	Common name
Urticaceae	*Urtica urens L.*	Burning Nettle
Umbelliferae	*Ammi majus L.*	Greater Ammi
Malvaceae	*Malva sylvestris L.*	Chickweed
Plantanginaceae	*Plantago major L.*	Broadleaf plantion
Rosaceae	*Rumex dentatus L.*	Dock
Solanaceae	*Sonchus olearcues L.*	Annual Sowthistle
Amaranthaceae	*Angallis arvensis L.*	Scarlet Pimpernel
Convolvulaceae	*Conyza discoridis L.*	Fleabane
Leguminosae	*Vicia monantha Rotz.*	Vetch
Marsileaceae	*Melilotus indicus L.*	Annual Yellow Sweetclover
	Medicago hispida Gaerth.	Burclover
Chenopodiaceae	*Beta vulgaris L.*	Wild Beets
	Cichrium pumlium L.	Chicory
	Chenopodium ambrosioides L.	Mexicantea
Cruciferae	*Brassica niger Koch.*	Black mustard
	Raphonus sativa var. *surtus L.*	Red radish
Euphorbiaceae *	*Ricinus communis L.*	Castor bean

*** Used as control.**

Insecticides used:

Commercial formulations of the following insecticides, representing different groups, were used in the bioassay experiments.

a) Carbamates.
1. Thiodicarb (Larvin 80% S.P.) Chemical name:- 3,7,9,13-tetramethyl-5,11-dioxa-2,8,14-trithio-4,7,9,12-tetra-azapentadeca-3,12-diene-6,10-dione. Introduced by E. I. Du Pont de Nemours.
b) Organophosphates.
1. Chlorpyrifos (Dursban 48% E.C.) Chemical name:- O,O-diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate. Introduced by Dow Elanco company.
c) Synthetic pyrethroids.
Esfenvalerate (Sumi-Alpha 5% E.C.) Chemical name:- 3-phenaxybenzyl(S)-2-(4-chlorophenyl)-3-methylbutyrate. Introduced by Sumitomo Chemical Co. Ltd.

B. Methods:
Preliminary Toxicity Test.

The purpose of this experiment was to choice certain plant species of the weed that may contain some naturally occurring bioactive components. Fresh leaves of the 16 tested plant species were used for feeding newly moulted 4th instar larvae of *S. littoralis.* Four replicates of 25 larvae/each were allowed to feed on leaves of the tested plant species in glass jar (400 ml). The leaves in each jar were replaced daily by new fresh ones. Castor bean leaves were used in the same way to serve as standard for comparison. Larvae were inspected daily and mortality percent were recorded at 2 day intervals. In each test, the following biological parameters were determined: larval duration, pupation percentage, pupal duration, adult emergence percentage, fecundity and egg hatch percent. Percent reduction in fecundity was calculated according to (Hornby and Garbner, 1987):

$$R = \frac{F_u - F_t}{F_u} \times 100$$

Where, R is percent of reduction; F_u is fecundity of moths developing from larvae fed on standard (*R. communis*) and F_t is fecundity of moths developing from larvae fed on the tested different host plants.

Percent sterility was calculated using Chamberlain formula (1962) which was modified by Topozada *et al.* (1966) as follows:

$$\% \text{ Sterility} = 100 - \frac{a \times b}{A \times B} \times 100$$

Where, a number of eggs laid/female in treatment; b, % of hatchability in treatment; A, number of eggs laid/female in untreated control and B, % of hatchability in untreated control.

Assessment of feeding *S. littoralis* larvae on fresh weed leaves treated with selected insecticides:

In this investigation, the leaf-dip technique was used to assess the effect of feeding *S. littoralis* larvae on fresh leaves of 12 weed species treated with three conventional synthetic insecticides representing organophosphates (chlorpyrifos), carbamates (thiodicarb) and synthetic pyrethroids (esfenvalerate). Newly moulted 4th instar larvae (20±2 mg/larva), were used.

Fresh leaves of the tested weeds were dipped in water dilution of the tested insecticide**s** for 10 seconds. The treated leaves were left to natural dryness before offered to the larvae. The larvae were allowed to feed on insecticide-treated weed leaves for 48h. At least six concentrations were prepared for each insecticide. Four replicates with 25 larvae/each were used for each concentration. For comparison, similar technique was followed for treating castor bean leaves with selected insecticides. Larvae fed on water-treated castor bean leaves served as control. Mortality percentages were recorded after 48h using Abbott's formula (Abbott, 1925). The toxicity regression lines were drawn on log concentration-probit paper and statistically analyzed according to the method described by Finney (1971). Factor of synergism was calculated according to Chadwick (1961) formula as follows:-

$$\text{Factor of synergism} = \frac{LC_{50} \text{ of the insecticide alone}}{LC_{50} \text{ of the insecticide in synergised form}}$$

Analysis of variance at 0.05 level was done by Duncan´s multiple test (1955)

RESULTS

Toxicity and Bioactivity of feeding cotton leafworm 4th larval instar on untreated fresh leaves of selected weeds:

Biological effects of natural feeding of *S. littoralis* larvae on fresh leaves of selected weeds.

Data concerning the biological activity of different tested plants when cotton leafworm 4 th larval instar were naturally fed on their fresh leaves are shown in (Tables 2 and 3). It was obvious that, continuous feeding for 14 to 20 days on fresh leaves of nine out of 17 tested plants resulted in 100% larval mortality, these plants includes: *Chenopodium ambrosioides* , *Cichrium pumlium* , *Conyza discoridis* , *Urtica urens* , *Angallis arvensis* , *Ammi majus* , *Medicago hispida* , *Plantago major* , and *Vicia monantha* , respectively (Table 2). However, approximately similar trend was recorded for another 4 plants, i.e., *Beta vulgaris* , *Raphonus sativa* var. *surtus* , *Rumex dentatus* , and *Melilotus indicus* , resulting in 97, 96, 92 and 83% larval mortality, respectively. The other three plants resulted in slight 18-37% larval mortality compared with negligible mortality 7% recorded when larvae were fed on the standard plant *Ricinus communis* . As shown in the same table the calculated larval developmental period when 4th larval instar were fed on fresh leaves of the tested weeds was affected. The larval duration was significantly prolonged by 42.57, 41.62, 38.6, 28.67, 16.49 and 10.96% when larvae were fed on *Medicago hispida* , *Vicia monantha* , *Melilotus indicus*, *Plantago major*, *Beta vulgaris* and *Cichrium pumlium*, respectively. In contrast feeding on other plants resulted in nonsignificant shortening in larval period ranged between 5 and 20% except for *Raphonus sativa* var. *surtus*, and larval duration of 30.05 and 30.22% was recorded, respectively when compared with the standard (*Ricinus communis*).

Table (2): Larval mortality and developmental periods following continuous feeding *S. littoralis* 4th larval instar on untreated fresh leaves of tested weeds.

Host plant	Initial Nº. of larvae	% Accumulated larval mortality at indicated day			Larval period *	
		2	4	Overall	days	% (+)
Ricinus communis (Control)	100	0	4	7	11.58 e	-----
Brassica niger	100	9	17	18	10.42 e	-10.01
Malva sylvestris	100	3	12	20	10.94 e	-5.52
Sonochus olearcues	100	12	27	37	10.81 e	-6.64
Melilotus indicus	100	2	10	83	16.05 c	+38.60
Rumex dentatus	100	5	15	92	10.43 e	-9.93
Raphonus sativa var. *surtus*	100	0	1	96	8.10 f	-30.05
Beta vulgaris	100	9	19	97	13.49 d	+16.49
Medicago hispida	100	2	3	100	16.51 a	+42.57
Conyza discoridis	100	0	4	100	8.08 f	-30.22
Vicia monantha	100	11	16	100	16.40 b	+41.62
Plantago major	100	7	19	100	14.90 d	+28.67
Ammi majus	100	10	14	100	10.15 e	-12.35
Anagalis arvensis	100	0	28	100	10.42 e	-10.01
Urtica urens	100	10	35	100	9.16 e	-20.89
Cichrium pumlium	100	4	32	100	12.85 e	+10.96
Chenopodium ambrosioides	100	36	40	100	9.95 e	-14.07

*** Larval period start from 4th instar to death or pupation.**
Mean followed by the same letter in the colum are not significantly different.

Data shown in Table (3) revealed that pupation percentages of the larvae that survived after feeding on leaves of 7 weeds were significantly reduced when compared with that fed on the standard *Ricinus communis.* The least pupation percentages were recorded in *Beta vulgaris* (3%) and *Raphonus sativa* var. *surtus* (4%) treatments, followed significantly by *Rumex dentatus* (8%) and *Melilotus indicus* (17%) treatments. The least effect on pupation percentages was recorded in treatments of *Malva sylvestris* (80%) and *Brassica niger* (82%) which were significantly less than the standard (93%). As for the pupal duration, it was obvious that duration was significantly shortened in most treatments, the least pupal duration was resulted in *Rumex dentatus* (7.0 days) and *Melilotus indicus* (8.0 days) recording reduction in duration of 30.13 and 20.16% than the standard (10.02 day). Feeding on other weeds reduced the pupal duration significantly and resulted in reduction than the standard ranged between 5.98% for *Malva sylvestris* and 10.37% for *Brassica niger.*

The percentage of adult emergence was significantly affected in three treatments compared with the control, which amounted 64.52% in *Ricinus communis.* Moth emergence percentage increased significantly and reached 88.23 in *Melilotus indicus* treatment whereas it decreased significantly to 51.25% in *Malva sylvestris* and 50% in *Raphonus sativa* var. *surtus.* Feeding on other tested hosts resulted in adult emergence percentages similar to the standard (*Ricinus communis*). As shown in Table (3) it was of interest to note that feeding larvae on *Beta vulgaris* produced female adult moths only whereas feeding larvae on *Raphonus sativa* var. *surtus* resulted in emergence of male adults.

Table (3): Pupation, moth emergence and biotic potentiality of cotton leafworm following, feedings *S. littoralis* 4th larval instar on untreated fresh leaves of tested weeds.

Host plant	Pupation (%)	Pupal duration (days)	Pupal duration Reduction (%) +	Moth emergence (%)	Total No. Eggs/ female	Reduction in fecundity	Hatchability (%)	Sterility (%)
Ricinus communis (Control)	93 a	10.02 a	-----	64.52 b	291.67 a	-----	94.50 a	-----
Brassica niger	82 b	8.98 b	10.37 a	71.43 b	41.67 d	85.71 a	75.00 b	88.76 a
Malva sylvestris	80 b	9.42 b	5.98 a	51.25 c	236.61 b	18.87 d	45.28 d	61.13 b
Sonochus olearcues	63 c	9.15 b	8.68 a	69.84 b	217.59 b	25.39 c	82.98 b	34.49 c
Melilotus indicus	17 d	8.00 c	20.16 a	88.23 a	37.50 d	87.14 a	66.67 c	90.93 a
Rumex dentatus	8 d	7.00 c	30.13 a	57.14 b	83.33 c	71.43 b	50.00 d	84.88 a
Raphonus sativa var. *surtus*	4 e	9.00 b	10.18 a	50.00 c	-----**	-----	-----	-----
Beta vulgaris	3 e	10.00 a	0.20 a	66.67 b	-----*	-----	-----	-----

*** Total emerged adults were females.**
**** Total emerged adults were males.**
Mean followed by the same letter in each colum are not significantly different.

It is obvious from the results shown in Table (3) that feeding larvae on different weeds drastically inhibited egg production in the resulted adult females. The fecundity was significantly reduced in moths resulted after feeding larvae on *Malva sylvestris, Sonchus olearcues, Rumex dentatus, Brassica niger* and *Melilotus indicus* recording 18.87, 25.39, 71.43, 85.71 and 87.14% reduction than the control. However, it is of interest to denote that feeding larvae on *Beta vulgaris* produced adult females only while feeding on *Raphonus sativa* var. *surtus* produced adult males. Tracing the effect on percentage hatchability, the highest percentage obtained was that recorded for eggs deposited by moths of the control, *Ricinus communis.* Hatchability percentages of eggs produced by moths resulted after feeding larvae on leaves of different weeds were significantly reduced. The highest reduction percentages were recorded in treatments of *Rumex dentatus* (50%) and *Malva sylvestris* (45.28%). The percentage sterility which takes into account fecundity and eggs viability confirmed the effect on fecundity where the highest sterility percentages were significantly recorded for eggs deposited in *Melilotus indicus, Brassica niger* and *Rumex dentatus* recording 90.93, 88.67 and 84.88% sterility respectively. Moderate but significant sterility percent of 61.13% was also detected in eggs deposited in *Malva sylvestris* treatment.

II-The combined effect of fresh weed leaves (natural components) and synthetic insecticides:

The joint action of feeding *S. littoralis* larvae on chlorpyrifos-treated weed leaves.

Data in Table (4) showed the LC_{50} values, slope, confidence limits and synergism factor after 48h exposure and feeding of *S. littoralis* 4th instar larvae on chlorpyrifos-treated leaves of 12 weeds compared with the standard, chlorpyrifos-treated *Ricinus communis* leaves. Data concerning 48h feeding the larvae on chlorpyrifos-treated weed leaves revealed slight to moderate synergistic activity for 11 of the 12 tested weeds. Again the most synergistic activity was obtained when the leaves of the same weeds *Medicago hispida* and *Sonchus olearcues* were treated with chlorpyrifos recording synergistic factors of 2.41 and 2.34 fold, respectively.

However, four weeds, named *Brassica niger, Vicia monantha, Beta vulgaris* and *Rumex dentatus* came next, recording synergistic factors of 1.59, 1.57, 1.56 and 1.52 fold, respectively. Slight synergistic activity ranged between 1.07-1.3 fold was achieved for 5 weeds while a case of antagonism of 0.25 fold was recorded when larvae were fed for 48h on chlorpyrifos-treated leaves of *Plantago major.*

Table (4): The combined effect of feeding *S. littoralis* 4th larval instar for 48h on natural components in fresh weed leaves treated with Chlorpyrifos .

Treatment (Insecticide + weed)	Slope±S.E	LC_{50} (95% C.L.) (ppm)	F.S*
Chlorpyrifos+*R.communis*	4.38 ± 0.95	28.80 (25.5-35.3)	1
Chlorp.+*M.hispida*	4.90 ± 1.39	11.94 (3.8-34.6)	2.41
Chlorp.+*S.olearcues*	5.94 ± 0.93	12.30 (10.6-13.7)	2.34
Chlorp.+*B.niger*	6.37 ± 1.07	18.03 (16.1-19.8)	1.59
Chlorp.+*V.monantha*	5.78 ± 0.94	18.25 (16.1-20)	1.57
Chlorp.+*B.vulgaris*	3.10 ± 0.77	18.44 (6.9-46.9)	1.56
Chlorp.+*R.dentatus*	4.56 ± 0.87	18.97 (16.3-21.14)	1.52
Chlorp.+*A.arvensis*	5.81 ± 1.4	22.08 (20-24.8)	1.30
Chlorp.+*C.ambrosioides*	6.80 ± 1.02	23.42 (21.6-25.4)	1.23
Chlorp.+*M.indicus*	6.66 ± 1.02	23.60 (21.8-25.7)	1.22
Chlorp.+*C.pumlium*	4.24 ± 1.45	23.85 (------------)	1.20
Chlorp.+*M.sylvestris*	4.39 ± 0.92	26.69 (23.8-31.5)	1.07
Chlorp.+*P.major*	1.12 ± 0.91	115.6 (-----------)	0.25

*** Factor of synergism**

The joint action of feeding *S. littoralis* larvae on esfenvalerate-treated weed leaves

Data in **T**able (5) show the LC_{50} values, slope, confidence limits and synergism factor after 48h exposure and feeding of *S. littoralis* 4th instar larvae on esfenvalerate-treated leaves of 12 weeds compared with the standard, esfenvalerate-treated *Ricinus communis* leaves. Data concerning 48h feeding the larvae on esfenvalerate treated weed leaves are shown in Table (5). In general, drastically higher synergistic activity was achieved when leaves of the same four weeds were treated with esfenvalerate. The combined effect of natural components in these leaves and esfenvalerate resulted in drastically high synergistic activity expressed as factor of synergism of 9.56, 5.98, 4.33 and 3.51 fold for *Plantago major, Malva sylvestris, Sonchus olearcues* and *Brassica niger,* respectively. However, three other weeds named *Rumex dentatus, Beta vulgaris* and *Cichrium pumlium* came next and resulted in slight potentiation whereas 5 of the tested weeds recorded an inhibitory action as elucidated by factor of synergism of 0.85, 0.66, 0.58, 0.56 and 0.44 fold for *Vicia monantha, Chenopodium ambrosioides, Melilotus indicus, Medicago hispida* and *Angallis arvensis,* respectively.

Table (5): The combined effect of feeding *S. littoralis* 4th larval instar for 48h on natural components in fresh weed leaves treated with Esfenvalerate.

Treatment (Insecticide + weed)	Slope±S.E	LC_{50} (95% C.L.) (ppm)	F.S*
Esfenvalerate+*R.communis*	1.26 ± 0.24	3.73 (2.7-5.6)	1
Esfen.+*P.major*	0.93 ± 0.28	0.39 (0.2-1)	9.56
Esfen.+*M.sylvestris*	0.91 ± 0.26	0.62 (0.1-1.4)	5.98
Esfen.+*S.olearcues*	1.35 ± 0.29	0.86 (0.3-1.5)	4.33
Esfen.+*B.niger*	0.85 ± 0.24	1.06 (0.2-2.1)	3.51
Esfen.+*R.dentatus*	2.25 ± 0.32	2.39 (1.2-3.1)	1.56
Esfen.+*B.vulgaris*	2.84 ± 0.37	3.14 (2.5-3.9)	1.18
Esfen.+*C.pumlium*	1.36 ± 0.45	3.69 (--------)	1.01
Esfen.+*V.monantha*	2.44 ± 0.30	4.37 (3.4-5.6)	0.85
Esfen.+*C.ambrosioides*	1.51 ± 0.26	5.60 (3.9-8.1)	0.66
Esfen.+*M.indicus*	2.84 ± 0.41	6.37 (5.1-7.9)	0.58
Esfen.+*M.hispida*	2.62 ± 0.40	6.63 (5.3-8.4)	0.56
Esfen.+*A.arvensis*	2.36 ± 0.36	8.42 (6.2-12.1)	0.44

*** Factor of synergism**

The joint action of feeding *S. littoralis* larvae on thiodicarb-treated weed leaves.

The result presented in Table (6) showed the LC_{50} values, slope, confidence limits and synergism factor after 48h exposure and feeding of *S. littoralis* 4th instar larvae on thiodicarb-treated leaves of 12 weeds compared with the standard, thiodicarb-treated *Ricinus communis* leaves. The toxicity of thiodicarb cieared that the same trend was almost achieved but with higher magnitude for the first two weed plants, recording synergism factor of 3.52 and 2.18 fold for *Sonchus olearcues* and *Malva sylvestris,* respectively and was followed by 1.74 fold for *Brassica niger.* However, slight synergism ranged between 1.1-1.39 fold was achieved when larvae were fed for 48 hr on thiodicarb-treated leaves of 5 weed plants including, *Angallis arvensis, Cichrium pumlium, Beta vulgaris, Medicago hispida* and *Melilotus indicus*. However, negligible inhibition in toxicity ca. 0.91-0.96 fold was recorded when larvae were fed on thiodicarb-treated leaves of *Plantago major, Rumex dentatus* and *Chenopodium ambrosioides*, respectively.

Table (6):The combined effect of feeding *S. littoralis* 4th larval instar for 48h on natural components in fresh weed leaves treated with Thiodicarb.

Treatment (Insecticide + weed)	Slope±S.E	LC_{50} (95%C.L.) (ppm)	F.S*
Thiodicarb+*R.communis*	1.07 ± 14.99	0.24 (9.5-28.9)	1
Thiod.+*S.olearcues*	1.55 ± 0.24	4.25 (2.7-6.0)	3.52
Thiod.+*M.sylvestris*	2.94 ± 6.88	0.82 (0.4-14.9)	2.18
Thiod.+*B.niger*	2.43 ± 8.57	0.83 (----------)	1.74
Thiod.+*V.monantha*	2.73 ± 9.67	0.99 (----------)	1.55
Thiod.+*A.arvensis*	2.14 ± 10.77	1.15 (----------)	1.39
Thiod.+*C.pumlium*	3.83 ± 11.54	0.55 (9.59-13.7)	1.29
Thiod.+*B.vulgaris*	1.46 ± 11.56	0.47 (----------)	1.29
Thiod.+*M.hispida*	4.28 ± 11.93	1.49 (----------)	1.25
Thiod.+*M.indicus*	3.07 ± 13.57	0.91 (----------)	1.10
Thiod.+*P.major*	1.58 ± 15.52	0.29 (11.2-23.6)	0.96
Thiod.+*R.dentatus*	1.71 ± 16.17	0.32 (11.9-23.9)	0.92
Thiod.+*C.ambrosioides*	2.05 ± 16.47	0.63(4.8-46969.4)	0.91

*** Factor of synergism**

From all aforementioned results (Table 4-6), it could be concluded that, treatment of fresh leaves of weeds with synthetic insecticides resulted either in an increase or decrease in toxicity against *S. littoratis* 4th larval instar fed on insecticide-treated weed leaves. According to Chadwick's formula, the highest synergistic ratio (>5 fold), was recorded for the synthetic pyrethoid esfenvalerate when combined with the fresh components in leaves of *Plantago major* and *Malva sylvestris* and *Sonchus olearcues* gave 4.33. However, a moderate synergistic activity (2-4 folds) was observed when larvae were fed on chlorpyrifos combined with fresh components in leaves of *Medicago hispida* and *Sonchus olearcues;* thiodicarb combined with fresh components in leaves of *Malva sylvestris* and *Sonchus olearcues* and esfenvalerate combined with components in fresh leaves of *Brassica niger* and *Sonchus olearcues.* In addition, a light synergistic activity was recorded with chlorpyrifos (1.56-1.59 fold), when combined with fresh components in leaves of *Beta vulgaris Brassica niger,* and *Vicia monantha;* thiodicarb (1.29-1.74 fold), when combined with components in fresh leaves of *Cichrium pumlium, Angallis arvensis, Vicia monantha* and *Brassica niger* and for esfenvalerate (1.18-1.56 fold), when combined with components in fresh leaves of *Beta vulgaris* and *Rumex dentatus.* On the contrary the inhibitory effect (Factor of synergism < 1 fold), was remarkably recorded when chlorpyrifos and thiodicarb were combined with components in fresh leaves of *Plantago major* and *Chenopodium ambrosioides,* respectively, whereas similar antagonistic activity was recorded when esfenvalerate was combined with components in fresh leaves of *Angallis arvensis, Medicago hispida* and *Melilotus indicus,* respectively.

DISCUSSION

Our data concerning the effect of larval feeding on different host plants are in agreement with findings of several researchers. The effect on larval duration expressed as prolongation or shortening support the early data of Moussa *et al*. (1960) who found that *S. littoralis* larvae reared on leaves of corn and grape vine surrendered a heavy mortality rate. The shortest larval duration was obtained when larvae were fed upon leaves of castor bean leaves and barseem while cotton leaves resulted in the longest period. Similarly, Hassanein *et al*. (1971) found that *Conyza discoridis* L., where significant decrease in larval duration feeding the lesser cotton leafworm, *Spodoptera exigua* larvae on cotton leaves prolonged larval period while feeding on potato leaves shortened it. Likewise Salama *et al*. (1971) reported that feeding on castor bean leaves shortened the larval and pupal duration while sweet potato prolonged it. Similar results was also reported by Nasr *et al*. (1973) who found that larval development was accelerated on beet leaves and somewhat retarded on jew's mallow. More recently El-Saadany *et al*. (1994) found that *S. littoralis* larval duration was greatly affected by different host plants where larvae fed on castor bean leaves showed the shortest larval or/and pupal stage duration while the longest was recorded for these fed on fenugreek. However, moderate duration was recorded on cotton and alfalfa. However, little or no work has been done so for as we know indicating the effect of larval food noctuids on the determination of the sex of the moths. In this respect Seamans and McMillan (1935) found that *Agrotis orthogonia* larvae fed on spring wheat, oats, barely, rye, wandering Jew and sugar beets produced more female than male pupae while the reverse was true when alfalfa, sweet clover, grass, winter wheat, Russian thistle, Canada thistle, pig weed and stink weed were fed.

Early studies of Moussa *et al*. (1960) indicated that larval food has a marked effect on number of eggs laid by moths, where moths produced from larvae fed on okra laid the highest number of eggs compared with those resulted from berseem, castor bean oil and cotton. In this respect, Hassanien *et al*. (1971) found that feeding *Spodoptera exigua* on cotton leaves stimulates the number of deposited eggs per female while sweet potato resulted in the least number. Nasr *et al*. (1973) found that female moths produced from larvae fed on castor bean leaves laid the highest number of eggs while sweet potato and jaw's mallow produced the least number.

Similarly, Zidan *et al*. (1985) found that the type of larval food had a great influence on fecundity of female moths. The castor bean leaves proved to be the most favourable food, followed by cotton while sweet potato leaves came last where the number of deposited eggs was drastically decreased in sweet potato compared with castor bean and cotton treatments. The authors explained such phenomenon in view of the existence of the highest content of crude protein and fat in castor bean leaves, followed by cotton in this respect. Generally, Rizk *et al*. (1991) found that feeding *S. littoralis* on different host plants affected significantly the biotic potential of the insect, i.e. larval stage duration, percent pupation, emergence of moths, number of deposited eggs while percent hatchability were not affected. The data reported here reveal in general that when larval instars of a polyphagous species were fed on insecticide-treated fresh leaves of weeds, the response of insect to insecticides may be greatly modified by the presence or absence of certain allelochemicals, rather than being an independent phenomenon. This suggests that insects may use the same chemical defence system against dietary poisons and synthetic xenobiotics.

An accurate measure of the true activity of the plant components cannot be made until the pure bioactive compound has been isolated and tested. In this respect it is of interest to note here that the methodology used in the present study, seeking mainly for detecting the effective components, was adopted to save time and efforts where the effect of the components in fresh leaves were tested directly without extraction, as fresh crude components, using insecticide-treated weed leaves technique. For explaining the synergistic or/and antagonistic activity when fresh leaves of weeds were treated with different insecticides, several authors indicated that allelochemicals present in host plants of polyphagous species are known to induce or suppress enzymes involved in detoxification of pesticides (Krieger *et al.,* 1971; Brattsten *et al.,* 1977; Yu *et al.,* 1979; Abd-Elghafar *et al.,* 1989).

Furthermore, data of a study carried out by Muehleisen *et al*. (1989) indicated that bollworm larvae use the same enzymatic pathways to respond to plant allelochemicals and insecticides. Differences in responses may related most closely to variations in the concentrations of allelochemicals in the diet. Also, Robertson *et al*. (1990) indicated that response of individuals of any polyphagous species to the pesticides might reflect differential metabolic effects of host plants rather than the extent or geographical distribution of genetically based resistance to the pesticide. As for studying, the combined effect of plant components and insecticides previous studies indicated that myristicin isolated from the edible part of parsnips was found to have insecticidal and synergistic properties against several insect species (Lichtenstein and Casida, 1963). Also, Lichtenstein *et al*. (1974) found that dill plant contains materials which are insecticidal and also exhibit synergistic properties with carbamate and organophosphate insecticides. Recently, Guirguis *et al*. (1991) found that citrus oil extracted from different fruit peels could be used as insecticide synergists against *S. littoralis* larvae.

Regarding the effect of plant components on susceptibility of insects to insecticides, Wood *et al*. (1981) found that larvae of the fall armyworm *Spodoptera frugiperda* reared on millet were 6X more susceptible to trichlorfon than larvae reared on bermudagrass, cotton, corn and soybean. It was found also that larvae reared on bermudagrass and millet was more susceptible to carbaryl and permethrin than larvae reared on corn, cotton or soybean. Similarly, Rizk and Kamel (1982) found that the larvae reared on tomato leaves proved to be more susceptible to synthetic pyrethroids than those reared on any other host. However, marked differences in the susceptibility of the larvae to pyrethroids were observed when larvae were reared on tomato in comparison to those reared on soybean and cowpea. Likewise, Muehleisen *et al*. (1989) found that feeding fresh excised flower buds to *Heliothis zea* larvae decreased tolerance to the O.P. methyl parathion whereas the toxicity of the pyrethroid insecticide permethrin was not affected. However, data indicated in general that bollworm larvae use the same enzymatic pathways to respond to plant allelochemicals and insecticides. Accordingly, differences in responses may relate most closely to variations in the concentrations of allelochemicals in the food. Also, Mataruga *et al*. (1996) found that short term change of the diet (3 days) from leaves of the favorable (oak) to leaves of unfavorable (locust) provoked an increase in glutathion-S transferase (GST) and glutathione peroxidase like (GSH-Px like) as well as in the amount of glutathione content (GSH). On the contrary, transferring the gypsy moth larvae reared on locust to oak leaves was followed by a decrease in GST, GSH-Px like activities and in the amount of GSH.

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السمية و النشاط الحيوى الناتج عن تغذية دودة ورق القطن على أوراق بعض الحشائش الطازجة

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هدف البحث هو دراسة السمية و التاثيرات البيولوجية للمبيدات عند خلطها بالحشائش المختارة على يرقات العمر الرابع لدودة ورق القطن. أوضحت النتائج المتحصل عليها تاثيرات مختلفة على العوامل البيولوجية عندما تغذت اليرقات على الأوراق الطازجة للحشائش غير المعاملة و النتائج كانت موت 100% لليرقات التى تغذت على 9 حشائش من ال 16 حشيشة.

مدة الطور اليرقى قد زادت بصورة معنوية ل 4 حشائش من 16 حشيشة. و نسبة التعذير قد قصرت بصورة معنوية ل 7 معاملات بعد تغذية اليرقات عليها ثم تعذيرها. مدة طور العذراء قد قصر بصورة معنوية فى أغلب المعاملات. نسبة خروج الفراشات زادت بصورة معنوية مع حشيشة واحدة فقط بينما انخفضت مع حشيشتين بصورة معنوية. تغذية اليرقات على الحشائش المختلفة ثبطتت بصورة حادة انتاج البيض. أوضحت النتائج ان نسبة الفقس للبيض الناتج عن معاملة الحشائش أظهرت انخفاض معنوى لحشيشتين فقط.

نتائج التغذية على نباتات الحشائش أوضحت زيادة معنوية فى عقم الفراشات لثلاث حشائش. عامل التنشيط الناتج عن خلط الحشائش بالمبيدات أظهر أن بعض نباتات الحشائش لها تاثير تنشيطى و البعض الاخرى لة تاثير تثبيطى بعد 48 ساعة من المعاملة. النتائج أظهرت تاثير من قليل الى متوسط على السمية عندما تم خلط الاوراق طازجة ل 9 حشائش بمبيد كلوربيريفوس.

ظهر النشاط التثبيطى عندما عوملت الآورق الطازجة ل 5 حشائش بمبيد إس فينفاليرات. و كان النشاط التنشيطى من قليل الى متوسط قد تم الحصول علية عندما غذيت اليرقات على اوراق 9 حشائش عوملت بمبيد ثيوديكارب. ظهر تاثير تثبيطى عندما عوملت فقط اوراق 3 حشائش بمبيد ثيوديكارب.

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