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BIOLOGICAL ACTIVITY OF ETHYL ACETATE EXTRACTS OF SOME WILD PLANTS ON COTTON LEAFWORM

(Spodoptera littoralis)

El-Sadaany, S. S[1]., R. A. El-Masry[1], A. M. Abo-Eyta[1], A. A. El-Sheakh[2], and Samah, A. El-Newary[2]

1. Agric. Biochemistry Dept., Fac. of Agric., Zagazig Univ., Egypt.
2. Plant Protection Research Institute, Dokki, Agriculture Research Center, Giza, Egypt.

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ABSTRACT: The biological activity of ethyl acetate extract of some wild plants, *Francoeuria crispa, Mesembryanthemum nodiflorum and Aizoon canariense* on Egyptian cotton leafworm, *Spodoptera littoralis*, after feeding 4th instar larvae with castor bean leaves treated with these extracts were evaluated. The three plants extracted successively by four solvents (petroleum ether, chloroform, ethyl acetate and ethanol). Ethyl acetate extracts of three plants were tested against 4th instar larvae of *S. littoralis* under laboratory condition. Obtained results showed that, *F. crispa* at 5% caused the highest reduction in pupation, female longevity and highest deformation. *M. nodiflorum* at 5% had the highest pupal mortality and sex ratio, lowest emergence of adults, number of deposited egg /female and hatchability. *M. nodiflorum* at 10% had the lowest sex ratio and male longevity. *A. canariense* at 5% had the highest malformation of adult and total injury, while at 10% had the failure exudes larvae of 4th, 5th and 6th instar larvae stages and prolongation at duration period of larvae.

Key words: Biological activity, ethyl acetate extract, *Francoeuria crispa, Mesembryanthemum nodeflorium, Aizoon canariense*, cotton leafworm.

INTRODUCTION

Recently valuable studies on different effects of plant extracts against many insect species were reported by several authors: where El-Saadany *et al.* (1994) found that fenugreek and dodonaea plants were not a preferable host of *S. littorals.* Sharaby *et al.* (1994) stated that hexane and chloroform dodonaea extracts caused a high pupal mortality, deformation of pupae, reduction on pupation, emergence of adults, reproduction of eggs and hatchability on *S. littoralis*. El-Gengaihi *et al.* (1997) isolated three alkaloid compounds (harmalol, harmaline and harmine) from *Peganum harmala* L. and tested these compounds against *S. littoralis*, they reported that these compounds had high mortality on larvae and pupae stage and latent effects as reduction on pupation, emergence of adults fecundity of female and hatchability. Salama and Ahmed (1997) reported that methanol extract of chinaberry, *Melia azedarach* had high insecticidal effect on *S. littoralis* reached to 100% mortality at 50ppm. Shoukry (2003) found that extracts of *Cyperus rotundus* caused larval mortality and latent effect on biological aspects of *S. littoralis* such as prolonged at larval duration period and reduction at pupation, emergence of adults, fecundity of female and hatchability. Essa (2003) reported that *Juniperus phoenicea* extracts had a harmful effect on *S. littoralis* as larval and pupal mortality and latent effects on biological aspects.

Three wild plants, *Francoreuia crispa, Mesembryanthemum nodiflorum* and *Aizoon canareinse* were investigated under laboratory conditions against *S. littoralis*. It is known that *F. crispa* was used in folk medicine in Egypt and Saudi Arabia to treat inflammation and as an insect repellent (Ross *et al.*, 1997). Al-Doghairi and Elhag (2003) found that the aqueous extracts of *F. crispa* leaves had insecticidal effect against larvae of *Culex pipiens* mosquitoes. Jocob and Peet (1989) stated that *M. nodiflorum* caused 20 cases of acute oxalate toxicity in sheep in Australia, where *M. nodefloruim* contained up to 18% soluble oxalate on dry weight base. Sathiyamoorthy *et al.* (1997) reported that aqueous *M. nodiflorum* extracts showed larvicidal activity against *Aedes aegypti* larvae. Rizk and Heiba (1990) reported that *A.canariense* had anti-inflammatory activity, both in vitro (inhibition of agonist-induced platelet aggregation) and in vivo (topical antierythema test, and cytotoxicity to human

mononuclear cells). Samir *et al.* (1997) isolated 26 components form oil of *F. crispa*, S. carvotanacetone was the major component of the oil (93%). Abd El- Mogib *et al.* (1990) isolated sesquiterpene lactones from the aerial parts of *F. crispa* from the polar parts. While the ether extract afforded triterpenes flavonoids, the guarianalides, the xanthanolides as well as the pseudoguaianolides.

Adam and Elhag (2000) reported that the toxic effect of *F. crispa* on rats.

The present investigation aimed to throw light on the biological activity of ethyl acetate extracts of three wild plants (*Francoria crisp, Mesembry-anthemum nodiflorum* and *Aizoon canareinse* against the cotton leafworm *Spodoptera littoralis* (Boisd.) under laboratory conditions.

MATERIALS AND METHODES

1. Insect Rearing

Susceptible strain of cotton leafworm, *S. littoralis* (Boisd.) was reared on castor bean leaves, *Ricinus communis* away from any insecticidal contamination under laboratory conditions, 27±2°C and R.H. of 65±5% for successive generations (Sharaby,1978).

2. Wild Plant Used and Extract Technique

Fresh plants of *F. crispa*, *M. nodiflorum* (L.) and *A. canareinse* were collected from El-Sharkia Governorate. The previously mentioned plants were identified by the Plant Department, Faculty of Science, Cairo University. The samples were cleaned from the dust and debris. The plant organs were washed in fresh water, then left to dry at room temperature for one week. The samples were dried finally in an oven at 40 °C, for 48hrs. The dried plant were grinded into a finely powdered material, then become suiTable for extraction and biological studies. The dry powder from three wild plants were successively extracted in 2 litter volumes of petroleum ether, chloroform, ethyl acetate and ethanol 70%, respectively by soaking for one week, where these solvents differ in their hydrophoecity so it can be extract different chemical substituents according to their polarity. After each solvent extraction the same plant material washed portionally by 2 litter pure of same solvent and plant material was allowed to dry thoroughly in air before using the new solvent. Extracts were dried by rotary evaporator at 200 rpm under vacuum 100 mpar (Büche

rotary evaporator) even obtained on dried matter which dissolved by 30 ml of pure solvent and transferred into clean beaker to dried in air at room temperature 25-35°C. The dried matter covered with cotton blages and kept in 5°C tell used. .These extracts tested against the 4th instar larvae of *S. littoralis*. In this study we were focused on the effect of chemical substituents extracted by ethyl acetate.

3. Biological Effect of Ethyl Acetate Extracts on 4th Instar Larvae of *S.littoralis*

The leaf dipping technique was used to tested the effect of ethyl acetate extracts (*F. crispa* at 5%, *M. nodiflorum* and *A. canareinse* at 5% and 10%) against 4th instar larvae of *S.littoralis* individually under laboratory condition. Disks of 2 cm diameter of the fresh castor bean leaves were dipped for 10 sec. in tested concentrations under investigation. A positive control disks were dipped in the solvent of ethyl acetate. Negative control disks were dipped in distilled water. The disks were left to dry under laboratory condition. The dried disks were offered to the 4th instar larvae stage of one day old which were starved for 6 hrs at the rate of one disk/larvae of *S.littoralis* and placed in a plastic cylinder tube of 3.4 cm diameter and 7.0 cm height and covered with a perforated plastic lid to permit good ventilation. Filter paper disk was wetted by 0.5 ml of distilled water and was put upon the bottom of plastic cylinder tube to keep the balance of humidity in treated disks of castor bean leaves .Four replicates of 10 larvae were made for each concentrations. The treated disks of castor bean leaves for each concentrations offered daily to tested larvae of *S.littoralis* for 48 hrs then the tested larvae were allowed to feed on untreated fresh castor bean leaves. Tested larvae were incubated at 27±2 °C and 65 ± 5% R.H. The tested larvae were daily inspected to know, larval mortality of 4th ,5th and 6th instars, larva failure to ecdysis 4th , 5th and 6th instars. Duration period of instar larvae (4th, 5th and 6th) as well as total larval duration, pupation percentage and pupal deformation. The formed pupae were weighted daily and were inspected to know, pupal weight, pupal mortality, pupal duration, adults emergence percentage, adult malformations and six ratio percentage. The newly emergened adults were sexed and kept in pairs in clean jars (450 ml). Each matting jar was

provided with 15% honey solution soaked in cotton wool, which was tied with wire for moths feeding. Honey solution was removed daily to avoid fermentation and growth of microorganisms. The newly laid egg masses were collected daily and counted then incubated under incubator conditions to hatch. The adults were inspected daily to know, adult longevity for male and female (pre-oviposion, oviposion and post-oviposion period), number of deposited egg by female in day, hatchability and total injury percentage.

RESULTS AND DISCUSSION

1. Biological Effect of Ethyl Acetate Extracts on Different Larval Stages of *S.littoralis*

Data in Table (1) indicated the effect of ethyl acetate extracts of *F. crispa* at 5%, *M. nodiflorum* and *A. canareinse* at 5% and 10% on larval stage of *S. littoralis* after treatment at 4th instar larvae orally.

1.1 Effect on 4th instar larvae

1.1.1 Duration of 4th instar larvae

The duration of 4th instar larvae was prolonged compared with the positive control. Such extended ranged between a minimum of 3±0.2 for *M. nodiflorum* at 5% to a maximum of 4.25±0.19 for *A. canareinse* at 10% compared with the positive control (2.6±0.13). Duration of 4th instar larvae of the negative control was 2±0.0.

1.1.2. Mortality of 4th instar larvae:

A. canareinse at 5% and 10% had no mortality of 4th instar larvae of *S. littoralis, M. nodiflorum* at 10% caused the highest mortality (5%). Both of the negative and positive control had no 4th instar larvae mortality.

1.1.3 Failure percentage of 4th instar larvae

The failure percentage of 4th instar larvae of *S. littoralis* was increased after treatment. *A. canareinse* at 10% recorded the highest failure percentage (20%), while *F. crispa* at 5% had no failure percentage compared with the positive control (5%). Negative control had no failure of 4th instar larvae percentage.

1.2 Effect of ethyl acetate extracts on 5th instar larvae

1.2.1 Percentage of larvae reached 5th instar larvae

The percentage of larvae reached 5th instar larvae from 4th

Table 1. Biological effect of ethyl acetate extracts on different larval stages of *S.littoralis*

Treatment	4th instar larvae				5th instar larvae				6th instar larvae				Total 4th, 5th and 6th larval instars		
	Initial No. of 4th instar larvae	Duration	Mort. %	Failure %	% of larvae reached 5th instar	Duration	Mort. %	Failure %	% of larvae reached 6th instar	Duration	Mort. %	Failure %	Duration	Mort. %	Failure %
Negative control	40	2.0±0.00	0.0	0.0	100	2.0±0.00	0.0	0.0	100	4.65±0.13	0.0	0.0	8.65±0.13	0.0	0.0
Positive control	40	2.6±0.13	0.0	5.0	95.0	5.3±10	0.0	0.0	95.0	5.2±0.08	0.0	5.3	11.75±0.13	0.0	10.0
F. crispa at 5%	40	3.2±0.20	2.5	0.0	97.5	4.3±0.11	0.0	5.1	90.0	4.8±0.1	0.0	5.4	12.00±0.10	2.5	10.0
M.nodiflorum at 5%	40	3.0±0.20	2.5	7.5	90.0	6.4±1.5	0.0	2.8	87.5	5.0±0.14	0.0	5.7	12.60±0.16	2.5	15.0
M.nodiflorum at 10%	40	3.2±0.16	5.0	10.0	85.0	4.0±0.15	0.0	0.0	85.0	5.1±0.11	0.0	0.0	13.00±0.15	5.0	10.0
A.canareinse at 5%	40	4.14±0.20	0.0	10.0	90.0	4.3±0.09	2.8	2.8	85.0	4.6±0.14	0.0	8.8	12.84±0.24	2.5	20.0
A.canareinse at 10%	40	4.25±0.19	0.0	20.0	80.0	5.0±0.15	0.0	12.5	70.0	5.0±0.32	7.14	10.7	14.25±0.40	5.0	37.5

instar larvae was decreased by ethyl acetate extracts. This decrease ranged between 80% for *A. canareinse* at 10% to 97.5% for *F. crispa* at 5% compared with the positive control (95%). All 4th instar larvae of the negative control succeeded to reached 5th instar larvae of *S. littoralis*.

1.2.2 Duration of 5th instar larvae

The duration of 5th instar larvae of *S. littoralis* was shortened compared with the positive control, except that of *M. nodiflorum* at 5% (6.43±1.15). Duration of 5th instar larvae ranged between a minimum of 4±0.15 for *M. nodiflorum* at 10% to a maximum of 5±0.15 for *A. canareinse* at 10% compared with the positive control (5.3±1). Duration of the negative control was 2±0.0.

1.2.3 Mortality of 5th instar larvae percentage

All tested extracts, the positive and the negative control had no 5th instar larvae mortality percentage, except that of *A. canareinse* at 5% which caused 2.8% mortality.

1.2.4 Failure of 5th instar larvae percentage

The failure of 5th instar larvae percentage ranged between a minimum of 2.8% for *M.nodiflorum* and *A. canareinse* at 5% to a maximum of 12.5% for *A. canareinse* at 10%. *M. nodiflorum* at 10% had no failure percentage and both of the negative and positive control followed the same trend.

1.3 Effect on 6th instar larvae

1.3.1 Percentage of larvae reached 6th instar larvae

The percentage of larvae reached 6th instar larvae was decreased compared with the positive control. The decrease ranged between a minimum of 70% for *A. canareinse* at 10% to 90% for *F. crispa* at 5% compared with the positive control (95%). All 5th instar larvae of the negative control succeeded to reached 6th instar larvae of *S. littoralis*.

1.3.2 Duration of 6th instar larvae

The duration of 6th instar larvae shortened compared with the positive control. The decrease ranged between 4.6±0.14 for *A.canareinse* at 5% to 5.1±0.11 for *M.nodiflorum* at 10% compared with the positive control (5.2±0.08). The duration of 6th instar larvae of negative control was 4.65±0.13.

1.3.3 Percentage of 6th instar larvae mortality

All treatments had no mortality, except that of *A. canareinse* at 10% which caused 7.14%. Both of negative and positive control had no mortality.

1.3.4 Failure of 6th instar larvae percentage

The failure of 6th instar larvae percentage ranged between a minimum of 5.4% for *F. crispa* at 5% to a maximum of 10.7% for *A. canareinse* at 10% compared with the positive control (5.3%). Both of negative control and *M. nodiflorum* at 10% had no failure of 6th instar larvae percentage.

1.4 Effect of ethyl acetate extracts on total larval stage

1.4.1 Duration of total larval stage

Total larval duration of *S. littoralis* was prolonged compared with the positive control. Such extension ranged between 12±0.1 for *F. crispa* at 5% to 14.25±0.4 for *A.canariense* at 10% compared with the positive control (11.75±0.13). Total larval duration of the negative control was 8.65±0.13.

1.4.2 Total larval mortality

Low concentrations of all plant extracts caused 2.5% total larval mortality, while the high concentrations caused 5%. Both of negative and positive control had no larval mortality.

1.4.3 Total failure of larval stage

A. canariense at 10% caused the highest failure of larval percentage (37.5%), while *F. crispa* at 5% and *M. nodiflorum* at 10% caused the same percentage of the positive control (10%). The negative control had no failure larval percentage.

From obtained results it could be noticed that, the effect of ethyl acetate extracts were decreased by increasing duration period. Ethyl acetate plant extracts prolonged larval duration. *A. canareinse* at 5% and 10% had the highest effect on larval stage, especially high concentration 10% which caused the highest total larval duration, mortality and failure.

Obtained results were agreed with those obtained by Shoukry (2003) who stated that *Cyperus rotundus* extracts caused prolongation on larval duration, mortality and decreasing in percentage of larvae reached 5th and 6th instar larvae of *S. littoralis* and Essa (2003) who found that *Juniperus phoenicea* extracts caused larval mortality and prolongation on larval duration of *S. littoralis*.

2. Effect of Ethyl Acetate Extracts on Pupal Stage of *S. littoralis*

Data in Table (2) showed the effect of ethyl acetate extracts of *F. crispa* at 5%, *M. nodiflorum* and *A. canariense* at 5% and 10% on pupal stage after treatment 4th instar larvae of *S. littoralis*.

2.1 Pupation percentage

Pupation percentage was decreased after treatment and *F. crispa* at 5% recorded the lowest percentage 85.7%, while *M. nodiflorum* at 5% was the highest 91% compared with the positive control (100%). *M.nodiflorum* and *A.canariense* at 10% had no effect on pupation percentage. The negative control had pupation percentage 100%.

2.2 Deformation percentage

Deformation percentage was increased after treatment and *F. crispa* at 5% showed the highest increase 14.3%, while *M. nodiflorum* at 5% showed the lowest increase 9% compared with the positive control (100%). The negative control had no deformed pupae and both of *M. nodiflorum* and *A.canariense* at 10% followed the same trend.

2.3 Pupal mortality

The pupal mortality percentage of *S. littoralis* was increased after treatment compared with the positive control, except that of *M. nodiflorum* at 10% (11.8%). The increase ranged between a minimum of 17.5% for *A.canariense* at 10% to a maximum of 23.3% for *M. nodiflorum* at 5% compared with the positive control (13.8%). The negative control had 2.5% pupal mortality.

2.4 Pupal duration

The pupal duration of *S.littoralis* was slightly affected compared with the positive control, except that of *A.canariense* at 10% (10.7±0.22). No clear difference was noticed between other treatments and the positive control. The pupal duration of the negative control was 10±0.16.

2.5 Pupal weight

The weight of pupae resulted from treated 4th instar larvae of *S.littoralis* was decreased compared with the positive control. The mean number of pupal weight ranged between a minimum of 0.2535±0.008 for *A.canariense* at 10% to a maximum of 0.334±0.1 for *F. crispa* at 5% compared with the positive control (0.344±0.1). The pupal weight of the positive control was nearly similar to the

Table 2: Effect of ethyl acetate extract of three wild plants on the pupal stage of *S. littoralis*

Treatments	Pupation %	Deformation %	Pupal mortality %	Pupal duration/ day	Pupal weight/g
Negative control	100	0.0	2.50	10±0.16	0.3402±0.10
Positive control	100	0.0	13.80	9.7±0.17	0.344±0.10
***F. crispa* at 5%**	85.7	14.3	20.00	9.7±0.2	0.334±0.10
***M. nodiflorum* at 5%**	91.0	9.0	23.30	9.3±0.2	0.307±0.005
***M. nodiflorum* at 10%**	100	0.0	11.80	9.33±0.12	0.294±0.007
***A.canariense* at 5%**	90.0	10.0	18.00	9.4±0.22	0.3027±0.007
***A.canariense* at 10%**	100	0.0	17.50	10.7±0.22	0.2535±0.008

negative control (0.344±0.1 and 0.3402±0.1, respectively).

From obtained results it could be noticed that, *M. nodiflorum* and *A. canariense* at 10% had no effect on pupation and deformation percentage. All extracts had slight effect on pupal duration and pupal weight, while these extracts had a notice harmful effect on pupae mortality. The low concentrations of *M. nodiflorum* and *A. canariense* were more effective than the high concentrations this may be due to the high concentration which caused antifeedant effect. *F. crispa* at 5% had the highest effect on pupal stage this was agreed with results obtained by Sathiyamoorthy *et al.* (1998) who reported that *F. crispa* at 5% had strong activity on growth inhibition (above 96%) of the Malaria parasite *Plasmodium falciparum*. The plant was positive for antimalarial activity.

Also Al-Doghairi and Elhag (2003) who stated that aqueous extracts of *F.* crispa leaves had a high toxicity against larvae of *Culex pipiens* mosquitoes. The highest concentration of *F. crispa* tested (0.25%) caused 55.3% mortality after 10 days, leading to 34.3% pupation and 21.2% adult emergence, no mosquito eggs were laid in media containing 0.05% aqueous extract from *F. crispa.*

Our idea was agreed with those obtained by Dimetry and Abd-Alla (1998) who reported that the saponifiable and unsaponifiable fractions of petroleum ether extracts of neem fruits showed a high pupal deformation of *S. littoralis*. Also Essa (2003) who stated that the topical application of acetone and ethanol extracts of *Juniperus phoenicea* on 4th instar larvae of *S. littoralis* decreased the pupation percentage, pupal duration, pupal weight and increased the deformation percentage and pupal mortality. Similarly Shoukry (2003) who found that the *Cyperus rotundus* extracts caused slight increase in pupal duration, deformation and reduction on pupation of *S. littoralis*.

3. Effect of Ethyl Acetate Extract on Adult Stage

Data given in Table (3) showed the effect of ethyl acetate extracts of *F. crispa* at 5% *M. nodiflorum* and *A. canareinse* at 5% and 10% on the adult stage of *S. littoralis* treated on the 4th instar larvae.

3.1 Emergence of adult percentage

The emerged adult moths of *S. littoralis* were decreased after treatment compared with the positive control, except that of *M. nodiflorum* at 10% (88.2%).

The decrease ranged between 76.7%, for *M. nodiflorum* at 5% to 82.5% for *A. canariense* at 10% compared with the positive control (86.2%). The emergence percentage of adult was 97.5% in normal control.

3.2 Malformation of adult

Ethyl acetate (the solvent) and ethyl acetate extracts caused a high malformation percentage of *S. littoralis* adult moths compared with that of normal (negative control). *A. canariense* at 5% caused the highest malformation percentage (34.8%), while at 10% showed the lowest percentage (15.8%) compared with the positive control (19.4%). The negative control had 7.7% malformed adult moths. The adult malformation classified according to the external characters of adults as follow: adult with one wing, adult with short wings, adult with shrunken wings, adult of pupae with adult antennae, adult with pupal upper parts or adult with typical pupal abdomen, the two shapes were pupal-adult intermediates, adult that could not free their heads from pupal skin and normal adult with small size.

3.3 Sex ratio

The sex ratio of emerged adult moths (male/female) of *S. littoralis* was increased after treatment compared with the positive control. The increase ranged between a minimum of 0.76 for *M. nodiflorum* at 10% to a maximum of 2.29 for 5% compared with the positive control (0.61). The sex ratio of the negative control was 1.35.

3.4 Adult longevity

The longevity of adults which means the period from emergence of adult to the death. Generally ethyl acetate (the solvent) and ethyl acetate extracts decreased the longevity of adults (male or female) of *S. littoralis*

3.4.1 Male longevity

The longevity of male moths emerged from *S. littoralis* larvae treated with ethyl acetate plant extracts was shortened compared with the positive control. The mean of decrease ranged between a minimum of 10.33±1 for *M.nodiflorum* at 10% to a maximum of 12.14±2.15 for *A. canariense* at 5% compared with the positive control (12.4±0.8). The male longevity of negative control was 19.14±1.9.

3.4.2 Female longevity

The longevity of female moths emerged from *S. littoralis* larvae treated with ethyl acetate plant extracts was prolonged compared with the positive

Table 3. Biological effect of ethyl acetate extracts on adult stage

Treatments	Emergence of adults percentage	Malformation of emerged adult	Sex ratio	No. of deposited eggs/ female	Hatch-ability %	Total injury %	Longevity of adults				
							Male	Female longevity			
								Total	Pre-ovi.	Ovi.	Post-ovi.
Negative control	97.5	7.70	1.35	2552 ±328	91.00	7.7	19.14±1.9	14.7±2.3	2.8±0.55	11.00±2.0	1.0±0.70
Positive control	86.2	19.40	0.61	1980±702	81.40	37.5	12.4±0.8	10.0±1.4	3.7±1.15	7.00±1.4	1.2±0.20
F. crispa at 5%	80.0	30.43	1.55	1876 ±363	86.23	60.0	11.55±2.0	9.7±0.8	1.9±0.45	6.50±0.9	1.3±0.37
M. nodiflorum at 5%	76.7	26.00	2.29	743±170	11.28	57.5	11.0±1.7	13.8±0.8	5.7±0.06	5.64±0.5	2.5±0.60
M. nodiflorum at 10%	88.2	23.33	0.76	2015±260	79.85	42.5	10.33±1.0	11.5±0.5	2.8±0.84	7.30±0.53	1.4±0.20
A. canareinse at 5%	82.0	34.80	1.44	1021±211	53.86	62.5	12.14±2.2	14.3±1.4	4.6±0.60	7.73±0.85	2.0±0.53
A. canareinse at 10%	82.5	15.8	0.90	1184±301	60.00	60.0	11.0±0.80	11.9±0.9	3.7±0.60	6.50±1.34	1.7±0.50

control, except that *F. crispa* at 5% which was lower than that of the positive control (9.7±0.8) and (10±1.4). The mean of increase ranged between a minimum of 11.5±0.5 for *M. nodiflorum* at 10% to a maximum of 14.3±1.4 for *A. canariense* at 5% compared with the positive control (10±1.4). The female longevity of negative control was 14.7±2.3.

The pre-oviposition period of *S. littoralis* female moths ranged between a minimum of 1.9±0.45 for *F. crispa* at 5% to a maximum of 5.7±0.06 for *M. nodiflorum* at 5% while the positive control was 3.7±1.15. The pre-oviposition period of negative control was 2.8±0.55.

The oviposition period of *S.littoralis* female moths ranged between a minimum of 5.64±0.5 for *M. nodiflorum* at 5% to a maximum of 7.73±0.85 for *A. canariense* at 5% while the positive control was 7±1.4. The oviposition period of negative control was 11±2.

The post-oviposition period of *S. littoralis* female moths was prolonged compared with the positive control. Such extenuation ranged between a minimum of 1.3±0.37 for *F. crispa* at 5% to a maximum of 2.5±0.6 for *M. nodiflorum* at 5% compared with the positive control (1.2±0.2). The post-oviposition period of negative control was 1±0.7.

3.5 Female fecundity

Ethyl acetate extracts decreased the mean number of deposited eggs / female moths of *S. littoralis* compared with the positive control, except that of *M. nodiflorum* at 10% (2015±260). The decrease ranged between a minimum of 743±170 for *M. nodiflorum* at 5% to a maximum of 1876 ± 363 for *F. crispa* at 5% compared with the positive control (1980±702). The mean number of deposited eggs /female of negative control was 2552±328.

3.6 Hatchability percentage

Ethyl acetate extracts caused a reduction effect on the hatching of laid eggs/ resulted female moths of *S. littoralis* compared with the positive control, except that of *F. crispa* at 5% was 86.23%. The decrease ranged between a minimum of 11.28% for *M. nodiflorum* at 5% to a maximum of 79.85% for *M. nodiflorum* at 10% compared with the positive control (81.4%). The hatchability percentage of negative control was 91%.

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3.7 Total injury percentage

All treatments even negative control had total injury percentage on *S. littoralis*. The total injury percentage was increased after treatment compared with the positive control. *A. canariense* at 5% showed the highest total injury percentage (62.5%), while *M. nodiflorum* at 10% recorded the lowest percentage (42.5%) compared with the positive control (37.5%). The total injury percentage of negative control was 7.7%.

Obtained results cleared that, ethyl acetate extracts for all studied plants had a high total injury especially the low concentration 5% where *A. canariense* at 5% caused the highest total injury. *M. nodiflorum* at 5% decreased number of deposited eggs/ female and hatchability very drastically. The longevity of adults was increased, while the oviposion period was decreased. Ethyl acetate extracts increased sex ratio, although decreased the fecundity of female. *M. nodiflorum* at 5% had the highest harmful effect on adult stage.

Our aim of this study was agreed with studies by Sharaby *et al.* (1994) who stated that both of hexane and chloroform extracts of dodonaea caused a high reduction on emergence of adults of *S. littoralis*. Both of chloroform extract of fenugreek and hexane extract of dodonaea showed a high adult deformation. All tested extracts reduced the fecundity of resulted female and ethanol extract of fenugreek caused the highest effect. As well as hatchability were reduced by these extracts and hexane extract of dodonaea caused the highest effect. Also Ragab (2001) found that treatment 4th instar larva of *S. littoralis* with some commercial oils of *Citrullus colocynthis*, *Eugenia* caryo*phyllus, Aloe vera, Boswellia serrata, Allium sativum, Prunus communis, Nigella sative* and *Brassica alba* at 2.5% caused reduction on emergence of adults, fecundity and fertility. *C. colo-cynthis, E. caryophyllus, A. vera, B. serrata* and *B. alba* caused no hatchability, while *P. communis, A. sativum* and *N. sativa* had significantly reduce on hatchability of *S. littoralis*.

Generally it can be noticed that ethyl acetate *of F. crispa, M. nodiflorum* and *A. canariense* caused high injury on *S. littoralis* at all life cycle. These extracts had a notice harmful effectiveness, *A. canariense* at 10% had the highest effect. These results were agreed with those results obtained with Samir *et al.* (1997) who isolated 26 components from oil of *F. crispa*, S. carvotanacetone was

the major component of the oil (93%). Abd El- Mogib *et al.* (1990) isolated sesquterpenes lactones from the aerial parts of *F. crispa* from the polar parts. While the ether extract afforded triterpenes flavonoids, the guari-analides, the xanthanolides as well as the pseudoguaianolides. Adam and Elhag (2000) stated that the toxicity of *F. crispa* on rats. Leaves of *F. crispa* at 10% caused an increase of aspartate amino transaminase (AST), gamma glutamyl transferase (GGT) activities, cholesterol and urea levels and a decrease of total protein and some other alterations in serum constituents compared with the control rats.

It could be concluded that the studied extracts could be used as pest control agents, with more study of their concentration and purification.

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النشاط البيولوجى لمستخلصات بعض النباتات البرية بخلات الاثيل وتأثيرها على دودة ورق القطن

سيد سليمان السعدنى[1] – رجب عبد الفتاح المصرى[1] – أحمد محمد ابوعيطه[1]
على عبد العزيز الشيخ[2] – سماح على النويرى[2]

١. قسم الكيمياء الحيوية الزراعية– كلية الزراعة – جامعة الزقازيق – مصر.

٢. معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – الجيزة – مصر.

تم تقييم التأثير البيولوجى لمستخلصات خلات الاثيل لبعض النباتات البرية *Francoeuria crispa, Mesembryanthemum nodiflorum, Aizoon canariense* على دودة ورق القطن بعد تغذية العمر الرابع لها على أوراق خروع معامل بتلك المستخلصات . حيث تم عمل استخلاص متتابع للنباتات البرية باستخدام أربع مذيبات عضوية (الأثير البترولى – الكلورفورم – خلات الاثيل والايثانول) حيث تختلف هذه المذيبات فى خواصها الهيدروفوبية. تم دراسة النشاط البيولوجى لمستخلص خلات الاثيل على دودة ورق القطن عند عمرها الرابع وذلك فى تجربة معملية. أوضحت النتائج المتحصل عليها أن مستخلص خلات الاثيل من نبات *F. crispa* عند تركيز ٥% أدى الى اكبر تناقص فى التعذر وعمر الأنثى كما أدى الى اكبر درجة من التشوه. وأن المستخلص من *M. nodeflorium* عند تركيز ٥% قد أدى الى أعلى نسبة موت فى طور التعذر وكذلك النسبة الجنسية بين الذكور والإناث واقل خروج للفراشات وكذلك اقل عدد من البيض والفقس. وان المعاملة بمستخلص خلات الاثيل لنبات *M. nodiflorum* بتركيز ١٠% كان اقل تأثيرا على النسبة الجنسية وطول عمر الذكور. بينما أدت المعاملة بمستخلص خلات الاثيل لنبات *A. canariense* عند تركيز ٥% الى حدوث اعلي درجة من التشوهات للفراشات وكذلك الضرر الكلى. وان المعاملة بمستخلص خلات الاثيل لنبات *A. canariense* عند تركيز ١٠% قد أدت الى حدوث فشل اليرقات فى الانسلاخ من العمر الرابع والخامس والسادس كما أحدثت إطالة فى العمر اليرقى.