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Insecticidal Activity of Different Wild Plant Extracts against *Aphis craccivora* Koch.

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ABSTRACT

The insecticidal activity of 29 wild plant extracts belonging to 13 families was determined against *Aphis craccivora* Koch. Under laboratory conditions. The tested plants were subjected to extraction successively with petroleum ether, chloroform, ethyl acetate then ethanol. Using petroleum ether in the first extraction step showed that 19 plant extracts gave high toxic action against *A. craccivora* with LC_{50} values ranged from 0.182 mg/cm^2 to 0.969 mg/cm^2. *Suaeda vermiculata, Melia azedarach* (Leaves), *Atriplex semibaccata* and *Halocnemon strobilaceum* showed superior toxicity with LC_{50} values 0.182, 0.218, 0.231 and 0.231 mg/cm^2, respectively. In the second extraction step by using chloroform, 18 plant extracts induced toxic effect against the tested insect with LC_{50} values ranged between 0.192 and 0.759 mg/cm^2. In the third extraction step by using the ethyl acetate, 20 plant extracts showed higher toxicity towards the tested plants with LC_{50} values ranged between 0.057 and 0.941 mg/cm^2. *Atriplex semibaccata, Suaeda vermiculata, Halocnemon strobilaceum* and *Suaeda fruticosa* revealed high insecticidal activity with LC_{50} values 0.057, 0.104, 0.159 and 0.161 mg/cm^2, respectively. Using ethanol in the fourth extraction step showed that 9 plant extracts gave high toxic action against *A. craccivora* with LC_{50} values ranged from 0.275 to 0.933 mg/cm^2. *Atriplex semibaccata, Suaeda vermiculata, Suaeda fruticosa* and *Pergularia tomentosa* induced toxic effect with LC_{50}'s 0.275, 0.338, 0.424 and 0.634 mg/cm^2, respectively.

Key Words: Insecticidal activity, Plant extracts, *Aphis craccivora*

INTRODUCTION

The development of agriculture brought the phenomenon of increases in the populations of pests and diseases and competition for food. Although synthetic organic pesticides appeared to provide a solution to the problems of pest control, it has become apparent that repeated application of pesticides can be an inadequate method of control.

The development of pest resistance and problems of environmental pollution have accompanied excessive reliance on pesticides. Such environmental problems have focused increased interest on pesticides occurring naturally in plants. Ideally these new types of pest control agents should be active against limited number of species including specific target organisms. Such agents consider as biodegradable to non-toxic products and can be suitable for use in programs of integrated pest management.

Use of natural botanical pesticides in an agro-ecosystem is now emerging as one of the prime means to protect crops against pests and to reduce the environment from pesticidal pollution, which is now a global problem. Botanical pesticides possess an array of properties including pesticidal activity, repellency to pests and antifeedancy (Prakash and Rao 1986, 1987 and 1995; Prakash *et al.*, 1987, 1989 and 1990 and Omara 1997).

Some of these indigenous resources have been in use for over a century to minimize losses due to pests and disease in agricultural production (Prakash *et al.*, 1990; Parmar and Devakumar, 1993; Puttarudriah and Bhatia 1995).

The aim of this study was to determine the insecticidal activity of different wild plant extracts against *Aphis craccivora* under laboratory conditions.

MATERIALS AND METHODS

Tested plants

29 wild plants free from insecticidal contamination were used in the present study according to published data (Mahasneha *et al.*, 1996) in concern of their bioactivity against harmful pests. These plants were collected from different areas in Sinai and El-Amryia region west north Delta, Egypt. The wild plants used belong to different families and species are illustrated in Table (1).

Table (1): Identification of collected wild plants used for extract preparation.

Family	Plants	Localities	Extracted parts
Chenopodiaceae			
	Arthrocnemon glaucum	El-Amryia	Whole plant
	Atriplex halimus	El-Amryia	Whole plant
	Atriplex nummularia	El-Amryia	Whole plant
	Atriplex semibaccata	El-Amryia	Whole plant
	Chenopodium morale	Sinai	Whole plant
	Hamada elegens	Sinai	Whole plant
	Halocnemon strobilaceum	Sinai	Whole plant
	Suaeda vermiculata	El-Amryia	Whole plant
	Suaeda fruticosa	El-Amryia	Whole plant
Compositae			
	Inula crithnoides	El-Amryia	Leaves and stem
	Jasonia montana	Sinai	Whole plant
	Conyza dioscoridis	Lake beach	Whole plant
Asclepiadaceae			
	Pergularia tomentosa	Sinai	Whole plant
	Solenostema argel	Sinai	Whole plant
Polygonaceae			
	Emix spinosus	El-Amryia	Whole plant
	Rumex dentatus	El-Amryia	Whole plant
Labiatae			
	Mentha longifolia	Lake beach	Whole plant
	Stachys aegyptiaca	Sinai	Whole plant
Melaiaceae			
	Melia azedarach (Leaves)	El-Kanater	Leaves
	Melia azedarach (Seeds)		Seeds
Solanaceae			
	Abrus precatorias	Market	Seeds
	Hyoscyamus muticus	Sinai	Whole plant
Zygophyllaceae			
	Peganum harmala	Sinai	Whole plant
	Zygophyllum album	Sinai	Whole plant
Concifera			
	Morettia dhilaena	Sinai	Whole plant
Plumbaginaceae			
	Limoniastrum moropetlum	El-Amryia	Whole plant
Scrophulariaceae			
	Verbascum sinuatum	Sinai	Whole plant
Tamaraciaceae			
	Tamarix nilotica	Sinai	Leaves and stem

Preparation of plant samples and extraction

Samples of the collected plants were left to dry for 2 weeks in the laboratory. Dried plants were ground using an electric mill, sieved and kept for extraction.

Plant extracts were prepared according to the method adopted by Afifi *et al.*, (1988) with some modifications. Samples of 200 gm each of powdered plant materials were successively extracted with organic solvents of increasing polarities, petroleum ether, chloroform, ethyl acetate and ethanol 95 %, respectively. Petroleum ether was used first where samples (each of 200 gm) of the dried plant material were soaked in 1000 ml solvent and kept for 48 hrs under laboratory conditions. The mixtures were mechanically shaken for 6 hrs. The extracts were then filtered over anhydrous sodium sulfate and petroleum ether was evaporated under reduced pressure using a rotary evaporator to dryness. The resulting crude extracts were weighted and kept in deep freezer until evaluation. The residual powders were allowed to dry before starting the successive extractions. For each experimental solvent the same procedure was used.

Tested insect

The present study was carried out to study the toxicity of plant extracts against the Cowpea aphid, *Aphis craccivora* Koch.

Lab strain of the black bean aphid, *A. craccivora* was obtained from the Economic Entomology and Pesticides Department, Faculty of Agriculture, Cairo University at Giza, Egypt. The aphids were cultured according to the following technique:

Faba bean, *Vicia faba* seeds were planted in plastic pots (12-cm diameter) at the rate of 6 – 7 seeds per pot. These pots were placed under a muslin cage to provide good sunlight and to keep plants away from any insect infestation. After seedlings reached about 10 cm, long the plants were taken to the laboratory and covered by cage to prevent contamination with other pest population. Infested leaves of *A. craccivora* were transferred to these plants and left them to reproduce under laboratory conditions of 25 ± 5 °C and 70 ± 5 % R.H. the colony was supplied with fresh faba bean plants from time to time according to necessity.

The insecticidal activity of different wild plant extracts

The same solvent, which used in the extraction, was used to dilute each of the crude extract. Series of concentrations for each of the tested extracts were prepared and investigated against *A. craccivora* using residue film technique.

A known volume of all tested concentrations was evenly spread at the bottom of Petri dishes surface 7 cm in diameter and kept until dryness. Several concentrations for each solvent extract were used and each one was replicated four times. After complete dryness of the film, number of adults were placed in each of the treated Petri dishes, covered and kept at room temperature for 24 hours then percent mortality was calculated. Control was prepared with the solvent only.

Statistical analysis and Toxicity lines

All figures obtained with different tests were subjected to statistical analysis to evaluate the relative efficiency of tested plant extracts as insecticides. In the present investigation all percent mortalities were corrected for the natural mortality according to Abbott's formula (1925). Mortality curves (LC-P Lines) were drawn on probity logarithmic graph papers according to the method developed by Finney (1952).

RESULTS AND DISCUSSION

The toxicity of 116 solvent extracts obtained from different wild plants was evaluated against *Aphis craccivora* Koch. using residual film technique. The LC_{50} and LC_{95} values were plotted and tabulated in Tables (2, 3, 4 and 5), with their corresponding slopes, toxicity index and the relative potencies. The data will be discussed depending on the type of solvent as follows:

Petroleum ether extracts

The results in Table (2) show the efficiency of the tested plant petroleum ether extracts against *Aphis craccivora*. The extract of *Suaeda vermiculata* extract was the most effective at the LC_{50} level whereas that of *Tamarix nilotica* was the least one.

On basis of the different criteria used (i.e., LC_{50} and LC_{95}, toxicity index and relative potency), the tested plant extracts could be classified into three categories. The first category contained 19 plant extracts that induced high toxic action (LC_{50}'s ranged from 0.182 to 0.969 mg/cm^2). Starting with *Suaeda vermiculata*, which gave the highest effect against *Aphis craccivora* with LC_{50} 0.182 mg/cm^2 followed descendingly by *Melia Azedarach* (Leaves) (0.218), *Atriplex semibaccata*, (0.231), *Halocnemon strobilaceum*, (0.231), *Morettia philaena* (0.275), *Chenopodium morale* (0.286), *Nitraria retusa* (0.301), *Suaeda fruticosa* (0.374), *Atriplex numularia* (0.436), *Arthrocnemon gloucum* (0.450), *Verbascum sinuatum* (0.513), *Hyoscyamus muticus* (0.541), *Rumex dentatus* (0.541), *Stachys aegyptiaca* (0.657), *Mentha longifolia* (0.678), *Conyza dioscoridis* (0.704), *Atriplex halimus* (0.824), *Pergularia tomentosa* (0.882), and then *Melia azedarach* (Seeds) (0.969).

As shown in Table (2) the toxicity indexes of such extracts at LC_{50} were 83.33, 78.64, 78.64, 66.05, 63.65, 60.35, 48.61, 41.71, 40.47, 35.45, 33.65, 33.65, 27.67, 26.82, 25.83, 22.08, 20.63 and 18.77 as toxic as the petroleum ether extract of *Suaeda vermiculata* at LC_{50}, respectively. The toxicity index of the other plant extracts was ranged between 16.56 and 2.84 %.

The second category included seven plants that gave considerable toxic effect against the test insect. These plant extracts could be arranged according to their LC_{50}'s in the following descending order;

Table (2): Toxicity of different petroleum ether plant extracts to *Aphis craccivora* using residual film technique.

Plant	LC_{50} mg/cm^2	LC_{90} mg/cm^2	Slope	* Index	** No of Folds
Suaeda vermiculata	0.182	1.356	1.88	100.00	35.15
Melia azedarach (Leaves)	0.218	1.273	2.15	83.33	29.90
Atriplex semibaccata	0.231	4.002	1.33	78.64	27.64
Halocnemon strobilaceum	0.231	2.884	1.50	78.64	27.64
Morettia philaena	0.275	1.109	2.73	66.05	23.22
Chenopodium morale	0.286	2.624	1.74	63.65	22.37
Nitraria retusa	0.301	3.532	1.53	60.35	21.21
Suaeda fruticosa	0.374	0.925	4.19	48.61	17.09
Atriplex nummularia	0.436	17.750	1.02	41.71	14.66
Arthrocnemon glaucum	0.450	1.686	2.87	40.47	14.22
Verbascum sinuatum	0.513	2.204	2.60	35.45	12.46
Hyoscyamus muticus	0.541	2.053	2.83	33.65	11.83
Rumex dentatus	0.541	17.773	1.47	33.65	11.83
Stachys aegyptiaca	0.657	3.144	2.42	27.67	9.73
Mentha longifolia	0.678	3.950	2.14	26.82	9.43
Conyza dioscoridis	0.704	3.040	2.58	25.83	9.08
Atriplex halimus	0.824	6.106	1.89	22.08	7.76
Pergularia tomentosa	0.882	11.823	1.46	20.63	7.25
Melia azedarach (Seeds)	0.969	4.547	2.45	18.77	6.60
Limoniastrum moropetlum	1.098	6.781	2.08	16.56	5.82
Abrus precatorias	1.525	6.314	2.66	11.93	4.19
Jasonia montana	1.552	23.100	1.40	11.72	4.12
Zygophyllum album	1.568	24.236	1.38	11.60	4.08
Solenostema argel	1.637	12.473	1.86	11.11	3.91
Hamada elegens	1.871	34.300	1.31	9.72	3.42
Inula crithnoides	1.881	41.159	1.23	9.67	3.40
Emix spinosus	2.624	27.933	1.60	6.93	2.44
Peganum harmala	4.236	80.880	1.28	4.29	1.51
Tamarix nilotica	6.394	47.693	1.48	2.84	1

* = Toxicity index compared with *Suaeda vermiculata*
** =Number of folds compared with *Tamarix nilotica*

Limoniastrum moropetlum (1.098), *Abrus precatorias* (1.525), *Jasonia montana* (1.552), *Zygophyllum album* (1.568), *Solenostema argel* (1.637), *Hamada elegens* (1.871), and *Inula crithnoides* (1.881).

The third category contained *Emix spinosus*, *Peganum harmala* and *Tamarix nilotica* that revealed an intermediate toxic action against *Aphis craccivora* with LC_{50} 2.624, 4.236 and 6.394 mg/cm^2, respectively.

Chloroform extracts

The data given in Table (3) elucidate the efficacy of the tested plant chloroform extracts against *Aphis craccivora*. It is evident that *Limoniastrum moropetlum* was 16.08 times as toxic as that of *Pergularia tomentosa* at the LC50 level.Based on the different previously mentioned criteria, the 29 tested plant chloroform extracts could be divided only into two groups. The first group revealed high insecticidal activity to *craccivora* (LC_{50}'s ranged from 0.192 to 0.759 mg/cm^2). The descending order of toxicity of this group of plant extracts at LC_{50} was of *L. moropetlum, S. vermiculata, A. semibaccata, T.nilotica, V. sinuatum, I. crithnoides,S. fruticosa, A. numularia, A. gloucum, C. morale, P. harmala, R. dentatus, A. halimus, M. philaena,E. spinosus, A. precatorias, H. elegens* and *H. muticus*. The respective values of LC_{50}'s were 0.192, 0.244, 0.249, 0.260, 0.306, 0.334, 0.364, 0.366, 0.420, 0.435, 0.447, 0.455, 0.467, 0.483, 0.494, 0.499, 0.759 and 0.759 mg/cm^2, respectively.

The second group represents 11 plant extracts that showed insecticidal activity against the tested insect. The efficiency of such extracts at LC_{50} could be arranged descendingly as follows: *S. aegyptiaca* (1.006), *C. dioscoridis* (1.167), *M. azedrach* (Seeds) (1.304), *M. azedrach* (Leaves) (1.406), *H. strobilaceum* (1.544), Table (3): Toxicity of different chloroform plant extracts to *Aphis craccivora* using residual film technique

Plant	LC_{50} mg/cm^2	LC_{90} mg/cm^2	Slope	* Index	** No of Folds
Limoniastrum moropetlum	0.192	1.663	1.75	100.00	16.08
Suaeda vermiculata	0.244	1.037	2.60	78.71	12.66
Atriplex semibaccata	0.249	1.158	2.46	77.11	12.40
Tamarix nilotica	0.260	1.325	2.41	74.02	11.90
Verbascum sinuatum	0.306	0.300	1.88	62.93	10.12
Inula crithnoides	0.334	7.484	1.22	57.51	9.25
Suaeda fruticosa	0.364	2.527	1.94	52.86	8.50
Atriplex nummularia	0.366	1.359	2.88	52.53	8.45
Arthrocnemon glaucum	0.420	1.400	3.15	45.75	7.36
Chenopodium morale	0.435	1.787	2.67	44.17	7.10
Peganum harmala	0.447	2.337	2.29	43.02	6.92
Rumex dentatus	0.455	1.790	2.76	42.29	6.80
Atriplex halimus	0.467	1.385	2.36	41.21	6.63
Morettia philaena	0.483	1.923	2.73	39.79	6.40
Emix spinosus	0.494	3.794	1.87	38.95	6.26
Abrus precatorias	0.499	3.092	2.07	38.54	6.20
Hamada elegens	0.759	6.188	1.80	25.35	4.08
Hyoscyamus muticus	0.759	2.339	3.39	25.35	4.08
Stachys aegyptiaca	1.006	5.925	2.13	19.12	3.07
Conyza dioscoridis	1.167	5.275	2.51	16.48	2.65
Melia azedarach (Seeds)	1.304	3.612	3.71	14.74	2.37
Melia azedarach (Leaves)	1.406	7.224	3.31	13.68	2.20
Halocnemon strobilaceum	1.544	10.519	1.96	12.46	2.00
Nitraria retusa	1.707	11.693	1.97	11.26	1.81
Jasonia montana	2.271	10.965	2.40	8.47	1.36
Zygophyllum album	2.277	17.981	1.83	8.45	1.35
Mentha longifolia	2.858	58.387	1.26	6.73	1.08
Solenostema argel	3.040	30.142	1.66	6.33	1.02
Pergularia tomentosa	3.092	82.137	1.56	6.22	1

* = Index compared with *Limoniastrum moropetlum*
** =Number of folds compared with *Pergularia tomentosa*

N. retusa (1.707), *J. montana* (2.271), *Z. album* (2.277), *M. longifolia* (2.858), *S. argel* (3.040) and *P. tomentosa* (3.092).

Ethyl acetate extracts

On basis of the various criteria used, the 29 plant extracts could be classified into three groups. The first group represents 20 plants that exhibited potent activity against *A. craccivora* (LC_{50} values ranged between 0.057 and 0.941 mg/cm^2). The descending order of effectiveness of such extracts at LC_{50} was as follows: *A. semibaccata, S. vermiculata, H. strobilaceum, S. fruticosa, I. crithnoides, T. nilotica, R. dentatus, A. halimus, M. azedrachta* (Seeds), *E. spinosus, M. philaena, C. morale, V. sinuatum, A. numularia, P. tomentosa, M. longifolia, A. gloucum, A. precatorias, S. aegyptiaca* and *L. moropetlum* (Table 4).

Regarding the toxicity index, it is evident that at LC_{50} level, *S. vermiculata* extract was 55.05 % as toxic as *A. semibaccata*. The toxicity of other plants was ranged from 6.08 to 36.09 %. As shown in Table (4), *A. semibaccata* was the most potent extract (100%) and it was 87.22 times as toxic as that of *H. elegens* extract.

The second category contained six plants that caused considerable toxic effect towards the test insect. These plants could be arranged according to their LC_{50}'s in the following descending order; *P. harmala* (1.282), *N. retusa* (1.369), *S. argel* (1.380), *H. muticus* (1.637), *M. azedrach* (Leaves) (1.876) and *J. montana* (1.986).

Table (4): Toxicity of different ethyl acetate plant extracts to *Aphis craccivora* using residual film technique

Plant	LC_{50} mg/cm^2	LC_{90} mg/cm^2	Slope	* Index	** No of Folds
Atriplex semibaccata	0.057	1.523	1.16	100.00	87.22
Suaeda vermiculata	0.104	0.470	2.42	55.05	48.02
Halocnemon strobilaceum	0.159	1.845	1.54	36.09	31.48
Suaeda fruticosa	0.161	1.338	1.79	35.51	30.97
Inula crithnoides	0.206	2.884	1.43	27.83	24.28
Tamarix nilotica	0.231	2.884	1.50	24.73	21.57
Rumex dentatus	0.262	0.959	2.92	21.80	19.01
Atriplex halimus	0.268	1.575	2.14	21.38	18.64
Melia azedrach (Seeds)	0.296	1.336	2.51	19.31	16.84
Emix spinosus	0.327	5.015	1.39	17.47	15.34
Morettia philaena	0.382	1.742	2.51	14.97	13.06
Chenopodium morale	0.418	1.512	2.95	13.67	11.92
Verbascum sinuatum	0.446	2.754	2.08	12.81	11.18
Atriplex nummularia	0.598	2.702	2.51	9.57	8.35
Pergularia tomentosa	0.598	3.534	2.17	9.57	8.35
Mentha longifolia	0.624	1.793	3.60	9.17	8.00
Arthrocnemon glaucum	0.676	5.249	1.84	8.47	7.38
Abrus precatorias	0.683	7.587	1.57	8.37	7.30
Stachys aegyptiaca	0.871	3.248	2.87	6.57	5.73
Limoniastrum moropetlum	0.941	4.236	1.75	6.08	5.30
Peganum harmala	1.282	5.015	2.77	4.46	3.89
Nitraria retusa	1.369	10.654	1.85	4.18	3.64
Solenostema argel	1.380	4.339	3.30	4.14	3.61
Hyoscyamus muticus	1.637	5.431	3.16	3.49	3.05
Melia azedarach (Leaves)	1.876	14.889	1.83	3.05	2.66
Jasonia montana	1.986	4.703	4.38	2.88	2.51
Zygophyllum album	2.599	36.248	1.44	2.20	1.92
Conyza dioscoridis	3.456	24.711	1.93	1.66	1.43
Hamada elegens	4.989	68.365	1.44	1.15	1.00

* = Toxicity index compared with *Atriplex semibaccata*
** =Number of folds compared with *Hamada elegens*

The third one includes *Z. album, C. dioscoridis* and *H. elegens* that gave moderate toxic effect towards the test insect with LC_{50} 2.599, 3.456 and 4.989 mg/cm^2, respectively (Table 4). Their toxicity indexes were 2.20, 1.66 and 1.15 %, respectively.

Ethanol extracts

According to the toxicity parameters used, the 29 plant extracts could be classified into three groups. The first group contained nine plants that revealed high toxic effect (LC_{50} values ranged from 0.275 to 0.933 mg/cm^2). The descending order of their efficacy at LC_{50} was of *A. semibaccata, S. vermiculata, S. fruticosa, P. tomentosa, R. dentatus, V. sinuatum, M. azedrachta* (Seeds), *S. argel* and *Z. album* (Table 5).

The second group of the tested extracts represents 17 plant that proved satisfactory toxic action towards the aphid (LC_{50} values varied from 1.052 to 2.650 mg/cm^2). Such plant extracts could be arranged according to their LC_{50} level in the following descending order *M. philaena, H. elegens, S. aegyptiaca, H. muticus, J. montana, P. harmala, C. morale, L. moropetlum, M. longifolia, N. retusa, C. dioscoridis, M. azedrachta* (Leaves), *I. crithnoides, H. strobilaceum, A. halimus, A. precatorias* and *A. gloucum*.

The third category indicated *T. nilotica, E. spinosus* and *A. numularia* that showed intermediate activity against *A. craccivora* with LC_{50} 4.287, 6.496 and 10.680 mg/cm^2. Their toxicity indexes were 6.42, 4.24 and 2.58 %, respectively (Table 5).

Table (5): Toxicity of different ethanol plant extracts to *Aphis craccivora* using residual film technique

Plant	LC_{50} mg/cm^2	LC_{90} mg/cm^2	Slope	* Index	** No of Folds
Atriplex semibaccata	0.275	2.754	1.65	100.00	38.78
Suaeda vermiculata	0.338	1.221	2.93	81.53	31.62
Suaeda fruticosa	0.424	1.905	2.51	65.01	25.21
Pergularia tomentosa	0.634	2.079	3.18	43.44	16.84
Rumex dentatus	0.650	2.154	3.16	42.40	16.44
Verbascum sinuatum	0.746	6.132	1.80	36.92	14.32
Melia azedarach (Seeds)	0.834	2.910	3.03	33.02	12.80
Solenostema argel	0.912	3.612	2.74	30.19	11.71
Zygophyllum album	0.933	8.575	1.71	29.52	11.45
Morettia philaena	1.052	5.639	2.25	26.17	10.15
Hamada elegens	1.055	4.184	2.75	26.10	10.12
Stachys aegyptiaca	1.102	5.665	2.43	25.00	9.69
Hyoscyamus muticus	1.242	4.859	2.77	22.17	8.60
Jasonia montana	1.283	5.249	2.69	21.64	8.32
Peganum harmala	1.300	5.795	2.55	21.18	8.22
Chenopodium morale	1.349	5.951	1.55	20.42	7.92
Limoniastrum moropetlum	1.367	19.230	1.47	20.15	7.81
Mentha longifolia	1.385	3.274	4.37	19.88	7.71
Nitraria retusa	1.624	16.266	1.64	16.96	6.58
Conyza dioscoridis	1.635	4.106	4.10	16.84	6.53
Melia azedarach (Leaves)	2.097	7.406	2.99	13.13	5.09
Inula crithnoides	2.365	9.069	2.81	11.65	4.53
Halocnemon strobilaceum	2.479	28.193	1.56	11.11	4.31
Atriplex halimus	2.536	9.796	2.80	10.86	4.21
Abrus precatorias	2.541	21.879	1.76	10.84	4.20
Arthrocnemon glaucum	2.650	6.106	4.57	10.39	4.03
Tamarix nilotica	4.287	34.326	1.82	6.42	2.49
Emix spinosus	6.496	29.259	2.52	4.24	1.64
Atriplex numularia	10.680	79.668	1.89	2.58	1

*= Index compared with *Atriplex semibaccata*

**=Number of folds compared with *Atriplex numularia*

Reviewing the aforementioned results, it could be concluded that, using petroleum ether in the first extraction step showed that 19 plant extracts gave high toxic action against *A. craccivora* with LC_{50} values ranged from 0.182 to 0.969 mg/cm^2 (Table 2). *S. vermiculata*, *M. azedrach* (leaves), *A. semibaccata* and *H. strobilaceum* showed superior toxicity. El-Bolok *et al*., (1989) indicated that *Spinacia oleracea* petroleum ether extract was slightly more effective than chloroform extract against *Agrotis ipsilon* larvae. Petroleum ether extract of *Atriplex halimus* showed strongly aphicidal activity against *A. gossypii* (El-Goagary, 1998). In the second extraction step by using chloroform, 18 plant extracts induced toxic effect against the tested insect with LC_{50} values ranged from 0.192 to 0.759 mg/cm^2 (Table 3). Some chloroform plant extracts exhibited a higher toxicity than petroleum ether extracts. This finding may be due to the polar activity of this solvent which leads to the elution of some polar active ingredients e.g. fatty acids and their esters. These extracts were *L. moroptlum, A. numularia, A. gloucum, A. precatorias* and *H. elegans*. In the third extraction step by using the ethyl acetate, 20 plant extracts showed higher toxicity towards the tested insect pest with LC_{50} values ranged from 0.057 to 0.941 mg/cm^2 (Table 4). *A. semibaccata, S. vermiculata, H. strobilaceum* and *S. fruticosa* showed superior toxicity. The potency of ethyl acetate plant extracts was reported by: Guirguis *et al*., (1989) against aphid species, Hosh *et al*., (1997) towards *Tribolium castaneum* and *Sitophilus zeamais*; Guirguis *et al*., (1991); Chen *et al*., (2000) and Roel, *et al*., (2000) against *Spodoptera* species. In the fourth extraction step with ethanol, it was shown that 9 plant extracts gave high toxic action against *A. craccivora* with LC_{50} values ranged from 0.275 to 0.933 mg/cm^2 (Table 4). *A. semibaccata, S. vermiculata, S. fruticosa* and *P. tomentosa* induced toxic effect. Stein and Klingauf (1990) tested the efficiency of 13 different plant species of tropics and subtropics for their insecticidal properties towards

Myzus persicae. They found that all ethanol extracts had an efficacy between 60 – 100 % mortality against the tested insect pest.

Omara *et al*., (1997) studied the effect of aqueous Neem seed kernel powder extract (ANSKPE) in concentrations 2, 3 and 4 % crude extract and Neem Azal-F in concentrations of 25, 50 and 100 ppm active ingredient (Azadirachtin) on *A. craccivora* infesting broad bean plants under field conditions. They concluded that both neem forms affected significantly the mean numbers of the pest and Neem Azal-F reduced the numbers of this pest clearer than those of ANSKPE.

Ethyl acetate extracts of *A. semibaccata*, *S. vermiculata* and *S. fruticosa* showed superior toxicity with LC_{50}'s 0.057, 0.104 and 0.161 mg/cm^2, respectively (Table 3). In comparison with the ethanol extracts, the same plants showed lower toxicities against the tested insect with LC_{50} values 0.275, 0.338 and 0.424 mg/cm^2, respectively. This is due to the lake of active ingredients eluted by the ethanol. The solvent related in polarity but prior to ethanol, e.g. ethyl acetate and chloroform, successively eluted the toxic constituents of such extracts.

As concluded, among 116 solvent tested plant extracts, it can be noticed that the ethyl acetate extracts of *Atriplex semibaccata, Suaeda vermiculata* and *Halocnemon strobilaceum* gave the most toxic effect against *A. craccivora*. These extracts were subjected to chemical analysis, further fractionation, separation and finally identification of their biologically active components, which seem to be responsible for such toxicity. Data will be published afterwards.

REFERENCES

Abbott, W. S. 1925. A method of computing the effectiveness of an insecticide. J. Econ. Ent. 18, 265 – 267.

Afifi, F. A.; Hekal, A. M. and Salem, M. 1988. Fenugreek seed extracts as protectants of wheat grains against certain stored product insects. Ann. Agric. Sci., Fac. Agric. Ain Shams Univ. Cairo, Egypt, 33 (2): 1331 – 1344.

Chen, L. I.; Hanhong, X. U.; Zhao-Shanhuan; Chen, L.; Xu. H. H. and Zhao, S. H. 2000. Studies on antifeeding activity of *Daphne tangutica* against tobacco cutworm, *Spodoptera litura*. J. South China Agric. Univ. 21 (1): 44 – 46.

El-Bolok, M.M.; El-Borollosy, F.M.; Hemeida, I.A. and El-Shershaby, M.M. (1989): Insecticidal effect of spinach extract on the greasy cutworm, *Agrotis ipsilon* (Hufn) (Lepidoptera: Noctuidae) with special reference to isolation and identification of active compounds. Zagazig J. Agric. Res., 16: 175 – 182.

El-Gougary, O. A. 1998. Insecticidal and synergistic activity of *Atriplex halimus* L. extracts. J. Egyptian Soc. Parasitol. 28 (1): 191 – 196.

Finney, D. J. 1952. Probit analysis statistical treatment of the sigmoid response curve. Cambridge Univ. Press.

Guirguis, M. W.; Gohar, K.; Watson, W. M. and Salem, R. 1989. Toxicity and anti-feedant activity of wild plant extracts against some insect pests. Agric. Res. Rev. 67 (1): 1 – 12.

Guirgus, M. W.; Gohar, K.; Watson, W. M. and Salem, R. 1991. Toxicity and latent effect of two wild plants extracts on the cotton leafworm, *Spodoptera littoralies*. Egyptain J. Agric. Res., 69 (1): 11 - 22

Hosh; May; Tanhtw; Sidik, M. (ed); Rejesus, B. M. (ed); Garcia, R. P. (ed); Champ, B. R. (ed); Bengston, M. (ed); Dharmaputaos, (ed); and Halid, H. 1997. Repellency of some plant extracts to the stored products beetles, *Tribolium castaneum* (Herbst) and *Sitophilus zeamais* Motsch. Biotrop. Special Publication 59, 209 – 215.

Mahasneh, A. M., Abbas, J. A. and El-Oqlah, A. A. 1996. Antimicrobial activity of extracts of herbal plants used in the traditional medicine of Bahrain. Phytherapy Res. 10 (3): 251 - 253

Omara, Shadia, M.; Kelany, I. M. and Kleeberg, H. 1997. Effect of an Aqueous Neem Seed kernel powder extract (ANSKPE) and Neem Azal-F on *Liriomyza congesta* (Beeker) and *Aphis craccivora* (Koch.) infesting Broad Bean at Zagazig Region, Sharkia Governorate, Egypt. Practic Oriented Results on use of Neem-Ingredients and Pheromones. Proceeding of the 5th workshop. Germany.

Parmar, B. S. and Devakumar, C. (Eds.) 1993. Botanical and bio-pesticides. Westvill Publishing House New Delhi. p 199.

Prakash, A. and Rao, J. 1986. Evaluation of plant products as antifeedants against the rice storage insects. Proc. Symp. Resid. and Environ. Pollution.: 201 – 205.

Prakash, A. and Rao, J. 1987. Use chemicals as grain protectants in storage ecosystems and its consequences. Bull. Grain Tech. 25 (1): 65 – 69.

Prakash, A. and Rao, J. 1995. Insect pest management in stored rice ecosystem. In Stored Grain Ecosystems Eds. Jayas, D.S. White, D.D.G. and Muir, W.E. Pubal. Marcel Dekker Inc. New Yourk p. 757.

Prakash, A.; Mahapatra, P. K. and Mathur, K. C. 1990. Isolation, Identification and evaluation of an oviposition inhibitor for storage insect pests from bengunia, Vitex negando Linn. (Verbenaceae). Bull. Grain. Tech. 28 (1): 33 – 52.

Prakash, A.; Rao, J. Gupta, S. P. and Binh, T. C. 1989. Evaluation of certain plant products as paddy grain protectants against Angoumos grain moth *Sitotroga cerealella* Oliv. J. Nature Con. 1: 7 – 13

Prakash, A.; Rao, J. Pasalu, J. I. C. and Mathur, K. C. 1987. Rice storage and insect management. B. R. Publishing Crop. New Delhi p. 337.

Puttarudriah, M. and Bhatia, K. L. 1995. A preliminary note on studies of Mysore plants as source of insecticides. Indian J. Ent. 17 (2): 165 – 174.

Roel, A. R.; Vendramin, J. D.; Frighetto, R. T. S. and Frighetto, N. 2000. Effect of ethyl acetate extract of *Trichilia pallida* Swartz (Meliaceae) on development and survival of fall armyworm. Bragantia. 59 (1): 52 – 58.

Stein, U. and Klingauf 1990. Insecticidal effects of plant extracts from tropical and subtropical species. Traditional method is good as long as they are effective. J. Appl. Ent. 110 : 160 – 166.

النشاط الابادى لمستخلصات بعض النباتات البرية ضد حشرة من اللوبيا *Aphis craccivora Koch.*

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تم تقدير النشاط الابادى لمستخلصات ٢٩ من النباتات البرية تنتمي إلى ١٣ عائلة نباتية مختلفة ضد حشرة من اللوبيا Cowpea aphid, *Aphis craccivora* Koch تحت ظروف المعمل. تم استخلاص هذه النباتات باستخدام أربعة مذيبات مختلفة متدرجة القطبية وهى كما يلي: الايثير البترولى، الكلوروفورم، اسيتات الايثيل، كحول الايثيل وتم الاستخلاص على أربعة خطوات متتابعة ثم بعد ذلك تقييم سمية هذه المستخلصات الناتجة ضد الحشرة محل الاختبار. في الخطوة الأولى تم تقييم مستخلص الايثير البترولى ووجد أن ١٩ مستخلص أعطت سمية عالية ضد حشرة المن المختبرة وكانت قيم الـ LC_{50} تتراوح من ٠٫٠١٨٢ إلى ٠٫٠٩٦٩ مجم/سم٢ كما اظهر كل من مستخلص الايثير البترولى لنباتات السويدة *Suaeda vermiculata* ، الزنزلاخت (أوراق) *Melia azedrach* (Leaves) و الهالوسنيم *Halocnemon strobilaceum* أعلى سمية تجاه الآفة وكانت قيم الـ LC_{50} على الترتيب كما يلي: ٠٫٠١٨٢ ، ٠٫٠٢١٨ ، ٠٫٠٢٣١ و ٠٫٠٢٣١ مجم/سم٢ . وبتقييم النشاط الابادى لمستخلصات الكلوروفورم الناتجة عن المرحلة الثانية للاستخلاص وجد ان ١٨ مستخلص نباتي حققت سمية تجاه الحشرة محل الدراسة وكانت قيم الـ LC_{50} تتراوح بين ٠٫٠١٩٢ إلى ٠٫٠٧٥٩ مجم/سم٢ كما وجد ان ٢٠ مستخلص ناتجة عن المرحلة الثالثة للاستخلاص باستخدام اسيتات الايثيل لها سمية عالية تجاه الحشرة المختبرة بقيم LC_{50} تتراوح بين ٠٫٠٠٥٧ إلى ٠٫٠٩٤١ مجم/سم٢ . مستخلص اسيتات الايثيل لكل من النباتات التالية: *Atriplex semibaccata, Suaeda vermiculatas, H. strobilaceum* and *S. fruticosa* كانت الأكثر كفاءة من حيث النشاط للآفة من حيث النشاط الابادى للآفة وكانت قيم الـ LC_{50} لها كما يلي: ٠٫٠٠٥٧ ، ٠٫٠١٠٤ ، ٠٫٠١٥٩ و ٠٫٠١٦١ مجم/سم٢ على الترتيب. أما المرحلة الرابعة والأخيرة وباستخدام الايثانول فى الاستخلاص فقد وجد أن ٩ مستخلصات أعطت سمية عالية تجاه حشرة من اللوبيا *Aphis craccivora* Koch وكانت قيم الـ LC_{50} تراوحت بين ٠٫٠٢٧٥ إلى ٠٫٠٩٣٣ مجم/سم٢، مستخلص الايثانول لنباتات: *Atriplex semibaccata, Suaeda vermiculatas, S. fruticosa* and *Pergularia tomentosa* كان لها تأثير سام وفعال ضد حشرة من اللوبيا وكانت قيم الـ LC_{50} كما يلي: ٠٫٠٢٧٥ ، ٠٫٠٣٣٨ ، ٠٫٠٤٢٤ و ٠٫٠٦٣٤ مجم/سم٢ على الترتيب.