REPELLENCY, TOXICITY AND BIOLOGICAL EFFECT OF SOME PLANT EXTRACTS ON EGG AND ADULT FEMALE STAGES OF *EUTETRANYCHUS ORIENTALIS* (KLEIN) .

EBRAHIM, H.M, M.A. ABD EL-SAMED AND A.F. EL-SAFTE

Plant Protection Research Institute, Agricultural Research Centre, Giza, Egypt.

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Abstract

Repellency and toxicity effects of plant extracts of citrus, spearmint, cumin and marjorum on egg and adult female stages of *E.orientalis* was studied. Citrus extract gave the highest degree of repellency followed by cumin, marjorum and spearmint extract on adult female after 24, 48 and 72hr. of treatment.

On the basis of the LC50 values, the toxic effect of citrus extract was 333.33, 866.66 and 678.57 folds as that of majorum, against 1,2 and 3-days old eggs of *E.orientalis*, respectively, while cumin and spearmint were the 2nd effective toxicants.

On the other hand, the spearmint extract was found to be the most effective toxicant on the adult female of *E.orientalis*.

Citrus extract treatments with sub-lethal doses (LC30 level) on the eggs of 3-day old resulted in a reduction in number of deposited eggs by female during first and second generations.

INTRODUCTION

As miticidal chemicals have harmful effects on fruit trees and create health hazard in humans and animals (Mansour and Ascher 1983, Barakat et al,1985) and many of them lack several desirable principles of a good miticide against a specific target species (Abo El-Ghar *et al.*, 1986 and El-Halawany *et al.*, 1988) attention has been diverted to use alternative safe and cheap methods for mite control.

Many plant extracts were found to be toxic and repellent to mites (El-Halawany *et al.*, 1988) . Some decrease egg hatching, and biological activities of resultant immatures and adults (Sawires *et al*, 1988, Amer *et al.*, 1989, Darwish, 1990 and Iskandar, 1993).

The present study was carried out to evaluate the repellency and toxicity effect of citronella, spearmint, cumin and majorum oils on egg and adult female stages

of the citrus brown mite, E.orientalis (Klein).

MATERIALS AND METHODS

Mite stock culture

Pure population of E.orientalis (Klein) was collected from heavily infested leaves of citrus trees (Mandarin), transferred to laboratory then some adult females were selected and reared on leaves of sweet potato cuttings (20 cm. long) inserted in bottles filled with water and kept at 25±2 ^{o}C and 65±5% R.H.

Fluorescent tubes (40 watt) were used to maintain 16 hours illumination.

To get a homogeneous and sensitive culture, this colony was left for one year under the previous laboratory conditions.

Plant extracts

Water extracts from shoots of Cuminum cyminum., Citrus aurantum., Mentha arvensis and Marjorana hortensis, were prepared by soaking 25 gm of each of the previous plant materials in 500 ml distilled water. After 72 hr., these were chopped and blended in a blender for six min., then filtered with a Whatman filter paper no. I. All filtrates were considered to be standard solutions of 100% concentration then kept in refrigerator. Dilutions of standard solutions were made by adding distilled water.

Bioassay test

Potato leaf discs carrying adult females were dipped in each concentration of the four mentioned plant oils extracts. Five replicates were used for every concentration. The treated discs were placed onto pads of wet cotton wool in petri-dishes and kept under laboratory conditions.

Percentages mortality of adult females were recorded to estimate LC50 and slope according to the method described by Finney (1952). Distilled water replicates served as control.

Hatching test

The toxicity effects of the four plant extracts were tested against 1,2 and 3 days old eggs of E.orientalis. Also, the late effects of citronella extract on the duration and fecundity of E.orientalis were studied, 3-days old eggs were treated with LC30 of citronella extract. After hatching, the larvae were allowed to develop till the adult stage. (F1 and F2). The experiments were conducted under laboratory con-

ditions and examination was made twice daily. Female fecundity was recorded in both F1 and F2. The toxicity index was determined by using Sun's equation (1950) :

$$\text{Sun's toxicity} = \frac{\text{LC50 of the standard materials}}{\text{LC50 of the tested materials}} \times 100$$

RESULTS AND DISCUSSION

The repellency of plant extracts of citrus, spearmint, cumin and marjorum were tested against adult females of *E.orientalis* after 24, 48 and 72 hr. of treatments .

Data in Table 1 indicated that the repellency effect decreased by increasing time after treatments.

Table 1. Repellency effect of plant extracts on adult females of *Eutetranychus orientalis* (Klein).

Plant extracts	Concentration %	Numbers and repellency % after application					
		24 hr.		48 hr.		72 hr.	
		No.	Repellency %	No.	Repellency %	No.	Repellency %
Citrus	0.1	38	65.78	36	55.55	34	50.00
	0.05	40	62.50	34	52.94	32	46.88
	0.025	38	57.89	34	47.06	30	43.33
	0.0125	39	51.28	35	40.00	30	33.33
	0.00625	40	45.00	34	38.24	32	25.00
Spearmint	10	38	56.75	36	41.66	34	32.35
	5	40	47.50	33	39.39	32	28.13
	1	38	44.73	30	36.66	28	25.00
	0.1	40	40.00	35	31.43	32	21.87
	0.01	37	35.14	32	28.13	26	19.23
	0.001	37	32.43	30	26.66	25	16.00
Marjorum	10	40	57.50	39	46.15	36	30.56
	5	40	42.50	39	30.76	35	28.57
	1	40	37.50	37	32.43	31	25.80
	0.1	38	31.58	36	25.00	34	20.59
Cumin	10	40	70.00	38	63.16	36	52.77
	5	40	65.00	35	57.14	30	43.33
	1	38	55.26	30	46.67	27	40.74
	0.1	39	48.71	35	40.00	30	33.33
	0.01	40	42.50	35	34.29	30	26.67
	0.001	37	35.14	31	32.26	25	20.00

No. = Number of adult females of E. orientalis (Klein)

The results cleared that citrus extract gave the highest degree of repellency followed by cumin, marjorum and spearmint extracts. These results are in agreement with the findings of Mansour and Ascher (1983), Sawires et al. (1988) and Shoeip (1990) who reported that some plant extracts such as neem, *Lantana camara*, cumin, spearmint, marjorum and citrus gave good repellency effect against adult female of *T.urticae*.

The sensitivity of 1,2 and 3 days old eggs of *E.orientalis* to four plant extracts were tested.

Data in Table 2 illustrated that the toxicity of citrus extract was the most toxic with smallest LC50 values 0.0003, 0.00015 and 0.00014% against 1,2 and 3 days old eggs of E.orientalis, respectively. Cumin and spearmint extracts ranked the 2nd. On the basis of the LC50 values, citrus extract was 333.33, 866.66 and 678.57 times as toxic as marjorum extract, against 1,2 and 3-days old eggs of E.orientalis, respectively.

Table 2. Toxic effect of plant extracts on 1,2 and 3-day old eggs of *E.orientalis*.

Plant extracts	1-day old		2-day old		3-day old		No. of fold compared with marjorum at IC50		
	LC50	slope	LC50	slope	LC50	slope	1-day old	2-day old	3-day old
Citrus	0.0003	0.85	0.00015	0.14	0.00014	0.47	333.33	866.66	678.57
cumin	0.00098	0.15	0.0010	0.25	0.00099	0.13	102.04	130.00	95.95
spearmint	0.0010	0.37	0.0011	0.25	0.0010	0.41	100.00	118.18	95.00
marjorum	0.10	0.18	0.13	0.52	0.19	0.19	1.00	1.00	1.00

These results are in agremment with those reported by Barakat et al. (1985), El-Halawany et al (1988) and Dimetry et al (1988) who reported that citronella oil produced high toxic effect against the egg stages of *T.urticae*.

When spearmint, citrus, cumin and marjorum extracts were tested against adult females of E.orientalis, proved to be the most effective toxicant Table 3. Its LC50 value was 0.00010, 0.00010 and 0.00011% after 24, 48 and 72 hr. of treatment, respectively.

Table 3. Toxic effect of plant extracts on adult females of *E.orientalis*.

Plant extracts	24 hr.		48 hr.		72 hr.		No. of fold compared with marjorum at IC50		
	LC50	slope	LC50	slope	LC50	slope	24 hr.	48 hr.	72 hr.
spearmint	0.00010	0.39	0.00010	0.49	0.00011	0.80	1500.00	1800.00	727.27
Citrus	0.00030	0.80	0.0010	1.40	0.00024	2.30	500.00	180.00	333.33
cumin	0.0011	0.50	0.0010	0.52	0.0011	0.89	136.36	180.00	72.72
marjorum	0.15	0.96	0.18	0.98	0.08	0.63	1.00	1.00	1.00

Citrus extract was the 2nd effective toxicant with LC50 value 0.00030, 0.0010 and 0.00024% after the aforementioned periods, respectively.

At LC50 level, spearmint was 1500, 1800 and 727.27 times as toxic as marjorum, after 24, 48 and 72 hr. of treatment, respectively.

Effect of plant extracts differed according to mite stage. Spearmint extract was the most effective against the adult female, while citrus extract proved to be the most toxic against 1,2 and 3-day old eggs.

Similar results, were obtained by Barakat *et al.* (1985), Abo El-Ghar *et al.* (1988), Ahmed (1988) and Amer *et al.* (1989) who mentioned that spearmint oil had excellent toxic effect against adult females of T.urticae and less effect against some natural enemies.

Biological effect of citrus extract on F1 and F2 of E.orientalis (Klein) after treating 3 day old eggs with LC30 (0.00010%).

The delayed effect of citrus extract on developmental immature stages caused 24% and 12% total mortality during F1 and F2, respectively, Table 4.

Life cycle duration prolonged to 11.65 and 11.78 days for F1 and F2, respectively compared with 9.92 days for the control.

The generation period of F1 and F2 was also prolonged, averaging 14.22 and 14.07 days compared with 12.60 days for the control.

Treating 3-day old eggs with LC30 reduced female fecundity. The average number of deposited eggs / female in F1 and F2 was about 10.92% and 6.07% of control. The obtained data are in agreement with those of Schauer and Schmutterer (1981), El-Halawany *et al.* (1988), Dimetry *et al.* (1988), Darwish (1990) and Iskandar (1993). They reported that plant extracts such as citronella, cumin, spearmint and thyme oils caused reduction in the female fecundity of *T.urticae*.

Table 4. Delayed effect of citrus extract on duration of developmental stages and fecundiy of E.orientalis female resulted from 3-day old eggs treated with LC30 (0.00010%).

Stages	F1		F2		Control	L. S. D.%
	Duration in days	Mortality	Duration in days	Mortality	Duration in days	
Incubation period	4.44±0.10	0.00	4.40±0.10	0.00	4.56±0.10	
Active larva	1.48±0.12	4.00	1.16±0.07	0.00	1.00±0.05	
Quiescent larva	1.25±0.20	4.00	1.28±0.09	4.00	0.92±0.04	
Active protonymph	1.26±0.11	4.00	1.21±0.08	0.00	0.84±0.05	
Quiescent protonymph	1.14±0.21	4.00	1.44±0.09	4.00	0.88±0.04	
Active Deutonymph	1.14±0.08	4.00	1.22±0.08	0.00	0.82±0.05	
Quiescent deutonymph	1.15±0.08	4.00	1.17±0.08	4.00	0.86±0.04	
Total immature stages	7.20*±0.21	24.00	7.35*±0.20	12.00	5.36±0.16	0.54
Life-cycle	11.65±0.24	24.00	11.78±0.25	12.00	9.92±0.17	
Pre-oviposition	2.89±0.26	4.00	3.09±0.17	0.00	2.68±0.16	
Generation period	14.22*±0.25	28.00	14.07*±0.29	12.00	12.60±0.23	0.86
Oviposition	5.50±0.25	4.00	5.86±0.28	0.00	5.96±0.24	
Post-oviposition	3.12±0.28	0.00	2.95±0.22	0.00	2.76±0.21	
Longevity	11.29±0.57	8.00	11.86±0.40	0.00	11.44±0.37	
Life-span	22.88±0.62	32.00	23.42±0.46	12.00	21.36±0.34	
Average number of deposited eggs/female	16.71*±0.24		17.62*±0.15		18.76±0.21	0.62
Reduction % of fecundity	10.92		6.07		00.00	

L.S.D. : Least Significant Difference.

* : Significant.

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التأثير الطارد والسام والبيولوجى لبعض المستخلصات النباتية على الأعمار المختلفة للبيض والإناث البالغة لاكاروس الموالح البنى

حسين محمد اسماعيل إبراهيم ، مجدى عبد الحكيم عبد الصمد ،

عزيزة فؤاد الصفتى

معهد بحوث وقاية النباتات – مركز البحوث الزراعية .

أظهرت المستخلصات النباتية لسيقان البرتقال البلدى والكمون و النعناع و البردقوش تأثيرا طاردا على اناث اكاروس الموالح البنى كما وجد أن نسبة الطرد تقل كلما زادت المدة بعد المعاملة كما أظهر مستخلص البرتقال أعلى نسبة طرد يليه الكمون والبردقوش والنعناع.

ولقد اظهرت المستخلصات السابقة تأثيرا ساما على البيض فى أعماره المختلفة وكان مستخلص البرتقال أكثرها تأثيرا يليه الكمون والنعناع ثم البردقوش وكانت قيم التركيز القاتل لنصف عدد البيض للبرتقال هى ٠,٠٠٠٣ ٪ ، ٠,٠٠٠١٥ ٪ ، ٠,٠٠٠١٤ ٪ لبيض عمر يوم ويومين وثلاث أيام على التوالى.

كذلك كان للمستخلصات السابقة أيضاً تأثيرا ساما على اناث الأكاروس البالغة وكان مستخلص النعناع هو الأكثر تأثيراً يليه البرتقال والكمون والبردقوش.

أظهرت نتائج معاملة البيض عمر ٣ أيام بالتركيز القاتل لمستخلص البرتقال ٠,٣٪ عند تركيز ٠,٠٠٠١٠٪ ومتابعة الأفراد الناتجة من المعاملة لمدة جيلين متتاليين الى طول مدة حياة الأطوار غير الكاملة – كذلك دورة الحياة حيث بلغت ١١,٦٥ ، ١١,٧٨ يوماً فى الجيل الأول والجيل الثانى على التوالى بالمقارنة بالكنترول ٩,٩٢ يوماً – كما طالت مدة الجيل وانخفضت الكفائة التناسلية للإناث بمقدار ١٠,٩٢٪ فى الجيل الأول ، ٦,٠٧٪ فى الجيل الثانى.