

EVALUATION OF SOME PLANT EXTRACTS AGAINST THE TWO-SPOTTED SPIDER MITE *Tetranychus urticae* KOCH (Acari : Tetranychidae)

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ABSTRACT

The efficiency of five plant water extracts namely Red pepper, Pomegranate, Lupine, Shihh and Garlic were studied against different stages of the phytophagous mite *Tetranychus urticae* Koch. Egg stage was more tolerant to all plant extracts than protonymph and adult female. The LC₅₀ values were 10.36, 9.38, 19.32, 23.95 and 52.45% for the egg stage compared with 1.16, 2.87, 5.87, 20.28 and 12.18% for the protonymph and 2.75, 4.82, 8.66, 3.53 and 15.45% for the adult female when treated by the mentioned plant extracts, respectively. The biological aspects of *T. urticae* were affected by treating eggs and adult female with LC₅₀ value of the five plant extracts. In egg treatment, hatchability was decreased while incubation period of eggs as well as life cycle were prolonged. After adult treatment, life cycle was prolonged and the female fecundity was decreased. The female longevity was shortened. Pomegranate was the most effective ovicide, while the Red pepper was the most effective extract against protonymph and adult female. A plastichouse experiment was conducted to evaluate the five plant extracts for control of the two-spotted spider mite *T. urticae* population. The percentages of reduction after 3, 7, 15 and 21 days from treatment with LC₂₅, LC₅₀ and LC₉₀ were 48.7, 74.6 and 75.7% for Red pepper extract; 61.0, 64.5 and 42.2% for Pomegranate extract; 49.9, 62.8 and 64.7% for Lupine extract; 33.4, 36.2 and 38.4% for Shihh extract; 38.6, 53.8 and 76.7% for Garlic extract.

INTRODUCTION

The phytophagous mites especially *Tetranychus urticae* Koch is among the major pests attacking a wide range of plant hosts, vegetables, cotton and fruit trees, and often caused considerable reduction in the yield in Egypt.

This pest could be controlled by different efficient acaricides, but the use of such materials is encountered with problems such as development of resistant strains, destroying natural enemies and pesticide residues are found in crops, soil and water; Pollution of the environment is also resulted.

Many investigators in different parts of the world initiated large efforts to find natural plant extracts which have a miticidal effect.

The aim of this study was to obtain some plant extracts namely Red-pepper, Lupine, Shihh, Pomegranate and Garlic to find out their acaricidal activity against eggs and adult females of *T.urticae*.

Consequently, the changes occurring in the biological aspects after treatment with the previous extracts at LC₅₀ levels should assume considerable importance.

MATERIALS AND METHODS

Five plant water extracts namely Red pepper (*Capsicum annum* L.), Lupine (*Lupinus termis* Forsk), Garlic (*Allium sativum* L.) , Shihh (*Artemisia judaica* L.) and Pomegranate (*Punica granatum* L.), were used for toxicological and biological experiments against the two-spotted spider mite *T. urticae*.

Rearing Technique of Mites:

A pure culture of the mite was maintained on detached mulberry leaves placed with the lower surface upwards on moist cotton pads in Petri dishes (20cm in diameter).

Extraction Procedure:

Plant parts were dried and grinded. Certain weights of the powders of the five plants were extracted by adding 100ml of boiling water to each one. The vessels were closed tightly for 24 hours then blended for 15min. The mixtures were filtered and each filtrate was completed to 100ml by water. Series of dilutions of the five plant extracts were prepared using distilled water. (El-Sisi and El-Hariry 1989).

Toxicity Tests:

Ovicidal action: Twenty adult females of *T. urticae* were allowed to lay eggs on the lower surface of mulberry leaf discs (2.5cm in diameter). Four discs were placed in each Petri dish on moist cotton wool pads (each disc was considered as a replicate). The females were removed after 24 h. and the eggs were counted. The discs carrying the eggs were dipped in the aqueous solutions of the five plant extracts for 10 sec. Five concentrations of each one were used to determine slope, LC₅₀ and LC₉₀'s according to Finney, 1952. The numbers of non-hatched eggs were counted and the percentage of mortality was corrected by using Abbott's formula, 1925.

Protonymph and adult tests: Ten *T. urticae* protonymphs and adults of the same age were transferred to a mulberry leaf discs (2.5cm in diameter) for studying the toxicity of the five plant extracts to the two-spotted spider mite. Each treatment was replicated four times. The discs carrying the individuals were dipped in the five concentrations of each of the five plant extracts, for each stage as indicated in the egg treatment.

Effect of the Plant Extracts on the Biology of *T. urticae*:

Changes in the biology of *T. urticae* were determined after treating eggs and adults with LC₅₀ concentrations of the five plant extracts. In egg treatment hatchability and incubation period were determined, and the newly hatched larvae were transferred individually to clean leaf discs of Sweet potato, and left to develop until reaching the adult stage to determine the life cycle and longevity.

In adult treatment, the females deposited their eggs, and then the same technique was followed as mentioned in the egg treatment until

reaching the adult stage. Adults were sexed, and twenty mated females were left singly to complete their life and the total number of eggs per female was estimated. Leaf discs were changed when needed. Examination was undertaken daily. An analysis of variance was done for incubation period, life cycle, longevity and fecundity after egg and adult treatments.

Plastichouse Experiment:

To evaluate the efficacy of the five plant extracts against the phytophagous mite *T. urticae* population, bean seeds of *Phaseolus vulgaris* L. were sown in pots. The bean seedlings were infested with the two-spotted spider mites three weeks after sowing. Three concentrations (LC₂₅, LC₅₀ and LC₉₀ values) of the five plant extracts were sprayed only once by the means of a manual atomizer, one month after sowing. Five pots (each represented a replicate) were sprayed with each concentration, while five pots were left untreated as control. One seedling (the same one) from each replicate was examined 3, 7, 15 and 21 days after treatment to count the moving stages of the two-spotted spider mite. A pre-count was made before spraying to estimate the percentage of reduction in mite population according to Henderson and Tilton equation, 1955. All experiments were carried out at a plastichouse temperature of 25 ± 2 °C and relative humidity of $65 \pm 5\%$

RESULTS AND DISCUSSION

Toxicity of Plant Water Extracts Against *T. urticae*:

It could be concluded that eggs were more tolerant than other stages of the two-spotted spider mite, as the LC₅₀ values were 10.36, 9.38, 19.32, 23.95 and 52.45% for egg stage compared with 1.16, 2.87, 5.87, 20.28 and 12.18% for the protonymph, and 2.75, 4.82, 8.66, 3.53 and 15.45% for the adult female when treated with Red pepper, Pomegranate, Lupine, Shihh and Garlic extracts, respectively (Fig 1-3).

Pomegranate was the most effective ovicide, while the Red pepper was the most effective extract against protonymph and adult female.

Effect of Plant Water Extracts on the Biological Aspects of *T. urticae*:

After treating *T. urticae* eggs and adults with LC₅₀ concentrations of the five plant extracts, changes in the biology were determined.

- 1- After egg treatment:** The results in (table 1) show that incubation period of eggs was significantly increased after treating eggs with the five plant extracts, which averaged 4.7, 4.7, 4.4, 4.9 and 4.0 days for Red pepper, Pomegranate, Lupine, Garlic and Shihh extracts respectively, compared with 3.8 days for untreated eggs. Treated eggs resulted in considerable prolongation of the life cycle period of *T. urticae* which averaged 10.9, 9.7, 9.1, 9.6 and 9.8 days for the same

plant extracts, respectively, compared with control check (8.6 days).

Table 1 :Effect of Treatment with some Water Plant Extracts on Biological Aspects of *T.urticae* Eggs.

Treatment	Average Periods in Days				Fecundity
	Incubation	Life Cycle	Generation	Longevity	
Red Pepper	4.70 ± 0.41 c	10.93 ± 0.71 e	12.20 ± 1.29 e	11.40 ± 4.76 ab	54.20 ± 45.90 a
Pomegranate	4.70 ± 0.55 c	9.70 ± 0.73 cd	10.80 ± 0.75 cd	14.30 ± 4.80 c	95.00 ± 50.00 cd
Lupin	4.40 ± 0.37 b	9.10 ± 0.67 b	10.10 ± 0.67 ab	18.40 ± 2.99 d	80.70 ± 27.20 cd
Shihh	4.90 ± 0.56 c	9.60 ± 0.66 c	10.20 ± 0.65 abc	11.20 ± 2.50 ab	54.40 ± 19.80 ab
Garlic	4.00 ± 0.32 a	9.80 ± 0.57 cd	10.50 ± 0.59 bcd	10.70 ± 3.40 a	57.70 ± 36.80 ab
Un-Treated	3.80 ± 0.20 a	8.60 ± 0.54 a	9.70 ± 0.64 a	16.10 ± 2.40 c	100.95 ± 25.50 d
L.S.D	0.20	0.40	0.60	2.20	15.90
F	36.00	25.00	15.10	23.50	14.63

2- After adult treatment: As shown in (Table 2) the life cycle of *T. urticae* was significantly prolonged with the treatment of plant extracts, which averaged 9.8, 8.9, 9.3, 8.8 and 8.6 days for Red pepper, Shihh, Pomegranate, Lupine and Garlic, respectively, compared with 8.6 days for those produced from untreated females. Longevity of females was significantly shortened to 12.4, 13.9, 13.5, 10.3 and 11.3 days for the same plant extracts, respectively, compared with control check (16.1 days). All plant extracts significantly affected the fecundity of the mite, where the total numbers of eggs per females were decreased to 55.1, 46.0, 59.0, 83.3 and 84.6 eggs/female for Red pepper, Pomegranate, Lupine, Garlic and Shihh, respectively, compared with 100.9 eggs for control check..

Table 2: Effect of Treatment with some Water Plant Extracts on Biological Aspects of *T.urticae* Adults

Treatment	Average Periods in Days				Fecundity
	Incubation	Life Cycle	Generation	Longevity	
Red Pepper	4.10 ± 0.20 bcd	9.80 ± 0.40 d	10.98 ± 0.72 d	12.40 ± 2.20 bc	55.10 ± 15.30 ab
Shihh	4.20 ± 0.50 cd	8.90 ± 0.40 b	9.70 ± 0.86 a	13.90 ± 2.02 d	84.6 ± 14.42 abcde
Pomegranate	4.20 ± 0.20 cd	9.30 ± 0.50 c	10.20 ± 0.56 bc	13.50 ± 2.70 cd	46.00 ± 13.70 a
Lupin	4.00 ± 0.23 bc	8.80 ± 0.70 ab	9.80 ± 0.91 ab	10.30 ± 2.90 a	59.00 ± 19.30 abc
Garlic	3.90 ± 0.20 ab	8.90 ± 0.40 b	10.10 ± 0.56 abc	11.30 ± 2.90 ab	83.30 ± 37.10 abcd
Un-Treated	3.80 ± 0.20 a	8.60 ± 0.54 a	9.70 ± 0.64 a	16.10 ± 2.41 e	100.90 ± 25.50 de

L.S.D	0.17	0.32	0.40	1.40	43.9
F	5.90	11.90	10.98	211.70	26.9

Effect of Plant Water Extracts on *T. urticae* population:

Table (3) includes the percentages of reduction in the two-spotted spider mite population on bean seedlings after different intervals following treatment with three concentrations of each of the five plant water extracts. It is clearly shown that the percentage of reduction increased as extract concentration increased, and successively increased along 7 days after treatment then started to decrease. The mean percentages of reduction after 3, 7, 15 and 21 days with LC₂₅, LC₅₀ and LC₉₀ were 48.7, 74.6 and 75.7% for Red pepper extract; 42.2, 64.5 and 61.0% for Pomegranate extract; 64.7, 62.8 and 49.9% for Lupine extract; 76.7, 53.8 and 38.6% for Garlic extract and 38.4, 36.2 and 33.4% for Shihh extract.

These previous results of the effect of the plant water extracts on the toxicity and biology of *T. urticae* are in agreement with those of several investigators who tested the miticidal effects of some plant extracts on mites. Schatier, M. and H. Schmutterer (1981) reported that aqueous extracts of high concentration (2.5, 5, 10%) of methanolic extracts of neem seed reduced the fecundity of *T. urticae*, similar results were obtained by Mansour and Ascher (1983) who found that extracts of neem seed kernels affected the behaviours and fecundity of *T. cinnabarinus*. Barakat *et al.* (1984) found the same results when observed that treatment with Devil's apple, Lupine, Black pepper, Caraway, Fenugreek, Onion, Turnip and Glowry bower plant extracts significantly shortened female longevity and decreased the fecundity. Also, Darwish (1990), Sawires *et al.* (1995) who stated that the adult females were more susceptible to all the tested plant extracts than the eggs of the two spotted spider mite. Nassar *et al.* (1995) tested the effect of Durlanta and Lantana plant extracts on the biology of the two spotted spider mite, they found that both extracts affected life cycle, longevity and the total number of deposited eggs per female. Iskander *et al.* (1996) found that treating eggs and adult females of *T. arabicus* with Shihh, Sorrel and Kalakh extracts prolonged the incubation period of eggs and life cycle, shortened the female longevity and decreased the female fecundity. El-Duweini and Sedrak (1997) stated that larvae were more susceptible to Jojoba oil than the deutonymphs, adult females and egg stages and the same results were obtained when tested the effect of Jojoba oil against *T. arabicus* population.

From the achieved results, these plant extracts could be used in integrated pest management programs after successful work under field condition is reached.

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تقييم فعالية بعض المستخلصات النباتية ضد العنكبوت الاحمر العادي
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أجريت دراسة فعالية خمسة مستخلصات نباتية هي الفلفل الاحمر، قشر الرمان، الترمس، الثوم و الشيح (استخلاص بالماء) ضد كل من البيض و الحوريات الاولى و الاناث البالغة لكاروس العنكبوت الاحمر العادي عند درجة حرارة $25 \pm 2^\circ \text{C}$ و رطوبة نسبية 65% .
أظهرت نتائج السمية أن طور البيض أكثر تحملاً للمستخلصات الخمسة عن باقي الاطوار .
وكانت التركيزات التي تسبب موت 50% من الافراد هي :-
١٠، ٣٦، ٩٠، ٣٨، ٩، ٣٢، ١٩، ٩٥، ٢٣، ٤٥، ٥٢، ٤٥ % لطور البيض مقارنة بالتركيزات ١، ١٦، ٢، ٨٧، ٥، ٨٧، ٢٠، ٢٨، ١٢، ١٨، % لطور الحورية الاولى و التركيزات ٢، ٧٥، ٤، ٨٢، ٨، ٦٦، ٣، ٥٣، ١٥، ٤٥، % لطور الاناث البالغة وذلك عند المعاملة بالمستخلصات النباتية الخمس المذكورة على الترتيب . كما تأثرت الظواهر البيولوجية لاطوار العنكبوت الاحمر عند المعاملة بالتركيزات التي تسبب ٥٠ % موت لهذه المستخلصات النباتية فعند معاملة البيض زادت فترة حضانة البيض و دورة الحياة . وايضاً عند معاملة الاناث البالغة طالبت فترة دورة الحياة كما قصرت فترة حياة الانثى . ايضاً تمت دراسة تأثير المستخلصات النباتية علي العنكبوت الاحمر في الصوبة النباتية و كان متوسط نسبة الابداء بعد ٣، ٧، ١٥، ٢١ يوماً من المعاملة بثلاث تركيزات مختلفة (LC₂₅, LC₅₀ and LC₉₀) هي ٧، ٤٨، ٦، ٧٤، ٧٥، ٧ % للفلفل الاحمر ٦١، ٦٤، ٥، ٤٢، % لمستخلص قشر الرمان و ٤٩، ٩٩، ٤٩، ٦٢، ٨، ٦٤، ٧، % لمستخلص الترمس و ٦، ٣٨، ٨، ٥٣، ٧٦، ٧، % لمستخلص الثوم و ٤، ٣٣، ٢، ٣٦، ٤، ٣٨، ٤، % لمستخلص الشيح .

Table 3: Effect of some plant water extractson the population of *T. urticae* on bean seedlings under greenhouse conditions (25±2c° and 65±5% R.H.)

Treatment	Concentration	Before Treatment	3 Days		7 Days		15 Days		21 Days		Mean	
			No.	Reduction %	No.	Reduction %	No.	Reduction %	No.	Reduction %	No.	Reduction %
Red Pepper	LC25 (2.03)	1162	702	51	837	52.8	958	52.5	2037	38.5	1133.50	48.7
	LC50 (2.75)	906	2950	74	250	82.2	289	81.6	1112	60.4	486.5	74.6
	LC90 (4.89)	708	204	76.6	210	80.5	236	80.8	770	64.9	353.5	75.7
Pomegranate	LC25 (2.76)	675	353	57.5	434	57.8	613	47.5	2212	5.8	903	42.2
	LC50 (4.82)	500	136	78	108	85	390	54.5	925	40.3	389.8	64.5
	LC90 (13.96)	384	95	80	94	83.9	350	57.4	800	32.7	334.8	61
Lupin	LC25 (5.24)	380	88	81.2	138	76.2	182	72.3	835	29	310.8	64.7
	LC50 (8.66)	415	98	80.8	128	79.8	256	64.4	950	26.1	358	62.8
	LC90 (22.42)	450	135	75.6	213	69	545	30	1743	25	659	49.9
Garlic	LC25 (9.83)	733	160	82.3	122	89.1	400	68.5	750	67	358	76.7
	LC50 (15.45)	956	425	63.9	362	75.2	868	43.4	1837	32.8	873	53.8
	LC90 (36.44)	553	328	51.8	310	63.2	650	32.1	1840	7.4	782	38.6
Shihh	LC25 (1.99)	575	164	76.9	436	50.3	820	17.7	1625	8.7	761.3	38.4
	LC50 (3.53)	310	133	65.2	217	54.1	450	16.1	1050	9.4	462.5	36.2
	LC90 (10.54)	425	192	63.3	321	50.5	625	15.1	1375	4.5	628.3	33.4
Control	-	280	1010	-	1250	-	1420	-	2540	-	1555	-