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# EFFICACY OF NATURAL EXTRACTION OF SOME PLANTS IN CONTROLING THE SPIDER MITE, *Tetranychus urticae* KOCH

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## ABSTRACT

The efficiency of acetone extracts from guava, lime and pomegranate plants was studied against egg and adult female stages. Results showed that egg stage was more tolerant to all plant extracts than adult female. The biological aspects of *T. urticae* were affected by treating eggs and adult females with LC50 value of the three plant extracts. Incubation period of eggs, lifecycle and generation period prolonged, while female fecundity decreased. Lime was the most effective extract against eggs and adult females.

## INTRODUCTION

The two spotted spider mite, *Tetranychus urticae* Koch is a harmful pest causing great damage to different agricultural crops. Abd El-Rahman(1996) recorded *T. urticae* infestation on 60 economic plant species varied among fiber crops, vegetables, fruits, medical and ornamental plants and cereal crops.

This pest could be controlled by different efficient acaricides, but the extensive use of such materials caused e.g., Pest resistance and harms to beneficial biocontrol agents, soil, water and air contamination and different hazards to man and his environment.

The wild and economic plants are considered the main sources of new chemicals for pest control. This encouraged many investigators in different parts of the world to initiate large efforts to find natural plant extracts which have a miticidal effect (El-Naggar, 1980; Schauer and Schmutterer, 1981; Mansour and Ascher, 1983; Barakat and Shereef, 1984; Afifi and Hafez, 1988; El-Halawany et al.,1988; Nassar et al, 1995; Sawires et al, 1995; Iskandar et al, 1996 and Hassan et al, 2005)

The present study aimed to determine the efficacy of some natural plant extracts such as fruit peels of pomegranate and lime and guava leaves against *T. urticae* eggs and adult females. This study was also conducted to evaluate the effect of the tested plant extracts at the LC50 level on biological aspects of *T. urticae.*

## MATERIALS AND METHODS

**Mite culture**:

A stock culture of *T urticae* was maintained on mulberry *Morus alba* L. leaves in an incubator at 26±1◦c and 65 ± 5% R.H.

**Test plants**:

| English name | Scientific name | Used part |
|---|---|---|
| Pomegranate | *Punica granatum* L. | Fruit Peels |
| Lime | *Citrus aurantifolia* L. | Fruit Peels |
| Guava | *Psidium guava* L. | Leaves |

**Extraction procedure:**

Plant parts of each sample were dried and grinded. 50 gm of the powder of every plant were extracted by adding 250 ml of acetone. The vessels were closed tightly for 24 hrs then blended for 15 min. The mixture was filtered through filter paper Watman no.1 and evaporated to dryness under vacume using a rotary evaporator in a water bath at 30 ◦c. The crude extract was weighed and adjusted to 10 ml volume with acetone. Serial dilutions of the three plant extracts were prepared.

**Toxicity Tests:**

**Toxicity to egg stage**

To test the effect of previous plant extracts on the egg stage, twenty adult females of *T. urticae* were transferred to the lower surface of mulberry leaf discs (1 inch in diameter). The discs were placed in petri-dishes on moist cotton. Four discs were used as for replicates for each treatment. The adult females left for 24 hrs for oviposition and later removed. The discs were dipped in various concentrations of each extract for 10 sec. and left to dry. Each test contained four concentrations. Seven days after treatment, the number of unhatched eggs was counted and the percentage of mortality was determined.

**Toxicity to adult stage**

Mulberry leaf discs (1inch in diameter) were treated by dipping technique for 10 sec. in four concentrations of each extract. Adult females in the same age were placed on mulberry leaf discs. Each concentration was replicated four times (100 females /treatment) the percentage of mortality was recorded after 24 hrs.

A control was included in each experiment. Mortality was corrected according to Abbott's formula (1925). The LC50, LC90 and slope values were calculated according to Finney (1971). The toxicity index was determined according to Sun (1950).

**Effect of The Tested Plant Extracts on The Biology of *T. urticae***

The changes occurring in the biological aspects after treating eggs and adults with LC50 values of the tested plants by using the procedure of Hassan et al. (2005) were recorded. In egg treatment, incubation period was determined, and the newly hatched larvae were placed individually each one on clean mulberry leaf discs, and left to develop until reaching adult stage to determine the life cycle and longevity.

In adult treatment, the females deposited their eggs, and the same technique was followed as mentioned in the egg treatment until reaching adult stage. Adults were sexed, and twenty mated females were left singly to

complete their life and the total number of eggs per female and egg hatchability were estimated. The Oviposition Deterrent Indices (ODI) were calculated using the equation of Lundgren (1975). Leaf discs were changed when needed. Examination was undertaken daily. An analysis of variance was done for incubation period, life cycle, generation, longevity, fecundity and egg hatchability after egg and adult treatments.

All experiments were incubated under controlled conditions of 26 ± 1◦c and 65 ± 5% R.H.

## RESULTS AND DISCUSSION

### Toxicity of Some Plants Extracts on Egg and Adult Female Stages of *T. urticae*

### Ovicidal action of plant extracts

Results in Table 1 indicated that guava extract was the most effective one followed by lime extract, while pomegranate extract was the least. The LC50 values of these extracts were 0.042, 0.042 and 0.0109 g/ml, respectively, while the LC90 values were 0.090, 0.117 and 1.879 g/ml, respectively.

### Toxicity to adults

Data presented in Table 1 showed that lime extract was the most effective at the LC50 level (0.113 g/ml) followed by pomegranate extract (0.156 g/ml), while guava extract had no toxic effect on *T. urticae* adult females at concentrations from 0.0125 to 0.1 g/ml. The LC90 values were 0.284 and 1.352 g/ml for lime and pomegranate extracts, respectively.

**Table 1: Toxicity of Plant Extracts on *T. urticae* Egg and Adult Female Stages**

| Plant extract | LC50 % g/ml | LC90 % g/ml | Slope | Toxicity index at LC50 | LC90 |
|---|---|---|---|---|---|
| **Eggs** | | | | | |
| Guava | 0.042 | 0.090 | 3.89 | 100 | 100 |
| Lime | 0.042 | 0.117 | 2.89 | 100 | 76.92 |
| Pomegranate | 0.109 | 1.879 | 1.035 | 38.53 | 4.79 |
| **Adult females** | | | | | |
| Lime | 0.113 | 0.284 | 3.21 | 100 | 100 |
| Guava | * N.e. | N.e. | ----- | ----- | ----- |
| Pomegranate | 0.156 | 1.352 | 1.37 | 72.44 | 21.01 |

*** N.e = No effect**

Toxicity data presented in Table 1 indicated that the egg stage was more susceptible to the three plant extracts than adult female stage of *T. urticae*

The toxicity index showed that lime extract was more toxic than pomegranate against eggs and adult females.

**Effect of Plant Extracts on The Biological Aspects of *T. urticae* after Eggs and Adult Females Treatment With LC50 Levels**

Table 2 showed that egg incubation period significantly increased after treating eggs with the three plant extracts, which averaged 5.70, 6.30 and 5.80 days for pomegranate, lime and guava extracts respectively, compared with 3.90 days for untreated eggs.

The duration of immature stages increased significantly in lime and guava treatment, while no significant differences were found between pomegranate and control. The mean periods of the immature stages were 5.30, 8.60 and 7.30 days for pomegranate, lime and guava , respectively, compared with an average of 5.20 days for the control. Treated eggs resulted in considerable prolongation of the life cycle of *T. urticae* which averaged 11.00,14.90 and 13.10 days for the same plant extracts respectively, compared with control (9.10 days). Similar results were found in the generation period as the pomegranate, lime and guava extracts significantly prolonged these period. It averaged 12.25, 15.90 and 14.40 days, respectively, compared with10.30 days for the control.

From results in Table 2, it was found that pomegranate and guava extracts significantly shortened adult female longevity to 10-90 and 11.30 days compared with 15.00 days in the control treatment, while there was no significant between Lime extract (15.30 days) and control (15.00 days).

Table 2 indicated that all treatments resulted in a considerably lower number of eggs deposited by females than those of the control. The rates of egg production (deterrent indicies %) averages were 45.70 (28.76%), 41.30 (33.33%) and 31.30(45.04%) for females in pomegranate, lime and guava treatments, respectively, as compared to 82.60 eggs per female in the control.

In case of adult females treatment, results presented in Table (3) showed that the incubation period, lifecycle and generation period significantly prolonged with the treatment of plant extracts, which average 6.10, 11.40 and 12.40 days, respectively for pomegranate, while in case of lime, it averaged 5.90,12.50 and 13.60 days, respectively, compared with 3.90,9.10 and 10.30 days for the control , respectively.

There was no significant effect of the tested plant extracts on longevity of adult females as compared with control (Table 3).

It's clear from Table (3) that pomegranate and lime extracts significantly affected the fecundity of the mite where the total numbers of eggs per female (deterrent index %) averaged 49.30 (25.25%) and 33 (42.91%) for pomegranate and lime treatments, respectively compared with 82.60 eggs per female in the control

The application of plant extracts on eggs and adult females had no significant effect on the percentage of egg hatchability except of lime treatment as compared with the control as shown in Tables 2 and 3.

It was evident that lime extract had stronger activity to either eggs or adult females of *T. urticae* than other plant extracts.

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These previous results of the effect of the plant extracts on the toxicity and the biology of *T. urticae* are in agreement with those of several investigators who tested the miticidal effects of some plant extracts on mites. Schatier and Schutterer (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 have been shown by several plant extracts when applied on *T. urticae* (Barakat et al.,1985; Abo-El-Ghar et al., 1986; El-Halawany et al., 1988; Dimetry et al.,1988 and Darwish, 1990). Nassar et al. (1995) tested the effect of duranta 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. Iskandar 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, while shortened the female longevity and decreased the female fecundity. Hassan et al. (2005) studied the efficiency of red pepper, pomegranate, lupine, shihh and garlic against different stages of *T. urticae*. They found that egg stage was more tolerant to all plant extracts than protonymph and adult female. Incubation period of eggs and lifecycle prolonged and the female fecundity decreased. pomegranate was the most effective ovicide, while the red pepper was the most effective extract against protonymph.

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

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## تاثير بعض المستخلصات النباتية على مكافحة العنكبوت الاحمر العادى تيترانيكاس يورتيكا

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اجرى هذا البحث لمعرفة فعالية المستخلصات النباتية من قشر الرمان, قشر الليمون, و ورق الجوافة باستخدام مذيب الاسيتون على طورى البيض و الانثى البالغة للعنكبوت الاحمر العادى تحت ظروف المعمل 26±1°م , رطوبة نسبية 65 ± 5%.

و اسفرت النتائج عن ان طور البيض اكثر تحملا لسمية هذة المستخلصات عن الانثى كما زادت مدة حضانة البيض بمعدل الضعف عن معاملة المقارنة فى حين قلت خصوبة الانثى من حيث وضع البيض بمعدل النصف تقريبا عن معاملة المقارنة .... كما لوحظ ان دورة الحياة بصفة عامة زادت بتاثير هذة المستخلصات بفارق معنوى عن مثيلتها فى المقارنة.

**Table 2: Efficiency of LC50 of Plant Extracts on Biological Aspects of *T.urticae* Eggs.**

| Plant extracts | Average period ± SD in days | | | | | Female fecundity | Deterrent index (%) | Hatchability (%) |
|---|---|---|---|---|---|---|---|---|
| | Incubation | Duration of immatures | Lifecycle | Generation | longevity | | | |
| pomegranate | 5.70±0.64 | 5.30±0.78 | 11.00±1.18 | 12.25±1.03 | 10.90±2.73 | 45.70±13.58 | 28.76 | 94.10 |
| Lime | 6.30±0.46 | 8.60±1.74 | 14.90±1.70 | 15.90±1.70 | 15.30±2.15 | 41.30±10.98 | 33.33 | 91.20 |
| Guava | 5.80±0.40 | 7.30±1.19 | 13.10±1.30 | 14.40±1.20 | 11.30±1.95 | 31.30±7.94 | 45.04 | 94.20 |
| Control | 3.90±0.54 | 5.20±0.40 | 9.10±0.54 | 10.30±0.46 | 15.00±1.79 | 82.60±16.75 | …….. | 98.40 |
| L.S.D. at 5% | 0.46 | 0.98 | 1.09 | 1.05 | 2.02 | 11.50 | …….. | 5.22 |

**Table 3: Efficiency of LC50 of Plant Extracts on Biological Aspects of *T. urticae* Adult Females**

| Plant extracts | Average period ± SD in days | | | | | Female fecundity | Deterrent index (%) | Hatchability (%) |
|---|---|---|---|---|---|---|---|---|
| | Incubation | Duration of immatures | Lifecycle | Generation | longevity | | | |
| pomegranate | 6.10±0.30 | 5.30±0.51 | 11.40±0.54 | 12.40±0.54 | 15.80±2.44 | 49.30±19.51 | 25.25 | 93.60 |
| Lime | 5.90±0.30 | 6.60±0.49 | 12.50±0.50 | 13.60±0.66 | 16.30±1.49 | 33.00±14.60 | 42.91 | 88.00 |
| Control | 3.90±0.54 | 5.20±0.40 | 9.10±0.54 | 10.30±0.46 | 15.00±1.79 | 82.60±16.75 | 0.00 | 98.40 |
| L.S.D. at 5% | 0.39 | 0.53 | 0.55 | 0.55 | …….. | 18.65 | …….. | 6.48 |