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# BIOLOGICAL AND TOXICOLOGICAL STUDIES OF CERTAIN PLANT EXTRACTS ON *EUTETRANYCHUS ANNECKEI* MEYER AND *TETRANYCHUS URTICAE* KOCH.

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## *Abstract*

The efficiency of ethanol extracts from Duranta and Lantana plants as expressed in LC50 and LC90 values against adult females of Eutertanychus anneckei Meyer was studied. The LC50 and LC90 for Duranta were 250.95 and 406.44 ppm,respectively. The corresponding values for Lantana were 564.93 amd 699.31 ppm. The two plant extracts did not affect egg hatchability of E.anneckei,while the newly hatched larvae failed to reach the adult stage.

The biological aspects of Tetranychus urticae Koch were more affected by Duranta and Lantana plant extracts.

T. urtica could be reared on Lantana leaves, a matter that prolonged its life cycle as compared with the control .Thiis mite species however never fed on Duranta leaves. After treatment the adult females of T.urticae with 500 and 1000 ppm of Duranta and Lantana extracts,the averages of life cycle durations were 10.8,10.6,12.68,and 9.40 days, respectivey. The longevity periods of adult females of T . urticae were highly affected,as they averaged 5.46,3.54,10.67 and 6.06 days,when treated with the two concentrations of Duranta and Lantana plant extracts,respectively compared with that of the control which averaged 15.57 days. The total number of deposited eggs per female were highly affected with Duranta and Lantana extracts,as it ranged between 1.47 and 23.87 eggs compared with 68.53 eggs for the control .

## INTRODUCTION

Mite control using acaricides on agricultural crops has become a routine practice by farmers all over Egypt. As a result of continuous application of these chemicals on mite infesting fruit crops,resistance problems have taken place as well as pollution of the environment . A new approach in pest control such as the use of natural plant products must receive considerable attention . In line with this,the toxicity and effect on biological aspects of both phytophagous mites Eutetranychus anneckei Meyer and Tetranychus uticae were investigated.

The present study was carried out to evaluate the plant extracts of *Lantana camara* L. and *Duranta ellisla* L. on the biological aspects of the two tetranychid species *E. anneckei* and *T. urticae.*

## MATERIALS AND METHODS

Two species of phytophagous mites were selected from Dokki (Giza Governorate), namely *E. anneckei* and *T. urticae* in order to study the effect of some plant extracts against them .

### Rearing technique of mites

A pure culture of each species was maintained on sweet potato cuttings with developed leaves immersed in jars of 8 cm in diameter and 15 cm high containing tap water throughout the experiment. Sweet potato leaf discs of 4 cm in diameter were used for rearing the mites .Five leaf discs were kept on a moist cotton pad in each Petri dish (20 cm diameter) and continuously moistened during each experiment. Each disc represented a replicate .

### Effect of plant extracts on the biological aspects of mites

For testing the miticidal activity of some plant extracts against the two phytophageous mites,E.anneckei and *T. urticae*, two species of plants namely *Lantana camara* L. and *Duranta ellisla* L, were collected and air dried at 40$^{o}$C , then ground in a food grinder into fine powder. Two hundred and fifty grams of the powder were

stirred for two hours in flask containing one litre of ethanol alcohol. The mixture was allowed to stand for about two days, stirred for another hour, and finally filtered. The solvent was evaporated undere reduced pressure at temperature not exceeding 50°C . The crude material obtained was weighed and re-dissolved in ethanol (I g extract/100 ml) to give 1% stock solution. Series of different concentrations from the stock solution were prepared and assessed for their biocidal activity against the two species of mites.

**Toxicity tests**

For studying the effect of the two plant extracts on the adult stages of the two phytophagous mites,twenty newly emerged adult females were transferred on each disc (5 cm diameter) then treated . Each treatment was repeated thrice for each concentration . The disc surface carrying the adults of the same age were sprayed with the eqeous dilution of the tested plant extract using a manual atomizer. Five concentrations of plant extracts were used to determine the slopes, $LC_{50}$'s and $LC_{90}$'s according to Finney (1952). The percentage mortality was corrected by using Abbott's formula (1925). The effect of the two plant extracts on egg hatchability of the two species was investigated.

Data concerning the changes occurring during the ontogeny of the two mites together,their developmental period and fecundity were reccorded twice daily. The data were statistcally analysed .

All experiments were incubated under controlled conditions of 28 ± 2°C and 64±5% R.H.

## RESULTS AND DISCUSSION

The miticidal activity of the tested extracts are summarized in Table 1. Duranta extract was two-folds higher in toxicity than Lantana extract at the $LC_{50}$ level where the $LC_{50}$'s of 215 and 565 ppm were obtained,respectively. At the $LC_{90}$ level,the trend of toxicity was similar and the $LC_{90}$'s406 and 696 ppm were obtained for the two extracts, respectively.

The two plant extracts did not affect the hatchability of eggs of *E. anneckei*, and the newly hatched larva failed to reach the adult stage. For this reason it was not possible to study the biological aspects of this mite species.

The finding that *L. camara* and *D. ellisla* extracts are highly toxic against *E. anneckei* strongly support the suggestion of using these extracts as miticides from plant origin in integrated pest management programmes.

These results are in agreement with the findings of Barakat *et al* . (1984 a) who studied the toxicity of ten plant extracts (Devil's apple,lupin,fenugreek,black pepper, caraway, gonybower, onion, garlic, turnip and canna) to adult and egg stages of *T. urticae* . They found that acetone extracts of all plants were more toxic to both adult and egg stages than those of diethylether extracts, except onion and garlic diethyl ether extracts which were more toxic against the adults than acetone extracts. Black pepper ether extract was more effective against the egg stage than acetone extract . El-Halawany *et al.* (1988) reported that cumin oil was more toxic to egg and adult stages of *T. urticae.*

Although the two plant extracts were highly toxic to the immature stages of *E. anneckei*, the preliminiary concentrations of the two plant extracts showed less

Table 1. Toxicity of ethanolic extracts of leaves of D. ellisla and L. camara against adult females of E. anneckei.

| Plant extract | $LC_{50}$ in ppm | $LC_{90}$ in ppm | Slope |
|---|---|---|---|
| *Duranta ellisla* | 251 | 406 | 5.09 |
| *Lantana camara* | 565 | 696 | 6.11 |

Table 2. Effect of plant extracts on the generation period of *T. urticae.*

| Development stage | Duration in days | | | | | | | | Lantana leaves | | Control | | L.S.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Plant extract concentration (in ppm) | | | | | | | | | | | | |
| | Duranta 500 ppm | | Duranta 1000 ppm | | Lantana 500 ppm | | Lantana 1000 ppm | | | | | | |
| | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | |
| Incubation | 3.40 ±0.51 | 3.40 +0.52 | 4.20 +1.17 | 4.10 +1.10 | 3.47 +0.62 | 3.50 +0.71 | 3.40 +0.51 | 3.40 +0.52 | 3.30 +0.59 | 3.50 +0.71 | 3.53 +0.89 | 3.30 +0.63 | |
| Larva A | 1.20 ±0.41 | 1.20 +0.42 | 0.93 +0.37 | 0.85 +0.24 | 1.60 +0.49 | 1.30 +0.48 | 0.87 +0.23 | 0.85 +0.24 | 1.53 +0.52 | 1.30 +0.48 | 1.40 +0.50 | 1.20 +0.42 | |
| Q | 1.13 ±0.35 | 1.10 +0.32 | 0.87 +0.23 | 0.75 +0.28 | 1.27 +0.44 | 1.10 +0.32 | 0.86 +0.23 | 0.85 +0.24 | 1.73 +0.46 | 1.50 +0.41 | 1.33 +0.49 | 1.10 +0.32 | |
| Protonymph A | 1.27 ±0.46 | 1.20 +0.42 | 1.17 +0.45 | 1.05 +0.37 | 1.80 +0.40 | 1.40 +0.52 | 1.10 +0.39 | 1.05 +0.37 | 1.47 +0.64 | 1.20 +0.44 | 1.80 +0.41 | 1.40 +0.52 | |
| Q | 1.20 ±0.41 | 1.20 +0.00 | 1.03 +0.29 | 1.15 +0.47 | 1.20 +0.44 | 1.40 +0.52 | 0.97 +0.13 | 0.95 +0.16 | 1.40 +0.51 | 1.20 +0.42 | 1.33 +0.48 | 1.30 +0.48 | |
| Deutonymph A | 1.27 ±0.46 | 1.20 +0.42 | 1.27 +0.46 | 1.10 +0.48 | 1.67 +0.47 | 1.60 +0.52 | 1.07 +0.26 | 1.10 +0.32 | 1.87 +0.52 | 1.40 +0.52 | 1.73 +0.46 | 1.50 +0.53 | |
| Q | 1.33 ±0.49 | 1.10 +0.48 | 1.13 +0.35 | 1.20 +0.45 | 1.67 +0.60 | 1.70 +0.48 | 1.13 +0.35 | 1.10 +0.32 | 1.73 +0.46 | 1.50 +0.42 | 1.17 +0.41 | 1.20 +0.42 | |
| Total immatures | 7.40 ±0.99 | 6.80 +0.91 | 6.40 +0.82 | 6.10 +0.71 | 9.21 +0.85 | 8.50 +0.53 | 6.00 +0.85 | 5.90 +0.81 | 9.73 +1.62 | 8.10 +0.71 | 8.78 +0.75 | 7.70 +0.79 | 0.818 |
| Life cycle | 10.8 ±1.15 | 10.2 +0.97 | 10.6 +1.41 | 10.2 +1.17 | 12.68 +1.18 | 12.0 +1.05 | 9.40 +1.12 | 9.30 +1.05 | 13.03 +1.16 | 11.6 +1.05 | 12.31 +0.62 | 11.0 +0.61 | 0.925 |
| Pre-oviposition | 1.13 ±0.35 | -- | 1.07 +0.26 | -- | 1.27 +0.46 | -- | 2.00 +0.65 | -- | 1.80 +0.68 | -- | 0.90 +0.39 | -- | |
| Generation | 11.93 ±1.23 | -- | 11.67 +1.49 | -- | 13.95 +1.39 | -- | 11.4 +1.54 | -- | 14.83 +1.26 | -- | 13.21 +0.79 | -- | 1.434 |

A : Active
Q : Quiescent

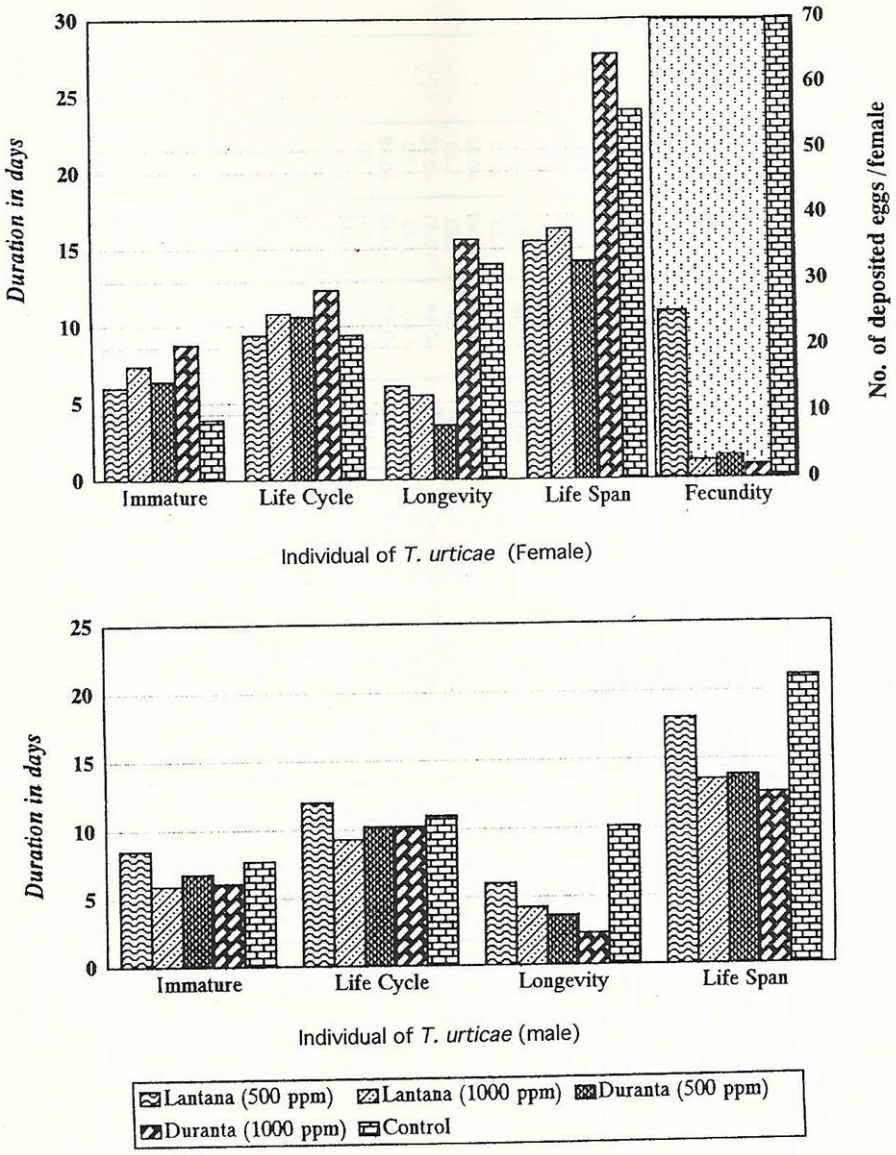


Fig. 1. Effect of plant extracts on *T. urticae* .

toxicity to the immature stages of *T. urticae*. Laboratory trials were therefore carried out to study the acaricidal activity of the two plant extracts on the biology of *T. urticae* after treatment with 500 and 1000 ppm of *L. camara* and *D. ellisla* at 28±2°C and 64 ± 5 % R.H.

During trial, the two plant extracts did not affect egg hatchability. Regarding the effect of plant extracts on the duration of immature stages of *T. urticae* (Table 2 and fig. 1). Duranta extract had shortened the duration of total immatures with the two concentrations 500 and 1000 ppm as it averaged 7.40 & 6.80 days and 6.40 & 6.10 days for female and male immatures, respectively as compared with the control (8.78 and 7.70 days in respect ). Concerning the influence of Lantana extract on the duration of immatures, the concentration 500 ppm prolonged this period, while the concentration 1000 ppm shortened it significantly. this was expressed by 9.21 & 8.50 days and 6.00 & 5.90 days for female and male immatures,respectively. Rearing on Lantana leaves had prolonged the duration of immatures significantly as it averaged 9.73 & 8.10 days, respectively.

The results also revealed that the spider mite could be reared on Lantana leaves, but the life cycle was prolonged as it averaged 13.03 and 11.60 days for female and male,respectively. Those of the control were12.31 and 11.0 days in respect. The mite however had never fed on the Duranta leaves. The concentration 1000 ppm from both extracts had shortened the period of life cycle of both sexes. A similar trend was found with 500 ppm Duranta extract as it shortened the life cycle of the spider mite. It averaged 10.60 & 10.20 days and 9.40 & 9.30 days for femle and male, respectively with the concentration 1000 ppm of Duranta and Lantana extract, respectively. The concentration 500 ppm of Duranta extract shortened the life cycle, while the same concentration of Lantana extract prolonged it (10.80 % 10.20 days and 12.68 & 12.0 days for female and male, respectively).

Similar results were obtained for the generation period as the Duranta extract shortened it significantly. It averaged 11.93 and 11.67 days with the concentrations 500 and 1000 ppm, respectively, (Table 2 and fig. 1) The concentration 1000 ppm of lantana extract shortended the generation period (11.4 days), while the concentration 500 ppm prolonged it (13.95 days), and behaved as lantana when the spider mite was reared on it (14.83 and 13.21 days for the control).

As demonstrated in Table 3 and Fig. 1, both plant extracts shortened the longevity of both sexes significantly. The longevity period averaged 5.46 % 3.60

Table 3. Effect of plant extracts on adult longevity, life span and fecundity of *T. urticae.*

| Development stage | Duration in days | | | | | | | | Lantana leaves | | Control | | L.S.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Plant extract concentration (in ppm) | | | | | | | | | | | | |
| | Duranta | | | | Lantana | | | | | | | | |
| | 500 ppm | | 1000 ppm | | 500 ppm | | 1000 ppm | | | | | | |
| | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | |
| Oviposition period | 3.13 +0.72 | -- | 1.40 +0.51 | -- | 7.87 +1.73 | -- | 2.13 +0.64 | -- | 1.46 +0.74 | -- | 12.77 +1.45 | -- | 0.826 |
| Post-oviposition period | 1.20 +0.41 | -- | 1.07 +0.26 | -- | 1.53 +0.74 | -- | 1.93 +0.70 | -- | 1.33 +0.49 | -- | 1.90 +1.09 | -- | |
| Longevity | 5.46 +0.77 | 3.60 +0.52 | 3.54 +0.52 | 2.30 +0.82 | 10.67 +1.45 | 6.00 +0.82 | 6.06 +0.83 | 4.20 +0.79 | 4.59 +0.91 | 3.50 +0.97 | 15.57 +0.96 | 10.10 +0.99 | 0.695 |
| Life span | 16.26 +1.29 | 13.8 +0.92 | 14.14 +1.29 | 12.5 +1.45 | 23.35 +2.43 | 18.0 +1.49 | 15.46 +1.68 | 13.5 +1.40 | 17.62 +1.40 | 15.10 +1.35 | 27.86 +0.92 | 21.10 +0.95 | 1.353 |
| Total no. of eggs/female | 3.73 +0.80 | -- | 1.47 +0.52 | -- | 23.87 +3.34 | -- | 2.60 +0.83 | -- | 1.60 +0.74 | -- | 68.53 +7.13 | -- | 3.201 |

days and 3.54 & 2.30 days for females and males as fed on Duranta as compared with the control which averaged 15.57 & 10.10 days. In case of Lantana extracts, the corresponding values averaged 10.67 & 6.0 days and 6.06 & 4.20 days .

The total number of deposited eggs per female was also highly affected particularly with Duranta extract . It averaged 3.73 & 1.47 eggs with two concentrations ( 68.53 eggs for the control ) , while it averaged 23.87 & 2.60 eggs with lantana extract ( Table 3 and fig . 1 ) .

The present results partially agree with those of Schauer and Schmutterer ( 1981 ) who reported that aqueous extracts and high concentrations of neem seeds methanolic extracts had reduced the fecundity of *T.urticae* . Similar results were obtained by Mansour and Ascher ( 1983 ) who found that extracts of neem seed kernels prepared with various solvents had affected the behaviour and fecundity of the carmine spider mite , *Tetranychus cinnabarinus* ( Boisd . ) . Barakat *et al* . ( 1984 b ) , studied the effected of devil's apple , lupin , black pepper, caraway, fenugreek,canna,onion,turnip and glowry bower on the biological aspects of *T. urticae* . They observed that treatment with plant extracts, while signifacantly shortened female adult longevity and ovipsition period and decreased number of eggs deposited by female, had no effect on egg hatchability. Darwish (1990), recorded that *T. urticae* female treated by Khella laid an average of 8.5 eggs compared with eggs of the control.

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# دراسات توكسيكولوجيه وبيولوجيه لبعض المستخلصات النباتيه على أكاروس الموالح البنى والعنكبوت الأحمر العادى

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أوضح البحث أن أكاروس الموالح البنى Eutetranychus anneckei أكثر حساسيه من أكاروس العنكبوت الأحمر العادى Tetranychus urticae عند معاملتهما بالمستخلص الإيثانولى لنباتى الدورانتا واللانتانا ، ولم تتأثر نسبة الفقس بالنسبه للنوعين السابقين . وأما بالنسبه لإناث أكاروس الموالح البنى فكانت قيمة $LC_{90}$, $LC_{50}$ هى ٩٥ر٢٥٠ ، ٤٤ر٤٠٦ جزء فى المليون بالنسبه للمستخلص الإيثانولى للدورانتا و ٩٣ر٥٦٤ ، ٣١ر٦٩٦ جزء فى المليون على الترتيب بالنسبه للمستخلص الإيثانولى للانتانا. وبالنسبه لإناث أكاروس العنكبوت الأحمر العادى فقد أكمل دورة حياته على الأوراق المعامله بالمستخلص الإيثانولى للدورانتا واللانتانا بالتركيزين ٥٠٠ و ١٠٠٠ جزء فى المليون ، وقد استغرقت دورة الحياه ٨ر١٠ ، ٦ر١٠ ، ٦٨ر١٢ ، ٤ر٩ يوماً على التوالى. ومتوسط مدة حياة الإناث هى ٤٦ر٥ ، ٥٤ر٣ ، ٦٧ر١٠ ، ٦ر٠٦ يوماً للتركيزين ٥٠٠ و ١٠٠٠ جزء فى المليون للدورانتا واللانتانا بالترتيب وذلك بمقارنتها بمتوسط فترة حياة الحشره الغير معامله والتى كانت ٥٧ر١٥ يوماً. ولقد أدت المعامله بالمستخلصات النباتيه إلى خفض الكفاءه التناسليه للإناث حيث بلغ متوسط ما تضعه الأنثى ما بين ٤٧ر١ و ٨٧ر٢٣ بيضه فى المعامله بمستخلصى الدورانتا واللانتانا ، بينما كانت ٥٣ر٦٨ بيضه فى الإناث الغير معامله.