

EFFECT OF DIFFERENT PLANT EXTRACTS AGAINST TWO-SPOTTED SPIDER MITE, *TETRANYCHUS URTICAE* KOCH AND PREDATORY MITE, *PHYTOSEIULUS PERSIMILIS* A.- H

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Abstract

Pink flowers, Black seed and garlic water extracts tested on adult females on the two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) and on the predatory mite, *Phytoseiulus persimilis* A.-H. Percentages of mortality on *T. urticae* were increased gradually with increasing concentration of Pink flowers, Garlic and Black seeds extracts. When compare between the effects of Pink flowers Garlic and Black seeds extracts on the adult females of *T. urticae* after 1, 3 and 7 days from treatment, Garlic extract, came in the first, then Black seeds extract and in the end came Pink flowers extract it can be concluded that by LC_{50} , LC_{90} values and slopes. The same results, were found against *P. persimilis*. In general, *T. urticae* gave more tolerance against the three extracts than *P. persimilis*.

INTRODUCTION

The two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) is a major economic pest attacking several kinds of fruit trees, field crops and vegetables especially strawberry, cucumber and cantaloupe.

T. urticae is considering serious economic pest; all stages of this mite are pests as plant feeders, except eggs. They have ability to produce webs on the host plants that coating them with a shiny dust which reduces the plant photosynthetic abilities. Its damage results from the sucking of plant juices with its piercing-sucking mouth parts, causing bronzed and off-coloured foliage. Under heavy infestations, defoliations and undersized poorly coloured fruit are produced. It affects the quantity and the size of fruits and also reduces their quality. In Egypt, many problems have been appeared as a result of the extensive use of synthetic acaricides, including acaricide resistance, residual contamination of human foods, mammalian toxicity and pollution of the environment. For that, entire world are going to reduce chemicals use and trying to introduce natural enemies and botanical extracts such as natural products.

Hosny *et al.*, (2001) studied the toxicity of various extracts of seeds of *Abrus precatorius* to females of *Tetranychus urticae*. Abo-Taka *et al.*, (1986); El-Beheiry *et al.*, (1987) and Abd El-Samad *et al.*, (1996) studied the toxic effect of the plant extracts against mites.

The present work aims to test some plant extracts for controlling the two-spotted spider mite, *Tetranychus urticae* Koch and its side effects on the predatory mite, *Phytoseiulus persimilis* A.-H.

MATERIALS AND METHODS

1. Preparing the two-spotted spider mite, *Tetranychus urticae* Koch (Acarina : Tetranychidae) and the predatory mite, *Phytoseiulus persimilis* A.-H. (Acari : Phytoseiidae) culture:

The initial inoculations of the prey and the predator populations were obtained from stock cultures maintained in two separated greenhouses belonging to Plant Protection Research Institute at Dokki district (Giza Governorate) and were reared under laboratory conditions at $25 \pm 2^\circ\text{C}$ and $65 \pm 5\%$ RH on kidney bean seeds, *Phaseolus vulgaris* (L.).

Individuals of the predatory mite, *Phytoseiulus persimilis* (Athias-Henriot) were obtained from its mass rearing on spider mites *T. urticae* Koch on bean plants in a greenhouse $60 \times 9\text{m}^2$ about 540 m^2 (EL-Halawany *et. al.*, 2000 & Heikal and Ibrahim 2002).

Garlic, Pink flowers and Black seeds were extracting with water. Extracts with different concentrations (0.25, 0.5 and 1.0 ml/ml) were tested. Mortality was recorded after 1, 3 and 7 days post treatment.

The toxic effect for the tested materials was evaluated by leaf disc dip technique according to Siegler (1947). Four discs of castor bean leaves were dipped in each concentration for 5 seconds and left to dry. Each treatment was replicated four times.

To measure the toxic effect of tested plant extracts on predatory mite, *P. persimilis*, all treatments were evaluated by leaf discs dip technique. A series of concentrations for each tested plant extract were prepared. Then, four discs of bean leaves were dipped in each concentration for 5 seconds and left to dry.

A number of the prey, *T. urticae* were added as a food for *P. persimilis*. Then, 5 adult female predatory mites were transferred to each disc using a brush (No 0.0). The discs were placed on a moist filter paper, which rested on a moist cotton wool pads in Petri dishes.

Statistical analysis

In laboratory tests, mortality percentages were calculated and corrected for natural mortalities by Abbott's formula 1925. The corrected percent mortalities were statistically compounded according Finney (1971) and plotted on probit analysis paper. The tested compounds were compared for their efficiency on the mites and its predator according to their LC_{50} , LC_{90} and slopes of the toxicity lines.

RESULTS AND DISCUSSION

1. Relative toxicity of different tested compounds on adult females of *Tetranychus urticae* and their side effect on adult of predatory mite *phytoseiules persimilis*

Pink flowers, Black seed and garlic extracts are the natural products used in these experiments against adult females of *T. urticae* and also their side effect against the predatory mite *P. persimilis*.

1.1. Relative toxicity of Pink flowers extract on adult females of *T. urticae*:

Data in Table (1) and Fig. (1) show the effect of Pink flowers extract on mortality percentages of adult females of *T. urticae*. Percentages mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Pink flowers extract. After 1 day from treatment the mortality percentage were 31, 18 and 11% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively. While the previous concentrations gave 22, 16 and 9% mortality, respectively after 3 days. While, after 7 days from treatment the mortality reached 19, 13 and 7% for the previous concentrations, respectively.

When compare between the effects of Pink flowers extract on the adult females of *T. urticae* after 1, 3 and 7 days from treatment it can be concluded that the LC₅₀ values of Pink flowers extract were 2.606, 6.49 and 7.67 for 1, 3 and 7 days, respectively (Table 1).

On base of the LC₉₀ values, Pink flowers extract show the same trend, whereas these LC₉₀ values were 28.91, 155.98 and 157.69 with 1, 3 and 7 days, respectively (Table 1).

On base of the slop values, Pink flowers extract gave 1.23, 0.93 and 0.98, respectively.

1.2. Relative toxicity of Pink flowers extract on adult of *P. persimilis*:

Data in Table (2) and Fig. (2) show the effect of Pink flowers extract on mortality percentages of adult of *P. persimilis*. Percentages of mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Pink flowers extract. After 1 day from treatment the mortality were 33, 21 and 13% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively. While the previous

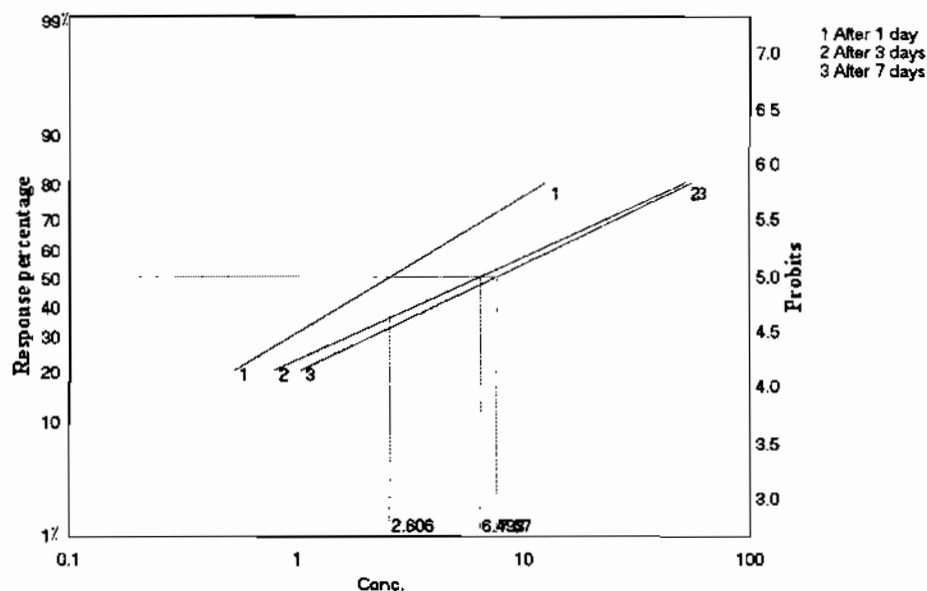


Fig. 1. Relative toxicity of Pink flowers extracts on adult females of *Tetranychus urticae* after feeding on bean leaves under laboratory conditions:

Table 1. LC_{50} values and slopes of Pink flowers extracts on adult females of *Tetranychus urticae* after feeding on treated bean leaves.

Parameters	Pink flowers extracts		
	1 days	3 days	7 days
LC_{50}	2.61	6.49	7.67
LC_{90}	28.91	155.98	157.69
Slope	1.23	0.928	0.976

concentrations gave 22, 15 and 10% mortality, respectively after 3 days. While, after 7 days from treatment the mortality were 20, 13 and 8% for the previous concentrations, respectively.

When compare between the effects of Pink flowers extract on the females of *P. persimilis* after 1, 3 and 7 days from treatment it can be concluded that the LC_{50} values of Pink flowers extract were 2.45, 8.18 and 7.89 for 1, 3 and 7 days, respectively (Table 2).

On base of the LC_{90} values, Pink flowers extract show the same trend, whereas these LC_{90} values were 32.34, 265.45 and 183.59 with 1, 3 and 7 days, respectively (Table 2).

On base of the slop values, Pink flowers extract gave 1.14, 0.85 and 0.94, respectively.

1.3. Relative toxicity of Garlic extract on adult females of *T. urticae* and on adults of *P. persimilis*:

Data in Table (3) and Fig. (3) show the effect of Garlic extract on mortality percentages of adult females of *T. urticae*. Percentages mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Garlic extract. After 1 day from treatment the mortality were 45, 38 and 29% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively. While the previous concentrations gave 41, 32 and 21% mortality, respectively after 3 days. While, after 7 days from treatment the mortality were 37, 28 and 20% for the previous concentrations, respectively.

When compare between the effects of Garlic extract on the adult females of *T. urticae* after 1, 3 and 7 days from treatment it can be concluded that the LC_{50} values of Garlic extract were 1.45, 1.67 and 2.46 for 1, 3 and 7 days, respectively (Table 3).

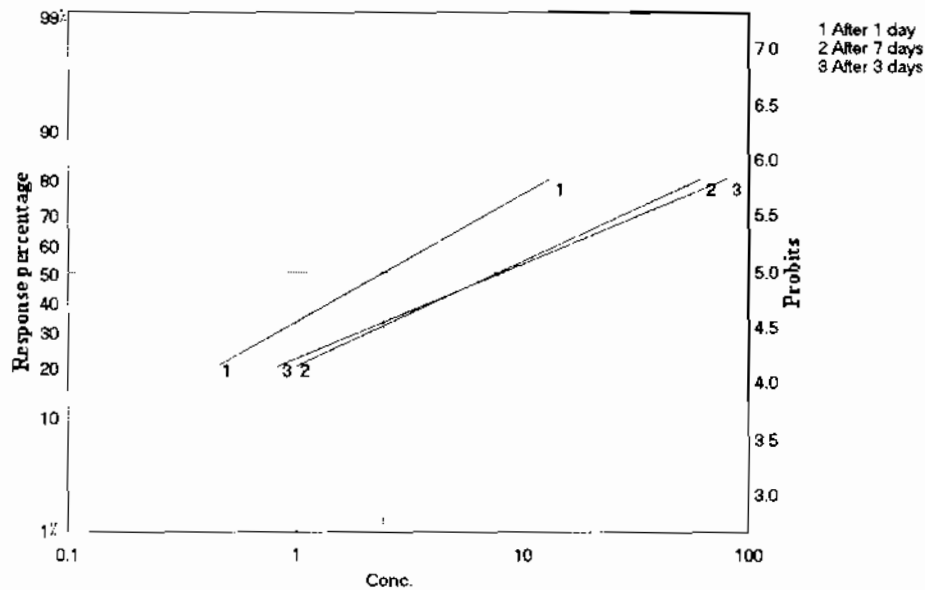


Fig. 2. Relative toxicity of Pink flowers extracts on adult of *Phytoseiulus persimilis* after feeding on bean oil leaves under laboratory conditions:

Table 2. LC_{50} values and slopes of Pink flowers extracts on adult of *Phytoseiulus persimilis* after feeding on treated bean oil leaves.

Parameters	Pink flowers extracts		
	1 days	3 days	7 days
LC_{50}	2.45	8.18	7.89
LC_{90}	32.34	265.45	183.59
Slope	1.14	0.85	0.94

On base of the LC_{90} values, Garlic extract show the same trend, whereas these LC_{90} values were 94.10, 36.66 and 80.77 with 1, 3 and 7 days, respectively (Table 3).

On base of the slop values, Garlic extract gave 0.71, 0.99 and 0.85, respectively (Table 3).

1.4. Relative toxicity of Garlic extract on adult of *P. persimilis*:

Data in Table (4) and Fig. (4) show the effect of Garlic extract on mortality percentages of adult of *P. persimilis*. Percentages of mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Garlic extract. After 1 day from treatment the mortality were 47, 39 and 31% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively. While the previous concentrations gave 42, 33 and 24% mortality, respectively after 3 days.

While, after 7 days from treatment the mortality were 38, 29 and 21% for the previous concentrations, respectively.

When compare between the effects of Garlic extract on the females of *P. persimilis* after 1, 3 and 7 days from treatment it can be concluded that the LC_{50} values of Pink flowers extract were 1.27, 1.72 and 2.32 for 1, 3 and 7 days, respectively (Table 4). On base of the LC_{90} values, Garlic extract show the same trend, whereas these LC_{90} values were 87.23, 58.6 and 80.79 with 1, 3 and 7 days, respectively (Table 4).

On base of the slop values, Pink flowers extract gave 0.69, 0.84 and 0.83, respectively.

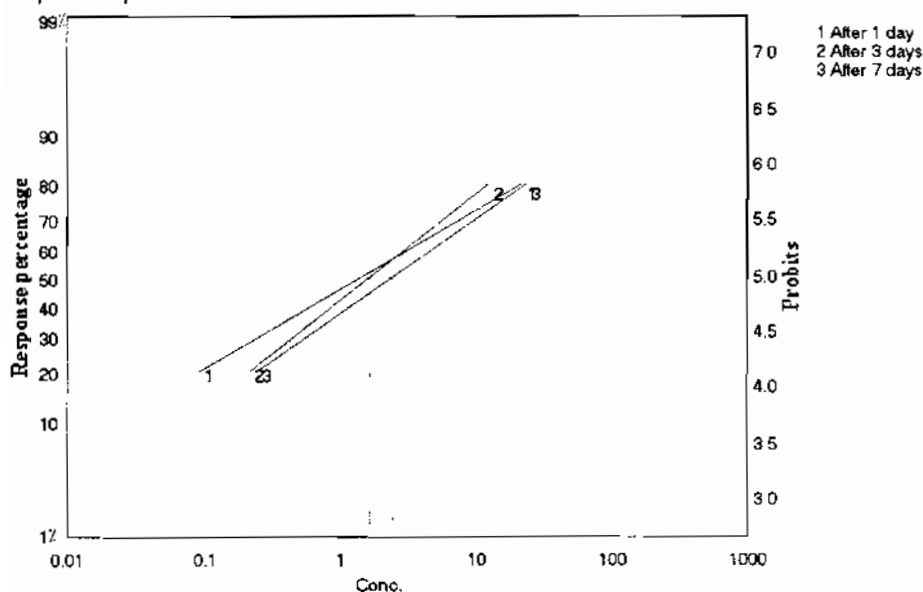


Fig. 3. Relative toxicity of Pink flowers extracts on adult of *phytoseiulus persimilis* after feeding on bean oil leaves under laboratory conditions:

Table 3. LC₅₀ values and slopes of Garlic extracts on adult females of *T. urticae* after feeding on treated bean leaves.

Parameters	Garlic extracts		
	1 days	3 days	7 days
LC ₅₀	1.45	1.67	2.46
LC ₉₀	94.10	36.67	80.77
Slope	0.71	0.99	0.85

1.5. Relative toxicity of Black seeds extract on adult females of *T. urticae* and on adult of *P. persimilis*:

Data in Table (5) and Fig. (5) show the effect of Black seeds extract on mortality percentages of adult females of *T. urticae*. Percentages of mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Black seeds extract. After 1 day from treatment the mortality were 43, 35 and 22% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively. While the previous concentrations gave 38, 27 and 18% mortality, respectively after 3 days. While, after 7 days from treatment the mortality were 29, 21 and 14% for the previous concentrations, respectively.

When compare between the effects of Black seeds extract on the adult females of *T. urticae* after 1, 3 and 7 days from treatment it can be concluded that the LC₅₀ values of Black seeds extract were 1.42, 2.01 and 4.26 for 1, 3 and 7 days, respectively (Table 5).

On base of the LC₉₀ values, Black seeds extract show the same trend, whereas these LC₉₀ values were 28.97, 36.99 and 125.33 after 1, 3 and 7 days from treatment respectively (Table 5).

On base of the slop values, Black seeds extract gave 0.98, 1.01 and 0.87, respectively (Table 5).

1.6. Relative toxicity of Black seeds extract on adult of *P. persimilis*:

Data in Table (6) and Fig. (6) show the effect of Black seeds extract on mortality percentages of adult of *P. persimilis*. Percentages of mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Black seeds extract. After 1 day from treatment the mortality were 46, 36 and 24% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively.

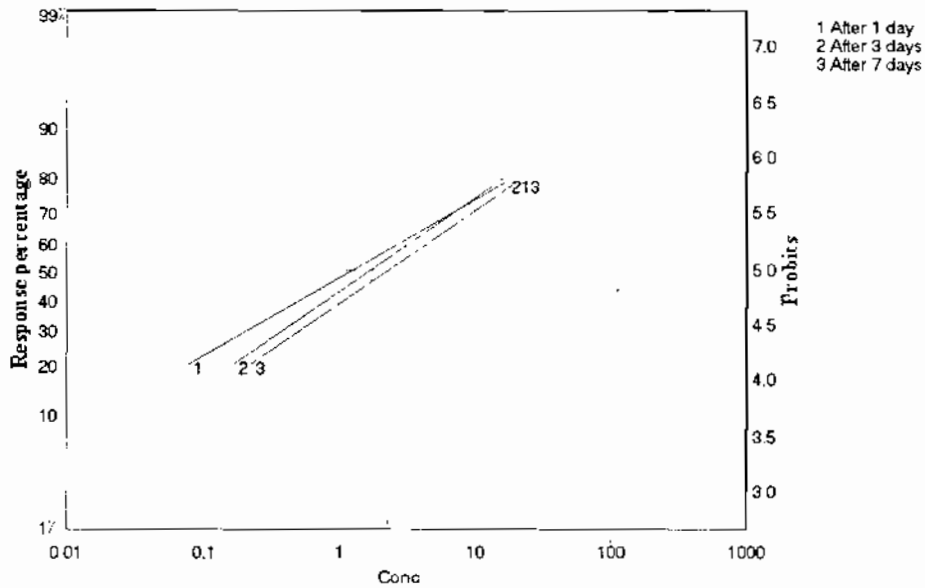


Fig. 4. Relative toxicity of Garlic extracts on adult of *phytoseiulus persimilis* after feeding on bean leaves under laboratory conditions:

Table. 4. LC_{50} values and slopes of Garlic extracts on adult of *phytoseiulus persimilis* after feeding on treated bean leaves.

Parameters	Garlic extracts		
	1 days	3 days	7 days
LC_{50}	1.27	1.72	2.32
LC_{90}	87.23	58.60	80.79
Slope	0.69	0.84	0.83

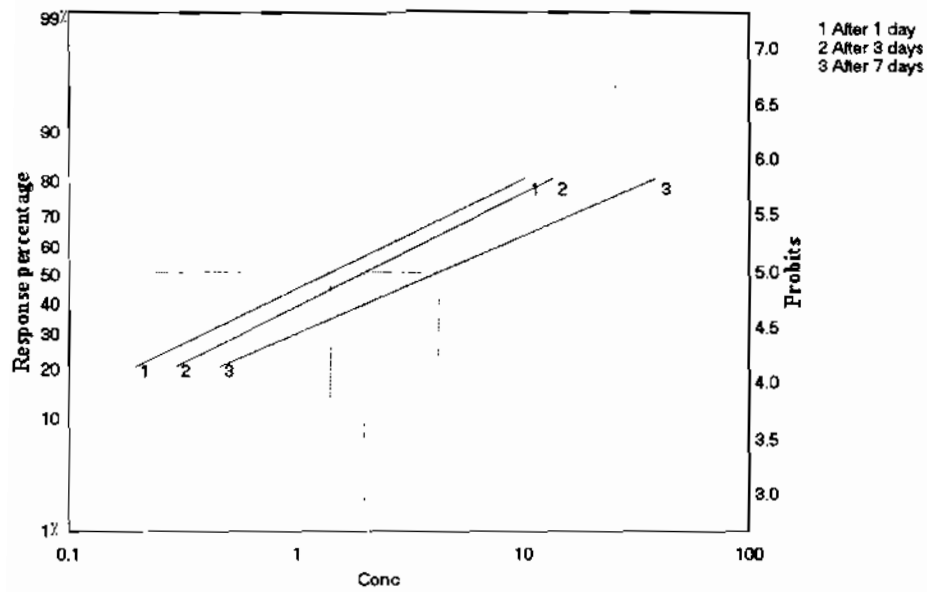


Fig. 5. Relative toxicity of Black seeds extracts on adult females of *Tetranychus urticae* after feeding on bean leaves under laboratory conditions:

Table 5. LC_{50} values and slopes of Black seeds extracts on adult females of *Tetranychus urticae* after feeding on treated bean leaves.

Parameters	Black seeds extracts		
	1 days	3 days	7 days
LC_{50}	1.42	2.01	4.26
LC_{90}	28.97	36.99	125.33
Slope	0.98	1.01	0.87

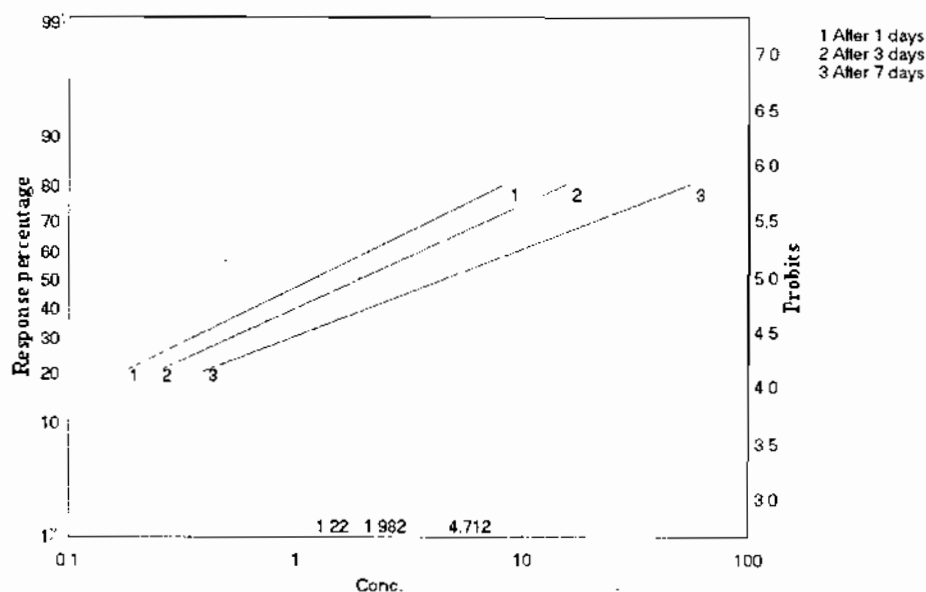


Fig. 6. Relative toxicity of Black seeds extracts on adult of *phytoseiulus persimilis* after feeding on bean leaves under laboratory conditions:

Table 6. LC_{50} values and slopes of Black seeds extracts on adult of *phytoseiulus persimilis* after feeding on treated bean leaves.

Parameters	Black seeds extracts		
	1 days	3 days	7 days
LC_{50}	1.22	1.98	4.71
LC_{90}	23.24	47.06	203.71
Slope	1.00	0.93	0.78

While the previous concentrations gave 39, 29 and 20% mortality, respectively after 3 days. While, after 7 days from treatment the mortality were 30, 22 and 16% for the previous concentrations, respectively.

When compare between the effects of Black seeds extract on the females of *P. persimilis* after 1, 3 and 7 days from treatment it can be concluded that the LC_{50} values of Pink flowers extract were 1.22, 1.98 and 4.71 after 1, 3 and 7 days, of treameate, respectively (Table 6).

On base of the LC_{90} values, Black seeds extract show the same trend, whereas these LC_{90} values were 23.24, 47.06 and 203.71 after 1, 3 and 7 days, of treameate, respectively (Table 6).

On base of the slop values, Black seeds extract gave 1.00, 0.93 and 0.78, respectively.

The results are agreement with those obtained by David and David (1997) they found that garlic, onions, and chives and its extracts have been popular press as a repellent for many arthropods. Also, 100% garlic juice gave reduction to *T. urticaes*

Abd El-Wahab (2003) found that the high concentration of the different plant extracts had a significant effect and resulted in a high percentage of mortality. All tested extracts were more toxic to the prey than to the predator, these results similar to those founded by Souliotis *et al.* (2000).

REFERENCES

1. Abbott's, W. S. 1925. A methods for computing the effectiveness of an insecticide. J. Econ. Entomol., 18 (7): 265.
2. Abd El-Samad, M. A., M. E. El-Halwany and K. M. El-Saied. 1996. Utilizing *Euseius scutalis* Athias-Henriot to control *Eutetranychus orientalis* (Klein) on citrus trees. Egypt. J. Agric. Res., 74 (3): 671-684.
3. Abd El-Wahab, H. A. 2003. Efficiency of leaves extracts of castor bean plant against *Aphis gossypii* (Glover) and *Tetranychus urticae* Koch on cucumber plant. J. Agric. Sc., Mansoura Univ., 28 (5): 4029-4038.
4. Abo Taka, S. M., G. E. Abo El-Ghar and A. A. Osdman. 1986. Impact of certain ornamental plant extracts on some biological aspects of the predatory mite, *Amblyseius gossipi* El-Badary (Acarina : Phytoseiidae). Menofia J. Agric. Res., 11: 1025-1033.
5. David, W. B. and R. A. David. 1997. Repellency of *Allium* extracts on two-spotted spider mites. Sna Research Conf., 42: 112-115.
6. El-Beheiry, M. M., A. A. Hassan and F. M. Hoda. 1987. The relationships between diet, biological aspects and susceptibility to different pesticides of the predatory mite, *Amblyseius gossipi* (El-Badry). J. Agric. Res. Tanta Univ., 13 (4): 1177-1184.
7. EL-Halawany, M. E., M. A Abd EL-Samad and H. M. Ebrahim. 2000. Biological control of the spider mite *Tetranychus urticae* Koch by the Phytoseiid mite *Phytoseiulus persimilis* (A.H.) compared with chemical control Bull. Ent. Soc. Egypt, Econ. Ser., 27, 2000 (63).
8. Finney, D. J. 1971. Probit analysis. Cambridge Univ. Press Cambridge, 33.
9. Heikal, I. H. and G. A. Ibrahim. 2002. Mass production of the phytoseiid predator, *Phytoseiulus macropilis* (Acari: phytoseiidae) Egypt. J. Agric. Res., 80 (3): 1173-1179.

10. Hosney, A. H., A. Y. Keratum, M. A. Salama and A. S. Derballa. 2001. Fungicidal and acaricidal activity of some pesticides against *Alternaria solani* and *Tetranychus urticae*. J. Pest Cont. & Environ. Sc., 9 (1): 73-92.
11. Iwuala, M. C. E. and E. O. E. Agbakwuru. 1981. Dentinal oil, potential insecticides: Tests with adults and nymph of *Periplaneta americana* and *Zonocerus varigtus*. J. Econ. Entomol. 74:149-252.
12. Mohammed, L. E. 1983. Local plant natural products heaving aphicidal effects against the black been aphid, *Aphis carecivora* (Homoptera: Aphididae). Med. Fac. L. and bouww. Rijksuniv. G. Gent vol. 84 No. 2. pp 215- 223.
13. Siegler, E. H. 1947. Leaf disc technique for laboratory tests of acaricides. J. Econ. Entomol., 40: 441-442.
14. Souliotis, P. P., M. D. Printziou and Z. D. Malissiova. 2000. Side effects of Neemark (*Azadirachta indica* A. Juss) and two new vegetable oils formulation on *Tetranychus urticae* Koch and its predator, *Phytoseiulus persimilis* Athias-Henriot. Bolletino di Zoologia Agraria-e-di-Bachicoltura, 32 (1): 25-33.
15. Sun, Y. P. 1950. Toxicity index an improved method of comparing the relative toxicity of insecticides. J. Econ. Entomol., 43: 45-53.
16. Wgglesworth, V. B. 1986. Water-proofing of the insect cuticle. Recent-Advance Insect-Hydrology-Morphology and Ecology. Pathak, S. C-ed- 1986. pp 1-4.

تأثير سمية بعض المستخلصات النباتية ضد العنكبوت الأحمر
TETRANYCHUS URTICAE KOCH والمفترس الأكاروسي
PHYTOSEIULUS PERSIMILIS A.-H.

أشرف عبد السلام هندي منجود ، علاء محمد حلوة

معهد بحوث وقاية النباتات- مركز البحوث الزراعية- الدقي- الجيزة

تم دراسة فاعلية بعض المستخلصات النباتية (مستخلص بذور الثوم ومستخلص القرنفل ومستخلص حبة البركة) علي أنثي العنكبوت الأحمر ذو البقعتين ومفترسه وأخذت النتائج بعد ١ يوم، ٣ أيام ، ٧ أيام من المعاملة.

أوضحت النتائج أنه: بصفة عامة أن فاعلية هذه المستخلصات زادت بزيادة التركيز وكان أعلي تأثير إبادي لمستخلص الثوم ضد أنثي العنكبوت الأحمر ويليها مستخلص حبة البركة وكان التأثير الأقل لمستخلص القرنفل بعد يوم ، ٣ أيام ، ٧ أيام بعد المعاملة بعد حساب قيم LC_{50} ، LC_{90} ومييل الخط المستقيم.

كما أوضحت النتائج نفس الفاعلية لهذه المستخلصات ضد المفترس الأكاروسي. ولكن كان المفترس الأكاروسي أكثر استجابته (أكثر حساسية) لهذه المستخلصات مقارنة بإنثا العنكبوت الأحمر.

وعليه يمكن استخدام هذه المستخلصات في برامج المكافحة المتكاملة لهذه الآفة لتقليل التلوث البيئي.