# TOXICITY OF MICROBIAL PESTICIDES (BIOFLY) AND CERTAIN PLANT EXTRACTS ON SOME BIOLOGICAL ASPEÇTS OF RED SPIDER MITE (KOCH.)

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## ABSTRACT

The present study was aimed to evaluate the residual effects of entomopathogenic fungi, *Beauvaria bassiana* (Biofly) and two plant extracts (black cumin and wormseed) on two-spotted spider mite, *Tetranychus uriticae* (Koch). Plant extracts were also evaluated when combined in mixtures with the acaricide fenpyroximate.

Results indicated that, Biofly was the highly toxic to adult female mites ($LC_{50}$ 48403 conidia/ml). Black cumin extract was of a moderate toxicity ($LC_{50}$ 887 ppm), while wormseed extract was the least ($LC_{50}$ 1861.3 ppm). Pronounced potentiation was observed when mixing fenpyroximate with the two tested plant extracts. Biofly was more toxic to older eggs than to younger ones ($LC_{50}$ 23531, 29061.71 and 34951 conidia/ml for 1, 2 and 3 days old eggs of spider mite, respectively). Black cumin and wormseed were the least toxic compounds to treated *T. uriticae* eggs after 1, 2 and 3 days ($LC_{50}$ 6744, 8027, 5051, 6011, 3219 and 4949.91 ppm respectively). Biofly had a moderate effect on mite fecundity, but back cumin and wormseed were highly reduced the number of eggs deposited by *T. uriticae*. Black cumin had a moderate effect on egg-hatchability, while Biofly and wormseed extracts were the least effective ones. Black cumin had a moderate effect on sterility followed by wormseed and Biofly, respectively. The tested plant extracts and Biofly had the ability to elongate the duration needed for all immature stages and the life cycle, while they were able to shorted the oviposition period and in the same time the adult female longevity.

## INTRODUCTION

Phytophagous mites are major pests of the main food crops and their potential for damage has become increasingly evident during the last few decades (Amano and Chaat, 1977). A wide range of chemicals have been applied for controlling the two-spotted mite. The wide use of the chemical compounds has resulted in many problems such as

population outbreaks and chemical resistance endangering human, health and wealth for all that world now do much to reduce chemical applications and trying to depend mainly on predators and the entornopathogens such as virus, bacteria and fungi in I.P.M. programmes.

Controlling phytophagous mites by a combination of biological and chemical methods has proved a less costly and more permanent method of control than have pesticides alone (Hislop and Prokopy, 1981). Sublethal effects can supplement mortality in several ways, for example, by causing the organism to avoid treated surfaces, by reducing the reproductive potential; (Jackson and Wilkins, 1985), and by interfering w~th feeding and oviposition (Hajjar and Ford, 1989).

Iskander *et al.,* (1996) reported that plant extracts showed ovicidal action, also affected adult female longevity and other biological aspects of *Tetranychus arabicus* Attiah. Nassef (1998) reported that black cumin had a considerable toxicity to *Tetranychus uriticae.*

Gamieh and Saadoon (1998) evaluated the influence ot sublethal concentrations (LC25) of the tested acaricides (Neron, Sanmite, Ortus, Vertemic and Siomide) on some biological aspects of T cucurbitaceaum. All compounds had the ability to elongate the pre-oviposition period, while they were able to decrease the adult female longevity, oviposition and post oviposition periods. Egg viability and female fecundity were adversely affected by all compounds, however, vertimic was more harmful compared with the other compounds in this respect. Hosny et al.(1998) found that the pyrethroids fenvalerate and deltamethrin were highly effective in decreasing spider mite fecundity.

Abdel-Samed (1998) studied the efficiency of the biocide compound, Biofly (3 X $10^7$ conidia, at 100 cc/100 L of water) on different egg stages and adult females of Tetranychus urticae (Koch). The biological aspects of *T. urticae* were also studied. The obtained results showed that the effect of this compound against egg stage was higher than against adult females, Moreover, three days old eggs were the most effectual of the others. The biological aspects of *T. urticae* when treated as one day old eggs with Biofly indicated that the average number of deposited eggs per female decreased to 95.9%. Moreover, it caused 90% mortality during immature stages.

Clearly, if chemical, microbial pesticides and biological methods are successfully integrated, then the impact of pesticides used to control

key pests and diseases must be minimized while the beneficial arthropods must be introduced.

The present study was carried out to evaluate the toxic effect of *Beauvaria bassiana* (Biofly), certain plants extracts such as black cumin and wormseed and mixtures of fenpyroximate with the two plant extracts tested singly against the egg stage and *Tetranychus uriticae* adult females and the side effect of sublethal concentration of the tested compounds on some biological aspects of *T. uriticae*

## MATERIALS AND METHODS

### 1-Mite Cultures:

The two-spotted spider mite, *Tetranychus urticae* (Koch) (Acarina: Tetranychidae), colonies were obtained from castor bean plants from Kafr El-Sheikh governorate and reared under laboratory conditions according to Dittrich (1962). The prey culture was kept at 25 ± 2°C under 16 hours photoperiod to encourage plant growth, and 70 ± 5 R.H. The same culture of *T. urticae* was reared on tomato and green beans using the same technique.

### 2-Chemicals tested:

Four compounds including microbial one were used

**Fenpyroximate**: *tert*-butyl (*E*)-a-(1,3-dimethyl-5-phenoxypyrazol-4-ylmethyleneamino-oxy)-*p*-toluate as 5% S.C.; **Biofly :** The trade name of entomopathogenic fungus (*Beauveria bassiana*) (Balsamo) as a liquied microbial pesticide containing 3 x$10^7$ conidia/ml. It was supplied by El-NasserCompany for Fertilizers and Pesticides. Egypt and two plant extracts (black cumin and wormseed).

Plants extracted and investigated in the present study

| Scientific name | Common name | Plant used |
|---|---|---|
| Fam. Ranubculaceae *Nigella sativum* linn. | Black cumin | Seed |
| Fam. Compositae *Artemisia cinae* L. | Wormseed | Leaves |

**3-Experimental techniques:**

**3.1-Toxicity of tested compounds to the adult female mites *T. urticae* and eggs:**

The toxic effect of tested compounds to *Tetranychus urticae* adult females and their deposited eggs were evaluated by the leaf disc dip technique according to siegler (1947). Mortality counts were made 24 hours after treatment for adults. Correction for the control mortality was made by Abbott's formula (1925). **Mortality (%)** =

$$\frac{\text{Mortality \% of the treatment - Mortality \% of the control}}{\text{100 - Mortality \% of the control}} \text{X100}$$

Egg mortality: The percentage of mortality was calculated as follows : = (a/b) X 100

Where: a= unhatched eggs b= total number of eggs which counted before treatment with toxicant

The joint action was evaluated by the equation of co-toxicity factor, described by Mansur *et al.*, (1966):

$$\text{Co-toxicity factor} = \frac{\text{Observed \% mortality} - \text{Expected \% mortality}}{\text{Expected \% mortality}} \text{ X 100}$$

This factor was used to differentiate the obtained results into three categories. A positive factor of +20 or more is considered potentiation, a negative factor of -20 or more means antagonism and the intermediate value between -20 or +20 was considered only as additive effect.

**3.2-Effect of compound residues on *T. urticae* egg fecundity and fertility:**

The residual effect of each tested chemical at $LC_{25}$ level on adult prey mites was evaluated according to Keratum *et al.*, (1994). The percent of sterility in mated females was calculated according to Toppozada *et al.*, (1966).

$$\text{\% sterility} = 100 - (ab/AB \text{ X } 100)$$

Where:

a= No. of egg laid/female in treatment
b=% hatchability in treatment
A= No. of egg laid/female in control
B=% hatchability in control

**3.3-Effect of compound residues on some biological aspects of *T. urticae* (Koch):**

The residual effect of the tested compounds on some biological aspects of mites was studied or detected using the method followed by Smith *et al.*, (1963).

## RESULTS AND DISCUSSION

**1- Toxicity of tested compounds to adult females of two-spotted spider mite *T.urticae*.**

The results (Table 1) showed that, black cumin was more toxic than worm-seed with $LC_{50}$ values of 887 and 1861.3 ppm respectively. Wormseed and black cumin have slope values of 1.67 and 1.25 respectively. It is known as respected by Hoskins and Gordon (1956) that the slope value of log concentration-probit line is considered as a reaction indicator between the chemical and the effected organism.

Table (1): Toxicity and mixtures of tested compounds against adult females of two-spotted spider mite *T. urticae*

| Compounds | $LC_{50}$ ppm | Confidence limits of $LC_{50}$ | | Toxicity index | Slope value | Co-toxicity factor |
|---|---|---|---|---|---|---|
| Pesticide | | | | | | |
| Fenpyroximate | 232.44 | 167.19 | 305.21 | 100 | 1.76 | |
| Plant extracts | | | | | | |
| Black cumin | 887 | 646 | 1253 | 26.21 | 1.25 | +50** |
| Wormseed | 1861.3 | 1277 | 2479 | 12.49 | 1.67 | +30• |
| Biofly* | 48403 | 32473 | 70831 | -- | 1.19 | -- |

*$LC_{50}$ was determined as conidia/ml, ** Fenpyroximate with black cumin and •Fenpyroximate with wormseed

Black cumin and wormseed were toxic to *T. urticae* adults, these results are in agreement with the findings of El-Halawany *et al* (1988). Black cumin and wormseed were toxic to *T. urticae* adults, these results are in agreement with the findings of El-Halawany *et al.*, (1988) reported that cumin oil was more toxic for adult stage of *T. arabicus* than other tested extracts. Iskander *et al.*, (1996) found that shih extract had stronger activity to adult females of *T. arabicus*, while Nassef (1998)found that the vegetative oil (black cumin) had a considerable toxicity to *T. urticae*.

Data presented in Table (1) indicated that 2 pairs showed different levels of potentiation. 1- Fenpyroximate with black cumin (+50), 2- Fenpyroximate with wormseed (+30). Barakat et al., (1985) who studied 100 miture of five pesticides and tyen plant extracts to adult females of *T. urticae*. Results indicated that out of 100 mixtures tested, only 56 pairs showed pontiation, 2 pairs produced additive effect and 32 pairs disclosed antagonistic effect.

The joint action of the mixtures were found effective against *T. urticae* by many investigators in laboratory (Dewar and Haylock, 1995; Ahn et al., 1996 and Ismail, 1997) and in field (Osman and Zaki, 1985; Abdel –All et al., 1990 and Ahn et al., 1996).

Results showed that the LC50 of Biofly (*B. bassiana*) was 48403 conidia/ml. the present results confirmed that the microbial pesticide was less toxic to *T. urticae.* Absel-Samad (1998) indicated that the biocide compound (*B. bassiana*) at $3x10^4$ conidia/ml was tested against the adult females of *T. urticae*, resulted in 45.69 mortality percentage. Who found that again under field condition, the average reduction in population density of *T. urticae* was 71.06% after the forth application with *B. bassiana.*

**2- Ovicidal action of the tested compounds against *T. urticae*:**

The toxicity of different tested compounds on one-day, 2 and 3 days old-eggs of *T. urticae* are presented in Table (2). The data indicated that the black cumin and wormseed (plant extracts) in a category of least effective compounds on the 1, 2 and 3 days old eggs of spider mite with LC50 values of 6744, 8027, 5051, 6011, 3219 and 4949.91 ppm respectively.

The slope values of the log concentration-probit lines (Table 2) indicate that black cumin has the highest slope value (1.33, 1.31 and 1.49), while wormseed has the lowest ones (1.32, 1.18 and 1.16). In other words, the highest slope values mean more homogeneity in response of egg population towards the tested compounds. It could be, concluded that the tested compounds proved to be more toxic to older eggs than to younger ones. The obtained results are in agreement with that recorded by (El-Monairy *et al.*, 1994; Abdel-Samed, 1998 and Derbalah, 1999).

The toxic effect of entomopathogenic fungi, Biofly on eggs of two-spotted spider mite *T. urticae* at different stages, the results in Table

(2) showed that, the most ovicidal effect of Biofly was on eggs of 72 hours age ($LC_{50}$ value 23531 conidial/ml).

Table (2): Toxicity of tested compounds on different egg stages of the *T. urticae*:

| Compounds | $LC_{50}$ | C. L. | | Slope value |
|---|---|---|---|---|
| | | Lower | Upper | |
| Plant extracts | 1-day old eggs | | | |
| Black cumin | 6744 | 5628 | 8200 | 1.33 |
| Wormseed | 8027 | 6493 | 10238 | 1.32 |
| Biofly* | 34951 | 26339 | 43608 | 0.93 |
| Plant extracts | 2-days old eggs | | | |
| Black cumin | 5051 | 4179 | 6188 | 1.31 |
| Wormseed | 6011 | 4655 | 7931 | 1.18 |
| Biofly* | 29061.7 | 18431 | 38926 | 0.96 |
| Plant extracts | 3-days old eggs | | | |
| Black cumin | 3219 | 2674 | 3822 | 1.49 |
| Wormseed | 4949.9 | 3996 | 6149 | 1.16 |
| Biofly* | 23531 | 12642 | 33106 | 0.94 |

C.L.=Confidence limits, *$LC_{50}$ was determined as conidia/ml

It could be concluded that there is a negative relationship between number of conidia/ml enough to prevent 50% of mite eggs to hatch and the egg age. In other words the biofly is more toxic to older eggs than to younger ones. The present results are in agreement with Adbel-Samad (1998) found that, Biofly was effective on different ages of eggs stages. Moreover, three days old eggs were the most effective than 2-days old eggs and one day old eggs. Derbalah (1999) found that microbial pesticide (Biofly) was toxic at different ages 6, 12 and 24 hours. Moreover, eggs of 24 hours age were the more affected than 12 and 6 hours age eggs.

**3- Effect of compounds residue on biology of two-spotted spider mite *T. urticae:***

**3.1- Egg deposition:**

The effect of sublethal concentration of tested compounds (LC25) on eggs deposited by the adult female mites, *T. urticae* was studied. The data in Table (3) indicated that, plant extracts (blak cumin and wormseed) caused high reduction in eggs deposit compared to the control treatment through the first day. Biofly was with negative. Through the

second day of oviposition, plant extract (black cumin and wormseed) were still of the highest effect on the fecundity of mite comparable to the control treatment, while no significant differences between Biofly and the control treatment in their effects on egg deposition. Through the third day of egg deposition, Biofly was of similar effects on egg deposition and not significantly different from the control treatment.

Table (3): Effect of tested compounds residues on egg deposition and egg hatchability of *T. urticae*:

| Compounds | Egg deposition | | | | Egg hatchability | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | General mean | Mean no. of hatched eggs* | | | General mean |
| | | | | | 24 hrs. | 48 hrs. | 72 hrs. | |
| 1-miceobial pesticides | | | | | | | | |
| Biofly | 7.75b | 5.50b | 4.50a | 5.92a | 15.0b | 10.25b | 7.25b | 10.83b |
| Control | 9.25a | 7.25a | 5.25a | 7.25a | 19.75a | 14.75a | 10.75a | 15.08a |
| LSD 5% | 0.93 | 1.12 | 0.80 | 1.98 | 1.13 | 1.39 | 1.10 | 7.87 |
| LSD 1% | 1.29 | 1.55 | 1.11 | 2.73 | 1.57 | 1.92 | 1.52 | 10.87 |
| 2-Plant extracts | | | | | | | | |
| Black cumin | 4.0c | 3.25c | 2.25b | 3.17b | 15.25b | 10.00c | 6.25c | 10.50b |
| Wormseed | 5.50b | 4.25b | 2.75b | 4.17b | 17.0b | 11.00b | 7.25b | 11.75b |
| Control | 12.0a | 10.25a | 7.0a | 9.75a | 19.75a | 14.50a | 9.75a | 14.67a |
| LSD 5% | 1.19 | 0.80 | 1.00 | 2.28 | 3.87 | 2.12 | 0.80 | 15.25 |
| LSD 1% | 1.71 | 1.15 | 1.43 | 3.27 | 5.56 | 3.04 | 1.15 | 21.89 |

A= mean number of eggs deposited/adult at first 24 hours, B= mean number of eggs deposited/adult at second 24 hours, C= mean number of eggs deposited/adult at third 24 hours * mean no. taken for 10 adults.

Black cumin was still of the highest effect on the fecundity of mite followed by wormseed and there are no significant differences between them. From the mean number of eggs deposited by one adult female *T. urticae*/day on leaf discs treated by different compounds (Table 3) results suggested that, plant extracts were the most effective compounds on egg deposition and Biofly was of little on this biotic aspect.

The obtained results were in agreement with that recorded by (Keratum, 1993; Ayyappath *et al.*, 1997 and Hossny *et al.*, 1998). Many investigators showed that plant extracts had a positive effect on egg deposition of the spider mite.

Amer, *et al.,* (1989) found that, treatment of raspberry leaf discs with the $LC_{50}$ and $LC_{25}$ of the petroleum ether extract significantly decreased the number of eggs deposited by females. Dimetry *et al.,* (1990) reported that, spraying females with the $LC_{25}$ for beta-amyrin caused a significant reduction in fecundity and the viability of resulting eggs. Dimetry, *et al.,* (1993) found that, mite feeding on leaf disc treated with different concentration of the two neem seed kernel extract of *Azadirachta indica* showed a significant reduction in the total number of eggs laid. Derbalah (1999) showed that Biofly had a little effect on rate of egg deposition.

**3.1- Egg hatchability:**

Data in table (3) indicated that through the three days it was apparent that, black cumin had a moderate effect on egg hatchability, wormseed and Biofly were the least effective compounds on egg hatchability of *T. urticae*. The present results were in agreement with those of (Hossny *et al.*, 1998 and Derbalah, 1999).

The data in Table (4) showed the comparative effect of the selected compounds ($LC_{25}$) on egg production of treated adult female mites during 3 days. Biofly was the last effective compound on the total number of eggs laid. The female fecundity decreased by 18.39%. Plant extracts (black cumin and wormseed) were highly affected the total number of eggs laid. The decreased rates were 67.52% and 57.26% of black cumin and wormseed respectively.

From the previous results, % sterility in mated treated females was calculated by the equation of Toppozada *et al.,* 1966 and recorded in Table (4). These results indicated generally that, the compounds could be of sterial action or (caused sterility). Plant extracts (black cumin and wormseed) had a moderate effect on sterility. The percent of sterility in the mated females were 77.26 and 65.91 for black cumin and wormseed respectively. While, Biofly gave sterility not more than 41.31%. Many workers found similar results on mites (Dimetry et al., 1993; Nasser et al., 1995; Osman, 1997 and Gamieh and Saadomm, 1988).

Table (4): Effect of tested compounds on reduction in egg laying and sterility in one emerging adult mated female of *T. urticae*:

| Treatment | Number of eggs/female during 3 days after treatment | % R | % hatch | % S |
|---|---|---|---|---|
| 1-miceobial pesticides | | | | |
| Biofly | 17.72 | 18.39 | 70.77 | 41.31 |
| Control | 21.75 | - | 98.41 | - |
| 2-Plant extracts | | | | |
| Black cumin | 9.50 | 67.52 | 68.75 | 77.26 |
| Wormseed | 12.50 | 57.26 | 78.33 | 65.91 |
| Control | 29.25 | - | 98.18 | - |

%R = % Reduction in No. of egg/female, %S = % sterility in mated female

**4-Effect of certain plant extracts with ($LC_{50}$) on the biological aspects of *T. urticae*:**

The results in Table showed that the black cumin and wormseed significantly increased the duration of active larvae, the values were 3.13 and 2.75 days respectively, compared with 1.3 8 days for the control. The quiescent larvae averaged 1.88 and 1.63 days for black cumin and wormseed treatments compared with an average of 1. 13 days for the control. The duration quiescent protonymph averaged 1.88 and 1.63 days for black cumin and wormseed treatments, compared with an average 1.25 days for the control. The duration of the active deutonymph was significantly increased for black cumin and wormseed treatment, 2.88 and 2.75 days respectively, compared with 1.75 days for the control. The mean periods of the immature stages were 13.75 and 12.25 days for black cumin and wormseed respectively, compared with average of 8.50 days for the control (Table 5).

The plant extracts treatments resulted in considerable prolongation for the holl life-cycle periods of *T urticde* (18.13 days for black cumin) and (16.38 day for wormseed) while it was 12.38 days for control. Similar results were obtained for the generation period for both. It was averaged 20.38, and 18.38 days for the corresponding plant extracts, compared with 14.13 days for the control.

From the results in Table 5, it was found that the plant extracts shortened significantly the female adult longevity and- the owipoisition period of *T urticae* the means being 6.00 & 1.75 for black cumin and 7.25 & 3.00 days for wormseed while control gave 12.25 & 8.88 days respectively.

The recorded total numbers of deposited eggs per female were highly affected when using the plant extracts against adult females of *T urticae* were 5.50 and 8.00 eggs for black cumin and wormseed compared with 64.00 eggs for the control. The reduction percentages of fecundity were 91.41% and 87.50% for black cumin and wormseed respectively (Table5). It was evident that black cumin had stronger effect on adult of *T urticae* than wormseed.

These previous results were in agreement with that recorded by (Schauer and Schmutterer, 1981; Barakat *et al.*, 1985; Abo El-Ghar *et al,* 1986; El-Halawany *et al*, 1988; Dimetry *et al*, 1990; Amer *et al*, 1989; Abo El-Ghar *et al*, 1990 and Darwish, 1990). Nassar *et al.* (1995) showed that after treatment the adult females of *T urticae* with 500 and 1000 ppm. of Duranta and Lantana extracts, the average of life cycle durations were 10.8, 10.6, 12.68 and 9.40 days, respectively. 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, compared with., 15.57 of the control.! 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. Iskander *et al* (1996) showed that the biological aspects of *T arabicus* were more affected by Shihh than Sorrel and Kalakh extracts.

Table (5): Effect of black cumin and wormseed on biological aspects of *T. urticae* after adult females treatment with $LC_{25}$ level.

| Developmental stages | Black cumin | | Wormseed | | Control | LSD | |
|---|---|---|---|---|---|---|---|
| | Duration (in days) | Mortality % | Duration (in days) | Mortality % | Duration (in days) | 5% | 1% |
| Incubation period | 4.25±0.29 | | 4.13±0.25 | | 3.87±0.25 | - | - |
| Active larva | 3.13±0.25a | 23.08 | 2.75±0.29a | 15.38 | 1.38±0.25b | 0.42 | 0.61 |
| Quiescent larva | 1.88±0.25a | 15.38 | 1.63±0.48ab | 7.69 | 1.13±0.25b | 0.55 | 0.79 |
| Active protonymph | 2.13±0.25 | 7.69 | 1.75±0.29 | 0.00 | 1.63±0.25 | - | - |
| Quiescent protonymph | 1.88±0.25a | 0.00 | 1.63±0.25ab | 7.69 | 1.25±0.29b | 0.24 | 0.61 |
| Active deutonymph | 2.88±0.25a | 0.00 | 2.75±0.29a | 0.00 | 1.75±0.29b | 0.44 | 0.64 |
| Quiescent deutonymph | 2.00±0.41 | 0.00 | 1.75±0.29 | 0.00 | 1.38±0.48 | - | - |
| Total immature stages | 13.75±0.50a | 46.15 | 12.25±0.29b | 30.76 | 8.50±0.82c | 0.92 | 1.33 |
| Life cycle | 18.13±0.48a | | 16.38±0.48b | | 12.38±0.85c | 1.01 | 1.45 |
| Pre-oviposition | 2.25±0.29 | | 2.00±0.41 | | 1.75±0.29 | - | - |
| Generation period | 20.38±0.63a | | 18.38±0.85b | | 14.13±0.63c | 1.14 | 1.64 |
| oviposition period | 1.75±0.29c | | 3.00±0.41b | | 8.88±0.48a | 0.64 | 0.92 |
| Post-oviposition | 2.00±0.41 | | 2.25±0.50 | | 1.63±0.25 | - | - |
| Longevity | 6.00±0.41c | | 7.25±0.50b | | 12.25±0.50a | 0.75 | 1.08 |
| Life span | 24.13±0.85 | | 23.63±0.48 | | 24.63±0.48 | - | - |
| Average number of deposited egg/female | 5.50±0.58c | | 8.00±1.15b | | 64.00±1.83a | 2.07 | 2.97 |
| Reduction % of fecundity | 91.41 | | 87.50 | | 0.00 | | |

**5- The residual effect of Biofly on biological aspects of *T. urticae*:**

The residual effect of Biofly with 3 x $10^4$ conidia/ml (recommended dose) on the biology of adult females T urticae was studied. Results showed that the incubation period was slightly increased to 5.13 days compared with 4.88 days for control. The duration of active and quiescent larvae were increased to 3.75 and 1.25 days respectively, compared with 2.5 and 0.88 days for control. The duration of the active and quiescent protonymphs were increased to 2.5 and 1.5 days compared with 1.63 and 1. 13 days of the control, respectively. The aspects for active and quiescent deutonymphs were 2.0 and 1.25 days compared with 1.88 and 0.75 days for control. The duration of the total immature stages was increased to 12.25 days compared with 8.75 days of the control, respectively. The mortality percentages were 31.25, 17.5, 3.75 and 2.5 in active larvae, active protonymphs, active deutonymphs and quiescent deutonymphs of *T urticae* respectively (Table 6).

Table (6): Effect of Biofly on biological aspects of *T. urticae* treated with $3x10^4$ conidia/ml

| Developmental stages | Duration (in days) | %M | C.D. (in days) |
|---|---|---|---|
| Incubation period | 5.13±0.25 | | 4.88±0.25 |
| Active larva | 3.75±0.50 | 31.25 | 2.5±0.58 |
| Quiescent larva | 1.25±0.29 | 0.00 | 0.88±0.25 |
| Active protonymph | 2.5±0.58 | 17.50 | 1.63±0.48 |
| Quiescent protonymph | 1.5±0.58 | 0.00 | 1.13±0.25 |
| Active deutonymph | 2.0±0.41 | 3.75 | 1.88±0.25 |
| Quiescent deutonymph | 1.25±0.29 | 2.5 | 0.75±0.29 |
| Total immature stages | 12.25±0.65 | 55 | 8.75±0.65 |
| Life cycle | 17.38±0.48 | | 13.63±0.63 |
| Pre-oviposition | 1.75±0.29 | | 1.13±0.25 |
| Generation period | 19.13±0.48 | | 14.75±0.65 |
| oviposition period | 2.5±0.58 | | 7.25±0.65 |
| Post-oviposition | 2.0±0.41 | | 1.75±0.29 |
| Longevity | 6.25±0.50 | | 10.13±0.85 |
| Life span | 23.63±0.63 | | 23.75±1.44 |
| Average number of deposited egg/female | 11.00±0.82 | | 55.00±1.41 |
| Reduction % of fecundity | 80 | | 0.0 |

%M = % Mortality, C.D. = Control Duration

Generally, the total mortality percentage was 55% during the hall immature stages. The life cycle, pre-oviposition and generation period were prolonged more than control. They were 17.384 1.75 and 19.13 days for the abov6 mentioned periods, while they were 13.63, 1.13 and 14.7) days for the control, respectively.

The oviposition period was highly decreased to 2.5 days while it wa; 7.25 days in the control. The reduction in the number of the deposited eggs per the resulting female was 11.00 eggs compared with 5500 eggs for control. The reduction percentage of fecundity was 80%. The percent results were in agreement with the findings of Abdel-Samad (1998).

**6-The residual effect of Biofly on biological aspects of *T. urticae* after treated one day old eggs.**

The residual effect of Biofly when the tested (3 x $10^4$ and 2.1 X $10^4$ conidia/ml) were used against the egg stage (one day) and the delayed effect on the biology of *T urticae* was also, studied.

Results in Table (7) showed that the B iofly treatment with 3 x $10^4$ conidia/ml (recommended dose) significantly increased the incubation period of the eggs followed by Biofly with 2.1x $10^4$ conidia/ml ($LC_{25}$). The incubation period of eggs lasted for 4.75 and 4.13 days for Biofly 3 x $10^4$ and 2.1 x $10^4$ conidia/ml respectively, compared with 4.00 days of the control. The duration of active larvae and protonymph were increased to 4.63 & 4.13 and 3.00 & 2.00 days for Biofly 3 x $10^4$ and 2.1 X $10^4$ conidia/ml compared with 1.38 and 1.50 days for the control respectively. The mean periods of the immature stages were 15.88 and 11.88 days for Biofly with 3 x $10^4$ and 2.1 X $10^4$ conidia/ml respectively, compared with an average of 7.56 days for the control (Table 7). The mortality percentage were 50, 25, 8.33, 4.17 and 22.22, 13.89, 2.79, 2.79 in the active larvae, active protonymphs, active deutonymphs and quiescent deutonymphs with treatment Biofly 3 x $10^4$ and 2.1 X $10^4$ conidia/ml on T urticae respectively.

The life cycle, pre-oviposition and generation period were 20.63, 2.00, 22.63 and 16.00, 1.25, 17.25 day for Biofly with 3 x $10^4$ and 2.1 X $10^4$ conidia/ml respectively, compared with 11.56 & 1 ".13 12,69 days for the control respectively while, significant differences were found between Biofly 3 x $10^4$ , 2.1 X $10^4$ conidia/ml and control.

From the results in Table 18, it was found that Biofly shortened the female adult longevity and the oviposition period T urticae

significantly; the means being 5.50, 1.00 and 7.00, 3.75 days for Biofly 3 x $10^4$ and 2.1 X $10^4$ conidia/ml respectively, compared with a mean of 11.25 & 8.75 days for the control.

Data also showed that the total numbers of deposited eggs per fem ale were highly affected with Biofly 3 x 104 and 2.1 x 104 conidia/ml, values were 4.00 and 20.00 eggs respectively, compared with 61.50 eggs for the control. The reduction percentages of fecundity were 93.49% and 67.48% for Biofly 3 x $10^4$ and 2.1 X $10^4$ conidia/ml respectively.

The present results are in agreement with the findings of AbdelSamad (1998) who found that the biological aspects of T urticae when treated one day old eggs with Biofly indicated that the average number of deposited eggs per female decrea sed to 95.9%. Moreover, it caused 90% mortality during immature stages.

Total or average numbers of deposited eggs per fernale were highly affected when suing the plant extracts against adult females of *T urticae* equal 5.5 and 8.00 eggs for black cumin and wormseed compared with 64.00 eggs for the control. The reduction percentages of fecundity were 91.41% and 87.50% for black cumin and wormseed respectively (Table 5).

It was evident that black cumin extract had stronger effect on adult of *T urticae* than extract of wormseed. These previous results were in agreement with that recorded by (Schauer and Schimutterer, 198 1, Barakat *et al.* 1985; Abo EI-Ghar *et al.*, 1986, El-Halawany *et al.* 1988; Dimetry *et al.* 1990; Amer *et al.*, 1989; Abo EI-Ghar *et al.*, 1990 and Darwish, 1990). Nassar *et al.*, (1995), showed that after treatment the adult female of *T urticae* with 500 and1000 ppm. of *Duranta* and *Lantana* extracts, the average of life cycle duration were 10.8, 10.6, 12.68 and 9.40 days, respectively. 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, compared with 15.57of the control. The total numbers 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. Iskander *et al.* (1996). Showed that the biological aspects for T arahicus were more affected by Shihh than Sorrel and and Kalakh extracts.

Table (7): The residual effect of biofly on the biological aspects of *T urticae*

| Developmental stages | Biofly | | | | Control Duration (in days) | LSD | |
|---|---|---|---|---|---|---|---|
| | Duration (in days) | Mortality % | Duration (in days) | Mortality % | | 5% | 1% |
| Incubation period | 4.75±0.29a | | 4.13±0.25b | | 4.00±0.41b | 0.51 | 0.72 |
| Active larva | 4.63±0.48a | 50.0 | 3.25±0.29b | 22.22 | 1.38±0.48c | 0.68 | 0.98 |
| Quiescent larva | 1.50±0.58 | 0.0 | 1.13±0.25 | 0.0 | 0.88±0.25 | - | - |
| Active protonymph | 4.13±0.63a | 25.0 | 3.0±0.41b | 13.89 | 1.50±0.58c | 0.87 | 1.26 |
| Quiescent protonymph | 1.38±0.48 | 0.0 | 1.13±0.25 | 0.0 | 0.94±0.31 | - | - |
| Active deutonymph | 2.50±0.58 | 8.33 | 2.0±0.41 | 2.79 | 1.75±0.29 | - | - |
| Quiescent deutonymph | 1.75±0.29a | 4.17 | 1.38±0.25ab | 2.79 | 1.13±0.25b | 0.42 | 0.61 |
| Total immature stages | 15.8±1.70a | 87.5 | 11.88±0.75b | 41.69 | 7.56±0.92c | 1.92 | 2.75 |
| Life cycle | 20.63±1.9a | | 16.0±0.58b | | 11.56±0.77c | 1.96 | 2.81 |
| Pre-oviposition | 2.00±0.41a | | 1.25±0.29b | | 1.13±0.25b | 0.52 | 0.74 |
| Generation period | 22.63±1.5a | | 17.25±0.65b | | 12.69±0.55c | 1.59 | 2.28 |
| oviposition period | 1.00±0.41c | | 3.75±0.29b | | 8.75±0.50a | 0.65 | 0.94 |
| Post-oviposition | 2.50±0.58a | | 2.00±0.41ab | | 1.38±0.48b | 0.79 | 1.13 |
| Longevity | 5.50±0.41c | | 7.00±0.41b | | 11.25±0.50a | 0.71 | 1.01 |
| Life span | 26.13±1.9a | | 23.0±0.41b | | 22.81±0.38a | 1.74 | 2.49 |
| Average number of deposited egg/female | 4.0±0.82c | | 20.0±0.82b | | 61.5±1.29a | 1.60 | 2.30 |
| Reduction % of fecundity | 93.49 | | 67.48 | | 0.0 | | |

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## الملخص العربي

التاثير السام للمبيد الميكروبى بيوفلاى وبعض المستخلصات النباتية على بعض الخصائص البيولوجية للاكاروس (تترانيكس اورتيكا)

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وجهت الدراسة الحالية لتقيم النشاط الابادى للمبيد الحيوى (البيوفلاى) وهو مستحضر من فطر *Beauvaria bassiana* واثنان من المستخلصات النباتية (بذور حبة البركة ، الشيح الخرسانى) ضد أفة العنكبوت الاحمر (تترانيكس اوريتكا) وكذلك تقيم التاثير المشترك للمبيد الاكاروسى الفينبروكسيمت فى مخلوط منه مع المستخلصات النباتية.

ويمكن تلخيص النتائج التى تحققت من هذه الدراسة فى النقاط التالية:-

١- المبيد الحيوى (بيوفلاى) كانت سمية عالية على الاناث البالغة حيث كانت $LC_{50}$ (٤٨٤٠٣ كونيديا/مل)

٢- مستخلص حبة البركة كان له سمية متوسطة حيث بلغت قيمة $LC_{50}$ (٨٨٧ جزء فى المليون)، بينما المستخلص النباتى (الشيح الخرسانى) كان اقل المركبات سمية على الاناث البالغة للعنكبوت الاحمر حيث بلغت قيمة $LC_{50}$ (١٨٦١,٣ جزء فى المليون).

٣- بدراسة التاثير المشترك لخلائط المبيد مع المستخلصات النباتية وجد ان المستخلصات النباتية ادت الى تنشيط فعل المبيد وكان التنشيط واضحا.

٤- كانت سمية المبيد الحيوى (بيوفلاى) عالية على بيض الاكاروس عمر ٧٢ ساعة وكانت قيمة $LC_{50}$ (٢٣٥٣١ كونيديا/مل) تم تلا فى التاثير الاسام للبيض عمر ٤٨ ساعة من وضعه حيث كانت قيمة $LC_{50}$ (٢٩٠٦١,٧١ كونيديا/مل) بينما كانت سمية المبيد الحيوى (بيوفلاى) منخفضة على البيض عمر ٢٤ ساعة من وضعه حيث كانت قيمة $LC_{50}$ (٣٤٩٥١ كونيديا/مل)

٥- مستخلص بذور حبة البركة والشيح الخرسانى كانت لهما سمية منخفضة على طور البيضة عمر يوم واحد وعمر يومين وعمر ثلاثة ايام حيث كانت قيمة $LC_{50}$ هى ٦٧٤٤, ٨٠٢٧, ٥٠٥١, ٦٠١١, ٣٢١٩, ٤٩٤٩,٩١ جزء فى المليون على الترتيب.

٦- البيوفلاى كان له تاثير ضعيف على خصوبة الاناث البالغة للاكاروس بينما مستخلص حبة البركة والشيح الخرسانى كان لهما تاثيرا عاليا فى خفض معدل وضع البيض.

٧- مستخلص حبة البركة كانم له تاثيرا متوسطا على معدل فقس البيض الموضوع بينما البيوفلاى ومستخلص الشيح الخرسانى كانلهما تاثير منخفض على معدل الفقس.

٨- المستخلص النباتى لحبة البركة كان له تثير متوسط على تعقيم الاناث يليه مستخلص الشيح الخرسانى ثم البيوفلاى كان اقلهم تاثيرا. وجد ان المستخلصات النباتية المستخدمة والبيوفلاى يطيل من فترة الاطوار الغير كاملة ودورة الحياة وفترة قبل وضع البيض وفترة الجيل . بينما تقل طول فترة طول الحياة للاناث البالغة وفترة وضع البيض وكان مستخلص حبة البركة اشد تاثيرا من مستخلص الشيح الخرسانى.