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Effectiveness of Some Microorganisms, Biogas manure and Boric acid on *Tetranychus urticae* Koch and *Typhlodromus negevi* Swirski and Amitai Under laboratory Conditions

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ABSTRACT

For optimal biological mite management, it is important to know if the tested compounds have adverse undesirable effects on the predatory mite. The toxicity effects of some saves compounds (Manure Tea (M.Tea), Manure neem Tea (M.N.Tea) and Boric acid) or some microorganisms (*Spirulina platensis, Anabaena azollae*, *Paenibacillus polymyxa*, *Pleurotus columbinus*) comparing with recommended compound 'Abamectin' were tested against the adult females of two-spotted spider mite, *Tetranychus urticae* Koch and adult females of its predatory mite, *T. negevi* Swirski and Amitai ,under laboratory conditions. The mortality percentages of *T. urticae* and toxicity of *T. negevi* Swirski and Amitai were recorded after 24, 48 and 72 hours from treatment, which were increased gradually with increasing the exposure time of the tested compounds. Abamectin gave highly percent reduction and toxicity against the adult females of *T.urticae* and its predatory mite, *T. negevi* so came in the first category.M.Tea, M.N.Tea and Boric acid came in the second category with moderate mortality percentages against *T. urticae* and toxicity of *T. negevi*. The microorganisms "*Paenibacillus polymyxa Anabaena azollae*, *Pleurotus columbinus* and *Spirulina platensis"* came in the last category. Generally, the adult female of *T. negevi* were more tolerant comparing with adult females of *T. urticae.* Statistical analysis show highly significant differences between the tested save compounds and recommended compound (Abamectin) against the adult females of *T. urticea* and *T. negevi*. Also, studied the gross fertility and fecundity of adult females of *T. urticae* and *T. negevi* after treated with differ compounds. It was found *T. urticae* and *T. negevi* females laid significantly fewer eggs on the treated than on untreated. Compounds caused significant cumulative oviposition-deterring and egg hatching of adult females of both *T. urticea* and *T. negevi* after 72 hours.

Key words: Abamectin, M.Tea, M.N.Tea, *Spirulina platensis, Anabaena azollae*, *Paenibacillus polymyxa, Pleurotus columbinus* and Boric acid, *T. urticae*, *T. negevi*, gross fertility and fecundity.

Introduction

The two-spotted spider mite, *Tetranychus urticae* Koch, is one of the most important mite pest species with a wide range of host plants and world distribution (Bolland *et al.,* 1998). *T. urticae* is an important one in a global distribution. Its phytophagous nature, high reproductive potential and short life cycle rapid resistance development too many acaricides often after a few applications. On the other hand, the great reliance on chemical pesticides had its serious drawbacks, manifested in resistance problems and high residue levels in food products (fruits, vegetables, grains and seeds) that may hinder its marketing (Gamal *et al.,* 2007). Phytoseiid mites are important biological control agents because of their well-known capacity to suppress pest mite populations, mainly tetranychids in diverse cropping system (Colfer *et al.,* 2004). Two mite predators of the family Phytoseiidae have been found in association with the two-spotted spider mite on cucumber and pepper fields in Egypt. *Neoseiulus barkeri* (Hughes) (Acari: Phytoseiidae) is an oligophagous predatory mite. *T. negevi* Swirski and Amitai (Acari: Phytoseiidae) is the agriculturally important predator of spider and eriophyid mites (Abou-Awad *et al.,* 1998 and Momen ,2010).

The effects of pesticides on *T. urticae* are being widely studied and its resistance to new products is frequently monitored (Castagnoli *et al.,* 2005). Failures of chemical control of *T. urticae* caused by resistance have been reported in several countries for compounds (Sato *et al*., 2004). The target now are going to reduce chemicals use trying to introduce predators and the entomopathogens (such as virus, bacteria and fungi) in integrated pest management (IPM) programs. These natural enemies are frequently responsible for maintaining spider mite populations below damaging levels (Ismail *et al.,* 2009). *Anabaena azallae* is a prokaryotic, filamentous nitrogen fixing cyanobacterium that is symbiotically associated with the small eukaryotic water from *Azolla pinnata*. The endosymbiont is contained within specialized leaf cavities of the fern under natural conditions. Cyanobacteria from the symbiosis have also been isolated and cultured independently of the fern (Abd El-Aal, 2013). Cyanobacteria that excrete a great number of substances have been reported to benefit

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plants by producing growth-promoting regulators (PGPR), vitamins, amino acids, polypeptides, antibacterial and antifungal substances that exert phytopathogenbio control, and polymers, especially exopolysaccharides, that improve soil structure and exoenzyme activity (Zaccaro *et al.*, 2001). *Spirulina platensis* produced a great variety of secondary metabolites Gervick *et al.* (2001), such as nitrogen-containing compounds, polyketides, lipopeptides, cyclic peptides and others. Efficacies of algal culture filtrates decreased with their dilution that may be due to the differences in toxic substances present in the culture filtrates. Abdel-baky, *et al.* (2009) indicated that *S. platensis* secretes organic substances or metabolic products such as phycobiline, phenols, terpenoids, steroids, polysaccharides and saponins. Low concentrations of saponin fractions increased mortality of *B. alexandrina* snails, miracidia, cercariae and adult.

The present work aims to study the toxicity effects of different save compounds on the two-spotted spider mite, *T. urticae* Koch and its predatory mite, *T. negevi* Swirski and Amitai also, studied the gross fertility and fecundity of these adult females after treated with different compounds under laboratory conditions.

Materials and Methods

Mites tested culture:

The original populations of *T. urticae* and its predator were obtained from stock cultures maintained in two separated greenhouses belonging to Plant Protection Research Institute at Dokki district (Giza Governorate) and reared under laboratory conditions at 25±2°C and 65±5% RH on kidney bean plants, *Phaseolus vulgaris* (L.).The predacious mite *T. negevi* reared in plastic boxes (26 x 15 x 10 cm), a cotton pad was put in the middle of each box, provided with water as a barrier to prevent predatory mite individuals from escaping in addition to a tangle foot strip at the box edges. Highly infested bean leaves with *T. urticae* were provided as food sources to predacious mite in the laboratory. Individuals of the predator mite, *T. negevi* were obtained from its mass rearing on spider mites *T. urticae* on bean plants in a greenhouse 60×9 m^2 about 540 m^2 (El-Halawany *et al.,* 2000 and Heikal and Ibrahim 2002).

Tested compounds :

The compounds and microorganisms used in the present experiments were:

Abamectin 1.8% EC (Vertemic) with concentration (40 cm^3/100 LW): A commercial product used in these trails in which the active ingredients formulated by International, Egypt Company: 5-*O*-demethylavermectin A_{1a} (i) mixture with 5-*O*-demethyl-25-de (1-methylpropyl)-25-(1-methylethyl) avermectin A_{1a} (ii).

- Bio organic liquid tea manure (M. Tea) with concentration (10%).
- Bio organic liquid tea manure (M. Tea) + Neem with concentration (10%).
- *Spirulina platensis* 60%.
- *Anabaena azollae* 60%.
- *Paenibacillus polymyxa* 80%.
- *Pleurotus columbinus* 60%.
- Boric acid with concentration (1.6 mg/L.).

Inocula used:

Paenibacillus polymyxa was kindly provided by Biofertilizers Production Unit, Soils, Water and Environ. Res. Inst., Agric. Res. Center (ARC), Giza, Egypt.

Preparation of bacteria inocula:

Paenibacillus polymyxa was grown on nutrient broth (Difico Manual, 1984) incubated for 24 hr at 30ºC to obtain population of $5X10^9$cfu/ml culture. Number of cells/ml in used culture: concentration of *Paenibacillus polymyxa*) as 10^{10} /ml in mother culture "$8x10^9$/ml in 80%".

Preparation of Bio Organic Liquid Manures (Bio gas manure tea):

It is prepared using animal farm dung as base material. The basic principle is to allow a mixture of animal residues in textile Bag and immersed in water with rate of 1: 2 (w/v) to ferment over a certain periods in a plastic water container and then closed and stirred every 3 days for 28 days. The biomass in the textile bag will get fully fermented passes through three biochemical stages as described previously (Parawira *et al.,* 2008; Demirel and Scherer, 2008 and Ntaikou *et al.,* 2010).

During the fermentation process samples of the fermented manure at the start (three days) and after 7 days were analysis and recorded. The liquid manure would ready in 10 : 20 day for use which sieved and diluted with water before spraying. The standard dilution is one part liquid manure in ten parts water and sprayed on the foliage (Thimmaiah, 2010). Spraying should be done in the evening or cool sunshine hours.

Algal and fungal source and growth conditions:

*Anabaena azolla*e and *Spirulina platensis* were obtained from the Microbiology Department, Soils Water and Environment Res. Inst., ARC, Giza. *Ananbaena azolla* strain which isolated from *Azolla pinnata* (Abd El-Aal, 2013) was grown on BG11 medium (Rippka *et al.,* 1979) while *Spirulina platensis* was cultured on Zarrouk medium. Cultures were incubated in a growth chamber under continuous illumination (2000 lux) and temperature of 25 ˚C ± 2 ˚C for *Anabaena azollae* while the mesophilic alga *Spirulina platensis* (35 ˚C ± 2 ˚C), white rot fungi (*Pleurotus columbinus*) was obtained from Unit of Mushroom Production , Faculty of Agriculture, Ain Shams University and was grown on Potato Dextrose Agar medium, PDA (Martin, 1950).

Method of application:

The effect of different compounds (Abamectin, M.Tea, M.N.Tea, and Boric acid) and some microorganisms *(Spirulina platensis, Anabaena azollae*, *Paenibacillus polymyxa and Pleurotus columbinus*) were evaluated under laboratory conditions. All treatments of the toxic effect for the tested compounds on the two-spotted spider mite, *T.urticae* and its predatory mite, *T.negevi*. All compounds were occurred by leaf disc dip technique according to Siegler (1947). Diluted compounds of these compounds were prepared by distilled water to compare between themes. Then, discs (2 cm diam.) of kidney bean leaves were dipped in each concentration and others in distilled water (control) for, 5 seconds and left to dry.

Adult females of T. urticae mortality:

Ten adult females of the two spotted spider mites were transferred to the lower surface to each disc of kidney bean leaf discs (10 adult female/leaf disc) treated previously.

Adult females of T. negevi toxicity:

Ten adult females of predacious mite *T. negevi* were transferred to each kidney bean leaf disc (5 cm in diameter) treated previously, 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. A number of the preys, *T. urticae* were added as a food for *T. negevi*. Each treatment was replicated four times. Mortality was recorded after 24, 48 and 72hours post treatments.

Evaluated as effects on its fecundity and fertility:

The isolated female survivors were placed individually on untreated leaf discs. Over the following 10 days, the females were transferred every 48h to new discs and the number of females alive *(*Fs*)* and eggs laid were simultaneously monitored. Hatch rate was defined as the percentage of eggs hatched from a total number of eggs laid. Gross fecundity (the number of eggs laid per female) and gross fertility (the number of eggs hatched per female) were calculated according to Carey (1993).

Statistical analysis:

The natural mortality was corrected according to Abbott's formula (Abbott, 1925).The data were subjected to analysis of variance (ANOVA) and the means were compared by L.S.D. test at 0.05 level, using SAS programme (SAS Institute, 1988).

Results and Discussion

Toxicity of different saves compounds on T.urticae:

Percent mortality:

According to the obtained data (Table 1), different mortality percentages were recorded, when adult females of *T. urticae* were treated with different saves compounds (M.Tea, M.N.Tea, *Spirulina platensis, Anabaena azollae*, *Paenibacillus polymyxa, Pleurotus columbinus* and Boric acid) comparing with recommended compound 'Abamectin'. The recommended compound'Abamectin' gave 89.7, 100 and 100% after 24, 48 and 72 hours, respectively with average mortality number 96.6% and came in the first category.

Abamectin has been shown to cause significant mortality and reduction in the mobility and fecundity of *T. urticae* (Zhang & Sanderson, 1990). Also, Ismail *et al.* (2009) found cyhalothrin and abamectin have a special effect on *T. urticae* and considered the best compounds that have a special importance in integrated mite management. Thus it could be recommended in IPM programs.

The mortality percentages were 69.1, 89.7 and 100% after 24, 48 and 72 hours, respectively with average mortality number 86.3% when treated with M.Tea, while the mortality percentages reached to 82.1, 85.7 and 89.2% after 24, 48 and 72 hours, respectively with average mortality number 85.7% when treated with M.N.Tea, the two compounds came in the second category. Whereas, Boric acid gave62.2, 74.9 and 88.9% mortality percentages after 24, 48 and 72 hours, respectively with average mortality number 75.3%.

It was found successive foliar sprays of plant nutrients and foliar fertilizers in aqueous solutions of extreme pH values, without employing toxic organic compounds. Repeatedly applied sprays causing the pH changes provide an effective, cheap, and environmentally friendly way of fighting plant pests. The pH on the leaves after spraying gradually returns from the extreme value toward neutrality in few hours (Dimenstein and Nes, 2013).

The other compounds came in the last category, *Paenibacillus polymyxa* gave 58.8, 64.2 and 70.4% mortality percentages after 24, 48 and 72 hours, respectively with average mortality number 64.5%, *Anabaena azollae* gave 41.6, 53.4 and 74.1% mortality percentages after 24, 48 and 72 hours, respectively with average mortality number 56.4%, *Pleurotus columbinus* gave 31.3, 42.7 and 59.3% mortality percentages after 24, 48 and 72 hours, respectively with average mortality number 44.4%, finally, *Spirulina platensis* gave 27.8, 35.5 and 40.7% mortality percentages after 24, 48 and 72 hours, respectively with average mortality number 34.7%.

*Bacillus thuringiensis*is widely used in agriculture for the control of many insect pathogens. It is characterized by the production of crystal proteins (d-endotoxins) with a specific activity against certain insect species (Beegle and Yamamoto 1992), mites and protozoa (Feitelson *et al.*, 1992).

Fungi invade the body of flies, penetrate and develop to kill the host. After death, spores are released to infect other flies. Used the fungus *Erynia montana* from entomophthorales as a potential biological agent of *L. mali*to show mortality of 34-95% when larvae were exposed and 44-78% when adults were exposed to conidia in lab trials (Betterley, 1989).

Statistical analysis in (Table 1) shows significant differences between the tested save compounds and recommended compound (abamactin) on the adult females of *T. urticea* (F = 197.45, L.S.D. 0.05 = 4.655).

The obtained results are agree with those obtained by El-Khateeb *et al.* (2004) who evaluated the effectiveness of some new safe chemicals against the moving stages of the two-spotted spider mite, *T.urticae*. They found that (Dipel 2X (*Bacillus thuringiensis*) at 50 g, S -1283 at 150 ml) and Three Targets (plant oils, fatty acids and essential micronutrients) at 500 ml/100 liters of water gave percent reduction (74.98 and 75.82%), and 73.70, 74.86 and 74.53%, respectively. Three Targets at the lowest rate of 250 ml/100 liters water was the least effective material with 67.9, 68.03 and 68.80% reduction.

Table 1: Mortality percentages and average numbers of different save compounds on the two-spotted spider mite, *Tetranychus urticae* Koch and its predatory mite *T. negevi* Swirski and Amitai under laboratory

Material	Stage	Periods after treatment						Average	
		24 h		48 h		72 h			
		Mean No.	%Mortality	Mean No.	%Mortality	Mean No.	%Mortality	Mean No.	%Mortality
Vertimec	*T. urticae*	0.7	89.7	0.0	100	0.0	100	0.2	96.6
	T. negevi	1.4	86.0	1.9	81.3	2.1	78.7	1.8	82.0
M.Tea	*T. urticae*	4.0	69.1	1.0	89.7	0.0	100	1.7	86.3
	T. negevi	4.9	51.0	3.0	70.0	2.0	80.0	3.3	67.0
M.N.Tea	*T. urticae*	1.7	82.1	1.3	85.7	1.0	89.2	1.3	85.7
	T. negevi	2.5	75.3	3.9	60.0	2.5	72.8	3.0	69.4
Spirulina platensis	*T. urticae*	7.0	27.8	6.0	35.5	5.3	40.7	6.1	34.7
	T. negevi	7.3	26.7	6.3	37.0	5.8	42.0	6.5	35.2
Anabaena azollae	*T. urticae*	5.7	41.6	4.3	53.4	2.3	74.1	4.1	56.4
	T. negevi	7.3	26.7	6.3	36.7	5.0	46.2	6.2	36.5
Paenibacillus polymyxa	*T. urticae*	4.3	58.8	3.3	64.2	2.7	70.4	3.4	64.5
	T. negevi	5.0	50.0	3.6	64.0	3.0	67.7	3.9	60.6
Pleurotus columbinus	*T. urticae*	6.7	31.3	5.3	42.7	3.7	59.3	5.2	44.4
	T. negevi	7.0	30.0	5.7	43.0	4.3	53.8	5.7	42.3
Boric. A.	*T. urticae*	3.7	62.2	2.3	74.9	1.0	88.9	2.3	75.3
	T. negevi	6.7	33.3	3.3	66.7	2.0	78.5	4.0	59.5
Control	*T. urticae*	9.7	-	9.3	-	9.0	-	9.3	-
	T. negevi	10	-	10	-	9.3	-	9.8	-
F value	*T. urticae*	-	-	-	-	-	-	-	197.45***
LSD $_{0.05}$	*T. urticae*	-	-	-	-	-	-	-	4.655
F value	*T. negevi*	-	-	-	-	-	-	-	138.52***
LSD $_{0.05}$	*T. negevi*	-	-	-	-	-	-	-	1.8318

Fertility and Fecundity:

After treated with differ M.Tea, M.N.Tea, *Spirulina platensis, Anabaena azollae*, *Paenibacillus polymyxa* , *Pleurotus columbinus* and Boric acid comparing with recommended compound 'Abamectin', these compounds caused deferent percentages of mortalities; after that the remains adult females were isolated and placed individually on untreated leaf discs over the following 10 days to determine fertility and fecundity.

T. urticae females laid significantly fewer eggs on the treated than on untreated after treatments with previous compounds. These compounds caused low egg laying on treated surface comparing with control. All concentrations caused significant cumulative oviposition-deterring effects after 72 hours.

Laboratory observations reported that, no adult females of *T. urticae* deposited eggs due to the effectiveness of Abamectin and M.Tea.The gross fecundity (the number of eggs laid per female)of the adult females of *T. urticae* reached to 38.7, 24.2, 19.8, 18.9, 7.9 and 7.4 eggs when treated with *Spirulina platensis, Pleurotus columbinus, Paenibacillus polymyxa, Anabaena azollae*, M.N.Tea and Boric acid, respectively comparing with control which the fecundity reached to 69.7 eggs.

Nauen *et al.* (2005) found that the fecundity of two-spotted spider mite females directly treated onbean leaves was strongly reduced 48h after treatment with spiromesifen concentrations ranging between 0.064 and 40 mg/l: the lowest concentration halved the number of eggs laid, while the highest brought fecundityalmost to null. The treated females that laid eggs in the first four days had lowered hatch rates of sublethal activity of spirodiclofen (Van Pottelberge*et al.,* 2009).

Also, laboratory study's indicated that, no egg hatching of adult females of *T. urticae* due to the effectiveness of Abamectin and M.Tea. The gross fertility (the number of eggs hatched per female)of the adult females of *T. urticae* reached to 30.4, 19.9, 16.7, 15.7,5.9 and 5.1 eggs when treated with *Spirulina platensis, Pleurotus columbinus, Paenibacillus polymyxa* , *Anabaena azollae*, M.N.Tea and Boric acid, respectively.

Toxicity of different saves compounds on T. negevi :

- Percent mortality:

According to the obtained data (Table 1), different toxicity percentages were recorded, when adult females of *T. negevi* were treated with different saves compounds (M.Tea, M.N.Tea, *Spirulina platensis, Anabaena azollae*, *Paenibacillus polymyxa, Pleurotus columbinus* and Boric acid) comparing with recommended compound 'Abamectin'. The recommended compound'Abamectin' gave 86.0, 81.3 and 78.7% after 24, 48 and 72 hours, respectively with average toxicity number 82.0% and came in the first category.

The toxicity percentages were 75.3, 60.0and 72.8% after 24, 48 and 72 hours, respectively with average mortality number 69.4% when treated with M.N.Tea, while the toxicity percentages reached to 51.0, 70.0 and 80.0% after 24, 48 and 72 hours, respectively with average mortality number 67.0% when treated with M.Tea, the two compounds came in the second category on adult females of *T. negevi* .

Saenz *et al.* (2007) showed that, fenpyroximate was considered slightly persistent for *Galendromus occidentalis* and *P. persimilis*, while abamectin was also slightly persistent for *P. persimilis* only.

Whereas, *Paenibacillus polymyxa* gave 50.0, 80.0 and 88.2%toxicitypercentages after 24, 48 and 72 hours, respectively with average mortality number 73.1%adult females of *T. negevi.*

The other compounds came in the last category, Boric acid gave 33.3, 66.7 and 78.5% toxicity percentages after 24, 48 and 72 hours, respectively with average toxicity number 59.5%, *Anabaena azollae* gave 26.7, 36.7 and 46.2% toxicity percentages after 24, 48 and 72 hours, respectively with average toxicity number 36.5%, *Pleurotus columbinus* gave 30.0, 43.0and 53.8% toxicity percentages after 24, 48 and 72 hours, respectively with average toxicity number 42.3%, finally, *Spirulina platensis* gave 26.7, 37.0 and 42.0% toxicity percentages after 24, 48 and 72 hours, respectively with average toxicity number 35.2%adult females of *T. negevi.*

Statistical analysis in (Table 1) shows significant differences between the tested save compounds and recommended compound (Vertimic) on the adult females of *T. negevi* (F = 138.52, L.S.D. 0.05 = 1.8318).

Kim *et al.* (2005) showed that application of abamectin was highly toxic to *Amblyseius cucumeris* (Oudemans) adult females causing 92% mortality at 168 h after treatment and the number of eggs deposited by adult female predators decreased to 5.4 compared to 131.6 in the control.

Multiple species of *Paenibacillus polymyxa* can promote plant growth and health in a variety of ways, some species suppresses insect pests by producing antibiotic metabolites, while others stimulate plant host defenses prior to pathogen infection (Govindasamy *et al.*, 2008).

Fertility and Fecundity:

After treated with differ M.Tea, M.N.Tea, *Spirulina platensis, Anabaena azollae*, *Paenibacillus polymyxa, Pleurotus columbinus* and Boric acid comparing with recommended compound 'Abamectin', these compounds caused deferent percentages of toxicity of *T. negevi* , after that the remains adult females were isolated and placed individually on untreated leaf discs over the following 10 days to determine fertility and fecundity (Table 2).

T. negevi female aid significantly fewer eggs on the treated than on untreated after treatments with previous compounds. These compounds caused low egg laying on treated surface comparing with control. All concentrations caused significant cumulative oviposition-deterring effects after 72 hours.

Laboratory observations reported that, no adult females of *T. negevi* deposited eggs due to the effectiveness of Abamectin and M.Tea. The gross fecundity (the number of eggs laid per female) of the adult females of *T. negevi* reached to 31.8, 22.3, 12.5, 14.2, 7.8 and 5.1 eggs when treated with *Anabaena azollae, Spirulina platensis,* Boric acid, *Pleurotus columbinus, Paenibacillus polymyxa* and M.N.Tea, respectively. Comparing with control which the fecundity reached to 58.2 eggs. Kavousiand Talebi (2003) showed that heptenophosat the recommended concentration increased the fecundity of *P. persimilis*. Also, James (1997) reported increased fecundity in *Amblyseius victoriensis* by imidacloprid. The fecundity-enhancing property of hexythiazox can make *P. persimilis* an excellent choice as a biological control agent in greenhouses and other horticulture crops.

Table 2: Fecundity of adult females of the two-spotted spider mite, *Tetranychus urticae* Koch and its predatory mite, *T. negevi* Swirski and Amitai after treated with different save compounds and microorganisms under laboratory conditions.

Material	Stage	Gross fecundity ±SE	Gross fertility ±SE
Vertimec	*T. urticae*	0.0±0.0	0.0±0.0
	T. negevi	0.0±0.0	0.0±0.0
M.Tea	*T. urticae*	0.0±0.0	0.0±0.0
	T. negevi	7.8±0.24	5.1±0.06
M.N.Tea	*T. urticae*	7.4±0.46	5.7±0.40
	T. negevi	0.0±0.0	0.0±0.0
Spirulina platensis	*T. urticae*	38.7±0.40	30.4±0.23
	T. negevi	28.4±0.23	22.3±0.17
Anabaena azollae	*T. urticae*	18.9±0.52	15.7±0.40
	T. negevi	36.1±0.06	31.8±0.46
Paenibacillus polymyxa	*T. urticae*	19.8±0.12	16.7±0.40
	T. negevi	9.8±0.15	7.8±0.41
Pleurotus columbinus	*T. urticae*	24.2±0.69	19.9±0.52
	T. negevi	16.7±0.40	14.2±0.12
Boric. A.	*T. urticae*	7.4±0.23	5.1±0.06
	T. negevi	16.9±0.06	12.5±0.29
Control	*T. urticae*	69.8±0.46	69.7±0.40
	T. negevi	58.4±0.23	58.2±0.12

Gross fecundity (the number of eggs laid per female
Gross fertility (the number of eggs hatched per female)

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