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Efficacy of predatory phytoseiid mites and biopesticides for controlling *Tetranychus urticae* (Acari: Tetranychidae) infesting *Phaseolus vulgaris*

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Abstract:

The kidney bean *Phaseolus vulgaris* L. is one of the most important economic vegetable crops cultivated in Egypt and many countries of the world as a main source of protein. This study dealt with the efficiency of two predatory phytoseiid mites, *Phytoseiulus persimilis* Athias-Henriot, *Typhlodromips swirskii* (Athias-Henriot) (Acari: Phytoseiidae); fungal pathogen *Beauveria bassiana* (Balsamo) and the biopesticide Abamectin 1.8 EC. + mineral oil Cable against the eggs, immature and adults of *Tetranychus urticae* Koch (Acari: Tetranychidae) infesting two cultivars of both *P. vulgaris* (Hama and Bolista) under net house conditions at Beheira Governorate during 2016 season. Highly reduction percentage was achieved by the predatory mite *P. persimilis,* the biopesticide Abamectin 1.8 EC. + mineral oil Cable and fungal pathogen *B.bassiana* , followed by the other predatory mite *T. swirskii* when compared with the untreated plants. Also, the results indicated that accarine pests are only a part of biological complex of which predacious mites, particularly phytoseiid group, could be of value in checking infestations.

Introduction

The kidney bean *Phaseolus vulgaris* L. is the popularity of the crop originates from the fact that it is relatively easy to produce, lavorful and versatile and a good source of nutrition. According to the report of economic affairs sector, Department of Agricultural Economics, Ministry of Agriculture (2007), the cultivated area was about 73022 feddens with production 330257 tones for green beans and 49639 feddens with production 60794 tones for dry beans in many Governorates for exportation and local consumption. The kidney bean plants are infested by many pests which cause a great damage in both quantity and quality. The spider mite, *Tetranychus urticae* Koch (Acari:

Tetranychidae) and some piercing sucking pests' viz. *Thrips tabaci* (Lindeman) (Thysanoptera: Thripidae), *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) and the leaf miner *Liriomyza* spp. (Diptera: Agromyzidae) are the majority pests infested kidney bean cultivars (El-Saiedy *et al*., 2012). These pests cause great damage to the plant feeds on the plant sap causing serious damage varying according to the degree of infestations (Habashy, 2000; Iskandar *et al.*, 2002; Mahgoub, 2006; Abd El Gawwad, 2008 and El-Saiedy *et al.,* 2011).

The aforementioned pests have been rapidly developing resistance to a series of pestisids and have recently assumed a new aspect of multiple resistances (Pree *et al.,* 2002). The extensive use of pesticides can promote negative impacts on human health and on ecosystems, besides reducing the number of species and density of natural enemies, developing resistance and increasing production costs. To reduce these problems, it is necessary to reduce the chemical control by replacement of such pesticides by using biocides with releasing predatory mites. Biological control means the control of pests with predators, parasitoids and pathogens. Successful biocontrol can be obtained in many cases (Messelink *et al.,* 2006 and 2008). *Phytoseiulus persimilis* Athias-Henriot and *Typhlodromips swirskii* (Athias-Henriot) (Acari: Phytoseiidae) are a polyphagous predators capable of preying on a number of spider mites (Momen and El-Saway, 1993; Bolckmans *et al*., 2005; Van Houten *et al.,* 2007; Abdallah *et al*., 2012; El-Kholy and El-Saiedy, 2009; Calvo *et al*., 2011; Elmoghazy *et al*., 2011; Dimetry *et al*., 2012; Abdallah *et al*., 2014 and Abou-Awad *et al*., 2017).

The present study aims to evaluate the efficiency of the predatory mits *P. persimilis* and *T. swirskii* as well as the fungus, *Beauveria bassiana* and the biocide Abamectin+ mineral oil Cable on two varieties (Hama and Bolista) of kidney bean plants under controlled net house conditions against the egg, immature stages and adults of *T. urticae* during 2016 plantation season at Behaira Governorate.

Mateials and methods

1. Experimental design:

To study the effect of different types of biocontrol agents, four treatments were carried out on kidney bean plants in Beheira Governorate , using the two predatory mites, *P. persimilis* and *T. swirskii*, the fungus, *B. bassiana* + mineral oil Cable oil, and the biocide Abamectin 1.8EC + mineral oil Cable oil. The aforementioned experimental treatments were compared with untreated plants (control).

Kidney beans (*P. vulgaris*) Hama and Bolista cultivars seeds were planted in the net house on 16th October, 2016. The net house was divided into ten equal plots. Each plot was divided into three separated replicates (each one represented by five rows about 25 m^{-} long). The trail plots were arranged in randomized complete block design for each treatment. All the experimental plots received the standard cultivation practices of that area including organic and mineral fertilization, drip irrigation and mechanical control was applied to remove weeds. Pesticides were avoided entirely.

2. The efficiency of predators mites and fungal pathogen to control *Tetranychus urticae*:

2.1. *Phytossulus persimilis* and *Typhlodrompis swirskii* predators:

2.1.1. Prey culture:

T. urticae, was reared on kidney been plants, *P. vulgaris* planted in plastic pots at the rate of 20 seeds/pot

and put in isolated greenhouse of 2m width, 2m length and 2.5m height covered with a fine mesh (anti-virus) plastic net (500 holes/inch). When bean seedling were 7-10 days old inoculated with leaves infested with *T. urticae* collected from cucumber plants presented from Giza Governorate and when individuals of the *T. urticae* moved to the new foliage of bean plant the dried leaves of cucumber were removed 2 days later. Pots were planted and infested every 3-4 days to provide continuous spider mite production.

2.1.2. Predators rearing:

The phytoseiid predators, *P. persimilis* and *T. swirskii* were reared using methods modified by (McMurtry and Seriven, 1965), large plastic box 25x25x10 cm were used, cotton pad were put in the middle of each box on 2cm thick piece of sponge, leaving a space provided with water as a barrier to prevent predatory mites from escaping. Excised bean leaves highly infested with *T. urticae* were provided every other day as food source. The plastic boxes were kept in an incubator at 25 ±1ºC and 70±5% R.H., water was added daily to maintain suitable moisture for the predators rearing.

2.1.3. Mass rearing of the predatory mites:

Mass rearing was conducted in two separated small greenhouses for each predator with dimension 5m width, 7m length and 2.5m height. Bean plants were cultivated as host plants and infested with two spotted spider mite *T. urticae* as a prey when the population of spider mite increased to suitable population. Then, the predator mites were transferred to each infested bean plants. The various subjects were carried out at average temperature 25-30 ºC and relative humidity 65 ± 10%. When the population of the predator mites increased gradually where the rate of population investigated daily and supported with prey until the populations of the predators become suitable for collecting.

2.1.4. Releasing of the predatory mites:

P. persimilis was released with level 1:10 predators: prey one time, while *T. swirskii* was released with level 1:7 predators: prey two times thought the experimental time (15th of February and 22nd of March). The required population numbers of predatory mite individuals were calculated according to the following formula (EI-Saiedy, 2003):

$$\text{Released number} = \frac{\text{Total no. of } \textbf{\textit{Tetranychus urticae}} \text{ in treatment X predator level}}{\text{Prey level}}$$

The infestation bean leaves with the predatory mite were transferred in an ice-box to the greenhouse and then distributed on infested kidney bean plants except the treatment which kept free from any controlling agents.

2.2. *Beauveria bassiana* spraying:

Also, *B. bassiana* was sprayed three times through the experiment The commercial pathogen compound biofly, *B. bassiana* was used at the rate of 75cc/100 liter of well water (free chlorine). The fungal pathogen and Abamectin were sprayed thrice on 15th of February, 22nd of March and 27th of April 2016).

3. The efficiency of biopesticde to control *Tetranychus urticae*:

Abamectin 1.8 EC.: Formulation Type: Emulsifiable concentrate derived from a soil actinomycete (*Streptomyces avermitilis*) and has strong insecticidal, nematicidal and acaricidal activity (Wang and Wu, 2007) was also used at the rate of 100cc + 250cc mineral oil Cable 2/100 liter of water. The fungal pathogen and Abamectin were sprayed thrice on 15th of February, 22nd of March and 27th of April 2016).

4. **Sampling Procedure:**

For estimating the effect of four treatments of two cultivars of kidney bean plants, samples of 30 leaves from the three replicates of each treatment were randomly picked up just before release were mite population were counted as pre-count. This procedure was repeated as post-counts. Samples were also obtained from adjacent non-released treatment (control) at weekly intervals from the time of application until the end of this experiment. Each sample was kept in a tightly closed paper bag and transferred to the laboratory for inspection using a stereomicroscope. Number of eggs, immatures (larvae and nymphs) and adult stages of *T. urticae* were counted and recorded for each treatment.

5. Statistical analysis:

The percentages of reduction in the number of the previously mentioned pests were calculated by using the reduction equation of Henderson and Tilton (1955). The statistical analyses (ANOVA) of the obtained data were performed by using SAS program (SAS Institute, 2003) which runs under WIN. Also the difference between means was conducted by using Duncan's (Duncan, 1955) multiple range tests in this program.

Results and discussion

The reducing effect of the two phytoseiid predators *P. persimilis* and *T. swirskii*, fungal pathogen *B. bassiana* and biocide Abamectin+ mineral oil Cable against *T. urticae* eggs, immature and adults infested two beans cultivars (Hama and Bolista) were evaluated during 2016 season.

1. Egg stage:

Data organized in Table (1) indicated that the examined sample of kidney bean leaves collected just before applying the four controlling agents (*P. persimilis* and *T. swirskii*, *B. bassiana* and Abamectin+ mineral oil Cable) (pre-count) were harbored with averages 9.80, 9.70, 9.75 and 9.80 eggs/leaf of *T. urticae* , respectively and 9.90 for untreated Bolista leaves while Hama leaves had 21.5, 21.4, 21.38, 21.62 and 21.35 for the previously mentioned treatments, respectively .

After one week, the obtained results indicated reductions in number of the target pest in applied four treatments on both cultivars, as *T. urticae* eggs averaged 6.3, 8.1, 4.40 and 0.10 eggs/leaf, on the examined Bolista plants and 16.35, 23.5, 3.56 and 0.9 on Hama cultivar of the *P. prisimilis*, *T. swirskii*, *B. bassiana* and Abamectin + mineral oil Cable treatments, respectively. While it averaged 13.5 and 24.35 eggs/leaf for the control treatment on the two respectively arranged cultivars. The corresponding reduction percent in mite counts after one week from application were 68.07, 35.47, 80.52 and 88.27%, on Bolista and 49.26, 18.57, 85.14 and 95.62 % on Hama variety, respectively.

By increasing the time after application, the releasing of *P. persimilis* showed reduction of eggs to reach zero egg/leaf with general seasonal average 2.67 and 11.42 eggs/inch^2, while for the second treatment it reached after ten weeks of release with seasonal average 11.70 and 44.68 eggs/inch^2 on both Bolista and hama, respectively. Also, in the other two treatments (*B. bassiana* and Abamectin + mineral oil Cable) the infestations with the mite eggs were fluctuated until the end of the season during the 17 week of evaluation with allover mean 18.64 and 4.61 eggs/ inch^2 on Bolista and 9.72 and 6.08 for Hama , respectively.

Statistical analysis of the reduction percentages (Table, 2) showed that, controlling of *T. urticae* eggs on Bolista and Hama bean plants with the *P. persimilis,* Abamectin

+mineral oil Cable and *B. bassiana* led to lower infestation rate with reduction percentages (88.98, 89.51 and 84.04% and 80.07, 94.25 and 89.13%, respectively), followed significantly by the application of *T. swriskii* with percentages 66.89 and 51.52% of both the two planted cultivars. (L.S.D = 10.78 and 11.31).

These data proved that releasing of *P. persimilis* at level 1:10, *B. bassiana* and Abamectin +mineral oil Cable oil gave the best results of controlling of *T. urticae* eggs infesting the tested plants in net house, as statistically, this treatment occupied the lowest degree of infestation.

Table (1): Mean numbers of *Tetranychus urticae* eggs / leaf on two kidney bean varitites under net house conditions affected by releasing two predatory mites, *Beauveria bassiana* and the biocide abamactin +mineral oil cable spraying at Beheira Governorate during 2016 season.

Varitites	Bolista					Hama				
Inspections date / Treatment	*P.prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable	control	*P.prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable	control
Feb.,15th *	9.90	9.70	9.75	9.80	9.80	21.50	21.40	21.38	21.62	21.35
22nd	6.30	8.10	4.40	0.10	13.50	16.35	23.50	3.56	0.90	24.35
28th	5.20	10.40	6.40	1.90	16.20	15.40	24.60	4.48	1.34	30.14
Mar.,7th	5.30	11.60	9.40	4.20	18.10	17.20	30.60	8.43	3.11	37.11
15th	4.80	10.40	12.60	8.20	20.30	16.35	31.50	12.40	7.90	44.90
22nd	4.90	12.3**	7.10**	0.30**	24.80	17.23	32.00	17.30**	11.34**	58.70
29th	3.30	9.90	9.40	1.40	29.10	16.40	33.20	2.95	1.11	70.50
Apr.,6rth	2.40	13.10	12.20	3.20	33.60	18.32	36.80	5.33	4.33	83.40
13th	1.20	11.60	14.60	5.20	37.11	16.30	34.90	7.60	6.20	95.30
20th	1.00	12.50	17.70	7.80	40.90	14.90	43.11	10.33	7.18	115.50
27th	0.80	13.90	23.50**	11.10**	50.40	13.80	48.10	16.80**	11.35**	142.60
May,4th	0.00	14.80	20.00	0.30	76.30	7.40	50.11	3.00	0.84	173.00
11th	0.00	11.60	26.70	0.20	98.00	2.18	52.00	5.70	1.35	194.70
18th	0.00	9.20	31.00	3.50	110.00	0.85	78.30	8.80	3.14	204.50
25th	0.00	11.80	33.90	4.20	115.90	0.00	70.33	1.90	5.42	210.70
Jun, 2nd	0.00	14.60	37.60	7.10	123.60	0.00	74.00	14.70	7.18	217.50
10th	0.00	13.20	40.60	9.90	118.90	0.00	75.14	20.60	9.11	234.60
Average ± SE	2.67± 0.72 C	11.70± 0.46 BC	18.64±2.81 B	4.61±0.91 C	55.12±10.18 A	11.42±1.87 C	44.68±4.65 B	9.72±1.55 C	6.08±1.30 C	115.23±18.61 A
F =	20..18					28.41				
L.S.D. =	13.4					24.39				

Values singed by the same letter of the same varity are not significantly different at alpha = 0.05 % level.
**Re-spray

Table (2): Reduction persentages of *Tetranychus urticae* eggs / leaf on two kidney bean varitites under net hous conditions affected by releasing two predatory mites, *Beauveria bassiana*, and the biocide abamactin +mineral oil cable spraying at Beheira Governorate during 2016 season.

Varitites	*Bolista*				*Hama*			
Inspections date / Treatment	*P.prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable	*P.prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable
Feb.,22nd	53.52	39.02	89.94	98.96	33.32	3.72	85.38	96.36
28th	68.07	35.47	80.52	88.27	49.26	18.57	85.14	95.62
Mar.,7th	70.85	35.22	63.61	76.90	53.97	17.74	77.28	91.74
15th	76.35	48.19	49.84	59.76	63.84	30.01	72.38	82.65
22nd	80.32	49.84**	94.93 **	98.99 **	70.85	45.61	70.53 **	80.95 **
29th	88.57	65.78	89.80	95.25	76.90	53.02	95.82	98.45
Apr.,6rh	93.03	60.57	84.73	90.56	78.19	55.98	93.61	94.88
13th	96.83	68.39	80.53	85.92	83.02	63.46	92.03	93.58
20th	97.69	69.02	75.40	81.03	87.19	62.76	91.06	93.87
27th	98.42	72.11	70.85**	77.89**	90.39	66.35	88.22 **	92.15 **
May,4th	100.00	80.38	98.15	99.65	95.75	71.10	98.27	99.52
11th	100.00	88.07	96.78	99.82	98.89	73.35	97.07	99.32
18th	100.00	91.56	95.52	96.86	99.59	61.80	95.70	98.49
25th	100.00	89.70	94.05	96.40	100.00	66.70	99.10	97.46
Jun, 2nd	100.00	88.05	92.57	94.23	100.00	66.06	93.24	96.74
10th	100.00	88.81	87.48	91.68	100.00	68.05	91.22	96.17
Average	88.98 A	66.89 B	84.04 A	89.51 A	80.07 B	51.52 C	89.13 AB	94.25 A
F =	7.74				22.76			
L.S.D. = 10.28	10.78				11.31			

Values singed by the same letter of the same varity are not significantly different at alpha = 0.05 % level.
**Re-spray

2. Immature stages:

As previously indicated in case of *T. urticae* eggs, the relative population density of immature stages infesting the two bean varieties was also affected, significantly, with the application of the tested control agents during experimental time (Tables, 3 and 4).

The differences in seasonal mean counts of immature stages infestation of *T. urticae* to bean leaves were significantly higher on the untreated plants as it harbored the highest mean number of immature stages (42.37 and 97.34 immature/inch^2 of Bolista and Hama, respectively), being differ from which controlled with *T. swriskii* which showed moderate immature infestation (16.62 and 10.53 immature/inch^2 of both varieties), the leaves of other three remaining applications, *P. persimilis* , *B. bassiana* and Abamectin_+mineral oil Cable were subjected to the lowest number of *T. urticae* immature stages

(3.06, 6.56 and 4.62 immature/inch^{2}on Bolista variety and (10.69, 10.53 and 6.45 immature/inch^2 on Hama leaves, respectively. (L.S.D. =9.61 and 20.35)

As it obvious from Table (4), the general mean in reduction percentages in *T. urticae* immature due to releasing of *P. persimilis, B. bassiana* and Abamectin +mineral oil Cable gave the highest mean percentage of reduction (85.44, 81.40 and 86.47% for Bolista and 79.59, 87.54 and 86.72% with Hama cultivar, respectively) followed significantly by the treatment of *T. swriskii* (49.28 and 54.17%) being significantly different from the previously mentioned three treatments on the two cultivated varieties. (L.S.D. values were 11.57 and 11.94, respectively).

Table (3): Mean numbers of *Tetranychus urticae* immature / leaf on two kidney bean varitites under net house conditions affected by releasing two predatory mites, *Beauveria bassiana* and the biocide abamactin +mineral oil Cable spraying at Beheira Governorate during 2016 season.

Varitites	Bolista					Hama				
Inspections date / Treatment	*P.prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable	control	*P.prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable	control
Feb.,15th	9.93	9.43	9.00	9.17	9.90	18.52	18.48	18.43	18.50	18.56
22nd	6.35	9.38	1.10	0.32	11.10	15.40	19.35	4.32	1.35	23.70
28th	7.35	10.30	3.40	1.50	14.13	16.32	20.18	6.35	3.11	28.71
Mar.,7th	5.37	10.40	6.50	3.50	17.18	13.56	26.18	8.33	5.22	34.30
15th	6.70	12.11	8.34	7.44	19.90	12.04	28.14	14.35	9.18	41.40
22nd	4.40	13.15**	1.25**	0.20 **	21.14	17.30	30.18	2.84**	1.09**	50.14
29th	3.86	15.13	1.46	11.30	24.90	15.20	32.18	4.58	1.48	62.13
Apr.,6rh	3.60	14.30	3.15	2.65	30.80	13.65	30.34	7.14	4.26	70.40
13th	2.14	16.60	7.40	3.50	34.70	14.90	34.11	9.18	7.00	85.13
20th	1.35	17.70	9.50	6.35	38.60	16.31	31.11	15.33	10.53	100.13
27th	0.95	18.70	13.80**	8.90**	41.50	17.23	36.30	3.11**	0.48**	115.90
May,4th	0.00	20.11	1.90	0.14	48.90	9.23	40.35	5.22	1.18	123.40
11th	0.00	19.50	3.70	1.80	53.80	2.14	45.35	7.18	2.00	145.90
18th	0.00	20.60	5.60	2.35	68.30	0.00	50.13	11.10	4.58	160.80
25th	0.00	23.70	8.50	3.90	78.50	0.00	48.50	16.38	8.13	175.13
Jun, 2nd	0.00	24.80	11.60	6.45	95.30	0.00	54.13	20.13	14.52	200.14
10th	0.00	26.70	15.30	9.13	111.60	0.00	60.14	25.00	17.35	218.90
Average ± SE	3.06 ±0.77 C	16.62 ±1.33 B	6.56 ±1.07 C	4.62 ±0.87 C	42.37 ±7.35 A	10.69 ± 1.74 C	35.6 ± 3.01 B	10.53 ± 1.60 C	6.45 ± 1.41 C	97.34 ± 15.65 A
F	23.02					27.96				
L.S.D.	9.61					20.35				

Values singed by the same letter of the same varity are not significantly different at alpha = 0.05 % level. **Re-spray

Table (4): Reduction persentages of *Tetranychus urticae* immature /inch2 on two kidney bean varitites under net hous conditions affected by releasing two predatory mites, *Beauveria bassiana* and the biocide abamactin +mineral oil Cable spraying at Beheira Governorate during 2016 season.

Varitites	*Bolista*				*Hama*			
Inspections date / Treatment	*P.prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable	*P.prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable
Feb.,15th	43.08	11.47	89.10	96.90	34.99	18.09	81.66	94.84
22nd	48.24	23.63	73.53	88.58	43.13	29.48	77.75	90.19
28th	68.90	36.58	58.38	78.08	60.45	23.43	75.57	86.22
Mar.,7th	66.50	36.25	53.90	59.77	70.90	31.81	65.13	79.92
15th	79.29	34.83**	93.50 **	98.98 **	65.48	39.61	94.30 **	98.03 **
22nd	84.58	36.34	93.55	51.17	75.52	48.04	92.58	97.84
29th	88.37	51.36	88.75	90.74	80.60	56.76	89.80	94.52
Apr.,6rh	93.86	49.88	76.54	89.15	82.49	59.80	89.15	92.56
13th	96.52	51.96	72.93	82.30	83.70	68.83	84.60	79.63
20th	97.72	52.79	63.42 **	76.92 **	85.13	68.58	97.30 **	54.32 **
27th	100.00	56.92	95.73	99.69	92.52	67.20	95.74	41.17
May,4th	100.00	62.03	92.43	96.40	98.53	68.82	95.05	98.76
11th	100.00	68.40	90.98	96.30	100.00	68.72	93.06	97.42
18th	100.00	68.37	88.09	94.65	100.00	72.22	90.59	95.80
25th	100.00	72.74	86.61	92.72	100.00	72.87	89.88	93.43
Jun, 2nd	100.00	74.94	84.92	91.20	100.00	72.44	88.51	92.82
10th	85.44 A	49.28 B	81.40 A	86.47 A	79.59 A	54.17 B	87.54 A	86.72 A
F	18.76				13.73			
L.S.D.	11.57				11.94			

Values singed by the same letter of the same varity are not significantly different at alpha = 0.05 % level.
**Re-spray

3.Adult stage:

Efficacy of *B. bassiana* and Abamectin + mineral oil Cable and the two predacious mites (*P. persimilis* and *T. swriskii*) against the population density of the adults of *T. urticae* infesting leaves of two bean cultivars are arranged in Tables (5 and 6). Revealed data clear that, the examined bean leaves before the application of the previous controlling agents against the adults as pre-count ranged between 3.5 and 3.6 individuals/ inch^2 on Bolista and 7.00 and 7.34 on Hama. Twenty-four hours after treatment, the count of the mite showed varied efficacy of the used treatments as the highest efficacy occurred due to *B. bassiana* and Abamactin + mineral oil Cable which reduced the infestation to 0.17 and 0.01 individuals/ inch^2, followed by *P. persimilis*, (2.8 individuals/ inch^2) then

T. swriskii releasing, (3.00 individuals/ inch^2) also the same trend observed with Hama as the corresponding counts were, 5.11, 1.00, 6.35 and 8.13 individuals/ inch^2, respectively.

With respect to the allover mean of all the previously seasonal inspections after 17 weeks of application, recorded data in Table (5) illustrated that, the highest reduction were observed with using the three treatments; *P. persimilis,* Abamactin +mineral oil Cable and *B. bassiana* as the bean leaves harbourd with 1.37, 2.27 and 3.08 individuals/ inch^2 on Bolista variety while with Hama the corresponding seasonal means were 4.91, 4.80 and 12.08 adults/ inch^2 respectively. For the efficacy of *T. swriskii* on the two cultivars, the seasonal average showed statistically moderate effect (10.83 adults/ inch^2 on Bolista and 18.30 adults/ inch^2 on Hama cultivar. On the other hand, the untreated plants infested with the highest means, 19.72 and 40.20 individuals/ inch^2 for the two cultivars, respectively.

Regarding the mean reduction for the four treatments, higher reduction percentages were recorded by Abamactin +mineral oil Cable followed by the phytoseiid predator *P. persimilis* and *B. bassiana.* After 17 weeks of treatment the statistical arrangement of their mean percentages were 88.04, 85.09, 83.69% on Bolista and 87.15, 82.81 and 82.17% on Hama for the aforementioned controlling agents, respectively. Also the statistical analyses showed no significant differences among them. (L.S.D. = 9.47 and 9.51). While the reduction percentages were the lesser of the other application, *T. swirskii,* which averaged 40.76 and 48.77% of adult stage for the same bean cultivars, respectively.

These results are an almost at the same direction with those of many researchers. El-Saiedy (2003) mentioned that *Neoseiulus californicus* (McGregor) (Acari: Phytoseiidae) and *P. persimilis* were the best predators for controlling *T. urticae* on strawberry. El-Saiedy *et al.* (2008) on two eggplant cultivars in open field. Who evaluated the efficacy of three predatory phytoseiid mites, *P. persimilis*, *Neoseiulus cucumeris* (Oudemans) (Acari: Phytoseiidae) and *N. californicus* and a biocide for controlling *T. urticae.* Also our results were in agreement with Rhodes *et al.* (2006) who observed that among the combination treatments, *P. persimilis* / *N. californicus* treatment significantly reduced *T. urticae* numbers compared with the untreated treatment, but was not as efficient as *N. californicus* alone. Xu and Enkegaard (2010) who stated that, *A. swirskii* consumed the same amount of the various types of spider mite nymphs except of the active deutonymphs of which significantly fewer were consumed. The latter is presumably in part a reflection of deutonymphs being larger and more active and thus more difficult to conquer and in part a reflection of a more pronounced congregating and web producing habit of deutonymphs compared to protonymphs there by slow downing the movements of *A. swirskii*. The latter is in accordance with notes by Van Houten *et al.* (2007) that *A. swirskii* was hardly found in the webbing of *T. urticae*. In nature, accarine pests are only a part of biological complex of which predacious mites, particularly phytoseiid group, could be of value in checking infestations. Many workers have reported that phytoseiids have a role to play in the control of acarine pests (Rasmy *et al.*, 2003; Abou-Awad *et al*., 2009 and Abou-Awad *et al*., 2017).

Table (5): Mean numbersof *Tetranychus urticae* adults / leaf on two kidney bean varitites under net hous conditions affected by releasing two predatory mites, *Beauveria bassiana* and the biocide abamactin +mineral oil Cable spraying at Beheira Governorate during 2016 season.

Varitites	Bolista					Hama				
Inspections date / Treatment	*P.prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable	control	*P.prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable	control
Feb.,15th	3.60	3.56	3.47	3.50	3.55	7.22	7.25	7.00	7.34	7.23
22nd	2.80	3.00	0.17	0.01	4.35	6.35	8.13	5.11	1.00	9.44
28th	2.65	4.11	1.18	0.45	6.00	5.44	9.33	6.33	1.95	13.50
Mar.,7th	2.40	5.00	2.18	2.00	7.33	8.43	10.11	7.18	3.90	16.55
15th	3.40	6.98	4.18	3.95	9.11	9.33	12.50	11.11	6.18	20.33
22nd	3.00	7.00**	0.65**	0.36**	10.90	7.11	12.50	18.23**	8.33**	25.14
29th	2.13	8.14	0.98	0.84	12.30	6.33	16.22	6.11	0.95	28.60
Apr.,6th	1.40	9.50	1.25	1.00	16.33	6.50	15.22	5.42	2.30	33.00
13th	0.94	10.85	3.15	2.13	18.33	7.14	18.35	8.33	4.13	37.14
20th	0.88	13.90	6.90	4.11	21.11	6.30	21.11	12.30	7.30	42.90
27th	0.14	12.80	7.15**	6.11**	24.35	5.11	23.90	18.50**	11.60**	50.80
May,4th	0.00	14.60	0.35	0.25	26.13	4.22	26.40	9.40	0.13	52.70
11th	0.00	15.30	0.95	0.75	29.11	3.10	28.33	13.50	0.90	58.90
18th	0.00	16.40	2.14	1.13	32.11	0.95	27.80	15.30	2.11	61.14
25th	0.00	17.60	3.90	2.30	35.90	0.00	22.90	17.60	4.55	68.90
Jun, 2nd	0.00	18.50	5.84	3.50	37.17	0.00	26.90	20.50	7.30	73.40
10th	0.00	16.90	7.97	6.17	41.16	0.00	24.22	23.50	11.56	83.71
Average ± SE	1.37±0.33 C	10.83±1.29 B	3.08±0.62 C	2.27±0.48 C	19.72±2.99 A	4.91±0.74 C	18.30±1.80 B	12.08±1.43 BC	4.80±0.89 C	40.20±5.75 A
F	27.03					26.89				
LSD	4.23					7.93				

Values singed by the same letter of the same varity are not significantly different at alpha = 0.05 % level.
**Re-spray

Table (6): Reduction persentages of *Tetranychus urticae* aduls /inch2 on two kidney bean varitites under net hous conditions affected by releasing two predatory mites, *Beauveria bassiana* and the biocide abamactin +mineral oil Cable spraying at Beheira Governorate during 2016 season.

Varitites	*Bolista*				*Hama*			
Inspections date / Treatment	*P. prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable	*P. prisimilis*	*T. swirskii*	*B. bassiana*	Abamactin +Mineral oil cable
Feb.,15th	36.53	31.03	96.04	99.77	41.05	13.76	71.07	89.58
22nd	56.45	31.50	80.05	92.39	64.69	30.79	75.01	85.79
28th	67.71	31.79	69.83	72.33	55.36	38.83	76.70	76.82
Mar.,7th	63.20	23.38	53.46	56.02	59.78	38.43	70.76	70.10
15th	72.86	35.78**	93.95**	96.65**	75.22	50.21	61.02 **	67.41 **
22nd	82.92	33.82	91.92	93.07	80.60	43.21	88.48	96.73
29th	91.55	41.82	92.24	93.79	82.74	53.81	91.24	93.14
Apr.,6th	94.94	40.81	82.57	88.21	83.15	50.52	87.89	89.06
13th	95.89	34.15	66.85	80.25	91.22	50.72	84.64	83.26
20th	99.43	47.43	70.22 **	74.5**	94.63	52.89	80.55 **	77.54 **
27th	100.00	44.13	98.64	99.03	97.97	49.84	90.40	99.76
May,4th	100.00	47.44	96.69	97.39	98.66	51.83	90.45	98.50
11th	100.00	48.93	93.24	96.43	99.93	54.47	90.15	96.61
18th	100.00	50.97	88.98	93.50	100.00	66.72	86.36	93.50
25th	100.00	50.23	84.06	90.45	100.00	63.30	85.01	90.22
Jun, 2nd	100.00	58.94	80.36	84.80	100.00	71.03	84.93	86.42
10th	85.09 A	40.76 B	83.69 A	88.04 A	82.81 A	48.77 B	82.17 A	87.15 A
F	40.77				27.98			
LSD	9.97				9.51			

Values singed by the same letter of the same varity are not significantly different at alpha = 0.05 % level.
**Re-spray

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