

FIELD TRIALS TO EVALUATE THE RELEASE OF THE PREDATORY MITE *Phytoseiulus persimilis* A. – H. AND THE LADY BUG *Stethorus gilvifrons* MULSANT IN SUPPRESSING THE POPULATION OF *Tetranychus urticae* infesting BEAN PLANTS.

Nassar, O. A.; A. H. Fouly and M. A. Osman

Agricultural Zoology Department, Faculty of Agriculture, Mansoura University, Mansoura 35516, Egypt.

ABSTRACT

Field trials were conducted at the farm of the faculty of agriculture, Mansoura University in order to evaluate the efficacy of the predatory mite *P. persimilis* and the predatory insect *S. gilvifrons* in suppressing the population of the two spotted spider mite *T. urticae* after release of the predacious arthropods in open field cultivated with green beans. Three suggested levels of the predator : prey ratio were used, namely 1:20, 1: 40and 1:60 for both predacious arthropods. The percent reduction in egg stages of *T. urticae* at the first level was 76.17 and 85.5 for the predatory mite and insect respectively after 25 day of release. While the present reduction in moving stages of *T. urticae* at the first level was 78.28 and 84.97 for the predatory mite and insect respectively after the same period of the release.

INTRODUCTION

High reproduction rates along with rapid developmental times give spider mites, especially the two spotted spider mite *Tetranychus urticae*, the potential for population outbreaks that can cause sever economic damage.

This potentiality of spider mites gives the biological control a great attention especially the ability of these pests to acquire resistance to acaricides (Sabelis, 1981 and Geoghiou, 1990). Also, as reported before by several researchers that phytoseiid mites and the coccinellid beetles are the most important predators as biological control agents all over the world (Gerson and smiley, 1990; Gilstrap, 1995; McMurtry and Croft, 1997; Osman, 2000; Kishimoto, 2003 and Roy *et al.* 2003).

Therefore, it was necessary to evaluate the role of exotic predatory mite *P. persimilis* under the field condition in Egypt. Also, evaluate the role of *S. gilvifrons*, as one of the most dominant and obligate predators of tetranychid mites in Egypt, in suppressing *T. urticae* populations infesting bean plants under field condition at Mansoura district.

MATERIALS AND METHODS

Release Technique

The experiment was carried out during 2003, at the farm of the Faculty of Agriculture, Mansoura University. Trials were done in seven plots,

each plot 8 × 9 m . The plots were cultivated with green beans *Phaseolus vulgaris* and left one month for growing up without any mite infestation. Each plot was considered a treatment, where the first one was a control and the other six were represented levels of release.

Pure cultures of the predatory mite *P. persimilis* were reared using methods modified from (McMurty and Scriven, 1965). Pure cultures of the predatory coccinellid *S. gilvifrons* kept in plastic boxes 20 cm × 10 cm × 5 cm covered with muslin on the top and the bottom covered with filter paper. The boxes were provided with pieces of leaves of castor plants heavily infested with spider mites *T. urticae* as a food source.

Five plants in each plot were used as a replicate that artificially infested with leaves of *Ricinus communis* heavily infested with the spider mites *T. urticae*. Each plant was caged individually under muslin 120 cm × 50cm and represent a replicate was repeated five times for each treatment.

Spider mite populations were left to increase for twenty days in the field. After that, all stages of spider mites were counted on plant leaf samples (3 leaves / plant or 9 leaflets / plant). The predatory mite *P. persimilis* was released in three levels to evaluate their effectiveness in controlling *T. urticae* infesting bean plants under field conditions. The suggested predator : prey ratio 1 : 20, 1 : 40, 1 : 60, respectively . On other hand, the same levels were used with the predatory coccinellid *S. gilvifrons*. The control plot remained free without predatory mites or coccinellids.

Predatory mites and insects prepared for release process were kept in the incubator under temperature of 10 °C for 5 minutes to eliminate mite and coccinellid activity in order to help for their handling. Female predatory mites and insects were transferred to discs of castor plant and then inserted inside tubes. The tubes were closed by a piece of muslin to prevent mite and coccinellid from escaping. All tubes prepared for release were put in ice box to keep the mites and coccinellids inactive till transferring them to the field. The release was carried out 1-2 hours before sunset and 2-3 days after crop irrigation to warrant suitable air temperature and relative humidity for introduction of predatory.

Samples of three leaves (9 leaflets) from each plant under cages were randomly taken from each plot after regular intervals of 5 days and continuously up to 25 days. Collected samples were carefully transferred to the laboratory inside cellophane bags with small pieces of cotton wool soaked in ether. These samples were directly inspected under stereoscopic binocular microscope to estimate living and consumed individuals of *T. urticae* at different levels of the predatism of *P. persimilis* and *S. gilvifrons*. Any stages of the predatory mites and coccinellids were collected carefully and placed on bean plant. The predators efficiency was determined and evaluated where Data were statically analyzed using Henderson and Tilton formula (1955).

RESULTS AND DISCUSSION

Data listed in Table (1) showed that release *P. persimilis* at levels 1 : 20, 1 : 40 and 1 : 60, respectively caused reduction percentages of eggs

of *T. urticae* 58.41 %, 51.57 % and 42.67 after 5 days, while these percentages were 65.48 %, 59.19 % and 53.78, for *S. gilvifrons* release at 1 : 20, 1 : 40 and 1 : 60, respectively.

After 10 days from release the reduction percentages of eggs of *T. urticae* were 61.04%, 56.90 and 48.14, respectively for predatory mite and 72.50 %, 66.85 % and 57.64 % for *S. gilvifrons* at the same previous levels respectively.

Moreover, after 15 days the reduction percentages of eggs of *T. urticae* were 65.82 %, 62.70 % and 53.48 by *P. persimilis* at levels 1 : 20, 1 : 40 and 1 : 60, respectively. On the other hand the reduction percentages by *S. gilvifrons* were 76.41 %, 71.02 % and 63.36 % at levels 1 : 20, 1 : 40 and 1 : 60, respectively. 20 days after release Data in Table (1) showed that the *P. persimilis* and *S. gilvifrons* caused the reduction percentages of eggs of *T. urticae* to be 72.76 %, 67.56 %, 58.90 and 81.41 %, 75.43 %, 69.50 % at the aforementioned release levels, respectively.

After 25 days reduction percentages of *T. urticae* eggs increased to 76.17 %, 72.15 % and 66.52 % by *P. persimilis* and 85.00 %, 79.50 % and 71.34 % at the three levels, respectively. From the previous results, it was noticed that the reduction percentages of eggs of *T. urticae* by *P. persimilis* after 5, 10, 15, 20 and 25 days was 58.41 %, 61.04 %, 65.82 %, 72.76 % and 76.17 % at T₁; 51.57 %, 56.90 %, 62.70 %, 67.56 and 72.15 % T₂ and 42.67 %, 48.14 %, 53.48 %, 58.90 % and 66.52 %, at T₃ respectively. Table (1)

Table (1) : Reduction Percentage (%) of *Tetranychus urticae* koch eggs on bean plants after releasing different levels of *Phytoseiulus persimilis* Athias-Henriot and *Stethorus gilvifrons* (Muslant)

| Day Treatment | Time after release (days) | | | | |
|----------------------|-----------------------------|-------------|-------------|-------------|-------------|
| | 5 | 10 | 15 | 20 | 25 |
| | % Reduction | % Reduction | % Reduction | % Reduction | % Reduction |
| <i>P. persimilis</i> | | | | | |
| T1 (1 : 20) | 58.41 | 61.04 | 65.82 | 72.76 | 76.17 |
| T2 (1 : 40) | 51.57 | 56.90 | 62.70 | 67.56 | 72.15 |
| T3 (1 : 60) | 42.67 | 48.14 | 53.48 | 58.90 | 66.52 |
| <i>S. gilvifrons</i> | | | | | |
| T4 (1 : 20) | 65.48 | 72.50 | 76.41 | 81.41 | 85.00 |
| T5 (1 : 40) | 59.19 | 66.85 | 71.02 | 75.43 | 79.50 |
| T6 (1 : 60) | 53.78 | 57.64 | 63.36 | 69.50 | 71.34 |

Reduction percentages of eggs of *T. urticae* by *S. gilvifrons* and after 5, 10, 15, 20 and 25 days were 65.48 %, 72.50 %, 76.41 %, 81.41 % and 85.00 at T₄ and 59.19 %, 66.85 %, 71.02 %, 75.43 % and 79.50 % T₅ and 53.78 %, 57.64 %, 63.36 %, 69.50 % and 71.34 %, at T₆ respectively.

On the other hand Data in Table (2) showed that release *P. persimilis* at levels 1 : 20, 1 : 40 and 1 : 60, respectively caused reduction percentages of moving stages of *T. urticae* 58.09 %, 53.90 % and 45.20 % after 5 days, while these percentages were 64.10 %, 56.92 % and 52.31 %, respectively when released *S. gilvifrons* at 1 : 20, 1 : 40 and 1 : 60, respectively.

After 10 days from release the reduction percentages of moving stages of *T. urticae* were 65.07%, 61.58 % and 52.16 %, respectively when using *P. persimilis* at levels 1 : 20, 1 : 40 and 1 : 60, respectively. Also, *S. gilvifrons* caused reduction percentages of moving stages of *T. urticae* 69.04 %, 65.47 % and 60.98 % at the same previous levels respectively.

Moreover, after 15 days the reduction percentages of moving stages of *T. urticae* were 69.42 %, 66.08 % and 58.63 % by *P. persimilis* at levels 1 : 20, 1 : 40 and 1 : 60, respectively. On the other hand the reduction percentages by *S. gilvifrons* were 75.41 %, 70.39 % and 67.22 % at levels 1 : 20, 1 : 40 and 1 : 60, respectively.

20 days after release Data in Table (2) showed that the *P. persimilis* and *S. gilvifrons* caused the reduction percentages of *T. urticae* moving stages 73.71 %, 70.01 %, 64.07 % and 82.34 %, 76.99 %, 70.25 % at levels 1 : 20, 1 : 40 and 1 : 60, respectively.

Table (2) : Reduction Percentage (%) of *Tetranychus urticae* moving stages of infesting bean plants after releasing different levels of *Phytoseiulus persimilis* (Athias-Henriot) and *Stethorus gilvifrons* (Muslant)

| Day | Time after release (days) | | | | |
|-----------------------------|-----------------------------|-------------|-------------|-------------|-------------|
| | 5 | 10 | 15 | 20 | 25 |
| Treatment | % Reduction | % Reduction | % Reduction | % Reduction | % Reduction |
| <i>P. persimilis</i> | | | | | |
| T1 (1 : 20) | 58.09 | 65.07 | 69.42 | 73.71 | 78.28 |
| T2 (1 : 40) | 53.90 | 61.58 | 66.08 | 70.01 | 73.39 |
| T3 (1 : 60) | 45.20 | 52.16 | 58.63 | 64.07 | 67.53 |
| <i>S. gilvifrons</i> | | | | | |
| T4 (1 : 20) | 64.10 | 69.04 | 75.41 | 82.34 | 84.97 |
| T5 (1 : 40) | 56.92 | 65.47 | 70.39 | 76.99 | 80.26 |
| T6 (1 : 60) | 52.31 | 60.98 | 67.22 | 70.25 | 76.71 |

After 25 days the reduction percentages of moving stages of *T. urticae* increased to 78.28 %, 73.39 % and 67.53 by *P. persimilis* at levels (T1) 1 : 20, (T2) 1 : 40 and (T3) 1 : 60, respectively and 84.97 %, 80.26 % and 76.71 % at levels 1 : 20, 1 : 40 and 1 : 60, for *S. gilvifrons* respectively.

In the other words, the reduction percentages of moving stages of *T. urticae* by *P. persimilis* at T1 (1 predator : 20 prey) after 5, 10, 15, 20 and 25 days were 58.09 %, 65.07 %, 69.42 %, 73.71 % and 78.28 % , respectively; at T2 (1 predator : 40 prey) 53.90 %, 61.58 %, 66.08 %, 70.01 and 73.39 % and at T3 (1 predator : 60 prey) 45.20 %, 52.16 %, 58.63 %, 64.07 % and 67.53 %, respectively.

Moreover, reduction percentages of *T. urticae* eggs by *S. gilvifrons* at T4 (1 predator : 20 prey) and T5 (1 predator : 40 prey) after 5, 10, 15, 20 and 25 days were 64.10 %, 69.04 %, 75.41 %, 82.34 % and 84.97 % and 56.92 %, 65.47 %, 70.39 %, 76.99 % and 80.26 %, respectively. At T6

(1 predator : 60 prey) was 52.31 %, 60.89 %, 67.22 %, 70.25 % and 76.71 %, respectively.

Similar results were obtained by Ho (1990) who used *A. fallacis* and *P. persimilis* that gave effective control of *Tetranychus kanzawai* after introduction onto potted tea plants at a ratio of 1:20 in a greenhouse. On the 10th and 14th day after release, the percentage control by *N. fallacis* was 72.8 and 88.6, resp., while that by *P. persimilis* was 84.0 and 99.1. In field trials in Taiwan, both predators, but especially *P. persimilis*, reduced the numbers of *T. kanzawai* to less than one mite/leaf.

Also, Bonomo (1991) stated that release of *P. persimilis* gave effective control of the mite *T. urticae* at ratio 1:10. Moreover, Chermiti (1992) found that One release of *P. persimilis* at a rate of one predator for 10 *T. urticae* was sufficient to control a pest population. The population of *T. urticae* was reduced in 3 weeks and completely eliminated in 7 weeks.

On the other hand Campbell and Lilley (1999) showed that *P. persimilis* decreased *T. urticae* when the prey: predator ratio reached approximately 10:1 when release on two varieties of dwarf hops.

Similar results were obtained by Opit *et al.* (2004) who found that *P. persimilis* significantly reduced *T. urticae* populations 1 week after release at ratios of 1:4 and 1:20, on ivy geraniums and kept them at low levels thereafter.

As concerning, lady bug *S. gilvifrons* Jiang *et al.* (1982) showed that the *Stethorus punctillum* (Weise), an important predator of tetranychid mites, and its effectiveness in controlling cotton pests. When the predator was released in cotton fields, percentage control of tetranychids was lasted for 18 days. The best predator : prey ratio for control was 1 : 130.

Moreover, Huang *et al.* (1988) stated that the coccinellid *Stethorus siphonulus* Kapur was suppressed the number of *Panonychus citri*. In citrus orchards when released predator at densities of 20-40 individuals/tree and that is agree with previous results. Also, (Shimoda *et al.*,1993; Ehara and Shinkaji, 1996; Gotoh and Gomi, 2000; Kishimoto,2002; Kitashima and Gotoh, 2003).were found *Stethorus japonicus* Kamiya suppressed *T. urticae* and the *T. kanzawai* in fields of apple, citrus, tea, pear, hydrangea and kudzu vine.

From the previous results it can be conclude that *P. persimilis*, is one of the most dominant exotic phytoseiid mites in Egypt, which may play an important role as an effective factors for reducing the population of the two spotted spider mite beside other factors in IPM scheme. Also, lady bug *S. gilvifrons* belonging to the genus *Stethorus* is obligate predator of tetranychid mites. Therefore, it is highly recommended to play an important role for suppressing *T. urticae* in open field and under greenhouse. From the previous results the predatory mite and insect under investigation are promising as biological control agents of spider mite and there is feasibility of using it in the IPM programmes.

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تجارب حقلية لتقييم اطلاق المفترس الأكاروسى *P. persimilis* والمفترس الحشرى *S. gilvifrons* لضبط تعداد العنكبوت الأحمر ذو البقعين *T. urticae* على نباتات الفاصوليا
عمر عبد الحميد السيد نصار، احمد حسن فولى و محمد على احمد عثمان
قسم الحيوان الزراعى- كلية الزراعة – جامعة المنصورة

اجريت تجارب حقلية بمزرعة كلية الزراعة جامعة المنصورة لتقييم اطلاق المفترس *P. persimilis* والمفترس الحشرى *S. gilvifrons* لضبط تعداد العنكبوت الاحمر ذو البقعين *T. urticae* على نباتات الفاصوليا. حيث تم الاطلاق بمستويات ١:٢٠, ١:٤٠, ١:٦٠ لكلا المفترسين واطهرت النتائج حدوث انخفاض فى طور البيض للعنكبوت الاحمر ذو البقعين *T. urticae* عند مستوى ١:٢٠ وكان مقدار الانخفاض بعد ٢٥ يوم ٧٦,١٦% للمفترس الاكاروسى , ٨٥,٥% للمفترس الحشرى *S. gilvifrons* بينما كان الانخفاض فى الاطوار المتحركة للعنكبوت الاحمر عند نفس المستوى ١:٢٠ ٧٨,٢٥% للمفترس الاكاروسى و ٨٤,٧٧% للمفترس الحشرى بعد ٢٥ يوم من الاطلاق.