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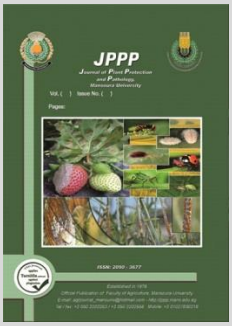
Role of *Stethours gilvifrons* (Mulsant) as Biological Control Agents of the Two Spotted Spider Mite *Tetranychus urticae* Koch

Fatma M. Saleh*; Amira E. Mesbah and OLA M. Roshdy

Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza, Egypt.



ABSTRACT

Predaceous insects is an effective important biological control agents of feeding on *Tetranychus urticae* Koch and decreasing the number during 2018 season to study the optimal predator: prey ratios for the release of *Stethours gilvifrons* (Mulsant) sacond larvae and adult stage for controlling the *T. urticae* on cotton plants *Gossypium burbadense* L. The obtained results showed that the effective control was gained after 12 days from released the second larvae and adult of the *S. gilvifrons* predator when the predator: prey ratios were 1:15 and 1:25 respectively. The regression analysis between predator: prey ratios of *S. gilvifrons* (larvae and adults) reduction percentages cleared that there were negatively high relationship of larvae and adult predators and prey ratios, which means that the reduction rate was increased with lower predator : prey ratios and vice versa .The results assured that the best control of *T.urticae* populations under semi field conditions was cleared by using the lower predator prey ratios (1:15 and 1:25) . Finally the predators can be used as biological control agents for *T.urticae* in cotten plantation under field conditions. The regression analysis between P: p ratios of *S. gilvifrons* adults and reduction percentage of the *T.urticae* mites , data showed there were negatively highly relationship of both predators larvae and adult which means that the reduction rate was increased with lower P: p ratios and vice versa.

Keywords: *Stethours gilvifrons (Mulsant), Tetranychus urticae Koch. release.*

INTRODUCTION

In present years, several important studies has been given to biological control has a great potential for use against the two spotted spider mites, *Tetranychus. urticae* Koch because it is one of the most damaging tetranychid mites based on successes of biological control against other mite and the abundance of biological control agents (Rott *et al*.,2000a). However, the spider mite *T.urtica* losses to vegetables and deciduous fruit orchards .The ladybird beetles *Stethours gilvifrons* (Mulsant) success of these biological control agents necessitates their presence in sufficient numbers of *T.urticae* when required to control mite.(Seidi and Gencer 2014) .These obstacles can be avoided by mass- rearing and mass-release on natural preys are among the role used in the biological control under controlled conditions for biological control of *T.urticae* on several economic crops. Now, the *T.urticae* has become a serious mite of several economic crops including cotton .Theory and practical of biological control suggest that generalist predators can be effective control agents. Field studies show that generalist predators can reduce mite numbers by a significant degree and in some cases reduce or prevent crop damage. Reduced plant vigor, stunting and deformed plant parts are common symptoms of mites infestations (Mirdul *et al*., 2002).

It involves the manipulation of trophic interactions to achieve a reduction in pest density (Ehler, 1996). Theory and practice of biological control suggest that generalist predators can be effective to control agents. This field studey showed that generalist predator species can reduce mites numbers by a significant degree and in some cases reduce or study This evidence is mainly from semi-field conditions (field cage) and providing that predator: prey ratios and the timing of releases are optimized. (Ibrahim 1988) reported that Several methods used to measure the effect of predators on tetranychid mites populations. One common technique is to use field cage conditions to enclose known numbers of predatory species with artificially known numbers of mites species .The aimed of this investigation to study the optimal predator prey ratios for release *S.gilvifrons* for controlling *T.urticae* on cotton field.

MATERIALS AND METHODS

Experimental traits were carried out at Mansoura distract Dakahlia Governate during 2018 seasons .

The *Gossypium burbadense* L.cotton plants in 1:1peatmoss to vermiculite mix in 20 cm diameter plastic pots when plants became available Plants were infested with two- spotted spider mites *Tetranychus.urticae* Koch(ten females and two males per/pot). *Stethorus. gilvifrons* (Mulsant). Adult and larvae were collected from the different crops in the farm of the Mansoura filed. The eggs laid by each female of predators were removed daily and monitored until hatching. The hatched larvae were reared individually to avoid cannibalism in tubes (10 cm. in diameter) until the first and the second instar or adult emergence.

Twenty cages were covered with muslin and prepared with one meter long zipper to facilitate counting of the pest and predator stages. Cotton plants under cages were sprayed with Malathion 57%. E.C. to kill any insects on the plants before releasing the predators. Two weeks after spraying, artificial infestation from the cotton plants

* **Corresponding author.**
E-mail address: dr.fatmasalehf0@gmail.com
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of tetranychid mites was made at the following numbers: 15, 25, 35, 45, 55 and 65/plant. The introduction of tetranychid mites was done by fine camel brush.

After two weeks from artificial infestation from tetranychid mite the coccinelled predator *S.gilvifrons* larvae and adult were released into the cages as early second instar larvae or as newly emerged adults, meanwhile, The following predator: prey ratios 1:15, 1:25, 1:35, 1:45, 1:55, and 1:65 were used for each stage. Four replicates were used at each predator: prey ratio and four replicates for check (without releasing).The number of *T.urticae* and the predator stages were carefully counted every one, three , seven ,ten and fourteen days to measure the success of the release rate. *S.gilvifrons* were estimated in each pot just before predators release and then every days was applied to calculated the redaction of *T.urticae* populations.

Data analysis: The *T.urticae* numbers at the predator: prey ratios were subjected to one way analysis of variance (ANOVA), predator: prey ratios and reduction percentages was run and the means separated using Duncan's Multiple Range Test (Costat, 1990). In addition, simple linear regression between predator : prey ratio and reduction percentage was run according to Abbott (1925).

Abbott's formula:

$$\text{Reduction \%} = \left(1 - \frac{\text{n in T after treatment}}{\text{n in Co after treatment}}\right) * 100$$

Where : n = number of *T.urticae* , T = treated , Co = control

RESULTS AND DISCUSSION

1– Release of *Stethours gilvifrons* (Mulsant) larvae .

A complete control of *T.urticae* populations was achieved after 12 days from release of the coccinellid larvae with the predator: prey ratios of 1:15 in (Table 1).

Table 1. The reduction percentage of *T. urticae* after release of *S. gilvifrons* larvae at different predator: prey ratio under field cage conditions on cotten plants at Mansoura distract.

Days after	P:p ratio					
Release	1:15	1:25	1:35	1:45	1:55	1:65
1	28.33	23.25	18.28	15.13	11.70	10.88
3	40.21	38.22	32.40	28.38	26.77	25.62
6	78.33	68.00	56.36	44.70	38.21	31.13
9	88.43	77.2	63.70	48.81	42.31	38.11
12	100	78.00	78.00	47.50	40.29	35.23
15	100	82.00	71.00	55.31	48.37	46.12
18	100	88.00	77.00	68.42	56.31	42.81
Average	76.47	64.95	56.67	44.04	37.71	32.84

It was observed that the number of *T.urticae* at these ratios remained zero for a period of 12 days after release of the predator larvae. The reduction percentage of these ratio was 100 % and in the predator: prey ratios 1:25was 88 % after 18 days from the introducing the predators larvae, respectively. When predator: prey ratios was 1:35 and 1: 45 , the reduction percentage were 71.00,55.31 % and 77.00,68.42 % after 15 days and 18 days from the introducing the predators larvae, then the *T.urticae* number remained zero after 12 with the predator prey ratio 1:15 from the release.

The obtained results showed that the average reduction percentages of *T.urticae* were76.47, 64.95,56.67,44.04,37.71and 32.84 % with the predator prey ratios 1:15, 1:25, 1:35, 1:45, 1:55 and 1:65 respectively during the period of release (Table 1). The statistical analysis assured that there was a significant decrease of *T.urticae* numbers at the different predator: prey ratios and days after release of *S.gilvifrons* larvae.

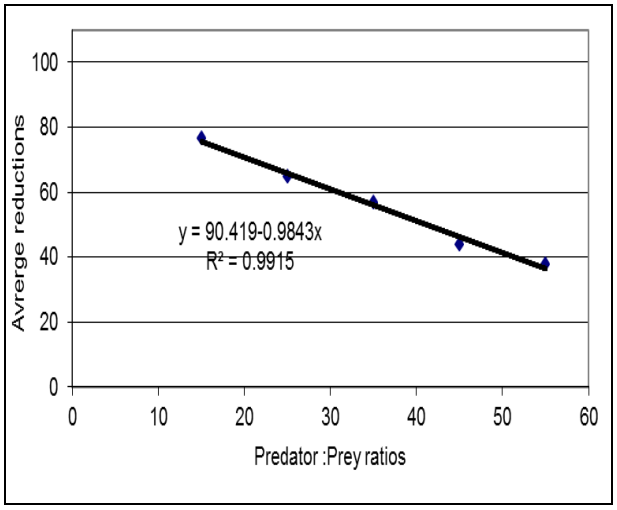

Figure 1. Simple linear regression between predators : prey ratios (X) and the reduction percentages of *S. gilvifrons* larvae under field cage conditions .

The regression equations between predator prey ratios of *S. gilvifrons* larvae (as independent variable X) and average reduction percentages of the two spotted spider mite (as dependent variable Y) were derived. The regression equation was (Y) = 90.419 - 0.9843X and the value of R^2 was 0.9915 (Figure 1). This equation indicated that there was a highly negative relationship between predator: prey ratios and reduction percentages which mean that the reduction rate was increased with lower predator prey ratios and vice versa.

2– Release of *Stethours gilvifrons* (Mulsant) adult.

The effective control by the *S.gilvifrons* adult of two spotted spider mite *T.urticae* populations was achieved after 12 days from release of the adult of the predators: prey ratios of 1:15 , 1:25 , 1:35 , 1:45 , 1:55 and 1:65 respectively were 100,99,89.22,84.5,87.6 and 70.3%with released by prey ratios). after release of the predaceous adult.

Data in Table (2) indicated that the average percentages reduction of *T.urticae* mite were 93.71 , 87.57 , 76.43 , 71.8 , 71.38 and 61.25 % with the predator prey ratios 1:15 , 1:25, 1:35, 1:45, 1:55 and 1:65 respectively during the release period. The results showed that the best control of *T.urticae* was decreased by using the lower predator prey ratios (1:15 and 1:25) after 18 days after release it were recorded 100 and100%respectivelly.

The result cleared that the *S. gilvifrons* larvae were effective in controlling *T.urticae* less than the adult of *S.gilvifrons* predators. The statistical analysis showed that there was a significant decrease of *T.urticae* numbers at the different predator: prey ratios and days after release of *S.gilvifrons* adults.

Table 2. Reduction percentage of *T. urticae* after release of *S. gilvifrons* adult at different predator: prey ratios under field cage conditions on cotten plants at Mansoura distract.

Days after	P:p ratio					
Release	1:15	1:25	1:35	1:45	1:55	1:65
1	81.00	65	62.34	51.22	43.58	38.7
3	89.00	72.51	55.75	54.33	48.87	39
6	91	83.5	63.50	56.45	68.13	51.2
9	95	93	80.25	77.70	73.60	68.22
12	100	99	89.22	84.50	87.60	70.3
15	100	100	90.81	87.5	88.21	78.1
18	100	100	93.2	91.49	89.70	83.22
Average	93.71	87.57	76.43	71.8	71.38	61.25

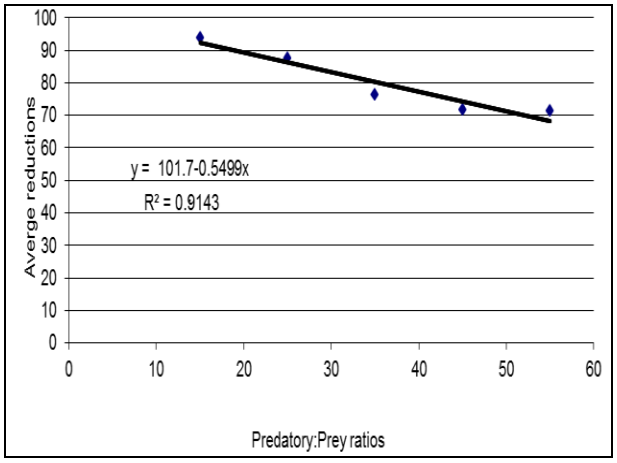

Figure 2. Simple linear regression between predator : prey ratio (X) and the reduction percentages (Y) of *S.gilvifrons* adults under field cage conditions .

The regression equations between predator prey ratios of *S.gilvifrons* adults (as independent variable X) and average reduction percentages of *T.urticae* (as dependent variable Y) were derived. The regression equation was (Y) = 101.7 - 0.5499X and the value of R^2 was 0.9143 (Figure 2). This equation indicated that there was a highly negative relationship between predator : prey ratios and reduction percentages which mean that the reduction rate was increased with lower predator prey ratios and vice versa . Biological control has a great potential for use against the Tetranychid mites, *T. urticae* based on successes of biological control against other mite and the abundance of biological control agents (Rott *et al*.,2000a). Naturally, occurring predators are usually not sufficient to control tetranychid mites populations and so augmentation release of predators into the agro-ecosystem would be necessary to gain successful biological control (Rott *et al*.,2000b); studied that the predator: prey ratio should be determined. The results of the current study clearly that the effective P: p ratios were 1:10 and 1:20 for the *S. gilivfrons* adults predators after nine day of release under field cage conditions. Moreover, the release of the predator at the rate of 1:30 could not possibly keep the population of *T.urticae* mite decresed to a satisfactory level after 12 days.

Successful control reduction by at least 90% was obtained by realease *S. gilivfrons* adult after 12 days from release achieved 100% reduction in *T. urticae* at 1: 30 , 1:40 and 1: 50 predator : prey ratio Abdel- salam , A . H .*et al*.(2010) .

Based on regression analysis between P: p ratios of *S. gilvifrons* adult of the cotton *T.urticae* mite, there were negatively strong relationship after 1 and 18 days from the release of predators. The reduction rate increased with lower larvae of the same predator. Ahmed *et al* (2006).To estimate the effectiveness of the coccinelle predator *S.gilvifrons* .The reduction percentage of mite population were 9.3 ,17.1 , 27.9 and 52.4%.after 1,2,3 and four releases. Abdel - salam, A.H. *et al*. (2010).recorded that there was a significant relationship from the level of release the adult of *S.gilvifrons* to control *T.urticae* and found the active Successful control reduction by at least 90% was obtained by realease of *S. gilvifrons* adult after 12 days from release achieved 100% reduction in *T. urticae* at 1:30 , 1:40 and 1: 50 predator : prey ratio . Meanwhile, Zibai and Hatami (2001) recorded that the predator : prey ratios of 1:30 and 1:90 significantly reduced the population of *A. gossypii*. At 1:30, there was no difference in efficacy between the use of the predators alone or in combination. At 1:90 , control using *H. variegata* alone, or in combination with *C. carnea* was equally effective.

The obtained results clear that the coccinellid predator adults was effective in controlling *B. argentifolii* more than the larvae of the same predator. Mohamed, Nadia, E. *et al*.(2008)recorded that The obtained results clear that the coccinellid predator adults were effective in controlling *B. argentifolii* more than the larvae of the same predator. These results was found to be closely match with those of Latifian and Vala (2017). Who resulted that there was significant relationship different release dates in terms of seasonal mean of population and growth rate of the pest and number of active predators.

In conclusion, these data cleared that the release parameters for successful use of *S. gilvifrons* second larvae and adult as a biological control agents of *T.urticae* under semi-field conditions. Therefore, releasing these predators (larvae or adult stages) on cotton plants. The adult is effective than larvae for controlling the *T.urticae* populations.

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دور المفترس (Mulsant) *Stethours gilvifrons* فى المكافحه البيولوجيه للعنكبوت الاحمر ذو البقعتين *Tetranychus urticae* Koch.

فاطمه محمد صالح، اميره الدسوقي مصباح و علا محمد رشدى

معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقي – الجيزة – مصر

المفترس(Mulsant) *Stethours gilvifrons*(االعمر اليرقي الثانى والطور الكامل) له دور هام وفعال في المكافحه البيولوجيه لخفض نسبه التعداد للعنكبوت الاحمر *Tetranychus urticae Koch* على نباتات القطن *Gossypium burbadense L.*. خلال موسم ٢٠١٨ لدراسه نسب اطلاق المفترس الي الفريسه. أظهرت النتائج أن التاثير الفعال تم تسجيله بعد ١٢ يوما من إطلاق يرقات العمر الثاني والحشرات الكامله من المفترس *S. gilvifrons* عندما كانت معدلات الاطلاق١:١٥و ١:٢٥ علي التوالى . بناء على تحليل لإنحدار بين المفترس *S. gilvifrons* (االعمر اليرقي الثانى والطور الكامل) : نسب الفريسة أن هناك علاقة قويه سالبه بين اليرقات والحشرات الكامله للمفترس والفريسه، مما يعني كلما كانت نسبه الانخفاض فى تعداد العنكبوت الاحمر يتزايد مع نسب الاطلاق المنخفضه و العكس صحيح . أكدت النتائج أن أفضل سيطرة على *T. urticae* تحت ظروف شبه حقليه باستخدام نسب منخفضه من المفترس الي الفريسه (١:١٥ و ١:٢٥). أخيرًا ، يمكن استخدام هذا المفترس كعنصر من عناصر المكافحة البيولوجيه للـ *T. urticae* في حقول القطن.