e-ISSN: 2455-667X

Annals of Natural Sciences
Vol. 5(1), March 2019: 11-17
Journal's URL: http://www.crsdindia.com/ans.html
Email: crsdindia@gmail.com

Annals of Natural Sciences

ORIGINAL ARTICLE

Biological Control of Chilli thrips; *Scirtothrips dorsalis,* a Phytophagous Pest of Chilli, *Capsicum annuum* Crop by the use of Predatory Mite, *Amblyseius cucumeris /Neoseilus cucumeris* under Net House Conditions during the Year 2014-2015

Manika Gupta[1] and Mahesh Chandra[2*]
[1]Department of Zoology, D.S. College, Aligarh
[2]Department of Zoology, Seth P.C. Bagla College, Hathras
*Corresponding Author's Email: maheshagnivanshi@gmail.com

ABSTRACT

Chilli crops are heavily infected by insect pests'. Scirtothrips dorsalis is the major constraints in the higher productivity of chilli and its yields. In the present study, the biological experiments were successfully carried out on S. dorsalis with their selected predator, Amblyseius cucumeris. All the experiments were done in 3 different sets / microplots of one net house. Each treated and replicated with three times. In the first microplot, the selected numbers of predator was introduced on the thrips population. A day after release, it was found that the average number of alive thrips was recorded as 35.60, and, thus, the reduction rate in the percentage of thrips population was recorded at 20.8%. It was further examined and on examination it was found that the percentage reduction was 48.5%. At the close of the third week, the average number of alive Scirtothrips dorsalis was examined by proper methods and it was found 11.60 at the reduction percent of 68.2%. In the second microplot of the net house, a day after of the release of the predator's population, it was recorded that the reduction rate in the thrips population was at 27.6%. After the second release of the predators it was found that the number of Scirtothrips dorsalis after one day was reduced by 52.4%. In the third release the rate of reduction of thrips was reduced at 74.02%. The same examination was done at the same net house in the third microplot with the release of more number of predators. A day after observation it was found that the rate of reduction was recorded at 33.9%. In this manner, the total reduction rate came to 82.32% of the experimental net house. In order to confirm the progressive data towards the desired research results, statistical analysis of the data with T-test was done and thus the results were obtained.

Key words: *Chilli, Scirtothrips dorsalis, Amblyseius cucumeris, Biological control, T-Test*

Received: 4th January 2019, Revised: 20th January 2019, Accepted: 25th January 2019

How to cite this article:
Gupta M. and Chandra M. (2019): Biological Control of Chilli thrips; *Scirtothrips dorsalis,* a Phytophagous Pest of Chilli, *Capsicum annuum* Crop by the use of Predatory Mite, *Amblyseius cucumeris /Neoseilus cucumeris* under Net House Conditions during the Year 2014-2015. Annals of Natural Sciences, Vol. 5[1]: March, 2019: 11-17.

INTRODUCTION

In India, the production of chilli is popular in all its corners, but there are several states which do not produce as much chilli as they consume. The production of chilli is found at large scale in those states, where climate is generally hot and dry (Butani, 1976). As per the estimations based on different researchers, it is concluded that the area of chilli production all over the world around 105 million hectare. In the total area of chilli production about 7 million tonnes of chilli is produced all over the world.

It is used as a potent spice all over the world and in the total trade of spices in the world about 16% is covered by chilli. It's expensive use in spices is making it an impatient item of trade. Cosmetic damage largely affects the chilli fruits, which is directly proportional to

yield loss. On the other hand, pests cause indirect damage in the form of several deformities and affect the growth of the plant. This crop is known to harbour more than 50 insects and 2 mite pests. Among the *Scirtothrips dorsalis* is the major constraint for higher productivity of chilli yields. These pests suck and attack the crop at seedling stage itself and continue till first harvest, causing severe losses and mortality upto 55%. Regular studies of environmental concerns have revealed varieties of insects and their behavioural patterns.

It is on the basis of such studies that certain methods are evolved to curb the growth of insects (Dent, 2000). A better side of the knowledge is related to the relative value of the beneficial insects and it is increasingly recognized. Biological control of pest is a safe alternative. It has been known since 1874. This method may replace pesticides and can bring good results at both ways – at economic threshold and on environmental issues (De Bach, 1964). It is a safe method in which a living organism is used against another living organism in the scheme of nature where killing is the means of survival. *Macrotracheliella nigra,* a minute pirate bug is an important natural predator, because of their potential to control a variety of *Scirtothrips* species (Gupta, 2015).

Amblyseius is a large genus of predatory mites belonging to the family; Phytoseiidae. Many members of this genus feed on the population of other mites and also on thrips. (Boucek, 1968). Mites0 are not parasitic but they are free-living and have predatory habit. They can be recognized by the single pair of spiracles positioned laterally on the body. *Cucumeris* is a predator, better known for thrips control (Dogramaci, *et al*., 2011). Net house experimental studies regarding the biological control potential of predatory mite against *Scirtothrips dorsalis*, a constraint pest of chilli, attempted in this research study.

MATERIALS AND METHODS

In order to facilitate our research, and to obtain the pure yield production of chilli, *Capsicum annuum* under established experimental net house conditions, chilli seedlings transplanted in sets of three micro plots. In total, one net house was prepared for our controlled experiments. We collected certain sample plants from different nurseries and transplanted them in the experimental Micro-plots in order to find out results over damage on chilli plants with the help of our biological experiments. The Net House was naturally ventilated and climatically controlled. It was made free from weeds and grass at regular intervals.

EXPERIMENTAL DESIGN

The net house was in size of 3x2 m with 4.5 ft height of the net. However, the cultivation of sampled plants has been arranged in a systematic linear fashion. Each plant was separated from the other at the distance of about 40-50 centimetres. The distance was maintained from row-to-row and plant-to-plant. These microplots were covered by nylon net. Each biological treatment was replicated at three times with the help of selected predators. Each experiment was performed till the population of thrips reached at Economic Threshold Level (ETL). In this manner, we calculated the mortality in the experimental units.

ECONOMIC THRESHOLD LEVEL (ETL)

Economic threshold is related to the economic value of the crop, of course, a beneficial ratio between the cost of production and the cost gained in yield. It may be defined as the level of control of the pests at economically viable cost– to reduce the pest population so as to save economic injury to the crop.

- Economic thresholds = action threshold.
- *Et al*ways lowers than EIL (economic injury level).

STATSTICAL ANALYSIS

In order to confirm the progressive data towards the desired research results, statistical analysis of the data with T-test was done as in the following pages and thus the results were obtained.

Sample – 1

Gain in percentage reduction of alive number of *Scirtothrips dorsalis* during first release and second release.

(48.5 – 20.8), (52.4 – 27.6), (59.02 – 33.9)

x_i = 27.7, 24.8, 25.12

Sample – 2

Gain in percentage reduction of alive number of *Scirtothrips dorsalis* during second release and third release.

(68.2 – 48.5), (74.02 – 52.4), (82.32 – 59.02)

y_i = 19.7, 21.62, 23.3

$\bar{X}$(Mean of 1st Sample) = $\frac{27.7+24.8+25.12}{3}$

$$\bar{X} = \frac{77.62}{3}$$

$$\bar{X} = 25.8$$

$\bar{Y}$ (Mean of 2nd Sample) = $\frac{19.7+21.62+23.3}{3}$

$$\bar{Y} = \frac{64.62}{3}$$

$$\bar{Y} = 21.54$$

The Sum of Square Deviation

$$\sum (x_i - \bar{X})^2 = (27.7 - 25.8)^2 + (24.8 - 25.8)^2 + (25.12 - 25.8)^2$$

$$= (1.9)^2 + (1)^2 + (0.68)^2$$

$$\sum (x_i - \bar{X})^2 = 5.07$$

$$\sum (y_i - \bar{Y})^2 = (19.7 - 21.54)^2 + (21.62 - 21.54)^2 + (23.3 - 21.54)^2$$

$$= (1.84)^2 + (0.08)^2 + (1.76)^2$$

$$\sum (y_i - \bar{Y})^2 = 6.5$$

S = Standard Deviation

$$S = \sqrt{\frac{\Sigma(x_i-\bar{X})^2+\Sigma(y_i-\bar{Y})^2}{n_1+n_2-2}}$$

Degree of Freedom

$$d.f = n_1 + n_2 - 2$$

$$S = \sqrt{\frac{5.07+6.5}{3+3-2}}$$

$$S = 1.7$$

Null Hypothesis (H_0)

Assume that difference between gain in percentage reduction of alive *Scirtothrips dorsalis* during two successive releases is not significantly different.

$$|t| = \frac{\bar{X} \sim \bar{Y}}{S\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$

$$|t| = \frac{(25.8-21.54)}{1.7\sqrt{\frac{1}{3}+\frac{1}{3}}}$$

$$|t| = 3.08$$

OBSERVATIONS

In order to find out the feasibility and viability of the biological control method on chilli crop to reduce the infestation of thrips, experiments were made in the net house conditions by releasing the natural enemies of thrips of course, predators and parasitoids and the percentage of reduction in the population of thrips was observed and examined. The population of thrips started reducing instantly, but after some time the infestation of thrips began to increase as the predators and parasitoids as selected in number could not consume the increasing number of thrips with as much speed as the population of thrips multiplied. So, a week after the equal number of predators and parasitoids was again released and then the population of thrips began to decrease rapidly. At the third release of the predators and parasitoids, the reduction in the population of thrips accelerated fast, and, thus, viable results were obtained.

Table 1: Effect of Predator; *Amblyseius cucumeris* on the population of *Scirtothrips dorsalis* in Chilli field of First Net House during the year 2014-15

Experimental Microplot	First Release				Second Release (After 1 Week)				Third Release (After 1 Week)			
	Initial No. of S.d.*/ Plant	No. of A.c. release**	Avg. No. of alive S.d. after 1 day	% reduction	No. of remain-ing S.d.*/ Plant	No. of A.c. release	Avg. No. of alive S.d. after 1 day	% reduction	No. of remain-ing S.d.*/ Plant	No. of A.c. release	Avg. No. of alive S.d. after 1 day	% reduction
I	45	40	35.60	20.8	70.4	40	36.5	48.5	36.5	40	11.60	68.2
II	45	45	32.54	27.6	63.5	45	30.2	52.4	33.50	45	8.70	74.02
III	45	50	29.71	33.9	57.6	50	23.6	59.02	30.6	50	5.41	82.32

* Mean Value, ** All the number of predators were releases in each micro-plot

S.d. = *Scirtothrips dorsalis*, A.c = *Amblyseius cucumeris*

DISCUSSION

In the net house of first microplot the initial number of *S. dorsalis* was 45. In order to find out the effect of biological control, the predators in number 40 were released. A day after, it was found that the reduction percentage in the population of the thrips was recorded at 20.8%. The plot was supervised properly and second release of predators was done after one week at the rate of 40. At that time the remaining number of *Scirtothrips dorsalis* was 70.4. After one day, it was further examined and on examination it was found that the percentage reduction was 48.5%. In the same microplot, the third release was done after two weeks of the first release and 40 predators were again released to control the remaining number of *Scirtothrips dorsalis*. At the close of the third week, the average number of alive *Scirtothrips dorsalis* was examined by proper methods and it was found 11.60 at the reduction percent of 68.2%.

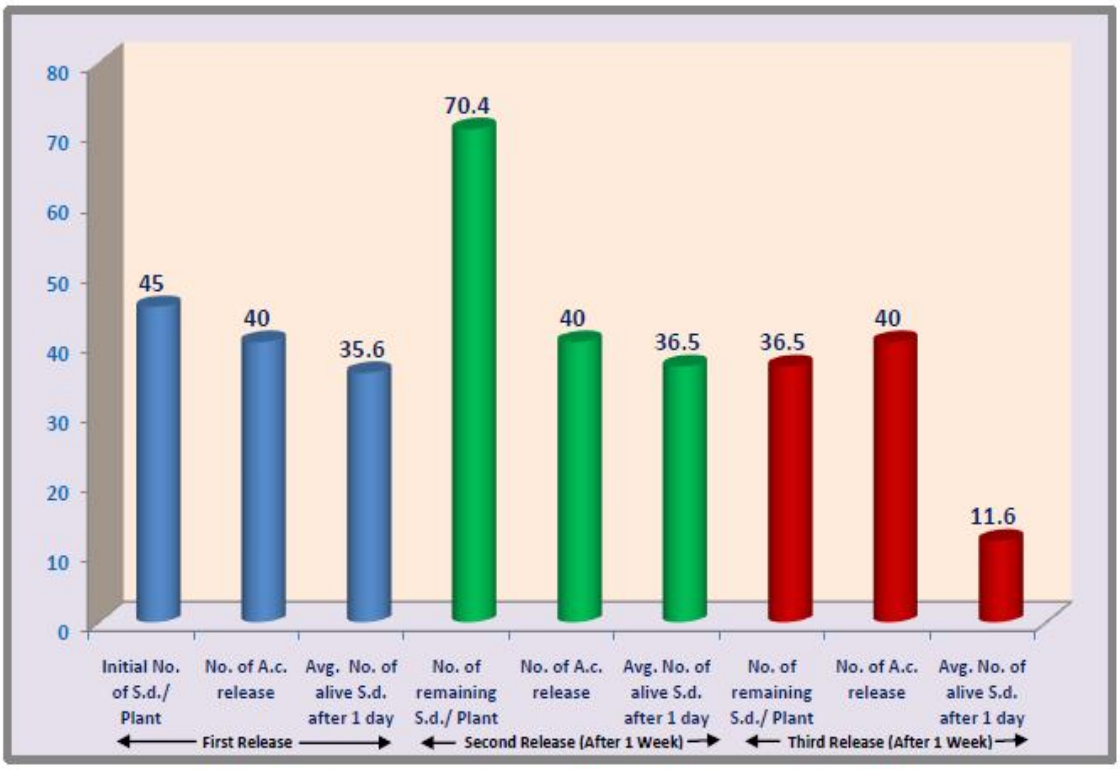

Fig. 1: Effect of Predator; Amblyseius cucumeris on the population of Scirtothrips dorsalis in Chilli field of First Net House during the year 2014-15 (I Microplot)

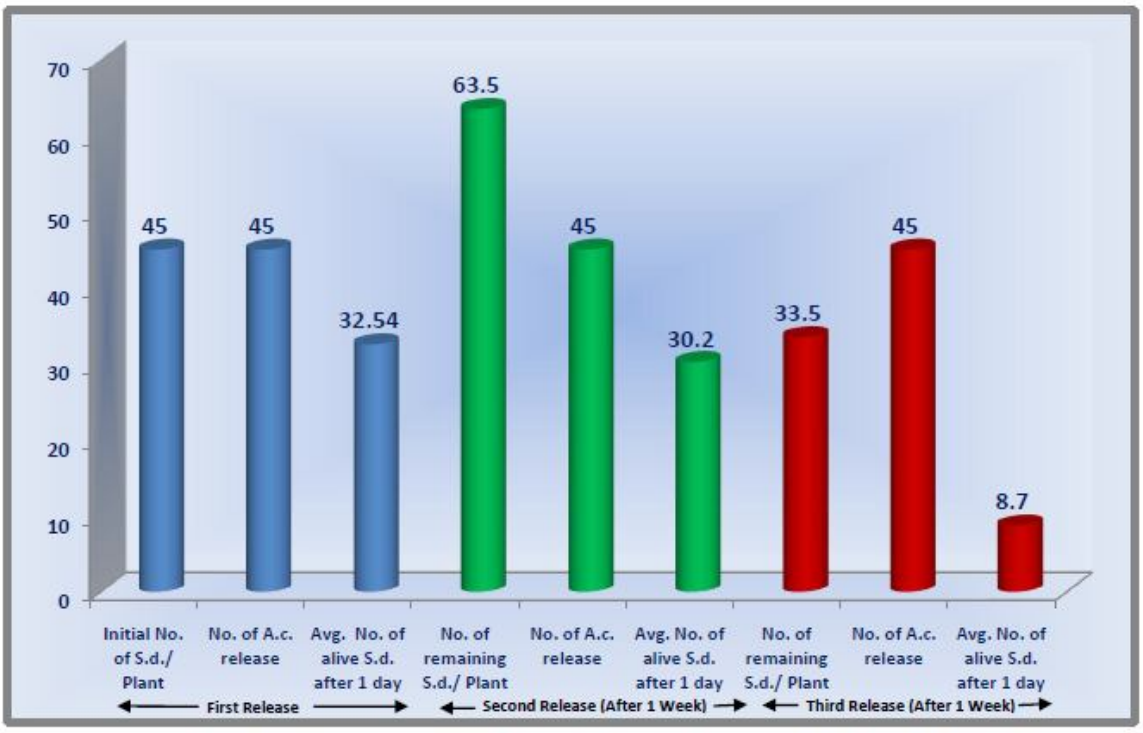

Fig. 2: Effect of Predator; *Amblyseius cucumeris* on the population of *Scirtothrips dorsalis* in Chilli field of First Net House during the year 2014-15 (II Microplot)

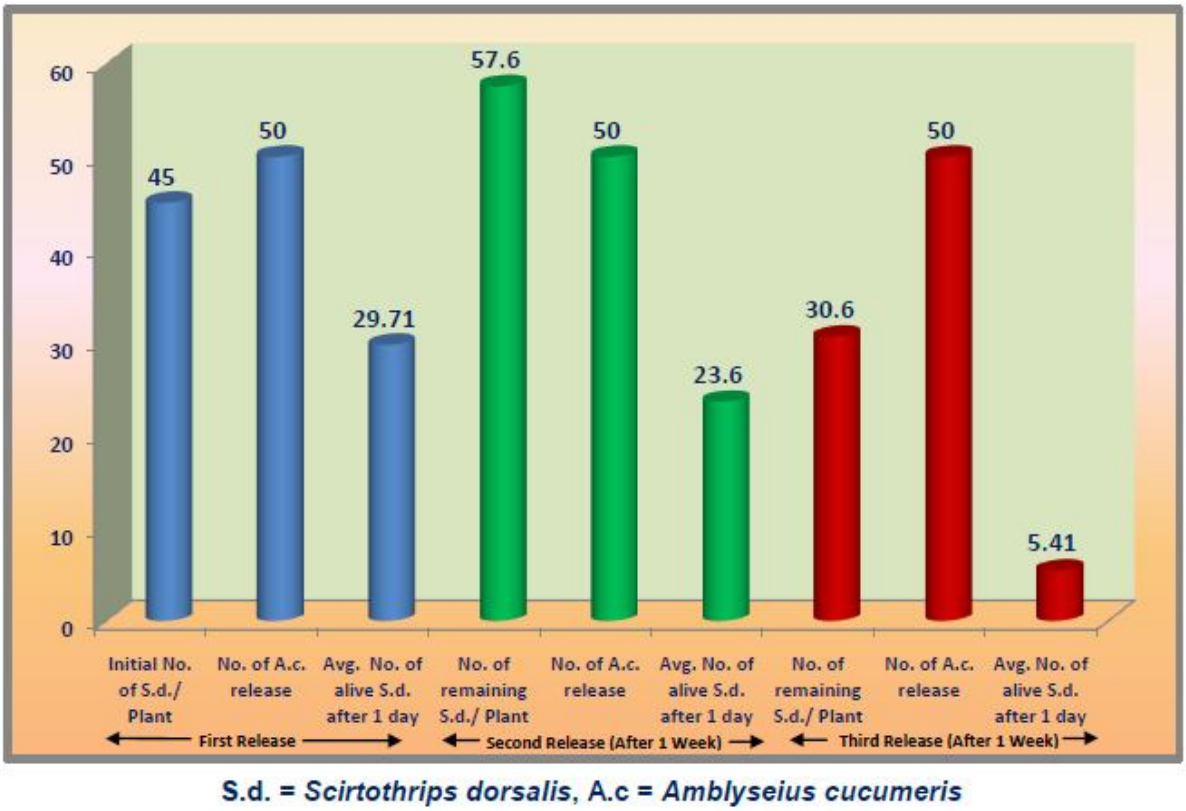

Fig. 3: Effect of Predator; *Amblyseius cucumeris* on the population of *Scirtothrips dorsalis* in Chilli field of First Net House during the year 2014-15 (III Microplot)

In the second microplot of the net house, the initial number of *Scirtothrips dorsalis* was the same (45) of *Scirtothrips dorsalis* as in the first microplot. But, the rate of the release predators was increased. It was made 45 in number in order to see its effectiveness in a better way. A day after of the first release of the predators, it was recorded that the reduction rate in the thrips population was at 27.6%. The second release of predators was done after one week as it was done in the first microplot. When the effect was examined, it was found that the number of *Scirtothrips dorsalis* after one day was reduced by 52.4%. In the third release the remaining number of thrips, *Scirtothrips dorsalis* was found 33.50 after examination. In our examination after one day, the average number of alive *Scirtothrips dorsalis* was calculated as 8.70 and the rate of reduction of thrips was reduced at 74.02%.

The same examination was done at the same net house in the third microplot with the release of more number of predators i.e. 50. The initial number of *Scirtothrips dorsalis* was same as the first and second microplot i.e. 45. A day after observation it was found that the average number of alive *Scirtothrips dorsalis* was 29.71 and in this manner the rate of reduction was recorded at 33.9%. At the time of the second release (after 1 week) of the predators the remaining number of *Scirtothrips dorsalis* was 57.6. When the result was examined over *Scirtothrips dorsalis* population, it was found that the average number of alive *Scirtothrips dorsalis* reduced to 23.6 at the rate of 59.02%. The third release was done after one week of the second release again at the same rate of predators i.e. 50. At this time the remaining number of *Scirtothrips dorsalis* was recorded as 30.6. When the effect was seen and examined, it was found that the average of alive *Scirtothrips dorsalis* reduced considerably. It was only 5.41 per plant. In this manner, the total reduction rate came to 82.32% of the first net house.

CONCLUSION

Null Hypothesis (H_0):

Assume that difference between gain in percentage reduction of alive *Scirtothrips dorsalis* during two successive releases is not significantly different.

Tabulated $| t |_{0.05}$ for Degree of Freedom 4 is 2.78 which is smaller than 3.08. Hence, Null Hypothesis (H_0) is accepted at 5% level of significance. The gain in % reduction of the two samples is not significantly different and it is accepted at 5% level.Thus, we conclude statistically that the percentage gain in *Scirtothrips dorsalis* reduction is affected by the release of predators; *Amblyseius cucumeris*, during two successive releases.

REFERENCES

1. Butani D.K. (1976): Pests and Diseases of Chillies and Their Control. *Pesticides*, Vol. 10, pp. 38-41.
2. Boucek, Z. and Askew R.R. (1968): Palearctic Eulophidae (excl. Tetrastichinae) (Hym. Chalcidoidea). Index of entomophagous insects 3. Le Francois, Paris, pp. 260.
3. De Bach P. (1964): The Scope of Biological Control. P. 3-20. *In* Biological Control of Insect Pests and Weeds (P. DeBach, editor). Chapman and Hall Ltd., London, p. 844.
4. Dent D. (2000): Insect Pest Management. 2nd Edn., CABI Publishing, Massochusetts, U.S.A., ISBN : 0-85199-340-0, p. 366.
5. Dogramaci, Mahmut, Arthurs, Steven, P., Chen, Jijanjun, Mckenzie, Cindy, Irrizary, Fabieli and Osborne, Lance (2011): Management of Chilli Thrips; *Scirtothrips dorsalis* (Thysanoptera: Thripidae) on peppers by *Amblyseius swirskii* (Aeari: Phytoseiidae) and *Orius insidiosus* (Hemiptera: Anthocoridae). *Biological Control*, 59: 340-347.
6. Gupta M. (2017): *Macrotracheliella nigra*, (Minute Pirate Bug): A Anthocorid Predator on Rasping and Sucking thrips pests of chilli, *Capsicum annuum* in district Aligarh of Western Uttar Pradesh During the Year 2015-2016. Asian journal of Agriculture and Life Sciences, Vol.2, pp. 31-35.