UNIVERSITY OF SINDH JOURNAL OF ANIMAL SCIENCES
Vol. 1, Issue 1, pp: (21-26), November, 2017
Email: editor.usjas@usindh.edu.pk
Website: http://sujo.usindh.edu.pk/index.php/USJAS
ISSN(E): 2523-6067
ISSN(P): 2521-8328
© Published by University of Sindh, Jamshoro
(USJAS)

# Comparative Effectiveness of Egg and Larval Stages of *Chrysoperla carnea* against Sucking Insect Pests of Cotton Crop

**Faqeer Muhammad Chandio, Syed Shahzad Ali Bukhari, Muhammad Irfan Jat**

Department of Entomology, , Faculty of Crop Protection, Sindh Agriculture University, Tandojam, Pakistan

**ARTICLE INFORMATION**

***Article History:***
Received: 20th August, 2017
Accepted: 30th October 2017
Published online: 16th November 2017

***Author's contribution***
FMC is the principle researcher designed the idea of study. SSABA write up manuscript prepared the tables. Further, MIJ collected the samples confirmed its identification and noticed the effectiveness of Egg and Larval Stages.

***Key words:***
*Chrysoperla carnea,*
Sucking insect pest, Comparative effectiveness,
Egg and larval stages,
Cotton crop.

*Similar Index Report:* 14 %

## ABSTRACT

To determine the comparative effectiveness of egg and larval stages of *Chrysoperla carnea* against sucking insect pests of cotton crop this study was designed. . The study was conducted on the local cotton variety i-e SADORI during 2014. The experiment was designed in Randomized Complete Block Design (RCBD) with 03 treatments and 04 replication. The study indicated that the maximum infestation of *Amrasca bigutulla bigutulla* (2.75±0.26a) *Thrip tabaci* (13.06±0.19a) and *Bemisia tabaci* (7.17±0.30a) on cotton field were observed when crop was in the pre-treatment observation, whereas, after releasing of bio-control agent (*Chrysoperla carnea* larvae) in fields it was observed that the minimum infestation of *Amrasca bigutulla bigutulla* (0.49±0.22c), *Thrip tabaci* (5.40±1.29c), *Bemisia tabaci* (1.33±1.18c) and the maximum predator population of *Chrysoperla carnea* (1.47±0.17a) in the month of July. Further, in the month of August the minimum monthly mean infestation of *Amrasca bigutulla bigutulla* (0.42±0.25c), *Thrip tabaci* (4.32±1.31c) and *Bemisia tabaci* (1.55±1.2c) were recorded and the maximum predator population of *Chrysoperla carnea* (1.85±0.13a) were also observed. Similarly, the result also revealed that the maximum predator population of *Chrysoperla carnea* (1.79±0.18a) and minimum monthly mean infestation of *Amrasca bigutulla bigutulla* (0.14±0.15c) *Thrip tabaci* (1.33±0.74c) and *Bemisia tabaci* (0.58±0.45c) were recorded in the month of September.

## 1. INTRODUCTION

Cotton is one of Pakistan's major Kharif (summer) crops which significantly contributes to the national economy. Cotton production is forecast at 9.0 million 480 lb bales (11.5 million 170 kg bales or 1.96 million metric tons (MMT). In the light of the significant reduction in the 2015crop, forecasting the 2016 crop is more an exercise in anticipating farmer behavior than analyzing agronomic factors or considering rolling or Olympic averages. Faced with Cotton area is forecast at 2.7 million hectares, a four percent drop from the from the official 2015/16 low cotton prices in 2015, formers opted to limit their use of insecticides to control cotton insect pests estimate as farmers are expected to shift some area away from cotton but not a lot (USDA GAIN: Pakistan Cotton and Products Annual 2016/17). Now a days, most of the cotton producing countries are facing severe problem due to emergence of cotton insect pests such as, insect sucking pests and bollworms which impact on reducing cotton production severely, the intensity of their attack sometimes so severe that they can cause major destruction of the crop [1]. In Pakistan cotton crop is attacked by a variety of sucking insect pests, out of which jassid, *Amrasca bigutulla bigutulla*, whitefly, *Bemisia tabaci*; thrips, *Thrips tabaci* are the most important [2]. Sucking insect pests have been reported to cause seed cotton loss up to 4.6% [3]. Farmers mostly rely on pesticide sprays to control insect pest. The repeated use of pesticide sprays is dangerous for the target and non-targeted

***Corresponding Author***: faqeermuhammadchandio@gmail.com

fauna of insects and for human health. Now therefore, target to reduce over reliance and ill effects of pesticide for pest management can be achieved through development of alternative pest control strategies. Biological control that involves use of predators and parasitoids is the key component of pest control strategy in an integrated manner [4]. The efficiency of *Aphidius matricariae* (Haliday), *Aphidoletes aphidimyza* (Rondani) and *Chrysoperla carnea* in controlling aphid species, *Aulacorthum solani* (Kaltenbach), *Macrosiphum euphorbiae* (Thomas), *Nasonovia ribisinigri* (Mosley) and *Myzus persicae* (Sulzer) in green house. All predators and parasitoids did not give satisfactory control to aphids. Only application of *C. carnea* resulted in reasonable aphid control. The augmentative use of *C. carnea* is very sustainable for crop insect pest reduction [5]. The use of chemicals has so far been considered the most effective means of control of the pests. Since the use of pesticides is wrought with several disadvantages, a biological control program based on integrated pest management is a more rational strategy [6]. Biological control by the use of predator *C. carnea* has also gained importance for pest management in Pakistan. Some recent studies provide a crucial example of release sites for lacewings against *Bemisia tabaci* (Genn) in cotton Zia *et al*., [7] observed to manage the population of aphids on wheat by releasing of *C. Carnea* [8]. Depicted results *C. carnea* can be used as an effective biological control agent for successful implementation of integrated pest management program to reduce the use of insecticides and save foreign exchange spent on pesticides import. The evaluation of *C. carnea* releases in the field showed that the releases of its larvae had better survival compared to the releases in egg form. The release of the second-instars larvae have proven very successful for the control of the green peach aphid in peppers, tomato an eggplant [9]. Lacewings commonly are sold and dispensed as eggs or adults, whereas, larval releases may sometimes be more effective. Eggs are less reliable because of the early releases and weather factors eggs did not hatch. Probably because of poor weather is extremely cold or hot at faster rates. At this moment, it is crucial to evaluate the biological and economic advantages of releasing one or the other developmental stages of *C. carnea* to devise efficient methods for introducing the role of various larval stages. Following the above facts, field studies were conducted to evaluate the field efficacy of different instar larvae of *C. carnea* against sucking insect pests.

## 2. MARERIALS AND METHODS

The experiment was conducted on to study the comparative effectiveness of egg and larval stages of laboratory reared predator*, C. carnea* in cotton crop against sucking insect pests. For experimentation conventional cotton variety Sadori was sown by plant protection division at experimental farm Nuclear Institute of Agriculture Tandojam (NIA). *C. carnea* neonate larvae about 100 in number, 250 eggs /card were obtained from bio-control laboratory reared culture at 26± 2 oC.

### 2.1 *Monitor the pre-treatment infestation of sucking insect pest*

The local or Desi cotton variety named Sadori was sown by plant protection division at experimental farm about half acre (25 meter in length and 15 meter in width) was distributed among four replication. Five plants were tagged from each replication to observe the infestation of sucking insect pest by counting top middle and bottom portion of plant for monitoring economic threshold level.

### 2.2 *Releasing of mass reared C. carnea*

The Ist instar (neonate) larvae of green lace wings predator were obtained from the laboratory culture reared on artificial diet at $26\pm2^{0}$C. For experimentation about 100 larvae of mass reared *C. carnea* and 250 eggs/card were released in experimental field against cotton insect sucking pests i.e. jassid *Amrasca bigutulla bigutulla* ,thrip *Thrips tabaci*(Lind),whitefly *Bemisia tabaci* (Genn) to monitor the comparative effectiveness of egg and larval stages of *C. carnea.*

### 2.3 *Observation recorded*

1st reduction of infestation was recorded from top, middle and bottom portion of plants from treated and untreated (control) plot.

### 2.4 *Statistical analysis*

All data were presented as mean values of 03 replicates. Data were analyzed statistically using analysis of variance (ANOVA) the method described by the Steel *et al.,* [10] Statistical software Statistix Version 8.1, Analytical Software. The significance of differences among means was compared by using Least Significant Difference (LSD) test.

## 3. RESULTS

The study was conducted in the cotton season 2014, to investigate the comparative effectiveness of egg and larval stages of *C. carnea* in cotton field. The

infestation level of cotton sucking insect pests i.e., jassid, *Amrasca bigutulla bigutulla* thrips, *Thrips tabaci* and white fly, *Bemisia tabaci* was in all three Randomize Complete Block Designs (RCBD).

The result in (Table-1) indicates for pretreatment observation, the infestation of jassid, *Amrasca bigutulla bigutulla* (2.75±0.26) thrip, *Thrip tabaci* (13.06±0.19) and white fly, *Bemisia tabaci* (7.17±0.30) was recorded in untreated (control) plot whereas, the infestation level (2.40±0.21), (12.75±0.22) and (6.57±0.31) was observed in the larva plot while, (2.55±0.22), (12.95±0.17) and (6.37±0.29a) was observed in the egg plot.

The results revealed in (Table- 2 ab) in the month of July on infestation show that, the maximum infestation of *Amrasca bigutulla bigutulla* (1.53±0.09) *Thrip tabaci* (12.07±0.21), and white fly, *Bemisia tabaci* (6.85±0.11) was recorded in the 1st and 3rd week of July in untreated (control) plot respectively, whereas, minimum infestation level of *Amrasca bigutulla bigutulla* (0.45±0.24) *T. tabaci* (4.33±1.1) and *B. tabaci* (1.03±1.17) noticed in the 1st and 4th week of July in the treatment where bio-control (*C. carnea)* larvae were released. Followed by infestation level of *Amrasca bigutulla bigutulla T. tabaci B. tabaci* it was observed in the 1st and 3rd week of July in the treatment where *C. carnea* eggs alone. Similarly, maximum predator population and was examined in 3rd and 4th week of July in the treatment where *C. carnea* larvae) released respectively. *C. carnea* eggs released alone while minimum predator population was recorded in 1st and 2nd week of July in untreated (control) plot. The results exposed in (Table. 3ab) suggest that in the month of August there is maximum infestation of *A. bigutulla bigutulla*, *T. tabaci* and *B. tabaci* was in the 4th week, whereas, the minimum infestation level of *A. bigutulla bigutulla , T. tabaci* and *B. tabaci* was observed in the 3rd . Followed by infestation level of *A. bigutulla bigutulla*, *T. tabaci* and *B. tabaci* in the 4th week. *C. carnea* eggs released in 1st week of August while, maximum predator population of *C. carnea* in the 4thweek in the 3rd week in the 1st week of August in the treatment where bio-control agent *C. carnea* larvae released respectively .Followed by in the 4th week in the 1st week of August in the treatment where *C. carnea* eggs release alone. whereas, minimum predator population in field.

The results indicated in (Table-4ab) in the month of September on infestation and predator population, show that the maximum infestation of *A. bigutulla bigutulla*, *T.tabaci* and *B.tabaci* was recorded in the Ist week i-e (1.48±0.17) (4.62±0.22), (2.75±0.11) in 2nd (0.58±0.03), (4.83±0.08), (2.65±0.18) in 3rd and (0.71±0.03), (4.91±0.05), (2.62±0.12) in the 4th week of September in untreated plot respectively in the 4th week of September where bio-control *C. carnea* larvae released. Followed by infestation level of *A. bigutulla bigutulla, T.tabaci* and *B. tabaci* in the 1st week of the September where *C. carnea* eggs released only. Maximum predator population of *C. carnea* in the 4th i-e (1.96±0.25) in the 3rd (1.88±0.23) in the 2nd and (1.54±0.02) in the Ist week of September in the treatment where *C. carnea* larvae were released and minimum predator population i-e (0.34±0.02) in the 1st week (0.35±0.02) in the 2nd (0.33±0.02) in the 3rd and (0.36±0.03) in the 4th week of the September in untreated plot.

**Table 1 Pre-treatment observation on the pest species**

| Treatments | Infestation | | |
|---|---|---|---|
| | Jassid | Thrip | White fly |
| **Egg** | 2.55±0.22a | 12.95±0.17a | 6.37±0.29a |
| **Larva** | 2.40±0.21a | 12.75±0.22a | 6.57±0.31a |
| **Control** | 2.75±0.26a | 13.06±0.2a | 7.17±0.30a |

**Table 2 Weekly observations on the infestations level of sucking pests and predator population of *C.carnea* in July**

**a.**

| Treatments | First week | | | | Second week | | | |
|---|---|---|---|---|---|---|---|---|
| | Jassid | Thrip | W.fly | Predator | Jassid | Thrip | W.fly | Predator |
| **Egg** | 0.70±0.22b | 7.44±1.24b | 2.00±1.13b | 0.54±0.01b | 0.81±0.17b | 6.90±1.32b | 5.12±0.36b | 0.54±0.02b |
| **Larva** | 0.45±0.24c | 5.86±1.38c | 1.03±1.17c | 1.18±0.10a | 0.55±0.2c | 5.68±1.39c | 1.62±1.20c | 1.47±0.12a |
| **Control** | 1.52±0.09a | 12.07±0.21a | 6.15±0.31a | 0.12±0.011c | 1.43±0.08a | 11.77±0.36a | 6.85±0.26a | 0.12±0.02c |

**b.**

| Treatments | Third week | | | | Fourth week | | | |
|---|---|---|---|---|---|---|---|---|
| | Jassid | Thrip | W.fly | Predator | Jassid | Thrip | W.fly | Predator |
| Egg | 0.80±0.20b | 6.93±1.25b | 5.60±0.47b | 0.77±0.13b | 0.61±0.24b | 5.63±0.99b | 3.30±0.97b | 0.82±0.16b |
| Larva | 0.54±0.22c | 5.75±1.32c | 1.62±1.14c | 1.52±0.27a | 0.45±0.24c | 4.33±1.1c | 1.07±1.23c | 1.72±0.19a |
| Control | 1.53±0.09a | 11.60±0.16a | 6.85±0.11a | 0.14±0.01c | 1.50±0.06a | 9.15±0.42a | 6.62±0.31a | 0.16±0.08c |

**Table 3 Weekly observations on the infestations level of sucking pests and predator population of *C.carnea* in August**

**a.**

| Treatments | First week | | | | Second week | | | |
|---|---|---|---|---|---|---|---|---|
| | Jassid | Thrip | W.fly | Predator | Jassid | Thrip | W. fly | Predator |
| Egg | 0.67±0.21b | 5.88±0.96b | 2.35±1.08b | 1.12±0.12b | 0.67±0.23b | 6.06±1.05b | 2.56±1.05b | 1.06±0.03b |
| Larva | 0.39±0.23c | 4.39±1.11c | 1.52±1.11c | 1.64±0.11a | 0.47±0.24c | 4.63±1.17c | 1.56±1.11c | 1.55±0.01a |
| Control | 1.42±0.10a | 9.37±0.23a | 6.35±0.14a | 0.32±0.01c | 1.53±0.08a | 9.85±0.43a | 6.47±0.20a | 0.37±0.01c |

**b.**

| Treatments | Third week | | | | Fourth week | | | |
|---|---|---|---|---|---|---|---|---|
| | Jassid | Thrip | W. fly | Predator | Jassid | Thrip | W. fly | Predator |
| Egg | 0.74±0.24b | 5.72±1.42b | 2.71±1.24b | 1.15±0.11b | 0.69±0.23b | 5.22±1.33b | 2.75±1.10b | 1.30±0.09b |
| Larva | 0.46±0.26c | 4.57±1.46c | 1.59±1.30c | 2.07±0.20a | 0.38±0.27c | 3.72±1.50c | 1.54±1.28c | 2.16±0.21a |
| Control | 1.64±0.07a | 10.88±0.48a | 7.32±0.26a | 0.35±0.01c | 1.65±0.27a | 9.77±1.41a | 6.92±1.24a | 0.38±0.05c |

**Table 4 Weekly observations on the infestations level of sucking pests and predator population of *C.carnea* in September**

**a.**

| Treatments | First week | | | | Second week | | | |
|---|---|---|---|---|---|---|---|---|
| | Jassid | Thrip | W. fly | Predator | Jassid | Thrip | W. fly | Predator |
| Egg | 0.23±0.07b | 2.34±0.55b | 1.20±0.37b | 1.23±0.01b | 0.64±0.25b | 2.75±0.52b | 1.25±0.41b | 1.23±0.10b |
| Larva | 0.10±0.08c | 1.18±0.69c | 0.43±0.46c | 1.54±0.02a | 0.20±0.29c | 1.35±0.72c | 0.68±0.46c | 1.88±0.23a |
| Control | 0.48±0.03a | 4.36±0.14a | 2.48±0.20a | 0.34±0.02c | 1.48±0.17a | 4.62±0.22a | 2.75±0.11a | 0.35±0.02c |

**b.**

| Treatments | Third week | | | | Fourth week | | | |
|---|---|---|---|---|---|---|---|---|
| | Jassid | Thrip | W. fly | Predator | Jassid | Thrip | W. fly | Predator |
| Egg | 0.27±0.08b | 2.40±0.66b | 1.25±0.40b | 1.28±0.07b | 0.27±0.12b | 2.65±0.61b | 1.38±0.35b | 1.30±0.06b |
| Larva | 0.13±0.10c | 1.30±0.78c | 0.56±0.47c | 1.96±0.25a | 0.13±0.13c | 1.37±0.77c | 0.65±0.43c | 1.78±0.24a |
| Control | 0.58±0.03a | 4.83±0.08a | 2.65±0.18a | 0.33±0.02c | 0.71±0.03a | 4.91±0.05a | 2.62±0.12a | 0.36±0.03c |

## 4. DISCUSSION

Cotton yield is reducing day by day because of many factors among which the major factor is direct damage caused by sucking insects i.e., *Amrasca bigutulla bigutulla, Thrip tabaci* and *Bemisia tabaci*, The present study was carried out to investigate the comparative effectiveness of egg and larval stages of *Chrysoperla carnea* in cotton field against jassid, thrip and whitefly under field conditions. The data point out that all the treatments were significantly superior over control. The maximum infestation of jassid , thrip and white fly was recorded in before treatments were applied in experimental field while, data was recorded on infestation level and predator population rate after releasing of bio-control agent. The minimum monthly mean infestation of *A. bigutulla bigutulla*, *T. tabaci* and *B.tabaci* was recorded and the maximum predator population of *C. carnea* was also observed in the month of July in biocontrol (larvae) plot whereas, the maximum infestation of *A. bigutulla bigutulla .T. tabaci B. tabaci* and minimum predator population was examined in untreated (control) plot. Followed by infestation level of *A. bigutulla bigutulla T. tabaci B. tabaci* and the predator population of *Chrysoperla carnea* in where eggs released alone. The minimum monthly mean infestation of *A. bigutulla bigutulla T. tabaci* and *B.tabaci* was recorded and the maximum predator population of Because of its abundance and broad habitat range it is extensively studied as an effective bio-control agent for most of the crop pests particularly. The effectiveness of laboratory reared *C. carnea* as an important predator of sucking insect pests in cotton fields [11]. *C. carnea* can be used as an effective biological control agent for successful implementation of integrated pest management program to reduce the use of insecticides and save foreign exchange spent on pesticides import. The efficiency of lacewing to control pests can be affected by many factors, including use of different predator instars which may be a crucial factor in the success of augmentative biological control. The evaluation of *C. carnea* releases in the field showed that the releases of its larvae had better survival compared to the releases in egg form. For example, releases of larvae have proven very successful for the control of the sucking insect in the field crop [12].

## 5. CONCLUSION

It may concluded from the present investigation that; *C. carnea* (Stephens) is an effective biological control against cotton sucking insect pest i.e. *Amrasca bigutulla bigutulla Thrip tabaci* and *Bemisia tabaci*. The approaches for bio-control *C. carnea* eggs and larvae were found effective. The predator population of *C. carnea* in cotton field was also observed in August and September.

## 6. CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

## REFERENCES

[1] G., O. Barrera, Simon, L. Villamizar, T. Williams and P. Caballero, "*Spodoptera frugiperda* multiple nucleopolyhedro viruses as a potential biological insecticide: genetic and phenotypic comparison of field isolates from Colombia" Biol Control. 58, 113-12, 2011

[2] Z, Ahmad "Insecticides Resistance Management in Cotton," Proc. ICAC-CCRI, Multan, Pakistan. :5-20, 1999.

[3] U.S., Satpute, D.N. Sarnaik and P.D. Bhalero, "Assessment of avoidable losses in cotton field due to sucking pests and bollworms," Ind. J. PI. Prot, 16(1): 37-39, 1988.

[4] R, J. Isaacs Tuell, A. Fiedler, M. Gardiner and D. Landis, "Maximizing arthropod mediated ecosystem services in agricultural landscapes: the role of native plants," Frontiers in Ecology and the Environment, 7:196-203, 2009.

[5] R.D. Gautam and A. Tesfaye, "Potential of green lacewing *Chrysoperla carnea* (Stephens) in crop pest management," New, Agric., 13: 147–58, 2002.

[6] M. Ahmed, Z.A. Zahir, N. Asghar and M. Asghar, "Inducing salt tolerance in mung bean through coinoculation with rhizobia and plant-growth-promoting rhizobacteria containing 1-aminocyclopropane-1-carboxylate deaminase," Canadian Journal of Micribiol, vol. 57 (7), pp. 578-589, 2011.

[7] K., F Zia. Hafeez, R. R. Khan, M. Arshad and U. Naeem-ullah, "Effectiveness of *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae) on the population of *Bemisia tabaci* (Homoptera: Aleyrodidae) in different cotton genotypes,"

Journal of Agriculture and Social Sciences, 4: 112116, 2008.

[8] J., M. Iqbal Ashfaq and A. Ali, "Management of aphids by augmentation of coccinellids and *Chrysoperla carnea* under field conditions on wheat," Pak. J. Agri. Sci., Vol. 45(1), 2008.

[9] M.J. Tauber, C.A. Tauber, K.M. Daane and K.S. Hagen, "Commercialization of predators: Recent lesson from greenlacewing (*Neuroptera:* Chrysopidae*: Chrysoerla*). American Entomologist, 46: pp. 26–38, 2000.

[10] R.G.D. Steel, J.H. Torrie and D.A. Dickey, "Principles and procedures of statistics: A biometrical approach. 3rd edition McGraw Hill Book Co. Inc. New York: pp. 400-428, 1997.

[11] D. Bar, D. Gerling and Y. Rossler, " Bionomics of the principal natural enemies attacking *Heliothis armigera* in cotton fields in Israel," Environmental Entomology, vol. 8, pp. 468-474, 1979.

[12] N.D. Usman, I.I. Inuwa and A.I. Iro, "The influence of unethical professional practices on the Management of construction projects in North-Eastern States of Nigeria," International Journal of Economic Development Research and Investment, vol. 3(2), pp. 124-129, 2012.