Testing of *Chrysoperla carnea* (S) against *Bimisia tabaci* in Bt. cotton crop under field conditions

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**Abstract**

The Green Lacewing, *Chrysoperla carnea* (Steph.) (Neuroptera: Chrysopidae) is a successful predatory insect; augmented for bio control practices especially for Integrated Pest Management. It is observed that green lacewing *C. carnea* (Steph.) has good potential of predation and caught good attention for its successful use against sucking insect pests. Currently it was evaluated for the management of white fly *Bemisia tabaci* infesting cotton crop. The data shown that the predator reduced white fly *B. tabaci* population significantly. Overall maximum population reduction was recorded in T-1 Chemical Control (6.01±3.75/leaf) followed by T-2 Bio-Control (green lacewing *C. carnea*) (6.84±3.90/leaf) as compare with control (8.50±4.93/leaf) While maximum population of Whitefly *B. tabaci* (10.40±5.75/leaf) recorded in non Bt. Control (NIAB-78). Acetamiprid 20SL has good toxicity recorded minimum predatory population (0.04/plant) in T-1 (Chemical Control plot); maximum were observed (0.3/plant) in T2 Bio-Control (Green Lacewing *C. carnea*) released plot.

**Keywords:** Bt. cotton, bio-control, *Chrysoperla carnea*, *Bimisia tabaci*, management

1. **Introduction**

Cotton (*Gossypium hirsutum* L.) is widely preferred cash crop and being source of raw material for textile industry, importance is always on rise. Cotton accounts for 5.2% of value added in agriculture and 1% of Gross Domestic Product; GoP (2017). Practiced across the Punjab and Sindh provinces of Pakistan, but the Punjab province is lead 80% production comes from Punjab while 18% from Sindh province (Ali et al., 2013) [3]. Cotton is attacked by a variety of insect pests, out of which jassid, *Amrasca devastans*; whitefly, *Bemisia tabaci*; thrips, *Thrips tabaci*; spotted bulbworm, *Earias spp.*; pink bulbworm, *Pectinophora gossypiella* and American bulbworm, *Helicoverpa armigera*, are the most important Ahmed (1999) [1]. Different approaches are applied by the farmers to manage these insect pests. In this aspect different approaches are applied in different ways. This includes the cultivation of Bt. cotton. Bt. cotton was among the first genetically modified (GM) crops to be used in commercial agriculture. A gene from the soil bacterium *Bacillus thuringiensis* (Bt.) was transferred to the cotton genome. (Matthews and Tunstall, 1994) [11]. In USA and China, Bt cotton was commercialized in the mid1990s, and today the technology covers about 30–40 per cent of the cotton area in both countries. (Carpenter et al. 2002) [4] transgenic plants have shown good results against targeted insect pests, but they are infested by the other insect pests such as sucking insects. Cotton whitely (*B. tabaci*) severely affect the economics of several cotton producing countries such as Pakistan due to direct damage by inhibition of photosynthetic activity and transmission of viral diseases to cotton that impairs the fiber quality (Ahmad, 1999) [4]. Natural enemies are a key component of IPM, and they are often recommended as the first line of defense in an IPM program (Lugojja et al., 2001) [9]. *Chrysoperla carnea*, one of the most important natural enemies has a great role in reducing the use of pesticides and environmental pollution in field crops and vegetables (Dean and Sterling, 1992) [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., 2008) [16].

The larval stage are more voracious feeder of soft bodied insect such as aphid, whitely, mealy bugs, thrips, mites, leaf hoppers, jassids, caterpillar and insect eggs (Ulhaq et al., 2006 and Sarwar and Salman, 2016) [14, 13]. In present study green lacewing, *C. carnea* a general predator evaluated as biological control agent in Bt. Cotton crop against the white fly (*B. tabaci*) insect one of the most important and heavy damaging sucking insect reported in Cotton under field conditions.
2. Materials and Methods
The research was conceded to appraise Chrysoperla carnea for the management of Whitefly Bemisia tabaci in Bt-Cotton crop under field conditions. Comparative population development of whitefly (B. tabaci) were recorded in NIAB-78 and Bt cotton. The crop was sown in the month of 2nd week of April at farmer’s field near Sindh Agriculture University, Tandojam. Sowing was done by dibbling method on ridges. All the inputs like fertilizer and irrigation were applied accordingly with recommended dosage.

The experiment was design with RCBD with four replications and four treatments;

| Treatment | Control Measure | Product          | Dose            |
|-----------|-----------------|------------------|-----------------|
| 01        | Chemical Control| Acetamaprid 20 SL| 200ml/Acre      |
| 02        | Biological Control| Chrysoperla carnea| 250-300 eggs/Card(15Cards/Acre) |
| 03        | Natural         | Check Bt         | -               |
| 04        | Natural         | Check Non Bt (NIAB-78) | - |
### Table 2: Mean Population of Whitefly, *Bemisia tabaci* (Genn.) on cotton crop under field conditions.

| Application | Pre Treatment | Post Treatment 3D | Post Treatment 7D |
|-------------|---------------|-------------------|-------------------|
|             | T1            | T2               | T3               |
| T4          | T1            | T2               | T3               | T4               | T3               | T4               |
| 01          | 5.77          | 5.51             | 5.23             | 5.22             | 3.26             | 5.56             | 5.49             | 5.11             | 4.17             | 4.28             | 6.40             | 6.38             |
| 02          | 5.39          | 6.17             | 6.19             | 6.27             | 3.10             | 4.90             | 5.19             | 6.18             | 4.24             | 4.46             | 5.30             | 5.46             |
| 03          | 12.30         | 12.45            | 13.43            | 16.23            | 7.10             | 7.23             | 13.16            | 14.66            | 9.33             | 9.51             | 14.00            | 16.50            |
| 04          | 11.34         | 10.7             | 15.14            | 15.97            | 8.14             | 9.30             | 15.20            | 14.17            | 7.10             | 7.23             | 13.16            | 14.66            |
| 05          | 10.05         | 8.07             | 12.09            | 13.08            | 6.10             | 7.25             | 10.11            | 11.66            | 7.10             | 7.23             | 13.16            | 14.66            |
| 06          | 10.05         | 8.07             | 12.09            | 13.08            | 6.10             | 7.25             | 10.11            | 11.66            | 7.10             | 7.23             | 13.16            | 14.66            |
| 07          | 4.77          | 5.51             | 5.87             | 12.22            | 2.26             | 4.56             | 5.49             | 11.11            | 3.10             | 4.10             | 5.50             | 9.90             |
| Mean        | 8.52          | 8.06             | 10.11            | 11.7             | 5.15             | 6.57             | 9.25             | 10.6             | 5.65             | 6.13             | 9.40             | 11.2             |

### Table 3: Comparative Control Percentage difference between Chemical and Bio-Control

| Application | Observation | Chemical | *C. carnea* |
|-------------|-------------|----------|-------------|
| 1<sup>st</sup> | Pre-Treatment | -10.32   | -5.35       |
|             | Post-Treatment 3D | 40.6193 | -1.27       |
|             | Post-Treatment 7D | 34.84   | 33.12       |
| 2<sup>nd</sup> | Pre-Treatment | 12.92    | 0.32        |
|             | Post-Treatment 3D | -40.26  | 5.58        |
|             | Post-Treatment 7D | 20.00   | 15.84       |
| 3<sup>rd</sup> | Pre-Treatment | 8.41     | 7.29        |
|             | Post-Treatment 3D | 19.51   | -6.418      |
|             | Post-Treatment 7D | 19.55   | 20.98       |
| 4<sup>th</sup> | Pre-Treatment | 2.13     | -8.16       |
|             | Post-Treatment 3D | 51.34   | 17.55       |
|             | Post-Treatment 7D | 33.35   | 32.07       |
| 5<sup>th</sup> | Pre-Treatment | 25.09    | 29.32       |
|             | Post-Treatment 3D | 46.44   | 38.81       |
|             | Post-Treatment 7D | 46.04   | 45.06       |
| 6<sup>th</sup> | Pre-Treatment | 16.87    | 33.25       |
|             | Post-Treatment 3D | 39.66   | 28.28       |
|             | Post-Treatment 7D | 50.48   | 26.56       |
| 7<sup>th</sup> | Pre-Treatment | 18.73    | 6.13        |
|             | Post-Treatment 3D | 58.83   | 16.93       |
|             | Post-Treatment 7D | 36.36   | 25.45       |

### Table 4: Mean Population of green lacewing, *Chrysoperla carnea* (Steph.) in different treatments on cotton crop under field conditions.

| Observation Date | T1 | T2 | T3 | T4 | Mean |
|------------------|----|----|----|----|------|
| 01-06-16         | 0  | 0  | 0  | 0  | 0    |
| 04-06-16         | 0  | 0  | 0  | 0  | 0    |
| 07-07-16         | 0  | 0  | 0  | 0  | 0    |
| 15-06-16         | 0.1| 0.55| 0.25| 0.2| 0.275|
| 18-06-16         | 0.05| 0.85| 0.15| 0.15| 0.3  |
| 22-06-16         | 0.1| 0.5| 0.2| 0.2| 0.25 |
| 30-06-16         | 0.1| 0.35| 0.1| 0.15| 0.175|
| 03-07-16         | 0.05| 0.55| 0.15| 0.2| 0.2375|
| 07-07-16         | 0.05| 0.45| 0.1| 0.15| 0.1875|
| 15-07-16         | 0.05| 0.35| 0.1| 0.15| 0.1625|
| 18-07-16         | 0.1| 0.3| 0.15| 0.05| 0.15 |
| 22-07-16         | 0.05| 0.4| 0.15| 0.25| 0.2125|
| 31-07-16         | 0.05| 0.35| 0.15| 0.2| 0.1875|
| 03-08-16         | 0| 0.35| 0.2| 0.25| 0.2  |
| 07-08-16         | 0| 0.55| 0.2| 0.2| 0.2375|
| 15-08-16         | 0| 0.15| 0.05| 0.05| 0.0625|
| 19-08-16         | 0.05| 0.15| 0.1| 0.05| 0.0875|
| 23-08-16         | 0.05| 0.35| 0.05| 0| 0.1125|
| 30-08-16         | 0| 0.25| 0| 0.05| 0.075 |
| 02-09-16         | 0.05| 0.3| 0| 0.05| 0.1  |
| 06-09-16         | 0.06| 0.39| 0.13| 0.1| 0.17 |
| 15-09-16         | 0| 0.25| 0| 0.05| 0.075 |
| 18-09-16         | 0.05| 0.3| 0| 0.1| 0.1125|
| 22-09-16         | 0.05| 0.25| 0| 0.05| 0.0875|
| **MEAN**         | 0.04| 0.3| 0.092917| 0.110417| 0.13583 |
4. Discussion
In present study different management options were tested on Bt- cotton against most damaging sucking insect pest. Release of *Chrysoperla carnea* cards in cotton for reduction of population of white fly was compared with control. Whitefly population was lower in Bt-cotton control compared to NIAB-78 control. Pest infestation was recorded continuous after its appearance.

However, in Chemical Control; Whitefly population was significantly lower than Bt-control. Results further indicate that Acetamaprid (20SL) was toxic to *C. carnea* and lowest population of *C. carnea* was recorded in Acetamaprid (20SL) applied treatment. Ameta and Sharma (2005) recorded reduction in population of *A. gossypii*, *A. biguttula* and *T. tabacci* after application of Insecticide. Chaudhary et al. (2005) also reported that confidor was superior than Clothianidin in controlling the aphid and jassid populations in cotton.

Saleh et al., (2017) studied that *Chrysoperla carnea* is a major predator of some white fly, aphid and thrips. Mansoor-ul-Hasan (2015) experiment results shown that integration of bio control agents such as *Chrysoperla carnea* proved as effective as chemical control using recommended insecticides against sucking insect pests.

Hamid et al. (2020) released the larvae of *Chrysoperla carnea* against whitefly in a greenhouse. Adult, eggs and nymph of *Bemisia tabaci* were affected by *C. carnea*. Overall mean population of whitefly indicated positive correlation with the number of larvae introduced.

Hanumantharaya and Naik (2007) studied the release of *Chrysoperla carnea* grubs at 0.75 and 1.0 laks/ha. Starting from 43 DAS reduced the sucking pest (leaf hoppers, thrips, aphids and whiteflies) and bollworm *H. armigera* and increased the seed cotton yield. Wadhawa and Gill (2007) studied the biodiversity of natural enemies on Bt and non-Bt cotton hybrids and found that Bt cotton hybrid recorded higher population of *Chrysoperla carnea* spiders, *Geocoris* bug, and yellow wasps. Manju et al. (2007) investigated the effect of Bt- cotton fed aphids on the feeding potential and development of *C. carnea* and reported no variation in the feeding potential and development period of larvae of *C. carnea* fed on aphids feeding on Bt and non Bt cotton plants. They recorded significantly higher number of natural enemies on Bt – Cotton compared with non Bt- cotton.

5. Conclusion
Both the treatments (*Chrysoperla carnea* and Acetamaprid 20SL) suppressed the whitefly population. The Acetamaprid 20SL was toxic to *C. carnea* (predator); lowest population was recorded in chemical control plot.

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