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Full Length Article

Effectiveness of *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae) on the Population of *Bemisia tabaci* (Homoptera: Aleyrodidae) in Different Cotton Genotypes

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ABSTRACT

Present study was conducted to determine the effectiveness of *Chrysoperla carnea* in sustainable biological control programs. The experiment was conducted on six advanced genotypes of cotton cultivars viz. MNH-552, CIM-707, SLH-284, IRFH-901, CIM-496 and FH-115. *Bemisia tabaci* (Genn.) (Homoptera: Aleyrodidae) was used as a prey in the presence and absence of its natural predator, *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae). *Chrysoperla carnea* depicted maximum reduction of whitefly population (57.35%) in 4th week of August in MNH-552 followed by 2nd week of September in MNH-552 (57.14%), 3rd week of August in FH-115 (55.24%) and 4th week of August in FH-115 (54.09%). The minimum reduction of whitefly was observed in 2nd week of July in MNH-552 (23.56%), 2nd week of August in SLH-284 (28.43%) and 1st week of July in IRFH-901 (30.06%). So the use of *C. carnea* as bio-intensive IPM program reduced the insecticides and saved foreign exchange that spent on pesticide import.

Key Words: Whitefly; Biological control; Bio-intensive IPM; Predator; Cotton

INTRODUCTION

Outbreaks of cotton whitefly 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 (Henneberry *et al*., 1999; Ahmad, 1999). Commonly three management strategies have been reported including pesticide evaluation, biological control (the evaluation of augmentative releases of commercially available natural enemies) and cultural control to suppress whiteflies (Hoddle & Robinson, 2004). Twenty three species of predators reported from cotton field including Coccinelids, Chrysopids, Lagaeids and formicids (Cheema *et al*., 1980). *Chrysoperla carnea* is a common species with voracious polyphagous and active larvae (Kareim, 1998) has got a considerable attention as a biological control agent because of its ability to control a variety of insect pests having higher searching ability and wide adaptability in field than other predators because it attack wide host range both adults and soft bodied pests of crops (Morrison, 1985). *Chrysoperla carnea* is used in augmentative programs for sustainable crop pest suppression (Gautam & Tesfaye, 2002). The objective of the present experiment was to find out the performance of *Chrysoperla carnea* for the control of cotton whitefly to reduce the use of pesticides.

MATERIALS AND METHODS

Six cotton cultivars, viz. MNH-552, CIM-707, SLH-284, IRFH-901, CIM-496 and FH-115 were grown at PARS, Faisalabad in 2005 in randomized complete block design (RCBD) having two treatment groups for each variety with three replications.

Egg cards of *Chrysoperla carnea* obtained from bio-control laboratory of Department of Agri. Entomology, University of Agriculture, Faisalabad. These cards were installed in all treated replications @ 30,000 eggs/acre approximately after the interval of fifteen days during the crop season. The crop was surveyed daily for appearance of whitefly which observed on 01-07-2005. There afterwards, it was visited after an interval of a week's time till 15-09-2005 when presence of whitefly could no longer cause economic injury. Three plants selected randomly from each replication and population of whitefly counted from upper, middle and lower portion of each plant in both treated and untreated plot. The average population of whitefly per leaf was considered to be an indirect reflection of pest resistance in plants and role of bio control agent in controlling insect pests, under reference, in these studies. To see the effectiveness of bio-control agent, mean population of whitefly under study in treated (biological control) plot was compared with that of untreated (control) plot. The difference between treatment means for various parameters were subjected to Duncan's Multiple Range Test (Steel & Torrie, 1980) at 5% level of probability.

RESULTS AND DISCUSSION

MNH-552. The population of whitefly was significantly

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Fig. 1. Trend of Whitefly Population in MNH-552

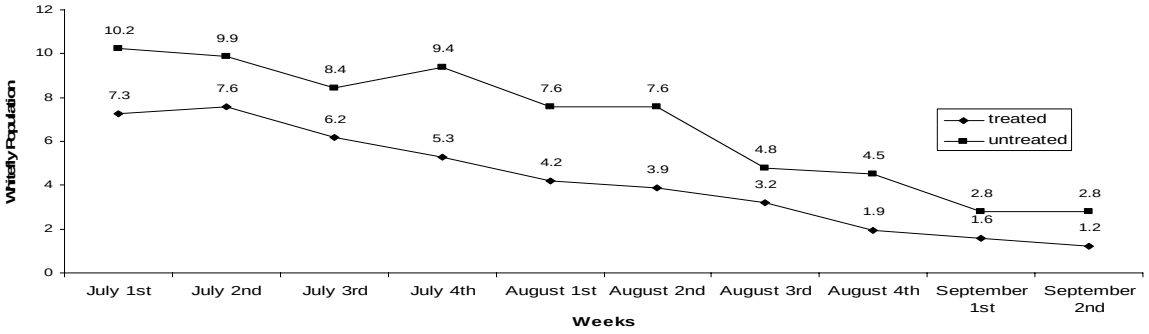


Fig. 2. Trend of Whitefly Population in CIM-707

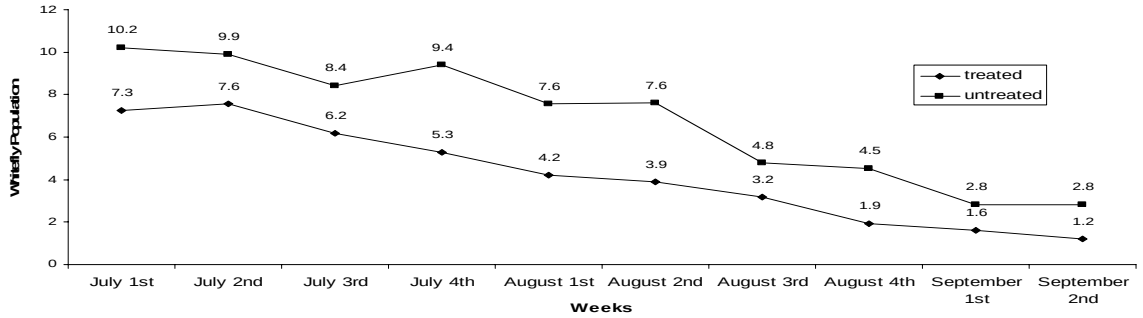


Fig. 3. Trend of Whitefly Population in IRFH-901

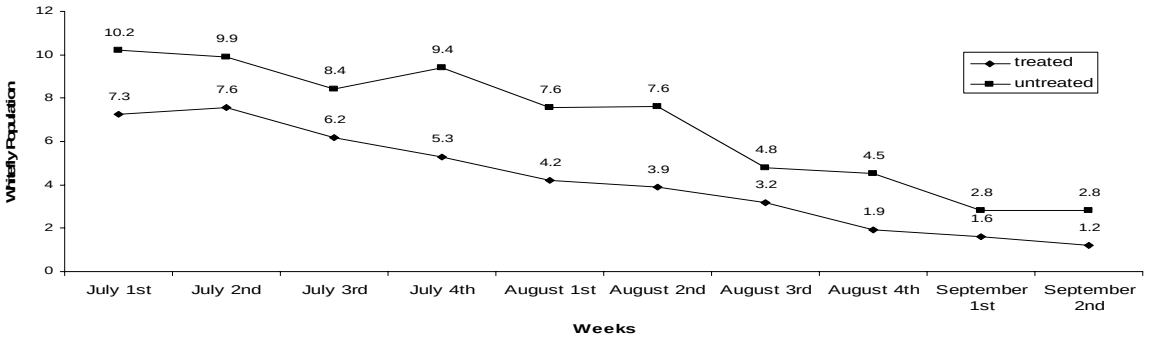
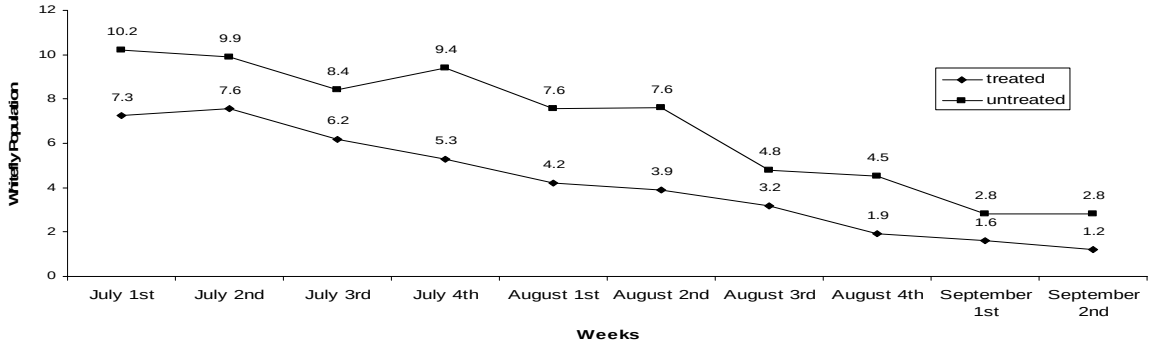


Fig. 4. Trend of Whitefly Population in SLH-284



maximum in both treated and untreated plots up to 4th week of July (Fig. 1). This population decreased gradually on the subsequent weeks of observations and the minimum population observed 1.2 and 2.8/leaf in treated and untreated

Fig. 5. Trend of Whitefly Population in CIM-496

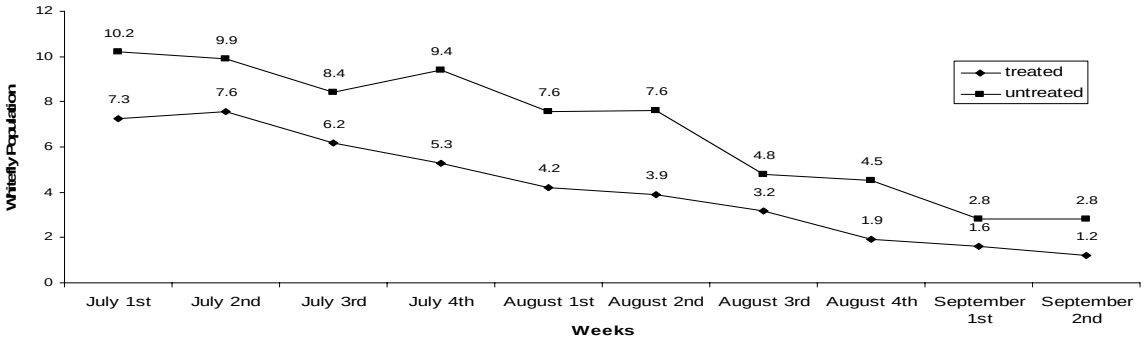


Fig. 6. Trend of Whitefly Population in FH-115

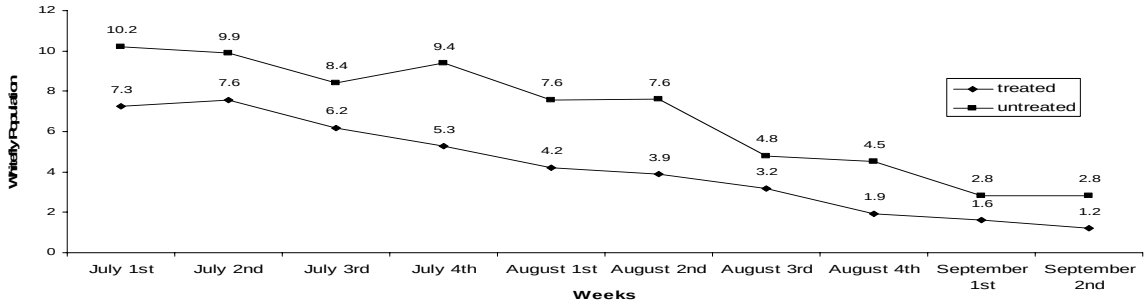
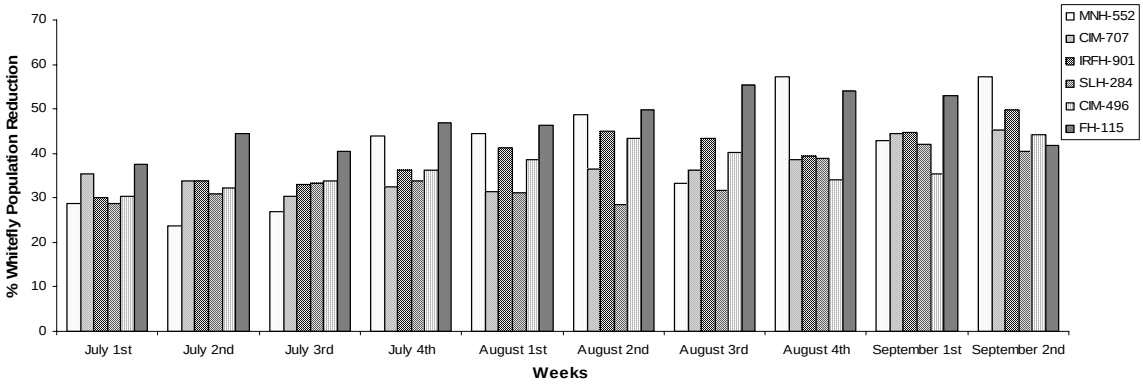


Fig. 7. Reduction of Whitefly population due to *Chrysoperla carnea* released plots (Treated Plots) during different weeks of observation



plots, respectively. The activity of *C. carnea* found maximum in 4th week of August, resulted in maximum reduction of whitefly 57.35% and followed by 57.14, 48.68, 44.49 and 43.87% on 2nd week of September, 2nd week of August, 1st week of August and 4th week of July, respectively. Therefore, abovementioned periods favored *C. carnea* to prey maximum, whereas 2nd week of July showed minimum reduction of whitefly 23.56%, which exhibited the minimum activity of *C. carnea* for predation (Fig. 7).

CIM-707. The population of whitefly recorded maximum on 1st week of July both in treated (6.2/leaf) and in untreated plots (9.5/leaf), which did not differ significantly with the whitefly population recorded up to 4th week of July in treated plot and 2nd week of July in untreated plots (Fig. 2). The minimum whitefly population was recorded to be 2.3 per leaf and 4.1 per leaf during 2nd week of September. *C. carnea* predated maximum on 2nd week of September that resulted in 45.14% reduction in whitefly population followed by 44.43, 38.57, 36.55, 36.20 and 35.31% on 1st week of September, 4th week of August, 2nd week of August, 3rd week of August and 1st week of July, respectively. The minimum activity of *C. carnea* observed on 1st week of August resulting in minimum reduction of whitefly 30.89% (Fig. 7).

IRFH-901. Maximum population (6.7 and 9.5 per leaf) was recorded in treated and un-treated plots, respectively on 1st week of July (Fig. 3). This population decreased gradually on the subsequent weeks both in treated and un-treated plots and reached to minimum of 2.6 and 5.1 per leaf respectively on 2nd week of September. A little variation found in population reduction of whitefly on various weeks of observation with maximum reduction in whitefly population 49.66% on 2nd week of September while minimum reduction of 30.06% on 1st week of July (Fig. 7).

SLH-284. A continuous and gradual decreasing trend in whitefly population per leaf observed both in treated and un-treated plots during various weeks of observation (Fig. 4) with maximum whitefly population recorded 6.3 and 8.9 per leaf in treated and un-treated plots, respectively on 1st week of July. This population was minimum on 2nd week of September 2.733 and 4.6 per leaf in treated and un-treated plots, respectively. The reduction of whitefly population recorded maximum on 1st week of September 41.98% followed by 40.58 and 38.80% on 2nd week of September and 4th week of August, respectively. The minimum reduction in whitefly population recorded 28.43% on 2nd week of August (Fig. 7).

CIM-496. The maximum population of whitefly recorded 6.20 and 8.90 per leaf in treated and un-treated plots respectively on 1st week of July (Fig. 5). This population decreased gradually on the subsequent weeks of observation in treated plots and un-treated plot. However, minimum population of whitefly recorded 2.4 and 4.3 per leaf in treated and un-treated plots, respectively in 2nd week of September. Maximum reduction in whitefly population observed 44.18% on 2nd week of September followed by 43.47, 40.32, 38.66 and 36.18% on 2nd week of August, 3rd week of August, 1st week of August and 4th week of July, respectively. The minimum activity of *C. carnea* observed on 1st week of July resulting in minimum population reduction 30.33% (Fig. 7).

FH-115. The results revealed highly significant difference among weeks both in treated and un-treated plots regarding whitefly population (Fig. 6). The maximum whitefly population recorded 6.4 per leaf on 1st week of July in treated plot and this population decreased gradually thereafter on the subsequent weeks. The minimum population observed 2.5 per leaf on 2nd week of September. The whitefly population recorded on 1st week of July was 10.3 per leaf in un-treated plots and this population increased thereafter and reached to 11.3 per leaf on 2nd week of July. The decreasing trend in population of whitefly was observed thereafter on the subsequent weeks and reached to a minimum of 4.3 per leaf on 2nd week of September. Variations were found in the data of percent reduction in whitefly population on various weeks 37.57% on 1st week of July and this reduction increased thereafter and reached up to 44.44% on 2nd week of July. The reduction in whitefly population was decreased on 3rd week of July 40.40% and again this reduction increased and reached up to 46.80% on 4th week of July. However the maximum reduction of 55.24% was observed on 3rd week of August (Fig. 7).

It was evident from the results that the effectiveness of *C. carnea* varied in different genotypes on various weeks of observation regarding whitefly population. *C. carnea* exhibited maximum effectiveness on 4th week of August for MNH-552, 1st week of September for SLH-284 and 3rd week of August for FH-115, whereas the maximum population reduction of whitefly was observed on 2nd week of September for MNH-552, CIM-707 and IRFH-901. *C. carnea*, being the generalist predator, consumes sucking pests (Chang, 1998) including 216-950 nymphs and adults of aphids and 510 nymphs of whitefly (Gautam & Tasfaye, 2002). Efficient pest management is accomplished by conservation of this predator and by managing immigrating adult population (Karahroudi & Hatami, 2003). Since half of the yield has been lost owing to recurring and imprudent appliance of chemicals so as to outcome in development resistance (Georghious & Lagunes, 1991), at that juncture, biological control is the paramount alternative, sustained by the augmentation of *C. carnea* in the containment of sucking pests particularly cotton whitefly *Bemisia tabaci* (Mohyuddin *et al*., 1997). Consequently, it is need of the day to persuade biological control based IPM by demonstrating and recommending it on large scale.

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