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UTILIZATION OF BIOCONTROL AGENTS IN THE MANAGEMENT OF OKRA PESTS

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ABSTRACT

Field studies on the efficacy of bio-control agents (lacewing and Trichograma) in the management of okra pests were carried out at the trial area of Entomology Section, Agriculture Research Institute, Tando Jam. Seeds of okra (Subz pari) were sown on 7th February 2017 in a complete randomized block design with three replications. The biocontrol agents, lacewing and Trichogramma (1300 eggs/card) each were released. Lacewing was found very effective against aphid, jassid and whitefly in the field. Aphid was found at early stage of crop and touched the maximum level in mid-February, therefore its population decreased quickly. Jassid increased linearly and was high after 6th week of observation and then decreased subsequently till picking of the crop. On the other hand, whitefly population increased linearly till 9th week of observation and then decreased and eventually disappeared from the crop on 19th week of observation. Trichogramma was observed as a main natural enemy of spotted bollworm of okra and reduced bollworm population. The population of bollworm increased slowly till harvesting of the crop. It is concluded from the present study that both the bio-control agents successfully lowered the populations of sucking and chewing insect pests and bollworms of okra. Lacewing was found effective against sucking insect pests while Trichogram efficiently controlled bollworms and are recommended for field applications. These bio-control agents can also be incorporated in IPM strategy.

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INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench), is one of the important vegetable crops, which is grown all over the year and used by everyone with great interest in Pakistan. Insect pests are the main factors to limit the cultivation of this crop. A number of pests like *Amrasca devastans, Earias vittella, Bemisia tabaci, Helicoverpa armigera, Thrips tabaci, Aphis gossypii* which attack cotton frequently have also been found to attack okra. Among them, *A. devastans, H. armigera* and *B. tabaci* are the notorious and major pests of okra (Lohar, 2001). Some of these pests also transmit pathogenic diseases (Dhaliwal et al., 1981; Sheedi, 1980). These insect pests are mostly controlled by synthetic insecticides. The indiscriminate use of these pesticides has been a main reason of environmental pollution and also resulted in killing of natural enemies. Therefore, the use of natural

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enemies could be the feasible alternatives to these chemicals and could occupy a central position in integrated pest management (Biesinger and Haefner, 2005; Sardana et al., 2005; Shivalıngaswamy et al., 2002; Telang et al., 2004).

This alarming situation has brought the attention of scientists towards eco-friendly management of okra and other crops (Kumawat et al., 2000). Predators and parasitoids are the key causes of decrease in insect pest population (Pfadt, 1980). Bio-control agents are being used for the eco-friendly management of insect pests (Al-Eryan et al., 2001; Bindu et al., 2003; Paulraj and Ignacımuthu, 2005; Singh and Brar, 2004). Predators and parasites are recognized as one of the important regulating factors to control the sucking and fruit boring pests. In order to avoid the losses produced by insects and to increase yield, it is important to control the pest populations at right time with suitable measures. The present study was carried out to determine the effects of natural enemies (*Chrysoperla carnea* and *Trichogramma* spp.) on insect pest populations of okra.

MATERIALS AND METHODS

The experimental work on the of utilization of biocontrol agents in the management of okra pests was carried out at Experimental Area of Entomology Section, Agriculture Research Institute, Tando Jam. The seeds of okra var. Subz parri were sown on 15th March, 2017 in a complete randomized block design with four replications. The bio-control agents (Lacewing and *Trichogramma*) were released in the field 45 days after sowing. There were three treatments as given in Table 1.

Table 1: Detail of treatments.

Treatment	Bio-control agents released	Eggs per card	No. of Cards per plot
T_1	Control	-	-
T_2	Lacewing	1300	5
T_3	Trichogramma	1300	5

The cards were changed with new ones after 15 days' gap. The cards were appended with the plant parts. Population fluctuation of insect pests was recorded on weekly basis by observing 30 randomly selected plants from each plot. Data were analyzed by analysis of variance (ANOVA) and differences among means were compared using LSD test. Population fluctuation was analyzed by simple logistic model (Southwood and Norton, 1973) by the following equation:

$Nt_i = Nt_0\, eRT$

Where Nt_i = number of pests at time interval i, Nt_0 = number of pests at time interval zero, e = the base of natural logarithm, R = the rate of increase and T = the time elapsed in days.

The equation was linearized as followed:

$\ln Nt_i = \ln Nt_0 + RT \;\; n \;\; r \;\; s \;\; F$

Where Nt_i = natural log of pests at time interval i, Nt_0 = the intercept of y on natural log pest population, R = the slope of curve and T = the time in days, n = the observations used in calculation, r = the correlation coefficient, s = standard deviation from regression and F- statistics.

The regression equations were computed using and the data transformed in log. This holds true for single species model with Deeveys type II population growth responses (Deevey, 1947).

RESULTS

Effect of biocontrol agents on sucking insect pests: Analysis of variance regarding effect of biocontrol agents on aphid population was highly significant (F=100.22 df=2, P< 0.01). Maximum reduction in aphid population was observed in treatment where lacewing was used. On the other hand, *Trichogramma* did not show a significant difference with control to decrease aphid population. The individual population of aphid in different treatments is given in figure 1.

It was observed that aphid appeared on okra crop at an early stage and touched the maximum level in mid of February. The population variation curve in regression analysis defined the pest population and time interval, which explained that pest number increased slowly from 1st week of November with a slope of 0.018X and r^2= 0.77 as shown in figure 2.

Efficiency of natural enemies against jassid revealed highly significant results (F=120.50 df=2, P< 0.01). The maximum number was observed in control treatment and the minimum number was recorded in the treatment where lacewing was applied followed by the treatment with Trichogramma. However, the difference between the two biocontrol agents was not significant as shown in figure 3.

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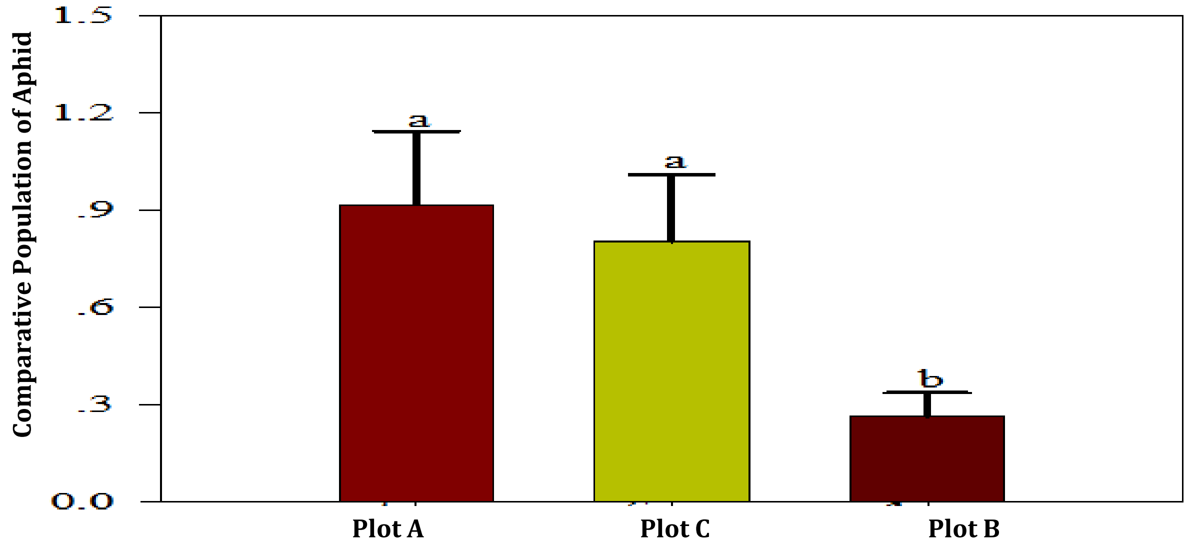

Figure 1. Effect of biocontrol agents against aphid.

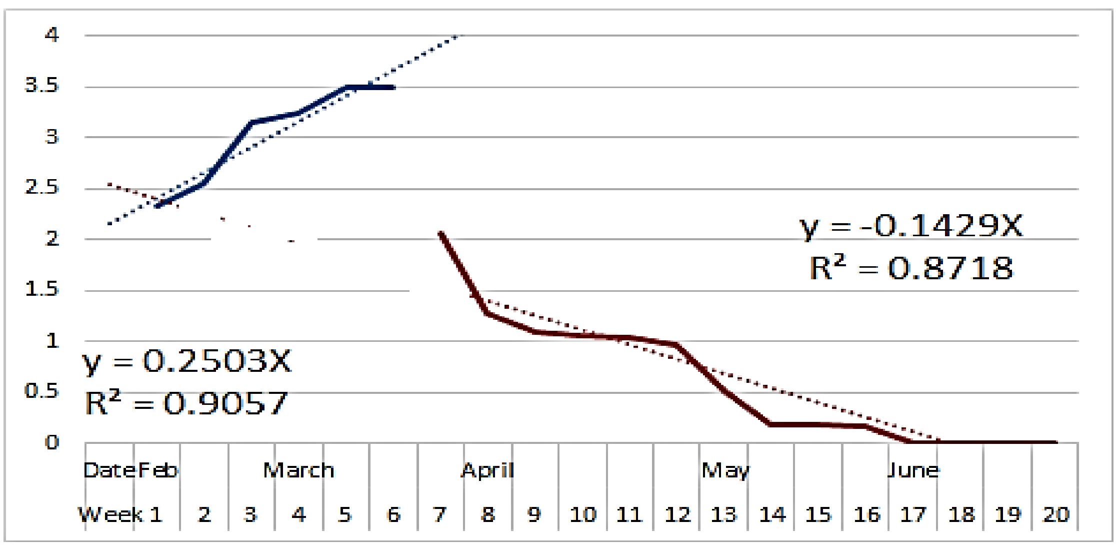

Figure 2. Population fluctuation of aphid in okra crop.

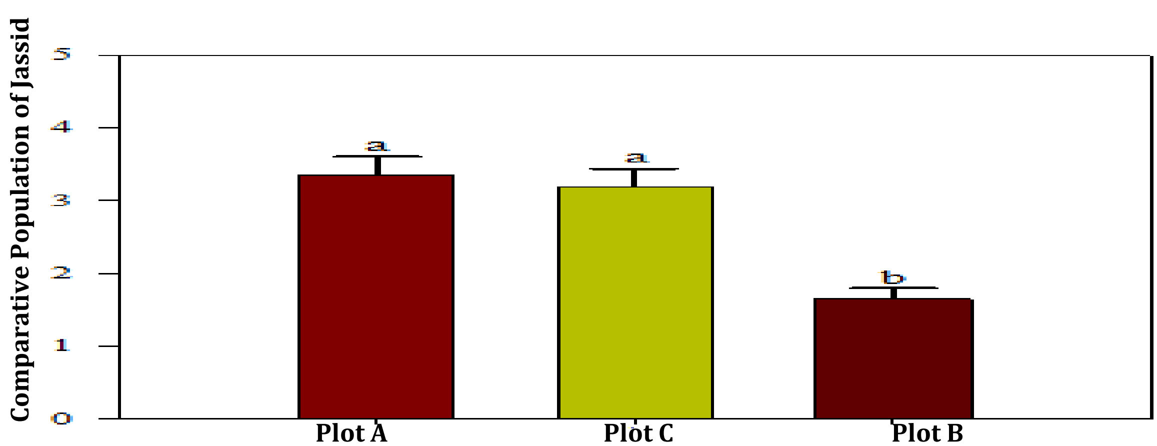

Figure 3. Effectiveness of biocontrol agents against jassid.

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It is clear from figure 4 that the number of jassid raised linearly and was high on the 6th week with growing trend 0.55X. İt indicted that one unit change in time is equal to change of 0.55 units in pest population. The R^2 (0.56) defined approximately 56% difference in pest population due to time interval. Thereafter, the number of pest decreased till picking of crop with a slope = -0.22X and R^2 = 0.90.

Feeding potential of biocontrol agents against whitefly demonstrated that maximum number was observed in the control treatment as indicated by ANOVA (F=120.50 df=2, P< 0.01). The minimum number of jassid was observed in the plots treated with lacewing followed by the plots treated with *Trichogramma*. The difference between the biocontrol treatments was found to be nonsignificant as shown in figure 5.

It is obvious from figure 6 that the population of whitefly reached its highest level till 9th week of observation with trend of increase 0.11X and $R^{2.}$ = 95. Thereafter the pest population decreased slowly, and it completely disappeared from crop on 19th week of observation. Regression analysis showed slope of -0.12X and R^2= 0.70.

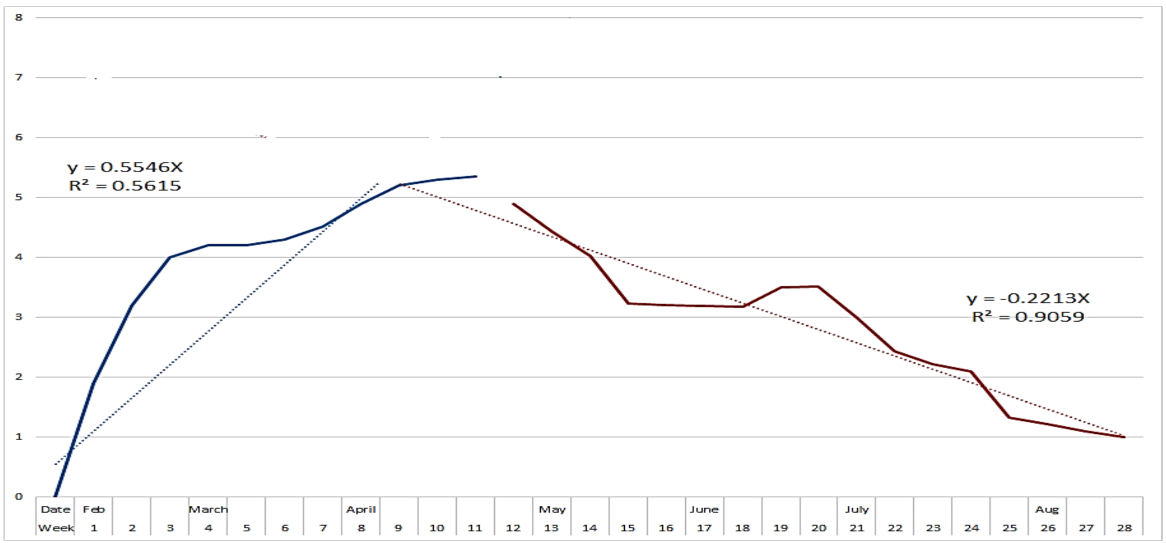

Figure 4. Population fluctuation of jassid in okra crop.

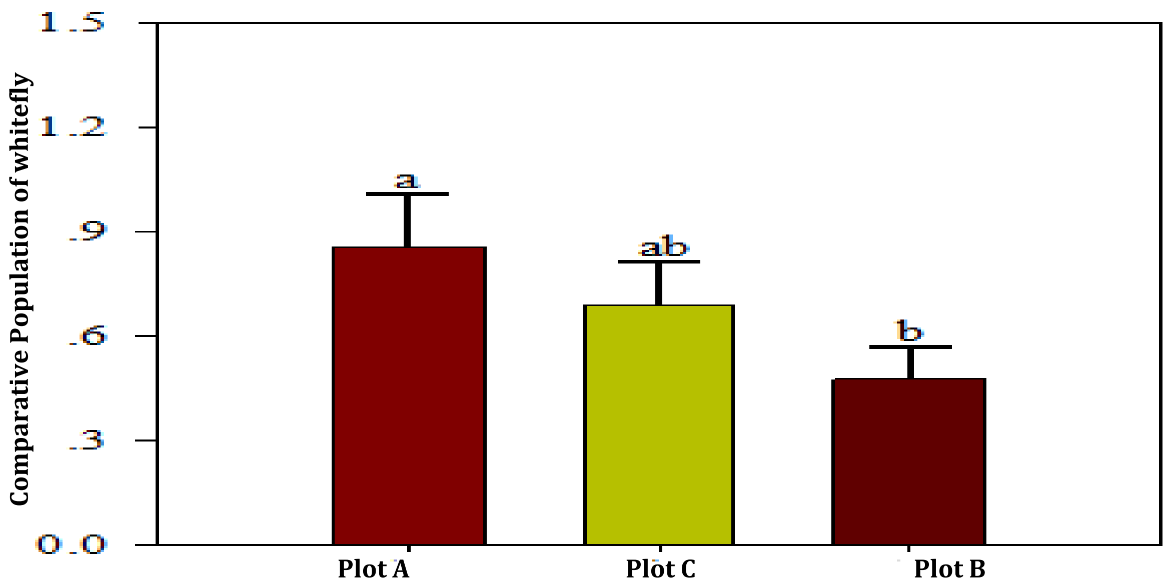

Figure 5. Feeding efficiency of natural enemies against whitefly.

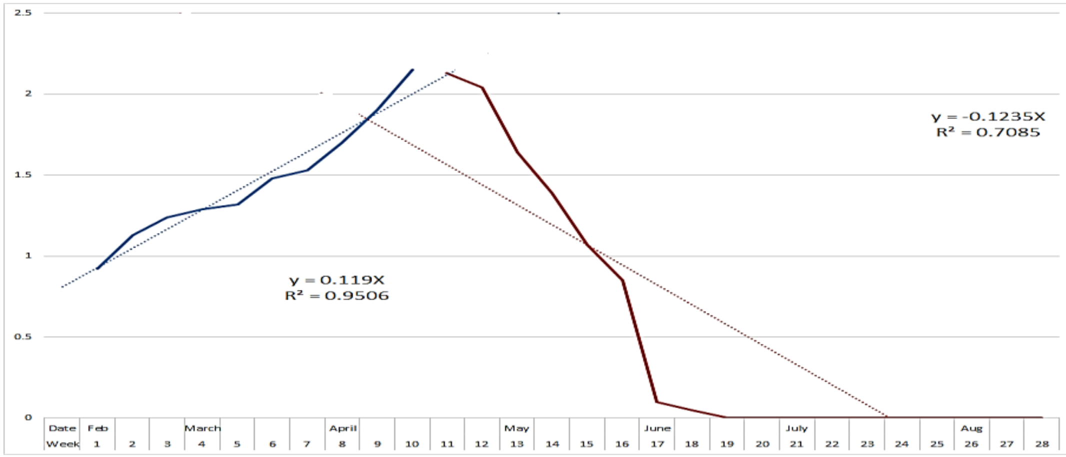

Figure 6. Population fluctuation of whitefly in Okra crop.

Chewing Insect Pests: The ANOVA revealed that there was a highly significant difference among treatments (F=21.64df=2, P< 0.01). The comparative feeding efficiency of natural enemies against spotted bollworm (SBW) showed that the population of the pest was the maximum in control plots. However, the population of the pest was found to be the minimum in *Trigogramma* treated plots followed by those treated with lacewing as shown in figure 7.

The result of population fluctuation of SBW divulged that the population increased slowly till harvesting of the crop with slope rate of increase 0.104X. İt showed that one unit change in time interval is equal to a change of 0.104 units in the population of pest as shown in figure 8.

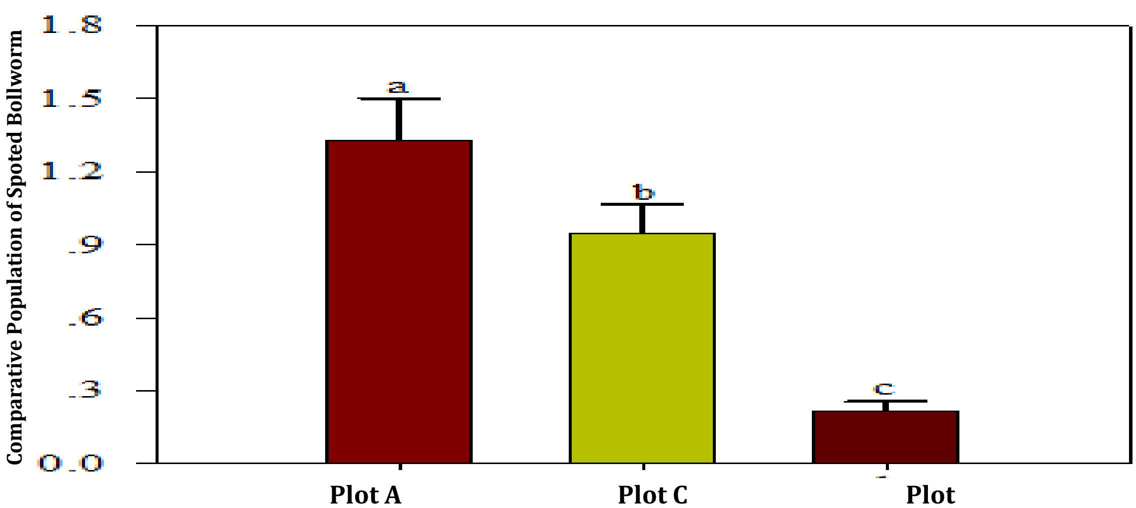

Figure 7. Effectiveness of biocontrol agents against spotted bollworm.

DISCUSSİON

The results of the present study showed promising effects of biocontrol agents (lacewing and Tricogramma) against sucking and chewing insect pests of okra. The major sucking insect pests observed during the vegetative growth were aphid, jassid and whitefly. Similar results were also reported by other researchers (Obeng-Ofori and Sackey, 2003) who reported that the major insect pests of okra were *Aphis gossypii* Glov, *Sylepta derogata* (F.), *Spodoptera litoralis*, *Bemisia tabaci* (Genn.) and *Zonocerus variegatus* (F.). These pests mostly damaged the leaves of okra. Likewise, Butani (1976) observed at least 20 species of insect pests which were found infesting okra crop.

The results reported in the present paper confirmed that the release of lacewing decreased 80% and 70.86 % populations of aphid and whitefly respectively. Jokar and Zarabi (2012) reported that *Chrysoperla carnea*

(Steph.) is the main predator of above pests. In our results, damage was found by fruit borer (*H. armigera*) at reproductive stage. This is in agreement with the results of Reddy and Puttaswamy (1985) who reported that *H. armigera* is a major pest of different crops at that stage. The findings of the present research are in conformity with those of Chang (1998). Gautam and Tesfaye (2002) reported that lacewing consumed 216-950 nymphs and adults of aphids and 510 nymphs of whitefly.

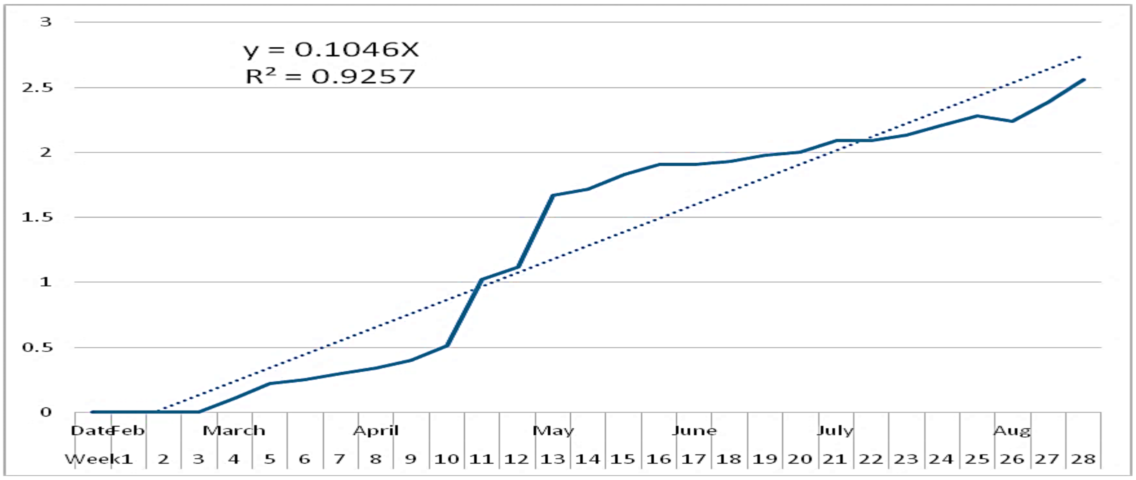

Figure 8. Population fluctuation of spotted bollworm in okra crop.

It can be concluded from the present results that *C. carnea* is a major predator and consumes a huge number of sucking pests. Similarly, Praveen (2001) in India assessed the efficiency of different biocontrol agents against okra pests. İt was found that *C. carnea* is very useful against the population of sucking in addition to the fruit borers pests. It is obvious from our data that the efficiency of both natural enemies varied against different pest species on okra. Regarding the efficiency against pest population, *C. carnea* and *T. chiloni* were observed highly active against sucking and chewing pests. Sman et al. (2012) reported that use of *Trichogramma* in combination with lacewing had a positive influence to reduce sucking and chewing pest population.

In the present assesment, *Trichogramma* was found a major natural enemy of chewing insect pests and reduced 74.14% and 89.38% populations of pink bollworm and spotted bollworm respectively as compared to controlled plots. Our results are in conformity with those of Reddy and Manjunatha (2000) who found that *Trichogramma* had positive effects against lepidopterous pest population in field crops. Shah (2008) reported that lacewing and *Trichogramma* were found the best biocontrol agents against fruit worm. Bolkan and Reinert (1994) also reported that *Trichogramma* had very high rates of natural enemy of eggs of various species of *H. armigera*.

CONCLUSION

It is concluded from the present study that both the biocontrol agents successfully lowered the populations of sucking and chewing insect pests and bollworms of okra. Lacewing was found effective against sucking insect pests while *Trichogramma* efficiently controlled bollworms and are recommended for field applications. These biocontrol agents can also be incorporated in IPM strategy.

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