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Effect of Different Densities of Trichogramma Chilonis (Ishii) against Lepidopteran Pests on Tomato

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Abstract:

An experiment was conducted to determine the effect of different densities of Trichogramma chilonis against lepidopteran pests on tomato against Fruit borers as an IPM strategy for pest control was carried out at farm field Hanif Jamali Farm near Tajpur, Tando Allahyar from February-May, 2012. Tomato "Hybrid-1359" variety was grown in a Randomized Complete Block Design (RCBD) on area of 1½ acre. The plot was divided into three (3) sub-plots, each comprised of ½ acre. Different Densities of Trichogramma chilonis i-e at 2500, 5000 and 10000 per plot were released against H. armigera at fortnightly intervals randomly. The results of present study reveal that maximum pre-treatment population of fruit borers appeared on tomato fruits in 1st week of February and increased gradually and reached to

its peak (4.08) per plant in May in control plot was higher than all the treated released plots and minimum population was recorded in T1 with (5.41 ± 1.16) per plant. The results further indicated that maximum mean population reduction (2.47±0.52) was recorded in T1 followed by (1.98±0.46) and (1.22±0.36) in T3. In treated released plots minimum population per plant were recorded as compared to control plot with (3.43±0.61) per plant. Furthermore, the study also indicated that maximum monthly reduction of borers population was recorded in T1 with (5.41 ± 1.16) followed by T2 and T3 with (4.46 ± 1.05) and (2.76 ± 0.83) respectively. However, minimum reduction (7.66 ± 1.38) was recorded in control (T4) plot. The LSD tests further confirmed that two separate groups A and B were formed indicating variation in control and released time intervals. However, the treatments among themselves were non-significant. The mean population of have positive correlation (r^2 = 0.3803) with temperature, as well as the relative humidity % also showed positive correlation (r^2 =-0.0599) with fruit borers population.

Key words: Densities, Lepidopteran, Tomato, Temperature and IPM

Introduction

Tomato (*Lycopersicon esculentum* Mill.) is one of the most important vegetables worldwide. As it is a relatively short duration crop and gives a high yield, it is economically attractive and the area under cultivation is increasing. Tomato belongs to the *Solanaceae* family. Tomatoes contribute to a healthy, well-balanced diet. They are rich in minerals, vitamins, essential amino acids, sugars and dietary fibers. Tomato contains vitamin B and C, iron and phosphorus. (Khalid, 2013). The fruits are eaten raw or cooked. Large quantities are used to produce soup, juice, ketchup, paste and powder (Yamashita, 2000). During the year 2008-09, the world tomato production exceeded 35 million tons, and stocks of finished commodity were almost exhausted at the beginning of the processing season. Demand on tomato processing products

increases by almost one million tons of raw material early (WPTC, 2009). The cultivation of tomato in Pakistan has been more intensified in the recent years. However, still the local production could not meet the domestic demand and sometimes tomato is imported. The instability in the tomato production is mainly associated with the high variation in area under tomato cultivation as well as other factors in relation to use of inputs and cultural practices (Khan *et al*., 2002).

Tomatoes are subject to attack by a large number of insect pests as aphids, leaf miners, stink bugs, and fruit worms cause minimal damage to the foliage. Among other insect pests of tomato that bore into fruits or buds include tomato fruit worm, tobacco budworm, tomato pinworm, vegetable leaf miner, blister beetles, cabbage looper, potato beetle, flea beetles, hornworms, aphids, green peach aphid, potato aphid, greenhouse whitefly, stink bug, Silver leaf whitefly, western flower, thrips, cutworms, southern potato wireworm, etc. (Krishna Moorthy *et al.,* 2003; Gajanana *et al.,* 2006). The use of insecticides provided temporary relief from insect pests but disrupted the ecological balance by eliminating natural enemies. In situations, where this ecological balance is disrupted, potential insect pests are relieved from the resistance imposed by their natural enemies and therefore, unhindered population growth resulted in pest outbreaks (Carvalho *et al.,* 2002). The name *Trichogramma* refers to a number of tiny wasps belonging to the family Trichogrammatidae. Most Trichogrammatid species will attack a range of host species. When the lepidopteran eggs are parasitized, the eggs turn black as the parasitoid develops inside. From these darkened eggs the adult wasps will eventually emerge (Bigler *et al*., 2003). The use of Trichogramma species as biocontrol agent is a recognized alternate of insecticides throughout the world. *T. chilonis* in Pakistan parasitizes the egg of *Acigona steniellsu* (Hanps.), *Agrotis ipsilon* (Hfn.), *Autographa nigrisigna* (Walk.), *Chilo*

infuscatellus (Sn.),*C. partellus* (Swinh.), *Emmalocera depressella* (Swinh.), *Heliothis armigera* (Hbn.), and *Spodoptera litura* (F.) indicating its potential for biological control of these insect pests (Van Lentern, 1987). The release density and time of release of the natural enemies also affect the parasitism level. (Farid *et al*. 2001) found that *T. chilonis* preferred one-day-old eggs as compared to 2 - 3 days old eggs; hence releases with shorter intervals developed prey densities to increase parasitism. (Guang *et al*. 1990 and Schmidt *et al*. 1999) found that *T. chilonis* significantly decreased its parasitization when the released once only and the eggs older than 48 hours at the time of encounter started decreasing parasitization. The host age at the time of parasitism appears to have implications on the fitness of progeny and parasitoids, which preferentially attack younger host eggs (Sequeira and Mackauer, 1994). Weekly release of parasitoid improved the prey density to a desired level.

Keeping the above points in view the present studies on effect of release time of egg parasitoid *T. chilonis* against tomato pests was carried out under field conditions.

Materials and Methods

The present research work on evaluation of different densities of *Trichogramma chilonis* against Lepidopteran pests on tomato was carried at Jamali Farm near Tajpur; district Tando Allahyar from January-May, 2012. Tomato "Hybrid-1359" variety was grown in a Randomized Complete Block Design (RCBD) on area of 1½ acre. The plot was divided into three (3) sub-plots, each comprised of ½ acre. Different Densities of *Trichogramma chilonis* i-e at 2500, 5000 and 10000 per plot were released against *H. armigera* at fortnightly intervals randomly. Pretreatment observations were recorded before release of cards/levels. Post-treatment observations were recorded at weekly intervals up to harvesting. Yield of treated

plots were compared with control plots. In the end, the data were analyzed statistically using Stat-8.1 computer program.

Results:

The study was carried out to determine the effect of different densities of T*richogramma chilonis* against lepidopteran pests on tomato at Hanif Jamali Farm, Tando Allahyar during Febuary to May, 2012.

The pre-treatment data in Table-1 indicate that the population of Fruit borer (*H. armigera)* appeared on tomato fruits in 1st week of February to last month of May. Control plot was higher than all the treated released plots and Highest population was recorded in T1 with (2.51±0.52) are followed by T2 (2.27±0.52) and minimum population was recorded on T3 (1.70±0.43) per plant.

The data in Table-2 indicated that maximum mean population was recorded in T1 (2.47±0.52) followed by (1.98±0.46) and (1.22±0.36) in T3. In treated released plots minimum population per plant were recorded as compared to control plot with (3.40±0.61) per plant.

Table-1 Mean Pre-treatment population of Fruit borer, *H. armigera* per plant in treated and control plot at Hanif Jamali Farm, from February to May, 2012.

Releases	Dates of Observation	No. of Trichogramma Eggs Released:				Temp: 0C	R.H%
		T1(2500)	T2(5000)	T3(10000)	T4 (Control)		
First	01-02-2012	3.12	2.84	3.32	2.78	12.00	49.00
Second	14-02-2012	2.82	2.68	2.26	2.98	15.75	44.00
Third	28-2-2012	2.72	2.32	1.98	3.08	21.50	61.00
Fourth	14-03-2012	2.54	2.20	1.32	3.44	22.00	43.00
Fifth	28-03-2012	2.54	2.20	1.32	3.44	21.25	45.00
Sixth	12-04-2012	2.54	2.20	1.32	3.44	23.50	53.00
Seventh	26-04-2012	2.50	2.08	1.12	3.54	20.25	49.00
Eighth	10-05-2012	2.38	1.82	0.62	3.84	26.50	55.00

Nineth	24-05-2012	1.48	2.14	2.11	4.08	30.50	40.00
	Mean ± S.E	**2.51±0.52**	**2.27±0.52**	**1.70±0.43**	**3.40±0.61**	**21.47±1.54**	**48.77±2.32**

T1=2500, T2=5000, T3=10000, T4= Control

Table-2 Mean Post-treatment population of Fruit borer, *Heliothis armigera* per plant in treated and control plot at Hanif Jamali Farm, from February to May, 2012

Releases	**Dates of Observation**	**No. of Trichogramma eggs released:**				**Temp: ^{0}C**	**R.H%**
		T1(2500)	**T2(5000)**	**T3(10000)**	**T4 (Control)**		
First	01-02-2012	2.74	2.44	2.14	2.88	12.00	49.00
Second	14-02-2012	2.68	2.49	1.90	3.12	15.75	44.00
Third	28-2-2012	2.58	2.10	1.58	3.20	21.50	61.00
Fourth	14-03-2012	2.54	2.08	1.28	3.38	22.00	43.00
Fifth	28-03-2012	2.46	1.98	1.00	3.48	21.25	45.00
Sixth	12-04-2012	2.40	1.90	0.88	3.60	23.50	53.00
Seventh	26-04-2012	2. 38	1.78	0.60	3.78	20.25	49.00
Eighth	10-05-2012	2. 32	1.58	0.30	3.94	26.50	55.00
Nineth	24-05-2012	2.18	1.49	1.36	3.56	30.50	40.00
	Mean ± S.E	**2.47±0.52**	**1.98±0.46**	**1.22±0.36**	**3.43±0.61**	**26.05±1.28**	**48.63±1.74**

T1=2500, T2=5000, T3=10000, T4= Control

The data in Table-3 indicate that maximum monthly reduction of Fruit borer *(H. armigera)* population was recorded in T1 with (5.41 ± 1.16) followed by T2 and T3 with (4.46 ± 1.05) and (2.76 ± 0.83) respectively. However highest reduction (7.66 ± 1.38) was recorded in control (T4) plot.

The ANOVA results also showed that treatments varied statistically significant at (P=<0.05) level indicating variance among treatments. The LSD tests further confirmed that two separate groups A and B were formed indicating variation in control and released time intervals. However, the treatments

among themselves are non-significant. The mean population of have positive correlation ($r^2 = 0.3803$) with temperature, as well as the relative humidity % also showed positive correlation ($r^2 = -0.0599$) with fruit borers population.

Table-3 Monthly mean population reduction of Fruit borer, *Heliothis armigera* on tomato per plant at Hanif Jamali Farm from February to May, 2012.

Monthly	Release Intervals (Treatments)				Temp: ^{0}C	R.H%
	T1	T2	T3	T4 (Control)		
February	8.00	7.03	5.62	9.02	17.81	49.25
March	4.86	4.06	2.28	6.86	22.88	50.50
April	4.07	3.68	1.48	7.72	30.56	43.75
May	4.72	3.07	1.66	7.05	32.94	51.00
Mean ± S.E	**5.41 ± 1.16**	**4.46 ± 1.05**	**2.76 ± 0.83**	**7.66 ± 1.38**	**51.91 ± 3.60**	**49.04 ± 3.50**

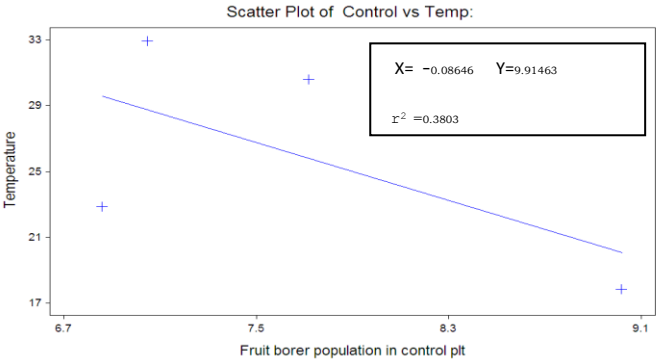

Fig: 1. Regression analysis between fruit borer in control plot v/s temperature

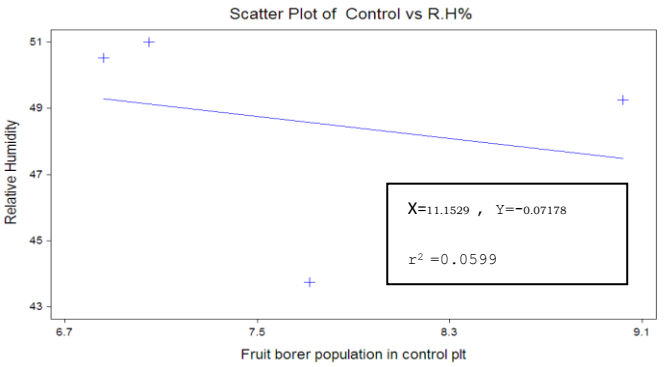

Fig: 2. Regression analysis between fruit borer in control plot v/s Relative Humidity

Discussion:

The present study on effect of different densities of Trichogramma chilonis against H. armigera revealed that maximum pest population of Fruit borers was recorded on control plot as compared to treated released plots. The study also depicted that maximum mean reduction population of Fruit bores H. armigera was recorded in T1 plot followed by T2, T3 and T4 plots respectively. The results of present study agree with those of Yolde et al. (2000) who released native strain of the predator T. chilonis (Ishii) against tomato fruit borer, H. Armigera. T. chilonis were found to be effective in a release ratio of 1/5 parasitoid l H. armigera and 1/20-40 predator/red spider mite, respectively, on tomatoes and cucumbers, but ineffective on eggplants. Khosa and Brar (2002) reported that the populations of the parasitoid T. chilonis from H. armigera eggs were laboratory-reared on eggs of Corcyra cephalonica.

The results present study also partially agree with those of Miura (2003) who evaluated the effectiveness of an egg parasitoid, T. chilonis Ishii, in suppressing numbers of the tomato fruit borer, H. armigera in three types of experiments, the response of T. chilonis to host density within a plant, the

response of T. chilonis to host density among plants, and the fluctuation of H. armigera populations with T. chilonis, The present study also in agreement with those of Ulrichs et al. (2006) who studied the release time of natural enemies and concluded that regular parasitoid releases at a low rate (50 wasp pupae/100 m2) have been conducted until parasitized H. armigera larvae were found in the crop.

The results also partially agree to those of Shahid et al. (2007) who evaluated T. chilonis (Ishii) against sugarcane stem borer (Chilo infuscatellus Snellen) in experimental plots of sugarcane in the field at Faisalabad, Pakistan. Among five treatments of T. chilonis, the treatment having 60,000 parasitized eggs per acre showed significant results causing 83% reduction in infestation of C. infuscatellus as compare to control having 30.67% infestation.

Conclusions

It was concluded from the present study that the effect of release of egg parasitoid Trichogramma chilonis (Ishii) on suppression of tomato fruit borer, H.armigera proved best in reduction damage severity. The best control of H.armigera can be achieved through the release of Trichogramma chilonis (Ishii) after every seven (7) days of interval. The yield was maximum abtained from 7-days plot as compared to 14 and 21 days plots. The effect of temperature and relative humidity was found positive with treatment means of H. armigera population in control plot.

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