EUROPEAN ACADEMIC RESEARCH
Vol. II, Issue 9/ December 2014

Impact Factor: 3.1 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Effect of Release Time on Egg Parasitoid *Trichogramma Chilonis* (ISHII) Against *Heliothis Armigera* (HBN.)

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Abstract:

An experiment was conducted to determine the effect of natural enemies on effect of release time of egg parasitoid Trichogramma chilonis (Ishii) against H. armigera as an IPM strategy for pest control was carried out at farmer field Hanif Jamali Farm near Tajpur, Tando Allahyar from February-May, 2012. The result showed that maximum pre-treatment population of H. armigera appeared on tomato fruits in 1st week of February and increased gradually reached to its peak (6.88/ plant) in May in control plot was higher than all the treated released plots whereas minimum population was recorded (5.17±1.13/plant) in 7 days interval. The result further indicated that maximum mean population reduction (1.29±0.28%) was recorded in 7 days interval followed by (2.01±0.35%) and (2.52±0.39%) in 21 days interval. In treated released plots minimum population per plant were recorded (5.22) as compared to control plot with per plant. Furthermore, the study also indicated that maximum monthly reduction of H.armigera population was observed (5.17±1.13%) in 7

days interval followed by 14 days interval and 21 days interval with (8.06±1.41) and (10.10±1.58%) respectively. However the minimum reduction (20.91±2.28%) was recorded in control plot. The results showed that the treatments varied significantly among treatments (P<0.05). The LSD tests further confirmed that two separate groups A and B were significantly different in control and released time intervals. The mean population of have positive correlation (r^2 = 0.9148) with temperature, as well as the relative humidity % also showed positive correlation (r^2 =-0.0002) with H.armigerapopulation.

Key words: Tomato, *H. armigera* (Hbn.), *T. chilonis* (Ishii), Biological control

Introduction

Tomato (*Lycopersicon esculentum* L.), a member of the Solanaceae family, is a widely grown delicious fruit vegetable crop adapted to wide range of soils and climate (Smith, 1994; Peralta and Spooner, 2001). The fruits are eaten raw or cooked. Large quantities are used to produce soup, juice, ketchup, paste and powder (Yamashita, 2000). 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).

A large number of insect pests damaged tomatoes from the time plants first emerge in the seed bed until harvest. 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. are the major insect pests of tomato crop (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. Natural enemies have been utilized to control the pests in different ways viz., augmentation, inoculation, attraction and conservation. The potential use of bio control agents are yet to be fully explored and evaluated in most pest systems (Ahmad *et al.,* 2011). However, there is an urgent need to develop strategies for effective use of natural enemies on field crops including vegetables because hazardous agrochemicals have created turbulence in the ecosystem (Carvalho *et al.,*2002).

The name *Trichogramma* refers to a number of tiny wasps belonging to the family Trichogrammatidae. *Trichogramma* have great potential as bio-control agents(Bigler *et al*., 2003).These are mass-produced and sold to farmers as small cards, which contain hundreds of parasitized eggs (Cheng, 1986; Ashraf *et al*, 1993).The use of Trichogramma species as biocontrol agent is a recognized alternate of insecticides throughout the world. *T. chilonis* (Ishii) 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 time and release density of the natural enemies 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).

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

Materials and Methods

The present research work on effect of release time of egg parasitoid *T. chilonis* (Ishii) against tomato pests i.e., fruit borer, *Helicoverpa armigera* was carried at the experimental area of Hanif Jamali Farm near Tajpur, Tandoallahyar from February - May, 2012.

Tomato "Hybrid-1359" variety was grown in a Randomized Complete Block Design (RCBD) with three replicates on 1.5 acre of area. Four treatments were applied in each replication. The four treatments included: T1 (eggs released after 7 days interval), T2 (eggs released after 14 days interval), T3 (eggs released after 21 days interval) and T4 (Control). 20000 *Trichogramma* eggs / acre were released. Whereas, 10000 *Trichogramma* eggs per replication were released. Pre-treatment observations from randomly selected 25 plants were recorded before releasing of natural enemy from treated and control plots. Post-treatment observations were recorded at weekly intervals. Eight (8) releases of natural enemies were carried out. The weekly data were grouped and means per plant and per month were calculated for interpretation of data.

The correlation between average population of *H. armigera* with temperature and relative humidity were done. The data were also statistically analyzed by using paired T-test between mean population of *H. armigera* in treated and control

plots. The yield of tomato were also recorded both in treated and control plots.

Results

The study was carried out to determine the effect of release time of egg parasitoid *Trichogramma chilonis* (Ishii) against *H. armigera* at Hanif Jamali Farm, Tandoallahyar during Febuary to May, 2012.

The pre-treatment data in Table-1 indicate that the population of *H.armigera* appeared on tomato fruits in 1st week of February and increased gradually.The maximum population was recoded (6.88 per plant) in May in control plot which was higher than all the other treated released plots and minimum population was recorded in T1 with (5.17±1.13) per plant.

The data in Table-2 indicated that maximum mean population reduction (1.29±0.28) was recorded in T1 followed by (2.01±0.35) and (2.52±0.39) in T3. In treated released plots minimum population per plant were recorded as compared to control plot with (5.22) per plant.

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

Week of Observation	Release Intervals (Treatments)				Temp: ^{0}C	R.H%
	T1 (7-days)	T2 (14-days)	T3 (21-days)	T4 (Control)		
1st Week February	3.12	2.84	3.32	2.96	12	49
2nd Week February	2.24	2.68	3.04	3.16	15.75	44
3rd Week February	2.84	3.16	2.84	3.32	21.5	61
4th Week February	2.64	2.88	3.52	3.56	22	43
1st Week March	3.04	3.44	3.64	3.76	21.25	45
2nd Week March	2.32	2.88	3.16	3.96	23.5	53
3rd Week March	2.56	2.76	3.28	4.08	20.25	49
4th Week March	2.08	2.96	3.08	4.32	26.5	55
1st Week April	1.72	2.64	2.8	4.6	30.5	40
2nd Week April	1.44	2.44	2.52	4.84	32	38
3rd Week April	1.24	2.36	2.76	5.36	29.75	47
4th Week April	0.96	2.12	2.32	5.56	30	50
1st Week May	0.72	1.92	2.12	5.84	31.25	44
2nd Week May	0.6	1.74	1.89	6.16	32.75	58
3rd Week May	0.36	1.56	1.76	6.36	33.25	51
4th Week May	0.28	1.08	1.44	6.88	34.5	51
Mean ± S.E	**1.76 ± 0.33**	**2.46 ± 0.39**	**2.71 ± 0.41**	**4.67 ± 0.54**	**26.05 ± 1.28**	**48.63 ± 1.74**

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

Week of Observation	Release Intervals (Treatments)				Temp: ^{0}C	R.H%
	T1 (7-days)	T2 (14-days)	T3 (21-days)	T4 (Control)		
1st Week February	2.48	2.64	3.32	3.12	12	49
2nd Week February	2.04	2.52	3.16	3.44	15.75	44
3rd Week February	2.32	2.72	2.76	3.72	21.5	61
4th Week February	2	2.6	3.32	3.96	22	43
1st Week March	2.24	2.84	3.44	4.08	21.25	45
2nd Week March	1.76	2.4	2.88	3.96	23.5	53
3rd Week March	1.64	2.36	2.92	4.6	20.25	49
4th Week March	1.48	2.52	2.84	4.84	26.5	55
1st Week April	1.2	2.16	2.64	5.16	30.5	40
2nd Week April	1.04	2	2.32	5.52	32	38
3rd Week April	0.8	1.76	2.28	5.84	29.75	47
4th Week April	0.68	1.56	2.12	6.12	30	50
1st Week May	0.44	1.24	1.96	6.64	31.25	44
2nd Week May	0.32	1.08	1.68	6.96	32.75	58
3rd Week May	0.16	0.96	1.52	7.56	33.25	51
4th Week May	0.08	0.88	1.24	8.12	34.5	51
Mean ± S.E	**1.29 ± 0.28**	**2.01 ± 0.35**	**2.52 ± 0.39**	**5.22 ± 0.57**	**26.05 ± 1.28**	**48.63 ± 1.74**

The data in Table-3 indicate that maximum monthly reduction of *H.armigera* population was recorded in T1 with (5.17±1.13) followed by T2 and T3 with (8.06±1.41) and (10.10±1.58) respectively. However minimum reduction (20.91±2.28) 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 have positive correlation ($r^2 = 0.9148$) with temperature, as well as the relative humidity % also showed positive correlation ($r^2 = -0.0002$) with *H.armigera* population.

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

Monthly	Release Intervals (Treatments)			
	T1 (7-days)	T2 (14-days)	T3 (21-days)	T4 (Control)
February	8.84	10.48	12.56	14.24
March	7.12	10.12	12.08	17.48
April	3.72	7.48	9.36	22.64
May	1	4.16	6.4	29.28
Mean ± S.E	**5.17 ± 1.13**	**8.06 ± 1.41**	**10.10 ± 1.58**	**20.9 ± 2.28**

Fig. 1 Average temperature °C and relative humidity % across different observation months at District Khairpur during 2012

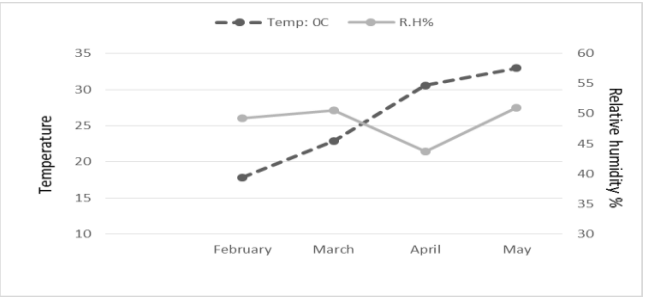

Fig. 2 Regression analysis between average population of control plot and Temperature

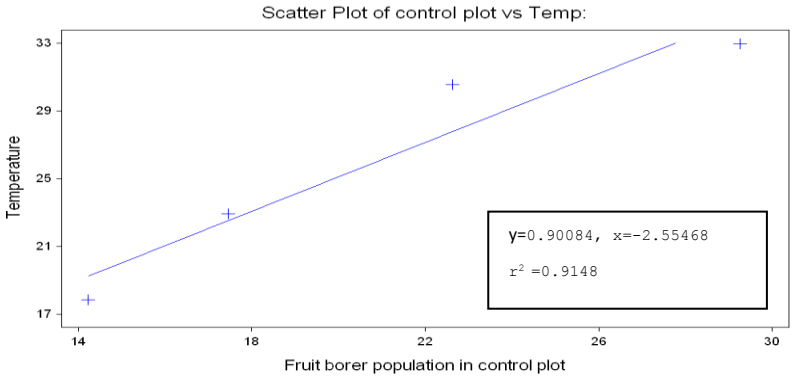

Fig-2. Regression analysis b/w Fruit borer in control plot vs Temperature

Fig. 3 Regression analysis between average population of control plot and relative humidity

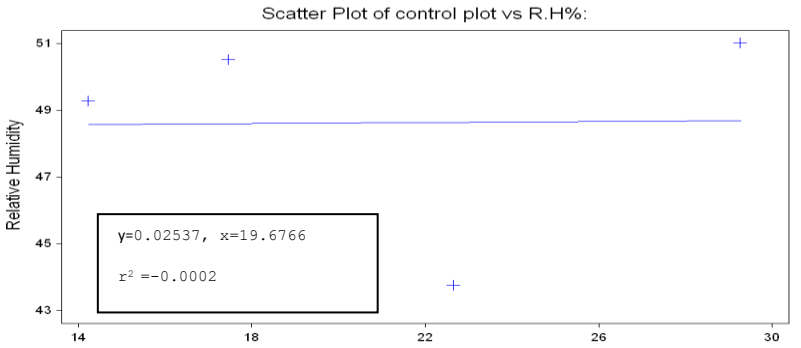

Fig-3. Regression analysis b/w Fruit borer in control plot vs R.H%:

Discussion

The present study on effect of release time of egg parasitoid *Trichogramma chilonis* (Ishii) against tomato pests i.e. *H. armigera* was carried at the experimental area Hanif Jamali Farm near Tajpur, Tandoallahyar from February to May, 2012. The results revealed that maximum pest population of *H. armigera* was recorded on control plot as compared to treated released plots. The study also depicted that maximum mean reduction population of *H.armigera* was recorded in T1 (7-days) plot followed by T2 (14-days) and T3 (21-days) 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 of 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*.Ulrichs*et al.,* (2006) studied the release time of natural enemies and concluded that regular parasitoid releases at a low rate (50 wasp pupae/100 m^2) have been conducted until parasitized *H. armigera* larvae were found in the crop. Shahid *et al.,*(2007) alsoevaluated *T. chilonis* (Ishii) against sugarcane stem borer (*Chilo infuscatellus* Snellen) and found significant results causing 83% reduction in infestation of *C. infuscatellus.*

Conclusions

It was concluded from the present study that the effect of release of egg parasitoid *Trichogramma chilonis* (Ishii) on supperation 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 obtained 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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