

EFFECT OF INUNDATIVE RELEASE OF *TRICHOGRAMMA CHILONIS* AGAINST *HELICOVERPA ARMIGERA* (HUBNER)(LEPIDOPTERA: NOCTUIDAE) ON YIELD OF PEA CROP

Rahim Jan¹, Bhai Khan Solangi^{2*}, Muhammad Azim Bizenjo³, Shafique Ahmed Memon⁴, Zahoor Ahmed Pandran⁵, Ali Asghar Gola⁴, Maqbool Ahmed jatoi³, Aminullah⁵, Muhammad Haroon³, Abdul Wahab⁴.

¹Department of Entomology, Balochistan Agriculture College Quetta-Pakistan. ²Department of Entomology, Sindh Agriculture University, Tandojam-Pakistan. ³Agriculture Research Institute Balochistan Quetta-Pakistan. ⁴Faculty of Agriculture University of LUAWMS Uthal, Balochistan, Pakistan. ⁵Department of Agriculture Extension, Water Management-Balochistan-Pakistan.

Corresponding Author email: mithakhan86.mk@gmail.com

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ABSTRACT

The present study was conducted at ARI Quetta during the year 2018, to know the outcome of egg parasitoid (*Trichogramma chilonis*) against *Helicoverpa armigera* and spotted bollworm complex. The observations were recorded on a weekly basis population of *Helicoverpa armigera* and spotted bollworm under control and biological control plots. The reduction percentage and crop yield were also calculated. Spotted bollworm maximum population in control plot were counted in the second week (15.82±2.48) and the minimum population was observed in the sixth week (12.56±1.53b) during ten weeks respectively. Spotted bollworm population in biological plot (*Trichogramma chilonis*) maximum population was observed (10.90±1.61) during 1 week and least population was observed in a tenth week (8.12±0.32) in the treated plot. *Helicoverpa armigera* population in control plot maximum population was counted (16.74±2.23) during 9th week and minimum population was observed (13.54±1.75 b) during 10 weeks duration, respectively. *Helicoverpa armigera* population in biological plot (*Trichogramma chilonis*) maximum population was counted (11.90±1.72a) and the minimum population was observed (9.08±0.33d) during 10 weeks of duration, respectively. Statistical analysis indicates that there was no significant variation in spotted bollworms and *Helicoverpa armigera* population for control plot in all weeks, but significant variation in a population of both lepidopteran complexes in biological control (*Trichogramma chilonis*) plot in all weeks. The data indicates that 61.33% and 66.57% reduction was observed in spotted bollworms and *Helicoverpa armigera*

under biological control (*Trichogramma chilonis*). It was noted that *Trichogramma chilonis* is a valuable biological agent for the Integrated Pest Management program.

Key: effect, release Trichogramma, Helicoverpa, Peas, crops.

INTRODUCTION

Peas (*Pisum sativum*) type of green seed vegetable that is grown inside a pod belongs to the Leguminosae family (Malik, 1994). Peas are full of protein, vitamin A, B, and C along with natural resources such as iron and phosphorus (Bajwa and Anon, 2002). Peas are an essential crop in Pakistan, which performs a foremost position in farmer saving. It is a familiar crop with the large marketable command to its nutrient importance. It is grown in wintry climate in plateau along with at some stage summer in high lands (Habib and Zamin, 2003). It shows as regards 40% of the overall traffic into pulses. The crop was mature more than the region of 15.8 thousand hectares among one hundred five thousand tones assembly of green pea with average yield (Anonymous, 2012).

Balochistan is mostly famous meant for the production of vegetables. For few years the vegetable industries are prospering in the area. Peas are an important vegetable of Balochistan cultivated under

an area of 545ha, in addition, to producing 6046 tons per year inside the region. Kalat and Makran divisions are the main districts for the production of these legumes. These two divisions contribute 2519 and 2229 tons per year (Anon, 2000). *Agrotis flammata* (Lepidoptera: Noctuidae) was to be the only insect pest attack to this crop (Bajwa, 2002). The farmers are reporting *Helicoverpa armigera* (Lepidoptera: Noctuidae) (American Boll-worm, ABW) to be the main problem of this region. (Baloch *et al.*, 2002). Cultivators of the region generally apply chemicals next to the insect pest (Malik *et al.*, 2002).

In rabbi season as starting of October northern plateau areas while the cold weather of concerning for four months period useful for growing pea. The region which is slowly changing from cool to hot weather is perfect in favour of pea growing. The most favourable high temperature for seed germination is concerning 22°C however, it can be able to germinate up to 5°C but at a sluggish speed. Peas are grown-up be statistically significant a tem-

perature of 13-18°C, to tolerant the coolness in an early step of growth. At afterward period the bloom and seed case are infected. As furrowed seed should be further responsive to high temperature of 30°C and exceeding still a day affect the seed case. The pea seed crop remains in the field for long-duration, are extremely infected in sowing value moment (Singh, 2011).

Trichogramma species is individual of the mainly used as bio-control agents and suitable to easy rear in insectaries along with energetic manner of living on eggs of aim hosts. Having the massive aptitude toward the parasitize ovum of bollworms in cotton (King *et al.*, 2010; Ahmad *et al.*, 2011). The biological wasp was seen awfully advantageous in cotton with having a huge prospective to manage bollworms in cotton, while the division of IPM approach (Ahmad *et al.*, 2015). Now *Trichogramma* species used as Biological control agents are the main extensively in the world partly for the reason that they are easy to rear. Several vital insect pests can be simply collected through extra control procedures in IPM (Saljoqi *et al.*, 2012).

Trichogramma chilonis is an egg parasitoid, (Hymenoptera: Trichogrammatidae) a minute biological wasp is a normal rival of numerous destructive lepidopterous insect pests of crops and vegetables. As well as thought-out an essential parasitoid used for a century. Field trial due to these parasitoids earlier close to 1975, occur future toward in charge of lepidopterous pests of sugarcane and callus. A century ago *T. chilonis* was used in contrast to lepidopterous pests of pea and other crops (Smith, 2014). The biological control safety is terrific for various ordinary rival be controlled by belonging to host and thus has not achieved for no target *spp.* Biological managing is fairly enduring protected efficient and surroundings amicable (Shenhmar *et al.*, 2003).

Trichogramma are an important parasitoid release as Biological Agents. This Biological, control agent mostly parasitize over 200 eggs of the Lepidopterans species (Saljoqi and Yu-rong, 2004). During harvest production method generally, the destroyed number of young insect ovum with indigenous populations of *T. chilonis* is to put off the pest but not sufficient as of reaching to damaging levels (Sen, 2003). Annually million acres land of farming crops as well as forests in thirteen countries the *T. chilonis* nine species releases (Thomson *et al.*, 2006). *T. chilonis* on sugarcane borer be extremely useful. The *T. chilonis* at 60,000 eggs they noted 83% decline of *C. infuscatellus* invasion. (Rafique *et al.*, 2007).

Helicoverpa armigera (Lepidoptera: Noctuidae) a crop borer is polypagous destructive pest that ass-

aults various crops in our country like pea, pigeon and chickpea commonly huge area is damaged by borer in the country. The larval stages of fruit borer are very destructive and serious damage the fruits edible part as well as decrease its yield as soon manage procedures are not functional. A single caterpillar can injury up to 12 or more fruits thus the cultivator countenance a huge amount of losses end the worth of pea fruit in the mart will be lesser (Hussain and Bilal, 2007). Bollworm complex is a major threat to quality crop production and bollworms pose a loss of billions of rupees every year (Somashékara *et al.* 2011).

The biological egg parasitoids such as *T. chilonis* and its multiplying ability in limelight due to its competent work (Parra and Zucchi, 2004). The different insecticides uses have given relief for short term damage from insects and pests. By eradicating the natural enemies disturbed the environmental balance. during such conditions, where the environmental stability distressed, insect pests have the ability of huge damage to suffer release as of the confrontation known toward them by their usual rival and owing to this, abandoned population increase results in severe pest outbreak (Carvalho *et al.*, 2002).

This study is helpful regarding the biological control using *T. chilonis* against sucking insect pests specifically *Helicoverpa armigera* in pea crop and also shows the effect on the improvement of crop yield. The biocontrol agent is easily derived from the laboratory stock culture and released in the field condition which reduces the cost of chemical insecticides.

The important experiment is intended to notice the effect of *Trichogramma chilonis* (Hymenoptera: Trichogrammatidae) against *Helicoverpa armigera* under field situation at the Agriculture Research Institute Quetta with the following most important objectives.

MATERIALS AND METHODS

Research was managed in ARI Quetta during summer 2018. The conducted experiment was composed of two treatments each with three replications in Randomized Complete Block Design (RCBD). The plot range occur 8 x 5 m also each treatment with three buffer zone were maintained. The replications distances were between 2 m.

T. CHILONIS REARING: The *Trichogramma chilonis* rearing was done at the research lab of the Directorate Plant protection Agriculture Research Institution Quetta on a standard diet by the procedure.

FIELD PREPARATION AND RELEASE OF TRICHOGRAMMA: The field was arranged for peas among

regular civilizing practices. The trial was managed on a healthy equipped seedbed, ploughed double used for obtaining bumper crop. Transplantation was prepared in April. The discharge of trichocards were in progress while the pea crop reached in flowering period. Entirely six emancipate were completed on ten days distance during cropping period. The trichocards (laboratory culture) from which the coming out was predictable in few hours were chosen in laboratory; the compulsory figures of parasitized eggs on card was counted. Trichocards having amount of three hundred parasitized eggs were useful to each plot except manage. The trichocards were curved up with the metal rod and positioned in the midpoint of each plot. The lesser section of the rod was greased to avoid the entrance of ants and any addition crawling insects.

STUDY PARAMETERS: Ten plants plot¹ was selected randomly. Larvae lying on every selected plant are counted in addition to recorded at one-week intervals. This method was repeated for the entire six releases. The grown-up peas were together independently as of every plot. Weight along with the amount of spoiled plants is recorded for every plot individually. Entire produce of peas were resolute by combining the yields of peas and picking for each plot.

Yield = whole weight of peas together as of every plot.

Percent mass defeat = wt, of injured peas x 100
Entire wt of peas.

ANALYSIS DATA: A figure of every parameter was statistical analysis. One way study of discrepancy and Least significant difference (LSD) analysis be worked out toward knowing the significance at <0.05 level of probability with statistical parcel 'Statistics' **8.1**

RESULTS :

SPOTTED BOLLWORM POPULATION ON PEA PLANTS AFTER *T. CHILONIS* CARDS RELEASES:

The finding in Table 1 signifies the spotted bollworm population in the manage plot was counted as 14.42±2.58, 15.50±2.56, 13.38±1.51, 13.98±2.05, 15.06±2.34, 12.56±1.53, 14.40±2.60, 15.02±2.40, 15.82±2.48 and 13.56±2.24 during 1st, and tenth working weeks distance, relatively. The number of spotted bollworms on pea crop has been watched in zigzag style in the managed plot, where nonorganic management is applied. The fact additional established in observation among weeks was seen no-significant distinction within spotted bollworm number in pea crop. As upper limit populace has renowned during the second week (15.82±2.48) watching

along with least amount of population in spotted bollworm was viewed in sixth week (12.56±1.53) in manage plot.

However the outcome as regards spotted bollworm population in the treated plot (*Trichogramma achilonis*) were calculated as 10.90±1.61, 10.06±1.23, 9.94±2.00, 9.88±1.10, 9.68±1.32, 9.63±1.51, 8.75±1.46, 8.72±0.66, 8.25±0.87 and 8.12±0.32 during first and 10th week's duration, relatively. Apex stage spotted bollworm is monitored for the duration of 1st and 2nd weeks; later spotted bollworm populace is turning down in linear series as of 3rd and 10th weeks. Additionally, statistical studies display important distinctions of spotted bollworm inhabitants among dissimilar observation weeks in pea. As the highest population is founded during first week (10.90±1.61) watching as well as least populace of spotted bollworm has been watched in tenth week (8.12±0.32) in treated plot. While outcome shown to spotted bollworm inhabitants was significantly turn down in take care of organizing suitable the occurrence of *Trichogramma spp* compared to manage plot. *Trichogramma spp* an egg parasitoid is a successful bio-control on lepidopterous insect pest. During recent finding, *Trichogramma* condensed the pest population from-61. The discovery are equivalent with some earlier studies for example, Telang *et al.*, (2004). Masood *et al.*, (2011) and Aziz *et al.*, (2012) statement with the intention of *T. chilonis* source 23% to 49% lessening in invasion while useful next to spotted bollworm on okra crop beside as well as arrangement with a single treatment.

THE POPULATION OF *HELICOVERPA ARMIGERA* ON PEA PLANTS AFTER *T. CHILONIS* CARDS RELEASES:

The facts in Table 2 indicates *Helicoverpa armigera* populace in manage plot was calculated 15.80±1.99, 16.50±2.65, 14.64±1.61, 15.12±2.21, 16.00±2.31, 13.54±1.75, 15.66±2.37, 16.16±2.40, 16.74±2.23 and 14.74±2.37 during first and tenth weeks period, correspondingly. The population of *Helicoverpa armigera* in pea was observed as zigzag manner in manage plot was applied. The results further indicated that *Helicoverpa armigera* population between the weeks against pea was non-significant.

Helicoverpa armigera population in the biological plot (*Trichogramma chilonis*) was counted as 11.90±1.72, 11.06±1.21, 10.94±1.04, 10.72±1.60, 10.58±1.17, 9.58±1.12, 10.54±1.92, 9.44±0.82, 9.28±1.39 and 9.08±0.33 during first to tenth week's period, correspondingly. Peak stage of *Helicoverpa armigera* is observed during first and 2nd weeks after that *Helicoverpa armigera* populace is turn down in linear series as of third to

tenth weeks. Results demonstrated a significant difference in *Helicoverpa armigera* population between the weeks against pea.

The finding is additionally shown that *Helicoverpa armigera* population were dramatically reduced in biological control plot (*Trichogramma chilonis*) like compared to manage plot *Helicoverpa armigera* (lepidopterous) polyphagous pest of different fruits and vegetables. Finding of the field learning are similar to finding of Ahmed *et al.*, (1996) *Trichogramma chilonis* a minute wasp it has been used in pea, cotton, corn, sugarcane and other fruits and vegetable crop as bio-agent to control the lepidopterous pest each year around the world. The resulting finding releasing of bio-agent dramatically reduced the pest population. The result of *Trichogramma chilonis* reduced the pest damage on crop up to 70%. *T. chilonis* is a successful biological control species to reduce the damage of infestation on fruits and vegetables.

Table 1: Spotted bollworm Population on a pea plants after *T. chilonis* cards Releases.

Observation weeks	Treated plot	Control plot
1 st	10.90±1.61 a	14.42±2.58 ab
2 nd	10.06±1.23ab	15.50±2.56 a
3 rd	9.94±2.00 ab	13.38±1.51 ab
4 th	9.88±1.10abc	13.98±2.05 ab
5 th	9.68±1.32abcd	15.06±2.34 ab
6 th	9.63±1.51abcd	12.56±1.53 b
7 th	8.75±1.46bcd	14.40±2.60 ab
8 th	8.72±0.66bcd	15.02±2.40 ab
9 th	8.25±0.87 cd	15.82±2.48 a
10 th	8.12±0.32 d	13.56±2.24 ab
T-value	49.31	49.54

Alphabet Values in column did not change significant P -value <0.05

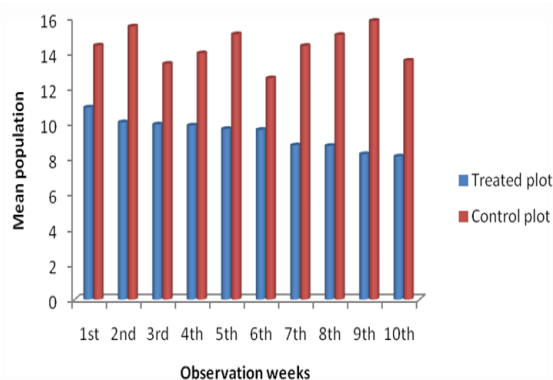


Figure 1: *Trichogramma chilonis* Releases in Pea Plants after Population of Spotted Bollworm.

Table 2: Population of *Helicoverpa armigera* on pea plants after *Trichogramma chilonis* cards releases

Observation weeks	Treated plot	Control plot
1 st	11.90±1.72a	15.80±1.99a
2 nd	11.06±1.21ab	16.50±2.65a
3 rd	10.94±1.04abc	14.64±1.61ab
4 th	10.72±1.60abcd	15.12±2.21ab
5 th	10.58±1.17abcd	16.00±2.31ab
6 th	9.58±1.12bcd	13.54±1.7b
7 th	10.54±1.92abcd	15.66±2.37ab
8 th	9.44±0.82bcd	16.16±2.40ab
9 th	9.28±1.39cd	16.74±2.23a
10 th	9.08±0.33d	14.74±2.37ab
T-value	44.38	48.58

Alphabet Values inside column did not change significant on P -value <0.05

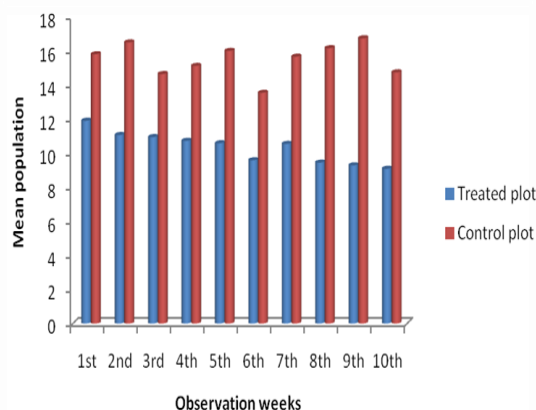


Figure 2: Population of *Helicoverpa armigera* on pea plants after *Trichogramma chilonis* Cards releases

REDUCTION PERCENTAGE: The data in Table 3 indicated that 61% and 66% decline was examined in spotted bollworms and *Helicoverpa armigera* under biological control (*Trichogramma chilonis*). It was recorded that *Trichogramma spp* is valuable biological agent used in IPM program. The finding of this study is similar to Arif *et al.*, (2015) who reported so as to *Trichogramma chilonis* is a brilliant organic agent against *Helicoverpa armigera* and found the significant lessening of *Helicoverpa armigera* in the field ranging as of 45%. The result is in line with Rajput *et al.*, (2015) they found a large number of parasitoid declines in the pest population. In Integrated Pest Management the *Trichogramma chilonis* successful and cheap and decline the pest population.

YIELD: The overall results indicated that the pea crop produced considerably maximum amount of yield (1537 kg plot⁻¹) when treated with biological agent (*Trichogramma chilonis*) as compared to pea yield of (1020 kg plot⁻¹) under control plot. The finding is in compliance by means of Usman *et al.*, (2012) founded 8428kg ha. Releasing a higher number of *Trichogramma* eggs which is 1537 kg ha⁻¹. The tiny distinction in yield might be a result of applying a large number of *Trichogramma* eggs or may well be due to varietal distinction of the crop as well as environmental factors. The results were in line with Amjad and Anjum (2002). Found to facilitate the pea cultivars fluctuate in their yield would be and adaptability due to diverse environment situations.

Table -3: Reduction percentage of *Helicoverpa armigera* and bollworm complex

Species	Control plot	Treated plot	Reduction (%)
Spotted bollworm	718.5	440.7	61.33
<i>Helicoverpa armigera</i>	774.5	515.61	66.57

SUMMARY

The population of spotted bollworm in manage plot was absolute best once count up as 15.82 ±2.48 during, 9th week. The populace of bollworm within pea crop used to be located as zigzag fashion in manipulate plot (where no organic control) used to be applied respectively the Result confirmed that non-significant similarity in pea.

In organic plot (*Trichogramma chilonis*) low-est the pest population was counted as 8.72± 0.66 and 8.25±0.87 all through 8th and ninth weeks respectively. Spotted bollworm populace was once downward in a linear sequence from 1st and 2nd weeks afterward. The Results demonstrated that significant difference in pea crop and *Helicoverpa armigera* population in manipulating plot best used to be counted as 16.50±2.65, and 16.74± 2.23 in the course of 2nd and 9th week respectively. The population of *Helicoverpa armigera* in pea was found as zigzag manner in control plot (untreated) was once applied. Results demonstrated non significant distinction in pea.

Helicoverpa armigera population in biological Plot (*Trichogramma chilonis*) lowest number was counted as 9.28±1.39 and 9.08±0.33 for the

duration of ninth and tenth weeks respectively. Pest population was once downward in a linear sequence from third to tenth weeks. Results validated the significant distinction in pea.

The facts show that 61.33% and 66.57% reduction was once examined in spotted bollworm and *Helicoverpa armigera* under biological control (*Trichogramma chilonis*). It is used to be located that organic valuable agent *Trichogramma chilonis* is integrated pest management system.

The pea crop produced an appreciably maximum quantity of yield (1537 kg plot⁻¹) when dealt with biological agent (*Trichogramma chilonis*) as in contrast to yield of (1020 kg plot⁻¹) under manipulate plot.

Trichogramma chilonis may be a useful bio-control agent for IPM programs in pea field. It was additionally deduced that the crop significantly improve the yield acre⁻¹ by using this biological agent compared to the control plot.

Trichogramma chilonis is a cheap and economic way for the integrated pest management program. *T. chilonis* should be released in pea field to suppress *Helicoverpa armigera* and bollworm complex.

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