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Evaluating the Efficiency of Trichogramma Pintoii and Bacillus Thuringiensis Var. Kurstaki on Corn Stem Borer, Ostrinia Nubilalis (Lepidoptera:Pyralidae) in Corn Fields of Moghan Plain

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ABSTRACT

Objective: In this study the efficacy of two agent of this biological control agent of corn stem borer in corn fields compared with common synthetic insecticides Endosolfan to find a suitable alternative for chemical control of pests in corn fields. **Methods:** In order to evaluate the efficiency of biocontrol agents of corn stem borer ,*Ostrinia nubilalis*, experiment was conducted in a randomized complete block by five treatments and four replication, including, Indoxacarb (Avant), Trichogramma wasps, *Bacillus thuringiensis* var: *kurstaki*, integration of *Trichogramma* sp. and Bt., and control as treatments number 1 to 5. In treatments with parasitoid release, four days after releasing the wasps, the number of parasitized eggs was recorded. In each plot, 20 plants were randomly selected for recording the number of the larval holes on corn stems. The number of damaged stems was recorded on the same number of corn plants before harvest. Statistically analysis of data was carried out by using MINITAB software. **Results:** In treated plots by egg parasitoid wasp, the range of egg parasitism was 10 to 28 percent. The number of larval holes was 1.05, 1.30, 1.55, 1.38, and 2.04 per plant in treatments number 1, 3, 4, and 5 respectively. There was significant difference among the treatments considering the number of larval holes. The number of damaged stem in treatments number 1, 3, 4, and 5 were 0.17, 0.59, 0.98, 0.80 and 1.60 per plant, respectively. There was significant difference among the treatments considering the number of damaged stems. Despite this, there was no significant difference among biological control treatments in the number of larval holes and number of damaged stems. The achieved results from present study were revealed that the efficiency of the egg parasitoid wasp, *Trichogramma* sp. is lower than examined Bt.

1.INTRODUCTION

European corn borer *Ostrinia nubilalais* is a major pest of corn in Moghan region of Iran and many countries. This pest cause significant decline in corn yield annually (Wang, 2005). In Moghan plain in the north- west of Iran, this pest has three generations that first generation occurs on wheat but does not make significant decline in wheat yield. Adults of this generation lay their eggs on corn leaves. Neonate larvae of *O. nubilalais* feed on leaves

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at first and then penetrate and feed throw stems of plant. This pest makes holes in the stem cause reduction in handling of materials to the aerial part of the plant and decrease the yield. Chemical control is the most common way to control these pests in many countries but due to destructive environmental effect of chemical pesticides in last decade researches have tried to find alternative for synthetic pesticides. Between alternative options biological control agents as like as parasitoid wasps and microbial agents has proved as admissible alternative for chemical pesticides (Nagarkatti & Nagaraja, 1997; Li, 1994; Charles *et al.*, 2000; Haffmann, 2006; Ahmad *et al.*, 2012). Adults of this parasitoid lay their eggs inside pest eggs and the Larvae of parasitoid feed inner material of pest eggs and decrease the larvae population.(Godfray, 1994). Genus Trichogramma wasps are host to hundreds of species of lepidopteran eggs (Nagarkatti & Nagaraja, 1997). In 1970 Trichogramma wasps for the first time used as biological control agent in China to control pests of corn and sugarcane (Li, 1994; Wang, 2005). In south Germany release of *Trichogramma evanecense* to control European corn borer *Ostrinia nubilalis* Hub indicated 80/5% to 96/8% reduction in plant damage (Neuffer, 1982). Kuhar (2004) used *Trichogramma ostriniae* for biological control of Eropean Corn Bore *Ostrinia nubilalis* Hub on potato plant and results showed that release of Trichogramma significantly reduce the number of larvae and damage on plant. Ahmad and Ashfaq (2012) in pakistan used *Trichogramma chilonis* (Ishii) successfully for the control of sugarcane stem borer (*Chilo infuscatellus*) under natural field conditions.

Bacillus thuringiensis is a biological control agent and is used extensively in integrated pest management programs specially for the control of Lepidoptera, Coleoptera and human disease insect vectors (Wei *et al.,* 2003). Tghizadeh (2006) evaluated the effect of Bt on cotton bollworm *Helicoverpa armigera* Hubner and results showed that Bt can control pests as a biological agent and can be accepted as an alternative compound for synthetic insecticides like Endosulfan. In this study the efficacy of two agent of this biological control agent of corn stem borer in corn fields compared with common synthetic insecticides Endosolfan to find a suitable alternative for chemical control of pests in corn fields.

2. MATERIALS AND METHODS

Trichogramma wasps had produced in the insectarium in north of Iran. The native genus of Trichogramma wasps were used to mass reared on *Ephestia kuhniella* eggs and they used in carts (Trichocart).Experiment conducted in corn field with 1/5 acre in northwest of Parsabad of Moghan. Five treatments were release of trichogramma, release of trichogramma plus Bt spray, Bt spray, Chemical insecticide and control respectively. For each treatment 4 replications observed.

In order to determine the limits of each plot, plants around plots marked by color spray. In addition on the corners of plots, wooden labels with treatment code was installed. Around every traestment 5 meters observed as border. In order to determine the time of adult emergence in the field, 10 pheromone traps were installed in different parts of the field. When traps showed the time of flying pick, the trichogramma wasps released in treatments with parasitoid release (parasitoid release, Bt plus parasitoid release). In each 10 m^2 one Trichocart. Because of the delay in emergence of adults in Moghan, 14 days later the second release of parasitoid carried out. In treatments with Bt (Bt and Bt plus parasitoid release treatments) at the emergence of 50% of first instars larvae the plots sprayed by formulated Bt suspension. In chemical control treatment Indoxacarb (Avant®) sprayed on plants as common pesticide for *O. nubilalis* on corn, in Moghan. Two weeks fter releasing the parasitoides in treatments with release of Trichogramma the egg masses of pest was counted and the number of parasited masses recorded. One month later in each plot 20 plants selected randomly and the number of larvael holes on the stems counted and recorded. At harvest time in each plot 20 plants selected randomly and the number of infected plants counted and recorded. Excel and MINITAB software used for data analysis.

3. RESULTS AND DISCUSSION

3.1. Parasitism of egg masses:

Results showed that parasitism of European corn borer egg masses in release treatments ranged from 10% to 28%. In control treatment there were no parasited egg messes.

3.2. Larvael holes on plants

Results of the number of holes in corn stalk in different treatments are presented in table 1. The most larvael holes were in control treatment and the lowest was observed in treatment with chemical pesticide Indoxacarb (Avant®). Between treatments with biological agents there were no significant differences. Analysis of variance for the number of holes is presented in table 2.

Table 1.

Number of European corn borer tunnels in corn stalk

Treatments	Number of samples	Replication	Mean of holes ± SE
Chemical Insecticide	20	4	1.16 ± 0.0826
Bt spray	20	4	1.45 ± 0.1224
Release of parasitoid	20	4	1.51 ± 0.0898
Release of parasitoid + Bt spray	20	4	1.45 ± 0.0117
Control	20	4	2.01 ± 0.1663

Table 2.

Analysis of Variance for number of larvael tunnels in corn stalk

Source	Degree of freedom	Sum of square	mean of square	F
Factor	4	1.5208	0.3802 **	6.92
Error	12	0.6592	0.0549	
Total	19	2.3764		

** significant difference in 1% level.

3.3. Larvael infection at harvest

Number of infected plants in different treatments is presented in Table 3.The most infected plants observed in control and the lowest in chemical treatment. Between treatments there were significant differences in 1%. But between biological agent treatments there were no significant difference. Analysis of variance for the larvae infection at harvest time is presented in table 2.

Table 3.

Number of infected plants at harvest

Treatments	Number of samples	Replication	Mean of holes ± SE
Chemical Insecticide	20	4	3.00 ± 0.408
Bt spray	20	4	11.5 ± 0.645
Release of parasitoid	20	4	16.50 ± 0.645
Release of parasitoid + Bt spray	20	4	20.00 ± 0.913
Control	20	4	33.25 ± 1.377

Table 4.

Analysis of Variance for number of infected plants at harvest

Source	Degree of freedom	Sum of square	mean of square	F
Factor	4	1997.80	499.45**	156.90
Error	12	38.20	3.18	
Total	19	2042.55		

** significant difference in 1% level.

DISCUSSION

As results showed the parasitism of egg masses in release treatments was lower than expected and this results are similar to finding of Haffmann (2006) in which egg parasitism was about 50% in many of their releasing fields and this results show that releasing of trichogramm alon can not reduce *O. nubilalis* population and its damage in corn filed (Wright *et al.,* 2002; Haffmann *et al.,* 2006). To find the reason of low parasitism of egg masses farther studiescarried out on Trichocarts and results showed that in 40% of carts the number of parasitoid pupa was less than 300 (the best number is 500 in each cart) and it can be very important factor to decrease the number of released wasps in the field.

Comparing the number of larvael holes on corn stalk showed the efficiency of Bt spray on reduction of larvael damage on plants. There was significant difference between the number of holes on plants with Bt spray and control. In addition there was significant difference between infected plants at harvest in Bt spray treatment and control. All these result show that Bt control act an important role in Integrated Pest Management programs. Significant difference of Bt treatment and chemical control confirm that Bt spray can not control this pest as like as chemical pesticides. The efficiency of Bt in decreasing the number of larvael damage on corn plants demonstrate that in long time management programs Bt can be a safe alternative for chemical insecticides. On the other hand finding of this study showed that there was no difference between Bt spray treatment and release of trichogramma plus Bt spray, so the combination of these

two factors did not increase the efficiency of each other. Despite the low efficiency of parasitoid wasps in pest control programs in this study, using the biological agent for pest control in fields for years can help other natural enemies to establish in the field and decrease the pest population under damage treshhold.

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