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Management of diamonback moth, *Plutella xylostella* L. on cabbage crop by release of *Bracon hebetor* Say under field conditions

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Abstract

A field experiment was conducted during February, 2017 at the Horticulture Instructional Farm, Pt. Kishorilal Shukla College of Horticulture and Research Station, Rajnandgaon (Chhattisgarh). Different treatments of *Bracon hebetor* were evaluated for their efficacy against *P. xylostella* on cabbage crop by releasing Bracocards *viz*., T_1 Bracocard (4 cocoons), T_2 Bracocard (8 cocoons), T_3 Bracocard (10 cocoons), T_4 Bracocard (15 cocoons), T_5 Bracocard (20 cocoons) and an untreated control. Among the treatments T_5 Bracocard (20 cocoons) was found most effective against *P. xylostella* as it recorded lowest larval population of (9.73/plant). The second best treatment was T_4 (12.20 larvae /plant) followed by T_3 (12.60 larvae /plant), T_2 (13.47 larvae /plant) and T_1 (16.27 larvae /plant).

Keywords: *Bracon hebetor,* diamonback moth, *Plutella xylostella* L., management

Introduction

Biological control has been a valuable tactic in pest management programs around the world for many years. Biological control is a natural phenomenon of plant and animal regulation by their natural enemies. Biological control is a tool used in Integrated Pest Management (IPM) for several field agricultural systems and in protected crops systems. This technology is economically viable, of low environmental impact, and does not present risks of environmental contamination, human health nor for domestic animals (Orr, 2009) [5]. Braconid is an important biological control agent for several insect pests (Heimpel *et al*., 1997; Darwish *et al*., 2003) [2, 1]. Braconids have been widely used in various studies related to host-parasitoid interactions due to its high reproductive rate, short generation time, and considerable range of host species (Yu *et al*., 2002) [7]. Biological control is both economically and ecologically feasible for farmers to use, in addition, helping to reduce the negative impacts of intensive chemical based pest management on the environment. Biological control methods have been highlighted by researchers as a promising alternative to chemical pesticide application for the control of economically important pests. Very little work on the aspect of Biological control of has been done so for in the state, and looking to the above aspects the present study was formed out.

Materials and Methods

A field experiment was conducted during February, 2017 at the Horticulture Instructional Farm, Pt. Kishorilal Shukla College of Horticulture and Research Station, Rajnandgaon (Chhattisgarh) with seven treatments, replicated thrice in Randomized Block Design. Before release of bracocard, larval population of diamondback moth was recorded and the post release observations were recorded after 2, 7, 12, 15 and 20 days (Table 3). Twenty one plants of cabbage were randomly selected, netted and the treatments (Table 2) were applied on the onset of maximum pest incidence. The number of healthy and parasitized larva was counted and percentage of parasitization was worked out from the recorded observations. Parasitized larvae was brought back to the laboratory and looked for the emergence of parasitoid species.

Table 1: Experimental Details

(a) Design	RBD
(b) Treatment	07
(c) Replication	03
(d) Planting distance	60×30 cm
(e) Replication spacing	2 meter
(f) Plot spacing	2 meter
(g) Cage size	2×2 meter
(h) Experimental Area	100 x 10 (L x W) = 1000 m^2
(i) Crop	Cabbage (*Brassica olerecia* var. *capitata*)
(j) Variety	Golden Acre
(k) Date of Bracocard release	17/02/2017
(l) Observation	(1) Pre-treatment
	(2) Post treatment (2, 7, 12, 15 and 20 Day after release)

Table 2: Treatments detail.

S.N.	Treatments
1.	Bracocard (4 cocoon)
2.	Bracocard (8 cocoon)
3.	Bracocard (10 cocoon)
4.	Bracocard (15 cocoon)
5.	Bracocard (20 cocoon)
6.	Covered plant without cocoon
7.	Control

Results and Discussion

During the experiment pretreatment observations were recorded on number of larvae per plant, a day prior to release of Bracocards. The plants were caged with muslin cloths after release of Bracocards which were placed in between cabbage leaves, to prevent any natural parasitization from out side. Observations were recorded after 2, 7, 12, 15 and 20 days after treatment. The larval population in the pretreatment observation ranged from 15.0 to 20.33 larvae per plant and non significant differences were observed among various treatments indicating more or less uniform infestation of the pest on the plants under experimentation (Table 3). Two days after release, the plants released with Bracocard (20 cocoons) recorded least larval population (12.33/plant) and differed significantly from rest of the treatments. Highest larval population (21.0/plant) was recorded in T_2 Bracocard (8 cocoons).At seven days of release, plants with T_3 Bracocard (10 cocoons) recorded least larval population, which was at par with T_5 Bracocard (20 cocoons), but differed significantly from T_1 Bracocard (4 cocoons), T_2 Bracocard (8 cocoons) and T_4 Bracocard (15 cocoons). The highest larval population (20.33/ plant) was recorded in covered plant without cocoon (T_6). Twelve day after release, the minimum number of larvae (8.67/plant) was recorded with T_5 Bracocard (20 cocoon) which was at par with T_4 Bracocard (15 cocoons), T_3 Bracocard (10 cocoons) and T_2 Bracocard (8 cocoons) but differed significantly from T_1 Bracocard (4 cocoons) and recorded as least effective against *P. xylostella.* Highest larval population of 20.0 per plant was noticed in un-treated control. Fifteen days after release of Bracocard, all treatments were significantly superior over untreated control and covered plant without cocoon. The plants with T_5 Bracocard (20 cocoons) recorded least larval population (5.0/plant). It was at par with T_4 Bracocard (15 cocoons), T_2 Bracocard (8 cocoon) but differed significantly from T_3 Bracocard (10 cocoons) and T_1 Bracocard (4 cocoons). Highest larval population of 20.67 per plant was noticed in un-treated control. Twenty day after release Plants with Bracocard (20 cocoons) recorded least larval population (9.33/plant) but differed significantly from rest of the treatments. The highest larval population (18.33/plant) was recorded in un-treated control.

Combined analysis indicated that the T_5 Bracocard (20 cocoons) was found most effective against *P. xylostella* as it recorded lowest larval population of (9.73/plant). The second best treatment was T_4 (12.20 larvae /plant) followed by T_3 (12.60 larvae /plant), T_2 (13.47 larvae /plant) and T_1 (16.27 larvae /plant) (Table 3 and Fig.1).

Similar findings were reported by Mohanty *et al.* (2000) [4] who released, *Bracon hebetor* in the coconut orchards infested by the black-headed caterpillar, *Opisina arenosella* (Lepidoptera : Cryptophasidae). Releases were made at fortnightly interval at 15, 20 and 25% of the pest population in four villages (Bramhagiri, Biraharekrushnapur, Batagaon and Kanthapur) in Puri district of Orissa, when populations were maximum during January and minimum in September. The most effective control of the pest was achieved, when the parasitoids release were 20% of the pest population. The parasitization ability and host searching ability of *B. hebetor* was higher. Mohanty *et al*. (2001) [3] further reported that Braconids as most effective biological tool to control the vegetable crop pest brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. Shoot (0.2-10.2%) and fruit (0.1-5.1%) damage was reduced in the parasitoid released field as compared to the control. The percent reduction in shoot and fruit damage gradually increased with the number of releases along with the age of the plants. Rajamanickam *et al*. (2002) [6] made inundative release of larval parasitoid *B. brevicornis* to manage coconut leaf eating caterpillar, *Opisina arenosella* at recommended dose at 21 days interval, estimated mean pest population/palm significantly reduced from 785.60 to 210.50 at 21 days. The above three findings are similar showing the reduction in larval populations of *P. xylostella* on cabbage at different doses.

Table 3: Management of diamonback moth, *Plutella xylostella* L. on cabbage crop by release of *Bracon hebetor* Say under field conditions.

S.N.	Treatments	Lraval population of DBM (Per plant)						Over all mean
		Pre-treatment	2DAT	7DAT	12DAT	15 DAT	20 DAT	
T_1	Bracocard (4 cocoons)	20.33 (4.61)	20.67 (4.65)d	19.67 (4.54)ef	16.67 (4.19)e	11.67 (3.54)cd	12.67 (3.69)bc	16.27 (4.12)bc
T_2	Bracocard (8 cocoons)	19.00 (4.45)	21.00 (4.69)de	16.67 (4.20)cd	11.33 (3.50)cd	6.33 (2.69)ab	12.00 (3.60)b	13.47 (3.91)b
T_3	Bracocard (10 cocoons)	15.00 (3.49)	16.33 (4.16)b	12.33 (3.64)a	11.00 (3.46)c	10.33 (3.36)c	13.00 (3.74)bc	12.60 (3.67)ab
T_4	Bracocard (15 cocoons)	17.33 (4.26)	19.00 (4.46)bc	16.67 (4.19)c	10.00 (3.31)ab	5.67 (2.58)ab	9.67 (3.26)ab	12.20 (3.56)ab
T_5	Bracocard (20 cocoons)	17.00 (4.23)	12.33 (3.64)a	13.33 (3.78)b	8.67 (3.10)a	5.00 (2.44)a	9.33 (3.21)a	9.73 (3.23)a
T_6	Covered plant without cocoons	18.67 (4.41)	18.67 (4.41)bc	20.33 (4.61)g	20.67 (4.65)fe	20.33 (4.61)e	15.67 (4.08)d	19.13 (4.47)c
T_7	Control	17.67 (4.31)	17.67 (4.31)bc	19.33 (4.50)e	20.00 (4.58)f	20.67 (4.65)ef	18.33 (4.38)de	19.20 (4.48)cd
	SEm±	0.18	0.13	0.11	0.07	0.10	0.11	0.16
	CD at 5%	NS	0.41	0.36	0.22	0.34	0.35	0.49
	C. V. (%)	7.43	5.37	4.81	3.31	5.54	5.38	9.66

Figures in parenthesis are $\sqrt{x+0.5}$ transformed values.
Same letter in a column are not significantly different.

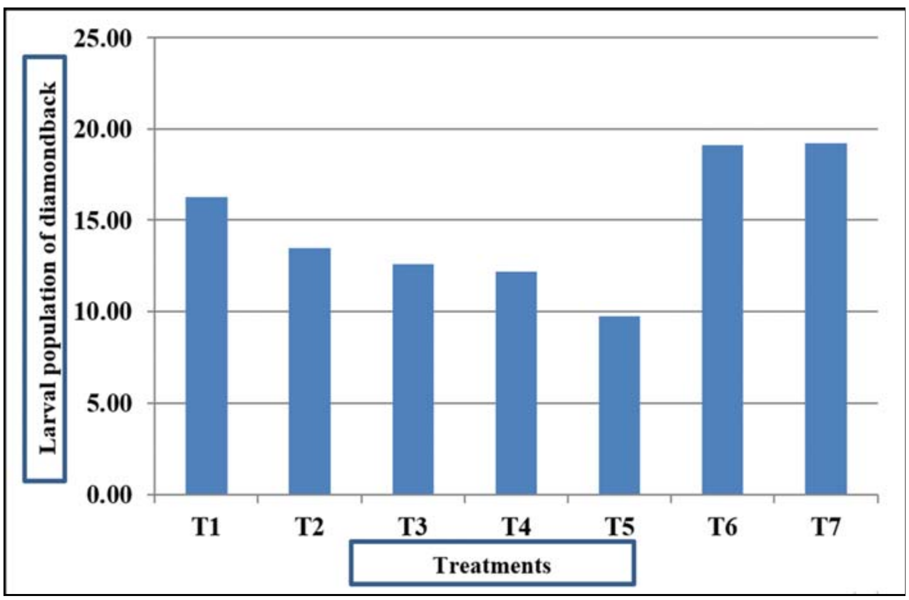

Fig 1: Management of Diamondback moth, *Plutella xylostella* L. on cabbage crop by release of *Bracon hebetor* Say under field conditions

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