International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(5): 176-178

Received: 19-07-2019
Accepted: 21-08-2019

Maryir Basar
Department of Entomology, COA, CAU, Imphal, Manipur, India

KH Ibohal Singh
Department of Entomology, COA, CAU, Imphal, Manipur, India

Correspondence
Maryir Basar
Department of Entomology, COA, CAU, Imphal, Manipur, India

Effect of two microbial insecticides against the cabbage butterfly *Pieris brassicae* Linnaeus under cabbage crop agro-ecosystem of Manipur valley

Maryir Basar and KH Ibohal Singh

Abstract
The field experiments were conducted at the College of Agriculture, Iroishemba, Imphal during *Rabi* seasons of 2016-17 and 2017-18 to study the bio-efficacy of two microbial insecticides each at three doses against the Cabbage butterfly (CB), *Pieris brassicae* Linnaeus and their effect on the yield of cabbage crop var. "Green Hero". There was high incidence of *P. brassicae* in the experimental crop variety. The insect maintained mean incidence of 65.33 to 69.40 per cent leaf damage. Thus, this pest was considered as the regular and major pest among the various species of butterfly observed in cabbage during the investigation. The results on the efficacy of microbial insecticides each at three doses against *P. brassicae* revealed that all the insecticidal treatments resulted in significantly suppression of the pest incidence in both the experimental years. The pooled mean data of two years based on three applications of insecticide indicated that Green pacer (*Metarhizium anisopliae*) @ 1500 g/ha proved the most effective treatment in reducing the incidence of the pest registering the minimum mean leaf damage of 49.93 per cent as against 67.57 per cent in untreated control followed by Mycojaal (*Beauveria bassiana*) 10 SC @ 1000 ml/ha and Green pacer (*M. anisopliae*) @ 1000 g/ha with a record of lower mean leaf damage of 51.68 and 51.85 per cent, respectively and did not differ significantly between them.

Keywords: Microbial insecticides, cabbage, *Pieris brassicae*, green pacer (*Metarhizium anisopliae*)

Introduction
Cabbage (*Brassica oleracea* var. *capitata* Linn.) is undoubtedly one of the most popular, oldest and extensively cultivated cole crops. Cabbage is a rich source of vitamins i.e. A, B_1, C and minerals like Ca, P, K, Na & Fe (Yawalkar, 1980) [9]. In India, cabbage (*Brassica oleracea* var. *capitata* Linnaeus) is one of the most important cole crops cultivated throughout the country during cold seasons. India ranks third in cabbage production in the World. In Manipur, the total area under cabbage is only 1,000 hectares with a production of 10,100 metric tonnes. In India, a total of 37 (thirty-seven) insect pests have been reported to feed on cabbage, of which the diamond back moth (*Plutella xylostella* Linnaeus), cabbage butterfly (*Pieris brassicae* Linnaeus), cabbage aphid (*Brevicoryne brassicae* Linnaeus) and the mustard aphid (*Lipaphis erysimi* Kaltenbach) are the major limiting factors for profitable cultivation of the crop (Sachan & Gangwar, 1980 and Lal *et al*., 2002) [3, 2].

Twelve species of insect pests have been observed to inflict damage on cole crops right from seedling to harvesting stage of crop growth which are of major importance in Manipur out of which, *Pieris* spp are considered to be the serious pests of cruciferous crops causing about 20-100 per cent damage (Sachan and Gangwar, 1980) [3]. *P. brassicae* is the large butterfly which is also called cabbage butterfly or cabbage white butterfly belonging to Pieridae family of order Lepidoptera. The egg appears to be yellow and becomes black and transparent few hours prior to hatching. Large white larvae are greenish grey with black dots and yellow lateral stripes, appears to be hairy with distinctive brown head and they experience four moultings with five instars. Males have white wings with black tips on forewings. Females have two black spots on each forewings. Underside of wing is pale greenish.

Several broad-spectrum synthetic organic insecticides are usually recommended for the effective control of these pests (Sarup *et al*., 1967; Thomas and Phadke, 1992; Singh *et al*., 1993; Sonkar and Desai, 1999) [4, 7, 5, 6]. However, these compounds are known to evoke multifarious problems including environmental pollution, health hazards, destruction of beneficial fauna like parasitic, predatory and pollinating insects, resistance to insecticides, resurgence of secondary insect pests etc.

Moreover, excessive use of such persistent insecticides on vegetables is acquiring a special concern since there is a little time lag between the last application and consumption. Owing to wide spectral problems with the use of these insecticides, use of eco-friendly insecticides like microbial insecticides is gaining popularity in pest management because of their safety to non – targeted organisms and non-biomagnification in the food chain. Moreover, chemical pesticide residues are the major constraints in the export of vegetables. Therefore, in the present scenario, total reliance on such pesticides is not desirable. There has to be the strengthening of natural pest suppression by use of more eco-friendly measures like bio-pesticides in order to give a sustainable pest management system on the crop.

Materials and Methods

Field experiments were conducted during *Rabi* seasons in the course of two consecutive years i.e. 2016-2017 and 2017-18 at the Vegetable Research Farm, College of Agriculture, Central Agricultural University, Iroisemba, Imphal to evaluate the efficacy of two microbial insecticides each at three different doses against the *Pieris brassicae* Linnaeus in cabbage variety "Green Hero" in the Randomized Block Design (RBD) with 8 (eight) treatments including one untreated control and each treatment was replicated thrice.

Spray solution consisting of different insecticides in desired concentration was prepared separately for each treatment. All the spray treatments were applied by a high volume hand compression knapsack sprayer thrice at ten (10) days intervals commencing from appearance of pests. The volume of the spray liquid was kept at 500 litre ha^{-1}. All the insecticides applied in the evening hours. Care was taken at the time of spraying to avoid drifting of the insecticidal spray solution from one plot to another and to give a thorough coverage of the plants. Plain water was sprayed on the plants of untreated control plots.

Observations recorded

The relative field efficacy of the test insecticides against *P. brassicae* was determined by recording the per cent leaf damage from five randomly selected plants of each plot. Observations were made at 1 day before, and 3, 5, 7 and 10 days after each application of insecticides.

Results and Discussion

Bio-efficacy of two microbial insecticides each at three different doses against *P. brassicae* in Cabbage var. "Green Hero" during *Rabi* seasons of 2016-17 and 2017-18

The mean data of two years on leaf damage incidence of *P. brassicae* presented in Table 1 and 2 revealed that the mean leaf damage significantly differed among the treatments at 3, 5, 7 and 10 DAA in both the years. Untreated control plots recorded 67.20 per cent and 67.93 per cent during *Rabi* seasons of 2016-17 and 2017-18, respectively. During 2016-17, Green pacer @ 1500 gm/ha treatment was most effective with 51.54 per cent leaf damage and was closely followed by Dichlorvos 76 SL @ 500 ml/ha (52.55%), Mycojaal 10 SC @ 1500 ml/ha(53.10%), Green pacer @ 1000 gm/ha(53.13%), Green pacer @ 500 gm/ha (56.87%) and Mycojaal 10 SC @ 500 ml/ha(57.59%) which were at par to each other (Table 1). Similarly, during the *Rabi* season of 2017-18 also, Green pacer @ 1500 gm/ha treatment remained the most effective treatment with 48.31 per cent leaf damage as against 67.93 per cent in untreated control, followed by Mycojaal 10 SC @ 1500 ml/ha(50.25%),Green pacer @ 1000 gm/ha (50.56%), Mycojaal 10 SC @ 1000 ml/ha (51.81%), Green pacer @ 500 ml/ha(52.80%), Dichlorvos 76 SL @ 500 ml/ha (55.54%) and Mycojaal 10 SC @ 500 ml/ha(56.63%), and there was no significant difference between them (Tables 1, 2 & 3).

The pooled mean data of two years presented in Tables 1, 2 & 3 revealed that Green pacer @ 1500 gm/ha proved to be the most effective insecticide in suppression of CB population with minimum mean leaf damage of 49.93 per cent against 67.57 per cent in untreated control. The second most effective treatment was Mycojaal 10 SC @ 1500 ml/ha (51.68%) and Green pacer @ 1000 gm/ha (51.85%). Mycozaal10 EC @ 500 ml/ha was found to be the least effective treatment against CB with a record of maximum mean leaf damage incidence of 57.11 per cent. However, all the insecticidal treatments recorded significantly lower leaf damage as compared to untreated control.Among the microbial insecticides each applied at three doses evaluated against *P. brassicae*, the Green pacer @ 1500 gm/ha, Mycojaal 10 SC @ 1500 ml/ha and Green pacer @ 1000 gm/ha treatments showed significantly superior in reducing the pest incidence.

The results obtained in this experiment on the effectiveness of Green pacer @ 1500 gm/ha, Mycojaal 10 SC @ 1500 ml/ha and Green pacer @ 1000 gm/ha against *P. brassicae* are in conformity with the findings of Atcha (1998) [1] who stated that the highest dose of 10^9 spores per plant of *B. bassiana* 5653 and *M. anisopliae* 180 caused 53.8 per cent, 50.6 per cent and 20.0 per cent mortality of larvae and pupae of a Lepidopteran pest (*P. xylostella*) on cabbage, respectively. The present findings of Mycojaal (*B. bassiana*) and Green pacer (*M. anisopliae*) are supported by Vodouhe (1999) [8] who tested seven strains of *B. bassiana* and two *M. anisopliae* strains for their virulence on *P. xylostella* and reported that the different strains of both fungus were found to be pathogenic to the larvae of *P. xylostella*.

Table 1: Relative effect of two microbial insecticides each at three doses on the incidence of cabbage butterfly, *P. brassicae* in cabbage var. "Green Hero" during *Rabi*, 2016-17 (data based on 1st, 2nd & 3rd spray)

Treatment	Dose in ml or gm per hectare	Mean leaf damage (%)			Pooled Mean	Composite Mean leaf damage(%) over 1st, 2nd and 3rd spray				
		1st spray	2nd spray	3rd spray		1 DBA	3 DAA	5 DAA	7 DAA	10 DAA
T_1= Mycojaal (*Beauveria bassiana*) 10 SC	500 ml	64.87	56.71	51.18	57.59	67.57	59.64	57.65	56.86	55.28
T_2= Mycojaal (*Beauveria bassiana*) 10 SC	1000 ml	65.44	57.78	51.73	58.32	69.40	61.05	58.40	56.72	55.77
T_3= Mycojaal (*Beauveria bassiana*) 10 SC	1500 ml	63.07	51.48	44.74	53.10	68.00	55.97	53.02	51.41	50.33
T_4= Green Pacer (*Metarhizium anisopliae*)	500 gm	63.83	56.41	50.36	56.87	65.33	59.33	56.96	55.79	54.88
T_5= Green Pacer (*Metarhizium anisopliae*)	1000 gm	61.43	52.52	45.45	53.13	65.63	55.30	53.74	51.61	50.47
T_6= Green Pacer (*Metarhizium anisopliae*)	1500 gm	61.17	49.89	43.57	51.54	66.20	53.81	52.01	50.54	48.13
T_7= Dichlorvos 76 SL	500 ml	60.77	50.80	46.08	52.55	66.97	54.40	53.25	50.92	49.55
T_0= Control (water)	_	65.17	67.89	68.53	67.20	65.90	66.70	67.21	67.48	68.16
SE(m) ±	_	1.50	1.40	1.33	2.86	1.53	3.02	2.75	2.53	2.38

CD(P=0.05)	_	3.22	3.00	2.84	6.14	NS	6.47	5.90	5.42	5.10

DBA= Days before application; DAA= Days after application; NS= Non significance; [1] Composite means of three replications recorded at 3, 5, 7 and 10 DAA

Table 2: Relative effect of two microbial insecticides on the incidence of cabbage butterfly, *P. brassicae* in cabbage var. "Green Hero" during *Rabi*, 2017-18 (data based on 1st, 2nd & 3rd spray)

Treatment	Dose in ml or gm per hectare	Mean leaf damage (%)			Pooled Mean	[1]Composite Mean leaf damage(%) over 1st %, 2nd and 3rd spray				
		1st spray	2nd spray	3rd spray		1 DBA	3 DAA	5 DAA	7 DAA	10 DAA
T_1= Mycojaal (*Beauveria bassiana*) 10 SC	500 ml	64.55	53.86	42.48	56.63	67.77	56.88	54.41	52.46	49.69
T_2= Mycojaal (*Beauveria bassiana*) 10 SC	1000 ml	63.85	51.07	40.51	51.81	69.00	55.57	52.44	50.24	47.28
T_3= Mycojaal (*Beauveria bassiana*) 10 SC	1500 ml	63.23	49.33	38.18	50.25	69.20	53.97	51.18	48.47	45.38
T_4= Green Pacer (*Metarhizium anisopliae*)	500 gm	63.44	53.14	41.83	52.8	67.87	56.69	54.11	50.58	48.35
T_5= Green Pacer (*Metarhizium anisopliae*)	1000 gm	62.53	49.99	39.16	50.56	67.67	54.06	51.81	48.75	45.91
T_6= Green Pacer (*Metarhizium anisopliae*)	1500 gm	61.55	47.52	35.86	48.31	68.00	51.98	49.43	46.27	43.41
T_7= Dichlorvos 76 SL	500 ml	66.73	55.82	44.07	55.54	69.00	58.83	56.78	53.97	51.81
T_0= Control (water)	_	67.37	67.38	69.04	67.93	67.00	67.96	68.12	67.21	68.56
SE(m) ±	_	1.31	1.36	1.59	3.68	1.15	3.66	3.63	3.57	3.37
CD(P=0.05)	_	2.80	2.92	3.42	7.90	2.47	7.85	7.78	7.66	7.22

DBA= Days before application; DAA= Days after application; NS= Non significance; [1] Composite means of three replications recorded at 3, 5, 7 and 10 DAA

Table 3: Efficacy of two microbial insecticides each at three doses against the cabbage butterfly, *P. brassicae* in cabbage var. "Green Hero" during *Rabi* seasons of 2016-2017and 2017-2018 (based on pooled data of two years)

Treatment	Dose in ml or gm per hectare	[1]Mean leaf damage (%) due to *P. brassicae*		[2]Pooled Mean
		Rabi, 2016-2017	*Rabi*, 2017-2018	
T_1= Mycojaal (*Beauveria bassiana*) 10 SC	500 ml	57.59	56.63	57.11
T_2= Mycojaal (*Beauveria bassiana*) 10 SC	1000 ml	58.32	51.81	55.07
T_3= Mycojaal (*Beauveria bassiana*) 10 SC	1500 ml	53.10	50.25	51.68
T_4= Green Pacer (*Metarhizium anisopliae*)	500 gm	56.87	52.8	54.84
T_5= Green Pacer (*Metarhizium anisopliae*)	1000 gm	53.13	50.56	51.85
T_6= Green Pacer (*Metarhizium anisopliae*)	1500 gm	51.54	48.31	49.93
T_7= Dichlorvos 76 SL	500 ml	52.55	55.54	54.05
T_0= Control (water)	_	67.20	67.93	67.57
SE(m) ±	_	2.86	3.68	1.47
CD(P=0.05)	_	6.14	7.90	3.47

[1]Mean of three sprays based on four time intervals of observations; [2] Mean of two years based on three replications

Conclusion

The results of the insecticides evaluation trial revealed that Green pacer @ 1500 gm/ha proved to be the most effective treatment in controlling *P. brassicae* with a minimum leaf damage incidence of 49.93 per cent against 51.68 to 57.11 per cent in rest of the insecticidal treatments and 67.57 per cent in untreated control. The effectiveness of Green pacer @ 1500 gm/ha was followed by Mycojaal 10 SC @ 1500 ml/ha (51.68%) and Green pacer @ 1000 gm/ha (51.85%) which showed non-significant difference from one another.

References

1. Atcha AC. The potential of *Beauveria bassiana* strains 5653 and 5654 and *Metarhizium anisopliae* strain 180 and of the virus Plxy GV-Nya 01 to control the diamond back moth *Plutella xylostella* (L.) on cabbage. M.Sc. Thesis, University of Lome, Togo, 1998.
2. Lal OP, Sinha SR, Srivastava YN. Evaluation of some promising insecticides against mustard aphid, *Lipaphis erysimi* Kalt. on cabbage under field condition. J Entomol. Res. 2002; 26(2):169-173.
3. Sachan JN, Gangwar SK. Vertical distribution of important pests of cole crops in Meghalaya as influenced by the environmental factors. Indian J Ent. 1980; 42(3):414-421.
4. Sarup P, Singh DS, Lal R, Wadhwa S. Testing of different pesticides as contact poisons against the adults of poisons against the adults of *Myzus persicae* Sulz. (Homoptera: Aphididae). Indian J Ent. 1967; 29(1):84-91.
5. Singh TVK, Raman Goud T, Reddy DDR. Control of Diamond back moth, *Plutella xylostella* L. with insecticides on cabbage. Pestology. 1993; 17(5):12-13.
6. Sonkar UB, Desai BD. Bio-efficacy of some insecticides against *Lipaphis erysimi* Kalt on mustard and their toxicity to ladybird beetles. Shashpa. 1998; 5(2):233-234.
7. Thomas J, Phadke KG. Field efficacy of chlorpyriphos and quinalphos EC and dusts as compared to oxydemeton methyl EC against aphid, *Lipaphis erysimi* (Kalt.) on rapeseed crop. Indian J Ent. 1992; 54(2):150-163.
8. Vodouhe S. Potential of entomopathogen *Beauveria bassiana* and *Metarhizium anisopliae* for the control of *Plutella xylostella* L. (Lepidoptera: Plutellidae): test of efficacy and persistence. M.Sc. Thesis, University of Abomey-Calavi, 1999.
9. Yawalkar KS. Vegetable crops in India. Eds. 1980; 11:36-46.