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Studies on the bioefficacy of entomopathogenic fungus *Beauveria bassiana* against *Plutella xylostella* (Linn) infesting cabbage

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Abstract
The bioefficacy of different concentrations of *Beauveria bassiana*, a field trail was conducted at Agricultural Research Farm, on cabbage. The treatments consisted of 2%, 4%, 6%, 8% and 10% of *Beauveria bassiana*. The total larval population was obtained on randomly selected plants in each plot before and at 1, 3, 7 and 14 days after treatment. All the treatments showed significantly superiority over control. The data of the two sprays showed th 10% *Beauveria bassiana* recorded maximum percent larval population reduction followed by 8%, 6%, 4% and 2% of *Beauveria bassiana*, so, among the different concentrations of *Beauveria bassiana* 10% was found to be the most effective in controlling the *Plutella xylostella*. Hence, a sequential spray with these treatments can be recommended to solve the problem of development of resistance in the above test pest.

Keywords: Bioefficacy, *Beauveria bassiana*, *Pluttella xylostella*, cabbage

Introduction
Cabbage (*Brassica oleracea* L. var. Capitata) is one of the most important cole crops belonging to family Cruciferae and is grown for the thickened main bud called "head". It has been developed from wild cabbage known as Cole wart (*Brassica oleracea* L. var *Sylvestris*), India is one of the important cabbages growing country in Asia, with an area of 2.4 lakh hectares with a total production of 56.2 lakh tones (Anonymous, 2004) and ranks next to cauliflower in area among cole crops. India is next to China in cabbage production [6]. It cover about 4% of total area under vegetables is India. Cabbage is rich in minerals like phosphorus, potassium, calcium, sodium, iron, vitamins A, B, C and proteins [7]. Cabbage has also medicinal value, as it helps to prevent constipation increases appetite, and speeds up digestion. Several insect pests are known to reduce the production of cabbage viz. Diamond back moth (*Plutella xylostella),* leaf webber (*Crocidolomia binotalis),* cabbage butter fly (*Pieris brassicae*), cabbage head borer (*Hellula undalis*), aphids (*Lipaphis erysimi, Brevicoryne brassicae* and *Myzus persiae*), Painted bug (*bargrada hilaris*), Bihar hairy caterpillar (*Spilosoma oblique*), tobacco caterpillar (*Spodoptera lilura*) Mustard sawfly (*Athalia lugens proxima*) etc.

Diamond Back moth, *Plutella xylostella (Linn)* (*Yponomeutidae: Lepidoptera*) has become a destructive pest of crucifers in many cabbage growing areas of the world [12, 20]. This pest is distributed North America, the southern portion of South America, India and Srilanka [10]. More management of this pest poses serious concern due to development of insecticide resistance to organophosphates [16], Carbamates [19] and Synthelic pyrethroids [14] causing about 60-80 percent yield loss [5]. In India it was first recorded in 1914 on cruciferous vegetables [9]. It is estimated that about 63 percent loss in marketable yield of cabbage due to attack of diamond back moth *Plutella xylostella* (L.) [13].

Control of insect pest by chemicals can be spectacular but it has its limitations such as high capital investment, non remunerative, short term measures and also the ill effects of a chemical pesticides on human health and the environment development of resistance in pests to pesticides and higher level of pesticides residue in food items, there is crying need to develop suitable alternative to chemical pesticides for use in pest control. Use of pest avoidance tactics, enhancement of biological pest suppression and adoption of other non- chemical methods of pest management would certainly be able to improve our capabilities in solving much of the pest problems. Biological control methods are one such alternative which can provide non-

hazards approach to pest control *Beauveria bassiana* is an entomopathogenic fungus belonging to the class Deuteromycetes which controls, effectively the *Lepidopterous*, Dipterous, Homopterous, Orthopterous and coleopterons pests' population. *Beaveria bassiana* is safe, non- pollution and eco-friendly, are effective in causing the mortality of insect pests of vegetables and well fit into the IPM programme. The present study was therefore, undertaken to test the bioefficacy of Entomopathogenic fungus *Beauveria bassiana* against *Plutella xylostella* (Linn) infesting cabbage.

Materials and Methods

The bioefficacy of different concentrations of *Beauveria bassiana* were evaluated in two field experiments. The experiment was laid out in RBD with six treatments including control and replicated thrice. The plot size of each treatment was. 2.0 m × 1.5 m.

a. Treatment application:

The treatments were imposed when there was peak infestation of test insects. Two application were given during the crop growth period in the plot at Research farm, SHUATS, Allahabad.

b. Preparation of spray fluids

The required quantity of *Beauveria bassiana* concentration was taken and mixed with distilled water and later made up to 2 liter, to get required volume of spray fluids. The spray fluid was stirred thoroughly before spraying.

c. Treatments application

The spraying was done during evening hours when the weather was still, a hand atomizer was used for applying the insecticide. The sprayer and container used for spray fluid were thoroughly cleaned with water before changing the concentration and rinsed with fluid spray to be prepared next. The plant was covered with the spray fluid and each plot (2 × 1.5 m) received 2 liter of spray fluid.

d. Recording data

For recording data five plant were selected randomly/ treatment/ replication and tagged with wax coated labels.

e. Observations recorded

The number of larvae per plant one day before treatment as pre-treatment count and 1, 3, 7 and 11 days after spray as post treatment counts with regards to the number of insects.

Isolation of fungus

The Fungus was isolated from dead *Inderbella quadrinotata*, (Guava Bark eating caterpillar) larvae collected from guava orchards of Allahabad Agricultural Institute -Deemed University, Allahabad. The culture was then purified on SDA media and maintained for use in the various experiments.

Preparation of different concentration of *Beauveria bassiana*

The fungus was removed from the flasks and then pressed in between the blotting paper. Then it was weighed for preparing different concentrations (weight/volume) of 2%, 4%, 6%, 8%, and 10% respectively.

i.e. 2% lab formulation: 2 gm *Beauveria bassiana* net in 98 ml distilled water.

4% lab formulation: 4 gm *Beuveria bassiana* net in 96ml distilled water.

6% lab formulation: 6 gm *Beuveria bassiana* net in 94ml distilled water.

8% lab formulation: 8gm *Beuveria bassiana* net in 92 ml. Distilled water. S

10% lab formulation: 10gm *Beuveria bassiana* net in 90 ml. Distilled water

Statistical Analysis: The present population reduction in different treatments over control was calculated from post treatment on *Plutella xyllostella* by using modified [1] as given by Flemming and Retanakaran (1985).

$$\text{Percentage population reduction} = 1 - \frac{\text{Post treatment pop. In test}}{\text{Pretreatment pop. In test}} \times \frac{\text{Pretreatment pop in control}}{\text{Post treatment pop. In control}} \times 100$$

The percentage population reduction were transformed into the corresponding angular transformed value and subjected to statistical analysis by using standard procedures. The data obtained were statistically analyzed by using "Two way classification".

Results and Discussion

Bioefficacy of different concentration of *Beauveria bassiana* aganist *Plutella xyllostella* population after two spraying (Table 1 and 2. Figure 1 and 2). The pre treatment data pertaining to the population of *Plutella xylostella* showed that the mean number of larvae population ranged between 5.40 to 2.80 larvae/plant during first spraying and 5.33 to 1.93.larvae/ plant during second spraying, one day prior to spraying. The post treatment data recorded with regard to number of larvae/plant at one day after spraying showed that all the treatments were significantly superior in bringing down the population over control.

First day after spraying

Among the different conc. of *Beauveria bassiana* 10% *Beauveria bassiana* (T_5) recorded the highest reduction of population (71.12%) recorded after first spraying and (73.69%) recorded after second spraying over control. The next best conc. of *Beauveria bassiana* was 8% (T_4) with (73.73.%) after first spraying and (82.27.%) after second spraying. All these treatment are at par with each other in bringing down the larvae population.

The bioefficacy of treatments on first day after spraying were found to be in following order.

After first spraying: $T_5>T_4>T_3>T_2>T_1> T_0$

After second spraying: $T_5>T_4>T_3>T_2>T_1> T_0$

Third day after spraying

The data recorded on third day after spraying showed that there was slight decrease in population, in comparison of first day after treatment. Among the treatments 10% *Beauveria bassiana* (T_5) recorded the highest reduction of population (78.73%) after first spraying and (82.27%) after second spraying over control. The next best treatment was 8% *Beauveria bassiana* (T_4) with (69.80%) after first spraying and (75.37%) after second spraying. All these treatments are

at par with each other in bringing down the larvae population.
The bio efficacy of treatments on third day after spraying were found to be in following order.
After first spraying: $T_5>T_4>T_3>T_2>T_1> T_o$
After second spraying: $T_5>T_4>T_3>T_2>T_1> T_o$

Seventh day after spraying

The data recorded on seventh day after spraying showed that there was slight increase in the population in comparison of third day after treatments, Among the treatments 10% *Beauveria bassiana* (T_5) recorded the highest reduction of population (74.92%) after first day spraying and (78.39%) after second spraying over control. The next best treatment was 8% *Beauveria bassiana* (T_4) with (65.70%) after first spraying and (70.75%) after second spraying. All the treatments are at par with each other in bringing down the larvae population
The bioefficacy of treatments on seventh day after spraying were found to be in following order.
After first spraying: $T_5>T_4>T_3>T_2>T_1> T_0$
After second spraying: $T_5>T_4>T_3>T_2>T_1> T_0$

Eleventh day after spraying

The data recorded on eleventh day after spraying showed that there was a slight increase in the population in comparison of first day after treatment. Among the treatments 10% *Beauveria bassiana* (T_5) recorded the highest reduction of population (65.08%) after first spraying and (70.71%) after second spraying over control. The next best treatment was 8% *Beauveria bassiana* (T_4) with (53.33%) after first spraying and (59.26%) after second spraying. All these treatments are at par with each other in bringing down the larvae population.
The bioefficacy of treatments on eleventh day after spraying were found to be in following order

After first spraying : $T_5>T_4>T_3>T_2>T_1> T_0$
After second spraying : $T_5>T_4>T_3>T_2>T_1> T_0$

The data on percent population reduction of *Plutella xylostella* over control after first and second spraying revealed that all the different concentrations of *Beauveria bassiana* were significantly superior over control. Among all the treatments highest percent larval reduction of *Plutella xylostella* was recorded in 10% *Beauveria bassiana* (72.46 to 76.27) followed by 8% *Beauveria bassiana* (62.65 to 68.01). This finding is similar to the findings of Ibrahim and Low (1993) and Venden berg *et al.,* (1998). Mahapatra and Gupta (1998) [15] reported that efficacy of the microbial pesticides increase with increase in concentrations which is in line with the present investigation.
Yoon (1999) [22] while evaluating *Beauveria bassiana* strain CS-1 against *Plutella xylostella* observed larval mortality of 86.2 and 66.5 percent. Selman *et al.,* (1997) [18] have also reported that pathogenicity of *Beauveria bassiana* to the *Plutella xylostella*.Puzari *et al.,* (2006) [17] have studied that *in vitro* inhibition of *Beauveria bassiana* (Bals) ill growth by different commonly used insecticide in rice have shown the some results. This fining is similar to the finding of Ali Alizedeh *et al.,* (2007) [3] reported the compatibility of *Beauveria bassiana* (Bals) with several pesticides. Acuna and Carballo (2000) also observed the moderate toxicity of *Beauveria bassiana* against *Plutella xylostella.* Zhand (2000) also reported that three different types of *B. bassiana* formulation applied on a total area of 800 ha resulted in population reduction by 86.9%, 80.9% and 78.5% respectively, which is in conformity with the present findings.
Thus, the entomopathogenic fungus *Beauveria bassiana* is effective against this pest and can be exploited as an effective component in integrated pest management of cabbage thereby reducing the use of synthetic insecticide.

Table 1: Bioefficacy of *Beauveria bassiana* against Diamond Back Moth, *Plutella xylostella* in field condition (First spray)

S. No.	Treatments	Pre-count	Percent reduction of *Plutella xylostella* population over control				
			1 DAT	3 DAT	7 DAT	11 DAT	Mean
T_0	Control	3.26	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T_1	2%*Beauveria bassiana*	2.80	47.22 (43.39)	57.78 (48.91)	48.33 (44.03)	36.11 (36.93)	47.36 (43.51)
T_2	4% *Beauveria bassiana*	3.40	51.11 (45.63)	63.06 (52.59)	57.08 (49.08)	43.47 (41.27)	53.68 (47.06)
T_3	6% *Beauveria bassiana*	4.00	57.33 (49.20)	65.56 (54.09)	60.33 (50.94)	46.56 (43.05)	57.45 (49.31)
T_4	8% *Beauveria bassiana*	5.06	61.77 (51.83)	69.80 (56.66)	65.70 (54.15)	53.33 (46.89)	62.65 (52.36)
T_5	10%*Beauveria bassiana*	5.40	71.12 (57.48)	78.73 (68.51)	74.92 (54.93)	65.08 (53.79)	72.46 (58.37)
F- test			S	S	S	S	
S.E.			2.898	2.722	2.664	2.772	
CD at 5% level			6.458	6.064	5.934	6.175	

* means of three replication
Figures in the parenthesis are the angular transformed (arc – sine) values

Table 2: Bioefficacy of *Beauveria bassiana* against Diamond Back Moth, *Plutella xylostella* in field condition (Second spray)

S. No.	Treatments	Pre-count	Percent reduction of *Plutella xylostella* population over control				
			1 DAT	3 DAT	7 DAT	11 DAT	Mean
T_0	Control	5.33	0.00 (0.000	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T_1	2%*Beauveria bassiana*	1.93	50.93 (45.52)	61.11 (51.41)	51.85 (46.09)	43.06 (41.09)	51.74 (45.97)
T_2	4% *Beauveria bassiana*	2.26	54.45 (47.58)	65.93 (54.27)	58.89 (50.13)	44.82 (42.02)	56.02 (48.45)
T_3	6% *Beauveria bassiana*	2.13	62.26	68.61	62.26	53.33	61.62

			(52.06)	(55.92)	(52.12)	(46.89)	(51.71)
T_4	8% *Beauveria bassiana*	3.00	66.67 (54.76)	75.37 (60.27)	70.75 (57.17)	59.26 (50.36)	68.01 (55.55)
T_5	10%*Beauveria bassiana*	3.06	73.69 (59.15)	82.27 (65.12)	78.39 (62.31)	70.71 (57.23)	76.27 (60.87)
F- test			S	S	S	S	
S.E.			4.031	5.370	3.682	3.279	
CD at 5% level			8.982	11.964	8.204	7.306	

* means of three replication

Figures in the parenthesis are the angular transformed (arc – sine) values

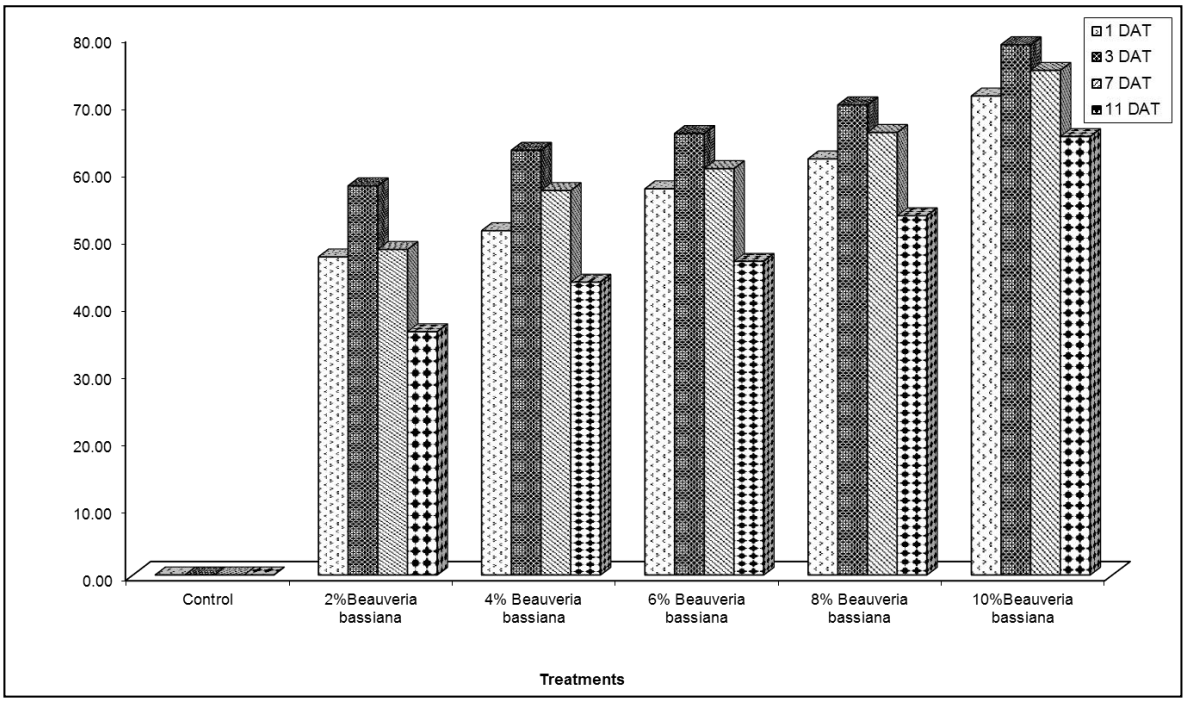

Fig 1: Bioefficacy of *Beauveria bassiana* against Diamond Back Moth, *Plutella xylostella* in field condition (First spray)

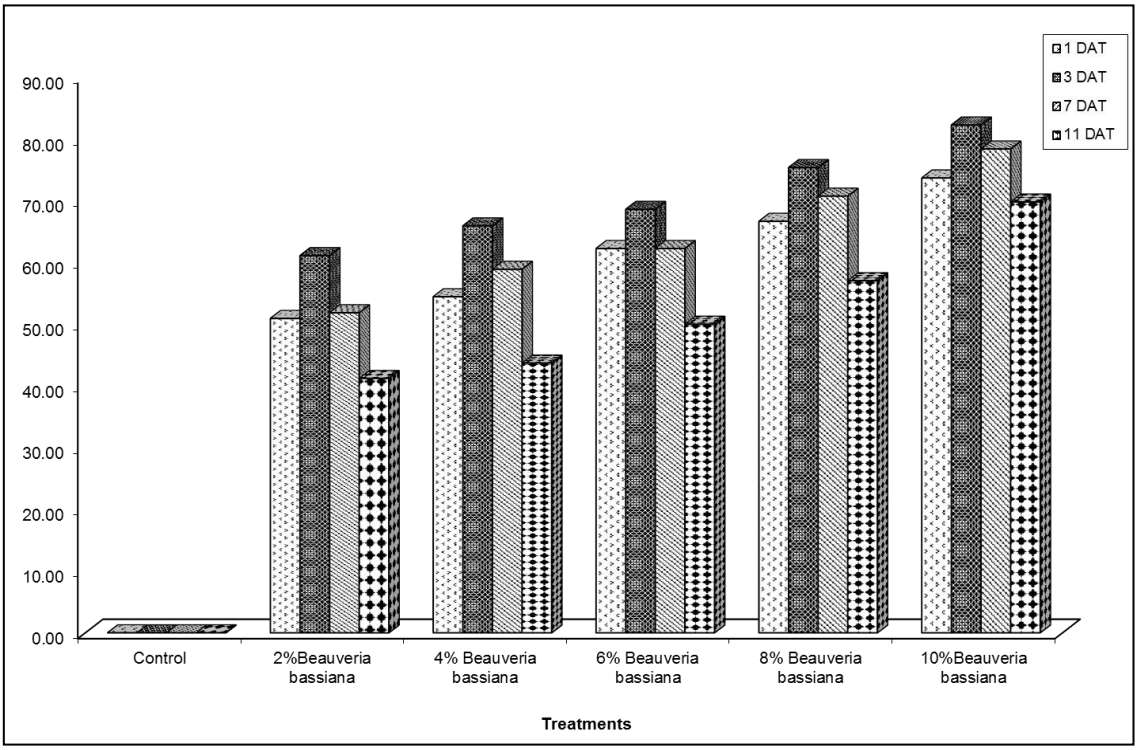

Fig 2: Bioefficacy of *Beauveria bassiana* against Diamond Back Moth, *Plutella xylostella* in field condition (Second spray)

References

1. Abborts WS. A method of computing the effectiveness of an insecticide. Journal of Economic Entomology. 1925; 18:256-267
2. Acuna PA, Carballo VM. Comparisons of *Beauveria bassiana* strain with insecticides use for control of *P.*

xylostella, Maneja Integrado de plagas. 2000; 56:52-57.
3. Ali-alizadeh, Mohamad Amin Samih, Masood Khezri, Rohallah Saberi Riseh. Compatibility of *Beauveria bassiana* (bals)Vuill. With several pesticides. International Journal of Agriculture and Biology. 2007; 7(1):31-34.
4. Anonymous. 2004. The Hindu Survey of India Agriculture. 2005, 51-56.
5. Bindra OS, Singh O, Ramzan M. Seasonal abundance of insect pests of cauliflower at Ludhiana (Punjab). Journal Research of Punjab Agricultural University. 1975; 14:66-69.
6. Chaddha KL. Handbook of Horticulture, ICAR, New Delhi-8, 2001, 365-367.
7. Chaudhary B. Vegetables National book trust of India, New Delhi 3, 1967, 37-38.
8. Fleming R, Retnakaran A. Evaluating Single treatment data using Abbott's formula with reference to insecticides. Journal of Economic Entomology. 1985; 78:1179-1181.
9. Fletcher TB. Some south Indian Insect supd Govt. Press Madras. 1914, 565.
10. Harcourt DG. Biology of the Diamond back moth, *Plutella maculipennis* (curt) Lepidoptera: Plutellidae) in Eastern Ontario. II life history, Behavior and host relationships, Canadian Entomologist. 1962; 89:554-564.
11. Ibrahim YB, Low W. Potential of mass production and field efficacy of iso lates of the entomopathogenic fungi *Beauveria bassiana* and *Paecilomyces fumosrosevs* against *Plutella xytostell*. International- Journal of Pest Management. 1993; 39(3):288-292.
12. Jones FGW, Jones MG. Pest of field crops, (3rd ed.) Edward Arnold Ltd., London. 1981, 82-83.
13. Krishna Kumar HK, Srinivasan K, Suman CL. Optimum control strategy of cabbage pests from a chemical control trial. Prog. Hort. 1983; 18:104-110.
14. Liu MY, Tzeng YJ, Sun CN. Diamond back moth resistance to several synthetic pyrethroids. Journal of Economic entomology. 1981; 74:393-396.
15. Mahapatro GK, Gupta GP. Bio potency test of some commercial formulations of *baccilus thuringiensis* against spotted bollworm *Earias vitella* Fab. Pestology. 1998; 22:13-17.
16. Noppun V, Saito T, Mujata T. Cultcular penenteation and metabolism of Phentoate in the resistant and susceptible diamond back moth *Plutella xylostella* L. Journal of Pesticide Sciences. 1986; 12:85-89.
17. Puzari KC, Hazarika LK, Pranab TJ. *In vitro* inhibition of *Beauveria bassiana* (bals) Vuill. Growth by different commonly used insecticides used in rice; Journal of biological control. 2006; 20(1):51-56
18. Selman BJ, Scmways MJ, Shah H. Biological control of Pests and weeds (Studies in biology no 132) Edward Arnold, London, 1997.
19. Sun CN, Chi H, Feng NT. Diamond back moth resistance to diazinon and methomyl en Taiwan, Journal of economic entomology. 1978; 71:551-554
20. Tolekar NS, Shelton AM. Biology, ecology and management of the diamond back moth, Annual Review Entomology. 1993; 38:275-301
21. Vandenberg JD, Shelton A, Wilsey M, Romos T. Assessment of *Beauveria bassiana* sprays for control of diamond back moth (Lepidoptera: Plutellidae) on crucifers. Journal - of - Economic – Entomology. 1998; 91(3):624-630.
22. Yoon CS, Sung GM. Potential of entomopathogenic fungus, *Beauveria bassiana* strain cs-1 as a biological control agent of *Plutella xylostella* (Lepidoptera: Yponomeutidae). Applied Entomology. 1999; 123:423-425