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# EFFICACY OF BIOSOFT *BEAUVERIA BASSIANA* (BALS.) VUILL AGAINST DIAMOND BACK MOTH, *PLUTELLA XYLOSTELLA* (L.) ON CABBAGE

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## ABSTRACT

The efficacy of Biosoft (a commercial preparation of *Beauveria bassiana*) was evaluated at three different doses (30, 40 and 50 g/10 lit. water) against diamondback moth, *Plutella xylostella* (L.) infesting cabbage on farmer's field in Anand district of Gujarat during 2007-08 and 2008-09. Biosoft ($2 \times 10^8$ cfu / g) at higher and medium doses effectively reduced the larval population of *P. xylostella*. Minimum incidence of the pest was found in the plots treated with (50 g/10 lit. water) of Biosoft followed by *Bacillus thuringiensis* (10 g/10 lit. water) and Biosoft applied @ 40 g/10 lit water. Maximum (564 q/ha) yield of cabbage heads was harvested from the plots sprayed with Biosoft (50 g/10 lit. water) followed by *Bt* and the medium dose of Biosoft. In terms of yield, medium and lower doses of Biosoft proved equally effective to quinalphos (0.05%). Biosoft did not show any adverse effect on the activity of *Apanteles plutellae* Kurd., a potential larval parasitoid of the pest indicating its safer properties to biocontrol agents.

**Key words:** Bio-efficacy, Biosoft, *Plutella*, Cabbage

The diamond backmoth (DBM), *Plutella xylostella* (L.) (Lepidoptera : Plutellidae) is the most destructive cosmopolitan insect pest of cole crops causing a yield reduction of 75 percent in cabbage (Roktaneen 1996). DBM was the first insect pest of crops reported to be resistant to DDT and now it has shown significant resistance to almost every synthetic insecticide applied in the field (Muhammad *et al.,* 2005); besides, insecticidal residues are also common in cabbage that is commonly consumed as salad.To overcome these problems, biological suppression of the pest is an effective alternative. Of the various biocontrol agents reported to manage *P. xylostella*, the entomopathogenic fungi, *Beauveria bassiana* (Bals.) Vuill. has been found quite effective. Pathogenicity of this fungi to DBM larvae has been proved in laboratory (Kato *et al.,* 1989 and Salman *et al.,* 1997), which is commercially available in the market under different trade names with different spore counts (CFU/g). Potential utility of the commercial formulations of *B. bassiana* for use against *P. xylostella* has been narrated by Vandenberg *et al.* (1998). "Biosoft", the mycoinsecticidal preparation based on *B. bassiana* has been marketed for the management of insect pests of crops. Information on bio-efficacy of this product against *P. xylostella* and its safety index to the potential natural biocontrol agent (*Apanteles plutellae* Kurd.) is lacking in this region; therefore, the present investigation was carried out.

## MATERIALS AND METHODS

A field experiment on testing the bio-efficacy of "Biosoft" against DBM, *P. xylostella* was conducted on farmer's field in hot spot area at Navli village of Anand district (Gujarat) during rabi season of 2007-08 and 2008-09. Healthy seedlings of cabbage cultivar Sutton Express were transplanted at a spacing of 45 × 45 cm during second fortnight of November during both years of experiment. The experiment was laid out in a Randomized Block Design with five replications. Gross and net plot size was 6.0m × 4.8m and 4.8m × 3.6 metre, respectively. There were eight treatments- Biosoft ($2 \times 10^8$ CFU/g) was tested at high (50 g/10 lit. water), medium (40) and low (30) doses alongwith three other biopesticides *i.e. Bacillus thuringiensis* (Halt 5% WP, $5 \times 10^7$ spores/mg, 10 lit. water), azadirachtin (Vanguard 1500 ppm, 50ml/10 lit. water) and HaNPV (Virin-H, 250 LE, 10ml/10 lit water); insecticide (quinalphos 0.05%) and an untreated control.

The crop was raised by adopting normal recommended agronomical practices, except plant protection. Spray fluid for each respective treatment was applied at 70 to 75 days after transplanting on appearance of the pest by using knapsack sprayer with hollow cone nozzle. Considering the incidence of DBM in cabbage crop, two sprays were made during both the years of study. Second spray was given 15 days after the first spray. Five

**Table 1. Effect of Biosoft (*B. bassiana*) on the incidence of *P. xylostella* infesting cabbage**

| S. No. | Treatments | No. of larvae/plant | | | | | | Overall Pooled Mean No. larvae/plant |
|---|---|---|---|---|---|---|---|---|
| | | 2007-08 | | | 2008-09 | | | |
| | | First spray | Second spray | Pooled | First spray | Second spray | Pooled | |
| 1. | Biosoft @ 50 g/10 lit. water | 1.50* (1.25) | 2.71 (6.34) | 2.10 (3.41) | 1.42 (1.01) | 1.17 (0.37) | 1.29 (0.66) | 1.70 (1.89) |
| 2. | Biosoft @ 40 g/10 lit. water | 1.65 (1.72) | 3.00 (8.00) | 2.33 (4.43) | 1.59 (1.53) | 1.21 (0.46) | 1.40 (0.96) | 1.86 (2.46) |
| 3. | Biosoft @ 30 g/10 lit. water | 1.75 (2.06) | 3.25 (9.56) | 2.50 (5.25) | 1.66 (1.76) | 1.27 (0.61) | 1.46 (1.13) | 1.98 (2.92) |
| 4. | Bacillus thuringiensis @ 10 g/10 lit. water | 1.62 (1.62) | 2.98 (7.88) | 2.30 (4.29) | 1.55 (1.40) | 1.19 (0.42) | 1.37 (0.88) | 1.83 (2.35) |
| 5. | Azadirachtin 1500 ppm @ 50 ml/10 lit. water | 2.04 (3.16) | 4.26 (17.15) | 3.15 (8.92) | 2.06 (3.24) | 1.29 (0.66) | 1.68 (1.82) | 2.41 (4.81) |
| 6. | HaNPV @ 10 ml/10 lit. water | 2.33 (4.34) | 4.70 (21.09) | 3.52 (11.39) | 2.60 (5.76) | 1.58 (1.50) | 2.09 (3.37) | 2.80 (6.84) |
| 7. | Quinalphos 0.05% | 2.11 (3.45) | 4.06 (15.48) | 3.09 (8.55) | 2.22 (3.93) | 1.28 (0.64) | 1.75 (2.06) | 2.42 (4.86) |
| 8. | Untreated control | 2.42 (4.86) | 4.92 (23.21) | 3.67 (12.47) | 2.61 (5.81) | 1.75 (2.06) | 2.18 (3.75) | 2.92 (7.53) |
| | S.Em ± | 0.09 | 0.04 | 0.26 | 0.09 | 0.09 | 0.15 | 0.15 |
| | C.D. at 5% | 0.25 | 0.12 | 0.86 | 0.26 | 0.26 | 0.51 | 0.43 |
| | C.V. (%) | 17.26 | 4.39 | 9.26 | 17.41 | 25.66 | 20.76 | 13.62 |

* transformed values Figures in parentheses are retransformed values

plants were randomly selected from each net plot area for recording the observations. Larval population of DBM were recorded on such selected plants a day prior and 3, 5 and 7 days after each spray. Based on the 3 post-spray observations, mean population of DBM larvae/plant was worked out. The data thus obtained were subjected to statistical analysis after square root transformation and presented in Table 1. Similarly, the cocoons of *Apanteles plutellae* Kurd., a most promising and potential larval parasitoid of *P. xylostella* in this region were recorded prior to and 7 days after each spray. The data were analyzed after suitable transformation and are presented in Table 2.

Cabbage heads were harvested from net plot area as and when they matured. Yield of cabbage heads was recorded treatment-wise during each picking. Based on these, yield data were converted into quintals per hectare and presented in Table 3.

**Table 2. Effect of Biosoft (*B. bassiana*) on the activity of *A. plutellae* in cabbage field**

| S. No. | Treatments | No. of *A. plutellae* cocoons/plant | | | |
|---|---|---|---|---|---|
| | | 2007-08 | | 2008-09 | |
| | | Before spray | 7 DAS | Before spray | 7 DAS |
| 1. | Biosoft @ 50 g/10 lit. water | 1.31* (0.72) | 1.17 (0.37) | 1.39* (0.93) | 1.31 (0.72) |
| 2. | Biosoft @ 40 g/10 lit. water | 1.39 (0.93) | 1.25 (0.56) | 1.46 (1.13) | 1.39 (0.93) |
| 3. | Biosoft @ 30 g/10 lit. water | 1.46 (1.13) | 1.31 (0.72) | 1.52 (1.31) | 1.43 (1.04) |
| 4. | *Bacillus thuringiensis* @ 10 g/10 lit. water | 1.39 (0.93) | 1.23 (0.51) | 1.43 (1.04) | 1.38 (0.90) |
| 5. | Azadirachtin 1500 ppm @ 50 ml/10 lit. water | 1.46 (1.13) | 1.31 (0.72) | 1.49 (1.22) | 1.43 (1.04) |
| 6. | HaNPV @ 10 ml/10 lit. water | 1.51 (1.28) | 1.23 (0.51) | 1.38 (0.90) | 1.38 (0.90) |
| 7. | Quinalphos 0.05% | 1.38 (0.90) | 1.08 (0.17) | 1.58 (1.50) | 1.08 (0.17) |
| 8. | Untreated control | 1.46 (1.13) | 1.21 (0.46) | 1.51 (1.28) | 1.38 (0.90) |
| | S.Em ± | 0.14 | 0.13 | 0.17 | 0.16 |
| | C.D. at 5% | NS | NS | NS | NS |
| | C.V. (%) | 22.02 | 23.12 | 25.19 | 26.20 |

* transformed values  Figures in parentheses are original values  NS = Not significant

**Table 3. Effect of Biosoft (*B. bassiana*) on yield of cabbage heads**

| S. No. | Treatments | Yield (q/ha) | | Pooled |
|---|---|---|---|---|
| | | 2007-08 | 2008-09 | Mean (q/ha) |
| 1. | Biosoft @ 50 g/10 lit. water | 620 | 509 | 564 |
| 2. | Biosoft @ 40 g/10 lit. water | 519 | 467 | 493 |
| 3. | Biosoft @ 30 g/10 lit. water | 479 | 440 | 459 |
| 4. | *Bacillus thuringiensis* @ 10 g/10 lit. water | 538 | 474 | 506 |
| 5. | Azadirachtin 1500 ppm @ 50 ml/10 lit. water | 459 | 420 | 440 |
| 6. | HaNPV @ 10 ml/10 lit. water | 365 | 346 | 356 |
| 7. | Quinalphos 0.05% | 467 | 430 | 448 |
| 8. | Untreated control | 348 | 341 | 344 |
| | S.Em ± | 30.17 | 26.20 | 21.10 |
| | C.D. at 5% | 84.92 | 73.73 | 58.49 |
| | C.V. (%) | 20.11 | 19.35 | 19.80 |

## RESULTS AND DISCUSSION

After first spray, the plots sprayed with higher (50 g/ 10 lit. water) doses of Biosoft registered minimum (1.25 larvae/plant) number of DBM larvae followed by *Bt* (1.02 larvae/plant). Similarly, the data for second spray indicated that the plots treated with higher doses of Biosoft exhibited significant reduction in the larval population (6.34 larvae/ plant). However, during the second year, all the three varied doses of Biosoft showed significantly lower (1.01 to 1.76 larvae/plant) larval population than other treatments evaluated after first spray. After the second spray, minimum (0.37 larva/plant) population of DBM larvae was recorded in the treatment Biosoft (@ 50 g/10 lit. water) followed by *Bt* (0.42) and Biosoft applied at medium (0.40) and lower (0.61) doses. These treatments were at par and proved significantly superior to the treatments of HaNPV and untreated check.

Shelton *et al.* (1998) reported that the commercial formulation "Mycotrol" (*B. bassiana*) was as effective as *Bt* product in preventing damage of *P. xylostella* on cabbage seedlings. During this study minimum (0.66 larvae/ plant) incidence of the pest was found in the plots treated with higher (50 g/10 lit. water) doses of Biosoft followed by *Bt* and Biosoft applied @ 40 g/10 lit. water. A similar reduction in larval population due to *B. bassiana* was reported by Ibrahim and Low (1993), Yarkulov (2000) and Das and Mandal (2005).

Yield of cabbage heads (Table 2) recorded during 2007-08 and 2008-09 revealed that maximum yield was harvested from the plots sprayed with Biosoft (50g/10 lit. water) followed by *Bt* and Biosoft (40g/10g lit. water). During both years the number of cocoons (pupae) of *Apanteles* sp. was not affected by the application of different doses of Biosoft.

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