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# Different *Bt* formulations against pod borer complex in pigeonpea ecosystem

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## ABSTRACT

An experiment was conducted to evaluate different *Bacillus thuringiensis* formulations for the management of podborers on pigeonpea for two years during 2010-11 and 2011-12 at Zonal Research Station, University of Agricultural Sciences, GKVK, Bangalore. Three formulations of *Bt* viz., Dipel, Halt and DOR were tested at 1.0 and 1.5 kg per ha and indoxacarb at 60 g a. i per ha was used as check. The results revealed that the lowest mean pod damage by *Helicoverpa* was recorded in indoxacarb with 19.94 per cent. Among *Bt* formulations, DOR *Bt* formulation at 1.5 kg per ha proved better by recording 28.89 per cent. The damage by podfly and field infestation by bruchid was also of the same trend. Total pod damage was also in indoxacarb with 40.61 followed by DOR *Bt* formulation at 1.5 kg per with 54.64 per cent. Highest yield was recorded in indoxacarb treatment with 1087 kg per ha followed by DOR *Bt* formulation with 895 kg per ha. The lowest yield was observed in untreated control with 599 kg per ha which was inferior to all other treatments.

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**Key words**: Pigeonpea, *Bt* formulation, *Helicoverpa*, podfly, bruchid.

## INTRODUCTION

Pigeon pea is a major legume crop in the tropics and subtropics and accounts for 5 per cent of world legume production (Hillocks *et al.,* 2000). Out of world's total area of 2.8 million hectares under pigeonpea, India has about 2.5 million hectares under this crop. Worldwide, over 30 species of Lepidoptera from six different families feed on the reproductive structures of pigeonpea (Shanower *et al.,* 1999). Podborer complex comprising of gram podborer, *Helicoverpa armigera* (Hubner), spotted podborer, *Maruca vitrata* (Geyer), podfly, *Melanagromzya obtusa* (Malloch), plume moth, *Exelastis atomosa* (Walsingham) and blue butterfly, *Lampides boeticus* (Linnaeus) cause considerable losses in the yield of pigeonpea. However, the damage to pod or seed at the reproductive stage by the podborer complex can significantly reduce the yields of pigeonpea. The potential of the plant to compensate insect caused injury at such a later stage is limited, resulting in losses. Among these gram podborer, *H. armigera* is one of the most dreaded insect pests in agriculture, accounting for the consumption of over 30 per cent to the total insecticide use worldwide. Frequent and rapid changes in cropping patterns and agro-ecosystems, the polyphagous nature of the pest, and its cosmopolitan abundance have multiplied the problem by manifolds globally. The problems of this pest are magnified due to its direct attack on fruiting structures, its voracious feeding habits, its high mobility and fecundity, its multivoltine, overlapping generations with facultative diapauses, its nocturnal behavior, migration and a propensity for acquiring resistance against insecticides (Sarode, 1999). The other lepidopteran borers *viz.,* spotted podborer, plume moth, podfly and blue butterflies are also potential pests causing heavy losses which may range up to 20 - 30 per cent.

In India, calendar sprays are recommended and followed with the first application of 50 per cent flowering and the second and third applications at ten-day intervals. Farmers now apply 6-8 times per season. The rapid increase in pesticide use on pigeonpea is alarming and emphasizes farmers' concern with insect pests. The trend also highlights the need for safe and effective management strategies. Use of different *Bacillus thuringiensis* formulations for the management of podborers on pigeonpea has received much attention, particularly in southern India through reliable control on pigeonpea has not been obtained (Shanower *et al.,* 1999). *Bt* products suffer from highly variable quality and limited distribution network than conventional insecticides hence, in order to evaluate available formulations of *Bt* this experiment was undertaken.

**Table 1.** Effect of different *Bacillus thuringiensis* formulations for the management of podborers of pigeonpea

| Treatments | % *Helicoverpa* | | | % field infestation of Bruchids | | | % Podfly | | | Mean total podborers % | Yield Kg/ha | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2010-11 | 2011-12 | Pooled | 2010-11 | 2011-12 | Pooled | 2010-11 | 2011-12 | pooled | | 2010-11 | 2011-12 | Mean |
| DOR Bt 1.0 kg /ha | 18.57 | 49.01 | 33.79 | 24.25 | 8.82 | 16.54 | 6.37 | 10.06 | 8.22 | 58.55 | 836 | 591 | 714 |
| DOR Bt 1.5 kg /ha | 16.08 | 41.87 | 28.98 | 26.47 | 8.34 | 17.41 | 7.24 | 9.26 | 8.25 | 54.64 | 1047 | 742 | 895 |
| Halt 1.0 kg/h | 19.41 | 44.51 | 31.96 | 31.56 | 9.00 | 20.28 | 10.21 | 9.55 | 9.88 | 62.12 | 935 | 649 | 792 |
| Halt 1.5 kg/ha | 17.36 | 42.57 | 29.97 | 27.45 | 6.76 | 17.11 | 9.24 | 9.19 | 9.22 | 56.3 | 1158 | 625 | 892 |
| Dipel 1,0 kgi/ha | 19.54 | 45.92 | 32.73 | 26.34 | 8.16 | 17.25 | 8.31 | 12.03 | 10.17 | 60.15 | 904 | 406 | 655 |
| Dipel 1,5 kg /ha | 17.32 | 43.86 | 30.59 | 24.21 | 8.56 | 16.39 | 7.54 | 11.96 | 9.75 | 56.73 | 836 | 558 | 697 |
| Indoxacarb 60 g ai/ha | 9.32 | 30.56 | 19.94 | 19.56 | 6.80 | 13.18 | 4.57 | 10.41 | 7.49 | 40.61 | 1258 | 916 | 1087 |
| Untreated control | 54.17 | 58.83 | 56.5 | 23.78 | 9.61 | 16.70 | 12.71 | 13.12 | 12.92 | 85.22 | 597 | 600 | 599 |
| S. Em. ± | | | **1.24** | | | **2.12** | | | **2.68** | | | | **84** |
| CD (5%) | | | **3.65** | | | **5.83.** | | | **6.85** | | | | **256** |
| CV (%) | | | **19.69** | | | **11.87** | | | **14.85** | | | | **12.54** |

## MATERIALS AND METHODS

The field trial was conducted to evaluate three different *Bt* formulations for the management of podborers on pigeonpea for two years during kharif 2010-11 and 2011-12 at Zonal Research Station, University of Agricultural Sciences, GKVK, Bangalore. The pigeonpea cultivar BRG-1 was used in the experiment with a randomized complete block design with 8 treatments [$T_1$ - DOR *Bt* 1.0 kg /ha, $T_2$ - DOR *Bt* 1.5 kg /ha, $T_3$ – Halt 1.0 kg/ha, $T_4$ - Halt 1.5 kg/ha, $T_5$ – Dipel 1.0 kg/ha, $T_6$ - Dipel 1.0 kg/ha, $T_7$ - Indoxacarb 60 g ai/ha and $T_8$ – Untreated check] and replicated thrice. The plot size 4 × 4.5 m and spacing between rows and plants was 90 cm and 20 cm, respectively. The spraying was done thrice at 700 l/ha spray fluid once at 50 per cent flowering and another at ten days interval from the first spray. From each plot, 10 plants were selected randomly and pods harvested separately. Observations were recorded on pod damage by the podborers and yield per plot was also recorded. Statistical interpretation of data was done by following the Fischer's analysis of variance technique as given by Panse and Sukhatme (1967).

## RESULTS AND DISCUSSION

The experiment was conducted along with standard check indoxacarb 60 g a. i/ha. All the treatments proved to be significantly superior to untreated control. The results revealed that the lowest mean pod damage by *Helicoverpa* was recorded in indoxacarb 60 g ai/ha with19.94 per cent. Among *Bt* formulations, DOR *Bt* formulation at 1.5 kg per ha proved better by recording 28.89 per cent, followed by Halt at 1.5 kg/ha and Dipel at 1.5 kg /ha. The field infestation by bruchid was lowest in indoxacarb with 13.18 per cent, followed by Dipel at 1.5 kg /ha and DOR at 1.0 kg per ha. The per cent damage by podfly was least in indoxacarb rather than by DOR at 1.0 kg per ha and DOR at 1.5 kg per ha showed in Table 1. Studies conducted by Reddy *et al.* (2001) showed that *B. thuringiensis* (Dipel®) was effective in reducing the damage due to podborers. Thakre *et al.* (2003) reported *B. thuringiensis* when used at 1000 g/ha reduced pod damage caused by Lepidopteran pests and also by the podborer complex better than neem seed extract at 5 per cent and neem leaf extract at 5 per cent, whereas the results of Sunil *et al.* (2004) against podborer indicated Dipel ® 8L (*B. thuringiensis kurstaki*) in combination with fresh neem leaf extract was effective in controlling *H. armigera* on pigeonpea. The highest yield was recorded in indoxacarb treatment followed by DOR *Bt* at 1.5 kg/ha with 895 kg per ha. The lowest yield was observed in untreated control with 599 kg per ha which was inferior to all other treatments showed in Table 1. The present study indicated that *B. thuringiensis* could be used effectively for the management of podborers in pigeonpea. However, wide variations in the efficacy of different commercial formulations were observed under field conditions. Under these circumstances, use of *B. thuringiensis* formulation in IPM package needs to be thoroughly investigated.

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