

Original Research Article

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Management of Banana Pseudostem Weevil – A Biological Approach

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ABSTRACT

The production and productivity of banana is governed by many biotic and abiotic factors. Among biotic factors, incidence of insect-pests is considered as one of the major hindrance in successful cultivation of banana. In India, about eight pests commonly infest the banana crops; but of these, the banana stem weevil (*Odoiporus longicollis*) is cosmopolite's insect pest that threatens the banana cultivation. The most common management practices followed for managing this pest includes cultural practices and application of insecticides. An attempt was made to manage this insect pest using biocontrol agents with the following treatments: *Beauveria bassiana* (1×10^7 spores/ml) spray at 5th, 6th and 7th months after planting; *Metarrhizium anisopliae* (1×10^7 spores/ml) spray at 5th, 6th and 7th months after planting; swabbing *B. bassiana* on the pseudostem at 5, 6 and 7 month after planting; swabbing *M. anisopliae* on the pseudostem at 5, 6 and 7 month after planting; *Heterorhabditis indica* spray at 5, 6, 7 month after planting; stem trap swapped with *B. bassiana* @ 10ml/trap at 5 month after planting; stem trap swapped with *H. indica* @ 1×10^9 IJS /ml at 5th month after planting; insecticidal check – chlorpyrifos (0.1%) and untreated Control. Three years of experimentation resulted that among the bio-agents, application of *B. bassiana* was found to be the most effective in reducing the population of banana stem weevil. Amongst the treatments, swabbing *B. bassiana* on the pseudostem at 5, 6 and 7 month after planting showed the best result followed by stem trapping of banana stem weevil swapped with *B. bassiana* @ 10ml/trap at 5 month after planting. There was 59.31 and 69.78 per cent reduction in pseudostem infestation over control at 7 months after planting and at harvest, respectively in the best treatment. However, insecticidal spray out yielded all the treatment in reducing the pest incidence and increasing the yield of banana.

Keywords

Banana pseudostem weevil, *Beauveria bassiana*, *Heterorhabditis indica*

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Introduction

Banana is the fourth most important crops in the developing world after rice, wheat and corn, and is cultivated in about 130 countries that lay in tropical and subtropical regions

(Anon, 2000). India is the world's largest producer of bananas and plantains, however, production and productivity of banana is largely influenced by the attack of insect pests. In India, banana corm weevil, *Cosmopolites sordidus* (Germar) and the banana pseudostem

borer, *Odoiporus longicollis* (Oliver) are considered as the major pests (Valmayor *et al.*, 1994; Gold *et al.*, 1999; Sripriya *et al.*, 2000; Padmanaban and Kandasamy, 2003) out of about 15 commonly occurring insect pests that infest the banana crop.

The monophagus banana pseudostem borer is commonly found in India, China, Malaysia, Indonesia, Nepal and Thailand and severely affects the production and productivity of banana in these countries (Visalakshi *et al.*, 1989, Valmayor *et al.*, 1994). The larvae make tunnels by feeding voraciously on the tissues of the succulent sheath and reach the true stem. Due to the tunneling activity of the larvae, the stem rots and falls down due to loss of tensile strength (Padmanaban and Sathiamoorthy, 2001). These tunnels also act as an infection court for many rot promoting organisms (Gold *et al.*, 2001). A yield loss ranging from 10-90 per cent has been reported depending on the stage of plant growth at which pest infestation occurs and also the efficiency of the management or cultivation practice followed (Padmanaban and Sathiamoorthy, 2001). Banana pseudostem is a common insect pest of banana in Assam.

All most all AAA banana genotypes are found to be susceptible to this pest (Das and Baruah, 2018). Monocropping for several years associated with poor management practices tremendously increases its infestation. The most common management practices followed for managing this pest includes cultural practices and application of insecticides. Application of chemical insecticides though the most effective method for managing this pest, but it poses threat to the environment causing air – ground water pollution and health hazards. Considering the importance of the problem and ill consequences of use of chemical insecticides, a field trial was conducted for management of banana pseudostem borer using biological agents.

Materials and Methods

Field experiment was conducted at the Horticultural Orchard, Assam Agricultural University, Jorhat -13 during 2010-2015 in a naturally infested field with banana pseudostem weevil, *Odoiporus longicollis*. The experiment was laid in randomized block design with nine treatments, each with three replications. The treatments included were: T₁: *Beauveria bassiana* (1×10^7 spores/ml) spray at 5th, 6th and 7th months after planting, T₂: *Metarrhizium anisopliae* (1×10^7 spores/ml) spray at 5th, 6th and 7th months after planting, T₃: swabbing *B. bassiana* (1×10^7 spores/ml) on the pseudostem at 5, 6 and 7 month after planting, T₄: swabbing *M. anisopliae* (1×10^7 spores/ml) on the pseudostem at 5, 6 and 7 month after planting, T₅: *Heterorhabditis indica* spray at 5, 6, 7 month after planting, T₆: stem trap swapped with *B. bassiana* @ 10ml/trap at 5 month after planting, T₇: stem trap swapped with *H. indica* @ 1×10^9 IJS /ml at 5th month after planting, T₈: insecticidal check – chlorpyrifos @ 0.1% (2.5 ml/lit) and T₉: untreated Control. Banana cultivar ‘Jahaji’ (susceptible to banana pseudostem weevil) was planted at a spacing of 1.5x1.5 m with eight plants per treatment.

The crop was raised in rainfed condition and all crop management activities were carried out as per package. Observations on per cent pseudostem infestation at 7 months after planting and at harvest and yield parameters were recorded.

For stem trapping, pseudostem of susceptible banana cultivar was longitudinally split in to two halves and then cut into about 2.0 ft pieces. Each single piece was treated with required quantity of biocontrol agents.

One such trap was used for an area of 2.25m². The traps were changed at weekly interval with a fresh trap.

Results and Discussion

Three years pooled data presented in Table 1 reflects that all the treatments significantly reduced the infestation of banana pseudostem weevil and increased plant growth parameters and yield of banana cv. 'Jahaji'. Amongst the treatments with biocontrol agents, swabbing *Beauveria bassiana* (1×10^7 spores/ml) on the pseudostem at 5, 6 and 7 months after planting (T₃) exhibited the best result in reducing the weevil infestation and increasing plant growth parameters and yield.

Among the treatments with biocontrol agents, maximum plant growth (113.10 cm) at harvest was recorded at T₃ i.e. swabbing *B. bassiana* on the pseudostem at 5, 6 and 7 months after planting. There was 4.32 per cent increase in plant growth over untreated control. Treatment with swabbing *Metarhizium anisopliae* on the pseudostem at 5, 6 and 7 month after planting (T₄), *Heterorhabditis indica* spray at 5, 6, 7 month after planting (T₅), stem trap swapped with *B. bassiana* @ 10ml/trap at 5 month after planting (T₆) and stem trap swapped with *H. indica* @ 1×10^9 IJS /ml at 5th MAP (T₇) were at par with the treatment T₃ in respect to plant height. Similarly, plant girth at harvest also was maximum at this treatment (T₃). A significant of 8.66 per cent in increase in plant girth was recorded at this treatment over untreated control. This treatment was followed by stem trap swapped with *B. bassiana* @ 10ml/trap at 5 month after planting (T₆), and was at par with T₃ (Table 1).

Lowest number of pseudostem infested plants at 7 months after planting and at harvest was recorded with swabbing *B. bassiana* on the pseudostem at 5, 6 and 7 month after planting (T₃), followed by stem trap swapped with *B. bassiana* @ 10ml/trap at 5 month after planting (T₆). There was 59.31 and 69.78 per cent reduction in pseudostem infestation over control at 7 months after planting and at

harvest, respectively; when banana pseudostem were swabbed with *B. bassiana* at 5, 6 and 7 month after planting (Table 1).

Swabbing *B. bassiana* on the pseudostem at 5, 6 and 7 months after planting significantly increased the yield and yield attributing parameters of banana over untreated control.

Maximum length of the finger, girth of the finger, number of hands per bunch and yield was recorded in this treatment than other bioagents treatment.

Use of entomopathogenic fungi had been reported with success for combating the infestation of banana weevils since 1970s (Ayala & Monzon 1977; Delattre & Jean-Bart 1978). Amongst the entomopathogenic fungi, *Beauveria bassiana* and *Metarhizium anisopliae* were found to be more promising in reducing the weevil population (Mesquita *et al.*, 1981; Pena *et al.*, 1995). Wang and Yen (1972) reported that banana pseudostem weevils were highly susceptible to the entomogenous fungus, *Metarhizium anisopliae*. *M. anisopliae* affected more than 90 per cent mortality under laboratory conditions.

Ferron (1981) stated that *B. bassiana* and *M. anisopliae* gained considerable attention as biological control agents for controlling cryptic insects, such as banana weevil, which were difficultly accessible to arthropod natural enemies. Padmanaban and Sathiamoorthy (2001) isolated a good number of fungal pathogens viz., *Fusarium solani*, *Mucor heimalis*, *Aspergillus niger* and *Scopulariopsis bevicaulis* from field population of *O. longicollis*, which may be effective in managing this pest. Padmanaban *et al.*, (2009) observed highest reduction of weevil infestation when stem traps were swabbed with rice chaffy grain formulation of *B. bassiana*.

Table.1 Effect of different biocontrol agents on management of banana pseudostem weevil (Mean of three years)

Treatments	Plant height at harvest (cm)	Plant girth at harvest (cm)	Number of plant infested (%) After 7 months	Intensity of infestation at harvesting stage	Length of finger (cm)	Girth of finger (cm)	No of hands/ bunch	Yield (kg /plant)
T ₁	108.77	70.75	32.09	34.40	15.36	8.82	8.7	12.53
T ₂	109.57	69.83	34.01	39.87	15.50	8.61	8.1	12.03
T ₃	113.10	75.25	25.04	31.63	15.70	9.32	9.7	14.40
T ₄	111.87	69.50	33.56	38.07	15.82	9.14	8.5	12.06
T ₅	110.40	70.08	35.15	45.30	15.03	8.37	7.1	11.18
T ₆	111.13	72.08	28.45	35.67	15.52	8.94	8.7	13.00
T ₇	112.90	70.42	33.21	36.37	15.52	8.46	7.5	11.73
T ₈	115.08	75.50	15.49	19.83	16.03	9.97	11.4	16.55
T ₉	108.42	69.25	39.89	53.70	10.07	6.90	7.1	9.13
CD (0.05)	2.91	4.30	2.48	5.71	0.96	0.57	0.56	0.73

They concluded that *B. bassiana* (isolate: 17–6) has potential as a biocontrol agent to manage pseudostem weevils of banana. Irulandi *et al.*, (2012) reported that stem trapping with *B. bassiana* could cause 56.75 per cent reduction of banana pseudostem weevil. In a laboratory study, Alagesan *et al.*, (2019) observed that *B. bassiana* isolate KH3 (1×10^8 conidia/mL⁻¹) was more bioeffective against *O. longicollis* larvae, causing >90% significant mortality in 12 and 18 days. The present study also is in agreement with the observation of the above authors and concludes that stem trapping with *Beauveria bassiana* can be effectively used for management of banana pseudostem weevil.

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