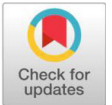


Research Article

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Infestation and management of banana pseudostem borer, *Odoiporus longicollis* Oliver

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ABSTRACT

The pseudostem borer, *Odoiporus longicollis* is a serious pest causing heavy losses to the banana growers. To manage the pest farmers rely on chemical insecticides even after bunch formation. Since the whole banana plant is edible in one way or the other for consumption, the usage of persistent insecticides will lead to residues. Therefore, studies were undertaken to assess the level of infestation by pseudostem borer in banana and to evaluate the botanical, neem formulation against banana pseudostem borer. Among the ten banana varieties screened for the infestation of pseudostem borer, the severity was maximum in Nendran (31.69%) followed by Red banana (19.07%). The pseudostem borer was recorded as a major pest in the banana varieties viz., Nendran, Red banana, Matti, and Palayamkottan (>10%) and a minor pest in the banana varieties viz., Robusta, Rasakathali, and Ney poovan (1-5%). The occurrence of *O. longicollis* was not observed in Karpooravalli, Monthan, and Peyan. According to the level of infestation, the banana varieties viz., Nendran and Red banana were found to be highly susceptible to *O. longicollis* and among them, nendran is best for trapping banana pseudostem borer and can be used as pseudostem traps. Application of azadirachtin 10000 ppm at 4 ml/l thrice at 5th, 6th, and 7th months after planting showed 55.57 and 59.35 per cent reduction of pseudostem borer over untreated check in nendran and red banana, respectively, and can be used for safe management of banana pseudostem borer.

Keywords: Banana, Pseudostem borer, *Odoiporus longicollis*, Banana varieties, Azadirachtin

Introduction

Banana, *Musa* sp. commonly known as the "Apple of Paradise" is the fourth most important commodity next to rice, wheat, and corn in the world. Bananas and plantains are very important among the tropical fruits of India and are the oldest cultivated fruits wrapped with essential nutrients which provide protective health impact. India is the major country leading the world in banana production with an annual output of about 14.2 million tonnes and ranks first in banana production and third in area among fruit crops [1]. More than 180 species of insect pests have been recorded in banana world over [2], and among them, 30 insect pests are designated as major pests [3]. In India, nineteen species infest bananas [4]. Of them, the pseudostem weevil, *Odoiporus longicollis* Oliver (Coleoptera: Curculionidae), a cosmopolitan pest is gaining importance as a serious pest causing heavy losses to the banana growers. Adult females of *O. longicollis* lay eggs in the outermost leaf sheath of banana. Larvae hatch from the eggs and bore into the living tissue, producing frass-filled tunnels that weaken the affected parts of the host plant and permit the invasion of fungal and bacterial

pathogens. Mature larvae pupate in cocoons made from plant fibres close to the exit holes. The pseudostem borer infestation usually starts from 5th months after planting. Initially, pin head sized holes can be located on the pseudostem, and later gummy ooze from the holes. Extensive infestation of this weevil makes the pseudostem weak and thus reduces the rate of flowering of the plant and finally results in undersized fruits or no fruiting at all [5]. The tunnels created by this pest on the host plants weaken the stem leading to premature falling of plants [6]. All the life stages of the borer can be visualized throughout the year. It has been estimated that this weevil causes 10-90 per cent yield loss depending on the infestation stage [7]. This economically important pest of banana has been reported throughout India viz., Andaman and Nicobar Islands, Assam, Bihar, Delhi, Gujarat, Haryana, Jammu & Kashmir, Kerala, Manipur, Sikkim, Tamil Nadu, Uttar Pradesh, and West Bengal [8]. In Southern India, banana is a major crop grown by the farmers, and management of this specific pest is greater havoc to the banana growers. Farmers rely on insecticidal compounds even after bunch formation, thereby creating residue problems as well as environmental contamination. Hence, the level of infestation of pseudostem borer was assessed in different banana varieties and the efficacy of botanical neem formulation against pseudostem borer was also studied.

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Materials and Methods

Assessment on the infestation of banana pseudostem borer

The different banana varieties/ cultivars commonly grown in three different locations were assessed for their susceptibility

to *O. longicollis*. Infestation levels of the pseudostem borer were recorded based on the percentage of plants infested. The damage grade index used for rating is as follows [9].

0	:	Plants with no symptoms
1	:	Plants with 1 to 5 bore holes on the pseudostem
2	:	Plants with 6 to 10 bore holes on the pseudostem
3	:	Plants with more than 10 bore holes on the pseudostem
4	:	Plants with pseudo stem about to break or already broken

Also based on the per cent plant infestation, damage was categorized as minor (1-5%), moderate (>5-10%), and major (>10%) [10].

Based on the level of infestation, the highly susceptible, susceptible, and less susceptible varieties were identified.

Efficacy of botanical neem formulation against banana pseudostem borer

The botanical neem formulation, azadirachtin 10000 ppm @ 4 ml/ l was evaluated against *O. longicollis* in three banana gardens each of nendran and red banana varieties by pseudostem injection and compared with farmers' practice of spraying of alphamethrin 10 SC @ 4 ml/l) and untreated check during 2021-22. Each treatment was replicated seven times and five plants/ replication were used for the study. Observations were recorded at the time of harvest on the per cent infestation of banana pseudostem borer and the population of adult weevils/ plant.

Statistical Analysis

The per cent infestation data were subjected to statistical analysis by adopting randomized block design using the package OP STAT after converting it to an arcsine percentage values. The data on the mean population of adult weevils were converted to square root values for statistical analysis.

Results and Discussion

Infestation of banana pseudostem borer

The per cent infestation of pseudostem borer was assessed on the banana varieties grown in three different locations for each variety. The data (Table 1) revealed that the severity of banana pseudostem borer, *O. longicollis* was maximum in Nendran (31.69%) followed by Red banana (19.07%). The pseudostem borer was recorded as a major pest in the banana varieties viz., Nendran, Red banana, Matti, and Palayamkottan (>10%). In the banana varieties viz., Robusta, Rasakathali, and Ney poovan it was categorized as a minor pest (1-5%). The occurrence of *O. longicollis* was not observed in Karpooravalli, Monthan, and Peyan.

The incidence of banana pseudostem weevil assessed in fifteen districts of Southern Karnataka [10] revealed that in ten districts the pest was categorized as a major pest and the remaining five districts as a minor pest.

Based on the damage grade index [9], it was observed that all the grade levels viz., 1 to 4 were observed in Nendran and 1 to 3 in Red banana, and thus it was evident that both the varieties are highly susceptible to the attack of *O. longicollis* (Table 2). The present finding is in tune with the findings that the varieties Nendran and Red kappa were highly susceptible to banana pseudostem borer [11]. This was also in agreement with the finding [12] that the highest level of infestation of pseudostem weevil was noticed on Nendran followed by Red banana. They also reported that the weevil attacked the other banana variety

such as Karpooravalli which deviated from the present findings in which nil incidences were recorded. The susceptibility of nendran and red banana to *O. longicollis* was already reported [13].

Efficacy of botanical neem formulation against banana pseudostem borer

The pseudostem injection of azadirachtin 10000 ppm at 4 ml/l tested in three banana gardens each of nendran and red banana revealed that the per cent reduction of pseudostem borer over untreated check was found to be less than the farmers' practice of spraying of alphamethrin 10 SC @ 4 ml/l (Tables 3 and 4). The farmers' practice recorded 11.43, 8.57, 11.43 and 8.57, 5.71, 8.57 per cent infestation of banana pseudostem borer in nendran and red banana varieties, respectively whereas, it was 14.29, 14.29, 17.14 and 11.43, 8.57, 11.43 per cent in the pseudostem injection of azadirachtin 10000 ppm @ 4 ml/l.

The pseudostem injection of azadirachtin 10000 ppm at 4 ml/l gave 54.53, 58.33, 53.85, and 55.54, 62.51, 59.99 per cent reduction of pseudostem borer over the untreated check. The farmers' practice showed a maximum of 70.26 per cent reduction over untreated check (Table 3). The mean population of adult weevils recorded at harvest also revealed that a maximum of 8.14 and 5.46 weevils/ plant was observed in the plots injected with azadirachtin 10000 ppm at 4 ml/l in nendran and red banana and it was 5.63 and 4.06 weevils/ plant in farmers' practice and 15.51 and 10.06 weevils/ plant in untreated check. The mean per cent reduction of adult weevils in pseudostem injected plants is 44.53 and 48.81 per cent in nendran and red banana varieties, respectively whereas it ranged between 58.10 and 68.15 per cent in the farmers' practice (Table 4).

The efficacy of neem was studied against banana pseudostem borer and the results stated that stem injection of Neemazal (4:4) recorded 93.81 per cent mortality of pseudostem borer after 96 hours of application [14]. Another finding revealed that stem injection of Azadirachtin showed the highest per cent mortality of 84.74 per cent after 96 hours of treatment [15]. It was also reported that neem based botanical formulations could be effective and safe to use in banana against pseudostem weevil [16].

Conclusion

Thus from the present study, it is concluded that the banana variety nendran can be used as pseudostem traps for trapping adult weevils in the banana fields and pseudostem injection of azadirachtin 10000 ppm @ 4 ml/ l and 4 ml/ plant at two different heights can be effectively used for the management of banana pseudostem borer, *O. longicollis*. Though the neem formulation is little less effective than the chemical insecticide, usage of chemicals in banana plants after bunch formation may lead to residues. In this context, pseudostem traps and neem applications can be integrated and used for the management of banana pseudostem borer.

Conflict of Interest: The authors declare no conflict of interest in the subject matter or materials discussed in this manuscript.

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Table 1. Infestation percentage of pseudostem borer, *Odoiporus longicollis* in different banana Varieties

S.N.	Banana varieties	Infestation of pseudostem borer (%)				Damage Rating
		Location I	Location II	Location III	Mean	
1.	Nendran	57.14	25.93	12.00	31.69 (33.33) ^e	Major
2.	Red Banana	23.33	13.88	20.00	19.07 (25.77) ^{de}	Major
3.	Matti	10.29	0.0	20.00	10.10 (15.27) ^{bcd}	Major
4.	Karpooravalli	0.0	0.0	0.0	0.0 (0.52) ^a	-
5.	Robusta	8.89	2.50	0.0	3.80 (8.99) ^{ab}	Minor
6.	Palayamkottan	19.23	18.75	5.00	14.33 (21.53) ^{cde}	Major
7.	Rasakathali	8.57	0.0	4.62	4.40 (9.98) ^{abc}	Minor
8.	Ney poovan	6.25	0.0	0.0	2.08 (5.17) ^{ab}	Minor
9.	Monthan	0.0	0.0	0.0	0.0 (0.52) ^a	-
10.	Peyan	0.0	0.0	0.0	0.0 (0.52) ^a	-
	SE.D	-	-	-	5.88	-
	CD (p=0.05)	-	-	-	12.35	-

Figures in parentheses are arc sine transformed values

Table 2. Damage grade index on the infestation level of banana pseudostem borer

Banana varieties	Total No. of banana plants	No. of banana plants under each Grade				
		0	1	2	3	4
Nendran	197	121	8	32	14	22
Red Banana	166	133	10	19	4	0
Matti	162	144	18	0	0	0
Robusta	125	119	6	0	0	0
Palayamkottan	98	81	10	7	0	0
Rasakathali	100	94	6	0	0	0
Ney poovan	16	15	1	0	0	0

Table 3. Efficacy of neem formulation against *O. longicollis*

Treatments	Per cent Infestation						Per cent reduction over untreated check					
	Nendran			Red Banana			Nendran			Red Banana		
	Loca tion 1	Loca tion 2	Loca tion 3	Loca tion 1	Loca tion 2	Loca tion 3	Loca tion 1	Loca tion 2	Loca tion 3	Loca tion 1	Loca tion 2	Loca tion 3
T1 - Pseudostem injection of azadirachtin 10000 ppm at 4 ml/l (1:4)	14.29 (18.97)	14.29 (18.97)	17.14 (22.76)	11.43 (15.17)	8.57 (11.38)	11.43 (15.17)	54.53	58.33	53.85	55.54	62.51	59.99
T2-Farmer Practice (spraying of alphamethrin 10 SC @ 4 ml/l)	11.43 (13.19)	8.57 (11.38)	11.43 (15.17)	8.57 (11.38)	5.71 (7.59)	8.57 (11.38)	63.63	75.01	69.22	66.67	75.02	70.00

T ₃ -Untreated Check	31.43 (33.79)	34.29 (35.60)	37.14 (37.41)	25.71 (30.17)	22.86 (28.36)	28.57 (31.98)	-	-	-	-	-	-
SE. D	7.24	5.75	5.79	7.07	6.29	5.80	-	-	-	-	-	-
CD (p = 0.05)	15.95	12.66	12.75	15.58	13.86	12.79	-	-	-	-	-	-

Figures in parentheses are arc sine transformed values.

Table 4. Efficacy of neem formulation against *O. longicollis*

Treatments	Mean population of adult weevils/ plant						Per cent reduction over untreated check					
	Nendran			Red Banana			Nendran			Red Banana		
	Loca tion 1	Loca tion 2	Loca tion 3	Loca tion 1	Loca tion 2	Loca tion 3	Loca tion 1	Loca tion 2	Loca tion 3	Loca tion 1	Loca tion 2	Loca tion 3
T ₁ - Pseudostem injection of azadirachtin 10000 ppm at 4 ml/l (1:4)	7.09 (2.84)	8.06 (3.01)	8.14 (3.02)	5.46 (2.54)	4.94 (2.44)	4.20 (2.28)	42.96	43.12	47.51	45.73	49.02	51.67
T ₂ -Farmer Practice (spraying of alphamethrin 10 SC @ 4 ml/l)	4.43 (2.33)	5.63 (2.57)	4.94 (2.43)	3.94 (2.22)	4.06 (2.25)	3.09 (2.02)	64.36	60.27	68.15	60.83	58.10	64.44
T ₃ -Untreated Check	12.43 (3.66)	14.17 (3.89)	15.51 (4.06)	10.06 (3.32)	9.69 (3.27)	8.69 (3.11)	-	-	-	-	-	-
SE. D	0.05	0.06	0.07	0.05	0.04	0.04	-	-	-	-	-	-
CD (p = 0.05)	0.11	0.13	0.15	0.12	0.08	0.08	-	-	-	-	-	-

Figures in parentheses are square root transformed values.

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