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Integrated management of top borer, *Scirpophaga excerptalis* Walker in sugarcane crop

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Abstract

The results of two years on larval population of top borer, *Scirpophaga excerptalis* showed remarkable variations under the influence of various treatments and were superior over untreated control. Percent reduction in larval population of top borer showed significant variation in the treatments. Treatment of endosulfan reduced the larval population to great extent (76.66%) followed by NPV (53.29%). The treatment with NSKE proved to be less effective (41.73%) against top borer. Two sprays with endosulfan gave highest per Rupee return (Rs. 4.29) followed by treatment having sprayed with neem seed kernel extract (Rs. 3.40), whereas, lowest per Rupee return of Rs 3.14 was recorded in the treatment having two sprays of NPV (Rs 3.14).

Keywords: Top borer, *Scirpophaga excerptalis*, sugarcane crop

Introduction

More than 200 species of insects are known from India, however, a few are considered as most devastating. Some of the common insects of the sugarcane, among them the sugarcane top borer, *Scirpophaga excerptalis* Walker is the most dangerous to mid-late maturing varieties and responsible for heavy loss in cane yield to the extent of 51% (Pandey *et al.* 1997; Madan *et al.* 1999) [10, 5]. Sugarcane infestation by *S. excerptalis* resulted in 30.08% weight loss and decreased cane length by 24.39% (Madan & Singh 2001) [4]. In Uttar Pradesh, India, a study by Singh & Singh (1997) [14] recorded reductions in cane stalk length by up to 68.0%, the number of internodes by up to 67%, cane weight by up to 86%, and CCS by up to 25.90% due to borer infestation. Among the pest, Gupta *et al.* (1993) [3] reported more than 45 per cent of yield losses in sugarcane are due to infestation by borer pests alone.

Integrated pest management that combines, cultural, mechanical, bio-pesticides and chemical pesticides. Bio-pesticides are certain natural plant products that belong to the so called secondary metabolites that include thousands alkaloids, terpenoids, phenolics and minor secondary chemicals. All parts of neem tree possess insecticidal property but seed kernel is the most active. Neem products appear to be quite promising against top borer ((Pandey *et al.* 1998; Abdullah *et al.* 2006) [11, 1]). Viral bio-pesticides of baculovirus group namely Nuclear Polyhedrosis Virus (NPV) after great scope as crop protection against on high value crops against lepidopteran pests (Misra *et al.*, 1991) [6]. A granulovirus was found to infect sugarcane top borer, *Scirpophaga excerptalis* for the first time and observed that this virus infects the larvae about 14.4% in the field (Singaravelu *et al.*, 1999) [13]. Western Uttar Pradesh is a great producer of sugarcane which attacked by top borer and caused suffered maximum damage to the crop. Keeping this in view, a study was conducted to determine the efficacy of insecticide and bio-pesticides against top borer.

Materials and Methods

Two experiments were conducted to determine the efficacy of insecticide and bio-pesticides against top borer, *S. excerptalis* in sugarcane crop during 2009 and 2010. The crop was planted in the fourth week of February and all the agronomical package of practices recommended for the region was followed in raising the crops. There were four treatments viz. endosulfan 35 EC (2 l/ha), NPV (500 LE/ha), Nem Seed Kernel Extract (NSKE) (5%) and control (untreated). Each treatment was repeated for five times. In a season, two sprays were given as per schedule when the larval population crossed the 1 or 2 larvae / 10 plants (economic threshold level) at 15 days intervals started from first week of July. The sprays were given with the help of knapsack sprayer in the evening hours. 1.0% Jaggery solution was used in NPV. Care was taken to avoid spray shift to adjacent plots. The population of larva was recorded on the 10 randomly selected plants in each plot of each treatment. The counts were made before spraying and on 5, 10 and 15 days after each spraying.

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The efficacy of bio-pesticides and insecticide was determined in terms of reduction in the larval population over control. The cane yield was recorded in each plot of each treatment. Cost benefit ratio was also calculated for each treatment on the basis of price of inputs like bio-pesticides, insecticide in the local market and labor charge and existing whole market price in Meerut at the time of harvesting. The reduction in yield and cost benefit ratio was calculated by applying the following formulae:-

$$\text{Yield reduction} = \text{Yield in a protected crop} - \text{yield in unprotected crop}$$

$$\text{Biopesticide / insecticide treatment threshold} = \frac{\text{Cost of pest control (Rs/ha)}}{\text{Price of the produce (Rs/Ha)}}$$

The statistical analysis of variance of the data obtained from experiments during different years including pooled data was done as per method by Panse and Sukatme (1967)^[7]. The data on larval population were analyzed after $\sqrt{x} + 1$ transformation and that of per cent values after angular transformation of $x + 1$ (Fisher and Yates 1982)^[2].

Results and Discussion

Field experiments were conducted in sugarcane crop during two consecutive years 2009 and 2010 to determine the efficacy of insecticide (endosulfan 35 EC) and bio-pesticides viz. NPV and Neem seed kernel Extract (NSKE) against top borer, *S. excerptalis* in sugarcane crop. The results after first and second spray were reported separately in Table 1 and 2. The pooled data of two years in Table 1 revealed that the

larval population of *S. excerptalis* showed remarkable variations under the influence of various treatments and were superior over untreated control. The pre-treatment counts on larval population were ranged from 5.07 to 5.60 larvae/ 10 plants. A significant reduction in its population was brought by the treatments after 10 days of their application, and as the exposure period increases from 5 to 15 days, the level of population was also increased in all treatments. However, in treatment with endosulfan, the level of larval population decreased to 0.73 larva/ 10 plants after 10 days of second spray. After 2nd spray, the mean larval population varied significantly between 1.33 to 7.21 larvae/10 plants, the lowest and highest being in endosulfan and untreated control, respectively. Percent reduction in larval population of top borer showed significant variation in the treatments. Treatment of endosulfan reduced the larval population to great extent (76.66%) followed by NPV (53.29%). The treatment with NSKE proved to be less effective (41.73%) against top borer (Table 1).

It was reported that systemic organophosphorus insecticide, reduced top borer incidence and increased cane yield over control (Pandey and Solanki 2007)^[12]. Application of endosulfan at 120 DAP gave the full protection from top borer (Pandya *et al.*, 2007)^[12]. In the present study, two sprays of endosulfan reduced the larval population by 76.66% which is in accordance to past studies. Two sprays of neem seed kernel extract was the third best, reduced the larval population up to 41.73%. Tewari (2001)^[15], Abdullah *et al* (2006)^[1] and Pandey (2014)^[9] also reported that the larval population kept low during the season by application of neem products.

Table 1: Integrated management of *Scirphophaga excerptalis* in sugarcane crop during 2009 & 2010 (Pooled).

Treatment	Dose	First spray						Second spray					
		Larvae/10 plants after days of I st spray						Larvae/10 plants after days of II nd spray					
		Pre treatment	5	10	15	Mean	Percent reduction	5	10	15	mean	Percent reduction	
Endosulfan 35 EC	2 l/ha	5.54	2.83	1.78	2.17	2.27(1.79) ^a	59.85(51.33) ^b	1.73	0.73	1.45	1.33(1.52) ^a	76.66(62.03) ^b	
NPV	500 LE/ha	5.07	3.57	2.73	2.77	3.03(2.00)	39.87(39.72)	2.57	2.17	2.33	2.35(1.82)	53.29(47.48)	
NSKE	5%	5.67	4.37	3.47	3.83	3.89(2.20)	31.43(34.58)	3.57	3.13	3.19	3.32(2.07)	41.73(40.78)	
Untreated	-	5.60	6.13	6.38	6.90	6.46(2.72)	0.00(5.74)	7.16	7.33	6.92	7.21(2.56)	0.00(5.74)	
SE(m) [±]	-	-	-	-	-	(0.059)	(1.06)	-	-	-	(0.052)	(1.73)	
CD at 0.5%	-	-	-	-	-	(0.18)**	(3.27)**	-	-	-	(0.16)**	(5.33)**	

a: $/x+1$ value.

b: Angular value of $x+1$.

**: Significant at 1%.

Table 2: Economic evaluation of management against *Scirphophaga excerptalis* in sugarcane crop during 2009 & 2010 (Pooled)

Treatment	Estimated yield (t/ha)	Increased over the control (t/ha)	Benefit (j)	Expense (j)	Cost/Benefit Ratio
Endosulfan 35EC (2 l/ha)	78.59	6.29	9624	2244	1:4.29
NPV (500 LE/ha)	75.70	3.40	5202	1658	1:3.14
NSKE (5%)	74.78	2.48	3794	1117	1:3.40
Untreated	72.30	-	-	-	-

The benefit cost analysis for each treatment showed that two sprays with endosulfan gave highest per Rupee return (Rs. 4.29) followed by treatment having sprayed with neem seed kernel extract (Rs. 3.40), whereas, lowest per Rupee return of Rs 3.14 was recorded in the treatment having two sprays of NPV (Rs 3.14). Treatment with two sprays of NSKE is proved to be the best treatment against *S. excerptalis* gave relatively higher return due to lower cost of plant protection (Table 2). It is concluded from the results that two sprays of endosulfan can give the maximum protection to the crop from the top borer during crop season. NPV gave the outstanding

performance as compared to neem seed kernel extract from reduction in larval population and increase in yield point of view. These findings would go a long way in developing eco-friendly management of top borer in sugarcane crop involving bio-pesticides as one of the alternative pest control tactics.

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