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Bio-Efficacy of Different Insecticides against Spotted Pod Borer *Maruca vitrata* (Geyer) Infesting Cowpea

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ABSTRACT: The study was conducted at the Education and Research Farm, Department of Agricultural Botany, College of Agriculture, Dapoli, Dr. Balasaheb Sawant Konakan Krishi Vidyapeeth, Dapoli (MS) India during *rabi* season of 2022 on the bio-efficacy of different insecticides *viz*., spinosad 45 per cent SC, emamectin benzoate 5 per cent SG, flubendiamide 480 per cent EC, chlorantraniliprole 18.5 per cent EC, lambda cyhalothrin 5 per cent EC, indoxacarb 14.5 per cent SC, and azadirachtin 1 per cent against spotted pod borer *Maruca vitrata* (Geyer) infesting cowpea. The overall result revealed that all the insecticidal treatments were significantly superior over untreated control in minimizing the larval population of *M. vitrata* infesting cowpea. Among the treatments, spinosad 45 EC @ 0.003 per cent was found more effective in reducing the pod damage (2.89%) and followed by indoxacarb 14.5 SC @ 0.014 per cent (3.96%). The next best treatments were emamectin benzoate 5 SG @ 0.002 per cent (4.76%), lambda cyhalothrin 5 EC @ 0.003 per cent (5.85%), chlorantraniliprole 18.5 EC @ 0.001 per cent (7.56%), flubendiamide 480 EC @ 0.002 per cent (7.90%) and azadirachtin 0.003 per cent (9.86%). The highest pod damage (16.99%) was recorded in the untreated control. The highest cowpea green pod yield (14.22q ha^{-1}) was achieved by spinosad 45 EC @ 0.003 per cent followed by indoxacarb 14.5 SC @ 0.014 per cent which recorded (13.70 q ha^{-1}), emamectin benzoate 5 SG @ 0.002 per cent(13.25 q ha^{-1}), lambda cyhalothrin 5 EC @ 0.003 per cent (12.36 q ha^{-1}), Chlorantraniliprole 18.5 EC @ 0.001 per cent(11.17 q ha^{-1}), Flubendiamide 480 EC @ 0.002 per cent (10.90 q ha^{-1}) and azadirachtin 1 @ 0.003 per cent (10.12 q ha^{-1}). Among all the treatments untreated control recorded lowest yield (9.14 q ha^{-1}).

Keywords: Pod damage, cowpea, yield, insecticides, spotted pod borer, *M. vitrata*.

INTRODUCTION

The cowpea (*Vigna unguiculata* L.) is an essential grain legume indigenous to Central Africa, thriving in tropical and subtropical regions. It belongs to the Fabaceae family and is consumed in various forms: as a grain, green pods, and leaves etc. Recognized for its nutritional value, especially in protein, it is versatile in culinary use. Beyond its significance in local cuisines, cowpea contributes to soil fertility by fixing nitrogen, cover crop, drought-tolerant, and has economic importance in agriculture. According to Oyewale and Bamaiyi (2013), the grain includes 54.85 per cent nitrogen free extract, 26.61 per cent protein, 3.99 per cent lipid, 56.24 per cent carbs, 8.60 per cent moisture, 3.84 per cent ash, 1.38 per cent crude fibre and 1.51 per cent gross energy (Yadav and Singh 2014).

Cowpea crops face significant challenges from various insect pests throughout their growth stages. The major pests include the spotted pod borer (*Maruca vitrata* Geyer), gram pod borer (*Helicoverpa armigera* Hubner), African pea moth (*Cydiaptychora* Meyrick), and Lycaenid Blue butterfly (*Lampides boeticus* Linnaeus). These pests, particularly borers, pose a substantial threat, leading to severe yield losses of up to 60 per cent. Managing these insect pests is crucial for increasing cowpea production and ensuring a higher yield.

The spotted pod borer, *Maruca vitrata* Geyer (Lepidoptera: Pyralidae), also known as the legume pod borer, poses a severe threat to grain legumes in tropical and subtropical regions due to its wide host range, widespread dispersion, and destructive nature. This pest targets both the vegetative and reproductive sections of the plant. The larvae of this pest exhibit a common feeding behavior, webbing on flower buds, blooms, and pods of pulses. This feeding habit provides protection to the larvae from natural predators and older class chemical applications (Yadav *et al*., 2015). The webbing behavior contributes to the resilience of the larvae against external threats, making effective pest management strategies crucial for mitigating the impact on pulse crops.

For controlling insect pests in cowpea crops, primary choice the chemical insecticides recommended by regulatory bodies such as CIB and RC. However, these label claimed insecticides need to be revalidated from time to time for the effective management of insect-pests (Bhamare *et al*., 2021). In this context, the present investigation was planned to investigate the bio-efficacy, of different insecticides against spotted pod borer *M. vitrata* infesting cowpea.

MATERIALS AND METHODS

During the *rabi* season of 2022, a field experiment was conducted at the Education and Research Farm, Department of Agricultural Botany, College of Agriculture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli (MS), India. The randomized block design (RBD) comprised eight treatments, each replicated thrice, focusing on the bio-efficacy of different label-recommended insecticides for cowpea against *M. vitrata*. The cowpea variety used was Konkan Sadabahar, grown in a spacing of 30cm × 30cm, following the recommended package of practices excluding plant protection measures. Eight insecticides, namely spinosad 45% SC, emamectin benzoate 5% SG, flubendiamide 480% EC, chlorantraniliprole 18.5% EC, lambda cyhalothrin 5% EC, indoxacarb 14.5% SC, and azadirachtin 1%, were assessed against *M. vitrata*, with water-sprayed plots serving as the control. Two applications of each insecticide were carried out at 50% flowering and 50% pod filling stages using a manually operated knapsack sprayer. This study provides valuable insights into the effectiveness of these insecticides in managing *M. vitrata* infestation in cowpea cultivation.

Method of recording observations. To assess the effectiveness of various insecticides, the total number of pods and the number of infested pods were quantified using the specified formula. The data were collected from five randomly chosen plants within each plot at intervals of 3, 7, 10, and 14 days post-application of the insecticides. Pre-count observations were documented before the initial insecticide application. Notably, the data collected at the 15-day mark after the first spray were regarded as the pre-count observations for the second spray. To facilitate statistical analysis, the obtained data underwent arcsine transformation. The percentage of pod damage was subsequently calculated using the formula established by Sravani *et al*. (2015).

$$\text{Per cent pod damage} = \frac{\text{Number of damaged pods per plant}}{\text{Total number of pods per plant}} \times 100$$

Yield. Crop harvesting was carried out manually, and the weights of healthy pods were recorded on a per-plot basis. These recorded weights were then converted to a hectare basis for a standardized assessment of yield differences among plots, allowing for a meaningful comparison of the effectiveness of different insecticide treatments.

RESULTS AND DISCUSSION

The overall mean percentage of pod damage resulting from two spray applications indicated that the treatment involving spinosad 45 EC at 0.003 per cent was notably effective in reducing pod damage, with indoxacarb 14.5 SC at 0.014 per cent also demonstrating significant efficacy. Following closely were emamectin benzoate 5 SG at 0.002 per cent, lambda cyhalothrin 5 EC at 0.003 per cent, chlorantraniliprole 18.5 EC at 0.001 per cent, flubendiamide 480 EC at 0.002 per cent, and azadirachtin 0.003 per cent. The untreated control exhibited the highest level of pod damage.

The findings of Akkabathula and Rana (2019) indicated that spinosad exhibited the minimum pod damage at 5.13 per cent, comparable to the effectiveness of indoxacarb (5.50%) and emamectin benzoate (5.66%) against Maruca vitrata infestation on pigeon pea. Conversely, flubendiamide recorded the maximum pod damage at 8.53%. These results align with Vaidya (2008) observations, where treatments involving 0.0033 per cent emamectin benzoate, 0.0035 per cent spinosad, and 0.005 per cent lambda cyhalothrin were significantly superior in controlling pod borer in cowpea.

Table 1: Efficacy of insecticides against pod borer, *M. vitrata* infesting cowpea (Cumulative average of two sprays).

Tr. No.	Treatment	Conc. (%)	Per cent pod damage				Overall Mean of two sprays
			3 DAS	7 DAS	10 DAS	14 DAS	
1	Spinosad 45 EC	0.003	3.26(10.11)	2.88(9.60)	3.23(9.99)	2.21(7.94)	2.89(9.41)
2	Emamectin benzoate 5 SG	0.002	6.17(14.23)	3.99(11.44)	3.92(11.13)	4.96(12.59)	4.76(12.34)
3	Flubendiamide 480 EC	0.002	7.33(15.70)	6.09(14.29)	8.12(16.53)	10.07(18.49)	7.90(16.25)
4	Chlorantraniliprole 18.5 EC	0.001	8.79(17.08)	7.11(15.39)	6.91(15.03)	7.44(15.79)	7.56(15.82)
5	Azadirachtin 1%	0.003	8.01(16.35)	7.72(16.13)	10.90(10.27)	12.84(20.99)	9.86(15.93)
6	Lambda cyhalothrin 5 EC	0.003	7.54(15.91)	4.51(12.26)	5.88(13.88)	5.49(13.22)	5.85(13.81)
7	Indoxacarb 14.5 SC	0.014	4.40(12.10)	4.43(12.11)	3.01(9.89)	4.03(10.55)	3.96(11.16)
8	Control	-	17.41(24.65)	14.73(22.57)	17.09(24.36)	18.76(25.65)	16.99(24.30)
	S.Em. +		0.22	0.20	0.22	0.22	0.21
	CD (p=0.05)		0.72	0.63	0.67	0.70	0.68

*Figures in the parentheses are arcsine values; DAS-Days after spray

Similarly, Patel *et al.* (2012) reported the efficacy of emamectin benzoate 5 SG (2.70%), indoxacarb 14.5 SC (2.98%), and spinosad 45 SC (3.58%) in managing *M. vitrata* on cowpea. Additionally, Rekha (2006) observed that emamectin benzoate, spinosad, and indoxacarb were significantly superior, resulting in lower pod damage percentages of 11.75, 12.92, and 14.01, respectively. These collective findings underscore the effectiveness of specific insecticides in managing pod borer infestation in diverse crops.

Yield. Table 2 presents the yield data of cowpea obtained from various plots treated with different insecticides.

Table 2: Yield of cowpea in different insecticidal treatments.

Tr. No.	Treatments	Conc. (%)	Yield q/ha
1	Spinosad 45 EC	0.003	14.22
2	Emamectin benzoate 5 SG	0.002	13.25
3	Flubendiamide 480 EC	0.002	10.90
4	Chlorantraniliprole 18.5 EC	0.001	11.17
5	Azadirachtin 1%	0.003	10.12
6	Lambda cyhalothrin 5 EC	0.003	12.36
7	Indoxacarb 14.5 SC	0.014	13.70
8	Control	-	9.14
SE (m)±			0.60
CD @ 5 %			1.83

The results of the study indicate that spinosad 45 EC at 0.003 per cent demonstrated the highest green pod yield, and it was statistically comparable to indoxacarb 14.5 SC at 0.014 per cent. Following closely, emamectin benzoate 5 SG at 0.002 percent, lambda cyhalothrin 5 EC at 0.003 per cent (comparable to chlorantraniliprole 18.5 EC at 0.001 per cent), flubendiamide 480 EC at 0.002 per cent, and azadirachtin 1 at 0.003 per cent exhibited favorable yields. In contrast, the untreated control recorded the lowest yield among all the treatments.

In Akkabathula and Rana (2019) study focusing on the pigeon pea pod borer complex, spinosad 45SC demonstrated the highest grain yield at 1360.54 Kg/ha, comparable to indoxacarb 14.5SC, emamectin benzoate 5WSG, and acetamiprid 20SP. Conversely, flubendiamide 20WG resulted in the lowest grain yield at 1037.41 Kg/ha, while the untreated control yielded the least at 816.32 kg/ha. Additionally, Vaidya (2008) observations in cowpea revealed that 0.0033 percent emamectin benzoate recorded the highest grain yield at 1316.97 Kg/ha, followed by 0.0035 per cent spinosad at 1296.81 Kg/ha, and 0.005 percent lambda-cyhalothrin at 1185.48 Kg/ha.

CONCLUSIONS

The study underscores the successful management of the cowpea spotted pod borer through a structured spray schedule. Despite its status as a significant pest for cowpea crops, the research reveals that the application of spinosad 45 EC at 0.003%, indoxacarb 14.5 SC at 0.014%, and emamectin benzoate 5 SG at 0.002% proved highly effective in protecting pods. The results suggest that incorporating these insecticides into the recommended spray routine can contribute to the efficient control of the cowpea spotted pod borer.

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