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Field efficacy of newer insecticide molecules against spotted pod borer, *Maruca vitrata* (Geyer) on black gram

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Abstract
A field experiment was conducted to determine the efficacy of ten chemical insecticides against spotted pod borer, *Maruca vitrata* (Geyer) infesting black gram. The results revealed that the least larval population was recorded in the treatment profenophos 50 EC + DDVP 76 EC (0.80 larvae/plant) followed by emamectin benzoate 5 SG + DDVP 76 EC (1.33 larvae/plant) and it was found on par with flubendiamide 480 SC + DDVP 76 EC (1.70 larvae/plant), spinosad 45 SC + DDVP 76 EC (1.83 larvae/plant) and thiodicarb 75 WP + DDVP 76 EC (1.83 larvae/plant). The treatment application of profenofos + DDVP @ 2ml + 0.5 ml per lit recorded lowest pod damage (7.13 per cent) and highest grain yield 9.20 (q/ha) in black gram. Thus, two sprays of profenophos 50 EC + DDVP 76 EC one at 50 % flowering and another at 15 days after first spray can be recommended to the farmers for management of spotted pod borer on black gram.

Keywords: Newer insecticides, spotted pod borer, *Maruca vitrata,* blackgram

1. Introduction

Black gram, *Vigna mungo* is one of the important pulse crop due to its nutritional and industrial values. It is cultivated mainly during *kharif* season. More than 200 insect pests belonging to 48 families from the orders of Lepidoptera, Coleoptera, Thysanoptera, Diptera, Hemiptera, Hymenoptera, Isoptera, Orthoptera and 7 species of Mites from the order Acarina have been reported to inflict severe damage at different growth stages of blackgram in different agro climatic conditions[11]. Among these, the spotted pod borer, *Maruca vitrata* is one of the devastating pest of pulses. It has been found feeding on species comprising of 20 genera and 6 families, the majority of which belong to Papilionaceae. Due its wider host range and destructiveness, it has become a persistent pest of pulses particularly on black gram, since the pulses being cultivated throughout the year in different seasons.

The infestation of *M. vitrata* initiates at vegetative stage of the black gram, where it webs the tender leaves at growing tip and feed on the chlorophyll content and makes tiny holes which then shifts to the inflorescence and webs the floral parts and feed on them due to which flower buds fail to open and drop off from the inflorescence [4]. It is a serious pest of grain legume crops including mung bean, pigeon pea and common beans [3]. It attacks crops right from the pre-flowering to pod maturing stage resulting in huge economic loss. Hence, the present study was undertaken to evaluate certain insecticides against spotted pod borer on black gram for its effective management.

2. Materials and Methods

The field experiment on black gram was conducted by sowing the popular black gram variety, DU-I at a spacing of 30 x 10 cm. A total of 11 treatments were replicated three times in randomized block design. The treatments T_1= Emamectin benzoate 5 SG + DDVP 76 EC @ 0.25 g/l + 0.5 ml/l, T_2= Flubendiamide 480 SC + DDVP 76 EC @ 0.3 ml/l + 0.5 ml/l, T_3= Lambda cyahalothrin 5 EC + DDVP 76 EC @ 0.5 ml/l + 0.5 ml/l, T_4= Profenophos 50 EC + DDVP 76 EC 2.0 @ ml/l + 0.5 ml/l, T_5= Thiodicarb 75 WP + DDVP 76 EC @ 1.0 g/l + 0.5 ml/l, T_6= Spinosad 45 SC + DDVP 76 EC @ 0.2 ml/l + 0.5 ml/l, T_7= *Nomuraea rileyi* @ 1.0 g/l, T_8= Nimbecidine + DDVP 76 EC @ 3.0 ml/l + 0.5 ml/l, T_9= DDVP 76 EC @ 0.5 ml/l, T_{10}= Rynaxypyr 20 SC + DDVP 76 EC @ 0.3 ml/l + 0.5 ml/l in comparison with T_{11}= Untreated check were evaluated for their efficacy against *M. vitrata*.

Thus two applications of respective insecticide, first at 50 % flowering and second at 15 days after first spray were carried out by using knapsack sprayer with 500 liters of spray solution per hectare. All the recommended practices were adopted for raising the crop.

The observation on larval population of *M. vitrata* was recorded a day before and at 3, 7 and 15 days after each spray application on five randomly selected plants in each plot. The pod damage was recorded at the time of picking/ harvesting of mature pods by counting the total number of pods and number of damaged pods on five plants selected randomly. Based on the net grain yield obtained on plot basis, the yield per hectare was computed for each treatment individually. Different data were subjected to statistical analysis.

3. Results and Discussion

3.1 Reduction in larval population

The data on mortality of *M. vitrata* larvae (Table 1) at a day before first spraying indicated no significant difference in larval population among various treatments. However, after 3 days, the least larval population was noticed in profenophos + DDVP (0.80 larvae/plant) which stood significantly superior over other treatments followed by emamectin benzoate + DDVP (1.33 larvae/plant), flubendiamide + DDVP (1.70 larvae/plant), spinosad + DDVP (1.83 larvae/plant) and thiodicarb + DDVP (1.83 larvae/plant). All these treatments were on par with each other. On the contrary, significantly higher larval population was recorded in *Nomuraea rileyi* treated plots (3.23 larvae/plant) (Table 1).

At seven days after spray, the lowest larval population (0.70 larvae/plant) was again recorded in profenophos + DDVP followed by emamectin benzoate + DDVP, flubendiamide + DDVP, spinosad + DDVP and thiodicarb + DDVP which harbored 1.17, 1.37, 1.47 and 1.47 larvae /plant, respectively and they were found superior to untreated check (4.60 larvae/Pl). At 15 days after spray, more or less similar trend was observed (Table 1).

Second spray was imposed after 15 days of first spray and the larval reduction trend in each treatment was more or less similar to that of its previous application. The application of profenophos + DDVP followed by emamectin benzoate + DDVP, flubendiamide + DDVP, spinosad + DDVP and thiodicarb + DDVP treatments maintained their superiority over other treatments.

These results are in agreement with the findings of [10] who reported that spinosad 45 SC (0.009%), profenophos 50 EC (0.05%) and lambda cyhalothrin 5 EC (0.005%) were found most effective against *M. vitrata* in black gram. Further, the results are also in conformity with [9] who revealed that flubendiamide 480 SC 24% + thiacloprid 24-48% SC recorded a comparatively high larval reduction followed by emamectin benzoate 5 SG and indoxacarb against *M. testulalis* on blackgram. In the present investigation, efficacy of dichlorvos 76 EC @ 0.5 ml/l is in agreement with [1] who recorded that dichlorvos was highly toxic to *M. vitrata* followed by spinosad 45 SC. Application of spinosad 45 SC 0.005 per cent was most effective against *M. vitrata* in urd bean recording highest mean larval reduction[7].

Table 1: Efficacy of newer insecticide molecules against spotted pod borer, *Maruca vitrata* in black gram

Sl. No.	Treatments	Dosage (g or ml/l)	No of larvae per plant						
			First spray				Second spray		
			1DBS	3 DAS	7 DAS	15 DAS	3 DAS	7 DAS	15 DAS
1	Emamectin benzoate 5 SG + DDVP 76 EC	0.25 g + 0.5 ml	4.07 (2.14)	1.33 (1.35)f	1.17 (1.29)e	1.01 (1.26)f g	1.37 (1.36)e	1.16 (1.29)d	1.17 (1.29)e f
2	Flubendiamide 480 SC + DDVP 76 EC	0.3 ml + 0.5 ml	4.00 (2.12)	1.70 (1.48)e f	1.37 (1.36)de	1.67 (1.47)e f	1.43 (1.39)de	1.13 (1.28)d	1.60 (1.45)de
3	Lambda cyhalothrin 5 EC + DDVP 76 EC	0.5 ml 0.5ml	4.30 (2.19)	2.43 (1.71)cd	2.17 (1.63)b c	2.40 (1.70)b cd	1.93 (1.56)cd	1.60 (1.45)cd	2.23 (1.65)b c
4	Profenophos 50 EC + DDVP 76 EC	2.0 ml + 0.5 ml	4.87 (2.31)	0.80 (1.14)g	0.70 (1.09)f	0.93 (1.20)g	0.70 (1.09)f	0.47 (0.98)e	0.93 (1.20)f
5	Thiodicarb 75 WP + DDVP 76 EC	1.0 g + 0.5 ml	4.37 (2.21)	1.83 (1.52)e f	1.47 (1.39)de	1.90 (1.54)c de	1.50 (1.41)de	1.20 (1.30)d	1.80 (1.51)cd
6	Spinosad 45 SC + DDVP 76 EC	0.2 ml + 0.ml	4.80 (2.29)	1.83 (1.52)e f	1.47 (1.40)de	1.83 (1.52)d e f	1.83 (1.53)c de	1.27 (1.33)d	1.73 (1.49)cd
7	*Nomuraea rileyi*	2.0 g	4.27 (2.18)	3.23 (1.93)b	3.83 (1.78)b	3.90 (1.82)b	3.86 (1.79)b	3.79 (1.74)b	3.98 (1.81)b
8	Nimbecidine + DDVP 76 EC	3.0 ml + 0.5 ml	5.10(2.36)	2.60 (1.76)b cd	2.13 (1.62)b c	2.37 (1.69)b cd	2.33 (1.68)b c	1.97 (1.57)c	2.17 (1.63)cd
9	DDVP 76 EC	0.5 ml	4.93 (2.32)	2.80 (1.81)b c	2.37 (1.69)b c	2.47 (1.72)b c	2.37 (1.69)b c	2.10 (1.60)b c	2.26 (1.67)b c
10	Rynaxypyr 20 SC + DDVP 76 EC	0.3 ml + 0.5 ml	4.74 (2.28)	2.07 (1.59)de	1.83 (1.51)cd	2.20 (1.63)c de	2.00 (1.57)cd	1.80 (1.51)c	2.10 (1.60)cd
11	Untreated check	--	4.10 (2.14)	4.40 (2.21)a	4.60 (2.26)a	4.70 (2.28)a	4.27 (2.18)a	4.80 (2.07)a	5.01 (2.26)a
	S.EM.±	--	0.09	0.07	0.08	0.07	0.07	0.06	0.07
	C.D. (5%)	--	NS	0.24	0.25	0.22	0.25	0.19	0.21
	C.V. %	--	14.17	8.03	10.92	9.02	12.40	11.74	15.91

DAS: Days after spray, DBS: Day before spray Figures in parentheses are x + 0.5 transformed values

4. Pod damage

The results from Table 2 revealed that the pod damage ranged from 7.13 to 13.73 per cent in different insecticidal treatments as compared to untreated control. The treatment, profenophos + DDVP (7.13%) recorded significantly lower pod damage and this was followed by emamectin benzoate + DDVP (8.19%), flubendiamide + DDVP (9.03%), spinosad + DDVP (9.40%) and thiodicarb + DDVP (10.00%). The next to follow included rynaxypyr + DDVP, lambda cyhalothrin + DDVP and nimbecidine + DDVP which recorded 10.37, 10.67 and 11.77 per cent pod damage, respectively (Table 2).

Similar findings of [8] with emamectin benzoate 5 SG (0.4g/l), flubendiamide 480 SC (0.2ml/l) and thiodicarb 75 WP (1.5g/l) in reducing the pod borer damage effectively in black gram are in support of the present results. According to [2] who reported that spinosad 45 SC (0.4ml/l) was effective in minimizing pod damage by *M. vitrata* in black gram followed by profenophos 50 EC @ 1.0 ml/l.

5. Grain yield

Significantly higher grain yield was obtained from profenophos 50 EC + DDVP 76 EC (9.20 q/ha) treated plots followed by emamectin benzoate 5 SG + DDVP 76 EC (8.82 q/ha) which was on par with flubendiamide 480 SC + DDVP 76 EC (8.63 q/ha), spinosad 45 SC + DDVP 76 EC (8.53 q/ha) and thiodicarb 75 WP + DDVP 76 EC (8.33 q/ha). However, the lowest grain yield was recorded in untreated control (5.81q/ha) followed by *N. rileyi* (6.43q/ha) (Table 2).

Grain yield recorded in various treatments during the present investigation are in agreement with the findings of [5] who observed that the profenophos 50 EC @ 2.0 ml/l in combination with dichlorvos 76 EC @ 0.5 ml/l registered highest grain yield (10.20 q/ha) in pigeon pea. However, [8] noticed that flubendiamide 480 SC (0.2ml/l), thiodicarb 75 WP (1.5g/l) and emamectin benzoate 5 SG (0.4g/l) were found effective in reducing the pod borer damage with higher yield in black gram. [6] Opined that the spinosad 45 SC @ 0.005 per cent was significantly superior over all other treatments with higher pod yield of black gram followed by thiodicarb 75 WP @ 0.075 per cent and dichlorvos @ 0.076 per cent which is also in conformity with the present results.

Table 2: Influence of newer insecticide molecules on pod damage and yield in black gram

Sl. No.	Treatments	Pod damage (%)	Grain yield (q/ha)
1	Emamectin benzoate 5 SG + DDVP 76 EC	8.19 (16.63)ab	8.82ab
2	Flubendiamide 480 SC + DDVP 76 EC	9.03 (17.48)ab	8.63ab
3	Lambda cyhalothrin 5 EC + DDVP 76 EC	10.67 (19.05)b c	8.04bc
4	Profenophos 50 EC + DDVP 76 EC	7.13 (15.48)a	9.20a
5	Thiodicarb 75 WP + DDVP 76 EC	10.00 (18.42)ab	8.33ab
6	Spinosad 45 SC + DDVP 76 EC	9.40 (17.84)ab	8.53ab
7	*Nomuraea rileyi*	15.67 (23.28)de	6.43de
8	Nimbecidine + DDVP 76 EC	11.77 (20.05)b c	7.82bc
9	DDVP 76 EC	13.73 (21.74)cd	7.04cd
10	Rynaxypyr 20 SC + DDVP 76 EC	10.37 (18.77)b c	7.90bc
11	Untreated check	20.43 (26.75)e	5.81e
	S.Em.±	0.73	0.34
	C.D. (5%)	2.17	1.02
	C.V. %	9.50	11.64

*Figures in parentheses are arcsine transformed values

6. Conclusion

From the present investigation, it may be concluded that the application of profenophos 50 EC + DDVP 76 EC or emamectin benzoate 5 SG + DDVP 76 EC once at 50 per cent flowering stage (40 DAS) and second at pod formation stage (15 DAS after the first spray) can provide effective protection against *M. vitrata*. Therefore, the safer chemical control methods reduce the pest population, pod and grain damage with higher yield in black gram.

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