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Efficacy of different insecticides on pod and grain damage due to pod borer complex (*Maruca testulalis*, *Helicoverpa armigera* and *Exelastis atomosa*) in pigeonpea during kharif season 2020-21

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Abstract

A field experiment was conducted during the *kharif* season of 2020-21 to evaluate the efficacy of different insecticides against the pod borer complex comprising *Maruca testulalis*, *Helicoverpa armigera*, and *Exelastis atomosa* in pigeonpea. The experiment included three insecticidal treatments and an untreated control. The treatments consisted of sequential sprays of flubendiamide followed by chlorantraniliprole (T₁), *Bacillus thuringiensis* (T₂), and emamectin benzoate (T₃). Observations were recorded on total number of pods and grains per plant, pod and grain damage percentage, reduction over control, grain yield, and increase in yield over control. The results indicated that T₁ recorded the lowest pod damage (12.41-13.52%) and grain damage (6.89-7.10%), along with the highest reduction in pod and grain damage and maximum grain yield (19.49-21.69 q/ha). Emamectin benzoate also performed effectively and remained statistically superior over *B. thuringiensis*. Untreated control plots recorded maximum pod and grain damage with the lowest grain yield. The study concluded that sequential application of flubendiamide followed by chlorantraniliprole proved most effective for the management of pigeonpea pod borer complex.

Keywords: Pigeonpea, pod borer complex, *Helicoverpa armigera*, *Maruca testulalis*, *Exelastis atomosa*, insecticides, grain damage, yield

Introduction

Pigeonpea (*Cajanus cajan*) is one of the most important pulse crops cultivated in India and plays a vital role in nutritional security due to its high protein content (Sharma, 2005) [10]. However, the productivity of pigeonpea is severely constrained by several insect pests, among which the pod borer complex is considered the most destructive (Lal and Yadav, 1998) [4]. The major pod borers attacking pigeonpea include *Helicoverpa armigera* (gram pod borer), *Maruca testulalis* (spotted pod borer), and *Exelastis atomosa* (plume moth) (Reed *et al.*, 1987) [9].

These pests damage flowers, pods, and developing grains, causing substantial quantitative and qualitative yield losses. Yield losses due to pod borers may range from 30-80% depending upon pest incidence and environmental conditions (Lateef and Reed, 1990) [5]. Conventional insecticides have been widely used for management; however, indiscriminate use has resulted in resistance development, resurgence, and environmental concerns (Kranthi *et al.*, 2002) [3]. Therefore, evaluation of newer insecticidal molecules and bio-pesticides is essential for sustainable pest management (Sharma, 2005) [10].

The present investigation was undertaken to evaluate the efficacy of different insecticides against pod and grain damage caused by pod borer complex in pigeonpea during the *kharif* season of 2020-21.

Materials and Methods

Experimental Site

The field experiment was conducted during the *kharif* season of 2020-21 at the experimental farm under natural infestation conditions of pod borer complex.

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Experimental Design

The experiment was laid out in a Randomized Block Design (RBD) with four treatments and suitable replications.

Treatments

Treatment	Insecticide	Dose
T ₁	First spray: Flubendiamide; Second spray: Chlorantraniliprole	0.3 ml/l each
T ₂	<i>Bacillus thuringiensis</i>	2 g/l
T ₃	Emamectin benzoate	0.4 g/l
T ₄	Control	Untreated

Observations Recorded

The following observations were recorded:

- Total number of pods per plant
- Mean pod damage (%)
- Reduction in pod damage over control (%)
- Total number of grains per plant
- Mean grain damage (%)
- Reduction in grain damage over control (%)
- Grain yield (q/ha)
- Percent increase in yield over control

The recorded data were statistically analysed. Percent data were transformed using square root transformation before analysis (Gomez and Gomez, 1984) ^[2].

Table 1: Efficacy of Different Insecticides on Pod and Grain Damage Due to Pod Borer Complex (*Maruca testulalis*, *Helicoverpa armigera* and *Exelastis atomosa*) in Pigeonpea During Kharif Season 2020-21.

Treatments	Dosages/ha	Total no. of pod/plant	Mean pod damage (%) / plant	Reduction in pod damage (%)	Total no. of grain/plant	Mean grain damage (%) / plant	Reduction in grain damage (%)	Grain yield (q/ha)	Increase over control (%)
T ₁ -1 st spray Flubendiamide-2 nd spray chlorantraniliprole	0.3 ml/l & 0.3 ml/l	V1 = 260.4 (16.15)	12.91 (3.66)	78.53	1041.6 (32.28)	7.00 (2.73)	77.40	21.69	54.82
		V2 = 230.1 (15.18)	13.52 (3.74)	75.18	920.4 (30.34)	7.10 (2.75)	75.50	20.48	49.38
		V3 = 190.2 (13.80)	12.41 (3.59)	74.48	760.8 (27.59)	6.89 (2.71)	77.90	19.49	45.12
T ₂ - <i>Bacillus thuringiensis</i>	2 gm/l	V1 = 230.5 (15.19)	34.57 (5.92)	42.50	922 (30.37)	17.00 (4.18)	45.12	17.6	25.62
		V2 = 210.6 (14.52)	31.52 (5.65)	42.14	737.1 (27.15)	16.80 (4.15)	42.02	16.35	19.26
		V3 = 171.2 (13.10)	25.21 (5.07)	48.15	684.8 (26.17)	18.48 (4.35)	40.75	17.69	31.72
T ₃ -Emamectin benzoate	0.4 gm/l	V1 = 251.1 (12.31)	17.88 (4.28)	70.26	1004.4 (31.70)	9.50 (3.16)	69.33	19.52	39.33
		V2 = 221.2 (14.88)	17.67 (4.26)	67.57	774.2 (27.83)	9.30 (3.13)	67.90	18.1	32.02
		V3 = 180.4 (13.44)	16.41 (4.11)	66.25	721.6 (26.87)	9.29 (3.12)	70.21	18.2	35.52
T ₄ -Control	-	V1 = 200.4 (14.17)	60.12 (7.78)		801.6 (28.32)	30.98 (5.61)		16.01	
		V2 = 181.6 (13.49)	54.48 (7.41)		726.4 (26.96)	28.98 (5.42)		15.81	
		V3 = 162.3 (12.75)	48.62 (7.00)		649.2 (25.48)	31.19		14.43	
SEM(±)		0.53	0.29		0.42	1.71		0.43	
CD(P = 0.05)		1.67	0.87		1.35	5.57		1.39	
CV(%)		8.30	9.45		8.00	8.15		8.41	

*Figures in parenthesis are square root transformed values

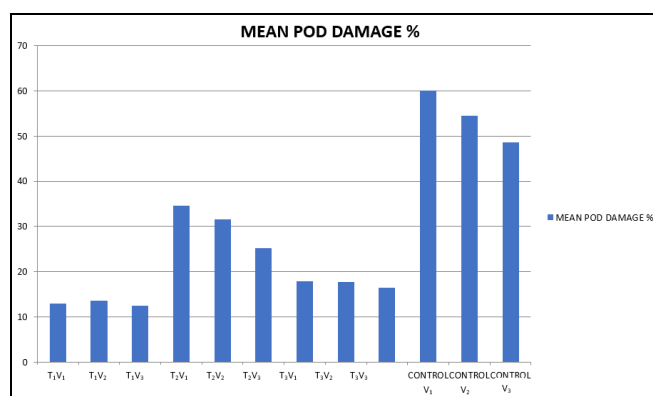


Fig 1: Level of pod damage by pod borer complex in pigeonpea treated with different insecticides.

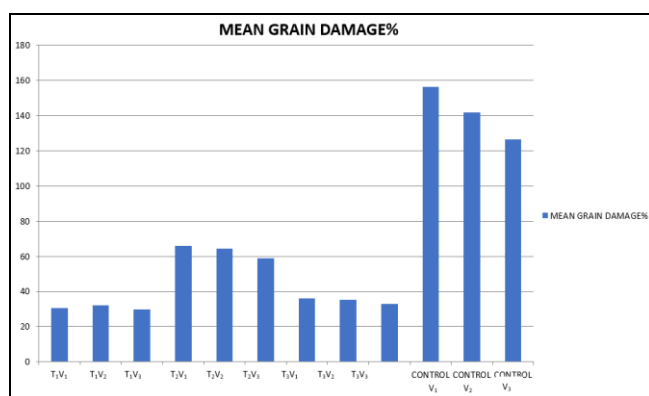


Fig 2: Level of grain damage by pod borer complex in pigeonpea treated with different insecticides.

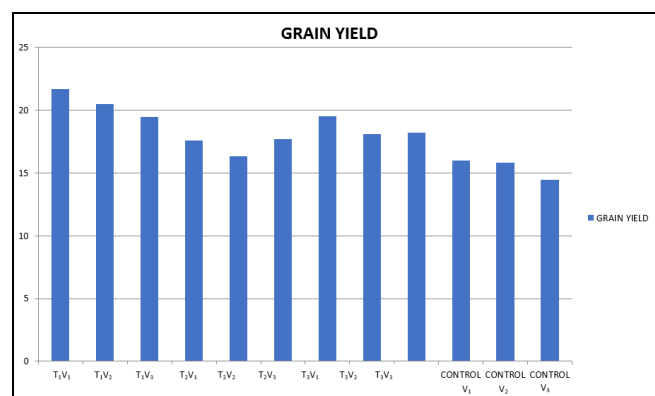


Fig 3: Grain yield of pigeonpea in different insecticides.

Results and Discussion

Effect on Pod Damage

The data revealed significant differences among treatments regarding pod damage caused by pod borer complex.

Among all treatments, T₁ (flubendiamide followed by chlorantraniliprole) recorded the lowest pod damage across all varieties. Pod damage ranged from 12.41% to 13.52%, with reduction over control ranging from 74.48% to 78.53%. The highest number of pods per plant was also recorded under this treatment. Similar findings were reported by Babariya *et al.* (2010) ^[1], who observed effective suppression of pod borer infestation with newer insecticidal molecules.

Emamectin benzoate (T₃) was the next effective treatment, recording pod damage between 16.41% and 17.88%, with pod damage reduction ranging from 66.25% to 70.26%. The findings are in agreement with those of Prakash *et al.* (2021) ^[7], who reported superior efficacy of Emamectin benzoate against pod borers in pigeonpea.

The bio-pesticide treatment, *Bacillus thuringiensis* (T₂), showed comparatively lower efficacy, with pod damage ranging from 25.21% to 34.57%. Similar moderate effectiveness of *B. thuringiensis* against lepidopteran borers has been documented by Singh and Verma (2006) ^[11].

Untreated control plots exhibited maximum pod damage (48.62-60.12%), indicating severe infestation under unprotected conditions.

The superior performance of T₁ may be attributed to the strong stomach and contact action of diamide insecticides against lepidopteran borers (Raghvani and Poshia, 2006) ^[8].

Effect on Grain Damage

Significant reduction in grain damage was observed in insecticide-treated plots compared with control.

T₁ recorded minimum grain damage ranging from 6.89% to 7.10%, with grain damage reduction of 75.50-77.90% over control. The treatment also produced the highest number of grains per plant. These results corroborate the findings of Yelshetty *et al.* (1999) ^[12], who reported effective reduction of grain damage in pigeonpea through newer insecticides.

T₃ recorded grain damage between 9.29% and 9.50%, while T₂ recorded comparatively higher grain damage (16.80-18.48%). Similar observations were made by Mehla (1990) ^[6], who found Emamectin and related insecticides effective in minimizing grain damage caused by *H. armigera*.

Control plots recorded maximum grain damage ranging from 28.98% to 31.19%, confirming the destructive nature of pod borer complex under untreated conditions.

These findings clearly indicate that newer insecticidal molecules effectively minimized larval feeding and protected developing grains (Sharma, 2005) ^[10].

Effect on Grain Yield

All insecticidal treatments significantly increased grain yield over untreated control.

The highest grain yield was recorded in T₁, ranging from 19.49 to 21.69 q/ha, with yield increase over control ranging from 45.12% to 54.82%. Similar enhancement in yield due to effective pod borer management has also been reported by Babariya *et al.* (2010) ^[1].

Emamectin benzoate (T₃) produced grain yields ranging from 18.10 to 19.52 q/ha, which was significantly higher than untreated control. The results are supported by Prakash *et al.* (2021) ^[7].

Bacillus thuringiensis recorded moderate yields ranging from 16.35 to 17.69 q/ha.

The untreated control recorded the lowest grain yield (14.43-16.01 q/ha), mainly due to higher pod and grain damage caused by the pest complex.

The increase in yield under insecticidal treatments was directly associated with reduced pod and grain damage (Lateef and Reed, 1990) ^[5].

Conclusion

The study revealed that all insecticidal treatments significantly reduced pod and grain damage caused by the pod borer complex in pigeonpea compared to untreated control. Among the treatments, sequential application of flubendiamide followed by chlorantraniliprole (T₁) proved most effective by recording minimum pod and grain damage and maximum grain yield. Emamectin benzoate (T₃) was the second-best treatment, while *Bacillus thuringiensis* (T₂) provided moderate control. The untreated control showed maximum infestation and lowest yield. Therefore, flubendiamide followed by chlorantraniliprole can be recommended for effective management of pod borers in pigeonpea during *kharif* season.

References

1. Babariya PM, Kabaria BB, Patel VN, Joshi MD. Chemical control of gram pod borer, *Helicoverpa armigera* Hubner infesting pigeonpea. Legume Res. 2010;33(3):224-226.
2. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd ed. New York: John Wiley and Sons; 1984. p. 1-680.
3. Kranthi KR, Jadhav DR, Wanjari RR, Kranthi S, Russell DA. Insecticide resistance in five major insect pests of cotton in India. Crop Prot. 2002;21(6):449-460.
4. Lal SS, Yadav CP. Pests of pigeonpea and their management. Indian Farming. 1998;48(8):35-40.
5. Lateef SS, Reed W. Review of crop losses caused by insect pests in pigeonpea internationally and in India. Trop Pest Manag. 1990;36(1):39-42.
6. Mehla JC. Chemical control of pod borer, *Heliothis armigera* (Hubner) on pigeonpea (*Cajanus cajan*). Indian J Entomol. 1990;52(2):203-205.
7. Prakash HT, Jagginavar SB, Mallappa B. Field evaluation of new molecule emamectin benzoate + lufenuron against pod borer in pigeonpea. J Entomol Zool Stud. 2021;9(1):251-255.

8. Raghvani BR, Poshia VK. Field efficacy of newer molecules of insecticides against pod borer in chickpea. *Pestology*. 2006;30(4):18-20.
9. Reed W, Lateef SS, Sithanantham S, Pawar CS. Pigeonpea insect pests and their management. In: *The pigeonpea*. Wallingford: CAB International; 1987. p. 283-318.
10. Sharma HC. *Heliothis/Helicoverpa* management: Emerging trends and strategies for future research. New Delhi: Oxford & IBH Publishing Company; 2005. p. 1-469.
11. Singh V, Verma PC. Management of pod borer (*Helicoverpa armigera*) in chickpea with newer chemicals. *Pestology*. 2006;30(6):36-38.
12. Yelshetty S, Gowda DKS, Patil BV. Efficacy of indoxacarb against pigeonpea pod borer *Helicoverpa armigera*. *Pestology*. 1999;23(7):60-64.