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Efficacy of newer insecticides against tur plume moth, *Exelastis atomosa* (Walsingham) on pigeonpea

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Abstract
The present study entitled, “Efficacy of newer insecticides against tur plume moth, *Exelastis atomosa* (Walsingham) on pigeonpea” was carried out at the Research Farm of Pulses Improvement Project, MPKV, Rahuri during the season *kharif* 2024. There were eight treatments *viz*., emamectin benzoate 5% SG, indoxacarb 14.50% SC, chlorantraniliprole 18.50% SC, lambda-cyhalothrin 5% EC, spinosad 45% EC, thiamethoxam 25% WG, acetamiprid 20% SP and untreated control. Studies on efficacy revealed that, chlorantraniliprole 18.50% SC @ 0.3 ml/L was superior treatment with minimum larval population of 0.29 larvae/plant and it was followed by indoxacarb 14.50% SC @ 0.7 ml/L (0.62 larvae/plant) and emamectin benzoate 5% SG @ 0.4 g/L (0.72 larvae/plant) which were at par with each other. The results of pod and grain damage due to tur plume moth on pigeonpea revealed that plot treated with chlorantraniliprole 18.50% SC @ 0.3 ml/L was superior in reducing pod and grain damage to lowest level of 1.90 and 1.03% respectively as compared to other treatments. The maximum grain yield was obtained from the plots treated with chlorantraniliprole 18.50% SC @ 0.3 ml/L (21.80 q/ha). Highest ICBR (1:6.70) was obtained from the treatment with emamectin benzoate 5% SG @ 0.4 g/L followed by indoxacarb 14.50% SC @ 0.7 ml/L (1:5.96) an chlorantraniliprole 18.50% SC @ 0.3 ml/L (1:5.60).

Keywords: Tur plume moth, *Exelastis atomosa*, efficacy, extent of pod and grain damage

Introduction

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is an important pulse crop widely cultivated across India and plays a vital role in the diet and livelihood of small and marginal farmers. Belonging to the family leguminosae and believed to be native to Africa, it is commonly known as “tur” or “arhar” and is mainly consumed as dal. The crop is sown with the onset of the monsoon, generally in June-July and is often intercropped with sorghum, pearl millet, maize, groundnut and cotton. Pigeonpea thrives between 14°N and 28°N latitude, where monsoon temperatures range from 28-30°C and post-monsoon temperatures from 17-22°C, with annual rainfall of 600-1400 mm, of which 80-90% occurs during the monsoon (Odeny, 2007) [5]. Globally, pigeonpea is grown on about 4.23 million ha with a production of 4.68 million tonnes and productivity of 751 kg/ha, with India being the largest producer. During 2023-24, pigeonpea occupied 5.05 million ha in India, producing 4.34 million tonnes with a productivity of 859 kg/ha. Karnataka ranked first in production, followed by Maharashtra and Uttar Pradesh. Maharashtra contributed 27.49% to national production, with an average productivity of 1035 kg/ha (Anonymous, 2024). More than 250 insect species are known to infest pigeonpea, though only a few cause economic damage. The most destructive are bud, flower, and pod feeders, particularly *Helicoverpa armigera*, *Exelastis atomosa and Melanagromyza obtusa*. Among these, the tur plume moth, *Exelastis atomosa*, is a key pest. Its larvae feed on flower buds and immature seeds, causing characteristic circular holes and complete their life cycle in 28-30 days. Yield losses of 5-10% have been reported due to this pest (Rawat *et al*., 2017) [8]. Indiscriminate pesticide use has resulted in resistance, resurgence, biodiversity loss and residue problems. Hence, evaluating newer insecticides and adopting need-based use within an IPM framework is essential for sustainable pigeonpea cultivation (Armes *et al*., 1992) [2].

Materials and Methods
Experimental site
The field experiment was conducted during *kharif* 2024 on Research farm of Pulses Improvement Project, MPKV, Rahuri, District Ahilyanagar, Maharashtra using the pigeonpea variety Phule Trupti to study efficacy of newer insecticides against tur plume moth, *Exelastis atomosa* (Walsingham) on pigeonpea.

Experimental design and field layout
The experiment was carried out in Randomized Block Design (RBD) with eight treatments including an untreated control with three replications, which is provided in Table 1. Total of 24 plots has been maintained for the experiment. The individual plot size was 4 × 4.5 m keeping row to row and plant to plant distance of 90 cm and 60 cm, respectively. The seeds of pigeonpea (Phule Trupti) was sown on July 6, 2024 during the season *Kharif* 2024 and the recommended package of practices was followed to raise the crop. The performance of each insecticide treatment was judged on the basis of larval population, pod damage, grain damage and grain yield.

Table 1: Treatment details for management tur plume moth on pigeonpea

Tr. No.	Treatments	Dosages (g or ml/L)
T1	Emamectin benzoate 5% SG	0.4
T_2	Indoxacarb 14.50% SC	0.7
T_3	Chlorantraniliprole 18.50% SC	0.3
T_4	Lambda cyhalothrin 5% EC	1.0
T_5	Spinosad 45% SC	0.4
T_6	Thiamethoxam 25% WG	0.4
T_7	Acetamiprid 20% SP	0.4
T_8	Untreated Control	-

Mehod of application
The insecticides were sprayed during the morning time using a knapsack sprayer. All the eight plots in each replication were treated simultaneously, ensuring that no spray drift affected the adjacent plots. During application, each plot received individual treatment to prevent cross contamination. Two sprays were conducted at an interval of 15 days.

Data collection
The efficacy of insecticides was evaluated by randomly selecting five plants from each treated plot for recording observations on number of tur plume moth larvae before each spray application and at 3, 7 and 14 days after the application of insecticide treatment (Warad, 2021) [11].

Pod damage: At the time of harvest, five plants earlier selected from each treated plot were observed for pod damage. Number of damaged pods and healthy pods were counted. From that per cent pod damage was calculated by using following formula (Warad, 2021) [11].

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

Grain damage: The pods were opened and examined for grain damage. From that per cent grain damage were calculated by using following formula (Warad, 2021) [11].

$$\text{Per cent grain damage} = \frac{\text{Number of damaged grains}}{\text{Total number of grains}} \times 100$$

Grain yield: Pigeonpea grain yield obtained from each net plot was recorded separately. The yield per plot was converted into yield per hectare. Yield was calculated under different treatments as per formula (Warad, 2021) [11].

$$\text{Yield (q/ha)} = \frac{1000}{\text{Net plot size}} \times \text{grain yield (kg/plot)}$$

Statistical analysis
Data on survival larval population were transformed to square root values and data on per cent pod and grain damage were transformed into arcsin values to stabilize the heterogeneous variances. The transformed data for the respective evaluation dates were analysed as a Randomized Block Design (RBD). The means of three replicates were compared by using the standard error (S.E.) and critical difference (C.D.) at 5 per cent to decide the significance of individual treatment effect. The yield data was subjected to statistical analysis (Panse and Sukhatme, 1967) [6].

Results and Discussion
Efficacy of newer insecticides against tur plume moth, *Exelastis atomosa* (Walsingham) on pigeonpea
After first spray
Data pertaining to efficacy of newer insecticides against tur plume moth, *Exelastis atomosa* on pigeonpea after first spray has been presented in Table 2. The precount observations recorded a day before foliar spray application showed that, the population of *E. atomosa* ranged between 2.53 to 2.91 larvae/plant and were found statistically non-significant.

Results of the mean efficacy of newer insecticides against tur plume moth, *E. atomosa* on pigeonpea at first spray revealed that, chlorantraniliprole 18.50% SC @ 0.3 ml/L recorded minimum mean average population of tur plume moth (0.42 larvae/plant) was proved most effective treatment. However, indoxacarb 14.50% SC @ 0.7 ml/L was found to be the next best treatment with 0.80 larvae/plant and stastically at par with emamectin benzoate 5% SG @ 0.4 g/L (0.88 larvae/plant). Whereas, spinosad 45% SC @ 0.4 ml/L and lambda-cyhalothrin 5% EC @ 1.0 ml/L recorded 1.33 and 1.43 larvae/plant, respectively. However, the treatment with acetamiprid 20% SP @ 0.4 g/L was proved less effective (2.05 larvae/plant) among all tested insecticides. In contrast, the untreated control showed the highest mean larval population of *E. atomosa*, recording 2.82 larvae/plant after first spray.

After second spray
Data pertaining to efficacy of newer insecticides against tur plume moth, *Exelastis atomosa* on pigeonpea after second spray has been presented in Table 2. All the treatments were found to be significantly superior to the untreated control in reducing the population of *Exelastis atomosa*. Outcome of mean efficacy of newer insecticides against tur plume moth on pigeonpea at second spray revealed that, the treatment chlorantraniliprole 18.50% SC @ 0.3 ml/L recorded minimum mean average survival population of tur plume moth (0.16 larvae/plant). Next best treatment was

indoxacarb 14.50% SC @ 0.7 ml/L with 0.46 larvae/plant and it was at par with emamectin benzoate 5% SG @ 0.4 g/L (0.55 larvae/plant). Whereas, spinosad 45% SC @ 0.4 ml/L and lambda-cyhalothrin 5% EC @ 1.0 ml/L recorded 0.91 and 0.97 larvae/plant, respectively. However, the treatment with acetamiprid 20% SP @ 0.4 g/L was found to be least effective among all tested insecticides (2.04 larvae/plant). In contrast, the untreated control showed the highest average population of tur plume moth, with 3.28 larvae/plant after the second spray.

Cumulative effect of first and second sprays

Data pertaining to efficacy of newer insecticides against tur plume moth, *Exelastis atomosa* on pigeonpea after spray has been presented in Table 3. The average number of *E. atomosa* larvae per plant prior to insecticidal treatments ranged from 2.53 to 2.91 and differences among treatments were non- significant. From the data, it was recorded that mean population of *E. atomosa* on pigeonpea ranged from 0.29 to 3.05 larvae/plant. All insecticidal treatments were shown to be statistically significant compared to the untreated control in lowering the mean average larval population. The treatment chlorantraniliprole 18.50% SC @ 0.3 ml/L was proved to be most effective treatment with lowest population of *E. atomosa* (0.29 larvae/plant). However, indoxacarb 14.50% SC @ 0.7 ml/L was proved to be next best treatment with 0.62 larvae/plant and stastically at par with emamectin benzoate 5% SG @ 0.4 g/L (0.72 larvae/plant). Whereas, spinosad 45% SC @ 0.4 ml/L and lambda-cyhalothrin 5% EC @ 1.0 ml/L recorded 1.12 and 1.20 larvae/plant, respectively. However, the treatment with acetamiprid 20% SP @ 0.4 g/L was found least efficacious (2.05 larvae/plant) among all tested insecticides. Whereas, untreated control showed highest mean larval population of tur plume moth (3.05 larvae/plant).

The results of present study are in accordance with findings of Warad (2021) [11] who noticed that, chlorantraniliprole 18.50% SC was found most promising treatment in conrolling tur plume moth population (0.27 larvae/ plant). However, it was followed by indoxacarb 14.50% SC (0.53 larvae/ plant) and emamectin benzoate 5% SG (0.58 larvae/ plant) which were at par to each other. The results regarding to larval population of *E. atomosa* also show similarity with findings of Dadas *et al.* (2019) [3] who reported that chlorantraniliprole 18.50% SC was found most superior treatment against tur plume moth of pigeonpea, however it was followed by indoxacarb 14.50% SC. Patidar and Vaishampayan (2022) [7] studied that, chlorantraniliprole 18.50% SC @ 0.3 ml/l and indoxacarb 14.50% SC @ 0.7 ml/L proved most effective treatment for controlling of pigeonpea pod borer complex.

Table 2: Efficacy of newer insecticides against tur plume moth, *Exelastis atomosa* on pigeonpea after spray

Tr. No.	Treatments	Dose (g or ml/L)	Pre-count	Number of larvae/plant after first spray				Number of larvae / plant after second spray				Mean
				3 DAS	7 DAS	14 DAS	Mean	3 DAS	7 DAS	14 DAS	Mean	
T_1	Emamectin benzoate	0.4	2.56	1.05	0.84	0.75	0.88	0.68	0.51	0.45	0.55	0.72
	5% SG		(1.75)	(1.24)	(1.15)	(1.12)	(1.17)	(1.08)	(1.01)	(0.97)	(1.02)	(1.09)
T_2	Indoxacarb	0.7	2.79	0.98	0.76	0.67	0.80	0.53	0.47	0.32	0.46	0.62
	14.50% SC		(1.81)	(1.22)	(1.12)	(1.08)	(1.14)	(1.01)	(0.98)	(0.94)	(0.98)	(1.05)
T_3	Chlorantraniliprole	0.3	2.65	0.57	0.38	0.31	0.42	0.19	0.15	0.13	0.16	0.29
	18.50% SC		(1.77)	(1.02)	(0.93)	(0.90)	(0.95)	(0.83)	(0.81)	(0.78)	(0.81)	(0.86)
T_4	Lambda-cyhalothrin	1.0	2.72	1.64	1.36	1.28	1.43	1.14	0.95	0.83	0.97	1.20
	5% EC		(1.78)	(1.46)	(1.36)	(1.33)	(1.38)	(1.28)	(1.21)	(1.15)	(1.21)	(1.30)
T_5	Spinosad	0.4	2.59	1.50	1.29	1.21	1.33	1.08	0.89	0.75	0.91	1.12
	45% SC		(1.76)	(1.43)	(1.34)	(1.31)	(1.36)	(1.25)	(1.18)	(1.13)	(1.19)	(1.28)
T_6	Thiamethoxam	0.4	2.91	1.93	1.72	2.04	1.90	1.98	1.35	2.37	1.90	1.90
	25% WG		(1.84)	(1.56)	(1.49)	(1.59)	(1.55)	(1.57)	(1.36)	(1.69)	(1.54)	(1.55)
T_7	Acetamiprid	0.4	2.74	2.04	1.89	2.23	2.05	2.07	1.43	2.63	2.04	2.05
	20% SP		(1.79)	(1.59)	(1.55)	(1.65)	(1.60)	(1.60)	(1.39)	(1.77)	(1.59)	(1.59)
T_8	Untreated control	-	2.53	2.72	2.84	2.89	2.82	3.15	3.21	3.47	3.28	3.05
			(1.74)	(1.79)	(1.81)	(1.83)	(1.81)	(1.90)	(1.92)	(1.98)	(1.93)	(1.87)
S. E. m (±)			0.08	0.06	0.06	0.05	0.06	0.05	0.05	0.05	0.05	0.06
C. D. @ 5%			N. S.	0.18	0.18	0.17	0.18	0.16	0.16	0.15	0.16	0.18

*Figures in parentheses are $\sqrt{x+0.5}$ transformed values, **DAS-Days After Spray

Efficacy of newer insecticides on the extent of pod and grain damage due to tur plume moth, *Exelastis atomosa* on pigeonpea

Seven insecticides were evaluted for their response to the infestation of tur plume moth, *E. atomosa* showed a significant variation with respect to pod and grain damage at harvest. The data on pod and grain damage caused by tur plume moth illustrated in Table 3

Pod damage

The result of pod damage due to *E. atomosa* indicated that chlorantraniliprole 18.50% SC was most effective in minimizing damage (1.90%), followed by indoxacarb 14.50% SC (2.82%) and emamectin benzoate 5% SG (3.27%), respectively and at par with each other. Next best treatment was spinosad 45% SC and lambda-cyhalothrin 5% EC which recorded 4.68% and 4.82% per cent pod damage, respectively. The treatments thiamethoxam 25% WG and acetamiprid 20% SP recorded highest pod damage than other treatments *i.e.* 7.44 and 8.02% respectively, but better in reducing pod damage than in untreated control (10.99%).

Grain damage

The result of grain damage caused by tur plume moth, *E. atomosa* showed that lowest grain damage was reported in chlorantraniliprole 18.50% SC (1.03%) which was followed by indoxacarb 14.50% SC (1.94%) and emamectin benzoate 5% SG (2.45%), respectively and stastically at par with each other. Next best treatment was spinosad 45% SC and lambda-cyhalothrin 5% EC with per cent grain damage 3.54% and 3.93%, respectively. The treatments thiamethoxam 25% WG and acetamiprid 20% SP showed highest grain damage than other treatments *i.e.* 6.36% and 6.74%, respectively but better in reducing grain damage than in untreated control (8.68%).

The result show similarity with findings of Warad (2021) [11] studied that chlorantraniliprole 18.50% SC recorded least pod and grain damage (2.13% and 5.34%) followed by indoxacarb 14.50% SC (3.67% and 7.70%) and emamectin benzoate 5% SG (3.98% and 7.93%) respectively, which were at par to each other. Similar results were also reported by Dadas *et al.* (2019) [3] who revealed that most effective treatment in minimizing pod damage caused by *E. atomosa* was treatment with chlorantraniliprole 18.50% SC (4.33%) followed by indoxacarb 14.50% SC (8.00%) and emamectin benzoate 5% SG (8.33%), respectively. Patidar and Vaishampayan (2022) [7] recorded minimum pod damage in chlorantraniliprole 18.50% SC followed by indoxacarb 14.50% SC and spinosad 45% SC, respectively in pigeonpea pod borer complex.

Table 3: Efficacy of newer insecticides on the extent of pod and grain damage due to tur plume moth, *Exelastis atomosa* on pigeonpea

Tr. No.	Treatments	Dose (g or ml/L)	% Pod damage	% Grain damage	Yield (q/ha)
T_1	Emamectin benzoate 5%	0.4	3.27	2.45	19.82
	SG		(10.42)*	(8.91)	
T_2	Indoxacarb 14.50% SC	0.7	2.82	1.94	20.53
			(9.66)	(8.00)	
T_3	Chlorantraniliprole	0.3	1.90	1.03	21.80
	18.50% SC		(7.79)	(5.82)	
T_4	Lambda-cyhaloathrin	1.0	4.82	3.93	18.09
	5% EC		(12.69)	(11.43)	
T_5	Spinosad 45% SC	0.4	4.68	3.54	18.44
			(12.49)	(10.83)	
T_6	Thiamethoxam 25% WG	0.4	7.44	6.36	17.56
			(15.83)	(14.56)	
T_7	Acetamiprid 20% SP	0.4	8.02	6.74	17.08
			(16.44)	(15.05)	
T_8	Untreated control	-	10.99	8.68	16.86
			(19.27)	(17.13)	
S. E.m (±)			0.60	0.51	0.41
C. D. @ 5%			1.84	1.55	1.22

* Figures in parentheses are arc sin transformed values.

Grain yield

In the present investigation, effective control of tur plume moth, *E. atomosa* had influenced the yield of pigeonpea to the extent of 0.22 to 4.94 q/ha increases over untreated control. Chlorantraniliprole 18.50% SC resulted in the highest grain yield (21.80 q/ha) among all treatments. Indoxacarb 14.50% SC was next best treatment by recording 20.53 q/ha grain yield of pigeonpea. However, it was followed by emamectin benzoate 5% SG (19.82 q/ha), spinosad 45% SC (18.44 q/ha), lambda-cyhalothrin 5% EC (18.09 q/ha), thiamethoxam 25% WG (17.56 q/ha) and acetamiprid 20% SP (17.08 q/ha), respectively. Among all the tested insecticidal treatments, thiamethoxam 25% WG @ 0.4 g/L and acetamiprid 20% SP @ 0.4 g/L recorded the lowest per cent increase in yield over the untreated control.

The result show similarity with findings of the earlier worker Warad (2021) [11] as they concluded that chlorantraniliprole 18.50% SC proved to be most effective against tur plume moth, resulting in highest grain yield of pigeonpea (17.18 q/ha) followed by indoxacarb 14.50% SC (15.55 q/ha) and emamectin benzoate 5% SG (14.92 q/ha). Dadas *et al.* (2019) [3] studied that using chlorantraniliprole 18.50% SC at 50% flowering and pod formation stages at 15 days interval resulted in a highest (8.79 q/ha) grain yield of pigeon pea. Similarly, Sreekanth *et al.* (2015) [9] showed that effective control of pod borer with the maximum yield of 8.86 q/ha when chlorantraniliprole 18.50% SC was sprayed thrice at the beginning of 50% flowering stage at 15 days interval.

Incremental Cost Benefit Ratio (ICBR) of different insecticidal treatments of pigeonpea

Among all the treatment, chlorantraniliprole 18.50% SC resulted in highest net profit of Rs. 31,697/- followed by indoxacarb 14.50% SC (Rs. 23,728/-) and emamectin benzoate 5% SG (Rs. 19,448/-). Highest ICBR value was obtained from emamectin benzoate 5% SG (1: 6.70) followed by indoxacarb 14.50% SC (1:5.96). Next in order of ICBR were the treatments with chlorantraniliprole 18.50% SC (1:5.60), lambda-cyhalothrin 5% EC (1:3.20), thiamethoxam 25% WG (1:1.04), acetamiprid 20% SP (1:0.20) and spinosad 45% SC (1:0.10).

The results of the present study with respect to the Incremental Cost Benefit Ratio (ICBR) are in agreement with the findings of earlier researchers Wadaskar *et al.* (2013) [10] who studied that the treatments with economic feasibility was emamectin benzoate 5% SG (1:5.1) and indoxacarb 14.50% SC (1:5.0).

Conclusion

Amongst the different insecticidal treatments, chlorantraniliprole 18.50% SC @ 0.3 ml/L was found most superior treatment in reducing tur plume moth population (0.29 larvae/plant) coupled with minimum pod and grain damage of 1.90 and 1.03 per cent, respectively. For the effective management of tur plume moth, *Exelastis atomosa* farmers can use emamectin benzoate 5% SG @ 0.4 g/L to obtain higher yield and net returns.

References

1. Anonymous. Crop outlook report of India, 2023-2024. 2024.
2. Armes NJ, Jadhav DR, Bond GS, King AB. Insecticide resistance in *Helicoverpa armigera* in south India. Pestic Sci. 1992;34(4):355-364.
3. Dadas SM, Gosalwad SS, Patil SK. Efficacy of different newer insecticides against pigeonpea pod borers. J Entomol Zool Stud. 2019;7(5):784-791.
4. Lal SS. Insect pests of pigeonpea and their management in pigeonpea. Indian Council of Agricultural Research. 1988;2:163-187.
5. Odeny DA. Biology of *Cajanus cajan* (pigeonpea). Food and Agriculture Organization; 2007.
6. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. Indian Council of Agricultural Research; 1967.
7. Patidar S, Vaishampayan S. Study the management of pigeonpea pod borer (*Helicoverpa armigera*) and pod fly (*Melanagromyza obtusa*) with suitable insecticides at Nimar region. Int J Recent Sci Res. 2022;13(6):1424-1429.
8. Rawat RK, Keval R, Ganguly S, Chakravarty S. Seasonal incidence of plume moth, *Exelastis atomosa* (Lepidoptera: Pterophoridae) on long duration pigeonpea, *Cajanus cajan*. Flora Fauna. 2017;23:445-520.
9. Sreekanth M, Lakshmi MS, Rao YK. Efficacy and economics of certain new generation novel insecticides against legume pod borer, *Maruca vitrata* (Geyer) on pigeonpea (*Cajanus cajan* L.). J Appl Biol Biotechnol. 2015;3(3):7-10.
10. Wadaskar RM, Bhalkare SK, Patil AN. Field efficacy of newer insecticides against pod borer complex of pigeon pea. J Food Legumes. 2013;26(1):62-66.
11. Warad PJ. Bioefficacy of various insecticides against pod borer complex of pigeonpea [*Cajanus cajan* (L.) Millsp.]. M.Sc. (Ag.) Thesis. Mahatma Phule Krishi Vidyapeeth, Rahuri; 2021.