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BIO-EFFICACY OF NEWER INSECTICIDES AGAINST BLISTER BEETLE AND POD SUCKING BUG IN PIGEONPEA (*CAJANUS CAJAN* L. MILLSP.)

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ABSTRACT

A field experiment was conducted during the *kharif* season of 2022 at the Agricultural Research Farm of B.R.D. P.G. College, Deoria (U.P.) to evaluate the bio-efficacy of newer insecticides against blister beetle (*Mylabris pustulata* Thunberg) and pod sucking bug (*Clavigralla gibbosa* Spinola) infesting pigeonpea (*Cajanus cajan* (L.) Millsp.). The experiment was laid out in a randomized block design with eight treatments including an untreated control, replicated thrice, using pigeonpea genotype UPAS-120. All insecticidal treatments significantly reduced pest populations compared to the control. Lambda-cyhalothrin 5% EC @ 2 ml l^{-1} proved most effective against blister beetle, while Emamectin benzoate 5% SG @ 1 g l^{-1} was the most effective against pod sucking bug. Other chemical insecticides showed moderate efficacy, whereas botanical treatments were comparatively less effective. The findings suggest that the judicious use of Lambda-cyhalothrin and Emamectin benzoate can provide effective management of major reproductive-stage pests of pigeonpea under Eastern Uttar Pradesh conditions.
Keywords **:** Bio-efficacy; blister beetle; pod sucking bug; pigeonpea and newer insecticides

Introduction

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is one of the most important pulse crops of India, belonging to the family Fabaceae, and is widely cultivated in the semi-arid tropics and sub-tropical regions. It is known by different names such as arhar, tur and redgram and is highly valued for its nutritional richness, containing substantial amounts of dietary protein (22.3%), carbohydrates (57.6%), fibre (1.5%) and minerals (3.5%) (Gupta *et al.*, 2006). Besides its nutritional importance, pigeonpea plays a vital role in sustainable agriculture by improving soil fertility through biological nitrogen fixation and by providing food, fodder and fuel to farming communities (Mittal and Ujagir, 2005).

Globally, pigeonpea is cultivated over an area of about 69.93 lakh hectares with a production of 59.61 million tonnes and an average productivity of 812.42 kg ha^{-1}. In India, the crop occupies approximately 42.3 lakh hectares with a production of 38.9 lakh tonnes and an average productivity of 919 kg ha^{-1} (Anonymous, 2019). Despite its wide cultivation and economic importance, pigeonpea productivity remains low, largely due to infestation by a complex of insect pests.

Among the biotic constraints affecting pigeonpea cultivation, blister beetle (*Mylabris pustulata* Thunberg) and pod sucking bug (*Clavigralla gibbosa* Spinola) are considered the most destructive pests during the flowering and pod development stages, particularly in Eastern Uttar Pradesh. In recent years, the problem of blister beetle infestation has intensified with the introduction of short-duration, photo-sensitive and determinate pigeon pea varieties possessing compact floral structures and shortened internodes, which favour higher pest incidence. Blister beetle is a voracious and polyphagous pest that feeds on floral parts such as petals, anthers, stigma and ovary, often resulting in complete flower destruction and poor pod formation. Although pigeon pea is the most preferred host for the development and survival of this pest (Balikai, 2000), severe damage may occur especially when infestation begins at the early flowering stage.

Apart from direct yield loss due to flower destruction, blister beetle infestation also has indirect adverse effects by reducing pollinator populations, thereby further affecting pod set and grain yield (Ghoneim, 2013). Among pulse crops, pigeon pea has been reported as the most preferred host for blister beetle during the reproductive phase (Durairaj, 2000 and Dasbak *et al.*, 2012). Durairaj and Ganapathy (1996) reported maximum beetle density of 19.4 beetles per plant on pigeon pea flowers, indicating the severity of infestation under favourable conditions.

Pod sucking bug (*Clavigralla gibbosa*) is another serious pest that threatens grain quality and yield of pigeon pea. It has emerged as a major pest due to favourable temperature and humidity conditions prevailing during the reproductive stage of the crop (Singh *et al.*, 2008 and Chakravarty *et al.*, 2016). The pest is known to cause significant economic losses in early and medium duration pigeon pea cultivars. Damage caused by pod sucking bug alone has been reported to range from 25 to 40 per cent, with substantial reductions in pod and grain weight at higher pest densities (Adati *et al.*, 2007 and Gopali *et al.*, 2013). Both nymphs and adults possess piercing and sucking mouthparts and feed on flower buds, pods and developing grains, resulting in shrivelled seeds and reduced market value (Bharat *et al.*, 2019).

Management of these pests primarily relies on chemical insecticides; however, indiscriminate use of conventional insecticides has led to problems such as resistance development, pest resurgence, environmental pollution and adverse effects on natural enemies. Therefore, there is a pressing need to evaluate newer insecticides that are effective, economical and relatively safer to the agro-ecosystem.

In view of the increasing severity of damage caused by blister beetle and pod sucking bug and the limitations of existing control measures, the present investigation was undertaken to study the bio-efficacy of newer insecticides against blister beetle and pod sucking bug in pigeon pea (*Cajanus cajan*).

Materials and Methods

The field experiment was conducted during the *kharif* season of 2022 at the Agricultural Research Farm, Department of Entomology, B.R.D. P.G. College, Deoria (Uttar Pradesh) to evaluate the bio-efficacy of newer insecticides against blister beetles and pod sucking bugs in pigeon pea (*Cajanus cajan* (L.) Millsp.).

The experiment was laid out in a Randomized Block Design (RBD) with eight treatments including untreated control, and each treatment was replicated three times. Each experimental plot measured 2 × 2 m², and the crop was sown at a spacing of 60 × 15 cm (row to row × plant to plant). The pigeon pea genotype UPAS-120 was used for the study. All recommended agronomic practices were followed uniformly throughout the cropping period to raise a healthy crop. The treatments evaluated were Flubendiamide 39.35 SC @ 0.5 ml l^{-1}, Lambda-cyhalothrin 5% EC @ 2 ml l^{-1}, Profenophos 40% + Cypermethrin 4% EC @ 1 ml l^{-1}, Spinetoram 11.7 SC @ 0.5 ml l^{-1}, Emamectin benzoate 5% SG @ 1 ml l^{-1}, Neem oil 5% @ 5 ml l^{-1}, Dr. Neem @ 3 ml l^{-1} and an untreated control. Insecticidal sprays were applied during the flowering stage of the crop using a knapsack sprayer. The population of blister beetle and pod sucking bug was recorded on a per plant basis by counting the number of insects on five randomly selected plants from each plot. Observations were taken one day before spraying and subsequently after the first and second sprays of the insecticides. The data recorded were subjected to appropriate statistical analysis to assess the effectiveness of the treatments.

Results and Discussion

Bio-efficacy of newer insecticides against blister beetle (*Mylabris pustulata*)

The data presented in Table 1 and Fig. 1clearly indicated that the pre-treatment population of blister beetle was uniformly distributed throughout the experimental field, showing non-significant differences among treatments. The initial population ranged from 3.93 to 4.93 beetles per plant. After insecticidal application, a significant reduction in blister beetle population was observed in all treated plots compared to the untreated control, indicating the effectiveness of the evaluated insecticides.

After the first spray, the minimum blister beetle population (1.00 beetle per plant) was recorded in plots treated with Lambda-cyhalothrin 5% EC @ 2 ml l^{-1}, which was significantly superior to all other treatments. This was followed by Profenophos 40% + Cypermethrin 4% EC @ 1 ml l^{-1} (1.40 beetles/plant) and Spinetoram 11.7 SC @ 0.5 ml l^{-1} (1.93 beetles/plant). Moderate efficacy was recorded with Flubendiamide 39.35 SC @ 0.5 ml l^{-1} (2.33 beetles/plant) and Emamectin benzoate 5% SG @ 1 g l^{-1} (2.67 beetles/plant), while botanical treatments such as Neem oil 5% and Dr. Neem were comparatively less effective. The maximum population (4.93 beetles/plant) was recorded in the control plot.

Following the second spray, Lambda-cyhalothrin 5% EC @ 2 ml l^{-1} again proved most effective by recording the lowest population (0.93 beetle/plant), followed by Profenophos + Cypermethrin (1.25 beetles/plant). Other insecticidal treatments showed moderate suppression of the pest, whereas botanical treatments recorded higher populations. The highest population (5.07 beetles/plant) was observed in untreated control.

After the third spray, Lambda-cyhalothrin 5% EC continued to maintain its superiority with the lowest blister beetle population (1.60 beetles/plant). It was followed by Profenophos + Cypermethrin (2.07 beetles/plant) and Spinetoram (2.53 beetles/plant). Flubendiamide and Emamectin benzoate showed moderate effectiveness, whereas Dr. Neem and Neem oil were least effective. The maximum population (5.40 beetles/plant) was consistently recorded in the control plot. The present findings are in close agreement with Pawar *et al.* (2013), who reported that lambda-cyhalothrin was highly effective in reducing adult blister beetle population in greengram. The results also corroborate the findings of Durairaj and Ganapathy (1999), who reported that *Mylabris pustulata* was highly susceptible to synthetic pyrethroids such as cypermethrin.

Bio-efficacy of newer insecticides against pod sucking bug (*Clavigralla gibbosa*)

The data presented in Table 2 and Fig. 2 revealed that the pre-treatment population of pod sucking bug was uniformly distributed across all plots, with non-significant variation. The population ranged from 3.67 to 5.20 bugs per plant. All insecticidal treatments were found to be significantly superior over the control after application. After the first spray, the lowest pod sucking bug population (1.20 bugs/plant) was recorded in plots treated with Emamectin benzoate 5% SG @ 1 g l^{-1}, which was significantly superior to all other treatments. This was followed by Spinetoram 11.7 SC @ 0.5 ml l^{-1} (1.60 bugs/plant) and Profenophos + Cypermethrin (2.13 bugs/plant). The botanical treatments recorded higher pest populations, while the maximum population (5.13 bugs/plant) was observed in control.

After the second spray, Emamectin benzoate 5% SG again recorded the minimum population (1.13 bugs/plant), followed by Spinetoram (1.30 bugs/plant). Other chemical treatments showed moderate effectiveness, whereas Neem oil and Dr. Neem remained least effective. The highest population (5.67 bugs/plant) was recorded in untreated control.

Following the third spray, Emamectin benzoate 5% SG maintained its superior efficacy by recording the lowest population (1.73 bugs/plant). It was followed by Spinetoram (2.27 bugs/plant) and Profenophos + Cypermethrin (2.73 bugs/plant). Botanical treatments were comparatively less effective, and the maximum population (5.87 bugs/plant) was recorded in the control plot.

The high efficacy of Emamectin benzoate against pod sucking bug observed in the present study is in close conformity with the findings of Mohapatra and Panda (2015), who also reported significantly lower pod bug populations in emamectin-treated plots compared to untreated control.

Conclusion

The study revealed that all insecticidal treatments significantly reduced the population of blister beetle (*Mylabris pustulata*) and pod sucking bug (*Clavigralla gibbosa*) in pigeon pea compared to the untreated control. Lambda-cyhalothrin 5% EC @ 2 ml l^{-1} was most effective against blister beetle, while Emamectin benzoate 5% SG @ 1 g l^{-1} proved superior for managing pod sucking bug. These insecticides can be recommended for effective pest management in pigeon pea under Eastern Uttar Pradesh conditions.

Table 1: Bio efficacy of newer insecticide against Blister Beetle/plant

Treatments	Doses (g/ml)	Mean Population of Blister beetle/plant			
		DBS	AFS	ASS	ATS
Flubendiamide 39.35%SC	0.5 ml/l	3.93 (1.98)	2.33 (1.68)	2.13 (1.62)	2.87 (1.83)
Lambda-cyhalothrin 5% EC	2 ml/l	4.37 (2.09)	1.00 (1.22)	0.93 (1.20)	1.60 (1.45)
Profenophos 40% + Cypermethrin 4% EC	1 ml/l	4.27 (2.06)	1.40 (1.38)	1.25 (1.32)	2.07 (1.60)
Spinetoram 11.7 SC	0.5 ml/l	4.93 (2.22)	1.93 (1.56)	1.80 (1.52)	2.53 (1.74)
Emamectin Benzoate 5 % SG	1g/l	4.80 (2.17)	2.67 (1.78)	2.40 (1.70)	3.40 (1.97)
Neem Oil 5%	5 ml/l	3.93 (1.96)	3.13 (1.91)	2.93 (1.85)	4.07 (2.14)

Dr. Neem	3 ml/l	4.08 (2.02)	3.60 (2.02)	2.67 (1.78)	3.73 (2.06)
Untreated		4.37 (2.08)	4.93 (2.33)	5.07 (2.36)	5.40 (2.43)
SEM		-	0.10	0.04	0.04
CD (5%)		NS	0.30	0.13	0.13

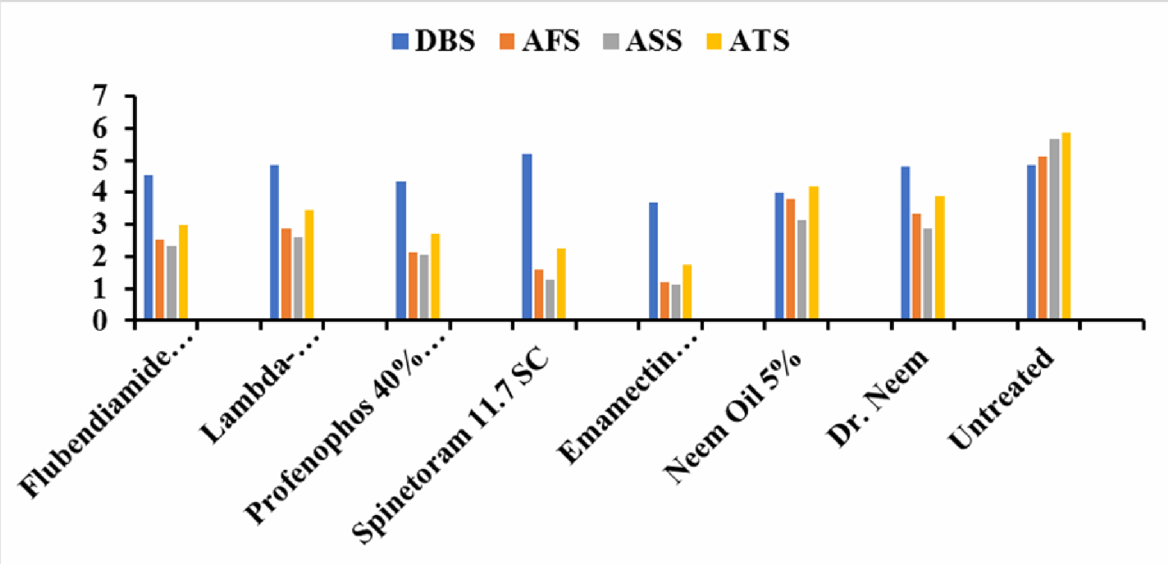

Fig. 1 : Bio efficacy of novel insecticides against blister beetle

Table 2: Bio efficacy of newer insecticide against Pod sucking bug/plant

Treatments	Doses (g/ml)	Mean Population of Pod sucking bug/plant			
		DBS	AFS	ASS	ATS
Flubendiamide 39.35%SC	0.5 ml/l	4.53 (2.24)	2.53 (1.74)	2.33 (1.68)	3.00 (1.87)
Lambda-cyhalothrin 5% EC	2 ml/l	4.87 (2.32)	2.87 (1.83)	2.60 (1.75)	3.47 (1.99)
Profenophos 40% + Cypermethrin 4% EC	1 ml/l	4.33 (2.20)	2.13 (1.62)	2.07 (1.60)	2.73 (1.80)
Spinetoram 11.7 SC	0.5 ml/l	5.20 (2.39)	1.60 (1.45)	1.30 (1.34)	2.27 (1.66)
Emamectin Benzoate 5 % SG	1g/l	3.67 (2.04)	1.20 (1.30)	1.13 (1.25)	1.73 (1.49)
Neem Oil 5%	5 ml/l	4.00 (2.12)	3.80 (2.07)	3.13 (1.91)	4.20 (2.17)
Dr. Neem	3 ml/l	4.80 (2.30)	3.33 (1.96)	2.87 (1.83)	3.87 (2.09)
Untreated		4.87 (2.32)	5.13 (2.37)	5.67 (2.48)	5.87 (2.52)
SEM		-	0.08	0.06	0.09
CD (5%)		NS	0.23	0.20	0.26

DBS: Day Before Spray, **AFS:** After First Spray, **ASS:** After Second Spray, **ATS:** After Third Spray

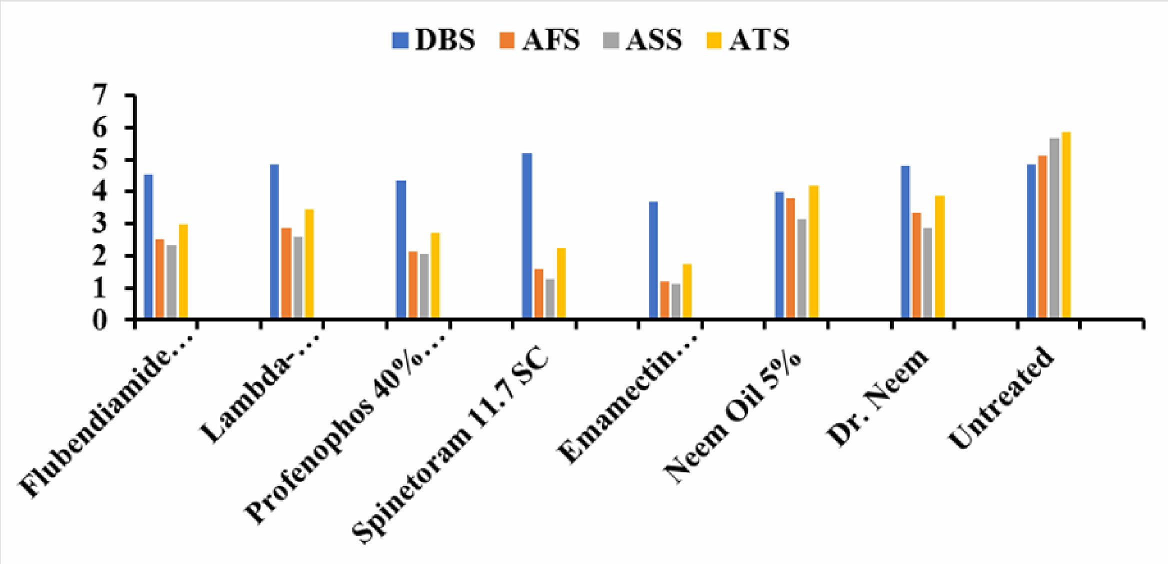

Fig. 2 : Bio efficacy of novel insecticides against pod sucking bug

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