Efficacy of insecticides against pod fly (*melanagromyzaobtusa*) infesting pigeonpea

ABSTRACT

Efficacy of insecticides against pod fly (*Melanagromyzaobtusa*Malloch) of pigeonpea was evaluated under field conditions. There were 9 treatments *viz.*,T_1:spinetoram 11.7% SC, T_2: indoxacarb 14.5% SC, T_3:chlorantraniliprole 18.5% SC, T_4:lambda-cyhalothrin 5% EC,T_5:fipronil 5% SC,T_6:acetamiprid 20% SP, T_7:emamectin benzoate 5%SG and T_8:quinalphos 25% EC and T_9: untreated control. Two sprays were applied at an interval of 15 days. The performance of each insecticide treatment was categorized on the basis of maggot population. The resultsrevealed that, chlorantraniliprole 18.5% SC @ 0.3 ml/l water was superior treatment in terms of least average population of pod flies (0.95 maggots/plant) and at par toindoxacarb 14.5% SC @ 0.7 ml/l water and spinetoram 11.7% SC @ 0.5 ml/l waterreported 0.98 and 1.05 maggots/plant, respectively.

Keywords: Insecticides, Pod fly (melanagromyzaobtusa), chlorantraniliprole, Indoxacarb

1. INTRODUCTION

Pigeonpea (*Cajanuscajan*L. Millsp.), also known as Red gram or Arhar or Tur. The term ‘pigeonpea’ was coined in Barbados, where its seeds were considered as an important pigeon feed (Gowda *et al*., 2011).It is thought to have originated in India. It belongs to the genus-*Cajanus*, subtribe-*Cajaninae*, family-Fabaceae. Pigeonpea is the second important pulse crop in India after chickpea grown in many countries and contributes important share in sustainable nutritional food security. The total world acreage under pulses is about 5 million hectares with production of 4.3million tonnes at 850 kg/ha yields level. Its cultivation is increasing in semi-arid areas because of the crop’s ability to thrive under prolonged drought and in degraded lands (Upadhyaya *et al.*, 2012). Since its domestication in the Indian sub-continent at least 3500 years ago, its seeds have become a common food in Asia, Africa and Latin America.

In India, it is mainly consumed in the form of split pulse as dal.The people consume pigeonpea as dry seeds and green peas as it is staple food crop for several communities in India (Tabo *et al.*, 1995). Its immature green seeds and pods are also consumed as a green vegetable. Its fiber quality is very great (7g/100g of seeds) (Kandhare, 2014). The defoliated leaves also add nitrogen and organic matter to the soil (Mafongoya*et al*., 2006). The husk of pods and leaves makes a valuable cattle fodder. The dry sticks of the pigeonpea plant used as fuel, thatches, storage bins (baskets) and now for biochar making etc. (Tiwari and Shivhare, 2017).Pigeonpea contains higher amounts of proteins (20% to 22%), carbohydrates (65%), fat (1.2%) and ash (3.9%) (Anonymous, 2005). Pigeonpea seeds are rich in potassium, phosphorus, magnesium, calcium and iodine and also provide essential amino acids like lysine, tyrosine and arginine, whereas cystine and methionine contents are low (Saxena *et al.*, 2010).

The principal causes for least productivity ofpigeonpeaare growing under poor conditions such as cultivating on marginal lands and lack of proper management techniques for controlling insect pests. The pests attacking red gram mainly damages pods and flowers and causes maximum economical damage. Red gram is attacked by several insect pests frequently. Among the insect pests of red gram, *Helicoverpaarmigera*, *Marucavitrata*, *Melanagromyzaobtusa*, *Exelastisatomosa*, and *Clavigrallagibbosa* damages the crop drastically. Among these pests, Pod fly, *Melanagromyzaobtusa* is notorious and serious pest that causes more than 20% to 80% damage to grains (Subharani and Singh, 2009).

Melanagromyzaobtusa (Diptera:Agromyzidae) is an important pigeonpea insect-pest in North- east Asia. It attacks the crop from the pod filling stage to pod maturity and lay eggs (oviposition) on inner walls of the pod. Adult females oviposit singly inside the epidermis, and once larvae emerge, they will feed on pods by mining into them and make them unfit for consumption and seed value also decreases.Pupa and maggots of pod fly are generally found inside the pod. In general, no symptoms are observed while the larvae growing inside the pod. Later adult fly comes out through the thin paper like membrane (window) which is a layer of pod wall left by larvae. Due to concealed way of life within the seeds, the pod fly attack remains unnoticed by farmer and thus it has become hard to control the pod fly. This pod fly infestation leads to reduced productivity and production.

Hence, it is inevitable to protect the crop from infestation of pod fly by using insecticides. Extensive use of conventional chemical insecticides may lead to development of resistance to insecticides, outbreak of secondary pest and the problem of residues in the food and fodder as chemical control is the most effective and produce instantaneous effects in reducing these menaces. Therefore, keeping this view and considering economic importance of pigeonpea this study was taken up to test the efficacy of insecticides against pigeonpea pod fly.

2. MATERIAL AND METHODS

The experiment on efficacy of insecticides against pod fly (*Melanagromyzaobtusa*) infestingpigeonpeawas carried out at Research Farm of Pulses Improvement Project, Mahatma Phule Krishi Vidyapeeth,Rahuriduring *kharif* 2023.There were 9 treatments.Consisting of different insecticides*viz.*,T_1:spinetoram 11.7% SC @ 0.5 ml/l water,T_2: indoxacarb 14.5% SC @ 0.7 ml/l water, T_3:chlorantraniliprole 18.5% SC @ 0.3 ml/l water, T_4:lambda-cyhalothrin 5% EC @ 1.0 ml/l water,T_5:fipronil 5% SC @ 0.66 ml/l water,T_6:acetamiprid 20% SP @ 0.4 g/l water, T_7:emamectin benzoate 5%SG @ 0.44 g/l water and T_8:quinalphos 25% EC @ 2.0 ml/l water tested for their efficacy against pod fly (*M. obtusa*). These treatments were replicated three times in randomized block design (RBD). The performance of each insecticide treatment was categorized on the basis of maggot population(number of maggots per 5pod per plant), percent pod damage and percent grain damageEach insecticidal treatment was sprayed twiceat an interval of 15 days. First spray was taken three months after sowing as pod fly attack was noticed.

The efficacy of insecticides was evaluated by selecting five plants randomly from each treated plot and 5 pods from each plant for recording observations on thebnumber of maggots of pod fly before each application and at 3, 7 and 14 days after the application of insecticide treatment.

3. RESULTS AND DISCUSSION

3.1 Efficacy of insecticides against pod fly (*M. obtusa*) on pigeonpea

First Spray:

The data presented in Table 1 represents population (maggot) of pigeonpea pod fly, *Melanagromyzaobtusa* on one day before, 3, 7 and 14 days after the first spray. The average population of *M. obtusa* one day before spray was ranged between 4.12 to 5.04 maggots/plant and were found statistically non-significant, suggesting that the population of pod fly on pigeonpea was uniform in field. Results of the mean efficacy of different insecticides against pod fly on pigeonpea at first spray revealed that, the insecticide chlorantraniliprole 18.5% SC @ 0.3 ml/l water recorded minimum mean average population of pod fly (1.34 maggots/plant) which was followed by the treatments with indoxacarb 14.5% SC @ 0.7 ml/l water and spinetoram 11.7% SC @ 0.5 ml/l water *i.e*.,1.40 and 1.46 maggots/plant, respectivelythat were at par with chlorantraniliprole 18.5% SC. Next best treatment was emamectin benzoate 5% SG @ 0.4 g/l of water with 1.69 maggots/plant and it was at par with acetamiprid 20% SP @ 0.4 g/l of water (1.75 maggots/plant) and lambda-cyhalothrin 5% EC @ 1.0 ml/l of water (1.80 maggots/plant). However, the treatment with quinalphos 25% EC @ 2.0 ml/l of water (2.07 maggots/plant) was found least effective among all tested insecticides. Whereas, untreated control recorded highest mean population of pod fly (4.58 maggots/plant) after first spray.

Table 1. Efficacy of insecticides against pod fly (*M. obtusa*) on pigeonpea after first spray

Tr. No.	Treatments	Dose g or ml/litre of water	Pre count	Number of maggots per plant			
				3 DAS**	7 DAS	14 DAS	Mean
1.	Spinetoram 11.7% SC	0.5 ml	4.76 (2.29)*	1.64 (1.46)	1.28 (1.33)	1.46 (1.40)	1.46 (1.40)
2.	Indoxacarb 14.5% SC	0.7 ml	4.84 (2.31)	1.58 (1.44)	1.22 (1.31)	1.42 (1.38)	1.40 (1.38)
3.	Chlorantraniliprole 18.5% SC	0.3 ml	4.32 (2.19)	1.52 (1.42)	1.14 (1.28)	1.36 (1.36)	1.34 (1.35)
4.	Lambda-cyhalothrin 5% EC	1.0 ml	4.12 (2.15)	2.06 (1.60)	1.58 (1.44)	1.76 (1.50)	1.80 (1.51)
5.	Fipronil 5% SC	0.66 ml	4.64 (2.27)	2.34 (1.69)	1.80 (1.52)	1.96 (1.57)	2.03 (1.59)
6.	Acetamiprid 20% SP	0.4 g	4.56 (2.25)	2.00 (1.58)	1.54 (1.43)	1.72 (1.49)	1.75 (1.50)
7.	Emamectin benzoate 5% SG	0.4 g	4.96 (2.33)	1.92 (1.55)	1.50 (1.41)	1.66 (1.47)	1.69 (1.48)

*Figures in parentheses indicate $\sqrt{x + 0.5}$ transformed values   N.S.- Non significant

8.	Quinalphos 25% EC	2.0 ml	5.04 (2.35)	2.38 (1.70)	1.84 (1.53)	1.99 (1.58)	2.07 (1.60)
9.	Untreated control	-	4.24 (2.18)	4.45 (2.22)	4.76 (2.29)	4.52 (2.24)	4.58 (2.25)
S. Em. ±			0.04	0.03	0.02	0.02	0.02
C. D. (5%)			N. S.	0.08	0.07	0.06	0.07

**DAS – Days after spraying

Second spray:

The data presented in Table 2 represents population (maggot) of pigeon pea pod fly, (*Melanagromyza obtuse*)on 3rd, 7th and 14th days after the second spray. Results of the mean efficacy of different insecticides against pod fly on pigeon pea after second spray revealed that, the application of chlorantraniliprole 18.5% SC @ 0.3 ml/l of water recorded minimum mean average survival population of pod fly (0.72 maggots/plant), which was at par with indoxacarb14.5%SC@0.7ml/l wate and spinetoram 11.7% SC @ 0.5 ml/l of water with 0.78 and 0.82 maggots/plant, respectively which were at par with each other. Next best treatment wasemamectin benzoate 5% SG @ 0.4 g/l of water with 1.01 maggots/plant and it was at par with acetamiprid 20% SP @ 0.4 g/l of water (1.07 maggots/plant)and lambda-cyhalothrin 5% EC @ 1.0 ml/l of water (1.11 maggots/plant). However, the treatment with quinalphos 25% EC @ 2.0 ml/l of water (1.37 maggots/plant) was found least effective among all tested insecticides. Whereas, untreated control recorded highest mean population of pod fly (4.79 maggots/plant) after second spray.

Table 2. Efficacy of insecticides against pod fly(*M.obtusa*) on pigeonpeaafter secondspray

Tr. No.	Treatments	Dose g or ml/litre of water	Number of maggots per plant			
			3 DAS**	7 DAS	14 DAS	Mean

*Figures in parentheses indicate √*x* + 0.5 transformed values **DAS – Days afterspraying

1.	Spinetoram 11.7% SC	0.5 ml	1.20 (1.30)*	0.74 (1.11)	0.54 (1.02)	0.82 (1.14)
2.	Indoxacarb 14.5% SC	0.7 ml	1.14 (1.28)	0.68 (1.09)	0.52 (1.01)	0.78 (1.12)
3.	Chlorantraniliprole 18.5% SC	0.3 ml	1.08 (1.26)	0.62 (1.06)	0.48 (0.99)	0.72 (1.10)
4.	Lambda-cyhalothrin 5% EC	1.0 ml	1.52 (1.42)	1.04 (1.24)	0.78 (1.13)	1.11 (1.26)
5.	Fipronil 5% SC	0.66 ml	1.77 (1.51)	1.26 (1.33)	0.94 (1.20)	1.32 (1.35)
6.	Acetamiprid 20% SP	0.4 g	1.48 (1.41)	0.98 (1.22)	0.74 (1.11)	1.07 (1.25)
7.	Emamectin benzoate 5% SG	0.4 g	1.42 (1.39)	0.92 (1.19)	0.68 (1.09)	1.01 (1.22)
8.	Quinalphos 25% EC	2.0 ml	1.80 (1.52)	1.30 (1.34)	1.00 (1.22)	1.37 (1.36)
9.	Untreated control	-	4.72 (2.28)	4.82 (2.31)	4.84 (2.31)	4.79 (2.30)
S. E.(m)±			0.03	0.02	0.03	0.02
C. D. (5 %)			0.08	0.07	0.08	0.07

Pooled mean of both sprays:

From the data, it was noticed that mean average population of *M. obtusa* on pigeonpea varied from 0.95 to 4.68 maggots/plant. All the treatments were found statistically significant over untreated control in reducing the mean average maggot population. The treatment chlorantraniliprole 18.5% SC @ 0.3 ml/l of water was found most promising treatment with least average population of *M. obtusa* (0.95maggots/plant) and it was followed by the treatmentsindoxacarb 14.5% SC @ 0.7 ml/l of water and spinetoram 11.7% SC @ 0.5 ml/l of water with 0.98 and 1.05maggots/plant, respectively and were at par with each other. The next best treatments wasemamectin benzoate 5% SG @ 0.4 g/l of water with 1.20 maggots/plant followed by acetamiprid 20% SP @ 0.4 g/l of waterand lambda-cyhalothrin 5% EC @ 1.0 ml/l of water with 1.26 and 1.32 mean average maggots/plant, respectively and which were at par with each other. Whereas, fipronil 5% SC @ 0.66 ml/l of water recorded 1.42 maggots/plant. However, the treatment with quinalphos 25% EC @ 2.0 ml/l of water with 1.50 maggots/plant was found least effective among all tested insecticides. Whereas, untreated control recorded highest mean population of pod flies (4.68 maggots/ plant).

Table 3.Cumulative efficacy of insecticides against pod fly (*Melanagromyzaobtusa*)of pigeonpea (average of two sprays)

Tr. No.	**Treatments**	**Dose g or**	**Pre count**	**Number of maggots per plant**

				3 DAS	7 DAS	14 DAS	Mean
1.	Spinetoram 11.7% SC	0.5 ml	4.76 *(2.29)	1.42 (1.38)	1.01 (1.22)	1.00 (1.21)	1.05 (1.27)
2.	Indoxacarb 14.5% SC	0.7 ml	4.84 (2.31)	1.36 (1.36)	0.95 (1.20)	0.97 (1.20)	0.98 (1.25)
3.	Chlorantraniliprole 18.5% SC	0.3 ml	4.32 (2.19)	1.30 (1.34)	0.88 (1.17)	0.92 (1.18)	0.95 (1.23)
4.	Lambda-cyhalothrin 5% EC	1.0 ml	4.12 (2.15)	1.79 (1.51)	1.31 (1.34)	1.27 (1.32)	1.32 (1.39)
5.	Fipronil 5% SC	0.66 ml	4.64 (2.27)	2.06 (1.60)	1.53 (1.42)	1.45 (1.38)	1.42 (1.47)
6.	Acetamiprid 20% SP	0.4 g	4.56 (2.25)	1.74 (1.49)	1.26 (1.32)	1.23 (1.30)	1.26 (1.37)
7.	Emamectin benzoate 5% SG	0.4 g	4.96 (2.33)	1.67 (1.47)	1.21 (1.30)	1.17 (1.28)	1.20 (1.35)
8.	Quinalphos 25% EC	2.0 ml	5.04 (2.35)	2.09 (1.61)	1.57 (1.43)	1.50 (1.40)	1.46 (1.48)
9.	Untreated control	-	4.24 (2.18)	4.58 (2.25)	4.79 (2.30)	4.68 (2.28)	4.68 (2.28)
S. E.(m)±			0.04	0.03	0.04	0.03	0.02
C. D. (5%)			N. S.	0.08	N. S.	0.08	0.07

*Figures in parentheses indicate $\sqrt{x + 0.5}$ transformed values   N.S.- Non significant

DAS – Days after spraying

The results of currentstudyshowed similarity with the findings of Dadas *et al.*(2019) who reported that, chlorantraniliprole 18.5% SC was proved most promising in reducing pod fly population. Present finding is also in consistence with Chiranjeevi and Sarnaik (2017) who evaluated the effect of different insecticide treatments on pod fly population.The result related to the population of *M. obtusa*, showed similarity with the Patel and Patel (2013) whoalso reported chlorantraniliprole @ 30 g a.i./ha was superior treatment against pigeonpeapod borer complex. Patidar and Vaishampayan (2022) found that chlorantraniliprole 18.5% SC@ 0.2ml/lfollowed by indoxacarb 14.5 % SChave good effect for control of pigeonpea borer complex.

CONCLUSION

From the present study, it can be concluded that the treatment chlorantraniliprole 18.5% SC was the most effective treatment, resulting in the lowest average pod fly population at 0.95maggots/plant.To effectively manage the pigeonpea pod fly (*Melanagromyzaobtusa*), farmers can use chlorantraniliprole 18.5% SC at a rate of 0.3 ml/l water to achieve higher yields and net returns.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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