EFFICACYOFINSECTICIDESAGAINSTPODFLY(*Melanagromyzaobtusa*)OF PIGEONPEA

ABSTRACT

Efficacy of insecticides against pod fly (*Melanagromyzaobtusa*) of pigeonpea was evaluated under field conditions. There are were 9 treatments *viz.*, chlorantraniliprole 18.5%SC,indoxacarb14.5%SC,spinetoram11.7%SC,emamectinbenzoate5%SG,acetamiprid20%SP,lambda-cyhalothrin5%EC,spinetoram11.7%SC,fipronil5%SC, quinalphos 25% EC and untreated control. Two sprays were conductedapplied at an interval of 15 days. The performance of each insecticide treatment was categorized on the basis of maggot population. The Rresults revealed that,foliar spray of chlorantraniliprole 18.5% SC @ 0.3 ml/l of water was superior treatment with in terms of least average population of pod flies (0.95 maggots/plant). However, it ,and at par towas followed byindoxacarb 14.5% SC @ 0.7 ml/l of water and spinetoram 11.7% SC @ 0.5 ml/l of water withreported 0.98 and 1.05 maggots/plant, respectively.and were at par witheach other.

1. INTRODUCTION

Pigeonpea (*Cajanus cajan*L. Millsp.), also known as Red gram orArhar orTur. 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 contributesimportantshareinsustainablenutritionalfoodsecurity.Itisanimportantgrainlegume crop predominantly grown in the Indian subcontinent as an important source of dietary protein. It is also cultivated in other parts of the world, including sub-Saharan Africa,LatinAmerica,theCaribbeanandSouth-EastAsia.Itscultivationisincreasingin 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 inAsia,Africa and Latin America.

In India, it is mainly consumed in the form of split pulse as dal. The people consumepigeonpeaasdryseedsandgreenpeasasitisstaplefoodcropforseveral

Comment [an1]: Remove the repeating information about cultivation of pigeon pea in India

Comment [an2]: Maintain proper sequence of information, “cultivation of pigeonpea in different country” write at one place, don’t break the follow communities in India (Tabo *et al*., 1995). Its immature green seeds and pods are also consumedasagreenvegetable.Pigeonpea'sfiberqualityisverygreat(7g/100g~~of~~seeds) (Kandhare, 2014).The defoliated leaves also adds 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 ~~are~~, used ~~for~~as fuel, thatches, storage bins (baskets) andnow ~~alsoatpresentdays~~for biocharmakingetc. (TiwariandShivhare,2017). Pigeonpea contains higheramounts ofproteins (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).

Comment [an3]: Inappropriate sentence, in text talking about fibre quality and giving the quantity of fibre in data.

The principal causes for least productivity ~~as growing~~of pigeonpeaare growing under poor conditions such as cultivating on marginal lands and lack of proper management techniques ~~in~~for controlling insect pests. ~~Those~~The pests attacking red gram mainly damages podsandflowersand~~that~~causesmaximumeconomicaldamage.Redgramisattackedby several insect pests ~~regularly~~frequently.Among the insect pests ~~attacking~~of red gram, *Helicoverpaarmigera*, *Maruca vitrata*, *Melanagromyzaobtusa*, *Exelastisatomosa*, and *Clavigralla gibbosa* damages ~~pigeonpea~~the crop drastically. Among ~~the~~these pests ~~above mentioned~~, Pod fly~~,~~(*Melanagromyzaobtuse*)is notorious and serious pest that causes more than 20~~%~~ to 80% damage to grains (Subharani and Singh, 2009).

Melanagromyzaobtusa(Diptera:Agromyzidae)isanimportantpigeonpeainsect-pest in North- eastAsia. ~~Pod fly~~It attacks the crop ~~during~~ from the pod filling stage to pod maturity ~~also starting from pod filling stage. They~~and lay eggs (oviposition) on inner walls ofthe pod. Adult females oviposit singlyinside the epidermis, and ~~after~~once larvae ~~coming out~~emerge, they will feed on pods by mining ~~in to it~~into them and ~~that leads the~~make ~~pods~~notthem unfit for consumption and seed value also decreases(LalandYadav,1993).~~Itfeedsoninternalpartsofthepod.~~Pupaand maggots ofpodflyaregenerallyfoundinsidethepod.Ingeneral,nosymptomsareobservedwhile the larvae growing inside the pod. Later adult fly comes out through the thin paper like membrane(window)whichisalayerofpodwallleftbylarvae.Duetoconcealedwayof life within the seeds, the pod fly attack remains unnoticed by farmer and thus it has becomehardtocontrolthepodfly.Thispodflyinfestationleadstoreducedproductivity and production.

Comment [an4]: Repeated information

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 residue~~s~~ in the food and fodder as chemical control is the most effective and produce instantaneouseffectsinreducingthesemenaces.Therefore,keepingthisviewand consideringeconomicimportanceofpigeonpea,thisstudywastakenuptotesttheefficacy of insecticides against pigeonpea pod fly.

2. MATERIALANDMETHODS

The experiment on efficacy of insecticides against pod fly (*Melanagromyzaobtusa*) of pigeonpea was carried out at Research Farm of Pulses Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri during *Kharif*,2023. There arewere 9 treatments were taken.consisting of Ddifferent insecticides *viz.*, spinetoram 11.7% SC @ 0.5 ml/l of water, indoxacarb 14.5% SC @ 0.7 ml/l of water, chlorantraniliprole 18.5% SC @ 0.3 ml/l of water, lambda-cyhalothrin 5% EC @ 1.0 ml/l of water, fipronil 5% SC @ 0.66 ml/l of water,acetamiprid20%SP@0.4g/lofwater,emamectinbenzoate5%SG@0.44g/lof water and quinalphos 25% EC @ 2.0 ml/l of water were 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 basisofmaggotpopulation (numberofmaggotsperplant),percentpoddamageandper cent grain damage. Each insecticidal treatment was sprayed twice Two sprays were conductedat an interval of 15 days.

Theefficacyofinsecticideswasevaluatedbyselectingfiveplantsrandomlyfrom each treated plot and 5 pods from each plant for recording observations on the number of maggots of pod fly before each application and at 3, 7, and 14 days after the application of insecticide treatment.

Comment [an5]: Specify the treatment name as T_1, T_2, etc for each treatment taken in the experiment

Comment [an6]: Specify the 1st spray interval in days after sowing of crop

3. RESULTSANDDISCUSSION

3.1 Efficacyofinsecticidesagainstpodfly(*M.obtusa*)onpigeonpea

First Spray:

The data presented in Table 1 represents population (maggot) of pigeonpea pod fly,(*Melanagromyzaobtuse*)ononeday before, 3, 7and14 days afterthefirstspray.The average population of *M. obtusa*one day before spray was ranged between 4.12 to 5.04 maggots/plantandwerefoundstatisticallynon-significant,suggestingthatthepopulation 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 treatment withinsecticide chlorantraniliprole 18.5% SC @ 0.3 ml/l of water recorded minimum mean average population of pod fly (1.34 maggots/plant) and which was followed by the treatments with indoxacarb 14.5% SC @ 0.7 ml/l of water and spinetoram 11.7% SC @ 0.5 ml/l of waterwith*i.e.*, 1.40 and 1.46 maggots/plant, respectively whichthat wereat par with each other. 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)andlambda-cyhalothrin5%EC@1.0ml/lofwater(1.80maggots/plant). Whereas, fipronil 5% SC @

Comment [an7]: Mention treatment number of superior treatment

Comment [an8]: As per the CD value,indoxcarb is showing at par results, kindly recheck the other treatments showed as at par or next best treatment in text

~~0.66 ml/l of water recorded 2.03 maggots/plant.~~ However, thetreatmentwithquinalphos25%EC@2.0ml/lofwater(2.07maggots/plant)was

Comment [an9]: No need of explaining about all treatment, specify about the most and least effective insecticide treatment 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 afterfirst spray

Tr. No.	Treatments	Dose gorml/litre of water	Pre count	Numberofmaggotsperplant			
				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.	Emamectinbenzoate 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)
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. E.(m)±			0.04	0.03	0.02	0.02	0.02
C.D. @5%			N. S.	0.08	0.07	0.06	0.07

*Figuresinparenthesesindicate$\sqrt{n+0.5}$transformed values N.S.-Nonsignificant
**DAS–Daysafterspraying

Secondspray:

The data presented in Table 2 represents population (maggot) of pigeonpea pod fly, (*Melanagromyzaobtuse*)on 3rd, 7th and 14th days after the second spray. Results of the mean efficacy of different insecticides against pod fly on pigeonpea ~~at~~after second spray revealed that, the ~~treatment with~~application of ~~insecticide~~ chlorantraniliprole 18.5% SC @ 0.3 ml/l of water recorded minimum mean average survival population of pod fly (0.72 maggots/plant)~~and,~~ whichwasat par with ~~followedbythetreatmentswith~~indoxacarb14.5%SC@0.7ml/l ~~of~~waterandspinetoram11.7%SC@0.5ml/lofwaterwith0.78and0.82maggots/plant, respectively which were at par with each other. Next best treatment was emamectin benzoate 5% SG @ 0.4 g/l of water with 1.01 maggots/plant and it was at par with acetamiprid20%SP@0.4g/lofwater(1.07maggots/plant)andlambda-cyhalothrin5% EC@1.0ml/lofwater(1.11maggots/plant).~~Whereas,fipronil5%SC@0.66ml/lof~~

Comment [an10]: Write in the format mentioned in journal submission guideline

Comment [an11]: As per the CD value, indoxcarb is showing at par results, kindly recheck the other treatments showed as at par or next best treatment in text

~~waterrecorded1.32maggots/plant.~~However,thetreatmentwithquinalphos25%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.

The results of current study showed 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.Theresult related to the population of *M. obtusa*, showed similarity with the Patel and Patel (2013) who also reported chlorantraniliprole @ 30 g a.i./ha was superior treatmentagainstpigeonpeapodborercomplex.PatidarandVaishampayan(2022)found that chlorantraniliprole 18.5 % SC @ 0.2 ml/l followed by indoxacarb 14.5 % SC have good effect for control of pigeonpea borer complex.

Comment [an12]: Discussion need to be written in more scientific way, explaining the efficacy of superior insecticide on pod fly in terms of its mode of action, etc

Table2.Efficacyofinsecticidesagainstpodfly(*M.obtusa*)onpigeonpeaaftersecond spray

Tr.No.	Treatments	Dose gorml/litre of water	Numberofmaggotsperplant			
			3 DAS**	7 DAS	14 DAS	Mean
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.	Emamectinbenzoate 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

*Figures in parentheses indicate $\sqrt{n} + 0.5$ transformed values**DAS – Days after spraying

Comment [an13]: Write in the format mentioned in journal submission guideline

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 (1.0 maggots/plant). This was followed by indoxacarb 14.5% SC and spinetoram11.7%SC,whichrecorded1.09and1.maggotsperplant,respectively;these three treatments were statistically at par with each other.Chlorantraniliprole 18.5% SC resultedinthelowestpercentageofpoddamageat8.74%andgraindamageat5.69%.To effectively manage the pigeonpea pod fly (*Melanagromyzaobtusa*), farmers can use chlorantraniliprole 18.5% SC at a rate of 0.3 ml/l of water to achieve higher yields and net returns.

Comment [an14]: Compared to which treatment, specify

Comment [an15]: Mention this in result and discussion section

Comment [an16]: Write conclusion in brief

DISCLAIMER(ARTIFICIALINTELLIGENCE)

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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