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Management of pod fly, *Melanagromyza obtusa* (Malloch) through newer insecticides

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ABSTRACT

A field experiment was carried out at research farm of T.C.A., Dholi (Muzaffarpur) during *Kharif* season 2019-2020 to manage the pod fly *Melanagromyza obtusa* (Malloch) through newer insecticides. All eight novel insecticides were substantially potential over control in lowering the damage caused by pod fly and also recorded increased yields. Minimal pod and grain damage was recorded in chlorantraniliprole 18.5 SC (11.63 % and 8.42 % respectively) followed by flubendiamide 480 SC (14.66% and 15.37%). The highest yield (1945 kg/ha) was recorded in chlorantraniliprole 18.5 SC as against 682 kg/ha in untreated control with a Cost Benefit Ratio (CBR) of 1:41.8.

Introduction

In India several crops are grown among them pulses are very important and responsible for producing higher financial benefits through large quantities of exports. Pigeon pea is one of the crops among the pulses which are grown mostly next to chick pea in India. It is a multipurpose legume. Red gram, tur and arhar are the few other names for Pigeon pea [*Cajanus cajan* (L.) Mill sp.]. Arhar leads to 80% of world's food production and it contains higher amounts of proteins (20% to 22%), carbohydrates (65%), fat (1.2%) and ash (3.9%) (Food and Agriculture Organization, 2005). Its fiber quality is very great (7g/100g of seeds) (Kandhare, 2014). Due to its good taste, several insect pests are also attacking pigeon pea beyond human consumption (Prasad and Singh, 2004). Red gram is attacked by several insect pests regularly and among all the insect pests attacking red gram, Pod fly (*Melanagromyza obtusa*) is notorious and serious pest that causes more than 20% to 80% damage to grains (Subharani and Singh, 2009). Pod fly attacks the crop during pod maturity also starting from pod filling stage. They lay eggs (oviposition) on inner walls of pod. Adult females oviposit single eggs inside the epidermis and after the larvae emerge out, it will feed on pods by mining in to it and causes damage because of which the pod is not fit for consumption and seed value also decreases.The control of the pest complex associated with pigeon pea has been attempted through various chemical management practices. Several crop pests have established maximum resistance to the various insecticides that are available. Hence it reduces the faith over insecticide control. The problem of controlling species which are resistant to chemicals and using different methods for reducing harmful effects on useful insects has provided support for increasing production of red gram. Actually the method to handle pigeon pea pod fly with following eco friendly norms is using target specific novel chemicals.

Material and Methods

Field trial was conducted in 2019-2020 at T.C.A Research Farm, Dholi, Muzaffarpur, a campus of

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Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar to determine effectiveness of new insecticides against pod fly, *M. obtusa* with the Bahar pigeon pea cultivar. Experiment was laid out in a Randomized Block Design with seven treatments viz., Buprofezin 25 SC (1ml l^{-1}), Diafenthiuron 50 WP (1 g/l),Dinotefuron 20SG (0.3 g/l), Flubendiamide 480 SC (0.3 ml/l), Indoxacarb 15.8EC (1ml/l), Chlorantraniliprole 18.5 SC (0.4 ml l^{-1}), Quinolphos 25EC (2 ml/l) including control. Treatments were repeated thrice with an individual plot size of 36 m^2 under standard agronomic practices. The spacing between rows and plants was 60 × 20 cm. Spacing of 1.5 m between treatment plots was followed in order to maintain distance between treatments.

The insecticides were sprayed twice, first at the time of the development of 50 per cent of pods and 2nd at 10 days after the 1st spray. Insecticides were applied with the help of foot sprayer. For each treatment spray mixtures were prepared freshly.

Observations were made on

a. **Counts of pod fly maggot population -** Count was done on randomly selected and labeled five plants per replication before spray and after ten days of 1st and 2nd spray. Plain water was sprayed in the control plot, and counts of pod fly were taken similar to those of insecticidal treatments.
b. **Grain and pod damage-** Randomly 200 pods and 100 grains were selected from every replication during harvest. And percent grain and pod damage was calculated using the formulae.

$$\text{Per cent pod/grain damage (\%)} = \frac{\text{No. of damaged pods or grain}}{\text{Total no. of pods}} \times 100$$

c. **Yield (kg/ ha)-** After pods ripening, harvesting was done treatment wise and dried for six to seven days and then thrashing was done. To determine effect of different treatments on yield, total yield per treatment was reported separately and afterward converted to kg/ha and subjected to statistical analysis and the yield gain was also determined using variations between yields of the sprayed and the unsprayed.
d. **Incremental Cost Benefit Ratio-** So as to calculate the ICBR ratio the net profit generated by deduction of cost of plant protection from the value of extra yield will be divided with cost of plant protection.

Results and Discussion

The effectiveness of various insecticides is depicted in fig 1 and discussed below.

a. Number of maggots

The data on maggot population of pod fly is presented on Table 1. Maggot population did not show any significant difference between treatments at one day before the first spray, which vary from 12.90 to 13.74 (Table 1) indicating uniform distribution of pest. Among the treatments, the less number of maggots per 100 pods was registered in Chlorantraniliprole (8.68) at ten days after first spray, which was substantially better than remaining insecticidal treatments while the larval population was high in untreated control (Table 1).

Table 1: Efficacy of insecticides against maggots of pod flies

Sl. No	Treatments	Dosage	Number of maggots per 100 pods		
			First spraying		Second spraying
			1 DBS	10 DAS	10DAS
T_1	Buprofezin 25 SC	200gm/ha	13.67	10.81	9.34
T_2	Difenthiuron 50 WP	350gm/ha	13.74	11.34	9.82
T_3	Dinotefuron 20SG	40gm/ha	12.90	10.00	9.00
T_4	Flubendiamide 480 SC	30gm/ha	13.45	9.1	7.32
T_5	Indoxacarb 15.8 EC	75gm/ha	13.44	9.35	7.84
T_6	Chlorantraniliprole 18.5 SC	30gm/ha	13.35	8.68	6.92
T_7	Quinolphos 25 EC	350gm/ha	12.97	13.2	11.64
T_8	Control	200gm/ha	13.0	29	32.94
	SEm ±		NS	**0.33**	**0.34**
	CD at 5%			**0.85**	**0.82**
	CV(%)			**12.11**	**12.94**

DBS- Days Before Sowing, DAS- Days After Sowing

Present findings are also in consistence with Chiranjeevi and Sarnaik (2017) who evaluated the effectiveness of different insecticide treatments on pod fly population. The analysis showed that chlorantraniliprole 18.5 SC @ 30 g a.i. was recorded as effective insecticide on 1, 3, 7, 10 and 14 days after 1st application, i.e. 46.33, 25.33, 16.67, 14.00 and 28.00 pod flies (larvae+pupae) per hundred pods respectively. The results is in relation to maggot population of *M. obtusa* is in accordance with Patel and patel (2013) who reported that chlorantraniliprole was the most effective insecticide against pod borer complex.

b. Grain or pod damage

The data on grain and pod damage is represented in Table 2 and illustrated in Figure 1 graphically. The observations reported on damage of pod caused by *M. obtusa* ranged from 11.63 to 64.66 percent in various insecticidal treatments. The data showed that damage of pod was substantially lower in chlorantraniliprole treated plots and was reported to be effective with 11.63 per cent pod damage across all treatments. Fluebendiamide and dinotefuron were found to be the next best treatments by reporting 14.66 and 15.66 per cent of damage of pod and were statistically parallel with one other and substantially superior to untreated control (64.66 per cent). Observations of grain damage due to *M. obtusa* varied between various treatments from 8.42 to 57.63 per cent (Table 2). The current results showed that infestation to grain was substantially reduced in insecticidal treated plots among them chlorantraniliprole was reported to be superior of all treatments with less percentage of grain damage (8.42%). Indoxacarb and flubendiamide were identified as next best treatments by recording grain damage of 14.25 and 15.37 per cent and were statistically equivalent to one other and substantially superior to untreated control (Table 2).

Table 2: Economics of different insecticidal treatments against pod fly on pigeon pea.

Treatments	Dose /ha	Per cent pod damage	(%) grain damage	Yield Kg/ha	Yield increased over control	Gross income over control	Cost of application (Rs/ha)	Net income (Rs/ha)	CBR
Buprofezin 25 SC	200gm/ha	20.33	15.53	1196	514	46,260	2,724	43,536	1:15.9
Difenthiuron 50 WP	350gm/ha	19.33	18.34	1159	477	42,930	3,174	39,756	1:12.5
Dinotefuron 20SG	40gm/ha	15.66	16.62	1228	546	49,140	2,744	46,396	1:16.9
Flubendiamide 480 SC	30gm/ha	14.66	15.37	1350	668	60,120	2,634	57,486	1:21
Indoxacarb 15.8EC	75gm/ha	28.83	14.25	1258	576	51,840	2,712	49,128	1:18.1
Chlorantraniliprole 18.5 SC	30gm/ha	11.63	8.42	1945	1263	113,670	2,652	111,018	1:41.8
Quinolphos 25EC	350gm/ha	21.3	17.65	1023	341	30,690	2,740	27,950	1:10.2
Control	-----	64.66	57.63	682			----		

c. The results are in consistence with Patel and Patel (2013) who performed experiment on bio-efficacy of various novel insecticides towards pod borer complex on the crop pigeon pea and reported that chlorantraniliprole @30 g a.i./ ha showed minimal percentage of pod damage (18.5%) caused by *H. armigera* and *M. obtusa* and maximum yield of pigeon pea.

d. Yield

Grain yields from various insecticidal treatments and their economics are displayed in Table 2. The data showed that all insecticide treatments had substantially more yields than untreated control. Between treatments, the maximum yield of 1945 kg/ha was recorded in Chlorantraniliprole, this may be due to its effectiveness for reducing the grain infestation and increasing the yield. Quinolphos recorded the minimum yield among the treatments (1023 kg/ha) (Table 2).

The present findings were in relation with the findings of Sreekanth *et al*., (2014) who reported that highest grain yield was in Chlorantraniliprole (686.1 kg/ha), followed by Flubendiamide (595.8 kg/ha).

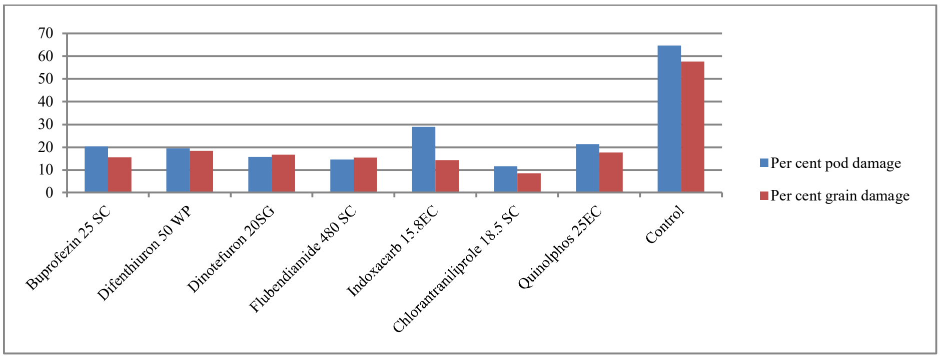

Figure 1: Effectiveness of insecticides towards percent pod and grain damage caused by *Melanoagrmyza obtusa* in pigeon pea

e. Incremental Cost Benefit Ratio (CBR)

The CBR ratio varied from 1:41.8 to 1:21. The highest CBR ratio was recorded with Chlorantraniliprole (1:41.8), proceeded by Flubendiamide (1:21), Indoxacarb (1:18.1). This is in accordance with the result of earlier worker Singh (2014) where in highest cost benefit ratio (1: 4.24) was obtained from chlorantraniliprole.

Conclusion

The chemical control method minimizes the pest population, pod and grain damage with higher yield. Keeping in view of the data of all the parameters, viz. number of larvae per plant, per cent pod damage and grain yield in different treatments, the new generation novel insecticides like such as Chlorantraniliprole, Flubendiamide and Indoxacarb were found to be efficient towards *M. obtusa* with the more percentage of pod damage reduction and increased yields compare to control. In addition to these, cost-effectiveness of Chlorantraniliprole and Flubendiamide was more and favorable with a CBR ratio of 1:41.8 and 1:21. Therefore, chemical management with new insecticides popularizes as an effective, practical alternative to avoid the development of resistance to pod borer complexes in pigeon pea and makes profitable cultivation of pigeon pea crop.

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Conflict of interest

The authors declare that they have no conflict of interest.

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