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Efficacy and Economics of Certain Newer Insecticides Against Pod Fly, *Melanagromyza obtusa* (Malloch) on Pigeonpea

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ABSTRACT

A field experiment conducted during *kharif*, 2013 to evaluate the efficacy and economics of certain newer insecticides against pod fly on pigeonpea revealed that there was a significant difference among the treatments with respect to per cent pod and grain damage. Pod damage ranged from 13.3 to 36.7% in various treatments whereas, grain damage was in the horizon of 6.8 to 16.6%. Grain damage due to pod fly was lowest in dimethoate (6.8%) and imidacloprid (10.1%) followed by clothianidin (11.2%) with 59.0, 39.1 and 32.5 per cent reduction over control, respectively. Dimethoate was found to be superior based on per cent pod and grain damage with highest grain yield of 1345 kg ha^{-1} and ICBR of 1:5.48.

Key words : Clothianidin, Dimethoate, ICBR, Imidacloprid,Insecticides, Pod fly, Thiamethoxam.

In India, pigeonpea is grown in 3.81 million ha with an annual production of 3.02 million tonnes and productivity of 806 Kg ha^{-1} whereas, in Andhra Pradesh, the area, production and productivity of pigeonpea is 4.81 lakh ha, 2.5 lakh tonnes and 520 Kg ha^{-1} respectively. (AICRP Report, 2014). The production of pigeonpea is very low even in the era of green revolution. Among the various constraints, insect pests are one of the major and important ones affecting the productivity of pigeonpea apart from ecological and biological constraints. Among the major pod infesting insects, pod fly *Melanagromyza obtusa* (Malloch) is the most serious and important pest of pigeonpea (Ahmad, 1938) and an important emerging constraint to increase the production and productivity of this crop under subsistence farming conditions causing 10-80 % damage (Shanower *et al*., 1999, Kumar and Nath, 2003) and estimated to cause a monitory loss of US$ 256 million annually (Anonymous, 1992).

The present studies were therefore, conducted to evaluate the efficacy of certain newer insecticides against pod fly.

MATERIAL AND METHODS

The experiment was laid out at Regional Agricultural Research Station (RARS), Lam Farm, Guntur in a Randomised Block Design (RBD) with seven treatments replicated thrice including untreated control. The size of each plot was 36 m^2 with an inter row spacing of 1.8m and an intra row spacing of 0.2m. The popular local variety ICPL-85063 (Lakshmi) obtained from the RARS, Lam Farm, Guntur, was selected for the experiment. Crop protection against other pod borers upto pod initiation stage was done by spraying flubendiamide @ 0.3 ml l^{-1} and coragen @ 0.3 ml l^{-1} at 15 days interval starting from flower bud initiation stage. The treatments were imposed by using knapsack sprayer @ 400-500 litres of spray solution ha^{-1} depending on stage of the crop. Each treatment was sprayed three times, the first being given at pod initiation stage of the crop, while 2nd and 3rd sprays were imposed at 10 days interval. Observations on following parameters were recorded.

Pod and grain damage (%)

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

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

Yield gain

Yield gain was calculated based on the differences between sprayed and unsprayed yields expressed as proportions of the unsprayed plot yields.

$$\text{Yield Gain} = \frac{\text{Yield}_{(\text{Sprayed})} - \text{Yield}_{(\text{Unsprayed})}}{\text{Yield}_{(\text{Unsprayed})}} \times 100$$

Incremental Cost Benefit Ratio

In order to evolve incremental cost benefit ratio, the net profit obtained by deducting the plant protection cost from the value of additional yield will be divided with the plant protection cost.

RESULTS AND DISCUSSION

The observations recorded on the pod damage due to *M. obtusa* in different insecticidal treatments ranged from 13.3 to 36.7 per cent (Table 1). The data revealed that the pod damage was significantly reduced in plots treated with dimethoate and was found effective among all the treatments with 13.3 per cent pod damage. Imidacloprid, clothianidin and thiamethoxam were found as next best treatments by recording 20.5, 22.2 and 27.2 per cent pod damage, respectively and were statistically at par with each other, but were significantly superior over control (36.7%). Azadirachtin and dichlorvos respectively with 30.2 and 28.7 per cent pod damage were least effective and were at par with control (36.7%).

The observations on the grain damage due to *M. obtusa* (Table 1) ranged from 6.8 to 16.6 per cent among different treatments. The present findings revealed that the grain damage was significantly reduced in plots treated with dimethoate and was found effective among all the treatments with least per cent grain damage (6.8%). Imidacloprid, clothianidin, dichlorvos and azadirachtin were found as next best treatments by recording 10.1, 11.2, 11.9 and 12.7 per cent grain damage, respectively and were statistically at par with each other and were significantly different from control. Thiamethoxam found to be least effective with 13.8 per cent grain damage and was at par with control (16.6%).

Dimethoate was found superior among all the insecticidal treatments with 63.8 and 59.0 per cent reduction of pod and grain damage respectively over control. Imidacloprid and clothianidin with 44.1 and 39.5 per cent reduction of pod damage respectively and 39.2 and 32.5 per cent reduction of grain damage respectively over control stood as next best treatments. Azadirachtin with 17.7 per cent reduction of pod damage over control was least effective. However, with 16.9 per cent reduction of grain damage over control, thiamethoxam was least effective.

The present findings were in conformity with the findings of Dar *et al.* (2005), Dar *et al.* (2009a), Dar *et al.* (2009b) and Sharma *et al.* (2011) who reported the effectiveness of conventional insecticides like dimethoate against pod fly on pigeonpea. Similarly, Srivastava and Mohapatra (2003) also reported that pod fly damage was least in plots treated with dimethoate (3.0%) with highest average grain yield of 14.2 q ha^{-1}.The results on imidacloprid were in agreement with Mishra *et al.* (2012) who reported that the mean pod damage due to pod borers and pod fly in pigeonpea was minimum (18.3%) when treated with imidacloprid 17.8 SL with an average grain yield of 18.51 q ha^{-1}.

The grain yield obtained in different insecticidal treatments and their economics were presented in Table 4.2. The data revealed that all the insecticidal treatments recorded significantly higher yields than the untreated control. Among the treatments, dimethoate recorded the highest yield of 1345 kg ha^{-1} with 133.9% increase over control (575 kg ha^{-1}). The treatments imidacloprid (1261 kg ha^{-1}) and clothianidin (1098 kg ha^{-1}) with 119.3 and 91.0 per cent increase in yield over untreated control (575 kg ha^{-1}) were moderately better, followed by dichlorvos (903.0 kg ha^{-1}) and azadirachtin (834 kg ha^{-1}). Thiamethoxam recorded lowest yield among the treatments (734 kg ha^{-1}).

With regard to Incremental Cost Benefit Ratio, it ranged from 1:0.12 to 1:5.48. The highest ICBR ratio was recorded with dimethoate (1:5.48) followed by imidacloprid (1:4.99), clothianidin (1:2.73), dichlorvos (1:1.83), azadirachtin (1:0.96) and thiamethoxam (1:0.12).

From the present findings, it could be evidenced that though the conventional insecticide dimethoate proved the best among the treatments, newer insecticides like imidacloprid and clothianidin were also found effective against pod fly with incremental benefit cost ratio of 1:4.99 and 1:2.73

Table 1. Efficacy of certain newer insecticides against pod fly.

Treatment and dose	Pod damage (%)	Reduction over control (%)	Grain damage (%)	Reduction over control (%)
Thiamethoxam 25 WG @ 0.4 g l^{-1}	27.2 (31.36)[bcd]	25.9	13.8 (21.75)[ab]	16.9
Imidacloprid 17.8 SL @ 0.2 ml l^{-1}	20.5 (26.87)[d]	44.1	10.1 (18.50)[c]	39.1
Clothianidin 50 WDG @ 0.1 g l^{-1}	22.2 (28.04)[cd]	39.5	11.2 (19.57)[bc]	32.5
Dichlorvos 76 EC @ 1.0 ml l^{-1}	28.7 (32.34)[abc]	21.8	11.9 (20.14)[bc]	28.3
Dimethoate 30 EC @ 2.0 ml l^{-1}	13.3 (21.32)[e]	63.8	6.8 (15.02)[d]	59.0
Azadirachtin 10,000 ppm @ 1.0 ml l^{-1}	30.2 (33.26)[ab]	17.7	12.7 (20.86)[bc]	23.5
Control	36.7 (37.24)[a]	—-	16.6 (24.03)[a]	—-
CD (P=0.05)	5.20	—-	2.81	—-
CV (%)	9.72	—-	7.91	—-

Values in parentheses are arc sine transformed values.
Sig. — Significant

Table 2. Economics of certain newer insecticides in the management of pod fly.

Treatment	Yield (kg ha^{-1})	Yield gain over control (%)	Additional yield over control (kg ha^{-1})	Value of additional yield per ha (Rs.)[A]	*Plant protection cost per ha (Rs.)[B]	Net profit (Rs.) [A-B]	ICBR (A-B) / B
Thiamethoxam	734.0[ab]	27.7	159	7632.0	6812.0	820.0	1:0.12
Imidacloprid	1261.0[de]	119.3	686	32928.0	5495.0	27433.0	1:4.99
Clothianidin	1098.0[cd]	91.0	523	25104.0	6737.0	18367.0	1:2.73
Dichlorvos	903.0[bc]	57.0	328	15744.0	5567.0	10177.0	1:1.83
Dimethoate	1345.0[e]	133.9	770	36960.0	5705.0	31255.0	1:5.48
Azadirachtin	834.0[b]	45.0	259	12432.0	6327.5	6104.5	1:0.96
Control	575.0[a]	—-	—-	—-	—-	—-	—-
CD (P=0.05)	219.18	—-	—-	—-	—-	—-	—-
CV (%)	12.77	—-	—-	—-	—-	—-	—-

Cost of redgram seed – Rs. 48/- per kg
Sig. — Significant
*Plant protection costs includes spray boy charges

Table 3. Correlation and regression studies on per cent pod & grain damage and yield of pigeonpea.

Character	*M. obtusa*	
	Correlation coefficients	Regression equations
Per cent pod damage and grain damage	0.626**	v= 0.252**x + 5.441
Per cent pod damage and yield	-0.736**	v = -26.24**x + 1634
Per cent grain damage and yield	-0.843**	v = -74.64**x + 1850

** — Significant at 1% level of significance (P = 0.01)

Figure 1. Efficacy of insecticides against per cent pod damage and per cent reduction over control due to pod fly.

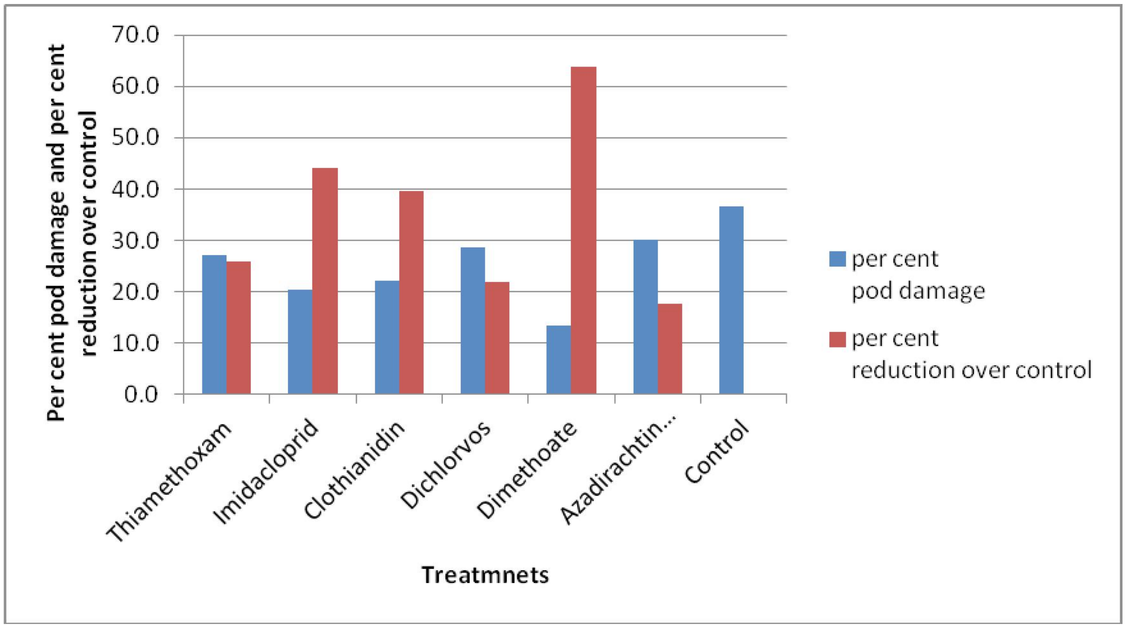
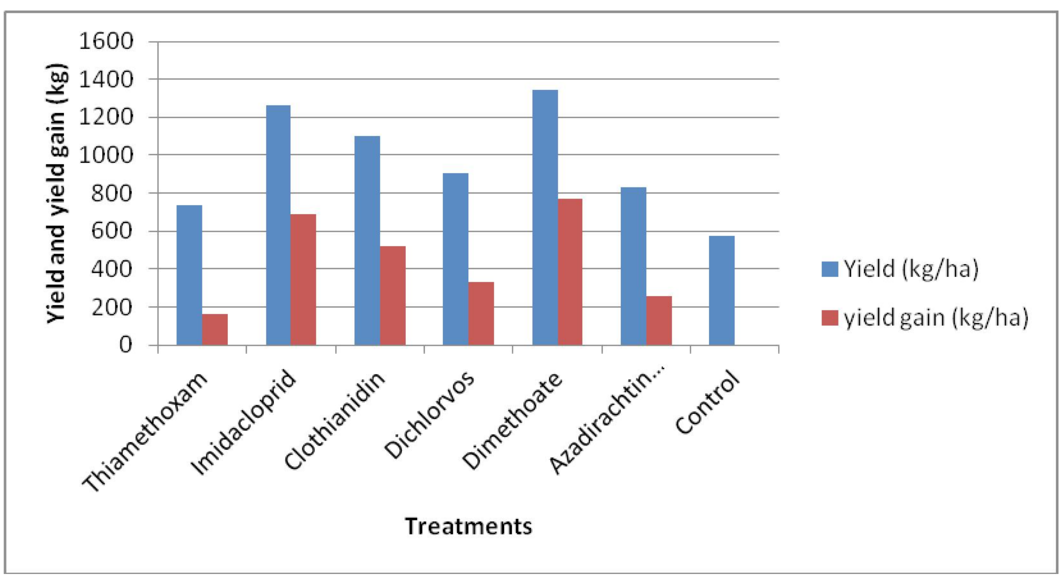


Figure 2. Effect of insecticidal treatments on yield and yield gain of pigeonpea.



respectively. Hence, it is suggested that the effective insecticides may be alternated in order to evade the development of resistance.

A significant positive correlation was observed between per cent pod damage and grain damage due to pod fly in different insecticidal treatments with r = 0.626. However, a significant negative correlation was observed between per cent pod damage and grain damage due to pod fly in different treatments and yield of pigeonpea with r = -0.736 and r = -0.843 respectively.

LITERATURE CITED

Ahmad T 1938 The tur pod fly, *Melanagromyza obtusa,* a pest of *Cajanus cajan Indian Journal of Agricultural Sciences.* 8 (1): 63-76 (Requested).

AICRP Report 2014 All India Co-ordinated Research Project on Pigeonpea Project Coordinator's Report Annual group meet 2013 Pp: 10-11.

Anonymous 1992 (*in*) *The Medium Term Plan.* International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh, India.

Dar M H, Rizvi P Q and Saxena H 2009a Evaluation of potent insecticides against pod fly (*Melanagromyza obtusa*) and its parasitoids in late pigeonpea (*Cajanus cajan* L. Millsp.) *Current Advances in Agricultural Science,s* 1 (2): 114-116.

Dar M H, Rizvi P Q and Saxena H 2009b Evaluation of relatively eco-friendly insecticides against pigeonpea pod fly, *Melanagromyza obtusa* (Malloch) in late pigeonpea *Trends in Biosciences,* 2 (2): 76-78.

Dar M H, Rizvi P Q and Gupta A 2005 Development of integrated management module for pod fly, *Melanagromyza obtusa* (Malloch) in late pigeonpea *Annals of Plant Protection Sciences,* 13 (2): 298-301.

Kumar A and Nath P 2003 Field efficacy of insecticides against pod bug (*Clavigralla gibbosa*) and pod fly (*Melanagromyza obtusa*) infesting pigeonpea *Annals of Plant Protection Sciences,* 11 (1): 31-34.

Mishra M K, Singh R P and Ali S 2012 Chemical control and avoidable yield losses of pigeonpea due to insect pests. *Annals of Plant Protection Sciences,* 20 (2): 306-309.

Shanower T G, Romeis J and Minja E M 1999 Insect pests of pigeonpea and their management *Annual Review of Entomology,* 44: 77-96.

Sharma O P, Bhosle B B, Kamble K R, Bhede B V and Sreeras N R 2011 Management of pigeonpea pod borers with special reference to pod fly (*Melanagromyza obtusa*) *Indian Journal of Agricultural Sciences,* 81 (6): 539-543.

Srivastava C P and Mohapatra S D 2003 Efficacy and economic of insecticides alongwith NSKE against pigeonpea pod fly and pod bug. *Annals of Plant Protection Sciences.* 11 (1): 143-145.

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