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Bioefficacy of different insecticidal treatments on pupal population of *Melanagromyza obtusa* (Malloch)

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Abstract
A field experiment was conducted to explore the bioefficacy of different insecticidal treatments (neem oil @ 3%, pongamia oil @ 3%, eucalyptus oil @ 5%, curry leaf extract @ 5%, custard apple seed extract @ 5%, chlorantraniliprole 18.5 SC @ 30 g a.i. per ha, flubendiamide 480 SC @ 48 g a.i. per ha, emamectin benzoate 5 SG @ 11 g a.i. per ha, triazophos 40 EC @ 500 g a.i. per ha, lambda-cyhalothrin 4.9 CS @ 25 g a.i. per ha and untreated control) on pupal population of *Melanagromyza obtusa* (Malloch) at Agriculture Research Station, Badnapur during *Kharif*, 2015-2016. The treatment with chlorantraniliprole 18.5 SC @ 30 g a.i. per ha was found best with minimum pupal population of *M. obtusa i.e.* 12.00, 9.00, 5.00, 3.33 and 10.00; and 11.00, 5.67, 5.67, 4.67 and 9.33 pupae per 100 pods on one, three, seven, ten and fourteen days after first and second spray and it was followed by neem oil @ 3%. The least effective treatment was *Eucalyptus* oil @ 5 per cent with maximum pupal population of *M. obtusa i.e.* 16.00, 21.00, 15.67, 15.67 and 25.33; and 14.33, 13.67, 16.33, 18.00 and 20.00 pupae per 100 pods at one, three, seven, ten and fourteen days after first and second spray. The result revealed that chlorantraniliprole 18.5 SC @ 30 g a.i. per ha was found best treatment with minimum pupal population after the both insecticidal spray.

Keywords: Bioefficacy, insecticides, pupae, *Melanagromyza obtusa*, pigeonpea and pod fly

1. Introduction

Pigeonpea [*Cajanus cajan* (L.) Millspaugh], also known as red gram, tur or arhar, is the second most important grain legume of India after chickpea [1]. The seeds and other parts of plant are fed upon by many insects with over 200 insect species have been recorded on pigeonpea crop [2]. The field losses are primarily caused by a pest complex that attacks the flowers and pods. The second most damaging pest of pigeonpea is the pod fly, *Melanagromyza obtusa* (Malloch). *M. obtusa* is a key biotic constraint for productivity in subsistence crop protection pattern; its damage varies up to 80 per cent and has been estimated about US $ 256 million annually [3]. This small black fly lays its eggs through the wall of the young pod, and its larva feeds in a seed. The small brown puparium is also formed inside the pod. So this pest is protected from predators, and contact insecticides, throughout most of its life. The fly emerges from the pod through a characteristic round hole [4]. For management of *M. obtusa*, agrochemicals are still the first choice of farmers. Insecticides are most commonly recommended, preferred and adopted means, especially for crop with high remunerative prices like pigeonpea. Hence, chemical measures are often termed as necessary evil in present pigeonpea pest management scenario. Several field studies to determine the efficacy of several insecticides applied alone for the control of pod fly [5, 6, 7]. However, these findings did not find acceptability and led to partial success. Exploring of insecticides with lesser residues and novel mode of action to reduce the pupal population of *M. obtusa* through making check for further development of life stages has become imperative. Keeping this in view, therefore the present studies were carried out to evaluate the bioefficacy of different insecticidal treatments on pupal population of *Melanagromyza obtusa* (Malloch).

2. Materials and Methods

With a view to evaluate bio-efficacy of newer insecticides against pod borer complex, a field experiment was conducted in randomized block design with eleven treatments replicated thrice at Research Farm, Agricultural Entomology Unit, Agricultural Research Station, Badnapur (VNMKV, Parbhani), Maharashtra, India during *Kharif* season of 2015-16. The plots having uniform size (Gross: 5.40 m x 4.80 m and Net: 4.80 m x 3.60 m), with a spacing of 60 cm x 30 cm and Cv. BDN-711 was used for the study. The crop was raised under rainfed conditions with recommended package of practices and only a protective irrigation was provided during flowering stage of the crop. Various insecticides were applied at respective dose with the help of knapsack sprayer and imposed in all three replication randomly. The first application of insecticidal treatment was made after first incidence of the pest, *M. obtusa*. The second spray was given at fifteen days interval after first spray. *M. obtusa* pupal population was recorded from the 100 randomly collected pods covering all the plants of each net plot for each treatment [8]. *M. obtusa* pupal population was counted at one day before spraying and one, three, seven, ten and fourteen days after each spraying [1, 9]. Figures of population obtained in different insecticidal treatments were √x+0.5 transformed. Thus, the data obtained on population of *M. obtusa* pupae in different insecticidal treatments was analyzed statistically by using randomized block design as per the methods suggested by Panse and Sukhatme [10] to draw meaningful conclusions.

3. Results and Discussion

The data on pupal population of pigeonpea pod fly, *M. obtusa* (Malloch) in different insecticide treatments at one day before, one, three, seven, ten and fourteen days after first spray application is presented in Table 1. The data revealed that the pupal population of *M. obtusa* was non-significant in all the treatments indicating even distribution of the pest at one day before spray application. From the data, it is clear that all the tested insecticides were found significantly superior over control. The treatment application of chorantriniliprole 18.5 SC @ 30 g a.i. per ha and neem oil @ 3 per cent emerged as best treatments which recorded least pupal population of *M. obtusa* on one, three, seven, ten and fourteen days after first spray *i.e.* 12.00, 9.00, 5.00, 3.33 and 10.00; and 13.33, 11.67, 6.00, 5.00 and 8.33 pod fly pupae per 100 pods, respectively indicating that more effective in reducing the pupal population of pod fly. This was followed by flubendiamide 480 SC @ 48 g a.i. per ha (14.33, 12.00, 7.67, 5.67 and 14.33 pod fly pupae per 100 pods), emamectin benzoate 5 SG @ 11 g a.i. per ha (15.00, 13.67, 8.33, 8.00 and 16.33 pod fly pupae per 100 pods) and lambda-cyhalothrin 4.9 CS @ 25 g a.i. per ha (15.33, 14.00, 8.33, 7.33 and 16.00 pod fly pupae per 100 pods) having at par effect with each other, respectively revealing that these treatments were effective against pod fly pupae and its reduction. The treatment application of custard apple seed extract @ 5 per cent (16.33, 15.00, 9.67, 7.67 and 17.00 pod fly pupae per 100 pods), *Pongamia* oil @ 3 per cent (16.00, 18.67, 11.00, 11.33 and 18.67 pod fly pupae per 100 pods), triazophos 40 EC @ 500 g a.i. per ha (16.33, 18.00, 9.67, 10.67 and 23.00 pod fly pupae per 100 pods) and curry leaf extract @ 5 per cent (18.67, 22.33, 11.00, 12.67 and 23.67 pod fly pupae per 100 pods) resulted in moderately suppressing the pupal population of *M. obtusa* and all these treatments exhibited at par effect with each other. The treatment application of *Eucalyptus* oil @ 5 per cent was least effective against *M. obtusa* pupae and recorded maximum pupal population of 16.00, 21.00, 15.67, 15.67 and 25.33 pod fly pupae per 100 pods on one, three, seven, ten and fourteen days after first spray. While, highest pupal population of *M. obtusa* was observed in control *i.e.* 19.67, 32.00, 38.67, 35.33 and 56.00 pod fly pupae per 100 pods.

Table 1: Effect of different insecticide treatments on pupal population of *M. obtusa* after first spray.

S. No.	Treatments	Pupal population of *M. obtusa* per 100 Pods					
		1 DBS	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS
1	Neem oil @ 3%	19.67 (4.49)	13.33 (3.72)	11.67 (3.49)	6.00 (2.55)	5.00 (2.35)	8.33 (2.97)
2	Pongamia oil @ 3%	20.33 (4.56)	16.00 (4.06)	18.67 (4.38)	11.00 (3.39)	11.33 (3.44)	18.67 (4.38)
3	Eucalyptus oil @ 5%	23.67 (4.92)	16.00 (4.06)	21.00 (4.64)	15.67 (4.02)	15.67 (4.02)	25.33 (5.08)
4	Curry Leaf Extract @ 5%	21.00 (4.64)	18.67 (4.38)	22.33 (4.78)	11.00 (3.39)	12.67 (3.63)	23.67 (4.92)
5	Custard Apple Seed Extract @ 5%	20.33 (4.56)	16.33 (4.10)	15.00 (3.94)	9.67 (3.19)	7.67 (2.86)	17.00 (4.18)
6	Chlorantraniliprole 18.5 SC @ 30 g a.i. per ha	21.67 (4.71)	12.00 (3.54)	9.00 (3.08)	5.00 (2.35)	3.33 (1.96)	10.00 (3.24)
7	Flubendiamide 480 SC @ 48 g a.i. per ha	21.33 (4.67)	14.33 (3.85)	12.00 (3.54)	7.67 (2.86)	5.67 (2.48)	14.33 (3.85)
8	Emamectin benzoate 5 SG @ 11 g a.i. per ha	22.00 (4.74)	15.00 (3.94)	13.67 (3.76)	8.33 (2.97)	8.00 (2.92)	16.33 (4.10)
9	Triazophos 40 EC @ 500 g a.i. per ha	24.33 (4.98)	16.33 (4.10)	18.00 (4.30)	9.67 (3.19)	10.67 (3.34)	23.00 (4.85)
10	Lambda-Cyhalothrin 4.9 CS @ 25 g a.i. per ha	19.67 (4.49)	15.33 (3.98)	14.00 (3.81)	8.33 (2.97)	7.33 (2.80)	16.00 (4.06)
11	Untreated Control	21.67 (4.71)	19.67 (4.49)	32.00 (5.70)	38.67 (6.26)	35.33 (5.99)	56.00 (7.52)
	SE ± (m)	0.20	0.11	0.24	0.20	0.18	0.20
	CD at 5%	NS	0.31	0.69	0.58	0.52	0.58
	CV	7.36	4.59	10.08	10.31	9.54	7.83

Figures of population in parenthesis are √x+0.5 transformed values.

The data presented in Table 2 indicating the pupal population of *M. obtusa* on one day before, one, three, seven, ten and fourteen days after second spray ranged from 4.67 to 53.67 pupae per 100 pods and non-significant difference was found among all the different treatments at one day before spray. The observations indicated that population of *M. obtusa* pupae was significantly reduced in treated plots as compared to untreated. The treatment application of chlorantraniliprole

18.5 SC @ 30 g a.i. per ha and neem oil @ 3 per cent was found as best treatments with minimum pupal population of *M. obtusa* on one, three, seven, ten and fourteen days after second spray *i.e.* 11.00, 5.67, 5.67, 4.67 and 9.33; 11.67, 7.33, 6.33, 6.00 and 9.67 pod fly pupae per 100 pods on one, three, seven, ten and fourteen days after second spray, indicating that these are more effective against pod fly pupae; followed by all other remaining treatments *i.e.* flubendiamide 480 SC @ 48 g a.i. per ha (13.33, 8.00, 8.33, 8.33 and 13.67 pod fly pupae per 100 pods), emamectin benzoate 5 SG @ 11 g a.i. per ha (13.33, 8.33, 9.33, 9.33 and 14.00 pod fly pupae per 100 pods) and lambda-cyhalothrin 4.9 CS @ 25 g a.i. per ha (13.00, 9.00, 9.67, 9.67 and 14.67 pod fly pupae per 100 pods) having at par effect with each other, respectively and indicating that the treatments were effective against pod fly pupae. The treatment application of custard apple seed extract @ 5 per cent (13.33, 9.33, 11.00, 10.67 and 15.00 pod fly pupae per 100 pods), *Pongamia* oil @ 3 per cent (13.67, 12.00, 12.00, 15.67 and 18.33 pod fly pupae per 100 pods), triazophos 40 EC @ 500 g a.i. per ha (14.00, 11.67, 10.00, 12.33 and 15.67 pod fly pupae per 100 pods) and curry leaf extract @ 5 per cent (12.67, 12.33, 11.67, 11.67 and 14.33 pod fly pupae per 100 pods) resulted in moderately suppressing the pupal population of *M. obtusa* and all these treatments exhibited at par effect with each other, respectively. The treatment application of *Eucalyptus* oil @ 5 per cent was least effective against *M. obtusa* pupae and recorded maximum pupal population of 14.33, 13.67, 16.33, 18.00 and 20.00 pod fly pupae per 100 pods on one, three, seven, ten and fourteen days after second spray, respectively. While, highest pupal population of *M. obtusa* was observed in untreated control *i.e.* 26.33, 20.33, 40.33, 44.67 and 53.67 pod fly pupae per 100 pods.

Table 2: Effect of different insecticide treatments on pupal population of *M. obtusa* after second spray.

S. No.	Treatments	Pupal population of *M. obtusa* per 100 Pods					
		1 DBS	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS
1	Neem oil @ 3%	24.00 (4.95)	11.67 (3.49)	7.33 (2.80)	6.33 (2.61)	6.00 (2.55)	9.67 (3.19)
2	Pongamia oil @ 3%	23.00 (4.85)	13.67 (3.76)	12.00 (3.54)	12.00 (3.54)	15.67 (4.02)	18.33 (4.34)
3	Eucalyptus oil @ 5%	24.33 (4.98)	14.33 (3.85)	13.67 (3.76)	16.33 (4.10)	18.00 (4.30)	20.00 (4.53)
4	Curry Leaf Extract @ 5%	24.67 (5.02)	12.67 (3.63)	12.33 (3.58)	11.67 (3.49)	11.67 (3.49)	14.33 (3.85)
5	Custard Apple Seed Extract @ 5%	24.00 (4.95)	13.33 (3.72)	9.33 (3.14)	11.00 (3.39)	10.67 (3.34)	15.00 (3.94)
6	Chlorantraniliprole 18.5 SC @ 30 g a.i. per ha	25.33 (5.08)	11.00 (3.39)	5.67 (2.48)	5.67 (2.48)	4.67 (2.27)	9.33 (3.14)
7	Flubendiamide 480 SC @ 48 g a.i. per ha	24.00 (4.95)	13.33 (3.72)	8.00 (2.92)	8.33 (2.97)	8.33 (2.97)	13.67 (3.76)
8	Emamectin benzoate 5 SG @ 11 g a.i. per ha	27.67 (5.31)	13.33 (3.72)	8.33 (2.97)	9.33 (3.14)	9.33 (3.14)	14.00 (3.81)
9	Triazophos 40 EC @ 500 g a.i. per ha	26.67 (5.21)	14.00 (3.81)	11.67 (3.49)	10.00 (3.24)	12.33 (3.58)	15.67 (4.02)
10	Lambda-Cyhalothrin 4.9 CS @ 25 g a.i. per ha	23.67 (4.92)	13.00 (3.67)	9.00 (3.08)	9.67 (3.19)	9.67 (3.19)	14.67 (3.89)
11	Untreated Control	53.33 (7.34)	26.33 (5.18)	20.33 (4.56)	40.33 (6.39)	44.67 (6.72)	53.67 (7.36)
	SE ± (m)	0.33	0.20	0.20	0.23	0.24	0.23
	CD at 5%	NS	0.59	0.57	0.67	0.71	0.66
	CV	11.04	9.32	10.34	11.41	11.83	9.53

Figures of population in parenthesis are $\sqrt{x+0.5}$ transformed values.

All the insecticidal treatments were effective in managing *M. obtusa* pupal population. Among all treatments, chlorantraniliprole 18.5 SC @ 30 g a.i./ha and neem oil @ 3 per cent was found best to manage the pupae of *M. obtusa*. The present findings are in accordance with earlier reports of [11] who reported 10 per cent neem oil to be significantly reducing pod fly incidence. Whereas, Triazophos 0.07 per cent can effectively reduce pod fly population [12]. Use of *Pongamia* oil can give an option for organically grown pulse crop in reducing pod fly infestation [13]. Eucalyptus oil is ineffective against pod fly [14]. As this was the study initiated for first time, meager review of literature is available. But earnest efforts were made to review the related literature which was found to be meaningful and having direct and indirect bearing on this study and furnished.

4. Conclusion

From the present study, it can be concluded that the insecticides *viz.*, chlorantraniliprole 18.5 SC @ 30 g a.i./ha and neem oil @ 3% were most effective against *M. obtusa* by recording minimum pupal population after the both insecticidal spray and these may be utilized for *M. obtusa* management in farmers fields through making check for further development of life stages due to their novel mode of action.

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