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EVALUATION OF NEW MOLECULE OF INSECTICIDES AGAINST POD FLY (*Melanagromyza obtusa*) OF PIGEON PEA

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ABSTRACT

Pod fly [*Melanagromyza obtusa* (Malloch)] is a key biotic constraint for productivity in subsistence crop protection pattern; its damage varies up to 80%; has been estimated about US $ 256 million annually. The research trial was accomplished at Research Farm of SASRD, Nagaland University during *Kharif* 2011 and 2012 in order to evaluate the new molecules against pod fly. The experiment was consisted 6 treatments (Trizophos 500 g ai. ha^{-1}, Emamectine benzoate 11 g ai. ha^{-1}, Emamectine benzoate 11 g ai. ha^{-1} + Acetamiprid 30 g ai. ha^{-1}, Flubendiamide 47 g ai. ha^{-1}, Chlorantraniliprole 40 g ai. ha^{-1} and Spinosade 75 g ai. ha^{-1}) compare with control. The lowest pod damage (9.7% and 9.3%), lowest grain damage (5.3% and 5%) and highest grain yield (1202 kg ha^{-1} and 1209 kg ha^{-1}) were obtained from Chlorantraniliprole followed by Emamectine benzoate+ Acetamiprid, Spinosade, Emamectine benzoate, Flubendiamide, Trizophos and all the treatments were significantly superior over control. The highest B: C ratio reward (1:4.24) was obtained from Chlorantraniliprole. The results indicated that Chlorantraniliprole was more effectual against pod damage, grain damage, yield and B: C ratio. The safer chemical control methods reduce the pod damage, grain damage and higher yield with high benefit: cost ratio, so therefore chemical control popularizes as an effective, practical alternative and makes lucrative cultivation of pigeon pea.

Keywords: Pigeon pea, Pod fly (Melanagromyza obtusa), New molecules, Pest management

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INTRODUCTION

Pigeon pea (*Cajanus cajan* L.) is one of the most important pulse crop, to be cultivated in more than 25 countries of the world on 5.8 million ha with 4.4 million tonnes of production, whereas in Asia it is grown in 5.07 million ha and producing 3.71 million tonnes in 2011 (FAO 2013). In India, pigeon pea cultivated on 4.09 million ha area with a production of 3.27 million tonnes (Anonymous 2011). Economic loss due to biotic stress factors has been estimated to be $US 8.48 billion (Sarika et al., 2013). Among biotic constraint for productivity in subsistence crop protection pattern, *Helicoverpa armigera* (Hubner), *Melanagromyza obtusa* (Malloch) and *Maruca vitrata* (Geyer) are the most detrimental insect pests. The pod fly (*M. obtusa*) lay eggs in developing pods and its larvae feed on developing seeds by making tunnel. Larvae consume its starchy portions and embryo, damaged embryo became unable to germinate and grains become shrivel. They excrete a trail of excreta, lead to development of saprophytic fungus, which renders the seed inedible. The infested immature pods do not show external evidence of damage until the fully grown larvae makes exit holes in the pod walls. The immature as well as damaging stage of pod fly surpass inside the pods and do not show any symptoms from outside until exit the adult, it makes complicacy to their management.

Those insecticides may be effectual which have ovicidal and translaminar action to create the lethal concentration in host at infestation points. Chlorantriniliprole and Flubendiamide are green level pesticide; it binds to insect ryanodine receptors in muscle cells, whereas Chlorantriniliprole has translaminar action also. Acetamiprid belongs to neonicotinoids group, which is systemic insecticide, has ovicidal and translaminar action. The biosynthetic pesticide, Emamectin derived from the fermentation of soil actinomycetes (*Streptomyces avermitilis*) and Spinosad derived from fermentation of actinomycetes (*Saccharopolyspora spinosa*). Hence, present investigations were carried out to assess the effective eco-friendly new chemistry widely accepted at integrated pest management parameters.

MATERIALS AND METHODS

The experimental materials consisted of pigeon pea Pod fly (*M. obtusa*) and chemicals *viz.* conventional pesticide Trizophos and other six eco-friendly new molecules like Emamectine benzoate, Acetamiprid, Flubendiamide, Spinosade and Chlorantriniliprole. The research trial was accomplished at Research Farm of SASRD, Nagaland University during *Kharif* 2011 and 2012. The experiment was designed in randomized block design with 7 treatments and 3 replications. Row to row and plant to plant spacing was maintained at 75 cm × 25 cm, respectively.

The treatments were assigned T1= Trizophos 500 g ai. ha^{-1}, T2= Emamectine benzoate 11 g ai. ha^{-1}, T3= Emamectine benzoate 11 g ai.+ Acetamiprid 30 g ai. ha^{-1}, T4= Flubendiamide 47 g ai. ha^{-1}, T5= Chlorantriniliprole 40 g ai. ha^{-1}, T6= Spinosade 75 g ai. ha^{-1} comparison with T7 = untreated (control) were evaluated for their efficacy against pod fly. The crop was raised with recommended agronomic practices. The first spray was applied at 50% flowering stage (first week of Dec.) and second spray was administered on 16 days after first spray through high volume hand operated knapsack sprayer with hollow cone nozzle and water volume was used 500 liters ha^{-1}. The surfactant was mixed in solution of pesticide in water. The sprays were applied always after 1600 h to minimize the toxicity for relative pollinators and support their conservation.

At harvest of the crop both healthy and damaged pods were plucked from 10 randomly selected plants from each treatment of entire three replications to estimate the pod and grain damage. Total number of pods, total number of their grains, *M. obtusa* infested pods and their infested grains were counted separately, thereafter the data were calculated in per cent pod damage and grain damage.

RESULTS AND DISCUSSION

The recorded data on pod damage during both the years are presented in table 1. It was revealed that all the insecticides were significantly effective in reducing the pod damage over control (untreated). The lowest pod damage (9.7% and 9.3%) was recorded with Chlorantriniliprole, whereas highest pod damage (24.7% and 23.7%) was recorded with untreated plot during 2011-12 and 2012-13, respectively. The lowest seed damage (5.3% and 5.0%) was recorded with Chlorantriniliprole, whereas highest seed damage (19% and 18.2%) were recorded with untreated plot during both consecutive experimental year.

Effectiveness of different new molecules to minimize the pod fly infestation reflected by grain yields. During 2012- 13, the highest yield (1209 kg ha^{-1}) was obtained from Chlorantriniliprole followed by Emamectine benzoate+ Acetamiprid, Spinosade, Emamectine benzoate, Flubendiamide, Trizophos, whereas lowest yield (736 kg ha^{-1})was recorded from control (table 1). The same trend was observed during former experimental years. This may be due to lowest pod and grain infestation from Chlorantriniliprole and highest infestation from control. The results of present study is also supported by Sharma et al. (2011) who reported Emamectine benzoate and Acetamiprid combination was superior for pod damage, seed damage and yield over conventional and bio-rational pesticides. The cost benefit ratio based on the average yield and same year pigeon pea support price gave realization over untreated (table 2). Table 2 showed that the Benefit Cost ratio reward was highest from Chlorantriniliprole (1: 3.92) followed by Emamectine benzoate+ Acetamiprid (1: 3.69), Spinosade (1:3.60), Flubendiamide (1: 3.59), Emamectine benzoate (1: 3.38), and Trizophos (1: 2.25) during 2011-12. In the succeeding year, almost similar trend was obtained. Usually all the treatments were lucrative as compared to control. This may be due to treatments effectiveness reduce the grain infestation and sustain the yield. The present findings corroborate by Chaudhary et al. (2008), they reported that chemical based IPM was more effective for pod fly management than other approaches.

Chlorantriniliprole showed superiority in respect of pod damage and yield may be due to their larvaecidal with highly translaminar action, instantly cessation of feeding and long lasting potency than other molecules. Ganiger, (2000) reported that the minimum seed damage with Chlorphyriphos+ Cypermethrin, followed by Triazophos+ Deltamethrin and Profenophos+ Cypermethrin combination. Bhushan and Nath (2005) reported that minimum grain damage by pod fly with intercrop with application of NSKE followed by Eendosulfan and NSKE. Flubendiamide has not translaminar action but it has phytotonic impacts which enhance the seed yield. The higher wax, total phenols, less reducing, non-reducing sugars and total amino acids are effectual compounds to reduce the pod and grain damage by pod fly (Pandey et al., 2011, Choudhary et al., 2013).

CONCLUSION

It may be concluded that the pod fly biology, entire immature stages were surpassing within the pod, therefore difficult to their management. The host plant resistance and biological control are effective to some extent whereas chemicals; which have ovicidal and tranlaminar action are more effectual against pod fly. The Chlorantriniliprole @ 40 g ai. ha^{-1} was found effectual for extenuate pod and grain damage and conserve yield with lucrative cultivation. The safer chemical control methods reduce the pod damage, grain damage and higher yield with high benefit: cost ratio, so therefore chemical control popularizes as an effective, practical alternative and makes lucrative cultivation of pigeon pea.

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Table 1. Pod damage and grain damage by pod fly in pigeon pea against different Eco-friendly treatment

SN.	Treatment	2011-12			2012-13		
		Mean pod damage (%)	Mean seed damage (%)	Average grain yield (kg ha^{-1})	Mean pod damage (%)	Mean seed damage (%)	Average grain yield (kg ha^{-1})
1	Trizophos 500 g ai. ha^{-1}	17.0 (4.18)	13.7 (3.76)	806.33	16.0 (4.06)	14.0 (3.81)	820.30
2	Emamectine benzoate 11 g ai. ha^{-1}	13.3 (3.72)	8.0 (2.91)	1035.67	12.3 (3.58)	8.0 (2.91)	1049.67
3	Emamectine benzoate 11 g ai. + Acetamiprid 30 g ai. ha^{-1}	11.0 (3.39)	6.7 (2.67)	1094.67	10.3 (3.29)	6.3 (2.61)	1107.67
4	Flubendiamide 47 g ai. ha^{-1}	14.3 (3.85)	11.3 (3.44)	988	14.0 (3.81)	11.3 (3.44)	1003.00
5	Chlorantriniliprole 40 g ai. ha^{-1}	9.7 (3.19)	5.3 (2.41)	1202	9.3 (3.13)	5.0 (2.34)	1209.00
6	Spinosade 75 g ai. ha^{-1}	12.3 (3.58)	7.7 (2.86)	1058.67	12.0 (3.53)	7.3 (2.79)	1073.67
7	Control	24.7 (5.02)	19.0 (4.41)	713	23.7 (4.91)	18.2 (4.31)	736.00
	SEm ±	0.05	0.09	7.17	0.08	0.11	20.16
	CD (P=0.05)	0.14	0.28	22.10	0.24	0.32	62.11

Figures in parentheses are square root transformed values

Table 2. Benefit cost ratio of pigeon pea pod fly management

SN.	Treatment	2011-12 Cost of treatment (Rs ha^{-1})	2011-12 Average grain yield (kg ha^{-1})	2011-12 Total Return (Rs ha^{-1})	2011-12 Realization over control (Rs ha^{-1})	2011-12 B : C ratio	2012-13 Cost of treatment (Rs ha^{-1})	2012-13 Average grain yield (kg ha^{-1})	2012-13 Total Return (Rs ha^{-1})	2012-13 Realization over control (Rs ha^{-1})	2012-13 B : C ratio
1	Trizophos 500 g ai. ha^{-1}	1600	806.33	31042.55	3592.05	1: 2.25	1600	820.30	35272.90	3624.90	1: 2.27
2	Emamectine benzoate 11 g ai. ha^{-1}	3680	1035.67	39874.45	12423.95	1: 3.38	3680	1049.67	45137.10	13489.10	1: 3.67
3	Emamectine benzoate 11 g ai. + Acetamiprid 30 g ai. ha^{-1}	3980	1094.67	42145.95	14695.45	1: 3.69	3980	1107.67	47631.10	15983.10	1: 4.02
4	Flubendiamide 47 g ai. ha^{-1}	2952	988.00	38038.00	10587.50	1: 3.59	2952	1003.00	43129.00	11481.00	1: 3.89
5	Chlorantriniliprole 40 g ai. ha^{-1}	4800	1202.00	46277.00	18826.50	1: 3.92	4800	1209.00	51987.00	20339.00	1: 4.24
6	Spinosade 75 g ai. ha^{-1}	3702	1058.67	40759.95	13309.45	1: 3.60	3702	1073.67	46169.10	14521.10	1: 3.92
7	Control	-	713.00	27450.50	0	-	-	736.00	31648.00	0	-

The pigeon pea market support price was Rs. 3850 t^{-1}2011-12
The pigeon pea market support price was Rs. 4300 t^{-1} 2012-13