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Bio-efficacy of Botanicals and Synthetic Pesticides against Pod Boring Weevil (*Apion clavipes*) and Pod fly (*Melanagromyza obtusa*) in Pigeon pea

Sandip Patra* • D. M. Firake • N.S. Azad Thakur

Division of Crop Protection, ICAR Research Complex for North Eastern Hill Region, Umiam-793103, Meghalaya

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ABSTRACT

A field experiment was conducted at Entomology Farm, ICAR Research Complex for North Eastern Hill Region, Umiam, Meghalaya to evaluate some botanicals and new generation pesticides against pod borer complex in pigeon pea. Pigeon pea variety 'Bahar' was sown in 4m X 3m plot size at 60cm (R-R) X 30cm (P-P) spacing with three replications. Infestation of *A. clavipes* and *M. obtusa* was significantly reduced in plots treated with botanicals and chemical pesticides compared to control. Infestation of *A. clavipes* and *M. obtusa* was significantly reduced in fipronil 5SC treated plots compared to other treatments. Among botanicals, karanjin 2EC was found to be the most effective treatment against *A. clavipes*; while pod fly damage was found minimum in neem oil treated plots. Fipronil 5SC was found to be the best insecticides with lowest grain damage and higher benefit cost ratio. Among botanicals; maximum benefit cost ratio was recorded in neem oil treatment.

1. Introduction

Pigeon pea (*Cajanus cajan* (L.) Millsp.) is one of the most important pulse crops in the South Asia. As a multiple purpose, it provides many benefits to resources-poor families: protein-rich grain, fuel, fodder, fencing material, improved soil fertility and control of soil erosion (Siambi *et al.*, 1992). India is the world's largest producer and consumer of pulses including pigeon pea. About 90% of the global pigeon pea area (4.9 M.ha.) is in India contributing to 93% of the global production (Anonymous, 2011). The crop is attacked by several insect pests from seedling to maturity stage, sometime causing massive damage to the crop. Among these, pod borer complex are more destructive and cause considerable yield losses. Pigeon pea pod fly *Melanagromyza obtusa* Malloch (Diptera: Agromyzidae) is a noxious pest of pigeon pea throughout the country. Crop losses due to pod fly has been estimated from 10-95% in different parts of India (Gangrade, 1963; Bindra and Jakhmola, 1967; Srivastava, *et al*., 1971 and Kooner, *et al*., 1972, Adgokar *et al.,* 1993). Pod boring weevil, *Apion clavipes* Gerst. (Coleoptera: Curculionidae) is another serious pest of pigeon pea in north eastern hilly region of India (Sachan and Gangwar, 1984). Pod boring weevil is abundantly found in North eastern states and it was also recorded from West Bengal and Bihar (Akhauri *et al*., 1996 and Bandyopadhyay *et al*., 2009). The grub enters into the seeds and start feeding on developing grain, causing 77.8% damage to pod and 43.1% damage to grain (Azad Thakur *et al.*, 1995). Adults also cause damage by feeding on leaves, young shoot and flower buds leading to poor pod set (Azad Thakur *et al.*, 2009). Though many insecticides have been evaluated and proved effective against these pests but frequent use of broad spectrum insecticides are causing much harm to the non-target organisms besides increasing residue problem. Therefore, an experiment was conducted with some botanicals and new generation insecticides to evaluate the efficacy against pod borer complex in pigeon pea.

*Corresponding author: sandippatra47@gmail.com

2. Materials and Methods

A field trial was conducted at Entomology Farm, ICAR Research Complex for North Eastern Hill Region, Umiam, Meghalaya during 2011 to evaluate the efficacy of botanical and synthetic insecticides against pod boring weevil and pod fly in pigeon pea. Pigeon pea variety 'Bahar' was sown in 4m X 3m plot size at 60cm(R-R) X 30cm (P-P) spacing during *kharif* season. Experiment was laid out in Randomized Block Design with three replications. Neem oil 0.03EC (0.3%), Karanjin (derisom 2EC) @ 0.004% (derived from *Pongamia pinnata*/ *P. glabra*), annonin (anosom 1EC) @0.002% (derived from *Annona squamosa*), thiamethoxam 25 WG @0.0082%, fipronil 5SC @0.0075%, spinosad 45SC @0.0338%, indoxacarb 14.5 SC @0.0145%, cypermethrin 10EC @ 0.01% were applied at pod formation stage and repeated after fifteen days of first spraying using spray fluid @500litre/ha. Observations on pod boring weevil damage were recorded at 14 days after each spraying by randomly picking hundred pods from each replication. Each pod was opened and infested pods were counted on the basis of presence of grub of weevil within the pods. In case of pod fly, observation was recorded only 30 days of first spraying from hundred pods collected randomly from each replication on the basis of presence of maggots inside the pods. Grain damage due to both pests was recorded from the hundred pods collected randomly at maturity of the crop. Yield data was kept separately during threshing for each treatment. Benefit-cost ratio was calculated on the basis of present market price. Data was subjected to analysis of variance after necessary transformation.

3. Results and Discussion

Weevil infestation in different treatments is shown in Table 1. Infestation of *A. clavipes* and *M. obtusa* was significantly reduced in plots treated with botanicals and chemical pesticides compared to control. Mean pod damage due to *A. clavipes* was significantly reduced in fipronil 5SC treated plots (10.47% damage) compared to control (31.25% damage) followed by cypermethrin 10EC (11.38% damage) and thiamethoxam 25WG (12.35% damage). Among botanicals, karanjin 2EC (Derisom) was found to be the most effective treatment against *A. clavipes* (15% damage). Pod damage caused by pod fly is depicted in Table 1. Minimum pod damage was found in fipronil 5SC treated plots (17.99% damage) at par with thiamethoxam 25WG (19.55% damage) and spinosad 45SC (22.69% damage). Among botanicals, pod fly infestation was considerably reduced in neem oil treated plots (28.41% damage).

Fipronil 5SC was found to be the best insecticides with lowest grain damage (14.06%) at par with thiamethoxam 25WG (15.96%) and spinosad 45SC (18.07%) (Table 1). Next best treatment was cypermethrin 10EC (20.71%) which was at par with indoxacarb 14.5SC (22.14%). All botanicals *viz*. anonin 1EC, neem oil 0.03 EC and karanjin 2EC treated plots recorded lesser grain damage compared to control. Economics of different treatments is shown in table 2. Highest yield was found in fipronil 5SC treated plots (650kg/ha) followed by thiamethoxam 25 WG, spinosad 45SC, cypermethrin 10EC, annonin 1EC, indoxacarb 14.5SC, neem oil 0.03EC and karanjin 2EC. Higher benefit-cost ratio was found in thiamethoxam 25WG (7.07) followed by cypermethrin 10EC (7.05) and fipronil 5SC (6.68) treated plots. Among the botanicals, neem oil 0.03EC was with high benefit cost ratio as compared to other botanicals. In the present study, all the insecticides were found effective against pod boring weevil and pod fly damage. Broad spectrum activity of fipronil is known against many agriculturally important pests (Walid *et al*., 1997; Grosman and Uptan, 2006; Mahal *et al*., 2008; Juang, 2009; Reddy and Sreehari, 2009; Patil *et al*., 2009 and Kavallieratos *et al*., 2010). Neo-nicotinoid insecticides such as imidacloprid and thimethoxam has been recommended for the management of pod fly (Sharma *et al*. 2010; Biradar and Navi, 2006). Cypermethrin was reported to be effective against pod borers of pigeon pea (Baruah and Ramesh Chauhan, 2002 and Sontakke and Mishra, 1991). Botanical pesticides were not as effective as other synthetic insecticides however efficacy were found to be significantly superior over untreated control. The present findings are falling in the line of Baviskar *et al.* (2002) who evaluated some plant extracts including neem and karanjin in comparison to chemical insecticide against pod borers of pigeon pea cv. C-11 and reported that the plant-based products were inferior to chemical insecticide, although these treatments performed better than the untreated control. This was also supported by the findings of Akhauri and Yadav (1999). Efficacy of karanjin, *Pongamia pinnata* (Verma *et al*., 2011; Vishal *et al.*, 2006) and *Annona squamosa* (Chitra *et al.,* 1993 and Sonkamble *et al.,* 2000) against different insect pests have also been reported earlier. Present study concludes that, fipronil is an effective pesticide against pod borer complex of pigeon pea and among botanicals neem oil can be used for the effective management for borers in pigeon pea

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Table 1. Bio-efficacy of botanicals and synthetic insecticides against pod boring weevil and pod fly in pigeon pea

Treatments	Concentration (%)	Pod damage (%) by pod boring weevil			Pod damage (%) by pod fly	Overall grain damage (%)	Protection of grain damage over control (%)
		First Picking	Second Picking	Mean			
Neem oil 0.03EC	0.3	20.67 (27.04)	22.83 (28.54)	21.75	28.41 (32.21)	30.05 (33.24)	45.59
Karnjin 2EC	0.004	19.00 (25.84)	11.00 (19.37)	15.00	32.26 (34.61)	31.19 (33.95)	43.52
Annonin 1EC	0.002	18.50 (25.48)	21.83 (27.85)	20.17	29.72 (33.04)	28.46 (32.24)	48.47
Thiamethoxam 25 WG	0.0082	11.00 (19.37)	13.70 (21.72)	12.35	19.55 (26.24)	15.96 (23.55)	71.10
Fipronil 5SC	0.0075	11.28 (19.62)	9.66 (18.11)	10.47	17.99 (25.10)	14.06 (22.02)	74.54
Spinosad 45SC	0.0338	14.17 (22.11)	17.83 (24.98)	16.00	22.69 (28.45)	18.07 (25.16)	67.28
Indoxacarb14.5SC	0.0145	16.00 (23.58)	12.50 (20.70)	14.25	25.80 (30.53)	22.14 (28.07)	59.91
Cypermethrin 10EC	0.01	10.67 (19.07)	12.10 (20.36)	11.38	25.87 (30.57)	20.71 (27.07)	62.50
Control	water	27.83 (31.84)	34.67 (36.07)	31.25	44.94 (42.10)	55.23 (48.00)	-
SEm	-	1.48	1.36	-	1.91	1.85	-
CD (P=0.05%)	**-**	**3.14**	**2.88**	**-**	**4.07**	**3.93**	**-**

Data parentheses are angular transformed values

Table 2. Economics of different insecticides against pod boring weevil and pod fly in pigeon pea

Treatments	Cost of insecticides (Rs/L or Kg)	Total quantity of insecticides required (L or Kg/ha)	Cost for insecticides (Rs/ha)	Labour cost for spraying (Rs/ha)	Total cost for 2 spraying (Rs/ha)	Yield (kg/ha)	Net gain over control (kg/ha)	Profit over control (Rs/ha)	Benefit-cost ratio (B:C)
Neem oil 0.03%EC	252	1.5	378.00	600.00	1956	411	107	6420	3.28
Karanjin 2%EC	1200	1.0	1200.00	600.00	3600	380	076	4560	1.27
Annonin 1%EC	1500	1.0	1500.00	600.00	4200	429	125	7500	1.78
Thiamethoxam 25 WG	5000	0.17	850.00	600.00	2900	646	342	20520	7.07
Fipronil 5SC	1270	0.75	952.50	600.00	3105	650	346	20760	6.68
Spinosad 45SC	12760	0.375	4785.00	600.00	10770	643	339	20340	1.89
Indoxacarb14.5SC	4300	0.5	2150.00	600.00	5500	429	125	7500	1.36
Cypermethrin10EC	500	0.5	250.00	600.00	1700	504	200	12000	7.05
Control	-	-	-	-	-	304	-	-	-

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