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Field efficacy and economics of some insecticides against spotted pod borer (*Maruca testulalis* Geyer) of black gram

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ABSTRACT

A *field experiment was conducted during 2008 and 2009 to evaluate the efficacy of some insecticides against spotted pod borer (Maruca testulalis Geyer) of black gram. Insecticides evaluated for the purpose were azadirachtin1500 ppm @ 1.5 l ha^{-1}, endosulfan35EC @ 300 g a.i. ha^{-1}, triazophos40EC @ 250 g a.i. ha^{-1}, thiamethoxam25WG @ 40 g a.i. ha^{-1}, lambda cyhalothrin5EC @ 40 g a.i. ha^{-1}, indoxacarb14.5SC @ 75 g a.i. ha^{-1}, and imidacloprid17.8SL @ 30 g a.i. ha^{-1}. Two round of spray of insecticides were given at fifteen days interval. The most effective insecticide evaluated against spotted pod borers was indoxacarb. Highest incremental cost benefit ratio was observed with triazophos40EC @ 250 g a.i ha^{-1}, being 21.53.*

Keywords: Efficacy, indoxacarb and *Maruca testulalis*

Black gram (*Vigna mungo* L.) is popularly known as urd bean or *mashkalai* or black bean. It is an important pulse crop which is native to India and having high nutritive value (Singh, 2004). Throughout the country, rain fed areas are occupied by black gram and its cultivation is spreading over 3.10 million ha area with a production of 1.40 million tonnes and yield 451 kg ha^{-1} in 2010 (Anon., 2011). Among the several factors responsible for such poor yield, undoubtedly, insect infestation is considered as one of the most important factor. On an average, 2.5 to 3.0 million tonnes of pulses are lost annually due to pest problems (Rabindra *et al.,* 2004). In India, avoidable yield loss to the tune of 7-35% due to insect-pest infestation in black gram and green gram has been recorded. The annual yield loss due to insect pests has been estimated to 30 per cent in urdbean and mung bean (Hamad and Dubey, 1983). Among insect pests, spotted pod borer, *Maruca testulalis* (Geyer) is a serious pest of grain legumes (Taylor 1967 and Raheja, 1974). *M. testulalis* is a major pest of black gram causing serious damage (Mia, 1998). Keeping this view in mind, studies were undertaken to test the field efficacy of some insecticides against *M. testulalis* Geyer on black gram (*Vigna mungo* L.).

MATERIALS AND METHODS

The field experiment was conducted at the Research Farm of the Institute of Agriculture (Palli Siksha Bhavana), Visva-Bharati, Birbhum, during summer of 2008 and at Raipur, Bankura, West Bengal during *kharif* season of 2009. The soil of the experimental site was sandy loam and clay loam respectively in texture with high per cent of sand and low per cent of clay and dry sub-humid and subtropical climate. The weather conditions during the period of investigation is characterized by the temperature range of maximum 26.3- 34.49°C and minimum 12.67-22.67°C and maximum RH 72.6-94% and minimum 22.29-51.57%, and total rainfall 8.70 mm during crop growth period in Birbhum district and the temperature range of maximum 31.80- 32.40°C and minimum 20.00-25.10°C and maximum RH 89- 93% and minimum 53-74%, and total rainfall 18.20 mm during crop growth period in Raipur, Bankura. Attempts were made to study field efficacy of some insecticides against *M. testulalis* on black gram (CV B-76) during summer and *kharif* season. The experiment was laid out in RBD with eight treatments [Azadirachtin1500ppm @ 1.5 l ha^{-1}, Endosulfan35%EC @ 300g *a.i.* ha^{-1}, Triazophos40%EC @ 250g *a.i.* ha^{-1}**,** Thiamethoxam25%WG @40 g *a.i.*ha^{-1}, Lambda cyhalothrin5%EC@ 40 g *a.i.* ha^{-1}**,** Indoxacarb14.5%SC @ 75 g *a.i.* ha^{-1}, Imidacloprid17.8%SL@ 30g *a.i.* ha^{-1}] including an untreated control and replicated three times. The crop was sown in 30×5 cm spacing in a plot size of 15m^2. The spraying was started at the initial incidence of pod borer. All the sprayings were done by using knapsack sprayer at an interval of 15 days. Barring border rows ten randomly selected plants were marked to count the number of pod borer larvae before spray and at 3, 7 and 10 days after each spray. The seed yield was recorded from net plot area and converted into q/ha. Cost benefit ratio for each treatment was calculated. Agronomic practices for growing of the crop were followed as per recommendations of the region.

RESULTS AND DISCUSSION

The results of the experiment carried out to evaluate the efficacy and cost benefit ratio of some newer insecticides against spotted pod borer (*Maruca testulalis* Geyer) on black gram are presented in the Table 1, 2 and 3. The number of borer was noted from 1.50 to 1.67 per plant before application of insecticides during summer 2008 in Birbhum. However, three days

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thiamethoxam (77.70%) and lambda-cyhalothrin (73.30%). After seven days, all the treatments were observed to check the pod borer incidence more efficiently and the population increased gradually in all the treatments. After three days of second spray, 82.40 per cent mortality was recorded in endosulfan followed by lambda cyhalothrin (81.00%) treated plots. The efficacy of azadirachtin (49.80%) was comparatively lower. After final spray indoxacarb (87.70%) proved to be most effective followed by endosulfan (79.37%), lambda-cyhalothrin (77.44%) and triazophos (77.19%) against legume pod borer. Azadirachtin was found to be least effective (60.59%) in controlling the spotted pod borer as shown in Table 1.

Table 1: Effect of insecticides on *M. testulalis* population of black gram during 2008 at Birbhum

Treatments	Dose (l/ ha^{-1} or g a.i ha^{-1})	Pre count (larvae plant^{-1})	PRI-1			Pre count (larvae plant^{-1}) before 2nd spray	PRI-2			Over all mean reduction (%)
			3 DAS*	7 DAS*	10 DAS*		3 DAS*	7 DAS*	10 DAS*	
Azadirachtin 1500 ppm	1.5 l/ha	1.67	51.9 (46.09)	78.0 (62.03)	61.8 (51.83)	1.20	49.80 (44.86)	63.90 (53.10)	58.10 (49.68)	60.59
Endosulfan 35 EC	300	1.70	66.5 (54.62)	74.3 (59.56)	88.2 (69.92)	1.27	84.20 (66.57)	86.80 (68.66)	76.30 (60.86)	79.37
Triazophos 40 EC	250	1.63	73.10 (58.79)	73.30 (58.88)	81.80 (64.72)	1.33	79.80 (63.26)	87.70 (69.47)	67.50 (55.22)	77.19
Thiamethoxam 25 WG	40	1.50	77.70 (61.83)	71.20 (57.53)	71.20 (57.53)	1.30	71.70 (57.84)	74.10 (59.38)	71.70 (57.84)	72.91
Lambda-cyhalothrin 5 EC	40	1.63	73.30 (58.86)	79.60 (63.13)	79.60 (63.16)	1.23	81.00 (64.15)	83.80 (66.24)	67.50 (55.26)	77.44
Indoxacarb 14.5 SC	75	1.53	82.70 (65.41)	93.40 (75.16)	89.30 (70.86)	1.37	78.00 (62.04)	95.10 (77.15)	87.70 (69.49)	87.70
Imidacloprid 17.8 SL	30	1.57	70.10 (56.88)	76.50 (61.02)	74.40 (59.63)	1.30	76.60 (61.09)	79.70 (63.19)	74.20 (59.50)	75.27
Untreated	Water	1.57	+6.40	+12.80	+23.50	2.17	16.90	20.10	30.80	
SEm (±)			**0.84**	**1.07**	**1.29**		**0.72**	**2.08**	**0.74**	
LSD (0.05)			**2.82**	**3.59**	**4.30**		**2.41**	**6.96**	**2.48**	

*Note: PRI-1 and PRI-2: Percentage reduction/ increase (t) after 1st and 2nd spray respectively over pretreatment count DAS= Days after spraying, * Significant at 5% level*

The number of pod borer during *kharif* season 2009 in Bankura was varied from 1.67 to 1.80 per plant before application of insecticides. Indoxacarb, triazophos and thiamethoxam showed better performance against spotted pod borer after three days of first spray. After seven days, indoxacarb treated plots recorded highest per cent reduction of pod borer (96.30%) followed by lambda-cyhalothrin (83.90%) and endosulfan (81.50%). After seven days of second spray, all the treatments were observed to check the spotted pod borer incidence more efficiently. After ten days, indoxacarb (87.10%) recorded highest per cent reduction of pod borer followed by endosulfan (77.90%). The overall mean per cent reduction was highest in indoxacarb (88.60%) treated plot followed by endosulfan (82.86%) and lambda-cyhalothrin (81.06%). The order of efficacy on the per cent reduction of borer over control plot was: indoxacarb> endosulfan> lambda-cyhalothrin> triazophos> Imidacloprid> thiamethoxam. Azadirachtin was found to be least effective (63.27%) in controlling the spotted pod borer as depicted in Table 2.

Table 2: Effect of insecticides on *M. testulalis* population of black gram during 2009 at Bankura

Treatments	Dose (l/ ha^{-1} or g a.i ha^{-1})	Pre count (larvae plant^{-1})	PRI-1			Pre count (larvae plant^{-1}) before 2nd spray	PRI-2			Over all mean reduction (%)
			3 DAS*	7 DAS*	10 DAS*		3 DAS*	7 DAS*	10 DAS*	
Azadirachtin 1500 ppm	1.5 l/ha	1.67	52.00 (46.12)	77.90 (61.99)	62.00 (51.94)	1.37	56.00 (48.47)	68.30 (55.74)	63.40 (52.75)	63.27
Endosulfan 35 EC	300	1.80	76.00 (60.65)	81.50 (64.56)	88.90 (70.51)	1.37	85.30 (67.45)	87.50 (69.31)	77.90 (61.99)	82.86
Triazophos 40 EC	250	1.77	75.50 (60.33)	75.40 (60.25)	83.10 (65.74)	1.40	81.00 (64.12)	88.10 (69.82)	69.00 (56.20)	78.68
Thiamethoxam 25 WG	40	1.77	81.20 (64.27)	75.40 (60.25)	75.40 (60.25)	1.43	74.00 (59.32)	76.40 (60.90)	74.00 (59.32)	76.03
Lambda-cyhalothrin 5 EC	40	1.67	86.00 (68.05)	83.90 (66.38)	80.00 (63.45)	1.37	82.90 (65.54)	83.00 (65.66)	70.50 (57.09)	81.06
Indoxacarb 14.5 SC	75	1.83	85.40 (67.52)	96.30 (78.90)	90.80 (72.38)	1.33	77.30 (61.55)	94.70 (76.64)	87.10 (68.95)	88.60
Imidacloprid 17.8 SL	30	1.77	73.50 (59.04)	79.20 (62.86)	77.30 (61.58)	1.40	78.60 (62.42)	81.00 (64.12)	76.20 (68.95)	77.63
Untreated	Water	1.80	+9.40	+20.50	+24.40	2.47	12.10	35.10	40.40	
SEm (±)			**0.80**	**1.02**	**0.84**		**0.73**	**1.85**	**0.21**	
LSD (0.05)			**2.68**	**3.42**	**2.80**		**2.45**	**6.18**	**0.69**	

*Note: PRI-1 and PRI-2: Percentage reduction/ increase (t) after 1st and 2nd spray respectively over pretreatment count DAS= Days after spraying, * Significant at 5% level*

Effect of endosulfan against the pod borers, *M. testulalis* Geyer was similar with the observation of Singh *et al.,* 2009. Lambda cyhalothrin 0.05% on Indian bean (Viroja, 2003) and indoxacarb 0.0145% on blackgram (Srihari and Patnaik, 2006) were also reported effective against *Maruca*. Triazophos and endosulfan were also effective against this pest reported by Sundara Babu and Rajasekaran, 1984. Dina and Medaiyedu, 1976 and Jackai, 1983 reported that endosulfan gave effective control of the pod borer on cowpea. Our results further confirm the previous reports.

Highest black gram seed yield was recorded in triazophos treated plot (12.52q/ha) followed by lambda cyhalothrin (11.70 q/ha) and indoxacarb (11.00 q/ha)**.** Highest cost benefit ratio was observed in triazophos 1:21.53 followed by lambda-cyhalothrin 1:18.55 and indoxacarb 1:11.53. The lowest cost benefit ratio was found in azadirachtin 1:7.41as as shown in table 3. Chaudhari, 1988 also reported that triazophos and endosulfan gave maximum benefit in controlling pod borers.

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Table 3: Economics of insecticides used against spotted pod borer of black gram

Treatments	Dose (l/ ha^{-1} or g a.i ha^{-1})	Seed yield (q ha^{-1})			Increased yield over control (q ha^{-1})	Value of increased yield (Rs. ha^{-1})	Cost of treatments (Rs. ha^{-1})			Net return (Rsha^{-1})	Cost benefit ratio
		2008	2009	Pooled			Insecticide (Double spray)	Labour	Total cost		
Azadirachtin 1500 ppm	1.5 l/ha	9.41	7.4	8.41	2.84	11360	450	900	1350	10010	1:7.41
Endosulfan 35 EC	300	10.04	8.00	9.02	3.45	13800	500	900	1400	12400	1:8.86
Triazophos 40 EC	250	13.80	11.23	12.52	6.95	27800	334	900	1234	26546	1:21.53
Thiamethoxam 25 WG	40	11.34	7.30	9.32	3.75	15000	350	900	1250	13750	1:11.00
Lambda-cyhalothrin 5 EC	40	13.00	10.40	11.70	6.13	24520	354	900	1254	23266	1:18.55
Indoxacarb 14.5 SC	75	12.30	9.70	11.00	5.43	21720	833	900	1733	19987	1:11.53
Imidacloprid 17.8 SL	30	10.79	8.04	9.42	3.85	15400	442	900	1342	14038	1:10.48
Untreated	-	6.80	4.34	5.57	-	-	-	-	-	-	-

Price of seed Rs. 4000.00 q $^{-1}$ Labour wages Rs. 100 day^{-1} man^{-1}.