



SHORT NOTE

Effect of IPM modules on natural enemies in bhendi ecosystem

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Bhendi, *Abelmoschus esculentus* (Linnaeus), one of the popular vegetables in India, is cultivated extensively all round the year for its immature fruits. It is rich in vitamins (A, B and C), calcium, potassium and other minerals (Saini, 1997). Bhendi plant is highly susceptible to various insect pests during the entire crop period. The presence of different life stages of pests attracts their natural enemies and which control pest species. Since bhendi fruits are consumed as raw, salad and also cooked with other ingredients, use of deadly insecticides to control the pests and harvested without waiting for the safety period when consumed, cause different health problems. Thereby in the present study, in order to reduce the use of excessive insecticides on bhendi, the modern concept of IPM has been taken into account and based on which four IPM modules were formulated and the effect of which against natural enemies were assessed.

The IPM modules were formulated and test verified at Pandit Jawaharlal Nehru College of Agriculture & Research Institute, Karaikal. The bhendi variety used was 'Arka Anamika' and the experiment was laid out in a simple Randomized Block Design (RBD) with five treatments replicated four times. The IPM modules comprising of different components are given in Table 1.

The natural enemy (coccinellids and spiders) populations were assessed by recording the number of individuals in each of the ten randomly selected plants per plot and expressed as numbers/plant. The population data were transformed to square root values.

Spiders

The present study indicated that there was no significant difference among different IPM modules against spider population in the I crop. It is evident from

Table 2 that the highest spider population was recorded in untreated check (0.36) and the least population in Insecticide module (M_3) (0.04). In the II crop significant differences were observed in the spider population *i.e.*, Low cost technology module (M_1) recorded higher spider population of 0.29 next to untreated check which recorded 0.39. The least population was recorded in insecticide module (0.08). The Bio-intensive module (M_2) and Insecticide module (M_3) were found to be on par with each other (Table 3).

Coccinellids

The coccinellids recorded in the bhendi ecosystem were *Menochilus sexmaculatus*, *Coccinella rependa* and *Micraspis* sp. In the I crop, there was gradual increase in the coccinellid population through out the crop period. Considering the mean population, the Insecticide module (M_3) recorded the least population (0.12). The highest coccinellid population was recorded in untreated check (1.55) followed by Low cost technology module (M_1) (0.88). The Bio-intensive module (M_2) and Existing recommendation module (M_4) recorded the mean population of 0.49 and 0.44 respectively (Table 4).

The population of coccinellids in the II crop is presented in Table 5. The similar trend as above was observed. Among the four different modules the highest mean population was recorded untreated check (0.76) followed by Low cost technology module (M_1) (0.53). The least population was observed in Insecticide module (M_3) (0.29) and the other two modules M_2 and M_4 recorded the population of 0.36 and 0.40 respectively (Table 5).

The natural enemy population though found to be less in different IPM modules when compared with untreated check, they were not eliminated completely

Table 1. Details of package in each IPM module for bhendi pests

Low Cost Technology Module (M ₁)	Biointensive Module (M ₂)	Insecticide Module (M ₃)	Existing Recommendation Module (M ₄)	Untreated Check
Soil incorporation of neem cake @ 250 Kg/ac	Seed treatment with imidacloprid (Tatamida 17.8 SL) @ 10 ml/ Kg of seeds	Seed treatment with imidacloprid (Tatamida 17.8 SL) @ 10 ml/ Kg of seeds	Spraying of dimethoate (Rogar 30 EC) @ 2 ml/l., combined with NSKE 50g/ l.	Unprotected crop
Intercropping with cowpea	Release of <i>Trichogramma chilonis</i> Ishii @ 6 cc/ac.	Spraying of acephate (Asataf 70 WP) @ 2 g/l.	Release of <i>Trichogramma chilonis</i> Ishii @ 6cc/ac.	
Provision of bird roaches and perches	Release of <i>Chrysoperla carnea</i> Stephens @ 2000 eggs/ac.	Spraying of profenofos (Celcron 50 EC) @ 2 ml/l.	Release of <i>Chrysoperla carnea</i> Stephens @ 2000 eggs/ac.	
Spraying of green pesticide (neem oil 1 per cent)	Setting up of pheromone traps (Bas-lure, Ervit-lure) @ 5/ ac. for <i>Earias</i> spp.		Collection and destruction of affected fruits	
Conservation of natural enemies (coccinellids and Spiders)	Spraying of <i>Bacillus thuringiensis</i> (Spicturin FC) 2 ml/l.		Setting up of pheromone traps (Bas-lure, Ervit-lure) @ 5/ ac. for <i>Earias</i> spp.	
Hand picking of larva			Spraying of <i>Bacillus thuringiensis</i> (Spicturin FC) 2 ml/l.	

Table 2. Efficacy of IPM modules on spider population - I Crop

Modules	Number of spiders (DAS)										Overall mean
	25	32	39	46	53	60	67	74	81	88	
Low Cost Technology Module (M ₁)	0.2	0.28	0.23	0.28	0.33	0.30	0.25	0.18	0.26		
Biointensive Module (M ₂)	0.15	0.13	0.20	0.18	0.28	1.18	0.18	0.15	0.31		
Insecticide module (M ₃)	0.00	0.03	0.03	0.00	0.13	0.05	0.05	0.03	0.04		
Existing Recommendation (M ₄)	0.18	0.23	0.13	0.08	0.23	0.10	0.13	0.13	0.15		
Untreated Check	0.30	0.40	0.33	0.33	0.43	0.43	0.35	0.30	0.36		
C. D. (p= 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS		

DAS- Days after sowing NS- Non significant

Table 3. Efficacy of IPM modules on spider population - II Crop

Modules	Number of spiders (DAS)										Overall mean
	26	33	36	40	47	54	61	68	75		
Low Cost Technology Module (M ₁)	0.20	0.33 (0.90) ^a	0.28 (0.87) ^{ab}	0.25 (0.86) ^{ab}	0.25 (0.87) ^{ab}	0.25 (0.86) ^a	0.48 (0.98) ^{ab}	0.28 (0.88) ^{ab}	0.35 (0.92) ^{ab}	0.29 (0.89) ^b	
Biointensive Module (M ₂)	0.15	0.25 (0.86) ^a	0.25 (0.87) ^{ab}	0.15 (0.80) ^{bc}	0.23 (0.85) ^{abc}	0.13 (0.79) ^b	0.28 (0.88) ^{bc}	0.15 (0.81) ^b	0.18 (0.82) ^{bc}	0.19 (0.83) ^c	
Insecticide Module (M ₃)	0.05	0.00 (0.71) ^b	0.03 (0.72) ^c	0.03 (0.72) ^d	0.10 (0.77) ^b	0.10 (0.77) ^b	0.13 (0.79) ^c	0.10 (0.77) ^b	0.18 (0.82) ^{bc}	0.08 (0.76) ^d	
Existing Recommendation (M ₄)	0.30	0.33 (0.91) ^a	0.13 (0.79) ^{bc}	0.05 (0.74) ^{cd}	0.15 (0.80) ^{bc}	0.13 (0.78) ^b	0.43 (0.96) ^b	0.15 (0.80) ^b	0.35 (0.92) ^a	0.22 (0.84) ^c	
Untreated Check	0.35	0.43 (0.96) ^a	0.40 (0.95) ^a	0.30 (0.89) ^a	0.30 (0.89) ^a	0.30 (0.89) ^a	0.63 (1.08) ^a	0.38 (0.93) ^a	0.40 (0.95) ^a	0.39 (0.94) ^a	
C. D. (p= 0.05)	NS	(0.12)**	(0.12)**	(0.07)**	(0.08)*	(0.08)*	(0.12)**	(0.11)*	(0.10)*	(0.04)**	

DAS - Days after sowing NS - Non significant * - Significant at 5% level ** - Significant at 1% level

Figures in parentheses are square root transformed values

In a column, means followed by a common letter(s) are not significantly different by DMRT (p=0.05)

Table 4. Efficacy of IPM modules on coccinellids population - I Crop

Modules	Number of coccinellids (DAS)							Overall mean
	32	39	46	53	60	67	74	
Low Cost Technology Module (M ₁)	0.10 (0.77) ^b	0.28 (0.88) ^b	0.28 (0.88) ^b	0.55 (1.02) ^a	0.95 (1.20) ^b	1.15 (1.28) ^b	2.83 (1.82) ^b	0.88 (1.12) ^b
Biointensive Module (M ₂)	0.05 (0.74) ^b	0.10 (0.77) ^b	0.18 (0.82) ^{bc}	0.25 (0.86) ^b	0.45 (0.97) ^{bc}	0.58 (1.03) ^c	1.80 (1.52) ^c	0.49 (0.96) ^{bc}
Insecticide Module (M ₃)	0.00 (0.71) ^b	0.00 (0.71) ^c	0.05 (0.74) ^c	0.08 (0.76) ^b	0.13 (0.79) ^c	0.20 (0.84) ^d	0.35 (0.92) ^d	0.12 (0.78) ^d
Existing Recommendation (M ₄)	0.03 (0.72) ^b	0.05 (0.74) ^c	0.13 (0.79) ^{bc}	0.20 (0.83) ^b	0.40 (0.94) ^c	0.55 (1.02) ^c	1.73 (1.49) ^c	0.44 (0.93) ^{cd}
Untreated Check	0.30 (0.89) ^a	0.63 (1.05) ^a	0.70 (1.09) ^a	0.80 (1.14) ^a	1.65 (1.45) ^a	2.20 (1.64) ^a	4.60 (2.25) ^a	1.55 (1.36) ^a
C. D. (p= 0.05)	(0.07)**	(0.12)**	(0.11)**	(0.14)**	(0.25)**	(0.16)**	(0.15)**	(0.16)**

DAS - Days after sowing ** - Significant at 1% level

Figures in parentheses are square root transformed values

In a column, means followed by a common letter(s) are not significantly different by DMRT (p=0.05)

Table 5. Efficacy of IPM modules on coccinellids population - II Crop

Modules	Number of coccinellids (DAS)										Overall mean
	33	36	40	47	54	61	68	75	Overall mean		
Low Cost Technology Module (M ₁)	0.08 (0.76) ^{ab}	0.18 (0.82) ^a	0.20 (0.83) ^b	0.28 (0.87) ^a	0.30 (0.86) ^{ab}	0.78 (1.13) ^{ab}	0.58	1.80	0.53 (0.97) ^b		
Biointensive Module (M ₂)	0.00 (0.71) ^b	0.08 (0.76) ^b	0.18 (0.78) ^b	0.13 (0.79) ^b	0.15 (0.80) ^{bc}	0.30 (0.89) ^b	0.50	1.60	0.36 (0.89) ^c		
Insecticide Module (M ₃)	0.00 (0.71) ^c	0.03 (0.72) ^b	0.05 (0.74) ^c	0.08 (0.76) ^b	0.10 (0.77) ^c	0.25 (0.86) ^b	0.45	1.43	0.29 (0.86) ^c		
Existing Recommendation (M ₄)	0.05 (0.74) ^b	0.03 (0.72) ^b	0.10 (0.77) ^b	0.13 (0.79) ^b	0.15 (0.80) ^{bc}	0.28 (0.88) ^b	0.35	2.13	0.40 (0.89) ^c		
Untreated Check	0.18 (0.82) ^a	0.23 (0.85) ^a	0.50 (0.99) ^a	0.38 (0.93) ^a	0.43 (0.96) ^a	1.28 (1.29) ^a	0.73	2.35	0.76 (1.08) ^a		
C. D. (p= 0.05)	(0.07) [*]	(0.06) ^{**}	(0.15) [*]	(0.12) [*]	(0.11) [*]	(0.28) [*]	NS	NS	(0.06) ^{**}		

DAS - Days after sowing NS - Non significant * - Significant at 5% level ** - Significant at 1% level

Figures in parentheses are square root transformed values

In a column, means followed by a common letter(s) are not significantly different by DMRT (p=0.05)

IPM modules on bhendi ecosystem

from the bhendi ecosystem. The highest population of natural enemies was recorded in untreated check followed by Low cost technology module (M_1) and the least population of natural enemy was recorded in Insecticide module (M_3). The decrease in the population of natural enemies in M_3 module might be due to the toxicity of insecticides used as components in this module. M_2 module was not more harmful to natural enemies though the seeds were treated with imidacloprid. The biosafety of imidacloprid used for seed treatment in Biointensive module (M_2) to some predators was already

reported by Katole and Patil (2000) who stated that imidacloprid at 10 g/ Kg of seed treatment allowed activities of maximum lady bird beetles.

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