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Efficacy of BIPM module against major insect pests of tomato

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Abstract

Field experiments was conducted during 2014-15, 2015-16 and 2016-17 to study the impact of Bio-intensive IPM on the incidence of major insect pests of tomato *viz*., Fruit borer, *Helicoverpa armigera*; Whitefly, *Bemisia tabaci* and Thrips, *Scirtothrips dorsalis*. The data revealed that no significance differences was observed in reducing the larval populations of *H. arimgera* in between Bio-intensive Integrated Pest Management or BIPM (2.23/plant) and chemical control (3.02/plant) plot during 2015-16, whereas the mean population of insect was only 2.32/plant at BIPM plot with a significant difference from that of chemical control plots (2.90/plant) during 2016-17. Highest number of *B. tabaci* was observed in untreated check i.e., 5.36, 8.11 and 4.99 per plant in comparison to BIPM (3.03, 2.67 and 2.60) and chemical control (2.58, 8.11 and 4.94) during 2014-15, 2015-16 and 2016-17, respectively. Similarly in case of *S. dorsalis* also the maximum number insects per plant was registered in untreated check (6.31, 7.21 and 12.16) as against the BIPM (3.23, 2.65 and 3.07) and chemical control plot(2.79, 1.92 and 4.78) during 2014-15, 2015-16 and 2016-17, respectively. In regards to the yield, highest yield of 291.8 q/ha and 242.83 q/ha was recorded in the BIPM module as against 287.0 q/ha and 234.70 q/ha in the chemical control plot. The minimum yield of 85.86, 201.5 and 196.0q/ha was registered in untreated control plot during 2014-15, 2015-16 and 2016-17, respectively. Yield result of the BIPM plot was satisfactory and it can be recommended to the farmers as a strong component of organic farming.

Keywords: Tomato, BIPM, *Helicoverpa armigera, Bemisia tabaci, Scirtothrips dorsalis, Trichogramma chilonis*

1. Introduction

Vegetables are the most essential component of the Indian diet and India is the world's second largest producer of vegetables with 11 per cent share next to China. Being a major vegetable in India, tomato is cultivated in an area of about 0.77 million hectare with an annual production of 18.28 million metric tonnes with a productivity of 16.1 metric tonnes per hectare [1]. In Assam, the crop is extensively cultivated in all the districts as a major cash crop in *rabi* season. The total area and annual production of the crop in Assam being 17.29 thousand hectares and 402.49 thousand tonnes, respectively [1]. The principal reason of low productivity of tomato is the heavy attack of insect pests. In India, as many as 16 pests of different groups have been observed feeding on tomato commencing from germination to harvesting stages, which not only reduce yield but also quality [2]. At present, farmers are mostly relying on chemical pesticides because of their quick knock down effect to manage the insect pests of tomato. But insecticides are not providing satisfactory control of the target pest due to the outbreak of secondary pests, development of insecticide resistance including resurgence which ultimately affect the whole ecosystem. Presence of residues of chemical insecticides *viz*., endosulfan, malathion and primiphosmithyl in market samples in various vegetables including tomato [3, 4] have been well documented. The increasing concern for environmental pollution has evoked a worldwide interest in the Bio intensive pest management, which can protect the crop in a ecofreindly manner [5, 6].

2. Materials and Methods

The experiment was conducted at Farmer's field, Uttar Garumora, Jorhat over an area of 0.5 ha for each treatment during 2014-15, 2015-16 and 2016-17 for three consecutive crop seasons to evaluate the efficacy of the BIPM module against insect pests of tomato. Altogether, there were three treatments. The BIPM module comprised of Seedling root dip treatment with Pseudomonas 2% solution, Installation of yellow sticky trap @ 50 no/ha, Spray of NSKE @ 5 % against sucking pests, Use of pheromone traps @ 15 /ha against *Helicoverpa armigera*, Six releases of *Trichogramma chilonis* @ 1,00,000 /ha from flower initiation stage at weekly intervals and Rouging of leaf curl disease affected plants. The module was evaluated in comparison with farmers' practice (chemical control) and untreated check in the farmers' field.

The treatment blocks of BIPM, Chemical control and untreated control plots were raised at 50 m isolation distance and each block was divided into 10 segments as replication. The twenty five days old tomato seedlings "var. Namdhari" was transplanted in the plot of 7.5 m^2 with 50cm X 30 cm. Six releases of *T. chilonis* were made at weekly interval starting from 45 days after transplanting. Trichocards each having 1000 parasitized eggs were cut in to 50 strips and were stapled uniformly to the undersides of the leaves in BIPM treatment. Observations on the incidence of *H. armigera* larvae were recorded on 10 randomly selected plants for each treatments block after each schedule spray. Apart from *H. Armigera,* thrips and whitefly were widely distributed and important one during the crop season. Sampling of sucking pests was done by counting the number of thrips and whitefly from 10 randomly selected plants considering 3 leaves (upper, middle and bottom) after each spray at various stages of plant growth i.e. 35, 50 and 65 DAT. Eight plucking were made at an interval of 5 days. The average fruit infestation on a number basis was also calculated from each treatment after each harvesting. Per cent fruit damage and weight of the marketable tomato fruits per plot were recorded at the time of harvesting. In chemical control plots, four rounds of dimethoate 30 EC @ 300 g a.i. per ha and lambda cyhalothrin 5EC @ 25g a.i.per ha was sprayed at 15 days interval, starting from 45 DAP. No pest management practice was followed in untreated plot. Alternatively four rounds of chemical sprays were made at 35, 45, 55 and 65 DAT in farmers practice plots

3. Results and Discussion

In the period during 2014-15, 2015-16 and 2016-17, tomato fruit borer, *Helicoverpa armigera*; Whitefly, *Bemisia tabaci* and Thrips, *Scirtothrips dorsalis* were observed as major insect pests in the untreated check. Chaudhuri *et al.* [7], Hath and Das [8], Reddy and Kumar [9] and Kharpuse [10] also reported the attack of aphid, *A. gossypii;* whitefly, *B. tabaci* and fruit borer, *H. armigera* on tomato.

In regards to the effect of the BIPM module on insect pests of tomato, the data revealed that no significance differences was observed in reducing the larval populations of *H. arimgera* in between the BIPM (2.23/plant) and chemical control (3.02/plant) plot during 2015-16, whereas the mean population of insect was only 2.32/plant at BIPM plot with a significant difference from that of chemical control plots (2.90/plant) during 2016-17 (Table 1). The mean number of insects in untreated control plot was 16.20, 6.30 and 5.20 during 2014, 2015-16 and 2016-17, respectively. Similarly, the average fruit infestation on number basis after imposing treatments was found to be 17.3, 13.5 and 9.87 per cent at BIPM plots as against 11.8, 16.12 and 12.47 per cent during 2014-15, 2015-16 and 2016-17, respectively at chemical control plot with significant differences in between the two treatments. The mean population whitefly (Table 2) was 2.29, 1.73 and 2.13 per plant at 65 DAT in BIPM plots as against 6.29, 10.77 and 6.67 in the untreated check during 2014-15, 2015-16 and 2016-17, respectively. Similarly, the mean population of thrips (Table 3) per plant was 2.62, 2.21 and 2.08 at BIPM where as 7.79, 7.21, 12.16 in chemical control plots after the 65 DAT of treatment. In case of yield (Table 4), highest yield of 291.8 q/ha and 242.83 q/ha was recorded in the BIPM module as against 287.0 q/ha and 234.70 q/ha in the chemical control plot. The minimum yield of 85.86, 201.5 and 196.0q/ha was registered in untreated control plot during 2014-15, 2015-16 and 2016-17, respectively. The present finding is in accordance with findings of Tiwari [11] and Kumawat [12] who observed that the yield of crops for both the IPM and chemical treatment plots were at par. In BIPM module different species of natural enemies were responsible for suppression of insect pests and same findings also reported by Krishna Moorthy *et al.,* [13], Rahaman *et al.* [14], Doddabasappa *et al.,* [15] and Khating *et al.* [16]

Table 1: Effect of BIPM module on incidence of against *Helicoverpa armigera* on tomato

Treatment	2014-15		2015-16		2016-17	
	Post treatments*	% damage fruit	Post treatments*	% damage fruit	Post treatments*	% damage fruit
BIPM	4.10c	17.3c (24.58)	2.23b	13.5c (31.46)	2.32c	9.87c (2.50)
Chemical Control	2.70b	11.8b (20.09)	3.02b	16.12b (31.97)	2.90b	12.47b (2.82)
Untreated control	16.20a	32.9a (35.00)	6.38a	25.37a (40.29)	5.2a	17.42a (3.34)
CD (=0.05)	1.04	0.22	1.46	0.27	0.60	0.13
CV %	14.40	5.21	35.30	5.74	16.10	3.52

*larval population/10 plants. Mean followed by same letter in a column do not differ significantly by DMRT (P=0.05).

Table 2: Effect of BIPM packageon incidence against *Bemisia tabaci* on tomato

Treatment	2014-15				2015-16				2016-17			
	35 DAT	50 DAT	65 DAT	Mean	35 DAT	50 DAT	65 DAT	Mean	35 DAT	50 DAT	65 DAT	Mean
BIPM	3.79 b	3.00 b	2.29 b	3.03	3.33c	2.85b	1.83b	2.67	3.08 b	2.58 b	2.13 b	2.60
Chemical Control	3.04 b	2.75 b	1.96 b	2.58	4.02b	3.61b	1.68b	3.37	2.87 b	2.42 b	1.84 b	2.38
Untreated control	4.46 a	5.33 a	6.29 a	5.36	5.88a	7.73a	10.77a	8.11	3.63 a	4.67 a	6.67 a	4.99
CD (=0.05)	0.70	0.44	0.41		0.53	1.18	0.82		0.39	0.67	0.39	
CV %	17.45	11.06	10.96		11.40	23.36	16.14		11.51	19.41	10.13	

Mean followed by same letter in a column do not differ significantly by DMRT (P=0.05).

Table 3: Effect of BIPM package on incidence against *Scertothrips dorsalis* on tomato

Treatment	2014-15				2015-16				2016-17			
	35 DAT	50 DAT	65 DAT	Mean	35 DAT	50 DAT	65 DAT	Mean	35 DAT	50 DAT	65 DAT	Mean
BIPM	3.87 b	3.21 b	2.62 b	3.23	3.21 ab	2.54 b	2.21 b	2.65	4.04c	3.08c	2.08c	3.07
Chemical Control	3.46 b	2.96 b	1.96 b	2.79	2.79 b	2.50 b	1.92 b	2.40	5.79b	4.67b	3.87b	4.78

Untreated control	5.00 [a]	6.13 [a]	7.79 [a]	6.31	3.54 [a]	4.13 [a]	7.21 [a]	4.96	9.42[a]	11.83[a]	12.16[a]	11.14
CD (=0.05)	0.93	0.87	0.66		0.55	0.43	0.74		0.79	0.88	0.57	
CV %	21.15	19.86	14.81		16.08	13.38	18.32		11.49	12.63	8.85	

Mean followed by same letter in a column do not differ significantly by DMRT (P=0.05).

Table 4: Effect of BIPM module on yield of tomato

Treatment	**2014-15**		**2015-16**		**2016-17**	
	Yield (q/ha)	**IOC**	**Yield (q/ha)**	**IOC**	**Yield (q/ha)**	**IOC**
BIPM	147.20[b]	61.34	291.8[b]	90.3	242.83[a]	46.82
Chemical Control	153.82[a]	67.96	287.0[b]	85.5	234.70[a]	38.69
Untreated control	85.86[c]		201.5[a]		196.01[b]	
CD (=0.05)	5.34		9.40		23.19	
CV %	4.41		3.37		9.61	

Increase over control (IOC). Mean followed by same letter in a column do not differ significantly by DMRT (P=0.05).

4. Conclusion

Synthetic chemical insecticides are very mush dangerous for human health and our living ecosystem. Therefore, use of the BIPM module may be an appropriate alternative of synthetic chemical dependant agriculture. Though the yield of BIPM plots slightly lower than the chemical control plot, then also we can recommend it to check the further deterioration of environment including soil, air and water.

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