Evaluation of certain microbial pesticides and cypermethrin against *Helicoverpa armigera* (Hubner) infesting tomato of Manipur valley

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Abstract— Field experiments were conducted to evaluate the effect of certain microbial insecticides against *Helicoverpa armigera* (Hubner) in tomato variety, Manikhumnu under the agro-climatic condition of Manipur valley. The results revealed that there were significant reduction of the pest in all insecticidal treatments. Among microbial insecticides tested, Spinosad 2.5 SC @1000ml ha^{-1} and Somstar-HA @500 ml ha^{-1} proved most effective in reducing the fruit damage due to *Helicoverpa armigera* (Hubner) and enhancing productivity in tomato. Both these microbial insecticides stood only next to cypermethrin @1000ml ha^{-1}, which gave the best result with respect to relative efficacy. Bouncer @1000 gm ha^{-1} and Soldier @1000gm ha^{-1} proved to be the least effective. Maximum fruit yield (25.03 t/ha) was harvested from the plots treated with Spinosad but, did not differ significantly with that of Somstar-HA (24.83 t/ha) treated plots. The minimum mean fruit yield (20.99 t/ha) was harvested from plots treated with Soldier as against 19.91 t/ha in untreated control. The mean extent of avoidable yield loss was worked out to be 22.59 per cent in the untreated control plots, which reduced to 2.68 to 18.39 per cent in the plots of microbial insecticidal treatments other than cypermethrin in which the avoidable loss has been taken as zero per cent.

Index Terms— Avoidable yield loss , fruit yield , *Helicoverpa armigera* , Manikhumnu, Manipur valley , microbial pesticides, tomato.

1 INTRODUCTION

Tomato (*Lycopersicon esculentum*) assumes its special significance among vegetables in Manipur. Among the various insect pests responsible for lowering the yield of tomato crop, the fruit borer, *Helicoverpa armigera* (Hubner), is highly destructive pest causing serious damage [10],[12], [5]. This pest is found to be the limiting factor in the production of tomato fruits. The monetary loss due to this pest in the country has been estimated over Rupees one thousand crores per year [3]

Considering the hazardous nature of pesticides it is imperative to find out the alternative strategies for the management of this pest. Keeping this in view the present study was undertaken to evaluate the effect of certain microbial pesticides against *H. armigera* on tomato under the agro-climatic condition of Manipur valley.

2 METHODOLOGY

The field experiments were conducted at Imphal Manipur using a tomato variety Manikhumnu. There were altogether thirteen treatments including one insecticidal check and one untreated control, laid out in Randomized Block Design, each replicated thrice. Each treatment was applied as foliar spray at desired dose twice at 10 days interval in evening hours, starting from the fruit initiation stage. Observations on fruit infestation were recorded one day ahead of first spray and seven and fifteen days after treatment from 10 randomly selected plants of each plot. For per cent fruit damage at each picking borer attacked and borer free fruits of individual plots were sorted out by recording their number and weights. The per cent fruit infestation was computed on the basis of the cumulative data of all pickings. The total weight of healthy and infested fruits for all pickings was pooled and converted to tonnes per hectare. The avoidable yield loss was computed in each treatment by using the formula [6].

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2.1 RESULTS AND DISCUSSIONS

Effect of microbial insecticides against *Helicoverpa armigera:*

The fruit infestation due to tomato fruit borer on number and weight basis data presented in Table-1 revealed that application of all the microbial insecticidal treatments resulted in significant reduction of the borer and demonstrated their superiority over untreated control significantly during both the experimental years.

The results based on two years pooled mean fruit damage by *Helicoverpa armigera* revealed that none of the microbial insecticides were significantly superior to cypermethrin 10 EC @1000 ml ha^{-1} with mean infestation of 3.30 per cent (on number basis) and 2.62 per cent (on weight basis). Among the different microbial insecticides Spinosad 2.5 SC @1000ml ha^{-1} and Somstar-HA @500 ml ha^{-1} stood next to cypermethrin with a record of 3.85 per cent (on number basis) and 3.33 per cent (on weight basis) and 5.78 per cent (on number basis) and 4.91 per cent (on weight basis) infestation, respectively . The other effective microbial insecticidal treatments were Lipel

@1000 gm ha^{-1} and Myco-jaal 10SC @1000 ml ha^{-1} recording mean fruit infestation on number basis of 6.52 and 9.50 per cent with corresponding mean infestation on weight basis of 6.14 and 6.16 per cent , respectively. Taking into consideration of both the experimental years of computed data, it was observed that Soldier applied @1000 gm ha^{-1} resulted in maximum fruit infestation of 19.48 per cent (on number basis) and 19.31 per cent (on weight basis) as against 22.31 per cent (on number basis) and 24.40 per cent (on weight basis) in untreated control (Table 1). The results generated here on the efficacy of cypermethrin against *H. armigera* is in accordance with the findings of [1]. As regards the efficacy of Spinosad against *H. armigera* obtained in the present study similar type of results were reported by [2], [9] who found that Spinosad 45SC was most effective in controlling the infestation of *H. armigera.* Suryawanshi *et al.*[11] also reported that the population of *H. armigera* was near susceptible to spinosad.

Effect of microbial insecticides on fruit yield of tomato var. Manikhumnu and estimation of *H. armigera* induced yield loss:

Reduction in fruit damage brought about by spraying of microbial insecticides resulted into higher productivity in tomato. The two years mean fruit yield ranged from 20.99 to 25.72 t ha^{-1} the lowest and highest being Soldier @1000 gm ha^{-1} and cypermethrin @1000 ml ha^{-1}. Application of Spinosad 2.5 SC @1000 ml ha^{-1} and Somstar-Ha @500 ml ha^{-1} proved equally efficacious and at par with cypermethrin by recording productivity of 25.03 t ha^{-1} and 24.83 t ha^{-1} followed by Lipel @1000 gm ha^{-1} with 24.54 t ha^{-1}. In the untreated control plots significantly lowest yield of 19.91 t ha^{-1} was harvested (Table-1)**.** Thus, the fruit yield obtained from all insecticides treated plots were significantly higher than that recorded in untreated control. The present findings received good support from the reports of other workers [7],[8],[4] and it could be inferred that microbial insecticides like Spinosad 2.5 SC @1000 ml ha^{-1}, Somstar-HA (HaNPV) @500 ml ha^{-1} might be fully utilized as eco-friendly tools in the strategies for management of *H. armigera* infesting tomato under agro-climatic conditions of Manipur valley.

Considering maximum realizable yield in cypermethrin treatment (25.72 t ha^{-1}) which also afforded maximum protection of the crop from the attack of *H. armigera* the avoidable yield loss was worked to be 22.59 per cent in the untreated control plots. Intervention with insecticidal treatments resulted in reduction of the mean avoidable loss, which varied from 2.68 to 18.39 per cent in different insecticidal treatments, the minimum in Spinosad treatment (2.68 per cent) (Table-1).

Table 1
Effect of certain microbial insecticides and cypermethrin on incidence of *Helicoverpa armigera* (Hubner) and productivity in tomato variety Manikhumnu

Treatment	Dose	Mean fruit infestation (%) (No. basis)	Mean fruit infestation (%) (weight basis)	Mean fruit yield (t/ha)	Mean (%) avoidable yield loss
Somstar-HA (HaNPV)	500 ml ha^{-1}	5.78 (13.91)	4.91 (12.80)	24.83	3.46
Granulosis virus	500 ml ha^{-1}	14.03 (21.99)	11.46 (19.79)	21.99	14.50
Myco-jaal 10SC (*Beauveria bassiana*)	1000 ml ha^{-1}	9.50 (17.95)	6.16 (14.37)	24.00	6.69
Racer (*Beauveria bassiana*)	1000 gm ha^{-1}	10.51 (18.92)	6.95 (15.26)	24.05	6.49
Jas Bessi (*Beauveria bassiana*)	1000 gm ha^{-1}	12.17 (20.42)	13.69 (21.72)	23.01	10.54
Lipel (*Bacillus thuringiensis* var. *kurstaki)*	1000 gm ha^{-1}	6.52 (14.79)	6.14 (14.35)	24.54	4.59
Jas Bt (*Bacillus thuringiensis* var. *kurstaki)*	1000 gm ha^{-1}	11.78 (20.07)	11.01 (19.38)	23.32	9.33
Mealikil (*Verticillium lecani*)	1000 gm ha^{-1}	12.58 (20.77)	13.98 (21.96)	22.16	13.84
Bouncer (*Steinernema carpocapsae)*	1000 gm ha^{-1}	16.41 (23.90)	18.33 (25.35)	21.28	17.26
Soldier (*Heterorhabditis indica*)	1000 gm ha^{-1}	19.48 (26.20)	19.31 (26.07)	20.99	18.39
Spinosad 2.5SC (*Saccharopolyspora spinosa*)	1000 ml ha^{-1}	3.85 (11.32)	3.33 (10.51)	25.03	2.68
Cypermethrin 10EC	1000 ml ha^{-1}	3.30 (10.47)	2.62 (9.32)	25.72	0.00
Untreated control	Water	22.31 (28.19)	24.40 (29.60)	19.91	22.59
SE(m)±		1.60	1.87	0.49	-

Figures in parenthesis are angular transformed values.

References

[1] Chandrakar,M.K., Chandrakar,H.K. and Shrivastava, S.K., "Efficacy of new insecticides against larva of gram pod borer, *Helicoverpa armigera* Hubner on gram," J. Appl. Zool. Res.,17(1):43-44, 2006

[2] Dandale, H.G., Rao, N.G.V., Tikar, S.N. and Nimbalkar, S.A., "Efficacy of spinosad against cotton bollworms in comparison with some synthetic pyrethroids," Pestology, 15(3):24-28, 2001.

[3] Jayraj,S., Ananthakrishnan,T.N and Veeresh,G.K., "Biological pest control in India :Progress and perspectives," RGICS Project No. 2, Rajiv Gandhi Institute of Contemporay Studies. New Delhi, 101 pp., 1994

[4] Joshi, N., Brar, K.S. and Maninder, "Efficacy of HaNPV for the management of *Helicoverpa armigera* Hubner on tomato," *J. Insect Sci., 19(1):76-78,* 2006.

[5] Krishnamoorthy, A. and Mani, M., "Biosuppression of *Helicoverpa*

armigera (Hubner) on tomato using two egg parasitoids, *Trichogramma brasiliensis* (Ashm.) and *T. pretiosum* (Riley)," J. Ent. Res., 20 (1): 37-41, 1996.

[6] Pawar, C.S., Pal, S.K., Das, V.S.K. and Singh, K.N., "Insecticide evaluation for the management of *Helicoverpa armigera* on chickpea," Pestology, 7(3):30-31, 1994.

[7] Sarangi, P.K. and Ojha, R., "Relative efficacy of some bio-pesticides on larvae of *Helicoverpa armigera* Hubner", J. Plant Prot. Environ., 2 (2):64-67, 2005.

[8] Singh, B. and Yadav, R.P., "Field efficacy of some microbial agents against *Helicoverpa armigera* Hubner in chickpea," J. Appl. Zool. Res.,16(1):5-6, 2005.

[9] Srinivasan, M.R., Jasmine, R.S., Kennedy, J.S. and Palaniswamy, S. "Evaluation of indoxacarb 14.5 SC and spinosad 45SC against cotton bollworm, *Helicoverpa armigera* Hubner," J. Plant Prot. Environ., 1 (1&2):1-4, 2004.

[10] Srinivasan, P.M., "Control of fruit borer, *Heliothis armiger*a (Hubner) on tomato," Indian J. Hort.,16:187-188, 1959.

[11] Suryawanshi, D.S., Bhede, B.V., Bhosale, S.V. and More, D.G., "Insecticide resistance in field population of American bollworm, *Helicoverpa armigera* Hubner (Lepidoptera:Noctuidae)," Indian J. Ent., 70 (1):44-46, 2004.

[12] Tiwari,G.C and Krishnamoorthy, P.N., "Yield loss in tomato caused by fruit borer," Indian J. agric. Sci., 54: 341-343, 1984.