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BIO-EFFICACY OF CERTAIN BOTANICAL AND BIO-RATIONAL PESTICIDE AGAINST TOMATO FRUIT BORER [HELICOVERPA ARMIGERA HUB.]

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ABSTRACT

A field experiment was conducted to study the efficacy of certain botanical and bio- rational pesticides against fruit borer [Helicoverpa armigera Hub.] on tomato. The experiment was conducted during the Rabi season 2017-18 at Gram Post Sukhari Sapna, Tahsil - Ambikapur (C.G.). Total two sprays were applied to protect the crop from H.armigera with three replications Neem Oil 5 ml/lit, Neem Seed Karnel Extract 5 ml/lit, Nimbicide 0.30ppm, Neem Leaf Extract 5ml/lit, HaNPV 1.5ml/lit, *Bacillus thuriengiensis* 2gm/lit,were evaluated against *Helicoverpa armigera* infesting Tomato. The observations on infestation of Helicoverpa *armigera* 3, 7 and 14 days after treatment (Post-treatment) at each spraying were recorded for computing the percent infestation reduction. The data were subjected to statistical analysis after appropriate transformation for interpretation. The treatment with recommended pesticide Neem Seed Karnel Extract was of the most effective treatment followed with and Nimbicide, Neem Leaf Extract, HaNPV, Neem Oil and *Bacillus thuriengiensis* Among the treatments the highest cost benefit ratio (C: B) of 1:18.51 was obtained with of Neem Seed Karnel Extract.

KEYWORDS: Efficacy, Bio-rational pesticides, *Helicoverpa armigera Hub.* Cost benefit ratio.

INTRODUCTION

Tomato, *Lycopersicon esculentum* Mill. is an important vegetable crop grown around the world occupying the daily food regime of a majority of people (Hussain and Bilal 2007). Tomato is one of the most popular and widely grown vegetables in the world, ranking second in importance next to potato. The first reference to the tomato appears in the writings of the 16th Century herbalists, but they are brief and only identify it as newly introduced into Europe. Evidences about the first cultivation of tomato has been complained and evaluated by Jenkins (1948).In India tomato crop is mainly grown in the states of A.P.Gujrat, Bihar, Madhya Pradesh, Chhattisgarh, M.H, Orissa, West Bengal, Karnataka, Jharkhand, Gujarat, Tamil Nadu, U.P. Rajasthan *etc*. Total area under the tomato crop in India is about 882.0 thousand hectare with production of 18735.9 thousand metric tonnes. (2013-14) (Source: Horticulture Statistics Division, Department of Agriculture, Cooperation and Farmers Welfare.).

Tomatoes contribute to a healthy, well-balanced diet. They are rich in minerals, vitamins, essential amino acids, sugars and dietary fibers. Tomato contains much vitamin B and C, iron and phosphorus. Tomato fruits are consumed fresh in salads or cooked in sauces, soup and meat or fish dishes. They can be processed into purées, juices and ketchup. Canned and dried tomatoes are economically important processed products**.** The most limiting factor cultivation in India is its susceptibility to various insect pests damaging the crop from time of planting till harvest**.** In India fruit borer is one of the important pests of tomato, limiting the production and market value of produce. Insect pest act as a limiting factor in harvesting high yields of healthy and quality of tomato fruits. About 16 insect and other pests' species which caused damage to tomato crop in India. The crop losses by *H. armigera* to the extent of 80 per cent have been reported by **[**Singh *et.al.* 2017]. The pest is highly polyphagous and reported on nearly 181 host plants [Awasthi and Awasthi 2017]. The fruit borer, *Helicoverpa armigera* (Hubner), is the most destructive pest of tomato in India, which is commonly known as gram pod borer, American bollworm and tomato fruit borer. Young larvae feed exclusively on foliage, flower buds and flowers, while the later instars of this insect bore into the fruit and render them unmarketable. A caterpillar may feed on a single fruit or move from fruit to fruit, thus damaging several fruits before becoming full grown for population. (Naika 2005).

Tomato fruit borer, Helicoverpa armigera is an important pest which causes considerable losses in quantity as well as quality of tomato fruits. The monetary loss due to this pest in India has been estimated over rupees one thousand corer per year and yield losses ranged from 14 – 100 percent on different crops. Due to its economic importance considerable amount of work has been done for its control by biological means but the biological means tried so far have not been successful because the larva is the damaging stage which bores and remains inside the tomato fruit. H. armigera has assumed such proportions in the country for the past decade, farmers and plant protection agencies of central and state governments of India have virtually become perplexed regarding its control which ultimately leads to an array of social, economical and political problems. In past decades unreasoned and systematic calendar spraying of chemical control on tomato has been replaced by integrated pest management in India. To improve upon this problem, the most commonly method for the control of this pest is to have a film of a insecticide over foliage and fruiting bodies (Hussain and Bilal 2007).

MATERIALS AND METHODS

Experiment was conducted to evaluate the efficacy of certain botanical and bio- rational pesticides in the management of *Helicoverpa armigera* Hub. in Tomato, *Lycopersicon esculentum Mill*. The experiment was conducted during the Rabi season 2017-18 at Gram Post Sukhari Sapna, Tahsil - Ambikapur (C.G.).The experiment was laid out in randomized block design with seven treatments replicated thrice in 3 X 3m plot size. The tomato (Kanchan variety) raised as per the recommended package of practices except plant protection measures.The details of treatments are given in table 1. The treatments were imposed by using knapsak sprayer @ 400-500 liters of spray solution/ha depending on stage of the crop. The crop received two sprays, the first being given when the damage crossed economic threshold while, the second spray was imposed 15 days after first spray. The observation of damaged fruit was recorded on 5 randomly selected plants in each plot. The observation was made first and second spray whereas, the post-treatment observations were made on 3rd, 7th and 14th day after each spray and analyzed statically for variance to compare the treatment means.

Table 1: Details of insecticides which used in Treatment trial.

Treatment No.	Name of treatment	Dose
T_1	Neem oil	5ml/lit
T_2	Neem karnal extract	5ml/lit
T_3	Nimbicide	0.30 ppm
T_4	Neem leaf extract	5ml/lit
T_5	HaNPV	1.5ml/lit
T_6	*Bacillus thuriengiensis* (Bt.)	2gm/lit
T_7	Water treatment (Control)	-

RESULTS AND DISCUSSION

Experiment result revealed that all the treatments were significantly superior over control. Among the treatments Neem Seed Karnel Extract maximum percent fruit damage reduction by fruit borer (91.02%). The highest effectiveness of Neem Seed Karnel Extract against fruit borer which are in agreement with the present findings. Neem Seed Karnel Extract (91.02%) followed by Nimbicide (81.95%), Neem Leaf Extract (75.36%), HaNPV (69.43%), Neem Oil(58.41%) and BT (55.98%), was least effective among all the treatments.

Table 2: Bio-Efficacy of Certain Botanical And Bio-Rational Pesticide Against Tomato Fruit Borer (*Helicoverpa armigera* Hub.), during 2017-2018 (1st spray).

1st Spray

ANOVA: 3 DAYS

SOV	D.F.	S.S.	M.S.	Fcal	Ftab	T
Rep	2.00	2.84	1.42			
Treat	6.00	16006.30	2667.72	2018.27	3	
Error	12.00	15.86	1.32			2.18
Total	20.00	16025.00				

ANOVA: 7 DAYS

SOV	D.F.	S.S.	M.S.	Fcal	Ftab	T
Rep	2.00	1.29	0.65			
Treat	6.00	15393.16	2565.53	1908.36	3	
Error	12.00	16.13	1.34			2.18
Total	20.00	15410.58				

ANOVA: 14 DAYS

SOV	D.F.	S.S.	M.S.	Fcal	Ftab	T
Rep	2.00	8.92	4.46			
Treat	6.00	14326.22	2387.70	465.82	3	
Error	12.00	61.51	5.13			2.18
Total	20.00	14396.65				

Table 3. Bio-Efficacy of Certain Botanical And Bio-Rational Pesticide Against Tomato Fruit Borer (*Helicoverpa armigera* Hub.), during 2017-2018 (2nd spray).

2nd spray

ANOVA: 3 DAYS

SOV	D.F.	S.S.	M.S.	Fcal	Ftab	T
Rep	2.00	14.98	7.49			
Treat	6.00	16598.47	2766.41	876.81	3	
Error	12.00	37.86	3.16			2.18
Total	20.00	16651.31				

ANOVA: 7 DAYS

SOV	D.F.	S.S.	M.S.	Fcal	Ftab	T
Rep	2.00	7.02	3.51			
Treat	6.00	16120.91	2686.82	464.05	3	
Error	12.00	69.48	5.79			2.18
Total	20.00	16197.41				

ANOVA: 14 DAYS

SOV	D.F.	S.S.	M.S.	Fcal	Ftab	T
Rep	2.00	25.51	12.76			
Treat	6.00	15593.17	2598.86	588.34	3	
Error	12.00	53.01	4.42			2.18
Total	20.00	15671.69				

Table 4: Analysis of Cost Benefit Ratio.

Treatment	Yield of q/ha	Cost of yield	Total cost of yield (Rs.)	Common cost (Rs.)	Treatment cost (Rs.)	Total cost (Rs.)	C:B ratio
Control	160	2000 Rs/q	320000	29080	--	29080	1:11.00
Neem Oil (5ml/lit)	227	2000 Rs/q	454000	29080	1880	30960	1:14.66
Neem Karnel Extract (5ml/lit)	280	2000 Rs/q	560000	29080	1180	30260	1:18.51
Nimbicide (0.3ppm)	265	2000 Rs/q	530000	29080	1768	30848	1:17.18
Neem Leaf Extract (5ml/lit)	247	2000 Rs/q	494000	29080	1572	30652	1:16.12
HaNPV (1.5ml/lit)	231	2000 Rs/q	462000	29080	1790	30870	1:14.97
***Bacillus thuriengiensis* 2gm/lit**	207	2000 Rs/q	414000	29080	1180	30260	1:13.68

The data with respect to cost benefit ratio (C:B) as influenced by various treatments is presented in table-1 and which revealed that the higher amount of monetary return was obtained with Neem Seed Karnel Extract (1:18.51) followed by Nimbicide0.3ppm(1:17.18), Neem Leaf Extract(1:16.12), HaNPV(1:14.97), Neem Oil(1:14.66), *Bacillus thuriengiensis* (1:13.68) and Control (1:11.00).

Yield

The highest fruit yield of 280 q/ha was registered in Neem Seed Karnel Extract which was followed by, Nimbicide265 q/ha, Neem Leaf Extract 247 q/ha, HaNPV 231 q/ha, Neem Oil 227 q/ha and BT 207 q/ha respectively As low as 160 q/ha was recorded in untreated control.

DISCUSSION

The effect of insecticide was observed on the basis of percentage fruit infestation and fruit damage due to the fruit borer. The cumulative (average) percentage infestation of fruit infestation and fruit damage was calculated to see the overall effects of various treatments and incremental cost benefit ratio was also worked out. Experiment laid out in RBD design with 3replication during experimentation, all the two spraying were carried out at an interval of 15 days. Different Botanical pesticides against tomato fruit borer, % over control reduction population was maximum percent population reduction was 90.20% and 92.40% in 3rd day of first and second spray respectively, when the larvae were treated with 5 ml/lit(0.5%) of Neem Seed Karnel Extract solution. The minimum percent of population reduction was 55.70% in 3rd day of first spray respectively, when the larvae were treated with 2gm/lit of *Bacillus thuriengiensis* and 56.97% in 3rd day of second spray respectively.

Different Botanical insecticide against tomato fruit borer, % over control reduction population maximum percent population reduction was 90.20% and 91.10% in 7th day of first and second spray respectively, when the larvae were treated with 5 ml/lit(0.5%) of Neem Seed Karnel Extract solution. The minimum percent of population reduction was 54.57% and 56.20% in 7th day of first and second spray respectively, when the larvae were treated with 2 gm/lit of, *Bacillus thuriengiensis* solution.

Different Botanical insecticide against tomato fruit borer, % over control reduction population maximum percent population reduction was 89.20% and 89.57% in 14th day of first and second spray respectively, when the larvae were treated with 5 ml/lit(0.5%) of Neem Seed Karnel Extract solution. The minimum percent of population reduction was 51.47% and

54.77% in 14th day of first and second spray respectively, when the larvae were treated with 2 gm/lit of, *Bacillus thuriengiensis* solution.

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