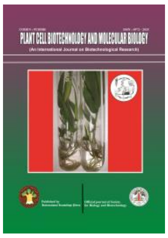

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Enhancing Okra Yield and Quality: Synergistic Impact of Biopesticides Combined with Cypermethrin against Shoot and Fruit Borer [*Earias vittella* Fab.]

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was conducted during *Kharif* 2018 at Central Research Farm, SHUATS, Naini, Prayagraj Seven different treatments viz., Neemoil (0.3%), NSKE (0.5 %), *Beauveria bassiana, Bacillus thuringiensis,* Cypermethrin 25 EC + *Beauveria bassiana*, Cypermethrin 25 EC + Neemoil (0.3 %) and Cypermethrin 25 % EC were evaluated against shoot and fruit borer, *Earias vittella*. Minimum per cent shoot infestation and fruit infestation were recorded in Cypermethrin 25% EC (check) with (3.51%, 4.66%) followed by Neemoil+ Cypermethrin (3.9%, 4.93%), Cypermethrin 25EC + *Beauveria bassiana*(5.17%, 5.49%), Neemoil (5.35%, 5.94%), NSKE (7.21%, 7.92%), *Bacillus thuringiensis* (7.52%, 8.90%),*Beauveria bassiana*(8.50%, 9.05%) and Control (11.77%, 14.65%) respectively. Among all the treatment studied, the best and most economical treatment was T_6 - Cypermethrin 25EC (1:3.48), T_7 - Cypermethrin 25EC + Neemoil (1:3.36), T_5 - Cypermethrin 25CE + *Beauveria bassiana*(1:3.07), T_1- Neemoil (1:2.91), T_2- NSKE (1:2.79), T_4- *Bacillus thuringiensis* (1:2.63), T_3- *Beauveria bassiana*(1:2.21), Control (1:1.81) respectively.

Keywords: Benefit cost ratio; Earias vittella [Feb]; bio-pesticides; okra.

1. INTRODUCTION

“Okra (*Abelmoschus esculentus),* commonly known as ladies’ finger, is an important vegetable crop belonging to the Malvaceae family. It grows in tropical and subtropical regions worldwide. Okra is one of the most popular vegetables in India, Japan, Pakistan, Burma, Iraq, Turkey, Bangladesh, Ghana, and Afghanistan. In India, it is grown during the summer as well as throughout the rainy season, and it can be cultivated all year in central and southern regions. Okra is widely grown in India due to its ease of cultivation, consistent yield, and ability to adapt to varying moisture conditions. Major okra-growing states in India include Punjab, Gujarat, Haryana, Maharashtra, and West Bengal. In India, okra is grown on 523 hectares, with a total production of 6416 metric tonnes” [1]. “Among vegetables, it occupies an important position and is grown extensively throughout India. In Uttar Pradesh, okra grown in an area of 11.6 thousand hectare with the production of 131.2 thousand tonnes per hectare [2] Okra is a nutritionally valuable vegetable. It has a higher nutritional value compared to tomatoes, eggplants, and most other cucurbits. Okra seeds contain protein, vegetable oil, vitamins A and B, calcium, phosphate, and iodine, making it a high-nutrient super food. Due to its nutritional and health benefits, okra is an essential part of the human diet” [3]. “It promotes intestinal health and reduces the risk of colorectal cancer. Okra also provides income for farmers and addresses malnutrition problems. Currently, vegetables account for only eight to ten percent of the total food consumption of Indian vegetarians. Therefore, it is essential to popularize vegetables as a key component of the diet, especially among the poorer segments of society. Emphasizing the importance of vegetables can help reduce the reliance on grains. Most vegetables are short-duration crops that can be harvested quickly, allowing farmers to increase their income per unit area by cultivating three to four crops annually” [4].

“Despite a large growing area and a wide range of cultivars, the supply of okra in the Indian market does not meet demand. Lower productivity is one of the main reasons for this discrepancy. A significant portion of the fruits produced is harmed by insect pests. Climate change, including variations in rainfall, temperature, and relative humidity, significantly impacts insect life. Analyzing pest behavior and population dynamics in relation to meteorological variables is crucial for developing successful pest management programs” [5]. “In the current era of climate change, insect pest situations are changing due to variations in abiotic factors” [4,6,7]. “Understanding past behavior and population dynamics concerning weather parameters is vital for effective insect management strategies. Okra attracts many insect pests, such as the shoot and fruit borer (*Earias vittella*), whitefly (*Bemisia tabaci*), mealy bug (*Phenacoccus solenopsis*), aphid (Aphis gossypii), leaf roller (*Sylepta derogata*), and thrips (*Thrips tabaci).* The terminal portion of growing shoots is bored by caterpillars, which move down by making tunnels inside. As a result, the shoot drop downward or dry up. Second, the larvae enter the fruit by making holes, rendering them unfit for human consumption. According to an estimate this pest can cause 36-90% loss in fruit yield of okra” [8]. “Chemical pesticides are often used to control these pests, but excessive use is toxic to human health and the environment. This not only increases cultivation costs but also leads to problems like insecticide resistance, the emergence of sucking insects, secondary pest outbreaks, harmful residues in the final yield, groundwater contamination, negative side effects, and the killing of non-target organisms. Understanding the behavior of major insect pests and their seasonal abundance in relation to weather parameters is critical for developing successful management strategies. Excessive pesticide use also results in insecticide residues in okra. Therefore, bio-pesticides could be used to combat significant insect pests on okra during the *Kharif* season when climatic conditions are ideal for their application" [7].

In today's era of Integrated Pest Management (IPM), all control methods are likely to be integrated. Insect-resistant plants provide optimal pest damage control, low production costs, and environmental benefits. Consequently, vegetable crops like okra have significant potential for developing pest-resistant varieties. The current trend in insect management is to reduce the use of traditional insecticides, not only to save money but also to reduce pollution and prevent the spread of chemical resistance in insect pests.

2. MATERIALS AND METHODS

To investigate the efficacy of different bio-pesticides against okra shoot and fruit borer [*Earias vittella* Fab.]. The experimental was conducted during *Kharif* 2018 at Central Research Field, Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, U.P. The variety of okra NAYAN-1 was sown and experiment was laid out in randomized block design (RBD) with three replications and plot size 4x4 m^2 was done respectively. The eight treatments was apply to testing the efficacy the treatments are Neem oil @ 3ml/lit (T1), NSKE (0.5%) @ 5ml/lit (T2), *Beauveria bassiana* @5gm/lit.(T3), *Bacillus thuringiensis* @ 2ml/lit. (T4), Cypermethrin 25EC+ *Beauveriabassiana*@1ml+3ml/lit. (T5), Cypermethrin 25EC @ 2ml/lit (T6), Cypermethrin 25EC +Neem oil (0.3%) @ 1ml+3ml/lit.(T7) and Untreated T (8). The observations were recorded one day before spray and 3rd, 7th, 14th, days after each treatments, five plants were selected randomly from each net plot area and healthy as well damaged shoot per plant and healthy fruit and damaged fruit were counted. The extent of the damage was computed by using the formula;the analysis of variance (ANNOVA) technique was applied for calculation of the data and the calculated values for the compared the tabular values at 5% level of probability.

Percent shoot infestation -

Percent Shoot damage= (Number of Infested Shoot) / (Total Number of Shoot) X 100

Percent Fruit infestation -

Percent Fruit damage= (Number of Infested Fruit) / (Total Number of Fruit) X100

Cost effectiveness of each treatment was assessed based on net returns. Net return of each treatment was worked out by deducting total cost of the treatment from gross returns. Total cost of production included both cultivation as well as plant protection charges Nalini and Kumar [9].

2.1 BCR (Benefit Cost Ratio)

Gross return = Marketable Yield x Market price

Net return = Gross return – Total cost

Benefit: Cost Ratio = (Net Return) / (Total Cost) X 100

3. RESULTS AND DISCUSSION

The results of the experiment entitled "Enhancing Okra Yield and Quality: Synergistic Impact of Biopesticides Combined with Cypermethrin against Shoot and Fruit Borer [*Earias vittella* Fab.]" to study cost benefit ratio during the *kharif* season of 2018. The data so obtained through observation on various aspects were subjected to statistical analysis wherever necessary and the complied mean data are tabulated in the following pages. Results obtained are presented aspect wise hereunder. It is evident from the overall shoot infestation (first spray) 3rd, 7th and 14thdays after spraying mean (Table 1, Fig. 1). Among all the treatments minimum shoot infestation was recorded in T_6- Cypermethrin 25 EC (3.30 %) followed by T_7- Cypermethrin 25 EC +Neemoil (3.90 %), T_5- Cypermethrin 25 EC+ *Beauveria bassiana* (4.70 %), T_1- Neemoil (4.81 %), T_2- NSKE (6.87 %), T_4- *Bacillus thuringiensis* (7.80%), T_3- *Beauveria bassiana* (8.20%) and T_8- Control (10.90%) was least effective and after 7th days after spray the minimum infestation of shoots was recorded from T_6- Cypermethrin 25 EC (3.30 %) treated plot followed by T_7- Cypermethrin 25 EC + Neemoil (3.90 %), T_5-

Cypermethrin 25 EC+ *Beauveria bassiana* (4.70 %), T_1- Neemoil (4.81 %), T_2- NSKE (6.87 %), T_4- *Bacillus thuringiensis* (7.80 %), T_3- *Beauveria bassiana* (8.20 %) and T_8- Control (10.90 %). Out of all the treatments T6 and T7 were non significant to each other. Similarly (T_7, $T_5$and T_1), (T_5, $T_1$and T_4) and (T_4, $T_2$and T_3) were also non-significant to each other but significant to remaining treatments and also found same trend at 14th days after first spray respectively.

The data presented in Table 2 indicated that, the results were statistically significant. All the treatments were statistically superior over control in reducing the fruit damage on number basis after second spray.Among all the treatment minimum fruit infestation was recorded in treatment T_6- Cypermethrin 25 EC (3.90 %) followed by T_7- Cypermethrin 25 EC +Neemoil (4.15 %),T_5- Cypermethrin 25 EC+ *Beauveria bassiana* (4.95 %), T_1- Neemoil (5.15 %), T_2- NSKE (7.10 %), T_4- *Bacillus thuringiensis* (8.50 %), T_3- *Beauveria bassiana* (8.44 %) and T_8- Control (13.51 %). Out of all the treatments T_6, T_7, T_5 and T_1 were the non-significant to each other. Similarly (T_5, T_1 and T_2) and (T_2, T_3 and T_4) were also non-significant to each other but significant to remaining treatments. 7th days after Among all the treatment minimum fruit infestation was recorded in treatment T_6- Cypermethrin 25 EC (4.84 %) followed by T_7- Cypermethrin 25 EC +Neemoil (5.02 %), T_5- Cypermethrin 25 EC+ *Beauveria bassiana* (5.45 %), T_1- Neemoil (5.85 %), T_2- NSKE (8.15 %), T_4- *Bacillus thuringiensis* (8.94 %), T_3- *Beauveria bassiana* (9.15 %) and T_8- Control (14.81 %) was least effective. Out of all the treatments T_6, T_7, T_5 and T_1 was non-significant to each other. Similarly (T_5, T_1 and T_2), and (T_2, T_4 and T_3) were also non-significant to each other but significant to remaining treatments and same trend are found 14th days after second spray respectively.

Table 1. Effect of Bio-pesticide in the combination with Cypermethrin on shoot infestation on okra after first spray

Treatments	% Shoot infestation				
	BS	**3 DAS**	**7 DAS**	**14 DAS**	**Mean**
T_1- Neemoil(0.3%)	9.7	4.81	5.33	5.9	5.35
T_2- NSKE(0.5%)	9.36	6.87	7.07	7.69	7.21
T_3- *Beauveria bassiana*	9.29	8.2	8.5	8.8	8.5
T_4- *Bacillus thuringiensis*	10.02	7.8	6.8	7.95	7.52
T_5-Cypermethrin 25 EC + *Beauveria bassiana*	9.48	4.7	5.1	5.7	5.17
T_6 –Cypermethrin 25 EC	10.16	3.3	3.5	3.73	3.51
T_7– Cypermethrin 25 EC + Neemoil (0.3%)	9.55	3.9	3.7	4.1	3.9
T_8-Control	9.68	10.9	11.9	12.5	11.77
F- test	NS	S	S	S	S
S. Ed. (±)		0.67	0.80	0.77	0.27
C.D. (P = 0.05)		1.44	1.71	1.66	0.58

BS- Before Spray; 3DAS- 3rd Days After Spray; 7th Days After Spray; 14th Days After Spray

Table 2. Effect of bio-pesticide in combination with cypermethrin on fruit infestation of okra after second spray

Treatments	% Fruit infestation				
	Before	**3 DAS**	**7 DAS**	**14 DAS**	**Mean**
T_1- Neemoil(0.3%)	10.39	5.15	5.85	6.81	5.94
T_2- NSKE(0.5%)	9.38	7.10	8.15	8.52	7.92
T_3- *Beauveria bassiana*	9.98	8.44	9.15	9.55	9.05
T_4- *Bacillus thuringiensis*	10.19	8.50	8.94	9.27	8.90
T_5- Cypermethrin 25EC + *Beauveria bassiana*	10.17	4.95	5.45	6.08	5.49
T_6 – Cypermethrin 25EC	9.65	3.90	4.84	5.24	4.66
T_7– Cypermethrin 25EC + Neemoil (0.3%)	8.95	4.15	5.02	5.62	4.93
T_0-Control	11.38	13.51	14.81	15.62	14.65
F -test	NS	S	S	S	S
S. Ed.(±)		1.09	1.26	1.24	0.18
C.D. (P = 0.05)		2.33	2.71	2.66	0.39

BS- Before Spray; 3DAS- 3rd Days After Spray; 7thDays After Spray; 14thDays After Spray

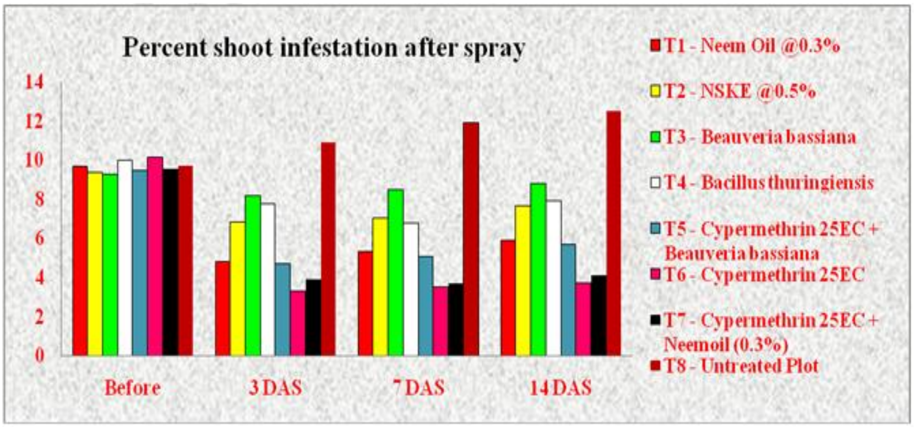

Fig. 1. Effect of bio-pesticide in combination with cypermethrin on shoot infestation of okra after first spray

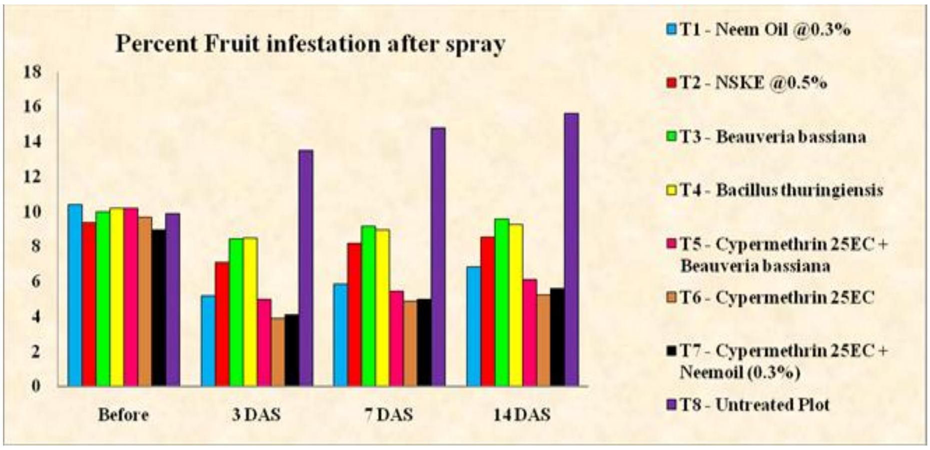

Fig. 2. Effect of bio-pesticide in combination with cypermethrin on fruit infestation of okra after second spray

Table 3. Economics of insecticides evaluated Shoot and Fruit Borer in okra

Treatment	Yield of q/ha	Cost of yield (/q)	Total cost of yield (₹)	Common cost	Treatment cost	Total cost
T_1- Neem oil (0.3%)	77.04	1700	130968	43036	1914	44950
T_2- NSKE (0.5%)	73.05	1700	124185	43036	1425	44461
T_3- *Beauveria bassiana*	58.48	1700	99416	43036	1887	44923
T_4- *Bacillus thuringiensis*	68.84	1700	117028	43036	1380	44416
T_5 -Cypermethrin 25CE + *Beauveria bassiana*	80.44	1700	136748	43036	1500	44536
T_6 -Cypermethrin 25EC	90.98	1700	154666	43036	1393	44429
T_7 -Cypermethrin 25EC +Neemoil(0.3%)	88.12	1700	149804	43036	1488	44524
Control	45.95	1700	78115	43036	………..	43036

Among all the treatment minimum shoot infestation was recorded in treatment treatmentT_6- Cypermethrin 25 EC (3.51 %) and T_7- Cypermethrin 25 EC +Neemoil (3.90 %) which are most effective and significant to each other, and fallowed by T_5- Cypermethrin 25 CE + *Beauveria bassiana* (5.17 %), T_1- Neemoil (5.35 %), T_2- NSKE (7.21 %), T_4- *Bacillus thuringiensis*

(7.52 %), T_3- *Beauveria bassiana* (8.50 %). Maximum infestation was recorded in T_0-Control (11.77 %) was least effective. Singh *et al*., (2012) reported that similarly fruit minimum infestation in Cypermethrin 25 EC. Nalini and Kumar (2016) reported against shoot and fruit borer, *Earias vittella*. Minimum percent of shoot infestation and percent fruit infestation were observed in cypermethrin. In this regard Devi *et al*., (2014) revealed significantly minimum shoot and fruit infestation in *Beauveria bassiana* and after 2nd spraying revealed that all the chemical treatments were superior over control. Among all the treatments minimum fruit infestation was recorded in treatment T_6- Cypermethrin 25 CE (4.66 %) followed by T_7- Cypermethrin 25 EC +Neemoil (4.93 %), and fallowed by T_5- Cypermethrin 25 EC+ *Beauveria bassiana* (5.49 %), T_1- Neemoil (5.94 %), T_2- NSKE (7.92 %), T_4- *Bacillus thuringiensis* (8.90 %), T_3- *Beauveria bassiana* (9.05 %) and T_0- Control (14.65 %), was least effective. Sahak and Lyall [10] and Patra et al. [11] reported the highest suppression of fruit infestation with Cypermethrin 25EC, followed by Neem oil, NSKE also found maximum control and superiority in Cypermethrin 25 EC @ 0.025% + neem oil 0.5% with second spray 3.3% and third spray 4.7% fruit infestation followed by Cypermethrin 25 EC @ 0.025% with 4.1% infestation in second spray and 6.7% infestation in third spray. The effectiveness of Cypermethrin 25 EC and Cypermethrin + Neemoil (8.91 %) was also recorded by Singh et al. [12,13] and similar result was found by Misra et al. [8] and Nachne et al. [14,15].

The highest yield was recorded inT_6 - Cypermethrin 25 EC (3.48 %), T_7 - Cypermethrin 25 EC +Neemoil (3 %) (3.36 %), When cost benefit ratio was worked out, interesting result was achieved [16]. Among the treatment studied, most economical treatment was T_5- Cypermethrin 25 CE + *Beauveria bassiana* (3.07 %), T_1- Neemoil (3 %) (2.91%), T_2- NSKE 5 % (2.79 %), T_4- *Bacillus thuringiensis* (2.63 %), T_3- *Beauveria bassiana* (2.21%).These present results are similar with the following reviews cited, the maximum marketable yield (110.71 q/ha) of healthy okra fruits and maximum profit (1:5.01) was obtained from plot treated with Cypermethrin. Similar results was found by Singh et al. [6] and Pardeshi et al. [17,18].

4. CONCLUSION

From the present study, the results showed that Cypermethrin 25 EC (T_6) is the most effective treatment against okra fruit and shoot infestation and produces maximum yield and recorded the highest Cost-Benefit ratio compared to other treatments. While T_7 -Cypermethrin 25 EC +Neemoil (3 %) (3.36%), (T_5) Cypermethrin 25 E+ *Beauveria bassiana*, and Neemoil (3 %) have shown average results and NSKE 5%, *Bacillus thuringiensis*, *Beauveria bassiana* were found to be the least effective in managing *Earias vittella.* Hence, it is suggested that the effective insecticides may be alternated in harmony with the existing Integrated pest management programs in order to avoid the problems associated with insecticidal resistance, pest resurgence etc., Botanicals are the part of integrated pest management in order to avoid indiscriminate use of pesticides causing pollution in theenvironment and not much harmful to beneficial insects.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anonymous. 2020-21 (Final) of Area and Production of Horticulture Crops, Department of agriculture & farmers welfare; 2021. Available:https://agricoop.nic.in.
2. Indian horticultural database, 2011.
3. Schippers R. African indigenous vegetables: An overview of the cultivated species. Natural Resources Institute /ACP-EU, Technical Centre for Agricultural and Rular Cooperation, CD ROM 214, Chatham, UK. 2002;62(4): 363-366.
4. Lal B, Dhurve V. Bio-efficacy of Different Biopesticides against Jassid, (Amrasca biguttula biguttula Ishida) Infesting Okra

[*Abelmoschus esculentus* (L.) Moench]. J. Exp. Agric. Int. [Internet]. 2024;46(1):37-4. Accessed On:2024 May 18. Available:https://journaljeai.com/index.php/JEAI/article/view/2289

5. Yadav JB, Singh RS, Tripathi RA. Effect of weather parameters in incidence of pest complex of okra. Annals of Plant Protection Sciences. 2007;15(2):477- 478.
6. Singh A, Yadav U. Evaluate the efficacy of different biopesticides with imidacloprid against maize spotted stem borer (Chilo partellus swinhoe) on maize under field conditions. Int. J. Plant Soil Sci. 2023; 35(18):1001-6. Accessed On:2024 May 18. Available:https://journalijpss.com/index.php/IJPSS/article/view/3364
7. Senthil-Nathan S. A review of biopesticides and their mode of action against insect pests. Environmental sustainability: Role of Green Technologies. 2014;49-63.
8. Misra HP, Dash DD, Mahapatra D. Efficacy of some insecticides against okra fruit borer, *Earias spp*. and leaf roller, *Sylepta derogata* Fab. Annals of Plant Protection Sciences. 2002;10(1):51-54.
9. Nalini C, Kumar A. Population dynamics and comparative efficacy of certain chemicals and bio-pesticides against okra shoot and fruit borer shoot and fruit borer (*Earias vitella).* The bioscan. 2016; 11(3):1589-1592.
10. Sahak Khan A, Lyall H. Efficacy ofchemical and plant products in the management of *Earias vittella* on okra. Annals Plant Protection Science. 2013; (21):283-285.
11. Patra S, Chatterjee ML, Samanta A. Field efficacy of insecticides for management of *Earias vittella* in okra. Annals Plant Protection Science. 2009; 17:471-472.
12. Singh AK, Tiwari MN, Om Prakash, Singh MP. A current review of cypermethrin-induced neurotoxicity and nigrostriatal dopaminergic neuro-degeneration. Bentham Science Publishers. 2012;10:64-71.
13. Nayar KK, Anntha Krishnan TN, David BV. General and Applied Entomology. Tata Mc. Graw Hill Publ. Co. Ltd., New Delhi. 1976;16(1):204-206.
14. Nachane MN, Narkhede AL, Khande DM, Sarode SV. Ovicidal action of newer insecticides and Bt formulations against *Earias vittella* (Fab.) on okra. PKV Research Journal. 2003;27:170 -172.
15. Rawat RR, Sahu HR. Estimation of losses in growth and yield of okra due to Empoasca devastans Dist. and *Earias spp.* Indian Journal of Entomology 1973;(35):252-254.
16. Singh SP, Kumar S, Singh NK. Efficacy of synthetic pyrethroids. Indian Journal of Agriculture Sciences. 2006;54: 517-519.
17. Pardeshi AM, Bharodia RK, Khande DM. Sarode SV. Ovicidal action of newer insecticides and Bt. formulations against (*Earias vitella* Fab.) on okra. PKV Res. J. 2011;27:170-172.
18. Verma RS, Updhay KD, Gupta SP, Singh R, Lodhi PS. Interaction between root knot nematode (*Meloidogyne javanica*) and spotted bollworm (*Earias fabia*) on okra & effect on yield Indian Journal of Plant Protection. 1985;12(2);131-133.

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