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AK Gore
Organic Farming Research & Training Centre, Vasantrao Naik Marathwada Krishi Vidyapeet, Parbhani, Maharashtra, India

SS Sant
Organic Farming Research & Training Centre, Vasantrao Naik Marathwada Krishi Vidyapeet, Parbhani, Maharashtra, India

AK Kadam
Organic Farming Research & Training Centre, Vasantrao Naik Marathwada Krishi Vidyapeet, Parbhani, Maharashtra, India

SS Dhurgude
Organic Farming Research & Training Centre, Vasantrao Naik Marathwada Krishi Vidyapeet, Parbhani, Maharashtra, India

SB Patange
Organic Farming Research & Training Centre, Vasantrao Naik Marathwada Krishi Vidyapeet, Parbhani, Maharashtra, India

Corresponding Author:
AK Gore
Organic Farming Research & Training Centre, Vasantrao Naik Marathwada Krishi Vidyapeet, Parbhani, Maharashtra, India

Effect of botanicals and bio-pesticides on sucking pest in cotton

AK Gore, SS Sant, AK Kadam, SS Dhurgude and SB Patange

Abstract
A field experiment was conducted to evaluate the effect of botanicals and bio-pesticides on sucking pest management in cotton at Organic Farming Research and Training Centre farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra) during 2019-20. The population of sucking pests *viz.*, aphid, jassid, whitefly and thrips reduced significantly in the plots treated with microbial biopesticide like NSKE 5% + *Verticilium lecani* and NSKE 5% + *Metarrhizium anisopliae* which showed reduction in population of pests at the end of last spraying. The present study signifies the importance of microbial biopesticides for ecofriendly and sustainable pest management indicating their potential utility in supplementing the integrated pest management strategies of cotton.

Keywords: cotton, sucking pests, pest population, microbial biopesticides

Introduction
Cotton (*Gossypium hirsutum* L.) is one of the important commercial crops popularly known as 'King of fibre' and 'White gold' of India. It provides 65% raw material to the textile industry and contribute 1/3rd of total foreign exchange earning of India. Among the various factors responsible for low productivity, insect pests are considered as major ones. In India about 184 insect pests have been reported to attack cotton crop causing 30-80% yield loss and constitute as one of the major limiting factors in cotton production [1, 2]. Sucking pests cause damage throughout the crop period with significant decline in yield by being assimilate sappers, stand reducers and light stealers. The yield loss of up to 21.2 percent [6] and 28.13 percent [7] has been reported due to sucking pests in cotton. Heavy infestation of sucking pests results in yellowing of leaves leading to wrinkling and distortion. Further, secretion of honeydew leads to growth of sooty mould which affects photosynthetic activity of the plants and eventually seed cotton yield. For the management of sucking pests use of insecticides is the permanent solution. Recent trend of organic farming and deleterious effect of chemical insecticides on natural enemies has necessitated the alternative approach for economical and eco-friendly management of insect pests. In this context microbial biopesticides attract considerable attention and significant findings have been documented on efficacy of microbial biopesticides in cotton and other various crops [8, 9, 10].

Materials and Methods
To assess the effects of botanicals and bio-pesticides on sucking pest management in cotton, field experiment was conducted at Organic Farming Research & Training Centre Farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra) during Kharif 2019-20. Cotton variety NH-635 was dibbled at spacing of 60 x 30 cm and raised under organic management practices. There were ten different treatments comprising of different botanicals and bio-pesticides T_1- NSKE 5%, T_2- *Bacillus thuringinesis* 5 ml/lit, T_3- *Beauveria bassiyana* 0.5%, T_4- *Metarrhizium anisopliae* 0.5%, T_5- *Verticilium lecani* 0.5%, T_6- NSKE 5%+ *Bacillus thuringinesis* 0.5%, T_7- NSKE 5% + *Beauveria bassiyana* 0.5%, T_8- NSKE 5% + *Metarrhizium anisopliae* 0.5%, T_9- NSKE 5% + *Verticilium lecani* 0.5% and T_{10}- Untreated Control (Table 1). Pure cultures of entomopathogenic fungi were obtained from Spawn Production Unit, VNMKV, Parbhani. All the treatments were replicated thrice in randomized block design (RBD). Considering the economic threshold level (ETL) of pest during the experimental period three sprays were given in the interval of 15 days and observations were recorded on 1st, 3rd, 7th and 14th day after spraying. Five plants were randomly selected from each net plot area and tagged for recording observations. Population of sucking pests *viz.*,

aphid (*Aphis gossypii* G.), jassid (*Amrasca biguttula biguttula* Ishida.), whitefly (*Bemisia tabaci* Gen.) and thrips (*Scirtothrips dorsalis* Hood.) was recorded from three leaves (top, middle and bottom) of each tagged plant and mean population of each sucking pest was worked out.

Table 1: Details of treatments used in the experiment

Treatment	Microbial insecticides
T_1	NSKE 5%
T_2	*Bacillus thuringinesis* 0.5%
T_3	*Beauveria bassiyana* 0.5%
T_4	*Metarrhizium anisopliae* 0.5%
T_5	*Verticilium lecani* 0.5%
T_6	NSKE 5%+ *Bacillus thuringinesis* 0.5%
T_7	NSKE 5% + *Beauveria bassiyana* 0.5%
T_8	NSKE 5% + *Metarrhizium anisopliae* 0.5%
T_9	NSKE 5% + *Verticilium lecani* 0.5%
T_{10}	Untreated Control

Results and Discussion

Jassid population (Table 2) recorded in different treatments under study revealed the significant suppression in all microbial biopesticide treatments over control treatment. However, application of NSKE 5% + *Verticilium lecani* (T_9) consistently showed reduction in population of pests from first to last spraying (from 1.82 to 0.87 no. of jassid population per three leaves) over rest of the all treatments and it was found at par with treatment T_8 i.e., NSKE 5% + *Metarhizium anisopliae* throughout first, second and third spray. The population of pest found to be highest in pre-count i.e., before spraying and it was decreasing with subsequent spraying and was found to be lowest at the end of third spray. However, highest population of jassid was recorded in control treatment. Whereas, the treatment T_5 i.e., *Verticilium lecani* was found on par with treatment T_8 i.e., NSKE 5% + *Metarhizium anisopliae* throughout first to last spray.

Thrips population (Table 3) recorded in different treatments under study revealed the significant suppression in all microbial biopesticide treatments over control treatment. Whereas, application of NSKE 5% + *Verticilium lecani* showed significantly superior reduction in population of pests from first to last spray (from 15.13 to 3.85 no. of thrips population per three leaves) over rest of the all treatments at second and third spray but which was found at par with treatment T_8 i.e NSKE 5% + *Metarhizium anisopliae* at first spray. However, highest population of thrips was recorded in control treatment.

White fly population (Table 4) was significantly affected due to all microbial biopesticide treatments over control. Whereas, application of NSKE 5% + *Verticilium lecani* showed significantly lowest population of pests at second and third spray (from 0.75 to 0.47 no. of white fly population per three leaves) over rest of the all treatments at second and third spray which was found at par with treatment T_8 i.e NSKE 5% + *Metarhizium anisopliae*. However, highest population of white fly was recorded in control treatment.

Application of NSKE 5% + *Verticilium lecani* showed significantly lowest population of aphids at first and second spray (from 4.77 to 4.67 no. of aphids population per three leaves) over rest of the all treatments and it was found at par with treatment T_8 i.e NSKE 5% + *Metarhizium anisopliae* at first spray. However, highest population of white fly was recorded in control treatment.

Table 2: Efficacy of different microbial biopesticides against jassid after spraying

		1st Spray						2nd Spray						3rd Spray					
Sr. No.	Treatments	No. of Jassids/leaf						No. of Jassids/leaf						No. of Jassids/leaf					
		Precount	1 DAS	3 DAS	7 DAS	14 DAS	Mean	Precount	1 DAS	3 DAS	7 DAS	14 DAS	Mean	Precount	1 DAS	3 DAS	7 DAS	14 DAS	Mean
T_1	NSKE 5%	4.27 (2.28)	3.17 (2.03)	1.30 (1.49)	1.10 (1.44)	3.40 (2.01)	2.65	2.10	2.37	3.90	5.80	3.54	2.10	3.93	2.27	2.70	2.97	2.97	2.97
T_2	*Bacillus thuringinesis*	4.06 (2.25)	4.16 (2.26)	4.00 (2.13)	4.10 (2.25)	5.27 (2.44)	4.32	5.00	5.30	5.57	6.20	5.52	5.00	5.70	4.47	5.60	4.90	5.17	5.17
T_3	*Beauveria bassiyana*	4.20 (2.23)	4.00 (2.22)	3.90 (2.19)	3.69 (2.13)	5.30 (2.49)	4.22	4.93	5.00	5.40	6.03	5.34	4.93	5.63	5.33	5.57	4.83	5.34	5.34
T_4	*Metarhizium anisopliae*	4.27 (2.29)	3.27 (2.03)	1.87 (1.69)	1.70 (1.63)	4.40 (2.26)	3.10	3.10	3.33	4.43	5.81	4.17	3.10	4.10	3.03	3.37	4.20	3.68	3.68
T_5	*Verticilium lecani*	4.31 (2.30)	2.65 (1.90)	1.00 (1.41)	0.90 (1.37)	1.77 (1.66)	2.13	2.50	1.80	1.53	2.67	2.13	2.13	1.60	1.70	2.40	3.60	2.33	1.60
T_6	NSKE 5% + *Bacillus thuringinesis*	4.23 (2.28)	3.55 (2.12)	2.40 (1.82)	2.00 (1.71)	5.10 (2.41)	3.46	4.30	4.60	5.22	5.90	5.01	4.30	5.10	5.30	5.00	4.80	5.05	5.05
T_7	NSKE 5% + *Beauveria bassiyana*	4.30 (2.28)	2.71 (1.90)	1.53 (1.55)	0.93 (1.38)	2.70 (1.91)	2.43	1.90	1.83	3.00	5.37	3.03	1.90	3.50	2.20	2.20	2.80	2.68	2.68
T_8	NSKE 5% + *Metarhizium anisopliae*	4.33 (2.30)	2.17 (2.03)	0.87 (1.36)	0.75 (1.30)	1.63 (1.61)	1.95	1.90	1.56	1.21	1.43	1.53	1.53	1.40	1.03	1.63	2.37	1.61	1.40
T_9	NSKE 5% + *Verticilium leccani*	4.37 (2.32)	2.05 (1.87)	0.77 (1.32)	0.50 (1.22)	1.43 (1.52)	1.82	1.17	0.70	1.03	1.37	1.07	1.07	0.87	0.93	1.53	2.30	1.41	0.87
T_{10}	Untreated control	4.00 (2.24)	4.17 (2.27)	4.26 (2.28)	4.20 (2.26)	5.67 (2.54)	4.46	5.50	5.83	5.90	6.20	5.86	5.50	6.30	5.53	5.70	5.00	5.63	5.63
	SE	0.22	0.10	0.12	0.03	0.16	0.08	0.19	0.15	0.20	0.14	0.09	0.19	0.11	0.15	0.10	0.18	0.06	0.06
	CD at 5%	NS	0.30	0.36	0.12	0.48	0.25	0.58	0.46	0.62	0.43	0.29	0.58	0.34	0.46	0.31	0.55	0.19	0.19
	CV	16.87	08.11	10.30	04.69	13.48	07.40	17.15	13.45	16.59	10.42	7.89	17.1	9.06	13.37	9.00	15.42	5.44	5.44

Table 3: Efficacy of different microbial biopesticides against thrips after spraying

Sr. No.	Treatments	1st Spray						2nd Spray					3rd Spray				
		No. of thrips/ leaf						No. of thrips/ leaf					No. of thrips/ leaf				
		Precount	1 DAS	3 DAS	7 DAS	14 DAS	Mean	1 DAS	3 DAS	7 DAS	14 DAS	Mean	1 DAS	3 DAS	7 DAS	14 DAS	Mean
T_1	NSKE 5%	31.17	18.10	8.33	14.37	17.87	17.97	11.17	7.20	9.27	11.50	9.79	5.73	2.10	6.84	5.80	5.12
T_2	*Bacillus thuringinesis*	33.70	20.27	15.17	25.03	25.90	24.01	18.30	13.50	15.27	15.67	15.69	10.03	5.47	12.60	10.03	9.53
T_3	*Beauveria bassiyana*	33.10	20.24	14.10	22.07	25.04	22.91	16.60	10.30	15.00	15.26	14.29	9.23	5.30	11.50	9.50	8.88
T_4	*Metarhizium anisopliae*	30.10	18.93	10.03	19.10	23.50	20.33	15.17	8.10	13.70	14.00	12.74	7.60	3.77	9.80	7.13	7.08
T_5	*Verticilium lecani*	35.03	15.10	6.10	12.57	15.70	16.90	10.43	6.17	8.00	10.13	8.68	4.30	1.47	6.17	5.53	4.37
T_6	NSKE 5% + *Bacillus thuringinesis*	32.20	19.10	12.10	20.05	24.33	21.56	16.17	10.30	14.80	14.70	13.99	8.10	4.10	10.03	7.50	7.43
T_7	NSKE 5% + *Beauveria bassiyana*	32.00	15.27	6.20	13.13	17.50	16.82	10.60	6.27	8.30	10.20	8.84	4.47	1.50	6.20	5.70	4.47
T_8	NSKE 5% + *Metarhizium anisopliae*	34.13	12.33	5.90	11.50	12.00	15.17	10.03	6.03	8.00	10.00	8.52	4.10	1.40	5.67	4.97	4.04
T_9	NSKE 5% + *Verticilium leccani*	30.20	13.80	6.03	12.27	13.36	15.13	9.30	6.00	7.37	9.40	8.02	3.80	1.20	5.50	4.90	3.85
T_{10}	Untreated control	31.20	28.50	20.13	28.00	26.10	26.79	21.30	18.10	15.83	16.10	17.83	12.00	9.60	15.00	10.07	11.67
	SE	0.51	0.22	0.15	0.17	0.2	0. 16	0.11	0.17	0.21	0.10	0.08	0.13	0.13	0.10	0.13	0.09
	CD at 5%	N.S.	0.66	0.46	0.52	0.59	0.50	0.35	0.50	0.62	0.30	0.26	0.40	0.39	0.30	0.41	0.26
	CV	15.46	8.47	7.08	7.12	7.61	6.39	5.39	9.37	10.40	6.31	4.36	8.49	11.05	10.24	8.43	5.69

Table 4: Efficacy of different microbial biopesticides against whitefly after spraying

Sr. No.	Treatments	2ndSpray						3rdSpray				
		No. of whiteflies/ leaf						No. of whiteflies/ leaf				
		Precount	1 DAS	3 DAS	7 DAS	14 DAS	Mean	1 DAS	3 DAS	7 DAS	14 DAS	Mean
T_1	NSKE 5%	1.77	1.47	0.90	0.60	1.30	1.21	0.83	0.53	0.53	1.37	0.82
T_2	*Bacillus thuringinesis*	1.83	1.70	1.60	1.43	2.00	1.71	1.57	1.33	1.93	2.40	1.81
T_3	*Beauveria bassiyana*	1.80	1.63	1.57	1.40	2.00	1.68	1.53	1.20	1.63	2.33	1.67
T_4	*Metarhizium anisopliae*	1.77	1.50	0.90	0.70	1.40	1.25	0.83	0.57	0.60	1.47	0.87
T_5	*Verticilium lecani*	1.70	1.30	0.70	0.50	0.80	1.00	0.68	0.43	0.40	1.20	0.68
T_6	NSKE 5% + *Bacillus thuringinesis*	1.73	1.57	1.03	0.73	1.90	1.39	0.90	0.83	1.03	2.17	1.23
T_7	NSKE 5% + *Beauveria bassiyana*	1.77	1.33	0.83	0.60	1.21	1.15	0.70	0.47	0.50	1.37	0.76
T_8	NSKE 5% + *Metarhizium anisopliae*	1.70	1.20	0.67	0.40	0.55	0.90	0.63	0.27	0.20	1.17	0.57
T_9	NSKE 5% + *Verticilium leccani*	1.50	1.13	0.50	0.33	0.30	0.75	0.40	0.23	0.20	1.03	0.47
T_{10}	Untreated control	1.87	1.73	1.70	1.63	4.00	2.19	1.80	1.67	1.93	2.67	2.02
	SE	0.11	0.09	0.07	0.08	0.07	0.05	0.07	0.06	0.05	0.07	0.05
	CD at 5%	N.S	N.S.	0.23	0.24	0.22	0.15	0.21	0.19	0.15	0.22	0.16
	CV	11.61	10.53	9.38	10.58	8.70	8.91	9.77	8.67	6.46	9.20	6.78

Table 5: Efficacy of different microbial biopesticides against aphids after spraying

Sr. No.	Treatments	1st Spray						3rd Spray				
		No. of aphids/ leaf						No. of aphids/ leaf				
		Precount	1 DAS	3 DAS	7 DAS	14 DAS	Mean	1 DAS	3 DAS	7 DAS	14 DAS	Mean
T_1	NSKE 5%	14.30	8.03	3.30	1.03	0.73	5.48	9.93	4.67	2.60	4.50	8.36
T_2	*Bacillus thuringinesis*	13.33	9.67	7.10	4.73	4.03	7.77	17.30	18.50	22.03	21.10	20.91
T_3	*Beauveria bassiyana*	13.87	9.40	6.80	4.03	3.50	7.52	12.50	14.10	18.30	20.47	17.51
T_4	*Metarhizium anisopliae*	15.20	8.13	3.47	1.08	0.90	5.76	10.17	6.63	4.03	5.17	9.56
T_5	*Verticilium lecani*	13.87	7.43	2.93	0.90	0.50	5.13	9.13	3.40	2.10	3.60	7.49
T_6	NSKE 5% + *Bacillus thuringinesis*	14.20	8.77	3.60	1.20	1.10	5.77	10.43	7.33	6.10	9.50	11.10
T_7	NSKE 5% + *Beauveria bassiyana*	14.74	7.50	3.10	1.00	0.53	5.37	9.14	3.50	2.50	3.87	7.66
T_8	NSKE 5% + *Metarhizium anisopliae*	13.53	7.23	2.63	0.30	0.37	4.81	6.42	3.70	3.82	4.82	4.69
T_9	NSKE 5% + *Verticilium leccani*	15.03	6.10	2.23	0.28	0.23	4.77	2.20	2.67	1.20	2.27	4.67
T_{10}	Untreated control	13.90	10.30	9.40	5.47	5.10	8.83	20.50	31.30	34.47	30.23	28.72
	SE	0.08	0.08	0.14	0.06	0.075	0.04	0.14	0.17	0.08	0.10	0.26
	CD at 5%	N.S.	0.25	0.43	0.20	0.22	0.14	0.44	0.53	0.26	0.31	0.88
	CV	3.96	4.87	11.03	7.06	8.25	3.13	7.58	10.21	5.30	5.80	14.12

Conclusion

1. Application of NSKE 5% + *Verticilium lecani* and NSKE 5% + *Metarhizium anisopliae* recorded effective reduction of pest population among all the treatments and found effective for pests like jassid, thrips, whitefly, aphid.
2. The rate of reduction of jassid population in NSKE 5% and *Metarhizium anisopliae* found to be lower than other treatments. *Metarhizium anisopliae* and *Verticilium lecani* shwed reduction in population of whiteflies after each spraying for 7-14 days, but later on the population increased rapidly as compared to rest bio pesticides.

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References

1. Sundarmurthy VT. Abundance of adult males of Helicoverpa armigera in poly crop system as affected by certain abiotic factors. Proceedings of fifth All India Coordinated Workshop on Biological Control of Crop Pests and Weeds 1985, 177-179.
2. Kranthi KR, Kranthi S, Ramesh K, Nagrare VS, Anupam Barik. Technical Bulltein: Advances in cotton IPM. Central Institute for Cotton Research, Nagpur 2009, 27.
3. Biradar VK, Vennila S. Pest management for *Bt* cotton: Need for conservation biological control. Current Science 2008;95(3):317-318.
4. Dhawan AK, Sindhu AS. Assessment of losses due to the attack of cotton jassid on hirsutum cotton. Indian Journal of Plant Protection 1986;14:45-50.
5. Chavan SJ, Bhosle BB, Bhute NK. Estimation of losses due to major insect pests in desi cotton in Maharashtra. Journal of Cotton Research and Development 2010;24(1):95-96.
6. Luo S, Naranjo SE, Wu K. Biological control of cotton pests in China. Biological Control 2014;68:6-14.
7. Rajashekhar M, Kalia VK. Native *Bt* strains efficacy against cotton aphid Aphis gossypi Glover. Journal of Pharmacognosy and Phytochemistry 2017;6(5):938-940.
8. Chattopadhyay P, Banerjee G, Mukherjee S. Recent trends of modern bacterial insecticides for pest control practice in integrated crop management system. 3 Biotech 2017;7(1):60.
9. Ghelani YH, Jhala RC, Vyas HN. Bioefficacy of botanicals and microbial insecticides against cotton aphid Aphis gossypii (Glover). Advances in Indian Entomology 2006;2(3):149-152.
10. Ambarish S, Shashikumar C, Shekara BG, Somu G. Field evaluation of bio-pesticides and insecticides against sucking insect pests of Bt-cotton under rainfed condition. Journal of Entomological Research 2017;41(4):383-386.
11. Kapadia MN, Gajera RC, Jethva DM. Bio-efficacy of mycoinsecticides against Thrips tabaci Lindeman on garlic. Agricultural Science Digest 2009;29(4):294-296.
12. Boricha HV, Raghvani KL, Joshi MD, Makadia RR, Varmora JM, Babariya PM. Bio-efficacy of biopesticides against thrips Thripstabaci infesting cotton. International Journal of Plant Protection 2010;3(1):43-45.
13. Naga Bharani S, Kohilambal H, Sivasubramanian P, Banuprathap G. Comparative efficacy of bio pesticides and insecticides against tomato thrips (Thrips tabaci Lind.) and their impact on coccinellid predators. The Bioscan 2015;10(1):207-210.
14. Sunil KY, Shweta Patel, Meena Agnihotri, Bisht RS. Efficacy of insecticides and bio-pesticides against sucking pests in black gram. Annals of Plant Protection Sciences 2015;23(2):223-226.