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BIO EFFICACY OF DIFFERENT MYCOINSECTICIDES FOR THE MANAGEMENT OF LEAF EATING CATERPILLAR, *SPODOPTERA LITURA* (F) IN TOBACCO NURSERY

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An experiment was carried out in bidi tobacco nursery for two years (2021-22 and 2022-23) to evaluate the efficacy of mycoinsecticides against Tobacco leaf eating caterpillar, *Spodoptera litura* (F). Two applications of *Metarhizium anisopliae* 1% WP, (2 10^8 CFU) @ 5 g/lit water or oil formulation of *Metarhizium anisopliae* 1% (2 10^8 CFU) @ 5 ml/ lit water for the management of leaf eating caterpillar, *Spodoptera litura* (Fab.) first at initiation of the pest and subsequent at 10 days after first spray found effective in bidi tobacco nursery.

A demonstration plot was also taken up to show effective insecticides for management of leaf eating caterpillar revealed that most effective treatment was chemical insecticide Emamectin benzoate 5 SG 0.0025%, followed by mycoinsecticide, *Metarhizium anisopliae* WP 1 (%) in comparisons with absolute control.

Mycoinsecticides become an ecofriendly module of integrated pest management (IPM) approach. This can be incorporated as additional component while formulating IPM strategy for sustainable management of leaf eating caterpillar in bidi tobacco nursery.

INTRODUCTION

Bidi tobacco, *Nicotiana tabacum* L is major crop of middle Gujarat agroclimatic zone. Tobacco leaf eating caterpillar, *Spodoptera litura* (F) is a regular and polyphagous pest of nursery and transplanted crop. The tobacco caterpillar, *S. litura*, is one of the most important insect pests of agricultural crops in the Asian tropics. It is widely distributed throughout tropical and temperate Asia, Australasia and the Pacific Islands (Feakin, 1973; Kranz *et al.*, 1977). The grown-up larvae feed voraciously on leaves and defoliate them. The seedlings become unfit for transplanting. The damage varies from 3 to 17 % in the nursery. Under favourable conditions the extent of loss may be about 80 % and entire nursery can be wiped out (Chari and Patel, 1972). Biopesticides offer several advantages over the chemical pesticides *viz.* safety, targeted activity to the desired pests, effective in lower quantities thereby offering lower exposure and quick decomposition to leave no residues and allowing field re-entry immediately after application and amenability to use in rotation with chemical pesticides as part of IPM programs. The use of fungal biological control agents is a rapidly developing field and is increasingly adopted and accepted worldwide management of agricultural pests (Jaronski, 2010; Hajek and Delalibera, 2010). Search for safer alternatives for pest management, which are less aggressive for the environment with possibilities of use in pest management and contributing to a safer and more efficient way of pest control (Sreedhar, 2014).

Hence, in the present study was taken up with a view to evaluate the efficacy of mycoinsecticides *viz*, *Beauveria bassiana*, *Metarhizium anisopliae* and *Nomuraearileyi* and its formulations against *S. litura* under nursery condition.

MATERIALS AND METHODS

The experiment was conducted in farm nursery at Bidi Tobacco Research Station, Anand Agricultural University, Anand, Gujarat for two years (2021-22 & 2022-23) in Randomized block design. Total eight treatments (Table 1) were imposed to the nursery plots measuring 34.56 m^2 with 1.44 m^2 (1.2 x 1.2 m) for each treatment replicated thrice, seeding of each plots were carried

Key words: Mycoinsecticides*Metarhizium anisopliae, Spodoptera litura*(F), Bidi tobacco

out with A 119 variety. All the agronomical practices followed for raising the tobacco nursery were same except the application of mycoinsecticides. Germination count recorded from ten quadrate (5 cm x 5 cm = 25 cm^2) randomly placed in each bed after germination of seeds. The first spray of biopesticides (5g or 5 ml/Lit) was applied at the initiation of pest infestation and subsequent one spray at 10 days after first spray by using manually operated knapsack sprayer with Duromist nozzle. The damage per cent seedlings worked out before the first pulling, by randomly selected 100 seedlings from each bed. The total healthy transplantable seedlings counted at the time of each pulling. The data were analysed using standard statistical method. The data were subjected to ANOVA.

Three large plots measuring 2.5 mt x 16 mt total 40 mt^2 were selected for the demonstration purpose at Bidi tobacco research station, AAU, Anand for recommended chemical insecticide Emamectin benzoate 5 SG 0.0025%, mycoinsecticide *Metarhizium anisopliae* WP 1 (%) and control. Ten repetitions were carried out in a plot for each treatment out of three plots in the year 2022-23. The data analysed by using standard statistical method.

RESULTS AND DISCUSSIONS

The data for the year 2021-22 on bio efficacy of different mycoinsecticides against leaf eating caterpillar, *S.litura* (F) under nursery condition of bidi tobacco is presented in Table 1. The result indicated that germination counts were uniform before impose of the treatment as the differences among the treatments is statistically non-significant. The maximum healthy transplantable seedlings were registered in *M. anisopliae* WP (1%) (592/bed) and it is at par with *M. anisopliae* oil formulation (1%) (525/bed). The per cent damaged seedlings were the highest in an absolute as well as treated control. The mycoinsecticide, *M. anisopliae* WP (1%) and *M. anisopliae* oil formulation (1%) registered numerically minimum per cent damage, 17.33 and 16.33, respectively.
Data presented in Table 1 for the year 2022-23 indicated that germination counts were uniform before treatment applied as the difference among the treatments is statistically at par with each other. The maximum healthy transplantable

Table 1: Effect of mycoinsecticides on germination count, per cent damaged seedlings and total number of healthy transplantable seedlings bidi tobacco nursery

Treatments	Germination count (25 cm^2)			Per cent damaged seedlings			Total number of healthy transplantable seedlings/bed		
	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled
Beauveria bassiana WP 1 (%)	10.13	9.00	9.56	16.67ab	16.68a	16.67	433	580	506ab
Beauveria bassiana Oil formulation 1 (%)	9.10	8.33	8.71	18.33abc	17.33ab	17.83	417	580	498ab
Metarhizium anisopliae WP 1 (%)	9.57	9.00	9.28	17.33ab	13.00a	15.17	592	640	616a
Metarhizium anisopliae Oil formulation 1 (%)	9.67	8.33	9.00	16.33a	13.33a	14.83	525	617	571ab
Nomuraea rileyi WP 1 (%)	10.27	8.67	9.47	18.67bc	16.00a	17.33	400	560	480bc
Nomuraea rileyi Oil formulation 1 (%)	10.40	8.67	9.53	16.67ab	15.67a	16.17	391	533	462bcd
Control (water spray)	9.87	9.00	9.43	19.67c	22.33bc	21.00	366	350	358cd
Control (No spray)	8.97	8.00	9.48	18.00abc	22.67c	20.33	350	340	345d
S.Em.± T	0.48	0.71	0.40	0.66	1.48	1.50	35.84	21.39	37.45
TxY	—	—	0.61	—	—	1.15	—	—	29.51
CD at 5% T	NS	NS	NS	2.00	4.49	NS	109	64.87	125.26
CV%	8.59	14.34	11.50	6.46	14.90	11.41	14.29	7.05	10.66

NS = Non-Significant;Treatment means with the letter/letters in common are not significant by Duncan's New Multiple Range Test at 5 % level of significance

seedlings were registered in *M. anisopliae* WP (1%) (540/bed) and at par with *M. anisopliae* oil formulation (1%) (617/bed). The per cent damaged seedlings were the highest 22.23% (Control Water spray) and 22.67% (Control No spray) both are at par with each other. The mycoinsecticide, *M. anisopliae* WP (1%) and *M. anisopliae* oil formulation (1%) revealed statistically minimum per cent damage, 13% and 13.3%, respectively.

The perusal of data on pooled results presented in Table 1 revealed that germination count remain uniform in experimental plots before impose of the treatment as the differences among the treatments is statistically non-significant. The maximum healthy transplantable seedlings were registered in *M. anisopliae* WP (1%) (616/bed) and it is at par with *M. anisopliae* oil formulation (1%) (571/bed). The highest damaged seedlings were noticed in control, water spray (21.00%) and at par with control, no spray (20.33%). Numerically, minimum damaged seedlings were noted in *M. anisopliae* WP (1%) (15.17%) and it is at par with *M anisopliae* oil formulation (1%) (14.83%).

Sahayaraj and Borgio (2010) reported the lowest LC_{50} ($2.47x10^4$ spore/ml) of *M. anisopliae* isolate against *S. litura*. The fungi, *M. anisopliae* @ $1x10^{12}$ spores/ ml was better treatment in respect to reduce the larval population of soybean defoliators (Panwar and Ghugal, 2015). The combinations with insecticides and *B. bassiana*, *M. anisopliae*, and *M. robert-sii*caused higher larval mortalities of*Rachiplusia nu* (Guenée) is one of the major lepidopteran pests defoliating soybeans in Argentina (Sebastian *et al* 2018).The cumulated mortality of *S. frugiperda* on eggs and neonates was highest with *M. anisopliae* ICIPE 41 (97.5%), followed by *M. anisopliae* ICIPE 7, 655, 40, 20 and 78 with total mortality of 96.0%, 95.0%, 93.5%, 93.0% and 92.0%, respectively (Komivi*et al.*, 2019).Husseini (2019) reported high efficacy of the entomopathogenic fungus, *M. anisopliae* against third and fifth larval instars of the cotton leafworm *S. littoralis*. These findings were more or less in agreement with our results.

Demonstration of recommended insecticides for the control of leaf eating caterpillar, *Spodoptera litura*(F) in bidi tobacco nursery.

The data indicated in Table 2 revealed that emamectinbenzoate registered minimum per cent damaged seedlings with highest (534) transplantable seedlings and significantly superior, the next best treatment was mycoinsecticide *Metarhizium anisopliae* WP 1 (%) recorded 17.70 % damaged seedlings and 466 transplantable seedlings in comparison to control (27.70 %, 365 respectively).

CONCLUSION

The fungal biopesticides like *Metarhizium anisopliae* effectively control leaf eating caterpillar, *S. litura* under nursery condition. Two applications of *Metarhizium anisopliae* 1% WP, 2 10^8 CFU 5 g/lit water OR oil formulation of *Metarhizium anisopliae* 1% (2 10^8 CFU) 5 ml/lit water for the management of leaf eating caterpillar, *Spodoptera*

Table 2: Evaluation of recommended chemical insecticide with mycoinsecticide for the control of leaf eating caterpillar, *Spodoptera litura* (F) in bidi tobacco nursery demonstration plot.

Treatments	Percent damage	Total transplantable seedlings / m^2
Emamectin benzoate 5 SG 0.0025%	12.10	534
Metarhizium anisopliae WP 1 (%)	17.70	466
Control (No spray)	27.70	365
S.Em ±	0.75	21.12
CD 0.05%	2.24	63.35
CV %	12.74	15.17

litura (Fab.) first at initiation of the pest and subsequent at 10 days interval found effective in bidi tobacco nursery.

This become an eco-friendly module of integrated pest management (IPM) approach, it can be incorporated as additional component while formulating IPM strategy for sustainable management of leaf eating caterpillar in bidi tobacco nursery.

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