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Bioefficacy of various formulations of biopesticides against white grub, *Leucopholis lepidophora* infesting sugarcane under field condition

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Abstract
Field experiment was conducted on the "Bioefficacy of various formulations of biopesticides against *Leucopholis lepidophora* (Blanchard) infesting sugarcane crop" during 2016-2017 at farmer's field in endemic area of pest in Kolhapur region during 2016-2017. In field studies the various formulations of EPNs, EPF *Metarhizium anisopliae* and *Beauveria bassiana* were tested for their efficacy against grubs of *L. lepidophora* (Blanchard). The treatment with *M. anisopliae*-talc base @ 5 gm per litre was found to be significantly superior over untreated control and recorded 9.36 per cent clumps mortality at 60 DAT. Treatment with Entomopathogenic Nematode-Powder @ 5 gm per litre showed 11.68 per cent clumps mortality at 60 DAT were next in order of efficacy. Treatment with Entomopathogenic Nematode-spong formulation, Entomopathogenic Nematode Granules were next in order of efficacy.

Keywords: Entomopathogenes, white grub, sugarcane

Introduction
Sugarcane (*Saccharum officinarum* L.) is the most important cash crop and plays the main role in Indian economy. Up till now 200 insect pests have been reported causing damage to sugarcane crop (David *et al.*, 1986) [4]. Among them, white grub has become the most important polyphagous pest causing serious threat to sugarcane crop since 1960 (Mohalkar *et al.*, 1977) [11]. About 40 different species under these subfamilies have been recorded as important pests of various crops in different parts of country white grubs remain a problem in varied agro ecosystem and soil types. White grubs (Coleoptera: Scarabaeidae) are soil inhabiting and root feeding immature stages of scarab beetles. The white grub family, Scarabaeidae is the second largest and omnipresent family within the order Coleoptera (Mishra and Singh, 1999) [10]. White grubs have become serious pests of most agricultural crops, fruits, vegetables, ornamental plants, plantation crops, pastures, turf and meadow grasses, lawns, golf courses and forest trees in different part of the world (Potter *et al.* 1992) [12]. Chemical control measures are ineffective since the pests are subterranean. This pest consider threat to sugarcane cultivation in parts of Kolhapur and Sangli districts (Adsule and Patil, 1990) [1].
The entomopathogenic fungi *M. anisopliae* and *B. bassiana* have been successfully utilized as potential biological control agents for many soil inhibiting insect pests (Bhagat *et al.*, 2003) [3]. The entomopathogenic nematodes (EPNs) are potential and most promising biological agents for the control of different insect pest of different crops, those are eco friendly and cost effective (Kaya and Gaugler, 1993 [6] and Ali *et al*. 2005) [2]. Entomopathogenic nematodes in the families Steinerematidae and Heterorhabiditidae are potential biocontrol agents (Gaugler, 1988) [5].
However, not much work has been reported on the utilization of various formulations of biopesticides against white grub, *L. lepidophora*. Hence present investigation was therefore undertaken to evaluate the efficacy of various formulations of biopesticides against white grub, *Leucopholis lepidophora* infesting sugarcane under field condition.

2. Materials and Methods

2.1 Field layout

Field trial was conducted at farmer's field in endemic area of pest in Kolhapur region during 2016-2017. Experimental design used Randomized Block Design with three replications and nine treatments. Plot size was 6 x 5 m^2 with spacing 90 cm x 90 cm, variety of Sugarcane was CO-86032.

2.2 Method of various formulations of biopesticides application

The suspension of various formulations of EPNs, EPF *M. anisopliae* and *B. bassiana* prepared according to the required quantity as per recommended dose given in Table 1. The application of various formulations of biopesticides was done by drenching through the hole made by using a crowbar and irrigated the field plots and granules were applied with equal quantity of sand (Manisegaran *et al.* 2011) [9].

2.3 Method of recording observations

The observations of field experiments was recorded 5 spots with 1 m^2 area per plot was selected randomly and the number of damaged clumps was counted at 15, 30, 45 and 60 days after treatment (Mane, 2010) [8]. The sugarcane clump mortality data recorded and was angularly transformed and subjected to analysis of variance.

3. Results and Discussion

Response of eight various formulations of biopesticides were tested for determining their bioefficacy against grubs of *L. lepidophora* (Blanchard) under field condition. The clumps mortality observed at fifteenth, thirtieth, fourty-fifth and sixtieth day interval after the treatment. The overall performance of the various formulations of the biopesticides against the white grub under field condition revealed that the treatment with *M. anisopliae*-talc based formulation registered significantly less 6.49, 7.36 and 9.20 and per cent clumps mortality. The treatment with Entomopathogenic Nematode-Powder base, Entomopathogenic Nematode-spong formulation, *M. anisopliae*-tablet and Entomopathogenic Nematode-Granules formulation were next in order of efficacy. The oil based formulations of *M. anisopliae* and *Beauveria* was found to be least effective in reducing the clumps mortality (Table 1).

3.1 Efficacy of various formulations of biopesticides at 15 DAT

The mortality of clumps ranged from 6.49 to 31.16 per cent as compared to 35.93 per cent in untreated control when the observations are taken at 15 DAT. The treatment with *M. anisopliae*-talc based at the dose of 5 gm per litre was significantly superior over all other treatments (6.49%) in reducing mortality of clumps. The treatment with Entomopathogenic Nematode-Powder was found next best treatment (8.49%) in reducing mortality of clumps, however it was on par with Entomopathogenic Nematode-spong formulation and Entomopathogenic Nematode-Granules formulation where 10.81 and 15.58 per cent mortality of clumps was recorded. The significant differences did not exist among the rest of the treatment (Table 1).

3.2 Efficacy of various formulations of biopesticides at 30 DAT

The mortality of clumps ranged from 7.36 to 32.45 per cent as compared to 37.52 per cent in untreated control when the observations are taken at 30 DAT. The treatment with *M. anisopliae*-talc based at the dose of 5 gm per litre was significantly superior over all other treatments (7.36%) in reducing mortality of clumps. The treatment with Entomopathogenic Nematode-Powder was found next best treatment (10.06%) in reducing mortality of clumps, However it was on par with Entomopathogenic Nematode-spong formulation where 12.55 per cent mortality of clumps was recorded. The treatment with Entomopathogenic Nematode-Granules, *M. anisopliae*-tablet and *M. anisopliae*-Granules next in order of efficacy on par with each other. Significant differences did not exist among the rest of the treatment. *M. anisopliae*-oil based 32.45 per cent and *Beauveria*-oil based formulations registered high clumps mortality 27.27 per cent (Fig.1).

3.3 Efficacy of various formulations of biopesticides at 45 DAT

The mortality of clumps ranged from 9.20 to 33.76 per cent as compared to 38.53 per cent in untreated control when the observations are taken at 45 DAT. The treatment with *M. anisopliae*-talc based at the dose of 5 gm per litre was significantly superior over all other treatments (9.20%) in reducing mortality of clumps. The treatment with Entomopathogenic Nematode-Powder was found next best treatment (10.65%) in reducing mortality of clumps, However Entomopathogenic Nematode-spong formulation, Entomopathogenic Nematode-Granules formulation and *M. anisopliae*-tablet where 13.85, 18.18 and 23.80 per cent mortality of clumps was recorded (Fig.1).

3.4 Efficacy of various formulations of biopesticides at 60 DAT

The mortality of clumps ranged from 9.36 to 35.06 per cent as compared to 40.25 per cent in untreated control when the observations are taken at 60 DAT. The treatment with *M. anisopliae*-talc based at the dose of 5 gm per litre was significantly superior over all other treatments (9.36%) in reducing mortality of clumps. The treatment with Entomopathogenic Nematode-Powder was found next best treatment (11.68%) in reducing mortality of clumps, However it was on par with Entomopathogenic Nematode-spong formulation where 15.15 per cent mortality of clumps was recorded (Table 1).

The present findings are in conformity with Kuley and Pokharkar (2009) [7] and Visalakshi *et al.* (2015) [13] who reported that *M. anisopliae* was effective than *Beauveria* under field condition for controlling white grub. However, not much work has been reported on the efficacy of various formulations of biopesticides against white grub from the literature reviewed.

Table 1: Efficacy of various formulations of biopesticides against third instar grub of *L. lepidophora* under field condition

Sr. No.	Treatment	Dose per litre	Per cent clumps mortality			
			15 DAT	30 DAT	45 DAT	60 DAT
1	*Metarhizium anisopliae* - talc based	5 gm	6.49 (14.76)	7.36 (15.74)	9.20 (17.66)	9.36 (17.81)
2	*Metarhizium anisopliae-granules*	5 gm	22.94 (28.62)	24.24 (29.49)	25.54 (30.36)	26.82 (31.19)
3	*Metarhizium anisopliae* Tablets	2 gm	20.77 (27.11)	22.07 (28.02)	23.80 (29.20)	25.54 (30.36)
4	Entomopathogenic Nematode - spong formulation	300 IJs	10.81 (19.20)	12.55 (20.75)	13.85 (21.85)	15.15 (22.91)
5	Entomopathogenic Nematode-Powder	5 gm	8.49 (16.94)	10.06 (18.49)	10.65 (19.05)	11.68 (19.98)
6	Entomopathogenic Nematode- Granules formulation	250 gm/plot	15.58 (23.25)	17.31 (24.59)	18.18 (24.24)	19.91 (26.50)
7	*Beauveria* - Oil based	5 ml	25.97 (30.64)	27.27 (31.48)	28.57 (32.81)	29.43 (32.85)
8	*Metarhizium anisopliae* - Oil based	5 ml	31.16 (33.93)	32.45 (34.73)	33.76 (35.52)	35.06 (36.31)
9	Untreated Control	_	35.93 (36.83)	37.52 (37.77)	38.53 (38.37)	40.25 (39.38)
	SE±		0.47	0.30	0.37	0.79
	CD at 5%		1.42	1.15	1.12	2.37

DAT- Days after Treatment
(Figures in the parenthesis are arc sin transformation)

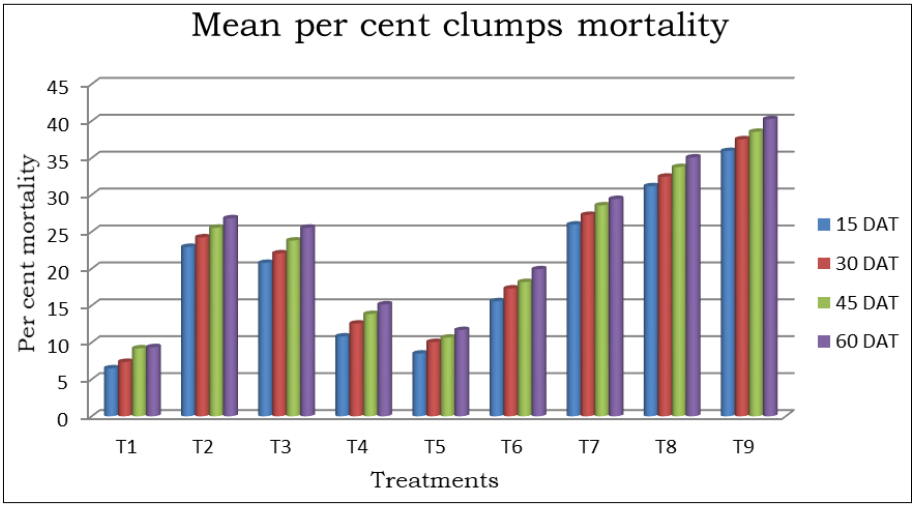

Fig 1: Bioefficacy of various formulations of biopesticides against White grub, *L. lepidophora* under field condition

4. Conclusion

Field evaluation of various biopesticides against white grub in sugarcane revealed that application of *M. anisopliae*-talc based at the dose of 5 gm per litre was found to be significantly superior over untreated control and recorded 9.36 per cent clumps mortality at 60 DAT. Treatment with Entomopathogenic Nematode-Powder with the dose of 5 gm per litre showed 11.68 per cent clumps mortality at 60 DAT were next in order of efficacy. Treatment with Entomopathogenic Nematode-spong formulation, Entomopathogenic Nematode Granules were next in order of efficacy.

The application of the chemical insecticide on the banks of the river causes the water pollution to the next villages and also creates the chances of resistance development in pest. So utilization of various formulations of biopesticides can increase the efficiency of control by reduction of the amount of applied insecticides, minimizing pest resistance and environmental contamination hazards. There are no references found regarding the bioefficacy of various formuations of EPNs, EPFs. So this finding will be useful for other workers for further studies.

5. References

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