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Combined efficacy of entomopathogenes and insecticides against white grub, *Leucopholis lepidophora* (Blanchard) infesting sugarcane *in vitro*

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Abstract
Laboratory experiment was conducted on the "Combined efficacy of entomopathogenes and insecticides against white grub, *Leucopholis lepidophora* (Blanchard) infesting sugarcane *in vitro*" during 2016-2017 in the Agricultural Entomology Section, College of Agriculture, Kolhapur. In laboratory bioassay studies the entomopathogens like, *Heterorhabditis indica*, *Metarrhizium anisopliae* and chemical insecticide Imidacloprid individually and different combinations were tested for their combine efficacy against third instar grubs of *L. lepidophora* (Blanchard). The treatment *M. anisopliae* + *H. indica* + Imidacloprid @ 75 gm + 75 gm + 8 ml was found most effective in controlling the white grub, *L. lepidophora*. The treatment of *M.anisopliae* + *H. indica* + Imidacloprid @ 75 gm + 75 gm + 8 ml recorded 73.33, 82.66 and 87.33 percent grub mortality at 7, 10 and 15 DAT respectively where untreated control recorded 13.00, 16.66 and 20.00 percent grub mortality respectively. The treatment with Imidacloprid, *M. anisopliae* + Imidacloprid and *H. indica* + *M. anisopliae* was found next in order of efficacy.

Keywords: Entomopathogenes, white grub, sugarcane

1. Introduction

Sugarcane, *Saccharum officinarum* L. is one of the most important commercial crops of the tropical countries and is the main source of sugar for hundreds of years in the world. The by products of sugarcane industry such as molasses, bagasse and press mud play an important role in national economy. The white grubs assumed the status of "National Pest" with the advent of modern agriculture during the 60's. The cultivators of sugarcane, paddy, jowar, tobacco, maize and chilli are facing the problem of white grubs in Kolhapur district. The principal pest species are *Leucopholis lepidophora, Holotrichia serrata, Holotrichia karschi, Holotrichia fissa, Anomala bengalensis* and *Phyllognathus dionysius.* White grub have became increasingly difficult pest in Kolhapur region particularly on the banks of rivers. The infestation has been reported throughout Maharashtra and the magnitude of problem has been wide spread over the past years. Although endemic to the sugarcane tract, it has been extending its potential range in the recent years apparently due to monoculture and minimum vertical diversity. Among the white grubs, *Leucopholis lepidophora* (Blanchard) has recently been reported to threat to sugarcane, paddy, and groundnut cultivation in the western Maharashtra especially in Kolhapur region (Mane 2011) [5]. In heavily infested sugarcane field, losses to the extent of 100 percent was also observed (Patil and Hapse, 1991) [7].

Pest management strategy depends primarily on the use of highly poisonous chemicals pesticides which is practically difficult and associated with high cost, environmental pollution and pesticide residue. Using high dose of chemical insecticides have lots of limitations as the infestation more pronounce on the banks of river. And higher dose of insecticides causes fear of development of resistance. Hence, there is a need for the development of alternate ecofriendly and economically feasible strategy for the control of white grub. Biological control may be promising in the management of white grub. The entomopathogenic fungi, entomopathogenic nematodes against white grub, *Holotrichia serrata*, (Supekar and Mohite, 2013) [9], *Leucopholis lepidophora*, (Bharti and Mohite, 2015) [3] and *Phyllognathus Dionysius*, (Rathour *et al*., 2015) [8] reported high infection rates in the grub population. Therefore keeping this in view, present investigations were taken-up to understand the compatibility of *Metarhizium anisopliae* and *Heterorhabditis indica* with imidacloprid to control white grub, *Leucopholis lepidophora* under laboratory experiment.

2. Materials and methods

Investigations under laboratory studies were carried out to study the bioefficacy of different combinations of entomopathogenic nematodes, *H. indica*, entomopathogenic fungi, *M. anisopliae* and chemical insecticide, Imidacloprid against white grub, *L. lepidophora* in the laboratory of Entomology Section, College of Agriculture, Kolhapur.

2.1 Collection and Maintenance of *Leucopholis lepidophora* grubs

For conducting experiment uninterrupted supply of grubs was essential, hence field survey was conducted around endemic pockets of Kolhapur region to collect grubs of *L. lepidophora.* Immediately after the collection of grubs, they were placed in sterile plastic vials with soil from the same collection site for transporting them to laboratory. Only one larva was put into each vial to avoid cannibalism and potato pieces and sugarcane roots were added to each vial as a diet.

2.2 Method of testing

The suspension of Imidacloprid, *M. anisopliae* and *H. indica*, individually and in given combinations prepared according to the required quantity as per recomonded dose. The laboratory bioassay studies were under taken as per the method suggested by Aldomario *et al*., (2010) [2] with slight modification. The larvae were treated with formulated suspension and then treated larvae were transferred separately into a sterile vial and pieces of sugarcane or potato provided as food for grubs. A set of ten larvae with three replications of each treatment and a control treated with distilled water was maintained. The sugarcane or potato pieces were changed every day. The grubs were kept at 25±2^{0}c and 65±5 percent R.H. till death.

2.3 Materials required

EPN, *H. indica* strain NBAII-101 used in present study were obtained from NBAII, Bangalore, the EPF, *M. anisopliae* available from Entomology Section, College of Agriculture, Kolhapur and chemical insecticide, Imidacloprid purchase from local market.

2.4 Observations

The grub mortality was recorded after the treatment at an interval of 7, 10 and 15 days after treatment. The exact time required to kill the test larva was strictly recorded.

2.5 Statistical analysis:

Data on percent mortality were corrected by Abbott's formula (Abbott, 1925) as follows.

$$\text{Corrected mortality} = \frac{T-C}{100-C} \times 100$$

Where,
T = Percent mortality in treatment.
C = Percent mortality in control.
Data on corrected grub mortality in laboratory and pot culture experiments were subjected to arcsine transformations, these transformed data was subjected to analysis of variance.

3. Results and Discussion

Seven different formulations of *M. anisopliae*, *H. indica* and imidacloprid individually and in combinations were tested for determining their combine bioefficacy against grubs of *L. lepidophora* (Blanchard). The dead grubs were observed on, seventh tenth and fiftinth day interval after the treatment. The treatment with *M. anisopliae* + *H. indica* + Imidacloprid cosistantly effective and found to be significantly superiorover all other treatments.

3.1 Efficacy of entomopathogens and insecticide individually and in combinations at 7 DAT

The mortality of the grubs ranged from 13 to 73.33 percent when the observations are taken at 7 DAT. The treatment with *M. anisopliae* + *H. indica* + Imidacloprid at the dose of 75 gm + 75 gm + 8 ml per fifteen litre recorded highest 73.33 percent mortality and found to be significantly superior over all other treatments. The treatment with imidacloprid 17.8 SL was next in order of efficacy recorded 57.33 percent mortality. In untreated control 13 percent mortality was recorded (Table 1).

3.2 Efficacy of entomopathogens and insecticide individually and in combinations at 10 DAT

At 10 DAT the treatment with of *M. anisopliae* + *H. indica* + Imidacloprid at the dose of 75 gm + 75 gm + 8 ml per fifteen liter found to be significantly superior over all other treatment and recorded 82.66 percent mortality as compared to 16.66 percent mortality in untreated control. The treatment with imidacloprid 17.8 SL was next in order of efficacy where 60.00 percent mortality was recorded (Table 1).

3.3 Efficacy of entomopathogens and insecticide individually and in combinations at 15 DAT

The treatment with of *M. anisopliae* + *H. indica* + Imidacloprid at the dose of 75 gm + 75 gm + 8 ml per fifteen litre was found to be constantly superior over all other treatment and recorded 87.33 percent mortality as against 20.00 percent mortality in untreated control. The treatment with imidacloprid 17.8 SL was next in order of efficacy where 62.66 percent mortality was recorded (Table 1).

The overall performance of the treatment with *M. anisopliae* + *H. indica* + Imidacloprid was most effective recording 73.33, 82.66 and 87.33 percent percent grub mortality when the observations were reorded at 7, 10 and 15 DAT and it was found to be significantly superior over all other treatments.The treatment with Imidacloprid 17.8 SL next in order of efficacy causing mortality of grub at 7, 10 and 15 DAT.

The compatibility of *H. indica* and insecticides has already been reported by the Negrisoli *et al.* (2010) [6]. In their experiment to study the combine effect of insecticide + EPN. They found that *H. indica* is compatible with pyrathrin and diflubenzuron. Koppenhofer *et al.*, (2000) [4] stated that the sinergestic interaction between imidacloprid + *H. indica* may be due to the sluggishness of imidacloprid treated white grub that facilitate host attachment and the subsequent penetration of *H. indica* and further concluded that Imidacloprid + *H. indica* combination may also applicable to other cropping system. However, not much work has been reported on the synergestic effect of *M. anisopliae* + *H. indica* + Imidacloprid from the literature reviewed.

Table 1: Evaluation of insecticides against grubs of *Leucopholis lepidophora* in Laboratory experiment:

Tr. No.	Treatment	Dose per 15 liter (gm/ml)	Mean percent mortality of grub		
			7 DAT	10 DAT	15 DAT
1	Imidacloprid (17.8 SL)	10	57.33 (49.22)	60.00 (50.77)	62.66 (52.35)
2	*Metarhizium anisopliae*	100	53.33 (46.91)	54.33 (47.49)	55.00 (48.84)
3	*H. indica*	100	42.33 (40.59)	46.00 (42.70)	48.00 (43.85)
4	*Metarhizium anisopliae* + Imidacloprid	75 + 8	49.66 (44.81)	53.33 (46.91)	54.66 (47.68)
5	*H. indica* + Imidacloprid	75 + 8	40.66 (39.61)	43.33 (41.16)	45.00 (42.13)
6	*Metarhizium anisopliae* + *H. indica*	75+ 75	47.00 (43.28)	49.33 (44.62)	50.66 (45.38)
7	*Metarhizium anisopliae* + *H. indica* + Imidacloprid	75 + 75 + 8	73.33 (58.93)	82.66 (65.43)	87.33 (69.22)
8	Untreted control	-	13.00 (21.02)	16.66 (24.05)	20.00 (26.85)
	S. Em.±		0.92	0.82	0.83
	CD (p= 0.05)		2.82	2.51	2.54

Note: figures in the parenthesis are arcsine transformed values

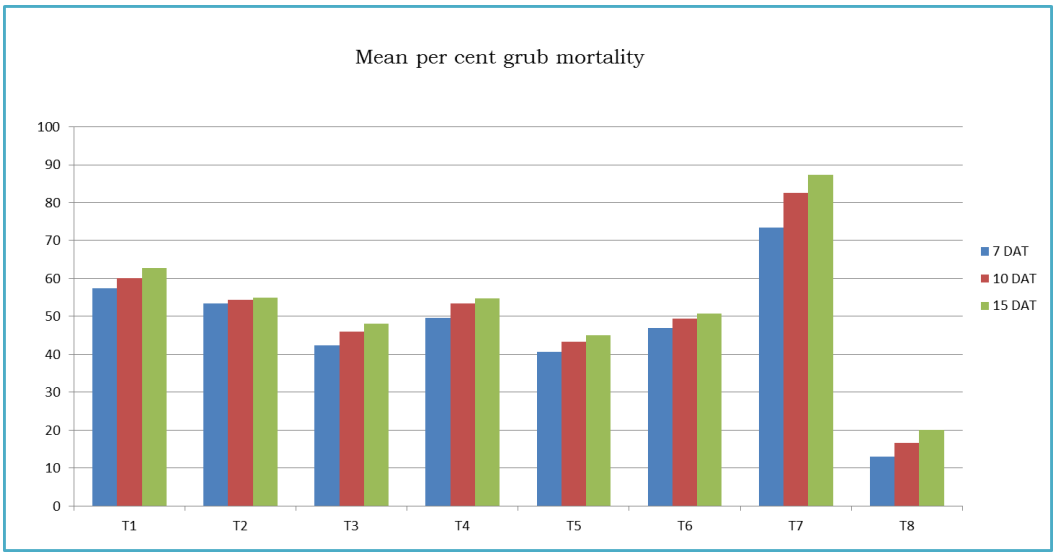

Fig 1: Bioefficacy of different biocontrol agents and insecticide individually and in combinations under laboratory bioassay studies against white grub.

4. Conclusion

The treatment with *M. anisopliae* + *H. indica* + Imidacloprid at the dose of 75 gm + 75 gm + 8 ml per fifteen liter was found promising against white grub, *L. Lepidophora* infesting sugarcane under Laboratory bioassay studies. The treatment of Imidacloprid is found to be next in order of efficacy after treatment with *M. anisopliae* + *H. indica* + Imidacloprid.

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.

Combined utilization of selective insecticides in association with entomopathogenes 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 EPNs, EPFs and insecticides combinations. So this finding will be useful for other workers for further studies.

5. Acknowledgment

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6. References

1. Abbott WS. A method of computing effectiveness of an insecticide. Journal of Economic Entomology. 1925; 18:265-267.
2. Aldomarino SN, Mauro SG, Carla RC, Barbosa N, Daniel B, Alexandre DS. Efficacy of Entomopathogenic nematodes (Nematoda: Rhabditida) and insecticide mixture to control *Spodoptera frugiperda* (Smith, 1797) (Lepidoptera: Noctuidae) in corn crops. Crop Protection, 2010; 29:677-683.
3. Bharti S, Mohite PB. Utilisation of Entomopathogenic nematodes against White grub, *Leucopholis lepidophora* (Blanchard) infesting Sugarcane. Reaserch Paper. Journal of Global Bioscience, 2015; 4(5):2437-2440.
4. Koppenhofer AM, Brown IM, Gaugler R, Grewal PS, Kaya HK, Klein MG. Synergism of Entomopathogenic nematodes and imidacloprid against white grubs: Greenhouse and field evaluation. Biological Control, 2000; 19:245-251.

5. Mane PB. Studies on utilisation of Entomopathogenic fungi against White grub, *Leucopholis lepidophora* (Blanchard) infesting Sugarcane. M.Sc. Thesis. Mahatma Phule Krishi Vidyapeeth, Rahuri, 2011.
6. Negrisoli SA, Mauro SG, Negrisoli RC. Compatibility of Entomopathogenic nematodes (Nematoda: Rhabdita) with registered insecticides for *Spodoptera frugiperda* (Smith, 1797) (Lepidoptera: Noctuidae) under laboratory conditions. Crop Protection. 2010; 29:545-549.
7. Patil AS, Hapse DG. Biology and chemical control of *Leucopholis lepidophora* (Coleoptera: Scarabidae) in sugarcane. Advance in management and conservation of soil fauna (Edt. Veersh *et al*.,) Oxford and IBH Pub. 1991, 209-215.
8. Rathour B, Mohite PB, Gite RB. Bioefficacy of Entomopathogenic nematode, *Steinernema carpocapsae* against White grub, *Phyllognathus Dionysius* Feb. under laboratory condition. Reaserch Paper. Journal of Global Bioscience, 2015; 4(8):3165-3170.
9. Supekar S, Mohite PB. Biocontrol Potential of Entomopathogenic Nematodes *Heterorhabditis* and *Steinernema* against Second Instar Grub of White grub, *Holotrichia serrata* Fab. Infesting Sugarcane. Journal of Global Bioscience, ISSN 2320-1355. 2013; 2:2437-2439.