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Biocontrol Potential of Entomopathogenic Nematodes *Heterorhabditis* and *Steinernema* Against Second Instar Grub of White grub, *Leucopholis lepidophora* (Blanchard)

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Abstract: ***The effectiveness of two entomopathogenic nematodes (EPN) viz., Heterorhabditis indica strain NBAII-104 and Steinernema carpocapsae strain NBAII-04 against second instar grubs of L. lepidophora (Blanchard) under pot culture experiment. At a concentration of 450 IJs ml^{-1}, H. indica recorded highest mortality (87.60%) at 15 DAT. While, S.carpocapsae recorded 54.05 per cent grub mortality at 450 IJs ml^{-1} at 15 DAT. We concluded that the NBAII-104 strain of H. indica was most virulent against second instar grubs of L. lepidophora.***

Keywords: entomopathogenic nematodes, *H. indica, S. carpocapsae*, white grub, *L. lepidophora*, second instar larva

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 in the world. Sugarcane contributes nearly 70 per cent to the world's total sugar production. It is considered as a cash crop and plays the key role in the economy of the Maharashtra. Globally, sugarcane is cultivated over an area of 25.4 million hectares with a production of 1794.3 million tones and productivity of 70.5 tones/ha (FAO, 2011). India ranks second in both area and production of sugarcane next to Brazil (FAO, 2010). Up till now 200 insect pests have been reported causing serious damage to sugarcane crop (David *et al*., 1986). Among them white grub has became the most important polyphagous pest causing serious damage to sugarcane since 1960 (Mohalkar *et al*., 1977). Among the white grubs, *Leucopholis lepidophora* (Blanchard) has recently been reported to thread to sugarcane, paddy, and ground nut cultivation in the western Maharastra especially in Kolhapur region (Patil and Hapse, 1986). Synthetic chemical insecticides used for pest management poses numerous problems *viz*., insecticide resistance, food hazards, ground water contamination and destruction of natural enemies. These disadvantages serve as a strong impetus for the development of alternative insect control measures. Attention to biological control agents were increasing recent years.

Entomopathogenic nematodes in the families Steinernematidae and Heterorhabiditidae are potential biocontrol agents (Gaugler, 1988). Most biocontrol agents take days or weeks to kill the pest but entomopathogenic nematodes with their symbiotic bacteria kills the pest within 24-48 h. Inexpensive, mass production, high virulence and broad host range are the important attributes whichextends over the other bio-control agents. Therefore the present study aims to investigate the bio-control potential of *Heterorhabditis indica* strain NBAII-104 and *Steinernema carpocapsae* strain NBAII-04 against *L. lepidophora.*

2. Material and Methods

Nematode culture: Commercially available entomopathogenic nematodes *Heterorhabditis indica* strain NBAII-104 and *Steinernema carpocapsae* strain NBAII-04 were procured from National Bureau of Agricultural Important Insects (NABAII), Bangalore.

Insect culture: The grubs of *L. lepidophora* of the second instar grub stage were collected from infested sugarcane farmers field from riverbank area and endemic pockets of Kolhapur district. Immediately after collection of the grubs, they were placed in sterile plastic vials (4 cm × 3.5 cm) with soil from the same collection site for transporting them to laboratory. A single larva was put into each. Potato pieces and sugarcane roots disinfected for 10 min in sodium hypochloride solution (0.5%) were placed to each vial as a diet. The larval culture maintained at 25±2^{0}c and 65±5 per cent R.H were used for pot culture.

Greenhouse Experiment

In pot culture experiments *H. indica* and *S. carpocapsae* were evaluated against second instar larvae at dosage of 100, 250, 350 and 450 IJs ml^{-1} prepared by serial dilution. Soil and FYM were mixed at 2:1 proportion. Before the addition of nematode suspension, the FYM was solarized. For solarization, the FYM was moistened and then spread into a 10 cm thick layer, which was covered with a polythene sheet, all sides of the sheet were covered with soil to make it leak proof. The solarization was done for 3 weeks and the temperature was recorded daily using soil thermometer. Grubs kept in FYM with sugarcane seedlings in earthen pots.

The experiment was carried out in Completely Randomized design with four replication and five treatments. Four treatments for each nematode were carried out whereas in the fifth treatment the pot was treated as control. Ten grubs of uniform size were for used each treatment.

The grub mortality was assessed at interval of 5, 10 and 15 days after treatment (DAT). The cause of larval death was confirmed by change in body colour of the cadaver which being evident due to the presence of symbiotic bacteria. Percentage larva mortalities were corrected by Abbott's formula (Abbott, 1925) and arcsine transformed before subjecting to analysis of variance (ANOVA).

3. Results and Discussion

The experiment conducted under greenhouse conditions revealed that *H. indica* was more effective than *S. carpocapsae* against second instar grubs of *L. lepidophora.* Studies conducted under pot culture experiment revealed that the treatment of *H. indica* @ 450 IJ ml^{-1} were most effective in controlling second instar grub of *L. lepidophora* (Blanchard). Treatment of *H. indica* recorded 45.33 to 87.60 per cent grub mortality at 15 DAT. While, *S. carpocapsae* recorded 26.61 to 54.05 per cent grub mortality.

Table 1: Evaluation of *H. indica* against second instar grubs of *L. lepidophora* in pot culture experiment

Treatment No	Dose IJs ml^{-1}	per cent grub mortality DAT*		
		5DAT	10DAT	15DAT
T_1	100	13.33 (21.39)**	25.00 (29.97)	45.33 (42.31)
T_2	250	15.00 (22.75)	27.66 (31.72)	57.50 (49.31)
T_3	350	20.33 (26.79)	33.66 (35.46)	70.83 (57.31)
T_4	450	26.00 (30.64)	38.00 (38.05)	87.60 (69.42)
T_5	Untreated control	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	SE±	0.72	0.68	0.77
	CD at 5%	2.32	2.19	2.48

*DAT: Days after treatment
**Figures in parentheses are arcsin transformed values

Table 2: Evaluation of *S. carpocapsae* against second instar grubs of *L. lepidophora* in pot culture experiment

Treatment No	Dose IJs ml^{-1}	per cent grub mortality DAT*		
		5DAT	10DAT	15DAT
T_1	100	9.66 (17.75)**	13.33 (21.39)	26.61 (31.03)
T_2	250	11.33 (19.59)	17.77 (24.92)	33.94 (35.62)
T_3	350	16.50 (23.95)	21.18 (27.37)	40.72 (39.64)
T_4	450	19.94 (26.52)	25.22 (30.13)	54.05 (47.32)
T_5	Untreated control	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	SE±	0.80	0.69	0.71
	CD at 5%	2.58	2.21	2.28

*DAT: Days after treatment
**Figures in parentheses are arcsin transformed values

The present findings were in line with that of observed by Chandel *et al*., (2005) who carried out pot culture experiment with *H. indica* against second instar grubs of *B. coriacaea* showed up to 100 per cent mortality. *Heterorhabditis* sp. a commercial preparation was evaluated against *Leucopholis burmeisteri* under laboratory conditions revealed that the mortality to the extent of 33.3 per cent when 240 IJs/pot was applied (Anonymous, 1996). Shelter *et al*., (1988) reported that 73 per cent control of Japanese beetle larvae with *H. bacteriophora* in turf grass compared with 55 per cent control by *S. carpocapsae*. Similarly, Glazer *et al*., (2007) also reported 70 to 90 per cent reduction in emergence of the beetles by *Heterorhabditis* sp. at highest concentration (100 IJs ml^{-1}) under green house condition.

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