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Mouneshwari R Kammar
ICAR-Krishi Vigyan Kendra, Bagalkote, University of Agricultural Sciences, Dharwad, Karnataka, India

Arjun R Sulagitti
ICAR-Krishi Vigyan Kendra, Bagalkote, University of Agricultural Sciences, Dharwad, Karnataka, India

Sudha S
ICAR-Krishi Vigyan Kendra, Bagalkote, University of Agricultural Sciences, Dharwad, Karnataka, India

Corresponding Author:
Mouneshwari R Kammar
ICAR-Krishi Vigyan Kendra, Bagalkote, University of Agricultural Sciences, Dharwad, Karnataka, India

Performance of biopesticides for management of white grub *Holotrichia serrata* in sugarcane

Mouneshwari R Kammar, Arjun R Sulagitti and Sudha S

Abstract
On Farm Testing was conducted to assess the performance of white grub menace in sugarcane by ICAR KVK Bagalkote during 2019-20 and 2020-21 using two bio-pesticides *i.e.*, *Metarhizium anisopliae* @ 5 kg/ac a technology recommended by UAS Dharwad and Entomopathogenic Nematodes (EPN) *Heterorhabditis indica* @ 3-4 kg/ac technology recommended by NBAIR, Bengaluru. Among these two treatments, soil application of *M. anisopliae* (4 x 10^9 cfu @ 5 kg/ha) at the time of planting was significantly effective in reducing white grub population within 30th day of application and recorded highest cane yield of 107.52 t/ha when compared with application of EPN (*H. indica*) based formulation (102.09 t/ha), while treatment with chemical control measure with chlorpyriphos 20 EC (10 ml/lit of water for drenching) has given 92 t/ha yield in sugarcane. The results proved that, application of *M.* anisopliae is best when compared to conventional method of white grub control and application of EPN (*H. indica*).

Keywords: White grub, *M. anisopliae*, EPN (*H. indica*), sugarcane

Introduction
Karnataka is a major producer of sugar after Maharashtra and Uttar Pradesh as per the statistics of 2022. In Karnataka, Belagavi and Bagalkote stand first and second respectively in the production and productivity of sugarcane and sugar. In Bagalkote, sugarcane is the major commercial crop with more than 1 lakh ha area and 12 active cane crushing factories. However, there are problems hindering the production of sugarcane including white grub, striga, arrowing leading to low yield and sugar recovery.

Some pests of sugarcane like sugarcane borers, sugarcane woolly aphids, sugarcane whitefly, scale insects and white grub are very regular pests throughout the year but among all the pests, white grub menace is severe in sugarcane growing belts of northern Karnataka (Kambrekar *et al.* 2015) [5]. The white grub in many crops causes losses to the extent of 40-80 per cent (Prasad *et al.* 1959) [14]. Among the various species of white grubs, *Holotrichia serrata* (Fabricius) has emerged as a key species by causing 30 to 40 per cent loss in sugarcane alone under irrigated ecosystem of northern Karnataka (Anon, 2013) [1].

Besides sugarcane other cultivated crops such as groundnut, onion, cereals, millets, pulses, vegetables and plantation crops were also attacked by white grub (David *et al*, 1986) [4]. The beetles have three larval instars with the third instar causing the greatest damage. These larvae are generally found immediately beneath cane stools in infested fields. Normally, only cane roots are eaten by the grubs, although, in some cases the base of the cane stalks is also eaten. Infested cane shows signs of water stress and lodging occurs in severely infested cane, and the crop may be deteriorating to such a degree that harvesting becomes uneconomic. Several techniques have been adopted for the management of white grubs including cultural, mechanical, biological, chemical and integrated methods suggested by various workers (Sahayaraj and Borgio, 2009; Srikanth and Singaravelu, 2011) [16, 18]. About 90 genera and 700 species of fungi representing a large group of entomophthorales (*Metarhizium* spp., *Beauveria* spp., and *Verticillium* spp.) which are entomopathogenic have been reported. Among these, *M. anisopliae* is of greater importance in the management of white grubs. *M. anisopliae* can be effectively utilized as one of the components in the management of white grubs (Chroton, 2007) [3].

Among the most promising bio-pesticides of root pests are the soil-borne nematodes that are obligate parasites of arthropods, also known as EPN in the family's *Steinernematidae* and *Heterorhabditidae*. Several species of EPN are currently used as classical, conservational, and augmentative biological control agents.

However, the EPN (*H. indica*) fungus persists in soils over long time periods, thus ensuring a more durable effect. Sugarcane crop is infested by white grubs after the onset of the summer showers. The grubs are subterranean having complex life cycle and actively feed on living roots, therefore the control of this pest becomes difficult. Adult collection and insecticidal applications are the major tactics of management followed against all the white grub species (Veeresh, 1974 and Raodeo, *et al*., 1976) [21, 15]. Early damage was similar in appearance to that of drought damage, with an initial yellowing of the leaves and drooping of the inner spindle leaf and later it causes leaves senescence and finally the maturing stalks deteriorates. In extreme cases, the whole clumps roots were damaged and all the canes in the clump lodged on ground due to its own weight.

The damaged clumps can be easily pulled out of the ground and subsequently the grubs tunnel into them. Farmers find it difficult to manage because of the lack of control over the damages they cause. In general, the management strategies depends primarily on the use of chemicals pesticides for the management of white grub in sugarcane crop. Several tactics have been adopted for the management of white grubs including cultural, mechanical, biological and chemical suggested by various workers. But the effectiveness is not encouraging due to difficult in application of these methods in sugarcane, because of its dense and dropping canopy, labor scarcity for mechanical collection and grubs are in the soil. Hence, an on farm testing was undertaken in farmers' fields to assess the effectiveness of two biopesticides against white grub management in sugarcane.

Materials and Methods

On farm testing was implemented at Honnakatti village of Bagalkote taluk during 2019-20 and 2020-21 in the same field continuously with three treatments TO1 being farmers practices (chemical management with Chlorpyriphos), TO2 application of *M. Anis*opliae @ 5 kg/ac a technology recommended by UAS Dharwad and TO3 was application of EPN (*H. indica)* @ 3-4 kg/ac technology recommended by NBAIR, Bengaluru. The treatments were imposed during planting of sugarcane during the month of June/July. *M. anisopliae* was purchased from KVK Bagalkote and EPN (*H. indica)* in the name of Grub Nash was purchased from Khandelwal biofertilizers, Borgaon, Belagavi, Karnataka. The bio-pesticide *M. Anisopliae* and *EPN* (*H. indica*) with required dose (5 kg/acre) were prepared and multiplied in well decomposed farm yard manure of 500 kgs at the time of application for easy handling and applied near root zone during planting (June/July). The sugarcane varieties, CoM 265 and Co 86032 were selected for the treatments in one acre each along with check plot and all the recommended packages of practices were adopted except for white grub management. Observations on grub population/m^2 in the root zone were recorded at 30 days after imposing treatment and yield and economics were recorded after harvest of cane.

Results

The results presented in table 1 revealed that the lowest grub population was recorded (1.315/ sq. m) in the plot applied with *M. anisopliae* on 30th day after application followed by application of EPN (*H. indica),* (1.85/m2) as compared to untreated check 3.00/m2. Accordingly there was 16.77 per cent and 10.89 percent increase in yields of sugarcane in the treatment applied with *M. Anisopliae* and EPN (*H. indica)* over the farmers practice respectively.

Cost of cultivation of sugarcane was more in the farmers practice, may be because of high cost of chemicals used to apply for the management of white grub in sugarcane (Rs. 96659), followed by treatment with application of EPN (Rs. 90783) and treatment applied with *M. anisopliae* (Rs. 90367). This indicated that, the cost of cultivation was almost similar in treatments with application of bio-pesticides. Manisekaran *et al*., 2011 [10] reported that application of *M. anisopliae* against sugarcane white grub *Holotrichia serrata* at 4 x 10^9 conidia ha^{-1} was found effective and registered 92% reduction in grub population on 60th days after planting. The fungus based natural enemies have successfully applied in countries like Austria, New Zealand and Australia (Keller, *et al* 2000) [8]. Use of fungal pathogens with different formulations such as fungus colonized grain or spore suspension (Keller *et al*., 1997) [6] are in use.

Application of *M. anisopliae* was found to be profitable when compared to application of EPN and chemical management of white grub, may be due to the fact that, application of *M. anisopliae* suppresses the white grub pest drastically in a shorter period of time, its efficacy would be for longer period and multiplication would happen in the soil for a year, hence need not be applied frequently. While the chemical method for controlling the white grub has efficacy for a shorter for a period of time and though it kills the white grub immediately but it needs to be used frequently. Present findings are in line with studies conducted by Nagaraj *et al*. (2017) [12] who found that *M. anisopliae* when used with FYM was found effective in management of root grub as compared to application of chlorpyriphos 20 EC.

Table 1: Comparative performance of bio agents in management of white grub in sugarcane

Parameters	2019-20			2020-21			Pooled data		
	TO1	TO2	TO3	TO1	TO2	TO3	TO1	TO2	TO3
Yield(t/ha)	91.67	105.83	102.08	92.53	109.20	102.10	92	107.52	102.09
% increase in yield	-	15.60	11.47	-	17.94	10.31	-	16.77	10.89
Grub Population/m2	3.20	1.33	1.93	3.07	1.30	1.77	3	1.315	1.85
Cost of Cultivation (Rs./ha)	96292	91667	92292	97025	89067	89275	96659	90367	90783
Gross Income (Rs./ha)	220000	254000	245000	231250	272917	255208	225625	263459	250104
Net Income (Rs./ha)	123708	162333	152708	137558	183850	165933	130633	173092	159321
B:C ratio	2.28	2.77	2.65	2.47	3.04	2.86	2.00	2.905	2.755

TO1: Drenching with Chloropyriphos TO2: *M. Anisopliae* @ 5 kg/ac TO3: *H. indica* @ 3-4 kg/ac

The present findings are in line with observations on large scale field application of *M. anisopliae* @ 3.3 x 10 [13] conidia ha^{-1} against gray back cane grub in Australia. They have recorded 50-60 and 70-90 per cent reduction in grub

population in plant cane and next ratoon crop respectively (Samson *et al*., 1999) [17].

Further, application of *M. anisopliae* at higher dosage was as good in reducing root damage by *Lepidiota negatoria* in sugarcane as observed by Samson *et al.*, (1999) [17]. *M. anisopliae* and *B. bassiana* @ 5 x 10^9 conidia ha^{-1} was found effective in reducing grub population (Bhagat *et al*., 2003) [2]. Samuels *et al*., (1990) obtained higher cane yield by the application of *M. anisopliae* @ 1 x 10^9. Keller (1998) suggested that repeated application of the EPN (*H.indica*) fungal formulations enhance the pest control process and white grubs could be controlled in field situations in various crops, like *H. consanguinea* infesting potatoes were controlled by *M. anisopliae* (Kulye and Pokharkhar, 2009) [9]. Present findings are in conformity with Thamaraichelvi *et al*., (2010) [19] reported that the biopesticide *M. anisopliae* at the concentration of 8 x 10^9 conidia per ml found to be effective in controlling the population of white grub and also reported that yield and quality parameters recorded were higher in treated plots compared to control plots. Present finding is in conformity with Pal *et al*., (2009) [13] reported that the biopesticides *M. anisopliae* at the concentration of 8 x 10^9 conidia / ml found to be effective in controlling the population of white grub and also reported that yield and quality parameters recorded were higher in treated plots compared to control plots.

In conclusion the soil application of *M. anisopliae* (4 x 10^9) CFU @ 5 kg / ha at the time of planting was significantly effective in reducing white grub population, followed by application of EPN.

References

1. Anonymous. Key facts about India's sugar sector, The Indian sugar mills association. (www.indiastat.com); c2013.
2. Bhagat RM, Gupta RBL, Yadav CPS. Field evaluation of two entomopathogenic fungal formulations against white grubs in Himachal Pradesh. Indian Journal of Entomology. 2003;65:76-81.
3. Chroton P. Insect pest control by entomopathogenic fungi. Mycologia. 2007;16(2):23-27.
4. David H, Nandagopal V, Anantha Narayana K. Recent studies on the control of white grubs, Holotrichia serrata Blanch infesting sugarcane. J of Soil Biology and Ecobiology. 1986;6:117-127.
5. Kambrekar DN, Mallapur CP, Balikai RA, Giraddi RS. Integrated pest management in all the crops (Kannada). Uni. Agric. Sci., Dharwad (India). 2015;59:101-104.
6. Keller E, Brenner H. Control of white grubs by treating adults with the fungus *Beauveria brongniartii*. Biocontrol Science and Technology. 1997;7:105-116.
7. Keller S. Use of fungi for pest control in sustainable agriculture. Phyto protection. 1998;99:56-60.
8. Keller S, David-Henriet AI, Schweizer C. Melolontha melolontha control sites in the canton Thuragau. In: S. Keller (Ed.). Integrated control of soil pest subgroup "Melolontha" Proceedings of the meeting, IOBL, Switzerland, 19-21 October 1998. IOBC/wprs bulletin. Keller S, Schweizer C. 2000;23:73-78.
9. Kulye MS, Pokharkar DS. Evaluation of two species of entomopathogenic fungi against white grub, Holotrichia consanguinea infesting potato in Maharastra, India. Journal of Biological Control. 2009;23(1):1- 4.
10. Manisegaran S, Lakshmi M, Srimohanapriya V. Field evaluation of *Metarhizium anisopliae* (Metschnikoff) Sorokin against Holotrichia serrata (Blanch) in Sugarcane. Journal of Biopesticides. 2011;4(2):190-193
11. Mohi-ud-din S, Zaki FA, Munshi NA, Jan A, Sultan P. Evaluation of some entomopathogenic fungal isolates from Kashmir for the biocontrol of white grub infesting turf in golf course. Journal of Biological Control. 2006;20:45-49.
12. Nagaraj L, Guledagudda SS, Kambrekar DN. An economic impact of white grub infestation on sugarcane in Northern Karnataka. Journal of Entomology and Zoology Studies. 2017;5(3):18-23.
13. Pal, Ravindra, Gaje Singh, CS Prasad, Nawab Ali, Arvind Kumar, SS Dhaka. Field evaluation of bio agents against Chilo partellus in maize. Annals of Plant Protection Sciences. 2009;17:325-327.
14. Prasad SK, Thakur C. White grub (*Lechnosterna consanguinea*) Blanch: A new menace to sugarcane. Indian J. Entomol. 1959;21:184-189.
15. Raodeo AK, Deshapande SV, Deshapande AD, Puri SN, Bilapate. A large scale campaign for the control of white grub, *Holotrichia serrata* Farmers in Maharashtra state, PANS. 1976;4:223-228.
16. Sahayaraj K, Borgio JF. Distribution of *Metarhizium anisopliae* (Metsch.) Sorokin (Deuteromycotina: Hyphomycetes) in Tamil Nadu, India. Its biocontrol potential on *Dysdercus cingulatus* (Fab.) (Hemiptera: Pyrrhocoridae). Achieves of Phytopathology Plant Protection. 2009;42(5):424-435.
17. Samson PR, Milner RJ, Ballard GK, Hogorth DM. Development of Metarhizium as biopesticides for sugarcane pest management, current progress and future prospects; c1999. p. 156-163.
18. Srikanth J, Singaravelu B. White grub (Holotrichia serrata) as pest of sugarcane and its management, Technical Bulletin No 197, Sugarcane Breeding Institute, Coimbatore; c2011. p. 1-8.
19. Thamaraiselvi C, Richard Thilagaraj W, Kandasamy R. A laboratory and field efficacy of entomopathogenic fungi, *Beauveria brongniarti*, *Beauveria bassiana* and *Metarhizium anisopliae* in the control of sugarcane white grub (Holotrichia serrata). Green farming. 2010;1:85-87.
20. Thamaraiselvi C, Richard Thilagaraj W, Kandasamy R. A laboratory and field efficacy of entomopathogenic fungi, *Beauveria brongniarti*, *Beauveria bassiana* and *Metarhizium anisopliae* in the control of sugarcane white grub (*Holotrichia serrata*). Green farming. 2010;1:85-87.
21. Veeresh GK. Root grub control, campaign in Karnataka. White grubs Newsletter. 1974;1:17-18.