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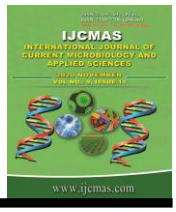

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Eco Friendly Approach for Management of White Grub *Holotrichia serrata* (Blanch) in Sugarcane

A. Thirumurugan[1], V. Ravichandran[2] and J. Jayakumar[3*]

[1]Sugarcane Research Station, Tamil Nadu Agricultural University, Melalathur, India
[2]Sugarcane Research Station, Tamil Nadu Agricultural University, Cuddalore, India
[3]Anbil Dharmalingam Agricultural College and Research Institute, Tamil Nadu Agricultural University, Trichy, India

**Corresponding author*

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A B S T R A C T

Field experiments were conducted in farmers holding during 2017-19 in view to develop ecofriendly strategies for the management of white grub in sugarcane crop. Various bio inoculants with required dose per hectare were prepared and multiplied in well decomposed farm yard manure of 50 kgs and mixed with 2500 kgs of decomposed FYM at the time of application for easy handling and applied near root zone during earthing up (during May/June). Among the various bio inoculants tested, soil application of *Metarhizium anisoplaie* (4 x 10^9 cfu @ 5 kg/ha at the time of earthing up would significantly effective in reducing white grub population (more than 80%) with in 45th day of application and recorded highest cane yield of 81.05 t/ha with commercial cane sugar of 12.61% which accounted for 37.28% higher yield than untreated control.

Introduction

Sugarcane is one of the important commercial crops in tropics and serves as the main source of sugar in the world. India is one of the leading countries in sugarcane cultivation with respect to area and production. During the period of last five decades the production, productivity and sugar recovery has also shown remarkable resilience in productivity growth rate. Today there is a growing concern about susceptibility of sugarcane production as the growth rate has stagnated and rather declining trend is seen in Tamil Nadu. Insect pest, among other factors, are considered as one of the main problems that reduce average productivity per unit area. Among the most important insect pest of sugarcane are scarabid beetles, which are commonly known as white grubs. White grubs have become increasingly difficult pests in Tamil Nadu during the last few years. Their infestation has been reported throughout the country and the magnitude of the problem has been widespread over the past years. Nearly 20 species of white grubs are reported to attack sugarcane in India. Of these, *Holotrichia serrata* (Blanch), *Anomala varicolor* (Gryll),

A. viridis (F), *Apogonia destructor* (Bos.), *Cyclocephala parallela* (Casey), *Dermolepidia pica* (Arrow), *Lepidiota stigma*, *Ligyrous subtropicious* (Blanch), *Leucopholis sp* (F), *Phyllophaga helleri* (Brsk) and *Schizonycha sp* have been reported to assume pest status in sugarcane growing regions (Yubak Dhoj, 2006). Besides sugarcane other cultivated crops such as groundnut, cereals, millets, pulses, vegetables and plantation crops were also attacked by white grub (David *et al*, 1986). 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. The yield loss due to white grubs was reported to be as high as 100 percent in Tamil Nadu (Thamarai Selvi *et al*, 2010). 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). About 90 genera and 700 species of fungi representing a large group of entomophthroals (*Metarhizium* spp., *Beauveria* spp., and *Verticillium* spp.) which are entomopathogenic have been reported. Among these, *Metarhizium* is of greater importance in the management of white grubs. *Metarhizium anisopliae* can be effectively utilized as one of the components in the management of white grubs (Mohi-ud-din *et al.*, 2006; Chroton, 2007).

Among the most promising bio-control agents of root pests are the soil-borne nematodes that are obligate parasites of arthropods, also known as entomopathogenic nematodes (EPN) in the families Steinernematidae and Heterorhabditidae. Several species of EPN are currently used as classical, conservational, and augmentative biological control agents. However, the entomopathogenic fungus persist 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). 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. In a majority of farming situation, control of these pests is having become increasingly difficult because of the lack of control over the damages they cause. In general, the management strategies depends primarily on the use of chemicals pesticides and the effective pesticides are not available for the management of white grub in sugarcane crops. 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 cane crops, because of its dense and dropping canopy, lack of adequate man power for mechanical collection and grubs are in the

soil. Hence, these experiments were laid out in farmers holding to assess the effectiveness of various bio inoculants against white grub in sugarcane cultivation.

Materials and Methods

Field experiments were carried out at Enthal village in M/s Dharani sugars Ltd, Polur command area and at Andiyappanur village in M/s. Tiruppattur co-operative sugar mill Ltd, Kethandapatti command area during 2017-19. The sugarcane varieties, CoC 24 and Co 86032 were rationed during last week of February with plot size of 6m x 5m was selected and all the recommended packages of practices were adopted except for white grub management.

There were five treatments along with untreated check as listed in table 1 were replicated thrice in a randomized block design. The bio inoculants with required dose per hectare were prepared and multiplied in well decomposed farm yard manure of 50 kgs, then multiplied in 500 kgs and mixed with 2500 kgs of well decomposed farm yard manure at the time of application for easy handling and applied near root zone during earthing up (during May / June). Observations on the number of white grubs per meter row in the root zone were recorded a day before and 15, 30 and 45 days after treatment. The data on the number of grubs were subjected to statistically analysed as per Gomez and Gomez, (1984).

Results and Discussion

The results presented in table 1 revealed that the highest (48.46%) grub population reduction was recorded *Metarhizium anisopliae* on 15^{th} day after application followed by *Beauvernia brongniarti* (30.27%) as compared to untreated check. On 30 days after application, *M. anisopliae* and *B. brongniarti* were significantly effective in reducing white grub population to the tune of 78.16% and 46.86% respectively as compared to untreated on 45^{th} and 60^{th} day also. Yield parameter *viz*., number of millable cane, cane yield and Commercial Cane Sugar% (CCS) were recorded at the time of harvest and presented in the table 2.

The treatment *M. anisopliae* applied plot recorded the highest cane yield of 81.05 t/ha with CCS of 12.61% which accounted for 37.28% higher yield than untreated control followed by *B. brongniarti* which recorded the cane yield of 75.39 t/ha with CCS of 12.65% which recorded 27.69% higher yield than untreated control. Manisekaran *et al.*, 2011 reported that application of *M. anisopliae* against sugarcane white grub *Holotrichia serrata* (Blanch) at 4 x 10^9 conidia ha^{-1} was found effective and registered 92% reduction in grub population on 60^{th} days after planting.

The fungus based natural enemies have successfully applied in countries like Austria, New Zealand and Australia (Keller, *et al* 2000). Use of fungal pathogens with different formulations such as fungus colonized grain or spore suspension (Keller *et al.*, 1997) are in use.

The present finding is in line with observation 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). *Metarhizium anisopliae* and *B. bassiana* @ 5 x 10^8 conidia ha^{-1} was found effective in reducing fruit fly population (Purwar 2013).

Table.1 Effect of eco-friendly treatments on white grub population

Treatments	Dose / ha	Percentage of reduction over pretreatment				Percentage of reduction over untreated control			
		15 DAT	30 DAT	45 DAT	60 DAT	15 DAT	30 DAT	45 DAT	60 DAT
T_1- ***Mearhizium anisopliae***	4 x 10^9 cfu 5 kg	41.37	75.90	86.25	79.32	48.46	78.16	87.54	80.64
T_2- ***Beauveria brongniarti***	4 x 10^9 cfu 5 kg	23.33	43.30	53.33	70.00	30.27	46.86	56.23	70.96
T_3- ***B. bassiana***	4 x 10^9 cfu 5 kg	-	14.26	24.97	32.15	12.09	25.02	34.40	38.72
T_4- EPN (***Heterorhabditis indica)***	8 x 10^9 nematodes / ha	-	20.68	37.95	44.88	6.09	28.12	48.77	48.40
T_5- EPN (***H. glasserie)***	8 x 10^9 nematodes / ha	3.52	31.02	34.54	34.54	15.18	37.49	40.67	38.72
T_6- Untreated control		-	-	-	-	-	-	-	-
CD		-	-	-	-	7.36	8.19	7.79	6.36

EPN- Entomopathogenic nematodes

Table.2 Effect of eco-friendly treatments on yield parameters of sugarcane

Treatments	NMC (000/ha)	Cane yield (t/ha)	Percentage increase over control	CCS (%)
T_1- ***Mearhizium anisopliae***	88.33	81.05	37.28	12.61
T_2- ***Beauveria brongniarti***	82.04	75.39	27.69	12.65
T_3- ***B. bassiana***	73.26	65.15	10.35	12.66
T_4- EPN (***Heterorhabditis indica)***	68.07	62.50	5.86	12.72
T_5- EPN (***H. glasserie)***	69.88	62.15	5.27	12.78
T_6- Untreated control	65.31	59.04	-	12.71
CD	6.13	3.24	-	NS

EPN- Entomopathogenic nematodes; NMC- Number of millable cane; CCS – Commercial cane sugar

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). *M. anisopliae* and *B. bassiana* @ 5 x 10^8 conidia ha^{-1} was found effective in reducing grub population (Bhagat *et al.,* 2003). 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 entomopathogenic 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). Present findings are in conformity with Thamaraichelvi *et al.,* (2010) 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) reported that the biopesticide *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 earthing up would significantly effective in reducing white grub population (more than 80%) with in 45th day of application and recorded highest cane yield of 81.05 t/ha with CCS of 12.61% which accounted for 37.28% higher yield than untreated control.

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References

Bhagat, R.M., Gupta, R.B. L. and Yadav C.P.S. 2003. Field evaluation of two entomopathogenic fungal formulations against white grubs in Himachal Pradesh. Indian Journal of Entomology, 65: 76-81.

Chroton, P. 2007. Insect pest control by entomopathogenic fungi. *Mycologia*, 16 (2): 23-27.

David, H., Nandagopal, V. and Anantha Narayana, K. 1986. Recent studies on the control of white grubs, *Holotrichia serrata* Blanch infesting sugarcane. Journal of Soil Biology and Ecobiology, 6: 117-127.

Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research, 2nd edition. John Wiley and Sons, New York, 680 PP.

Keller, S. 1998. Use of fungi for pest control in sustainable agriculture. Phytoprotection, 99:56-60.

Keller, S., David-Henriet, A.I. and Schweizer, C. 2000. *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, 23: 73-78.

Keller, S., Schweizer, C., Keller, E. and Brenner, H. 1997. Control of white grubs by treating adults with the fungus *Beauveria brongniartii*. Biocontrol Science and Technology, 7: 105-116.

Kulye, M.S. and Pokharkar, D.S. 2009. Evaluation of two species of entomopathogenic fungi against white grub, *Holotrichia consanguinea* infesting potato in Maharastra, India. Journal of Biological Control, 23(1): 1-4.

Manisegaran, S., Lakshmi, M. and Srimohanapriya, V. 2011. Field evaluation of *Metarhizium anisopliae* (Metschnikoff) Sorokin against *Holotrichia serrata* (Blanch) in Sugarcane. Journal of Biopesticides, 4(2): 190-193.

Mohi-ud-din, S., Zaki, F.A., Munshi, N.A., Jan, A. and Sultan, P. 2006. Evaluation of some entomopathogenic fungal isolates from Kashmir for the biocontrol of white grub infesting turf in golf course. Journal of Biological Control, 20: 45-49.

Pal, Ravindra, Gaje Singh, C.S. Prasad, Nawab Ali, Arvind Kumar and S.S. Dhaka. 2009. Field evaluation of bio agents against *Chilo partellus* in maize. Annals of Plant Protection Sciences, 17: 325-327.

Purwar, J.P. 2013. Bio-efficacy of entomopathogenic fungi against fruit fly infesting pear in Uttarakhand. Annals of Plant Protection Sciences, 21: 233-236.

Raodeo, A.K., Deshapande, S.V. Deshapande, A.D. Puri, S.N and Bilapate 1976. A large scale campaign for the control of white grub, *Holotrichia serrata* Farmers

in Maharashtra state, PANS.4: 223-228.

Sahayaraj, K. and Borgio, J. F. 2009. Distribution of *Metarhizium anisopliae* (Metsch.) Sorokin (Deuteromycotina: Hyphomycetes) in Tamil Nadu, India. Its biocontrol potential on *Dysdercus cingulatus* (Fab.) (Hemiptera: Pyrrhocoridae). Archieves of Phytopathology Plant Protection, 42 (5): 424-435.

Samson, P.R., Milner, R.J., Ballard, G.K. and Hogorth, D.M. 1999. Development of *Metarhizium* as biopesticides for sugarcane pest management, current progress and future prospects, 156-163 PP.

Samules, K.D.Z., Dinnock, D.E. and Bull, R.M. 1990. Scarabaeid larvae control in sugarcane using *Metarhizium anisopliae* Sorokin. Journal of Invertebrate Pathology, 55: 135-137.

Srikanth, J. and Singaravelu, B. 2011. White grub (*Holotrichia serrata)* as pest of sugarcane and its management., Technical Bulletin No 197 pp 1-8, Sugarcane Breeding Institute, Coimbatore

Thamaraiselvi, C., Richard Thilagaraj, W. and Kandasamy, R. 2010. 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, 1: 85-87.

Veeresh, G.K. 1974. Root grub control, campaign in Karnataka. White grubs Newsletter 1: 17-18.

Yubak Dhoj, G.C. 2006. White grubs (Coleoptera: Scarabaeidae) associated with Nepalese agriculture and their control with the indigenous entomopathogenic fungus *Metarhizium anisopliae* (Metsch.) Sorokin dissertation, 1-282 pp.

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