

RESEARCH AND DEVELOPMENTAL EFFORTS TO PREVENT THE DAMAGE CAUSED BY HOLOTRACHIA: A REVIEW

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ABSTRACT

The most destructive and widely distributed species of white grub in India are *Holotrachia consanguinea* and *Holotrachia serrata*. Several techniques have been used till date to determine the occurrence, culture and destruction of the grubs. As it causes 40-80% damage of the agricultural crop therefore different techniques from the past are being used to control the grubs among which bio-control agent (*Metarhizium anisopliae*) and EPNs are most common. With the advancement of time scientists have developed newer technologies for the control of grubs among which WSN is one of the most reliable techniques for monitoring the grub positions. Nowadays biocontrol agents like *Heterorhabditis indica* and *Steinernema abbasi* are used which proves to be more profitable for the agricultural sector.

KEYWORDS: Polyphagous, Metamorphosis, *Metarhizium anisopliae*, Imidachloprid, EPN, WSN

INTRODUCTION

White Grub (*Holotrachia consanguinea*) belongs to the second largest family Scarabaeidae and order Coleoptera. The pest is polyphagous in nature and has a wide range of hosts including but not limited to soybean, sugarcane, ground nut and corn. Both the voracity and polyphagous nature has contributed to the justified infamous image of the pest, it being responsible for sizeable yield losses all over the globe. The grub feeds on the soft root, nodules and girdles the primary roots causes wilting. The crops with tap root system like Ground nut are extremely prone to loss especially in the early stages

whereas the crops with fibrous root systems like Pearl Millet can withstand a substantial amount of infestation.(Paul, 1997)

LIFE CYCLE

H. consanguinea completes its life cycle in a year. It shows complete metamorphosis with life stages consisting of Adult, egg, grub and pupae (Figure 1). Adults come out from their hide out with the first rain in the month of May-June. The adults mate in the evening and, at dawn females return to the ground to deposit 15 to 20 eggs. After 7-10 days larvae hatch out from the egg and start feeding on the roots of the host plant. Larva becomes fully mature in about 8-10 weeks. Pupation takes place inside the soil at a depth of about 30-150 cm. Pupa stage lasts

for about a month. Adults show attraction towards the light and hence become more active at night. (Potter and Potter)



Fig. 1: Larva of white Grub

SIGNIFICANCE

White Grubs are wreaking havoc on a global level. It is the national pest of India (Yadava and Vijayaverjia, 1994) with the major hotspots in states like south Rajasthan, Uttarakhand, Himachal Pradesh, Maharashtra and Karnataka. It is a voracious pest which if left unchecked

accounts for 40-80% loss in yield causing loss in millions annually (Prasad and Thakur, 1959). The peculiar nature of damage destroys the vascular system of plants resulting in the irreversible loss of the entire plant which impacts the production on a large scale. The severity of the loss can be inferred from the bar graph in Figure 2.

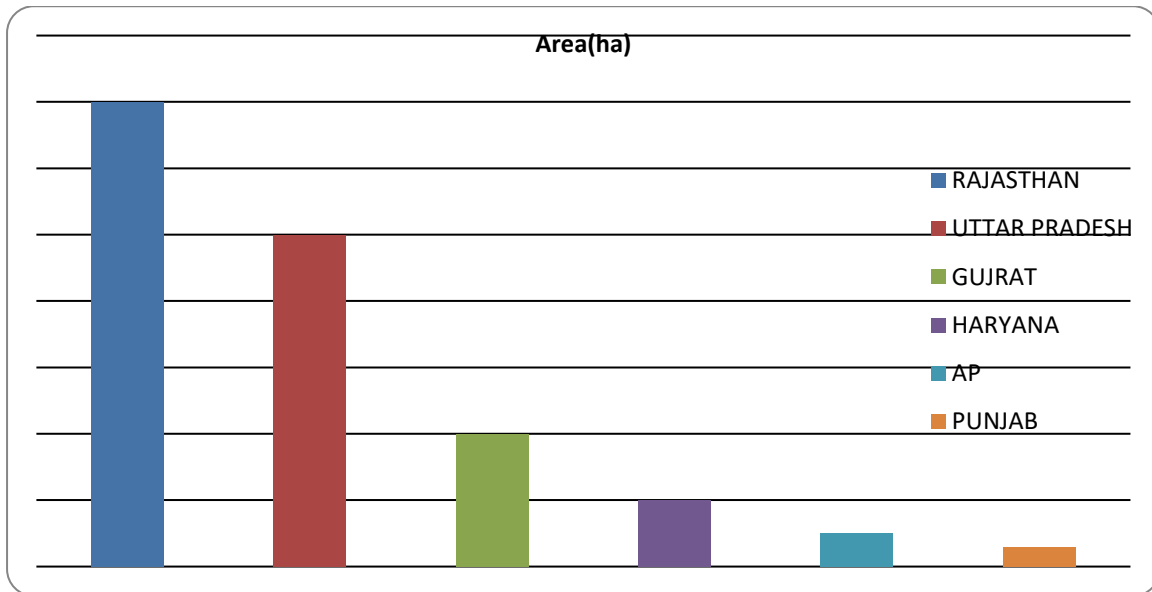


Figure 2: The graph above represents the infested area (hectares) by *Holotrichia* spp. (S.K. Paul,1977)

CONVENTIONAL METHODS FOR PREVENTION AND ERADICATION

Many experiments have been conducted to evaluate the effect caused by *Holotrichia consanguinea* in different regions of the world. As the pest has been a menace to the economic growth of the agriculture sector all over the world, different countries have adopted different techniques to deal with the damage caused by this major pest.

Research by Bohara, et. el, showed the use of a commonly known fungus *Metarhizium anisopliae* as a bio-control agent against WG. In their study, they showed that the indigenous isolate with concentration of 104 spores/ml and 102 spores/ml showed highest mortality of white grubs (Mane and Mohite(2014). Sorokin against white grub at lab condition in Chitwan, Nepal) independent studies have shown effective use of combinatorial use of insecticides like Imidacloprid with Fipronil against white grub. (Suthar (1994), Patel *et al.* (1985) and Patel and Patel (2000). Application of insecticides in seed furrows before the

sowing of tubers have shown to be effective when using chemicals like chlorpyriphos, clothianidine and imidacloprid Bhattacharyya, et. al, (2017).

EPN(Entomopathogenic nematode) like RW-14-N-C4a and Ho6 is responsible to cause 18-22% of grub mortality, RW-14-G-R3a-2 is responsible for 34-58% of grub mortality and RW14-M-C2a-3 is least effective and only can kill 2-6% of grub but these are not friendly with soil of world wide. (<https://ejbpc.springeropen.com>)

MODERN TECHNIQUES TO CONTRTOL WHITE GRUB

The past decades has seen a destructive damage caused by *Holotrichia consanguinea*. Many experiments have been conducted in different countries to overcome this ruinous problem. The present studies aim to evaluate the efficiency of modern technologies to check

the white grub population, thereby preventing the economic losses.

Bio-control agents are effective against the population of grub as well as very eco friendly. Grubs threaten the production of areca nut palm in Western Ghats, Eastern Ghats and Eastern regions of India. *Heterorhabditis indica* and *Steinernema abbasi* are biological controls which are used as EPN. Grub causes yield losses up to 40-42%. Due to less availability of nematode products, the cost raises very high. (Patil* and Rangasamy (2018). below mentioned data as taken from the year 2015 – 2017 in Table 2.

Table 2: Net Profit After Treatment ((Jagadeesh Patil and Vijayakumar Rangasamy 2018)

TREATMENTS	RATE/ha	NET PROFIT (US \$/ha)
<i>H. indica</i>	6.0*10 ⁸ IJs	5421.6
<i>S. Abbasi</i>	6.0*10 ⁸ IJs	2985.2

Some new technologies are developed to fight against white grub infestation in sugarcane. Biological mixtures of cadavers of an insect called *Galleria malonella* used as EPN. These EPN costs 1500/acre farm and only required 300 cadavers. Within 24 hours of it's death, the cadavers are ready to be released in the field. From these experiments population decreased by 69 percent/acre and increased the production of sugarcane by 60 percent/acre. (Umashankar Mishra (2017)

WSN (wireless sensor network) is an intelligent system which is used for monitoring white grub activity. Basically it works according to temperature, if the temperature is higher more the sound will be more detectable but it is less effective in cold days.(Hussain and Saleh(2017)

CONCLUSION

With every passing decade, the repeated use of conventional methods and practices helped grubs develop a certain level of tolerance which is alarming because there is not a single solution to this complex problem. It is time that we change the approach towards the problem. Instead of the quantitative approach, let's shift gear towards the qualitative approach, A Modern Approach, especially when the latest research and studies are showing a lot of promise both on the ecological and economical front.

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