EFFECTS OF SOWING DATE AND BIOPESTICIDE ON DENSITY OF WHITE GRUB *HOLOTRICHIA SERRATA* IN A TEAK NURSERY

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MESHRAM PB & HOMKAR U. 2011. Effects of sowing date and biopesticide on density of white grub *Holotrichia serrata* in a teak nursery. White grub *Holotrichia serrata* is the most destructive pest in teak nurseries in Madhya Pradesh, India. The grubs feed on roots of seedlings and cause severe damage to the entire root system. Field trials were conducted in teak nursery at Kanchangaon, Madhya Pradesh, India. The effects of different dates of sowing of teak seeds and efficacy of biopesticides, viz. neem *(Azadirachta indica)*, mahua *(Madhuca indica)*, karanj *(Pongamia pinnata)* and jatropa (*Jatropha curcas*) were studied on white grubs in teak nursery. Significant difference existed between the population of grubs and per cent of damaged seedlings. Damage was minimum at sowing date 11 March 2007, followed by 7 April. The maximum number of healthy seedlings was obtained in the seedlings sown in March followed by April. Neem at 5 kg per bed (size 10 × 1 m), followed by jatropha cake was found to be statistically significant over untreated control, minimising seedling damage due to white grub. In the integrated pest management against white grub, early sowing of teak seeds and application of biopesticide cakes are recommended instead of toxic pesticides in teak nurseries.

Keywords: Neem, karanj, jatropha, mahua, pest, damaged seedlings, biomass, microbial activity

MESHRAM PB & UDAY HOMKAR. 2011. Kesan tarikh penyemaian dan racun perosak biologi terhadap kepadatan tempayak putih *Holotrichia serrata* di tapak semaian pokok jati. Tempayak putih *Holotrichia serrata* merupakan perosak utama di tapak semaian pokok jati di Madhya Pradesh, India. Tempayak ini menyerang akar anak pokok dan mengakibatkan kerosakan teruk pada keseluruhan sistem akar. Ujian lapangan dijalankan di tapak semaian pokok jati di Kanchangaon, Madhya Pradesh, India. Kesan tarikh penyemaian biji benih pokok jati dan keberkesanan peracun perosak biologi daripada *Azadiracha indica, Madhuca indica, Pongamia pinnata* dan *Jatropha curcas* ke atas tempayak putih di tapak semaian dikaji. Perbezaan signifikan diperhatikan antara populasi tempayak dengan peratus anak benih yang rosak. Kerosakan anak benih adalah minimum pada 11 Mac 2007, diikuti oleh 7 April 2007. Penyemaian pada bulan Mac menghasilkan bilangan anak benih sihat yang maksimum, diikuti oleh bulan April. Berbanding kawalan, *A. indica* sebanyak 5 kg/batas (saiz 10 m × 1 m), diikuti oleh *J. curcas* dapat mengurangkan kerosakan anak benih akibat tempayak putih. Penyemaian awal biji benih pokok jati dan penggunaan racun perosak biologi disarankan dalam pengurusan perosak bersepadu di tapak semaian berbanding penggunaan racun perosak yang toksik.

INTRODUCTION

Teak (*Tectona grandis*) is one of the highly valuable timber species in India. Madhya Pradesh is the major teak producing state in India. Teak is the principal species covering 25 000 ha of afforested land (Prasad 1986). However, this important forest tree species is attacked by root feeding white grubs or chafers *Holotrichia serrata* in the nurseries. Grubs feed on roots and rootlets of teak seedlings and cause severe damage to the entire root system. In recent years, white grubs have reached the status of a serious pest in most of the teak nurseries in Madhya Pradesh with losses up to 80%. The grub menace is spreading wherever monoculture is being introduced.

White grubs *Lachnosterna* spp. have been found as pests of teak in the nursery (Beeson 1941, Mathur 1960) in India and cause widespread damage to seedlings in Maharashtra, India (Oka et al. 1979). Pesticides have been recommended for control (Vaishampayan & Bhandari 1981, Meshram et al. 1990, 1993). The use of chemical pesticides in nursery adversely affects the

chemical balance of the soil (Patil & Singh 1991). With the aim of preserving soil fertility and the environment, we sought alternative green biopesticide cakes produced indigenously on a large scale. Biopesticide cakes have both contact and systematic action in plants or act as soil amendments (Patil & Singh 1991). When applied to soil, the plants absorb pesticide through their roots and translocate it throughout the plant as protection against nematodes, termites and root grubs (Patil & Singh 1991). At present no such standard organic package has been developed for teak cultivation. As such, the present study was undertaken. The literature reveals that no information is available on cultural and biological methods against the white grub *H. serrata* in teak nurseries. Therefore, experiments were conducted to find out the effects of date of sowing of teak seeds and application of some biopesticide cakes on the infestation of white grub in teak nursery.

MATERIALS AND METHODS

In 2006, the nursery bed experienced severe grub damage. Therefore, sufficient population of grubs was available in 2007. The experiments were laid out in a teak nursery at Kanchangaon, Mohagaon Forest Project Division, Mandla, Madhya Pradesh Forest Development Corporation Ltd., India. The soil of the area was sandy loamy.

Effect of date of sowing on *H. serrata*

The teak seeds were sown on 11 March, 7 April, 6 May and 8 June 2007 in a randomised block design with three replications in 10 × 1 m bed size. Sowing procedure was uniform in all treatments. Observation of the grub population were recorded 90 days after germination of seedlings. Sample unit consisted of 1 m^2 and each bed was divided into three equal sections. One sample from each section was randomly selected. In each sample, soil was dug up to 30 cm to record the grub population (Bakshi 1977, Rudinsky 1977). Per cent incidence of damaged seedlings and total survival of seedlings were counted from the total of three replications. Data on per cent incidence of damaged seedlings, grub population and total healthy seedlings on different dates of sowing were analysed statistically.

Effect of application of biopesticide cakes on *H. serrata*

The treatments consisted of four organic nutritional biopesticide cakes: (1) neem (*Azadirachta indica*), (2) mahua (*Madhuka indica*), (3) karanj (*Pongamia pinnata*) and (4) jatropa (*Jatropa curcas*). The cake @ 5 kg per bed (size 10 × 1 m) was applied after teak seedlings had germinated. Each treatment was separated by a buffer bed of the same size. The observation on seedling, damaged seedlings, grub density and total healthy seedlings were recorded after 60 days.

Statistical analysis

Data were subjected to analysis of variance (ANOVA) and critical differences (CDs) were calculated by computer program SX statis PC DOS version 2.0, 1985, NH analytical software for computing the efficacy of treatments (Gomez & Gomez 1984). Percentages were transformed by arc sin $\sqrt{n}$ + 0.5 values.

RESULTS AND DISCUSSION

Effect of date of sowing on *H. serrata*

Significant differences existed in the population of grubs recorded on different dates of sowing with maximum population on 8 June 2007 (Figure 1). Total healthy seedlings obtained in seeds sown at four different dates indicated that the maximum healthy seedlings was obtained in the seeds of 11 March. Seeds sown on 11 March escaped damage by grubs. Maximum incidence of damaged seedlings, grub population and minimum healthy seedlings were recorded in seedlings sown on 8 June.

Effect of application of biopesticide cake on *H. serrata*

All treatments were equally effective and superior to the untreated control against white grubs (Table 1). The average population of white grubs, per cent incidence of damaged seedlings and number of healthy seedlings in treated beds after 60 days of treatment were observed from 3 to 5, 4 to 9, 153 to 179 respectively, compared

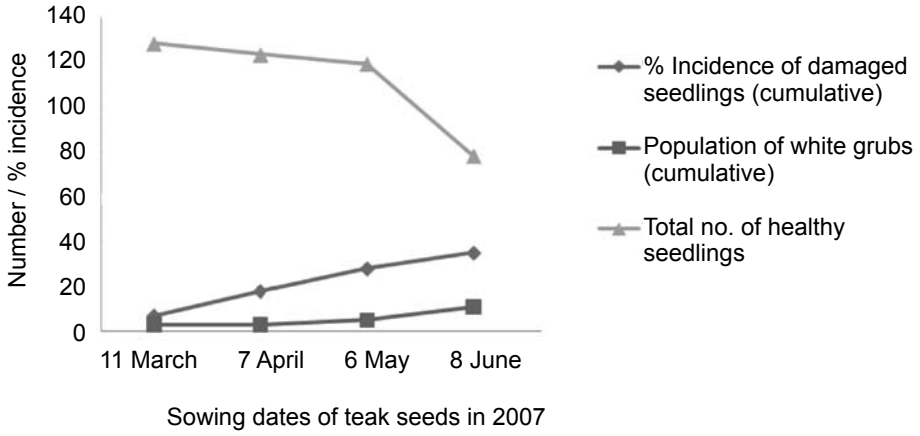

Figure 1 Effect of sowing date on the incidence of white grub *Holotrichia serrata*

Table 1 Effects of biopesticide cakes against white grub *Holotrichia serrata* in teak nursery

Treatment	Cost of biopesticide (rupee per kg)	Cumulative effect up to 60 days after germination		
		% Incidence of damaged seedling (1 × 1 m)	Population of white grub (3rd instar) (1 × 1 m)	Total no. of healthy seedling (1 × 1 m)
Azadirachta indica (neem) cake 5 kg	10.00	4.00 d (11.54)	3.00 b	179.00
Madhuca indica (mahua) cake 5 kg	15.00	7.00 bc (15.34)	4.00 b	163.00
Pongamia pinnata (karanj) cake 5 kg	15.00	9.00 b (17.460)	5.00 b	153.00
Jatropha curcas (jatropha) cake 5 kg	12.00	5.00 cd (12.92)	4.00 b	176.00
Control (untreated)		16.00 a (23.58)	9.00 a	112.00
SEM		1.11	1.03	2.41
CD (p = 0.05)		2.57	2.39	5.56

Data are arithmetic means of three replications; figures in parentheses are arc sin transformed values.

with 9, 16 and 112 in untreated controls. The lowest population of grubs was 3 in the treatment with neem cake as compared with 9 in untreated control. The other treatments, viz. jatropha, mahua and karanj were also effective against this pest. Neem, followed by jatropha was statistically significant over untreated control in minimising seedling damage due to white grub infestation and grub population.

Speers and Schmiege (1961) reported that white grubs of the genus *Phyllophaga* and other related genera feed on roots of conifers and hardwood stocks in forest nurseries and recommended control using fast active chemicals. White grubs caused damage to forest tree nurseries and young plantations of pine in Wisconsin (Shenefelt & Simkover 1950, Watts & Hatcher 1954). The biology of the studied pest is nearly the same as that of the white grub species attacking various agricultural crops (Joshi & Meshram 2008). Mitharuial et al. (2007) reported that the pearl millet sown on 17 June escaped the damage of *Rhinyptia indica* beetles and recorded highest yield and minimum losses. Mishra (2002) also reported that the potato crop planted in April and harvested on 1 September suffered tuber damage due to attack of white grub *Holotricha* spp. Early sowing of groundnut, i.e. mid-June may be useful in reducing the incidence of white grubs.

Among neem products, Achook 10 G @ 10 kg per ha as furrow application showed some

promising results for white grub control in groundnut crops (Patel et al. 1996). Mixing of 10 kg neem cake per bed size 10 × 1 m against white grub *H. serrata* for the protection of seedlings of *Withania somnifera* in a forest nursery in Poama, Chhindwara, Madhya Pradesh, India was recommended (Meshram 2005).

For managing this pest (both grub and adult), no single control measure would be effective (Mishra & Chandla 1989). Jackson and Klein (2006) reported that the integration of control methods has provided effective control for some species but there is a need for research to refine control measures and development of new options for management of important scarab pests. It is, therefore, of paramount importance that integrated approaches combining cultural practices and application of biopesticides at appropriate time be investigated.

It is suggested that in the integrated pest management schedule, two to four repeated deep ploughing of fields prior to the monsoon (April–May) be practised for exposing immature stages (grubs and pupae) for predation by natural enemies. Catching of adult beetles using light traps in the month of May–June (Meshram et al. 1990) is recommended. Pruning and spraying of contact insecticides on host plants (around nurseries) at the time of emergence of adult beetles (May–June) should be employed. The beetles prefer loose sandy soil for egg laying and hence raising seedlings and saplings in sandy soil invites beetles for egg laying. Soil work during monsoon should be avoided as it attracts beetles (Joshi & Meshram 2008). Early sowing (11 March) of seeds and prophylactic application of biopesticide cakes (*A. indica*) after germination of seeds are recommended (Meshram & Homkar 2006–2009). Soil mixing of 200 g phorate 10 G per bed size of 10 × 1 m (Vaishampayan & Bhandari 1981) or carbofuran (Furadon) 3 G 150 g per bed of 10 × 1 m (Joshi et al. 2001) from June–July is highly effective against white grubs. The biopesticide (biofuel) cakes also increase microbial activity including earthworm.

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