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***Research Article***

# WHITE GRUB 'KURMULA' (HOLOTRICHIA SERRATA) LEPIDOPTERA: LEPIDOPTRACEAE IN PRESERVED MULBERRY PLANT EXTRACT WITH CARBARYL

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## ABSTRACT
The white grub, Holotrichia serrata (Lepidoptera: Lepidoptraceae), is a major polyphagous pest that affects a variety of Indian crops, including roots in mulberry plantations. Although the query mentions Lepidoptera, H. serrata is actually a beetle species whose larvae eat roots and whose adults eat tree leaves (such Neem and Banyan). The larvae (white grubs) can result in a 12–80% decrease in crop yields. The main pest of stored Beetle in eri tree is the white grub, Holotrichia serrata. The efficacy of plant extract and chemical as grain protect ants against May June beetle in mulberry garden was compared in a comparative study. The 500gm beetle was treated in triplicate with 5% neem leaf extract, 5% lantana leaf extract, and 2% wood as hand carbary-l. The population of H. serrata was greatly decreased by plant extracts on many days at a time. The mortality rate due to carbaryl was 8.21% at 14DAT, while the rates for ash (7.67%) and the control group (7.34%) were lower. The average weight reduction in the control group was 44.9%, while it was low in ash (41.8%), lantana (38.4%), neem (34.2%) and carbaryl (19.5%). The control had the lowest germination rate (40%), while the treated seeds showed a higher germination percentage. Neem was discovered to be effective against storage pests among the botanical protect ants.

***Keywords****: Beetle, Holotrichia serrata, neem, lantana, ash, carbaryl, diversity and management.*

## INTRODUCTION
The silkworm, Bombyx Mori L is a valuable economic insect and also a means of turning leaf protein into silk. The silkworm was promoted as a valuable laboratory model for fundamental research in biology **(Adugna, H., 2006)** thanks to the historical and economic significance of silk production and its widespread use in industry and commerce. The pests, bugs, bacteria, and fungus are crucial to agriculture and pose a challenge to farmers because of the unfavorable environmental conditions. Since the farmers are using a variety of pesticides and insecticides to manage agricultural diseases, but the pests are resistant to those pesticides and are increasing the number of insects in the plants, which reduces output. Additionally, mulberry leaves are susceptible to a wide range of pests and diseases, and the pests cause crop failure by changing the chemical makeup of the leaves, which are clearly nutritionally deficient. The cultivation of mulberries is severely threatened by pests that attack the root and shoot, the plant's very foundation and structure. If has allowed to proliferate unchecked, these harmful bugs may destroy entire mulberry orchards, highlighting the necessity for farmers and agricultural students to learn how to identify them, their life cycles, and how to control them. Termites stem borers, and beetles are root and shoot feeders that cause widespread damage by boring through stems, eating roots, and compromising the plant's structural integrity, which in turn affects silk output and plant survival. The primary pests targeted are those that assault the mulberry plantation, such as the pink mealy bug and Maconelli coccus hirsutus (Green), but the precise molecular interaction is still unknown, and viral involvement has been ruled out. Recent discussions have focused on early diagnosis methods for tukra cases in mulberry **(Augna, H., 2007)** and numerous studies on bio-control of the mealy bug by the exotic enemy beetle, Cryptolaemus montrouzieri, as part of a pest management program**(Ahmad, T. *et. al.*, 2013)**. Different concentrations of botanicals were said to be helpful in controlling Tukra, also known as mealy bugs, in mulberry **(Carlos,**

**S., 2000)**. From the mulberry agro-ecosystem, a number of natural foes were documented **(Ileke, K.D., 2012)**. Newer threats are brought by the shifting mulberry environment, as mealy bugs and other pests become more prevalent and severe. In rain-fed sericulture tract of Uttar Pradesh and Assam, significant damage to mulberry by tukra has been recorded in recent years. Dimethoate, a popular insecticide used to control tukra, is ineffective against the illness, but dichlorvos is only marginally effective. Additionally, chemical disease control causes environmental contamination, and biological breakdown in soil causes toxicity **(Onu, I and Baba, G.O., 2003)**. At the international level, there is considerable agreement that either biological control should be used to eliminate the disease or that plant extracts with the potential to manage or eradicate it should be used. It has been reported that plant extracts from a variety of plants have the ability to inhibit mulberry diseases **(Udo, I.O. *et. al.,* 2010)**. The current study aims to determine the efficacy of the plant extract applied to mulberry leaves that have been infected with tukra and given to silkworms. Additionally, it seeks to understand the function of enzyme activity in tissues of silkworms of the cross-breed Pure Mysore multivoltine silkworm. Bombyx Mori L., the silkworm, is a valuable economic pest and a means of transforming leaf protein into silk. The silk industry's industrial and commercial usage, the historical and economic significance of its production and its worldwide applications have all made a significant contribution to the promotion of the silkworm as a potent laboratory model for fundamental biological study. The pests, bugs, germs, and fungi play a crucial role in agriculture because of the poor environmental circumstances, which causes issues for the farmers. Farmers are using a variety of pesticides and insecticides to combat agricultural diseases, but the pests are resistant to these pesticides, which are causing the number of insects in plants to increase and production to decline. Mulberry foliage is also susceptible to a variety of diseases and pests, and the pests cause crop failure by changing the biochemical composition of mulberry leaves, which are clearly nutritionally deficient, as well as by lowering the yield. The primary pests targeted here are the pink mealy bug and Maconelli coccus hirsutus (Green), which infest the mulberry orchard. However, the precise molecular level interaction is still unknown, and viral participation has been ruled out. The early diagnosis of the tukra occurrences in mulberry and the numerous experiments on bio-control of the mealy bug by beetle, Cryptolaemus montrouzieri of an exotic enemy as a part of the pest management program have all been discussed lately. Various concentrations of botanicals have been shown to be effective in controlling Tukra, which are mealy bugs that attack mulberry trees. From mulberry agro-ecosystem, a number of natural enemies were noted **(Joseph Rajkumar, A. *et. al.,* 1997)**. With pests like mealy bugs becoming more common and severe, the evolving environment in mulberry introduces new dangers. Recent years have seen significant tukra damage to mulberry in the rain-fed sericulture area of Uttar Pradesh and Assam. Dimethoate and dichlorvos, which are frequently used to treat Tukra, are ineffective at managing the illness. Additionally, the bio degradation of soil results in toxicity, while the chemical control of illness results in environmental contamination. At the international level, there is widespread backing for the use of either biological control to eradicate the disease or plant extracts that have the ability to control or eradicate the disease. It has been published that plant extracts from a wide range of plants can prevent mulberry illnesses **(Joyce, S.A. *et. al.,* 1994; Sankarnarayanan, C. *et. al.,* 2012 & Finchev, G.T., 1989)**. The purpose of the current investigation is to determine the impact of the plant extract applied to mulberry leaves that are infested with Tukra and fed to silkworms, as well as to analyze the function of enzyme activity in the tissues of silkworms of the cross breed Pure Mysore (Multivoltine hybrid) silkworm. Effects of Plant Extracts on the Frequency of Significant Pests (Tukra) are on the impact of mulberry leaves on the carbohydrate metabolism of the silkworm, Bombyx Mori L. The objective of this study was to evaluate the effectiveness of specific botanical powders on Beetle Holotrichia serrata ((Lepidoptera: Lepidoptraceae)) against beetles as well as the possibility of using these botanicals as sustainable alternative protect ants to synthetic insecticides in mulberry trees, employing techniques suitable with small-scale farmer practices in mulberry trees. These pests are especially harmful because their damage frequently goes unaddressed until it gets too serious. The interior structure may already be compromised by the time apparent symptoms manifest. Preventative measures are crucial for effective

crop protection of mulberry and increase the output of silk because their attacks frequently occur at certain times of the year or during particular phases of the mulberry plant's development.


**Fig: A-Life cycle: B-Larval stage: C-Ault stage of white Grub 'Kurmula' (Holotrichia serrata)**

## MATERIALS AND METHODS

***Site description:*** The experiment was carried out in the laboratory of the Department of Plant Protection of mulberry garden between February and May, 2018. Mulberry garden is located at Government College Campus. The altitude of the area is above sea level. The average rainfall and annual temperature of the area are 436mm and 26°C, respectively.

***Inoculation of white grubs:*** The contaminated Beetle seeds were cultivated in the lab until they had enough people to inoculate the treatments. Ten adults were used to inoculate each treatment with 500 g of clean Beetle seeds. In 1.5L plastic vials, ten adult white grubs (1:1 sex ratio) were released into each treatment. Every two weeks, observations were made. Every two weeks (14 days), the number of adult "Kurmula" that survived in each container was recorded. Later, the adult beetles' survival was determined. The number of exit holes per seed (Holotrichia spp.) was then chosen at random from 100 seeds per container after two months (57 days) of therapy.

***Treatments:*** Neem and lantana fresh leaves, which have insecticidal properties against Holotrichia spp, were collected from the mulberry garden, dried for a week in the shade, and treated with wood-ash, carbaryl, and control. The treatments used 2% of carbaryl and 5% of the ash and botanicals. Beetle seeds were combined with the treatments in a consistent and thorough manner.

***Data collection:***

Data were collected on white grub mortality and natality, grain damage, weight loss and seed germination. Adult mortality was recorded at 14days interval after application of the treatments. Insects that failed to respond to three probing using blunt dissecting probe were assumed dead and were included in the counts **(Onu and Baba, 2003)**.

$$\text{Percent of } mortality = \frac{No\ of\ dead\ insects}{\text{Total Number of beetle}} \times 100$$

Mulberry leaf damage in percent was assessed after a month of beetle inoculation and is calculated as

$$\text{Percent of mulberry } damage = \frac{No\ of\ perforatedgra}{Totalnoof\ insectsTotalnoof\ grainscounted} \times 100$$

Germination test of treated and untreated seeds was tested after three months from each treatment. Five beetles were selected randomly from the experimentally treated grains and control groups from each plastic vial.

***Statistical analysis:***

The statistical of t-ware, Genstat 4th edition was used for the analysis of variance (ANOVA) under the experimental design complete randomized design, with three replication each treatment. The analysis was performed at 5% level of significance.

## RESULTS AND DISCUSSION

***Effect of treatments in the mortality of adult beetle of white grubs:***

The results of this study, which demonstrated that the percentage of adult mortality was much higher in the second two weeks of applying the botanicals than in the first two weeks following treatment, are presented as the outcome of the mortality of white grubs. The percentage of deaths rose gradually with the length of exposure. The death rate of adult white grubs was greatly influenced by the treatments. At 14 DAT, there was a considerable variation in mortality among all the treatments and control, with carbaryl showing a high mortality rate (8.21%), while ash (7.67%) and control (7.34%) had low mortality rates. The mortality rate of white grubs was considerably lower at 28 DAT. At 9.6 percent, the control had a high death rate. The therapies and control were considerably different from one another at 42 DAT. But for the 28 DAT, 42DAT, and 56DAT, the control treatments had the lowest adult mortality rates for white grubs of the genus Holotrichia. The current conclusion concurs with **(Ahmad *et. al.,* 2015)**, who discovered that various physical, neem seed powder, and sesame oil treatments of muorus and Beetle effectively controlled the white beetle in laboratory settings. Azadiratins, which are toxic to insect pests of stored products **(Onu and Baba, 2003)** may be responsible for Holotrichia insecticidal activity. According to the study, the use of carbaryl, ash, and plant powders to treat Beetle seeds resulted in a high death rate in the first 28 days following treatment, and the treatment's efficacy improved out to 60 days. In laboratory settings, varying doses of carbaryl and A. indica powders killed more than half of adult white beetles **(Karunakar, G., 1990)**. Grubs have a lengthy history of being pests of forest trees and ranch production, and they have wreaked havoc in pine nurseries, resulting in losses ranging from 25% to 40% **(Karunakar, g. *et. al.,* 2000)**. Similar to the Potato, Maize, Wheat, Grain, Jawar, Bajara, Groundnut, Sesame, Sunflower, Chilies, Cotton, Sugarcane, Tobacco, Brinjal, Cucurbit, and woman's figure including turf, glades, yards, and timberland trees, the grubs feed on the underlying foundations of almost all of the harvests **(Kaya, H.K. *et. al.,* 2006)**. White grub **(Kaya, H.K. *et. al.,* 1997)** caused the pervasion's 100% harm to yields. The Scarabaeids, which include 22 species from 9 genera connected to groundnut in India, cause damage to groundnut and to the planet **(San, Diego., 2010; Koppenhofer, A.M., 2004 & Malan, A.P., *et. al.,* 2015)**. The white grub that damages groundnuts in the region includes **(Mehta, U.K., 1998; Malan, A.P. *et. al.,* 2008).** The best way to manage pests is still through prevention, which is both the most cost-effective and environmentally friendly strategy. Soil treatment before planting establishes a defense against pests that live in the soil. To enhance soil health and plant resistance to pest infestations, add organic material like well-decomposed farmyard manure. The right amount of space between mulberry plants promotes better air circulation and lowers humidity levels, both of which are conducive to the growth of pests. Prevent water logging conditions, which put stress on plants and increase their vulnerability to pest infestations. Regular weeding gets rid of alternative host plants that could support pest colonies.

**Effect of treatments on quality of Beetle:**

White grub beetles were severely impacted by plant extracts, which lowered their capacity to harm stored seeds in the lab. The percentage damage of treated seed at 14 DAT (13. 33%) was not significantly different from that of the control. The percentage of damage in all the treated seed and control was significantly different from one another at 28 DAT **(Sankarnarayanan, C. *et. al.,* 2015)**. Furthermore, at 42 and 56 DAT, the percentage damage in the treated seed and control was quite similar. Low mortality and high progeny emergence indicated that the insect population was growing, which resulted in more grain damage and less control. The white caused considerably less damage to the treated Beetle seeds

than to the control, which is why the treated samples had a lower weight loss than the control. Because the whites were only partially in contact with the treated Beetle seeds particularly those treated sequentially with carbaryl, neem, lantana, and ash the number of exit holes in the treated seeds decreased accordingly. To kill congregating scarabs, small neem trees could be sprayed with carbaryl, endosulfan, or chloropyriphos after the major summer rains **(Gau Anand., 2013; Morris, ONU., 1990)**. However, the cloropyriphos may have been sprayed over the neem trees' larger portions, reducing the defoliation caused by the scarabs. Imidacloprid 40% + Fipronil 40% - 80% WG @ 250 g for each ha and Clothianidin half WDG @ 250 gm for everywhere the protected and best medicines against white grub in groundnut, followed by Chlorpyriphos 20% EC @ 4000 ml for each ha. Even though Imidacloprid 40% + Fipronil 40%–80 WG @ 250 g for each has proved to be the most advantageous therapy (NICBR = 1:2.38), it was still shown to be the best course of action against white grub in groundnut cultivation. With the least plant mortality against white grub and the highest case yield, **(Parihar, A. *et. al.,* 2003)** found that an imidacloprid 600 FS treatment at 6.5 mL/kg seed was significantly superior to any other remaining medications, followed by a clothianidin 50 WDG treatment at 2.0 g/kg seed. The therapy combination of S1P1F2 (S1: imidacloprid 40% + fipronil 40%-80 WG @ 50 g for each ha, F2: urea 50 kg/ha, P1: Chlorpyriphos 20% EC @ 4 lit/ha) resulted in the greatest reduction in plant mortality compared to the S0, P0, and F0 (S0: No Seed treatment, P0: No pesticide application, F0: No utilization of urea), and a high yield of grub population was obtained.

***Organic management:***

The executive's framework for the white grub does not have a convincing outcome from the substance insect poisons, and these synthetic insecticides have dangerous effects on people and other living things. The plant extractives from Datura, Datura innoxia, and Bitti, Thevetia peruviana (Pers) were used for exploratory research. Biopesticides exhibit a range of toxicological and material qualities, as well as a variety of organic effects. According to **(Poinar, Jr, G.O; Potter, D.A., e. al., 1996)** the greatest repellency (98. 30%) was observed at a 5% concentration of ethanol after 3 hours of exposure. After 72 hours of insect exposure, the highest death rate (97. 00%) in white grub was observed at 5% concentration in (CH3)2CO. The results revealed that a sieversiana Ehrh has both residual toxicity and double qualities repellency, making it suitable for the ecologically sound management of chemical insecticides that replace white grub.

***Assessment of weight loss and germination test:***

The outcome of the Beetle seed germination is displayed. The pre-treatment germination percentage was not significantly different between the treatments and control **(Raodev, A.K. *et. al.,* 1976; Sankarnarayanan, C.B. *et. al.,* 2011)**. The germination percentage in the treated seeds, however, was quite high (after treatment). The treated seeds had the greatest germination rate, whereas the control group had the lowest rate (40%). This outcome demonstrated that the white strike had an impact on the control treatment's germination. Furthermore, the results demonstrated that the plant materials tested against the white grub had no negative impact on the Beetle seeds' ability to germinate. The treatments did not have a substantial impact on the weight decrease of kept Beetle seeds. Mean weight reduction in various therapies varied significantly from one another at 56 DAT. In the control group, the average weight loss was 44. 9%, but in the seeds treated with carbaryl, neem, lantana, and ash, it was 19.5%, 34.2%, 38.4%, and 41.8% respectively.

## CONCLUSION

Kurmula is the common name for the white grub, which is the most destructive nuisance to agro-plant crops in the Tarai belt subtropical region. The hideous insects congregate on several host trees and plants, devouring their leaves, flowers, and occasionally even the young organic fruits, resulting in financial loss, whereas the grubs live beneath the ground and feed efficiently on the live roots. In the current study, an attempt has been made to assess the species diversity of the scarab insects in several locations throughout

the Uttar Pradesh region. Thus, the use of various definitions of biopesticides can enhance the effectiveness of control by lowering the amount of insecticide used, reducing the likelihood of insect resistance, and lowering the risk of environmental pollution. According to the findings, the majority of botanical powders had insecticidal activity comparable to that of synthetic insecticides, and they were successful at killing white grubs. The treatments successfully attained high mortality of the adult white grub and greatly decreased weight loss by preventing oviposition by adult Holotrichia and the eggs' capacity to hatch. The majority of botanicals have anti-feed ant and repellent properties to manage the insect pests in Beetle and minimize the seed damage and weight reduction of the Morus leaf. Furthermore, the fact that these botanicals are locally available lowers the cost of rising beetle Kurmula larvae and makes it simpler for small farmers to do so. Consequently, the number of offspring produced by the plants was much less. Therefore, it lowers future infestations on the mulberry tree crop and promotes the sericulture larval life for the efficient production of silk.

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