

RESEARCH REPORT

Effectiveness of different plant extracts along with new chemistry insecticide against Defoliator pest wingless grasshopper (*Neorthacris acuticeps nilgiriensis* Uvarov) on mulberry

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**ABSTRACT**

On mulberry leaves, various insect pests strike. Among grasshopper species, the mulberry wingless grasshopper, *Neorthacris acuticeps nilgiriensis*, is the most dangerous pest of stored mulberry, and it is a severe pest of mulberry in the Mysore districts of Karnataka, where it is cultivated in black cotton soils under rain-fed conditions. Silk rearing center stores the feeding of adults and larvae. The extracts of *Lantana camara* and *Pongamia pinnata*, which were made using acetone and deltamethrin, were used. Five concentrations 0.01%, 0.02%, 0.03%, 0.04%, and 0.05% were made using a regulated concentration of the plants and the Deltamethrin. The filter paper was treated to test for any potential deadly effects against wingless grasshoppers. Following time intervals of 24, 48, and 72 hours, the death data was collected and subjected to statistical analysis using ANOVA (analysis of variance). The findings indicated that Deltamethrin is superior to plant extracts at suppressing the mulberry defoliator pests. According to the findings, the plant extract at a lower concentration was more effective at controlling wingless grasshoppers than other extracts that are safer for silkworms at a safer concentration. Additionally, this plant-based product is environmentally benign, readily accessible, and affordable.

Keywords: *Lantana camara*, *Pongamia pinnata*, deltamethrin, mortality, defoliator pest wingless grasshopper (*Neorthacris acuticeps nilgiriensis*).

INTRODUCTION

Sericulturists suffer financial losses as a result of a significant drop in mulberry leaf production caused by the wingless grasshopper *Neorthacris acuticeps nilgiriensis*. The sole food source for the silkworm, *Bombyx mori*, is mulberry. It is a perennial crop with deep roots that is grown in a row, in pairs of rows, or in a pit system, in any type of soil. The primary way to raise leaf yield is through the development of pest and disease resistant kinds that utilize better agronomic inputs. The yield and quality of mulberry silk per unit area determine the profitability and productivity of commercial sericulture.



Fig: Adult defoliator pest wingless grasshopper (*Neorthacris acuticeps nilgiriensis*)

Because of its abundant growth and green foliage throughout the year, the primary factor determining leaf quality is whether insects and non-insects attack it for space, food, or both. There are around 300 species of insect and non-insect pests that are known to infest mulberry at various times of the year and at different stages of crop development (Sujatha et al., 2014 & Siromani, 2003).

The primary insect species that cause harm to mulberry crops are members of the Hemiptera order. The wingless grasshopper, the *Neorthacris acuticeps nilgiriensis* Uvarov, and the long horned grasshopper are considered minor pests. *Neorthacris acuticeps nilgiriensis*, a wingless grasshopper species that feeds primarily on mulberry, is a significant pest of mulberry (*Morus* spp). It is found in the southern parts of India, particularly in rain-fed black cotton soil regions. The lower surface and edges of mulberry leaves are consumed by both nymphs and adults, resulting in a considerable decrease in leaf yield and quality that eventually has an impact on the productivity of sericulture mulberry and silkworm rearing. Numerous defoliator insect pests and lepidopteron insect pest larvae of them attack stored mulberry garden products. The wingless grasshopper, *Neorthacris acuticeps nilgiriensis* Uvarov, is a significant insect pest of stored commodities all over the world. The larvae and adults actively eat a wide variety of long-term commodities, including spices, beans, cereals, and more. The all-tender mulberry tree component of leaf is primarily targeted, resulting in its inadequate leaf development (Mondal, 1994 & Mishra BB et al 2011). When conditions are ideal (warm and humid), a large infestation happens. In addition, the wingless grasshopper, *Neorthacris acuticeps nilgiriensis* Uvarov, attacks in large numbers, shreds skin, and releases quinines and other harmful chemicals (Hussain et al 2005 & Isman MB et al 2006). The distribution of this insect is spread throughout many climatic zones

worldwide (Shafique et al, 2006). Between 10 and 20% of all development in storage cereals is attributed to a variety of environmental causes, according to Phillips and Throne (2010), who estimated total yearly post-harvest losses. For the management of insect pests in stored grains, traditional insecticides (fumigants and other synthetic insecticides) have been utilized. However, excessive, repeated, and foolish usage of these insecticides causes a lot of harm to people and the environment (Collins et al 2005 & Copping LG 2002). The use of these fumigants has resulted in soil pollution (Pietrantonio et al 1999) and the development of resistance in insects (Phosphine resistance) (Irshad et al 1990). A variety of stored grain insect pests develop resistance as a result of the indiscriminate use of organophosphates. The usage of these organophosphates then decreased (Fang et al 2002). As a result, it is necessary to create and employ pesticides that are environmentally friendly, less hazardous to humans, and effective at controlling insect pests in mulberry trees. The fumigants' toxicity and severity have caused negative impacts on people and natural foes, such as predators, parasites, and parasitoids (Islam MS 2005 & Hertlein MB et al 2011). Therefore, in order to address the issues caused by insect pest infestations in stored mulberry leaf and fruit products in rearing gardens, there is an urgent need to shift toward environmentally friendly and sustainable insect pest management strategies. Bio pesticides are among the best used chemicals for initiating an environmentally beneficial and effective control of insect pests in stored goods (Magdaalena WM 2009 & Najafabadi SSM et al 2014). Substances derived from plants possess both repellent and feeding deterrent qualities (Islam WA et al 2014 & Nazemi RJS 2008). For a large number of prior times, the insecticidal efficacy of a wide range of plant extracts, as well as that of some plant-based chemical products in general, was maintained and utilized throughout all the agricultural regions of the world (Regnault et al 2012 & Rehman HM

et al 2012). Plant extracts have the potential to be a reliable source for the successful control of insect pests in stored goods (Saljoqui AUR et al 2006 & Suthisut D et al 2011). Numerous plants have been employed in the past and are now used against various insect pests. Plant extracts have natural repellent effects against insect pests on mulberry products (Tripathi AKV et al 2001 & Tunc IBM et al 2000) and ovicidal effects. The harmful effects of extracts from two medicinal plants on *T. castaneum* were examined. The repellent properties of several plants have been studied against insect pests in stored grains (Wang JF et al 2006). Plant extracts have the ability to inhibit the growth of *T. castaneum* (Yang FL et al 2009). The use of *A. indica* and other plant materials has been used and proven to be helpful in controlling insect pests. *Ricinus communis* oils are harmful to *T. castaneum*. *Tribolium castaneum* (Herbst) may be successfully controlled with the use of garlic oil. It has been documented that repellent *Artemisia vulgaris* oils work against *Tribolium castaneum*. An extract of *Azadirachta indica* and several other plants was shown to be effective against the red flour beetle (Patil CS et al 1990). The insecticide potential of plant extracts of *Pongamia pinnata* and *Lantana camara* against *Neorthacris acuticeps nilgiriensis* was investigated. The comparative toxicity of phytochemical insecticides, deltamethrin, and lantana *Pongamia* plant extract is examined in relation to their ability to treat defoliator insect pests *Neorthacris acuticeps nilgiriensis*.

MATERIAL AND METHODS

The items covered were an incubator, sieves, rubber bands, electric grind, muslin fabric, and fine hair brushes, as well as a plant extract treated mulberry fruits and leaves, Deltamethrin, and the population of Wingless grasshopper, *Neorthacris acuticeps nilgiriensis* Uvarov. The mature wingless grasshoppers were collected from a mulberry garden or Seri-station, where the mulberry tree's soft leaves are now used for the current study. The population insects were stored in jars after gathering the mature Wingless grasshopper adults. The Wingless Grasshopper was raised on a medium of soft mulberry leaves and fruits. For improved insect culture, mulberry's delicate leaves and fruits were employed. These containers were stored in a growth chamber with a relative humidity of 80±5%RH and a temperature of 26±1°C (Krishnasamy et al 1973 and Jolly MS 1964). Adults were kept in jars for five days. Following that, adults were relocated to another

container. The flour contained the eggs of adult insects. After that, these eggs were raised in order to produce the first filial generation. The insects of this generation were the same age. Jars containing delicate leaves and mulberry fruits were given ideal environment. Adults of the same age were produced after the eggs hatched, and these were used in the experiment. Because the bioactivity of plant extracts varies greatly depending on a variety of parameters, a bioassay-guided fractionation strategy is often required to isolate the active chemicals. The plant component utilized, seasonal changes, and geographical growth environment all affect the chemical makeup and subsequent biological consequences. In order to identify, monitor, and improve these changes during the discovery process, bioassays are necessary. They evaluate the effects of these extracts on living cells or creatures. The plant matter was powdered by washing with distilled water, letting it dry in the shade, and then using an electric grinder to grind it. The solvent with plant powder was used to prepare for plant extraction. Twenty unsexed wingless grasshopper adults were put in the necessary container following the evaporation of acetone. Rubber bands were used to cover jars and prevent insects from getting out. Insect mortality data were collected at 24, 48, and 72 hours. The provided search results indicate that defoliator insecticide bioassays are quantitative methods used to ascertain the correlation between an insecticide's dosage and its poisonous impact (e. g. mortality) on a target organism, frequently measuring the median lethal dose or concentration. With one controlled concentration of Deltamethrin, which was created in 99.9 ml of distilled water from standard solution, five concentrations of 0.01%, 0.02%, 0.03%, 0.04%, and 0.05% were produced. The concentrations with a ratio of 0.3 ml were administered using a syringe. The concentrations were then transferred from filter paper and dried for one night. Insect's wingless grasshoppers were maintained separately at a rate of 20 per plate, with treated filter papers in each. Their mortality data was gathered at intervals of 24, 48, and 72 hours. Percent corrected mortality was calculated using the following Abbott's formula from 1925:

$$\text{Percentage (\%) Corrected Mortality: } \frac{M (\%) - (Mc \%)}{(100 - (Mc \%))} \times 100$$

Where, Mo= Observed mortality and Mc=Mortality in control unit

Complete Randomized Design was used to plan the experiment. Treatment means were compared using the

statistical standard error SE test, and the data were subjected to statistical analysis using analysis of variance (ANOVA).

RESULTS AND DISCUSSION

The efficacy of plant extracts against the wingless grasshopper defoliator pest on mulberry trees was tested. The findings of this experiment have been presented and discussed under the following headings.

That table lists the average percentage of mortality among populations of wingless grasshoppers as a result of various concentrations of the insecticide Deltamethrin at 24, 48, and 72 hours. The outcome demonstrates the proportion of mortality brought about by five exposure treatments of insecticide Deltamethrin with varying concentrations (0.01% to 0.05%) with one control group against wingless grasshopper at 24, 48, and 72 hours' exposure period. The findings indicated that higher concentrations raise mortality.

Table 1: Effectiveness of different plant extracts against defoliator pest wingless grasshopper (*Neorthacris acuticeps nilgriensis* Uvarov) on mulberry.

Treatment of Different phytochemicals concentration	Mean mortality of defoliator pest								
	Deltamethrin insecticide			<i>Lantana camara</i> insecticides			<i>Pongamia pinnata</i> insecticides		
	24 hrs	48 hrs	72 hrs	24 hrs	48 hrs	72 hrs	24 hrs	48 hrs	72 hrs
0.01%	30.03 ±2.10	37.57 ±2.10	52.72 ±2.29	2.45 ±1.72	10.72 ±2.11	21.82 ±2.69	0.01 ±1.75	0.07 ±1.78	5.45 ±2.15
0.02%	39.65 ±2.37	48.21 ±2.10	60.01 ±2.46	8.64 ±1.98	17.86 ±2.16	30.91 ±2.78	1.74 ±1.83	5.36 ±1.88	14.54 ±2.33
0.03%	50.01 ±2.45	60.71 ±2.23	69.09 ±2.7	18.96 ±2.11	23.22 ±2.35	36.36 ±3.22	7.01 ±2.11	12.06 ±2.00	21.82 ±2.71
0.04%	51.72 ±3.00	69.65 ±2.5	80.01 ±3.01	25.86 ±2.32	33.93 ±2.66	41.80 ±3.45	14.03 ±2.39	21.34 ±2.29	29.03 ±2.99
0.05%	65.51 ±3.08	78.50 ±2.98	95.90 ±3.35	34.48 ±2.43	41.07 ±2.98	53.72 ±3.81	22.80 ±2.48	23.20 ±2.52	41.82 ±3.04
Control	40.01 ±2.35	47.01 ±2.22	52.00 ±2.11	25.22 ±2.34	27.33 ±2.77	32.22 ±2.66	08.77 ±2.17	05.66 ±2.88	16.77 ±2.99

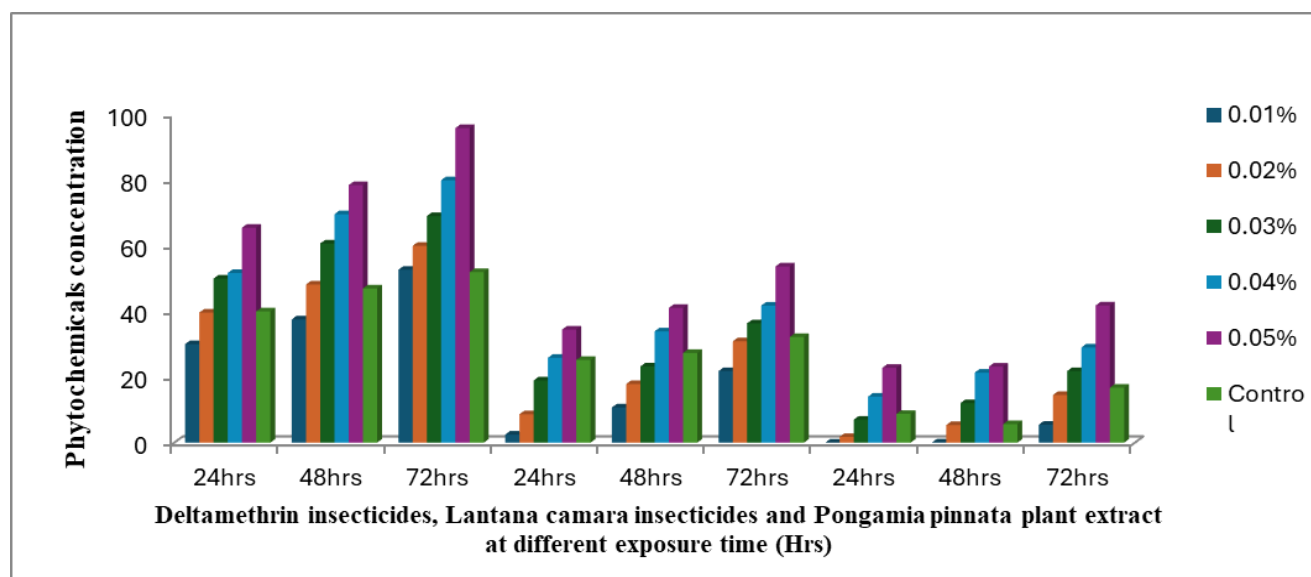


Figure 1: Effectiveness of different plant extracts against Defoliator pest wingless grasshopper (*Neorthacris acuticeps nilgriensis* Uvarov) on mulberry

The maximum average mortality rate was 95.90%, which occurred at a 0.05% concentration after 72 hours of exposure, while the lowest average mortality rate was 30.03%, which occurred at a 0.01% concentration after 24 hours of exposure. The mortality rate brought about by five insecticide Deltamethrin *Pongamia pinnata* exposure treatments at different concentrations (0.01%–0.05%) over 24, 48, and 72 hours with one control group against wingless grasshopper. The findings demonstrated that higher concentrations resulted in greater mortality. The greatest average death rate was 53.72% at a concentration of 0.05% after 72 hours of exposure, while the lowest was 2.45% at a concentration of 0.01% after 24 hours of exposure. According to the data, five exposure treatments of insecticide Deltamethrin *Pongamia pinnata* with various concentrations (0.01%–0.05%) with one control group against wingless grasshopper at 24, 48 and 72 hours' exposure period resulted in the percentage mortality. An increase in concentration resulted in higher death rates, according to the data. The maximum mean mortality rate was 41.82, which occurred at a 0.05% concentration and a 72-hour exposure period. The minimum mortality rate was 0.01, which occurred at a 0.01% concentration and a 24-hour exposure period. Compared to the control group, the lower larval mortality in silkworm batches treated with medicinal plant extracts might be because plants contain secondary metabolites that may have helped reduce mortality of silkworms against mixed infection by pathogens (*Bacillus* sp.+ *Staphylococcus* sp. and *Streptococcus* sp.) of late larval flacherie (Saranurmath CS et al 1992 & Sidhu NS et al 1968). These results are in line with those of (Priyadarshini P et al 2009), who found that the use of various medicinal plant extracts had a significant impact on the mortality rate of PM x CSR2 larvae. As opposed to control (9.77 and 12.44 %), the minimum larval mortality (2.66 and 4.22 %) was recorded in *Adathoda vesica* at 1:1 and 1:3 proportions against *Bacillus* sp. The mortality caused by grasserie and flacherie was also reported by Sridevi (2003) to be lower in medicinal plant extract-supplemented silkworm hybrids CSR2 x CSR4 and PM x CSR2 than in the control group. The lowest incidence of grasserie (5.50 and 4.00 %) and Flacherie (3.00 and 2.16%) was observed in *Withania somnifera* (Tayal MK et al 2014). This research demonstrates that administering varying doses of Deltamethrin, *Lantana camara*, and *Pongamia pinnata* plant extract can help prevent the late larval pathogenicity of mulberry silkworm organisms caused by viruses, bacteria, fungi, and protozoa, as well as

enhance the rearing of the pure Mysore silk worm breeds.

CONCLUSION

According to current data and observations, medicinal plant extract mimics silkworm larvae's tolerance to toxins and viral, bacterial, protozoan, and pathogenic infections; it also promotes the growth and development of silkworms and mulberry trees. We have come to the following conclusion about the agronomic practices under consideration having a noticeable impact on the occurrence of *Neorthacris acuticeps nilgiriensis* in mulberry gardens as a result of the current study conducted at the farmer level. Depending on the agronomic methods used, the frequency varies. But the effect of an autonomous agronomic practice cannot be isolated. As a result, actions taken in this direction would be helpful in producing data on the impact of an independent agronomic variable, allowing us to choose the best control strategy to mitigate the pest issue caused by these leaf-eating insect pests in the mulberry crop system. The use of botanicals is also increasing in sericulture, particularly in the control of silkworm infestations. The chemicals found in the botanicals have both antimicrobial and antiviral activity, which may be used in a variety of ways during silkworm culture. They are involved in fostering the development of silkworms and can indirectly contribute to lowering future BmNPV outbreaks. Deltamethrin, lantana, and *Pongamia* leaf extract were discovered to significantly reduce the larval mortality of the defoliator pest wingless grasshopper (*Neorthacris acuticeps nilgiriensis*), as well as enhance the economic characteristics of silkworm rearing life, such as larval weight, cocoon weight, shell weight, shell ratio, filament length, filament weight, and denier.

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