

RESEARCH ARTICLE

Effect of *Myrrh commiphora* (Guggul) leaf extract on the growth and larval development parameters of mulberry Silkworm *Bombyx mori* Linn

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ABSTRACT

Myrrh comphora, sometimes known as the medicinal or pest-repellent properties, is well known in ancient literature as a spiritual and therapeutic plant. Guggul is widely used in Ayurveda, Unani, Greek, and Roman medicine, and it is valued for its therapeutic effects as well as its importance in Hindu spiritual practices. Silk is a luxury commodity with strong demand, thus improving the quality of silk fiber is essential in sericulture. In laboratory experiments, extracts from the leaves of the *myrrh comphora* (Guggul) plant were compared to specific synthetic insecticides in their ability to combat mulberry defoliator pests. Guggul phytochemicals, leaf extracts of mulberry silkworm, and control were used to treat mulberry defoliator bugs that had invaded *Morus alba* leaves. Furthermore, silkworms were fed mulberry leaf pests that had been treated with the same insecticides. The impact of adding ethanolic extracts of Guggul (*Myrrh comphora*) leaf extracts to mulberry leaves on the growth and larval development parameters of silkworms (*Bombyx mori* L.), with a focus on the fifth instar, is examined in this study. Compared to the control group, the supplement dramatically increased larval growth, larval length, larval weight, and larval survival. The 5% ethanolic extract had the most noticeable impact among the tested concentrations. The excellent commercial features obtained by feeding silkworms mulberry leaves that had been treated with phytochemicals demonstrated that guggul leaf extract may be used in sericulture as a natural growth promoter for larvae. This study emphasizes the potential of adding Guggul (*Myrrh comphora*) leaf extracts as an environmentally friendly and affordable way to boost silkworm production and silk quality, thereby benefiting the sericulture sector.

Keywords: Guggul (*Myrrh comphora*) leaf extracts, phytochemicals fortification plant extract, larval parameters, larval duration, larval, weight, survival of silk worm larva (*Bombyx mori* L).

INTRODUCTION

From northern Africa to central Asia, the Burseraceae family includes the plant known by its common names, Guggul, Commiphora. However, it is most prevalent in northern India.

The leaves, bark, stems, and roots have medicinal uses and are effective in combating the mulberry tree's herpes simplex defoliator pests, which produce a yellowish resin called gum Guggul or Guggulu that has a balsamic aroma to deter pests. The bioactive potential of leaf extract from Guggul (*Myrrh comphora*) is the subject of this investigation. The physical characteristics were assessed based on pH, density, boiling temperature, solubility, smell, and color. The sole natural diet for silkworm, *Bombyx mori* L, is mulberry leaf (*Morus* spp). In over 59 nations, it is a lush, evergreen, perennial crop grown in all soil types, both rain-fed and irrigated, in row and pit systems, and as a hedge or avenue tree. India grows it in 23 states. Because of its rapid growth and abundant green foliage, which is produced in varying proportions throughout the year for food, space, or a combination of the two, the crop is susceptible to depredation by a variety of species. Thus far, more than 300 different insect and non-insect species are known to infest mulberry trees at different times of the year and at different stages of the plant's life cycle. The species makeup of various mulberry-infesting arthropods and the harm they cause differ depending on the agro-climatic circumstances, variety, and cropping system. The most significant insect species that are known to harm mulberry belong to the Orders Hemiptera, Lepidoptera, Coleoptera, Thysanoptera, Orthoptera, and Isoptera. The larvae of Lepidoptera are a significant and occasionally harmful class of pests that defoliate mulberry trees to different extents. From various nations, 37 species belonging to 16 families and 27 genera have been documented infesting mulberry so far. The leaf roller, *Diaphania pulverulentalis*, Bihar hairy caterpillar, *Spilosoma obliqua* Walker and cutworm, *Spodoptera litura*, are the lepidopteran pests that cause the most defoliation of the crop, while the bell moth, *Archips micaceana*, tussock caterpillars, *Euproctis fraterna* Moore and *E. subnotata* walker, and wasp moth, *Amata passalis* Fabricius, are found on mulberry trees on occasion. Lepidoptera larvae of the mulberry tree are a significant and occasionally destructive class of pests that causes varying degrees of defoliation. From various nations, 37 species belonging to 27 genera and 16 families have so far been reported to infest mulberry. Since the findings of this study would contribute more knowledge and evidence as potential use for the creation of pharmaceutical medicine, they will be beneficial to the entire scientific community. Additionally, this research will benefit the entire

scientific community by expanding our understanding of the bioactive potential found in the 5% ethanolic extract of this Guggul plant (*Myrrh comphora*). Additionally, it offers alternative therapies for typical problems with mulberry larval growth and development, particularly those related to the length of the mulberry larvae, their weight, and their survival. Overall, this substance enhances the quality of life for silkworm larvae, simplifies herbal therapy, and has the potential to reduce the costs associated with defoliating pests' pathogenicity to sericulture rearers.

MATERIAL AND METHODS

The study was carried out on the mulberry silkworm (*Bombyx mori* L), a multivoltine Pure Mysore × NB4D2 DFLs disease-free egg laying that was kept in plywood trays (23x20x5cm) under the perfect rearing conditions (**Krishnaswami et al. 1973 and Jolly, 1983**) in the laboratory media of a mulberry garden in a government college. The silkworm grainage Baharaich, Directorate of Sericulture Uttar Pradesh, provided the eggs. Using typical sericulture techniques (**Krishnaswami, 1986**), the silkworms were cultivated on mulberry leaves (*Morus alba*) in a regulated environment. Myrrh The extract of chemicals from *Commiphora myrrha* is known for its antioxidant and adaptogenic properties. Phytochemicals extracts boost silkworms' resilience to stress, especially in extreme environments. This results in higher cocoon yields and continuous silk manufacturing. Myrrh (*Commiphora myrrha*), an herb plant I gathered from my institution close to the nursery stores. Tap water was used to wash the plant leaves, and distilled water was used to rinse them. The extracts were made by combining distilled water with them at a weight by volume ratio (1:10) after they were crushed in an electric mixer. Twenty four to forty two hours are in a dark location, following five to ten minutes of 50 to 600c heat hot plates. The filtrate from filtering the crushed material solution via double-layered muslin fabric served as the stock solution. 0.5 ml of the stock solution was pipetted and diluted with 5 ml of distilled water to reach a 5% concentration. The stock solution was kept in a refrigerator, and a fresh dilution was made for use on the mulberry leaves and for feeding silkworms. Plant fed silkworms Treatment group and Kanva mulberry leaves at a concentration of 5%, the plant extract of myrrh (*Commiphora myrrha*) phytochemicals was sprayed

on the mulberry leaves that the silkworms were eating. With three repeats for each treatment, each group included 90 silkworms. Length of the larval stage is the amount of time between the larvae hatching and the third day of spinning was taken into account for calculating the larval duration of the fifth instar larvae. 90 larvae were chosen for observation (30 larvae in each of three batches). Every experiment was performed three times in a BOD incubator kept at $26\pm1^{\circ}\text{C}$, $80\pm5\%$ relative humidity, and 12 ± 1 hours of light per day. Each experiment was carried out three times. Using one-way ANOVA, the data were statistically analyzed. Weight of the larva the larval weight was estimated by recording the weights of 30 larvae (three batches of 10 larvae per batch) for each experiment replicate in a BOD incubator kept at $26\pm1^{\circ}\text{C}$, $80\pm5\%$ RH, and 121 hours of light each day. Each experiment was replicated three times. The weight of the larva was measured on the day that the fifth instar larvae ceased eating. Statistical analysis of the data was done using one method ANOVA. Larva Survival is in a similar manner, 90 larvae (three batches of 30, first instar larva in each batch) were monitored to determine the survival rate of the larvae. The quantity of larvae that reached the pupal stage was counted in order to determine the larval survival rate. The following formula was used to determine larval survival percent:

$$\text{Survival of larvae (\%)} = \frac{\text{No. of larvae pupated}}{\text{No. of first instar larvae taken for observation}} \times 100$$

The data obtained were analyzed statistically by one way ANOVA.

RESULTS AND DISCUSSION

As demonstrated in (Table & Fig), the phytochemicals-fortified ethanol extracts of Myrrh (*Commiphora myrrha*) that were sprayed on mulberry leaves affected various developmental and growth parameters of the silkworm, such as the length of the larval stage, the weight of the larva, and the survival rate of silkworm larvae (Emergence of 1st instar larvae from one developing fertile egg DFLs). The over variations are evaluated in terms of the silkworm's growth and development characteristics, such as larval duration, larval weight, and survival of silkworm larvae from silk moth eggs. The impact of phytochemicals from myrrh (*Commiphora myrrha*) leaf extract on the larvae and developmental and growth characteristics of silk worms is shown in the table. The phytochemicals found in plant extracts have an impact on the larval period of one DFL, which is shortened to 24.01 days, but the development and growth character is affected by the larval period of mulberry in control, which is 27.25 days of one DFL. The phytochemicals-fortified leaf extract has an impact on larval weight, which is 2.23 g, and the control reading shows that the larval weight is 1.61 g. In the same way, the highest survival percentage of larvae in plant extracts with phytochemicals is 91.82%, compared to 81.73% in the control group. The average development and growth was higher in the group using *Commiphora myrrha* ethanolic plant extracts than in the control group, according to the research. This suggests that the extract Myrrh (*Commiphora myrrha*) can modify the, as soon as well development criteria.

Table: 1- Effect of Supplementary Myrrh *Commiphora myrrha* phytochemicals ethanolic plant extract on different stages larval duration, larval weight and survival percentage of larval parameters of Silkworm *Bombyx mori* L.

Sr. No.	Phytochemicals fortification groups	Larval Duration (days)	Larval weight (gm)	Survival of Larvae (%)
1-	Control parameter of mulberry tree leaves	27.25 ± 0.351	1.61 ± 0.021	81.73 ± 1.287
2-	Phytochemicals treatments Myrrh (<i>Commiphora myrrha</i>) leaf extract	24.01 $\pm .232$	2.23 ± 0.055	91.82 ± 1.642

* $p < 0.01$ F-ratio= $n_1=4$ $n_2=10$ ANOVA F-ratio=78.18

Each value represents mean $\pm$ S.D. of three replicates.

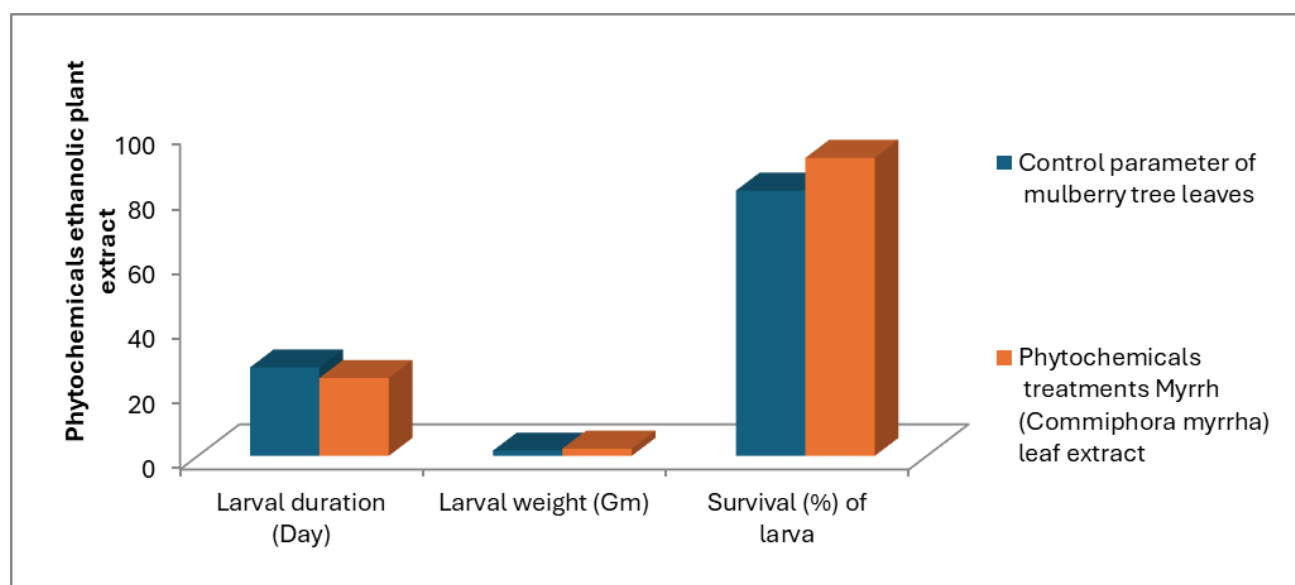


Fig. 1 Effect of Supplementary Myrrh *Commiphora myrrha* phytochemicals ethanolic plant extract on different stages larval duration, larval weight and survival percentage of larval parameters of Silkworm *Bombyx mori* L.

Phytochemicals supplementation with plant extracts during the current study markedly improved the development and growth of silkworm life compared to the controls development and cocoon formation to better silkworm life.

Insect pests belonging to numerous insect orders frequently impede the production of significant amounts of high-quality mulberry leaf (Sunil B. Avhad and Chandrashekar J. Hiware, 2013). Anusha, HG and Bhaskar RN (2014) found that the incidence of mealy bugs (19.21%), thrips (17.18%), whiteflies (12.62%), jassids (9.08%), and scale insects (8.24%). In a similar vein, the current research discovered that the Bihar Hairy Caterpillar damages mulberry leaves, which is harmful to silk manufacturing and silkworm diet. One of the major sap-sucking insect pests of mulberry is the thrip *Pseudodendrothrips mori* Niwa, which belongs to the order Thysanoptera, family Tripiidae. It is predicted that this pest causes a loss of 40–50% of the total leaf output. A Mahadeva (2011) suggest that the most damaging insect pest of mulberry plants is *Maconellicoccus hirstus*, which is just one of several pests that infect mulberry, *Morus* spp (Jagadish Naik M Samba Naik Palaindira P 2013). Among these "Eupterotemollifera alker" is a polyphagous pest that causes the most harm to mulberry plants (Gangwar SK 2012). Other insect pests infest mulberry, *Morus* spp. Due to increasing dangers for mulberry (Vijaya Kumari

N 2014), certain mulberry-sucking pests, such the pink mealy bug, thrips, spiraling whitefly, etc. , have developed resistance to the pesticides that are now available. With pests like mealy bugs becoming more prevalent and common, the shifting mulberry scene presents new challenges. In the last several years, tukra has caused severe harm to mulberry in the rain-fed sericulture area of Karnataka and Andhra Pradesh (Samba Naik A Suresh B Ravi babu BM Jagadish Naik 2013). The mealybug is a significant pest of mulberry, and it is not easy to eradicate. Due to its widespread distribution across tropical areas and diverse host range, this pest damages the quality and amount of leaves, leading to cocoon crop failure (Kotikal YK 1982; Madhuri et al 2014 and Sengupta K et al 1990). The chlorophyll content of the pest-infested mulberry leaves in Kanva (V1) was much lower, which had a big impact on the feeding behavior of mulberry silkworms and the growth of larvae. Tukra-affected leaves of the MR2, Mysore local, and S54 cultivars exhibited a large decrease in chlorophyll-b concentration. In Mysore local, the pest-infested leaves saw a minor reduction (1.32%), but in the leaves of the S54 kind, the drop was significant (80.00%). The chlorophyll-b concentration in the cultivars M5, S36, and V1 increased dramatically (Singh RN 1990; Malathesh et al 2009). The rise in the leaves of the V1 and M5 kinds was in the range of 9.08% to 13.78%, respectively. In mulberry leaves infected by pests the quantity of

chlorophyll-a varied, resulting in changes in the chlorophyll-b ratio. The chlorophyll- a/b ratio in the tukra-affected leaves of the Mysore local, M5, MR2, S36, S54, and V1 mulberry cultivars was considerably lower. Due to mealybug infestation, the leaves of the V1 mulberry cultivar and S54 exhibited the least (0.52%) and greatest (30.76%) reduction, respectively. In general, extracts from *M. azedarach* fruit, when applied to the plant surface, have a toxic and repellent effect against the whiteflies *Bemisia argentifolii* Bellows & Perring (Homoptera: Aleyrodidae) and *B. tabaci* (Gennadius) (Homoptera: Aleyrodidae), respectively (Donaid JB 1981; Dev Kishan et al 2013 and Rohit Kumar Verma et al 2013). The fact that the mortality rate of mulberry pest nymphs increased in comparison to the untreated control suggests that the majority of the toxic effects were attributable to the ethanolic plant extract of *Myrrh Commiphora myrrha* phytochemicals. The mortality rate of mulberry bugs was substantially lower, which was anticipated (Veerana G 1997; Gangopadhyay D 2008 and Monchan et al 2008). The experiment's second half revealed that the poisonous effects of Guggul plant extracts did have an impact on the silkworm's survival after eating treated leaves. Ethanolic plant extract from Guggul were produced and tested on immature mulberry pests as part of our continuing study on natural *Myrrh Commiphora myrrha* phytochemicals. The goal of the current study was, therefore, to assess how well these plant-derived extracts worked against mulberry pests and how they affected silkworms that ate mulberry leaves that had been treated. Even though the use of Guggul extract successfully killed mulberry bugs, there was no negative impact on silkworms because they were all still alive and moving. Conversely, every silkworm that was confined on leaves treated with an ethanolic plant extract of *Myrrh Commiphora myrrha* phytochemicals died 24 hours after being caged. Because it is well known that they affect the quantity and quality of silk production, diseased or pest-infested mulberry leaves are nutritionally deficient and cannot be used to feed silkworms. Since the mulberry plant is the sole food source for silkworms, it is imperative to take the necessary steps to control its pests and diseases.

CONCLUSION

In conclusion, the current investigation demonstrated that in laboratory settings, spraying *Myrrh Commiphora myrrha* phytochemicals ethanolic plant

extract on mulberry leaves caused a clear increase in nymphal mortality among mulberry defoliator pests. Furthermore, treated leaves had a beneficial impact on the survival rate of silkworms and the growth of larvae. Additional studies are necessary in the mulberry garden to assess the effectiveness of ethanolic plant extracts of *Myrrh Commiphora myrrha* phytochemicals under actual circumstances. Additionally, these extracts have the potential to be utilized as sustainable agriculture strategies against the mulberry pests, and their effects on the biological control agents of these pests must be evaluated. Furthermore, the findings of this investigation support investigating the impact of Guggul extracts on additional mulberry and tree pests. The current study found that leaf defoliator pests had a substantial impact on mulberry, changing its nutritional and metabolic processes in all its varieties. This infestation resulted in lower leaf production, reduced leaf quality in mulberry varieties, and its effects on silkworm development and cocoon production quality, all of which led to financial losses for sericulture farmers and the silk industry, which is now dominated by organic farming and phytochemicals fortification of *myrrh commiphora guggul* phytochemicals ethanolic plant extract.

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