



## Biological Management of the weed plant '*Parthenium hysterophorus*' through the Utilization of Striped Mealybugs (*Ferrisia virgata*)

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### Abstract

*Parthenium hysterophorus*, commonly known as parthenium weed, is an invasive plant species that poses a significant threat to agricultural productivity and biodiversity. Traditional management methods, including chemical herbicides, have shown limited efficacy and often result in detrimental environmental impacts. As an alternative approach, the potential of utilizing striped mealybugs (*Ferrisia virgata*) as a biological control agent for managing *Parthenium hysterophorus* was investigated. The paper explores the life cycle and feeding habits of striped mealybugs, their impact on *Parthenium hysterophorus*, and the potential benefits and limitations of employing this biological management strategy. The findings of this study provide valuable insights into the feasibility and effectiveness of using striped mealybugs as a sustainable and environment friendly solution for the control of *Parthenium hysterophorus*.

**Keywords:** *Parthenium hysterophorus*, *Ferrisia virgata*, Biological Management.

### I. Introduction

**About *Parthenium hysterophorus***- *Parthenium hysterophorus* is an aggressive weed species native to the America, but it has successfully invaded many parts of the world, including Africa, Asia, and Australia. (Dhileepan K. et. al. 1997) The weed's ability to adapt to diverse

environmental conditions and its high reproductive capacity have facilitated its rapid spread, leading to severe economic and ecological consequences. Conventional management practices, such as manual removal and chemical herbicides, have not been successful in controlling its proliferation, and alternative approaches are needed (Kumar S. et. al 1979).

**About Biological management-** Biological management, also known as biocontrol is a method of managing pests, diseases, and invasive plant species using natural predators, parasites, or pathogens. It is an alternative to traditional chemical-based approaches and aims to maintain ecological balance while reducing the negative impacts of pests on crops, forests, and other ecosystems. Biological management typically involves the introduction or augmentation of organisms that naturally prey on invasive species. These organisms are known as biological control agents. They can be predators, such as ladybugs, Mealybugs, lacewings, predatory mites, or parasitoids, which lay their eggs inside or on the pest, eventually killing it. The benefits of biological management include:

**Reduced dependence on synthetic weedicides:** Biological control can significantly reduce the need for chemical weedicides, minimizing the negative effects on human health and the environment.

**Long-term effectiveness:** Biological control agents can establish self-sustaining populations and provide long-lasting pest management solutions.

**Target specificity:** Biological control agents are often species-specific, meaning they only affect the target plant, minimizing harm to beneficial organisms and non-target species.

**Compatibility with other pest management practices:** Biological control can be integrated with other methods, such as cultural practices (e.g., crop rotation), physical barriers, or chemical controls, to create an effective and sustainable weed management strategy.

**Preservation of natural ecosystems:** Biological control helps maintain the balance of natural ecosystems by controlling invasive species and reducing the impact of weeds on native plants and animals.

**About Stiped Mealybugs-** Stiped mealybugs were chosen as experimental biological management agents because of their easy availability and their restricted spread over other plants. (Akanksha Tripathi-2023) Striped mealybugs, scientifically known as *Ferrisia virgata*, are small sap-sucking insects that belong to the family Pseudococcidae. They are commonly found in tropical and subtropical regions around the world. These pests are particularly damaging to a wide range of plants, including fruit trees, ornamental plants, and greenhouse crops. Here are some key characteristics and information about striped mealybugs:

**Appearance:** Adult striped mealybugs are small, oval-shaped insects measuring around 2-3 millimeters in length. They have a distinctive striped pattern, with alternating bands of light and dark brown on their bodies. The adult females are usually wingless, while the males have wings but do not feed.

**Life Cycle:** Striped mealybugs undergo incomplete metamorphosis, which means they have three stages: egg, nymph, and adult. The females lay their eggs in cottony egg masses, often hidden in protected areas like leaf axils or bark crevices. The eggs hatch into mobile nymphs, which go through several stages before becoming adults. (K.T. Awadallah 1979).

**Feeding Habits:** Striped mealybugs are piercing-sucking insects that feed on plant sap using their long, thread-like mouthparts. They insert these mouthparts into the plant tissues, causing damage and weakening the plants. As they feed, they excrete a sticky substance known as honeydew, which can promote the growth of black sooty mold on the plant's surface.

**Damage:** Mealybugs weaken plants by sucking sap, which can lead to stunted growth, yellowing leaves, and eventually plant death if left untreated. They also inject toxic saliva into the plants, which can further damage the tissues. Additionally, the honeydew excreted by mealybugs attracts ants and promotes the growth of black sooty mold, which can hinder photosynthesis.

## II. Materials and Methods

**Place and Time of Study-** All the experiments were carried out at the zoology department using potted parthenium plants inside insect-proof chambers during march-June 2023 in full sun environment. A total of 04 potted Healthy Parthenium plants were taken as experimental plants out of which one potted parthenium plant was taken as control plant.

### Collection of Mealybugs inoculums

Striped mealybugs (*Ferrisia virgata*) are very common on Shami (*Prosopis cineraria*) plants

and it was seen in the garden of Zoology department that two mid-sized Shami (*Prosopis cineraria*) plants were moderately infested with striped mealybugs (*Ferrisia virgata*) (Fig.-1). The adult mealybugs along with the cottony buildup and their eggs were collected with the help of brush in the glass petri-dishes and immediately covered with the glass cover. It was made sure to collect Mealybugs from different parts of the plant to get a diverse inoculum. Now the petri dish containing mealybugs was placed in a refrigerator, to slow down their activity and maintain their viability.



**Fig.-1 Showing Striped Mealybugs (*Ferrisia virgata*) infestation over Shami Plant**

**Inoculation of striped mealybugs –** The timing of mealybugs release over parthenium plants is crucial for their successful establishment. It's generally recommended to release them during the active growth phase of plants when sufficient foliage is available for their feeding. Therefore, the Collected inoculum of Striped Mealybugs (*Ferrisia virgata*) was introduced over the experimental potted healthy plants of *Parthenium*

*hysterophorus* during march-April when there was maximum foliar growth in the Parthenium plants. The inoculation was repeated after 7 days of first inoculation to insure the successful introduction of striped mealybugs (*Ferrisia virgata*) over experimental Parthenium plants inside the insect proof chamber. It was also insured that there is no other insect pest is present inside the insect proof chamber(Fig-2).





**Fig.-2 Showing Insect Proof Chamber for Inoculation of Insects Over Plants**

### **III. Results and Discussion**

It was observed in all the three experimental potted plants that the striped mealybugs have potentially infested successfully over the leaves as well as the stem parts. Mealybugs weakened the Parthenium plants by sucking sap and injecting the toxic saliva inside the plant parts which lead to stunted growth, yellowing leaves, and eventually plant death. The colonies of mealybugs were well established and they caused, less flowering most probably by lowering nutritional

supplies and photosynthesis when compared with the healthy control plant (Fig.-3 and Fig.-4).

It's important to note that the successful implementation of mealybugs for biological control requires careful consideration of various factors, such as vegetative growth period of the target weed plant as well as the environment of the area. This approach aims to reduce the negative impacts of parthenium weed on agriculture, ecosystems, and human health in an environment friendly, sustainable and cost-effective manner.



**Fig.-3 Showing Healthy Parthenium Potted Plant (Control)**



Fig.-4 Showing Mealybugs (*Ferrisia virgata*) infested Parthenium Potted Plant (Experimental)

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