



Eco-Friendly Management of striped mealybugs (*Ferrisia virgata*) Infestation over *Portulaca sp.* by using herbal Pesticide

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Abstract

Striped mealybugs (*Ferrisia virgata*) are economically significant pests that infest a wide range of agricultural and horticultural crops. Conventional synthetic pesticides have been widely used to control these pests; however, their excessive and indiscriminate use has led to detrimental effects on the environment and human health. As a result, there is a growing interest in developing eco-friendly pest management strategies. This research article aims to explore the potential of herbal pesticides for the eco-friendly management of striped mealybugs infesting *Portulaca sp.*

Keywords: *Ferrisia virgata*, synthetic pesticides, pest management, herbal pesticides.

I. Introduction

About *Portulaca sp.*- *Portulaca sp.* refers to the genus *Portulaca*, which is a group of flowering plants commonly known as purslanes. The genus belongs to the family *Portulacaceae* and comprises around 40-100 species, including both annual and perennial varieties. Purslanes are typically low-growing plants with thick, fleshy leaves and colourful flowers. They are known for their ability to thrive in hot and arid environments, making them popular choices for xeriscaping and rock gardens. The plants have

succulent leaves that store water, allowing them to withstand drought conditions. *Portulaca* species are found in various regions around the world, including North America, South America, Africa, and Eurasia. Some common species include *Portulaca grandiflora* and *Portulaca oleracea*.

Portulaca grandiflora, commonly known as moss rose or rose moss, is a popular ornamental plant valued for its vibrant, showy flowers. It is often cultivated as an annual and is available in a range of colours, including pink, red, yellow, orange, and white. The flowers open during the day and

close at night. *Portulaca oleracea*, commonly referred to as common purslane or pigweed, is a herbaceous annual plant that is considered a weed in many regions. However, it is also consumed as a leafy vegetable in some cultures due to its nutritional value. Overall, *Portulaca* species are

known for their adaptability, low maintenance requirements, and attractive flowers, making them a popular choice for every gardener looking for drought-tolerant plants with a splash of colour (Fig-1).



Fig.-1 Showing Colourful Flowers of *Portulaca* sp.

About Striped mealybugs-Striped mealybugs, also known as citrus mealybugs, are small insects that belong to the family Pseudococcidae. They are common pests of citrus trees, but they can also infest other fruit trees, ornamental plants, and greenhouse crops. Here's some information about striped mealybugs:

Appearance: Adult striped mealybugs are small, about 3-4 mm long, and have a distinct striped pattern on their bodies. They are oval-shaped and covered in a white, waxy secretion that gives them a cottony or mealy appearance.

Feeding Habits: Striped mealybugs are sap-sucking insects. They use their long, piercing mouthparts to extract plant juices from the leaves, stems, and fruits of host plants. Their feeding weakens the plant, leading to stunted growth, leaf yellowing, and even death in severe infestations.

Life Cycle: The life cycle of striped mealybugs consists of several stages: eggs, nymphs, and adults. The female mealybugs lay eggs in cottony masses, usually in protected areas such as leaf axils, bark crevices, or under protective coverings. The nymphs, known as crawlers, emerge from the eggs and move around until they find suitable feeding sites. They molt through several nymphal stages before becoming adults.(K.T. Awadallah 1979).

Damage and Symptoms: Striped mealybug infestations can cause visible damage to plants. Affected leaves may show yellowing, wilting, or distorted growth. The mealybugs themselves may be visible on the undersides of leaves, stems, or fruits (Fig-2). The waxy coating they produce can also accumulate on plant surfaces, leading to a sooty mold growth.



Fig-2 showing damage caused by Striped mealybugs (*Ferrisia virgata*) over *Portulaca sp.*

II. Materials and Methods

Place and time of Study- All these experiments were carried out at the department of zoology, M.L.K. P.G. College, Balrampur, inside the insect-proof chambers during January to May 2023 on potted *Portulaca sp.* plants. A total of 11 pots were taken inside insect-proof chambers of which two potted plants were kept as control plants while rest were taken as experimental plants for different concentrations of herbal pesticide use in two sets for each experiment.

Screening of suitable plants for pesticide use-It was observed during general inspection of garden of Zoology department, MLK PG College during winter season of 2023 that almost all of the plants were infested with striped mealybugs (*Ferrisia virgata*) either severely or mildly except the two midsize plants of Henna or Menhdi (*Lawsonia inermis*). The Bio-pesticidal characteristics of *Lawsonia inermis* was also reported at Desert Research Center, Cairo, Egypt (Razzik et al, 2018)

It was then selected as the potential Bio-pesticidal plant material for the management of striped mealybugs (*Ferrisia virgata*) Infestation over *Portulaca sp.* Ethanol was used as extraction solvent because there is a thick waxy layer over the mealybugs and water cannot penetrate it. So, it cannot carry the active compounds of herbal pesticide, while the ethyl alcohol has a good property to dissolve wax and penetrate deep carrying the herbal active compounds and insecticidal factors.

Preparation of plant material for alcoholic extraction -1 kilogram of fresh leaves of Mehndi (*Lawsonia inermis*) were taken, washed with mild soap, washed twice with water and then dried in open air inside insect-proof chambers initially for five days then weighed. Again, air dried for two more days. There was no weight loss observed in second weighing. Now the leaves were fine powdered using a grinder and stored for further extraction process.

Alcoholic extraction of *Lawsonia inermis* using the Soxhlet apparatus- Placed the fine powdered *Lawsonia inermis* leaves into the Soxhlet extractor using a filter paper properly stapled with stapler pin. Added 100ml of ethanol to the round-bottom flask. Attached the round-bottom flask to the heating mantle and started the heating process at 90°C. The ethanol gradually heated up and vaporized, condensing in the condenser and then dripping back into the Soxhlet extractor, extracting the desired active compounds from the

Lawsonia inermis plant Material. Allowed the extraction process to continue for 6 hours to ensure efficient extraction. Once the extraction process was completed, removed the round-bottom flask from the heating source and disconnected the apparatus. Filtered the extracted solution by passing it through a filter paper to remove any remaining plant material. Finally, stored the extracted *Lawsonia inermis* extract in a glass container, keeping it in a cool, dark place to maintain its stability and potency. (Fig-3)



Fig.-3 Showing *Lawsonia inermis* extraction by using Soxhlet apparatus

Standardization of most suitable Concentration of Biopesticide- The Ethanolic extract of *Lawsonia inermis* is prepared in absolute potency, however at this potency this extract may harm the leaves of plants if sprayed directly over the plant parts. Also, the higher concentration of herbal actives may harm the plants of *Portulaca sp.*

The Soxhlet extracted herbal extract is now taken as 100 percent concentrated extract and now it was diluted to different lower concentrations by

adding doubled distilled water to make its 10, 15, 20, 25, 30, 35, 40, 45, 50 percent solutions.

11 pots (Each with 10 inches diameter) of *Portulacca* plants were taken as experimental plants out of which two pots were kept as control plants and there was no spray of any type of herbal pesticide over control plants. Different concentrations of *Lawsonia inermis* leaf extracts were now sprayed over different pots starting from the 10 percent concentrated extract and their effect were shown as per table-1

Table-1 Effect of *Lawsonia inermis* Extracts over Stripped mealybugs infesting *Portulaca sp.*

<i>Lawsonia inermis</i> Extract	Concentration of Extract (%)					
	10	15	20	25	30	35
Effectiveness on Mealybugs (%)	28.18 ± 1.27	46.13 ± 1.48	65.88 ± 1.18	78.56 ± 1.88	96.08 ± 2.10	Adverse effect on <i>Portulaca sp.</i> Plants

The extract over the concentration of 35 percent were not used because the extract of 35 percent caused some adverse effect over the *portulaca sp.* Plants, therefore higher concentration of extract was not required.

Results

Different concentrations of ethanolic extracts of Mehndi (*Lawsonia inermis*) were used as herbal

pesticide for the management of stripped mealybugs infesting *Portulaca sp.* The 30 percent ethanolic extract was found most suitable and economical for the eco-friendly management of striped mealybugs (*Ferrisia virgata*) infestation over *Portulaca sp.*(Fig-4).



Fig-4 showing the infested plants before the treatment and after treatment with Plant Extract of *Lawsonia inermis*

Discussion

Being an important ornamental plant as well as local culinary plant, the *Portulaca sp.* required to be treated by using any of the pesticides as soon as possible. The herbal pesticides are the need of the hour because of the following reasons-

Environmentally friendly: Herbal pesticides are derived from natural sources such as plant extracts, essential oils, or other organic materials. They are biodegradable and pose minimal risk to the environment, non-target organisms, and beneficial insects. By using herbal pesticides, one can minimize the negative impact on the ecosystem compared to synthetic chemical pesticides.

Reduced chemical exposure: Traditional chemical pesticides often contain toxic substances that can be harmful to humans and animals, particularly if used improperly. Herbal pesticides provide an alternative solution that reduces chemical exposure for both farmers and consumers. They offer a safer option for managing pests on edible crops like *Portulaca sp.*

Residual effects: Some synthetic pesticides can leave residues on crops that may persist for an extended period, potentially leading to health concerns and contamination (Ritter L, 1995). Herbal pesticides, on the other hand, generally have lower residual effects. They tend to break down more quickly and leave fewer traces on the plants, making them preferable for crops like *Portulaca* that are commonly consumed.

Targeted pest control: Mealybugs are a specific pest that affects *Portulaca*, and herbal pesticides especially derived from *Lawsonia inermis* can effectively target and control these pests. Many herbal pesticides have demonstrated insecticidal properties against mealybugs, repelling or killing them while minimizing harm to other beneficial insects, such as bees or ladybugs. (Akanksha Tripathi 2012, 2021).

Resistance management: Continuous use of synthetic chemical pesticides can lead to the development of pesticide resistance in pests, making them less effective over time. Herbal pesticides, with their diverse modes of action, can help manage resistance issues by providing an alternative control method. Rotating between different herbal pesticides and integrating them into an integrated pest management (IPM) program can reduce the likelihood of resistance development.

Organic certification: For farmers growing *Portulaca* organically or seeking organic certification, the use of herbal pesticides aligns with organic farming principles. Organic standards generally promote the use of natural or

plant-based pest control methods, making herbal pesticides a suitable choice for managing mealybugs on *Portulaca* in organic production systems.

Conclusion

The present study will provide a comprehensive review of the potential of herbal pesticide derived from *Lawsonia inermis* for managing striped mealybugs. It will explore the efficacy of different herbal formulations, their mode of action, environmental impact, and integration into sustainable pest management programs. The research findings will contribute to the development of eco-friendly strategies for striped mealybug management, reducing reliance on synthetic pesticides and promoting a more sustainable and environmentally conscious approach to pest control.

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Access this Article in Online	
	Website: www.ijarbs.com
	Subject: Entomology
Quick Response Code	
DOI: 10.22192/ijarbs.2023.10.06.004	

How to cite this article:

Akanksha Tripathi. (2023). Eco-Friendly Management of striped mealybugs (*Ferrisia virgata*) Infestation over *Portulaca sp.* by using herbal Pesticide. Int. J. Adv. Res. Biol. Sci. 10(6): 34-40. DOI: <http://dx.doi.org/10.22192/ijarbs.2023.10.06.004>