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Efficacy of Herbal Pesticides Derived from Local Weeds of Devipatan Division of Uttar Pradesh against Mealybug Infestation

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Abstract

Mealybugs (Hemiptera: Pseudococcidae) are significant agricultural pests causing substantial crop losses in the Devipatan Division of Uttar Pradesh, India. The over-reliance on synthetic pesticides has led to environmental concerns, pest resistance, and health hazards, necessitating eco-friendly alternatives. This study evaluates the efficacy of herbal pesticides derived from locally abundant weeds in the Devipatan Division, including *Parthenium hysterophorus*, *Lantana camara*, *Ageratum conyzoides*, and *Chromolaena odorata*, against mealybug infestations. Extracts from these weeds were prepared using aqueous and ethanolic solvents and tested against *Phenacoccussolenopsis* and *Planococcus citri* under laboratory and field conditions. Results demonstrated that ethanolic extracts of *Parthenium hysterophorus* and *Lantana camara* exhibited significant insecticidal activity, achieving up to 85% and 78% mortality, respectively, at 5% concentration within 72 hours. Field trials confirmed a 60-70% reduction in mealybug populations on Hibiscus and citrus crops. These findings suggest that herbal pesticides from local weeds offer a sustainable, cost-effective, and environmentally friendly alternative for mealybug management in the region.

Keywords: Mealybugs, agricultural pests, weeds extract, *Lantana camara,* insecticidal activity

1. Introduction

Mealybugs are sap-sucking insects that cause severe damage to a wide range of crops, including Hibiscus, citrus, and vegetables, in the Devipatan Division of Uttar Pradesh, India. Species such as *Phenacoccus solenopsis* (Hibiscus mealybug) and *Planococcus citri* (citrus mealybug) are particularly destructive, leading to reduced crop yields and quality due to their feeding habits and secretion of honeydew, which promotes sooty mold growth. The conventional use of synthetic pesticides, such as organophosphates and neonicotinoids, has resulted in pest resistance,

environmental pollution, and adverse effects on non-target organisms and human health.

Botanical pesticides, derived from plants with insect-repellent or insecticidal properties, have emerged as a promising alternative due to their biodegradability, low toxicity, and reduced risk of pest resistance. The Devipatan Division, characterized by its rich biodiversity, harbors several weed species, such as *Parthenium hysterophorus*, *Lantana camara*, *Ageratum conyzoides*, and *Chromolaena odorata*, known to possess bioactive compounds with potential pesticidal properties. This study aims to evaluate the efficacy of herbal pesticides derived from these local weeds against mealybug infestations, focusing on their insecticidal and repellent effects under controlled and field conditions.

Fig.1- Mealybug infected twig of Hibiscus plant

2. Materials and Methods

2.1 Study Area

The study was conducted in the Devipatan Division, comprising Gonda, Bahraich, Shravasti, and Balrampur districts, located in Uttar Pradesh, India. The region has a subtropical climate with temperatures ranging from 15°C to 40°C and annual rainfall of 900-1200 mm, conducive to both crop cultivation and weed proliferation.

2.2 Plant Material Collection

Leaves and stems of *Parthenium hysterophorus*, *Lantana camara*, *Ageratum conyzoides*, and *Chromolaena odorata* were collected from wastelands and agricultural fields in the Devipatan Division during the monsoon season (July-September 2024). Plants were identified by botanists at the M.L.K. P. G. Cpllege, Balrampur.

2.3 Preparation of Herbal Extracts

Fresh plant material was shade-dried at 25°C for 10 days and ground into a fine powder. Two extraction methods were employed:

- Aqueous Extraction: 100 g of powdered plant material was soaked in 500 mL of distilled water for 48 hours, filtered, and concentrated to 100 mL.
- Ethanolic Extraction: 100 g of powdered material was extracted using 500 mL of 95% ethanol in a Soxhlet apparatus for 6 hours, followed by evaporation to obtain a crude extract.

Extracts were diluted to concentrations of 1%, 3%, and 5% (w/v) for bioassays.

2.4 Mealybug Rearing

Phenacoccus solenopsis and *Planococcus citri* were collected from infested Hibiscus and citrus fields, respectively, in Balrampur district. Insects were reared on *Hibiscus rosa-sinensis* leaves in a controlled environment (27±2°C, 65±5% RH) for one generation to ensure uniform age and health.

2.5 Laboratory Bioassays

2.5.1 Contact Toxicity Test

Second-instar nymphs of mealybugs (n=20 per replicate) were placed on filter paper in Petri dishes (9 cm diameter). Each dish was sprayed with 2 mL of plant extract at 1%, 3%, or 5% concentrations using a hand-held atomizer. Control treatments included distilled water and ethanol (solvent controls). Mortality was recorded at 24, 48, and 72 hours post-treatment. Insects were considered dead if they showed no movement when probed.

2.5.2 Repellency Test

A choice test was conducted using a Y-tube olfactometer. Twenty mealybugs were introduced into the base of the Y-tube, with one arm containing a Hibiscus swab treated with 0.5 mL of plant extract (5% concentration) and the other arm untreated. The number of mealybugs moving toward each arm was recorded after 30 minutes. Repellency percentage was calculated as:

$$\text{Percent Repellency (PR)} = C + TC - T \times 100$$

Where:

- **C** = Number of insects (or pests) in the **control** area
- **T** = Number of insects (or pests) in the **treated** area

2.6 Field Trials

Field experiments were conducted on Hibiscus (*Gossypium hirsutum*) and citrus (*Citrus reticulata*) fields in Balrampur district during October-November 2024. Plots (10 m²) were treated with 5% ethanolic extracts of the most effective plants (based on laboratory results) using a knapsack sprayer (10 L/ha). Control plots were sprayed with water. Mealybug populations were assessed before treatment and at 3, 7, and 14 days post-treatment by counting live insects on 10 randomly selected plants per plot.

2.7 Statistical Analysis

Mortality and repellency data were analyzed using one-way ANOVA followed by Tukey's HSD test ($p<0.05$). Field population data were analyzed using repeated-measures ANOVA. All analyses were performed using SPSS 26.0.

3. Results

3.1 Contact Toxicity

Ethanolic extracts of *Parthenium hysterophorus* and *Lantana camara* showed the highest mortality against both *Phenacoccus solenopsis* and *Planococcus citri*. At 5% concentration, *P. hysterophorus* caused 85.3±2.1% mortality in *P. solenopsis* and 82.7±1.9% in *P. citri* after 72 hours, while *L. camara* achieved 78.6±2.3% and 76.4±2.0%, respectively (Table 1). Aqueous

extracts were less effective, with *P. hysterophorus* causing 60.2±3.1% mortality in *P. solenopsis* at 5% concentration. *Ageratum conyzoides* and *Chromolaena odorata* showed moderate efficacy (50-65% mortality at 5%).

Table 1: Mortality (%) of Mealybugs After 72 Hours of Exposure to 5% Ethanolic Extracts

Plant Species	*P. solenopsis*	*P. citri*
Parthenium hysterophorus	85.3±2.1a	82.7±1.9a
Lantana camara	78.6±2.3b	76.4±2.0b
Ageratum conyzoides	62.8±2.5c	60.5±2.4c
Chromolaena odorata	58.4±2.8c	56.7±2.6c
Control (Ethanol)	5.2±1.0d	4.8±0.9d

Means followed by the same letter are not significantly different (Tukey's HSD, $p<0.05$).

3.2 Repellency

Parthenium hysterophorus exhibited the highest repellency (78.5±3.2% for *P. solenopsis* and 75.8±3.0% for *P. citri*), followed by *Lantana camara* (70.2±2.9% and 68.4±2.7%, respectively). *Ageratum conyzoides* and *Chromolaena odorata* showed moderate repellency (50-60%).

3.3 Field Trials

In field trials, ethanolic extracts of *P. hysterophorus* and *L. camara* reduced mealybug populations by 68.7±4.1% and 62.3±3.8%, respectively, on Hibiscus, and 65.4±3.9% and 60.1±3.5% on citrus after 14 days (Figure 1). Control plots showed no significant reduction.

Figure 1: Reduction in Mealybug Population (%) in Field Trials After 14 Days

Treatment	Hibiscus (%)	Citrus (%)
P. hysterophorus	68.7±4.1	65.4±3.9
L. camara	62.3±3.8	60.1±3.5
Control	2.5±0.8	2.1±0.7

3.4 Phytochemical Analysis

Preliminary phytochemical screening revealed the presence of alkaloids, terpenoids, and phenolic compounds in *P. hysterophorus* and *L. camara*, which likely contribute to their insecticidal and repellent properties.

4. Discussion

The high efficacy of *Parthenium hysterophorus* and *Lantana camara* can be attributed to their rich content of bioactive compounds, such as parthenin and lantadene, respectively, which act as antifeedants, repellents, and toxins. Ethanolic extracts outperformed aqueous extracts, likely due to better solubility of lipophilic compounds. These findings align with studies on other botanical pesticides, such as neem (*Azadirachta indica*), which is effective against mealybugs due to azadirachtin. The moderate efficacy of *Ageratum conyzoides* and *Chromolaena odorata* suggests potential for use in combination with more potent extracts to enhance efficacy.

Field results indicate that these herbal pesticides are viable for integrated pest management (IPM) programs, reducing reliance on synthetic pesticides. Their biodegradability and low toxicity to non-target organisms make them suitable for sustainable agriculture in the Devipatan Division. However, challenges such as standardization of extract preparation and large-scale application need further investigation.

5. Conclusion

Herbal pesticides derived from *Parthenium hysterophorus* and *Lantana camara* demonstrate significant potential for managing mealybug infestations in the Devipatan Division. Their high efficacy, coupled with environmental safety, positions them as viable alternatives to synthetic pesticides. Future research should focus on optimizing extraction methods, evaluating long-term effects, and developing formulations for commercial use.

6. References

1. Aktar, M. W., Sengupta, D., & Chowdhury, A. (2009). Impact of pesticides use in agriculture: Their benefits and hazards. *Interdisciplinary Toxicology, 2*(1), 1–12. https://doi.org/10.2478/v10102-009-0001-7
2. Awasthi, N., Dwivedi, S. K., & Tripathi, A. K. (2018). Evaluation of some plant extracts for their insecticidal properties against mealybug (*Phenacoccus solenopsis* Tinsley). *Journal of Entomological Research, 42*(3), 373–379.
3. Bhattacharya, A., & Nandini, D. (2016). Efficacy of some indigenous botanicals against mealybugs on okra. *International Journal of Plant Protection, 9*(1), 176–180.
4. Dhaliwal, G. S., Jindal, V., &Mohindru, B. (2015). Crop losses due to insect pests: Global and Indian scenario. *Indian Journal of Entomology, 77*(2), 165–168.
5. Dwivedi, H. D., & Shukla, S. (2024). Eco-friendly management of harmful colonization of mealybugs (*Family: Pseudococcidae*) over plants by using herbal pesticides in Devi-Patan Division of U.P. *Proceedings of the National Conference on Sustainable Agriculture and Biodiversity Conservation*, 142–148.
6. Isman, M. B. (2006). Botanical insecticides, deterrents, and repellents in modern agriculture and an increasingly regulated world. *Annual Review of Entomology, 51*, 45–66. https://doi.org/10.1146/annurev.ento.51.110104.151146
7. Kamaraj, C., Rahuman, A. A., Bagavan, A., & Abduz Zahir, A. (2010). Screening for the larvicidal activity of plant extracts against *Aedes aegypti* (Diptera: Culicidae). *Parasitology Research, 107*(5), 1271–1280.
8. Kumar, S., & Singh, R. (2019). Efficacy of some weed extracts against sucking pests of Hibiscus. *Journal of Pharmacognosy and Phytochemistry, 8*(5), 2020–2024.
9. Mahanta, S., Dutta, R., & Bora, D. (2020). Use of locally available weeds as bio-pesticides: An eco-friendly pest management approach. *Agricultural Reviews, 41*(2), 150–155.
10. Mani, M., Shivaraju, C., & Krishnamoorthy, A. (2014). Mealybugs and their management in horticultural crops. *Indian Council of Agricultural Research (ICAR) Publication*, New Delhi, India.
11. Pandey, N. D., & Pandey, R. S. (2002). *Principles and techniques of integrated pest management.*Agrobios (India).
12. Pavela, R. (2016). History, presence and perspective of using plant extracts as commercial botanical insecticides and repellents in crop protection. *Phytochemistry Reviews, 15*(5), 927–943.
13. Roy, S., & Saha, R. (2021). Comparative analysis of herbal pesticides against mealybug infestation on brinjal plants. *International Journal of Agricultural Sciences, 13*(4), 732–738.
14. Saxena, R. C. (1989). Insecticides from neem. In M. Jacobson (Ed.), *Focus on Phytochemical Pesticides* (Vol. 1, pp. 110–135). CRC Press.
15. Singh, P., & Singh, S. K. (2023). Potential of weed-based bio-pesticides for sustainable pest management in northern India. *Journal of Applied and Natural Science, 15*(2), 511–519.
16. Srivastava, A., & Yadav, R. K. (2017). Laboratory evaluation of some indigenous plants against mealybugs (*Pseudococcus spp.*). *Annals of Plant Protection Sciences, 25*(2), 341–345.
17. Tiwari, S., & Dwivedi, H. D. (2025). Role of bioactive compounds in weed-based pesticides for management of sucking pests. *Indian Journal of Environmental Research, 45*(1), 25–33.
18. Tripathi, A. K., & Singh, A. (2020). Botanical pesticides for eco-friendly pest management: A review. *Journal of Biopesticides, 13*(2), 100–112.

19. Venkatesan, T., & Jalali, S. K. (2019). Biological control of mealybugs in India: Present status and future prospects. *Journal of Biological Control, 33*(2), 97–107.

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