# Essential Oil-Based Pesticide for Sustainable Pest Management

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## Abstract:

My research aims to evaluate and develop plant-based essential oil pesticides ("EOs") as a sustainable alternative to synthetic, commercially produced pesticides.

My research will assess the control of common greenhouse pests using EOs, which can reduce negative impacts caused by overreliance on synthetic chemical pesticides. (2)

Ultimately, my research aims to advance eco-friendly agrarian practices and reduce reliance on harmful synthetic chemical pesticides.

A copper still is one of the more common extraction techniques for the steam distillation of many essential oils. $CO_2$ extraction on a larger scale is a newer process while being a safe, clean and effective method of extracting plant botanicals.

## Essential Oil Candidates:

**Thyme oil:** Active against a broad range of pests. Thyme oil contains thymol, a dominant constituent attributed to its insecticidal activity. (1)

**Peppermint oil:** Contains menthol, which has insecticidal properties against mites, aphids, and flies, effectively blocking the breathing structures. Having a repelling effect on insects as well.(1)

**Rosemary oil:** Contains 1,8-cineole, α-pinene, and camphor, and is effective in killing spider mites, and soft-bodied insects, effectively blocking the airways and paralyzing the pests. Fungicidal and bactericidal have been seen as well.(1)

**Black pepper oil:** Contains piperine, volatile oil, and when added to peppermint oil, rosemary oil, and other essential oils, will increase the effectiveness of the mortality rate of pests without increasing the concentration of oils applied to the plant.(1)

Close up of Mealybugs *Coccomorpha* on Cycad leaf *Zamia furfuracea*

## Materials and Methods:

**Essential Oil Formulation and Testing – Spring 2025:**

- EO efficacy and safety to be tested on multiple plant species: applied at 1%, 2%, and 3% concentrations on test plants such as *Coleus,* leaf lettuce, and corn to assess for foliar damage due to EO application.

**Greenhouse Setup – Summer 2025:**

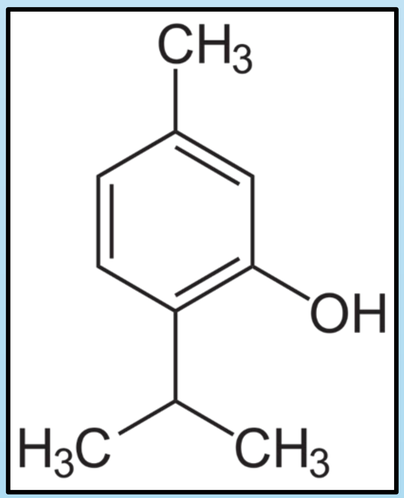
- Comparative analysis of **four** (4) plant treatment groups to assess the efficacy of EOs compared to granular systemic pesticides: group 1) soap solution only (control), 2) EOs only, 3) EOs + granular systemic pesticides, 4) granular systemic pesticide only.
- Each treatment includes twelve (12) plants for replication.

**Greenhouse Bioassays – Fall 2025:**

- EO treatments applied to pest-infested plants under controlled conditions.
- Pest mortality recorded at 24-, 48-, and 72-hour intervals.
- Repellency and behavioral changes will be monitored, with weekly retreatments if needed (Fall 2025).

**Comparative Analysis – Fall 2025:**

- Statistical comparison of mortality among treatments to determine the efficacy of EOs relative to granular pesticides.




*Thymol* is the principal aromatic component of thyme.

## Predictions/Projected Outcomes:

**Problem Statement**: Environmental degradation and toxicity from synthetic pesticides necessitate eco-friendly alternatives.(3)

**Proposed Solution**: Essential oil-based pesticides utilize plant-derived compounds to control pests while reducing ecological harm to the environment and beneficial pollinators.

**Research Focus**: My study aims to evaluate a custom-formulated pesticide derived wholly from botanical sources such as peppermint, thyme, rosemary, and black pepper essential oils through greenhouse trials.

## Future Directions:

**Timeline**: Pilot tests at the Auraria Science Building greenhouse will begin in Spring 2025, followed by experimental treatments in Fall 2025.

**Data Collection:** Pest mortality rates and plant health will be assessed to measure EO effectiveness. The collected data will be analyzed using statistical methods.

**Comparative Analysis:** EO efficacy will be statistically compared against granular systemic pesticides on plants infected with pests.

## Literature Cited:

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## Photo Citations:

https://en.wikipedia.org/wiki/Rosemary

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