Extraction of Custard Apple Oil and Neem Oil and its Application as a Biopesticide

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Abstract: *This abstract explores the utilization of custard apple oil and neem oil as biopesticides in pest management. Custard apple oil, derived from the seeds of the custard apple tree (Annona squamosa), and neem oil, obtained from the seeds of the neem tree (Azadirachta indica), have garnered attention for their insecticidal properties and environmentally friendly nature. These biopesticides contain bioactive compounds that exhibit insecticidal, repellent, and antiferential properties against a wide range of agricultural pests. They have demonstrated effectiveness in controlling insects, mites, and nematodes, offering an alternative to synthetic pesticides. Neem oil and custard apple oil are also biodegradable, offer little harm to organisms other than those intended for use, and are not toxic to people or the environment.. The use of these natural products in pest management aligns with sustainable agricultural practices and integrated pest management strategies. However, further research is required to optimize their application methods, dosage, and formulations to maximize their efficacy and ensure their practicality in various agricultural systems. Overall, custard apple oil and neem oil exhibit great potential as bio-pesticides, promoting eco-friendly pest control approaches in agriculture.*

Keywords: Biopesticides, Custard Apple Seeds, Mealy Bugs, Neem Seeds,

1. Introduction:

One of the most stubborn pests of many plants is the mealybug (Planococcus pacificus). They can be identified by long tail-like processes extending from the sides, back, or wings, as well as a white powdery coating that covers their entire body. They get food by sucking tree sap. Adults, 2 to 4 mm long, congregate in dry, protected areas, including the tips, bases of petioles near the adaxial junction, and the undersides of leaf fronds. Mealybugs consume plant fluids, and a prolonged infection can cause serious damage to the host plant. The most common type of damage is leaf and fruit deformation due to additional wax from mealybugs is produced during reproduction and through honeydew. On this honeydew, black mold can sometimes grow, further disfiguring the host plant.

They tend to live in herds and are social. As they eat, their waxy secretions coat the surface, and the honeydew frequently grows into the mold. Mealybugs are common pests of guava trees in greenhouses and if severely damaged can harm the tree. Ants are frequent visitors to colonies, which can deter natural enemies. Figure 2 shows a colony of white mealybugs on a guava leaf. Depending on the climate, there are three or four generations per year. All life stages are present on leaves and fruit during the summer, but when temperatures drop, scale insects hide under the host tree's bark. Here, breeding continues throughout the winter at a much slower rate. In spring, many caterpillars are born just in time to start eating fresh grass. The lifespan of each generation varies greatly depending on temperature and can range from one to four

months depending on the season of the year. Mealybugs can reproduce rapidly. The most common species is the long-tailed mealybug (Pseudococcus longispinus), which has been shown to reproduce up to 200 offspring within 2 to 3 weeks. Young-scale insects resemble adult insects and often feed alongside them. Before reaching maturity, each young spider goes through three pupal stages. Mealybugs are common in tropical, subtropical and climate zones and attack a wide variety of plants. Using pesticides to repel pests from crops is essential to maintaining agricultural productivity. Madison, endosulfan, lindane, malathion, methotrexate and menthol are currently the most frequently used synthetic insecticides for mealybug control. They are neurotoxic, non-biodegradable, foul-smelling, cause cancer and respiratory problems, deplete earthworm populations, reduce soil fertility, and cause air pollution., water and memory loss.
Therefore, a biological pesticide usually made from materials available in nature is what we need today. Since ancient times, biological pesticides have included neem oil and oil produced from ginger seeds. In the present study, oil was extracted using n-hexane and ethanol as solvents from custard apple seeds and Neem seeds and used as biopesticides to control mealybugs.
Sitaphal, also known as custard apple, is one of the largest fruits imported to India from tropical America. In various parts of India, it is also found in wild form. It is grown in West Bengal, Andhra Pradesh, Assam, Bihar, Karnataka, Maharashtra, Orissa and Tamil Nadu. Soursop seeds are widely distributed in nature. The neem tree (Azadirachta indica), a tropical evergreen native to the Indian subcontinent, produces neem seeds. Neem seeds have been used for centuries in many cultures for therapeutic, cosmetic, and agricultural benefits. Neem seeds are prized for their wide range of medicinal chemicals, which makes them a highly valuable ingredient.

2. Literature review:

This study evaluated the effectiveness of biopesticides against cotton aphids (Aphis gossypii Glov.) and two-spotted red spider mites (Tetranychus urticae Koch.). Hydroponic drip irrigation system 'DIHS' designed and used for experiments. The results showed that custard apple extract was the most effective, followed by matrine, spintoram, azadirachtin and neem extracts [1].

Neem (Azadirachta indica A. Juss) is a fast-growing evergreen tropical tree with insecticidal activities. Azadirachtin is a biological pesticide obtained from neem tree extract, which can be used to control various insect pests in agriculture. This review highlights the extracts, by-products, and role of neem as a potential biopesticide in agriculture [2].

This investigation evaluated the antibacterial and insecticidal effects of the traditional plant Annona squamosa. The methanol extract of Annona squamosa seeds contains alkaloid and flavonoid compounds that provide biological insecticidal properties. Biopesticides are environmentally friendly pesticides obtained from natural substances, bacteria and plants, which help reduce pollution and protect human and animal health [3].

Soxhlet extraction equipment is used to extract oil from custard apple seeds. Seed oil-based biopesticides are effective and environmentally friendly and are widely used in India. The optimal ratio between filler and solvent is 1:5. Chemical identification showed that the extract contained alkaloid and flavonoid compounds with biological pesticide properties [4].
The research aims to extract oil from custard apple seeds to produce natural organic pesticides. The solvent methanol was used to extract the oil, which was tested on 9 different plants for 9 days. The results showed that the most effective pesticide depends on the amount of methanol solvent used [5].

White-scale insects (Planococcus pacificus) are soft, white insects that attack plants and feed on sap. They reduce crop yields and carry viruses. Synthetic pesticides are used, but ecological biopesticides extracted from custard apple seeds are being evaluated [6].

Neem oil is effective against agricultural pests and has potential insecticidal and mosquito-repellent properties. Neem oil microemulsion is preferred over conventional pesticide systems due to its long-term thermodynamic stability, safety, low viscosity, economy and aesthetics. Molecular docking analysis showed that neem has a higher binding affinity for OBP [7].

Traditional neem oil processing methods are inefficient, tedious and time-consuming, and solutions are being proposed to improve product quality and quantity. A study was conducted on the traditional method of processing neem seed oil. Six main activities occur during the production process, which are:
collect the seeds, clean/sort the seeds, shell/sieve the seeds to separate the seeds from the shell, wash/sieve the seeds to separate the seeds from the shell, grind the seeds (reduce size) with a mortar and pestle and then extract. oil. All operations are currently performed manually. The problems associated with this treatment method were determined to be ineffective (as it only extracted about 35.26% of the available oil), tedious and time-consuming. Solutions to improve product quality and quantity have been proposed [8].

3. Methodology:

A. Material and Methods:

Materials:

1. Neem seeds
2. Custard Apple seeds
3. n-Hexane
4. Ethanol

Apparatus:

1. Soxhlet Extractor
2. Condenser
3. Heater
4. Stand

Process:

1. Take some custard apple seeds, wash, and dry them and then crush them.
2. Take 50 g of seed powder.
3. Take 300 ml of solvent(n-hexane/ethanol)
4. Insert the powder into a Soxhlet apparatus.
5. Place a round bottom flask on the heating mantle.
6. Connect the round bottom flask with the Soxhlet apparatus and attach the condenser at the top.
7. Heat the round bottom flask up to the solvent boiling points.
8. As soon as the heating starts vapour gets forms and moves upward in the condenser to condense.
9. The solvent is filled inside the apparatus until the solution in the tube reaches its peak point.
10. After crossing the peak point solution is collected at the round bottom flask.

11. Then leave it for a few minutes to get cool.
12. The solution is filtered out.
13. The collected solution is distilled, and the concentrated solution is collected.

Figure 1. Soxhlet Apparatus

Figure 2. Distillation Apparatus

B. Extraction Result:

Table 1. Observations

	Batch 1	**Batch 2**	**Batch 3**	**Batch 4**
Seed Name	Custard Apple	Custard Apple	Neem	Neem
Seed (gm)	50	50	50	50
Solvent Name	n-Hexane	Ethanol	n-Hexane	Ethanol
Solvent (ml)	300	300	300	300
Heating temperature (^{o}C)	75	75	75	75
1st cycle time (min)	65	70	72	62

2nd cycle time (min)	41	38	45	40
3rd cycle time (min)	39	30	38	36
Total Time (min)	111	108	155	138
Qty. of Oil obtained (ml)	8	6.5	9.5	7.4

Figure 3. Sample of Neem and Custard Apple in Ethanol

Figure 4. Sample of Neem oil and Custard apple in N-Hexane

C. Preparation and application of Bio-pesticide:

We obtained the oil through our experience and tested its insecticidal properties using standard methods. After studying the different properties of the oil, the oil is applied to the white area of the hibiscus plant as shown in the picture. Before applying oil to mealybugs on the surface of guava leaves, pre-preparation of a pure solution is carried out. The blank solution is prepared by mixing 6 parts labolene soap with 94 parts water. To this pure solution, a 20% ratio of custard apple seed oil is added and sprayed onto pest-infested surfaces with a spray gun.
In the present study (Planococcus pacificus), winged white-scale insects on the surface of hibiscus leaves were selected to test the effectiveness of the biopesticide extract we created from custard apple seeds. The surface covering the insect (mealybug) is selected and marked with a felt-tip pen. Inside the marked area, use a needle to count the number of white mealybugs. The prepared biological pesticide is then sprayed using a spray gun. After some time (e.g. 1 or 2 days), mealybugs will be counted again. We have tested our pesticide on the leaf of the Hibiscus Tree as shown in Figure 5.

Figure 5. Mealy Bugs on Hibiscus Plant

5. Result and Discussion:

Figure 6. Hibiscus Plant after Applying the Pesticide.

Table 2. Results

Sr. No	Day No	Mealy bug count
1	0	68
2	1	57
3	2	2
4	3	1
5	4	0

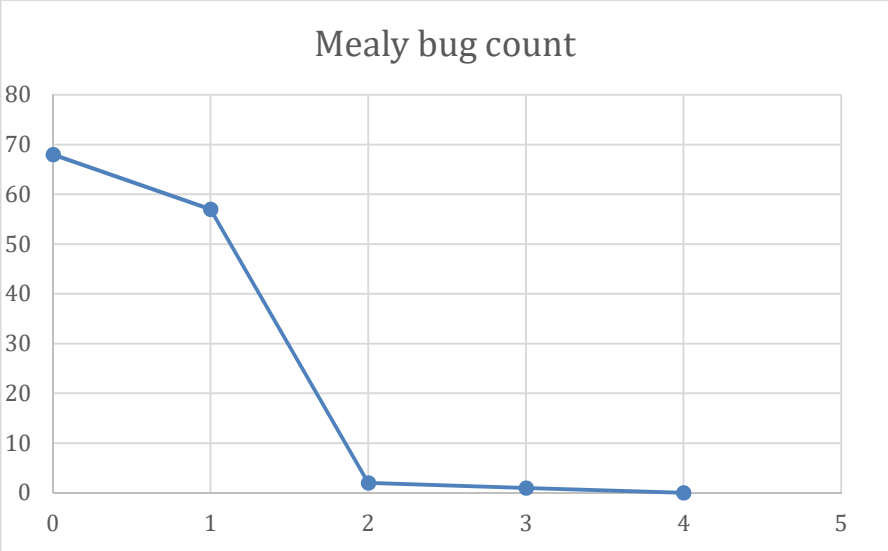

Figure 7. Graphical Presentation of the Result

6. Conclusions:

Developing effective biopesticides is crucial for promoting sustainable agriculture and reducing reliance on synthetic pesticides. This project will contribute to the growing body of knowledge on biopesticides, advancing our understanding of their efficacy, safety, and production methods. By harnessing nature's own defence mechanism, we can create a healthier and more sustainable agricultural system that ensures food security while preserving the environment for future generations.

7. Future Scope:

In future, we can test our extracted oil on different plants and on different plant diseases. We can extract the oil with the help of different solvents and different methods to find out the % recovery of oil. Due to its antibacterial, anti-inflammatory, and immunomodulatory qualities, neem oil and neem extracts will have potential use in medicines and healthcare items. Custard apple oil can be used as an ingredient in dietary supplements due to its potential antioxidant and anti-inflammatory properties.

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