

Green Solutions: The Role of Traditional Medicinal Plants in Insect Control Strategies

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Abstract: *Ethnomedicinal plants have been utilized for centuries to repel or kill insects globally. The transmission of this knowledge, primarily through village healers, has been hierarchical, resulting in limited ethnobotanical documentation of many herbal plant species. This study aims to document the insecticidal, repellent, and larvicidal properties of traditional medicinal plants. Over the past two decades, various studies and publications were reviewed, cataloging 25 traditional medicinal plants across 12 families. Different parts of these plants were prepared and applied in multiple forms to assess their effectiveness.*

Keywords: medicinal plants, traditional application, insecticides, larvicide, repellent

I. INTRODUCTION

Medicinal plants, whether cultivated or wild, are used for various purposes, including traditional herbal medicine, extraction of phytochemicals for homeopathic and Ayurvedic medicines, cosmetics, nutraceuticals, functional foods, and aromatherapy oils. In rural areas, inexpensive folk treatments provide health safety for economically disadvantaged populations. Additionally, medicinal plants support the livelihood of tribal communities, who collect and sell raw materials from forests in local markets.

Approximately 6,000 medicinal plants are available throughout the year, owing to the immense diversity of indigenous flora. These plants are crucial for both synthetic drug production and traditional medicine, with nearly 70% of synthetic drugs derived from plant sources. Maintaining healthy plant material is essential to ensure product quality. However, medicinal plants are becoming increasingly popular due to the rising market demand for plant-based products, coupled with insufficient supply caused by low production and pest and disease damages.

This review discusses currently used control measures for 25 medicinal plants and how these measures can be integrated to make cultivation profitable and environmentally friendly. The use of plant-derived substances against insects, as reviewed by Gahukar (2012), exemplifies such measures.

Vector control and personal protection against vector-borne diseases are vital measures to prevent these diseases. Traditional chemical-based interventions are becoming less effective due to resistance development, ecological disruption, and toxic effects on humans and non-target species. Thus, new plant-based insecticides, repellents, and larvicides need to be developed to provide environmentally safe, biodegradable, and effective solutions.

Plants have been historically used to combat blood-sucking insects, and this practice continues in many parts of the world. Recent efforts have focused on plant extracts or phytochemicals as potential sources for vector control. Many plant extracts and compounds have demonstrated promising insecticidal and larvicidal properties. Furthermore, repellents play a key role in preventing vector-borne diseases by reducing human-vector contact.

Many plant species produce substances that protect them by repelling or killing insects, which include repellents, feeding deterrents, toxins, and growth regulators. These compounds are effective against many mosquitoes and other biting Diptera. While these insecticidal/repellent properties have been traditionally passed down orally, there is a need to document and preserve this knowledge for future use.

II. MATERIALS AND METHODS

Data on insecticidal, larvicidal, and insect repellent plants were collected from published articles, theses, and research reports. Ethnobotanical publications and sources from the past two decades were reviewed using keywords like insecticide, repellent, larvicide, and medicinal plants. Data was organized into an Excel spreadsheet, detailing the scientific, family, and local names of each species, plant part used, and application methods.

III. RESULTS

The review cataloged 25 medicinal plants across 12 families. Six species were in the Lamiaceae family, while Rutaceae, Verbenaceae, and Solanaceae each had three species. Single species were noted in the Meliaceae, Caricaceae, Rhamnaceae, Euphorbiaceae, Cactaceae, and Cucurbitaceae families. These plants were used in various forms to repel or kill insects and larvae.

No.	Botanical Name	Family	Common Name	Habit	Parts	Methods of Application	Insects
1	Azadirachta indica	Meliaceae	Nimtree or Indian lilac	Trees	Leaves	Burn leaf to generate smoke	Insecticides
2	Carica papaya Linn.	Caricaceae	Papaya or pawpaw	Trees	Leaves	Crushing the dried leaves and apply the juice on the exposed parts of the body.	Mosquitoes and ticks repellent
3	Citrus aurantifolia (Christm.)	Rutaceae	Key lime or acid lime	Trees	Peels of fruits	Peels crushed and applying on exposed parts of the body. Fruit is squeezed with leaf of L. ocymifolia seed of L. sativum, Salvia schiperi, R. chalapensis and A. sativum, all of these are mixed together in water and drunk for Hen.	Insect repellent
4	Citrus sinensis (L.) Osb.	Rutaceae	sweet orange	Trees	Peals	Dried peels burned to generate smoke	Mosquitoes and house fly repellent
5	Eucalyptus globulus L.	Rutaceae	Tasmanian blue gum	Trees	Leavs	Peels crushed and applying on exposed parts of the body	Insecticides
6	Eucalyptus citrodora	Myrtaceae	lemon-scented gum	Trees	Whole plant and leaves	Burning whole plant and crushing leaves and applying on exposed body parts	Repel Mosquitoes, coachroaches, ticks, house fly and other haematophagous insects
7	Eucalyptus camaldulensis Dehn.	Myrtaceae	River red gum	Trees	Leaves	Burn whole plant to generatesmoke	Insecticides
8	Lantana camara L.	Verbenaceae	Lantana	Shrub	Whole part	Growing of plants as a living fence to repel insects like ticks	Repellent of pests
9	Vitex negundo L.	Verbenaceae	Chinese chaste tree, five-leaved chaste tree, or	Tree	Leaves	Burn whole plant to generatesmoke	Larvicidal Insecticidal

			horseshoe vitex				
10	Vitex trifolia	Verbenaceae	Common Blue Vitex, Legundi, Lenggundi, Lagundi,	Shrub/ small Tree	Leaves	Burn whole plant to generatesmoke	Larvicidal, Insecticidal
11	Solanum macrocarpon	Solanaceae	African Eggplant	Shrub/ small tree	Fruits	Fruit juice sprayed in the house	Insecticidal
12	Solanum nigrum	Solanaceae	Makoi or black nightshade	Shrub	leaf	Not explained	Insecticidal
13	Nicotiana tabacum	Solanaceae	Tobacco	Shrub	Leaf	Burn leaf to generate smoke	Deter mosquitoes indoo
14	Ziziphus spinachrist	Rhamnaceae	red date	Tree	Leaf/root	Leaf/root is added on fire and fumigates to eradicate flies	Insect repellent
15	Ricinus communis	Euphorbiaceae	Castor bean	Tree	seed	Seed crushed and its juice	Insecticidal

Table 1: Traditional medicinal plants used insecticide, larvicidal and repellent.

IV. DISCUSSION

Various plant parts, including leaves, stems, roots, and plant resins, were prepared in different forms. The most commonly used parts were leaves, followed by roots. Methods included burning plants, hanging fresh plants, preparing extracts, and growing plants as living fences to deter insects. Aqueous extracts showed larvicidal activity against insect larvae. Smoking was the most widely used method, followed by skin application.

The review identified several medicinal plants used as repellents, insecticides, and larvicides, indicating that plants contain a range of phytochemicals that can serve as alternative insect control agents.

V. CONCLUSION

This systematic review demonstrates the presence of many medicinal plants with insecticidal, repellent, and larvicidal properties. These plants hold promise for developing future commercial insecticidal agents that are environmentally safe and effective.

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