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Biopesticidal Activity of *Azadirachta Indica* A Juss

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ABSTRACT

Biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. For example, canola oil and baking soda have pesticidal applications and are considered biopesticides. NEEM (*Azadirachta indica* A Juss.) is well known in India for centuries for its medicinal properties. Besides, it is also a source of natural insecticides. The key insecticidal ingredient found in the neem tree is azadirachtin, the potent insect and mite killer, anti-feedant, and growth retardant isolated from the kernel of neem seeds. Azadirachtin is a highly oxidized triterpenoid having molecular formula of C35 H44 O16. This broad spectrum biocide provides the most effective, economic and lasting control of major pests of agricultural and plantation crops. It is the most environment friendly pesticide, highly biodegradable and leaves no residues on the food stuff. It is structurally similar to insect hormones called "ecdysones," which control the process of metamorphosis as the insects pass from larva to pupa to adult. Metamorphosis requires the careful synchrony of many hormones and other physiological changes to be successful, and azadirachtin seems to be an "ecdysone blocker." It blocks the insect's production and release of these vital hormones. Insects then will not molt, thus breaking their life cycle. . At the same time, Azadirachtin is used to control whiteflies, aphids, thrips, fungus gnats, caterpillars, beetles, mushroom flies, mealybugs, leafminers, gypsy moths and others on food, greenhouse crops, ornamentals and turf.

Keywords: Neem, Azadirachtin, Biopesticides

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INTRODUCTION

Biopesticides are pesticides with living organism which intervene in life cycle of the insect pest and will kill it by causing diseases. Biopesticides are important in ecofriendly pest management. Biopesticides are usually inherently less toxic than conventional pesticides. Biopesticides generally affect only the target pest and closely related organisms, in contrast to broad spectrum, conventional pesticides that may affect organisms as different as birds, insects, and mammals.Biopesticides often are effective in very small quantities and often decompose quickly, thereby resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides. Neem and its allelo chemicals have variety of effect on pests.140 active components have been identified to date that occur in different parts of tree. The most important component identified has been the tetratripernoids the azadiractin It has low risk of pest resistance due to different mode of action, specific effect on pests [1,2]. It specifically acts on Lepidopterons. Advantages.· Insect die due to starvation, Deterrence of growth , Egg sterility and Interference in the process of Oviposition.

Neem (*Azadirachta indica* A. Juss)
Family: Meliaceae,
Subfamily: Meliodeae,
Order: Meliales

Is an evergreen tree native to the Indian subcontinent. It also grows widely in several other countries of Asia, Australia, Africa and Central and South America. The tree grows on almost all kinds of soils including saline and alkali and the other wastelands. It grows as avenue, ornamental and agroforestry plantation or as shade tree along roadsides. For centuries, it has been held in high esteem by Indian folk for its medicinal and insecticidal properties. Various pans of the tree have been employed to obtain medicinal preparations used in Ayurvedic and Unani systems of medicines. It has been an age-old practice to place its dried leaves between folds of clothes to ward off moths, insects and other pests in stored rice, wheat and other grains. It is now considered to hold a great potential as pest control agent for use in agriculture. Owing to ever increasing public concerns about the harmful effects of toxic synthetic pesticides, neem based products have virtually taken the center-stage as a possible alternative [3-5]. The problems associated with synthetic pesticides such as pest resistance, environment contamination, toxic residues in food, feed and fibre, chronic toxicity, disruption of non-target organisms, etc., are practically non-existent with biopesticides based on neem. Initial studies on neem were focussed on the manurial, soil conditioning and pesticide value of its cake.Besides, Neem is a renewable source of various useful products .It finds application in medicines, soap making, pest control, nitrification inhibition, slow nutrient release manure,. cattle feed, fuel, energy, ete. It has emerged as the single most important source of pesticides and allied products. All parts of the tree such as leaf, flower, fruit, seed, kernel, bark, wood, and twig are biologically active, the maximum activity being associated with the seed kernel. Biopesticides based on neem are endowed with features of diverse activity and relative safety to non-target organisms. A broad spectrum of activity against insects, phyto-nematodes, plant pathogens, etc., is exhibited with multifarious modes of actions. Worldwide, more than 500 pest species are controlled. Its multi-pronged effects against insects as repellent, antifeedant, oviposition deterrent, molting or growth disrupt or, sterilant, ovicide and oviposition deterrent help to effectively control a variety of farm and household insect pests and pathogens infesting agricultural, plantation and cash crops. In agriculture, neem products are valued for their effect as slow N-release materials and as nitrification inhibitor also [6,7].

Common Names

- Margosa tree
- Nim
- Nimba in the Indonesian language
- Veembu in the Indian language
- Village dispensary

Distribution

The neem tree can be found growing in countries located in the equatorial belt.

- High tolerance in harsh environments
- Grows poorly in waterlogged and cold regions-A resilient tree 4-53 degree Celsius
- Grows best in the altitudes of sea level to 800 above level, well drain soil
- Substantial tolerance to saline conditions e.g Kingdom of Saudi Arabia uses saline water to irrigate their neem trees

Biology

The Neem has adapted to a wide range of climates. It thrives well in hot weather, where the maximum shade temperature is as high as 49°C and tolerates cold up to 0°C on altitudes up to 1500 meters . Neem is well established plant in at least 30 countries world-wide, in Asia, Africa and Central and South America. Some small scale plantations are also reportedly successful in the United States of America. The Neem grows on almost all types of soils including clay, saline and alkaline soils, with pH up to 8.5, but does well on black cotton soil and deep, well-drained soil with good sub-soil water. Unlike most other multipurpose tree species, it thrives well on dry, stony, shallow soils and even on soils having hard calcareous or clay pan, at a shallow depth. The tree improves the soil fertility and water-holding capacity as it has a unique property of calcium mining, which changes the acidic soils into neutral Neem tree needs little water and plenty of sunlight. The tree grows naturally in areas where the rainfall is in the range of 450 to 1200 mm. However, it has been introduced successfully even in areas where the rainfall is as low as 200 - 250 mm. It cannot withstand water-logged areas and poorly drained soils.The Neem grows slowly during the first year of planting. Young neem plants cannot tolerate intensive shade, frost or excessive cold. A Neem tree normally begins to bear fruit between 3 and 5 years and becomes fully productive in 10 years. A mature tree produce 30 - 50 kg. fruit every year.It is estimated that a Neem tree has a productive life span of 150 - 200 years.

Chemical Constituents

Neem contains a large number of chemically diverse and structurally complex bioactive tetranortriterpenoids commonly referred to as C-seco meliacins or limonoids. Some of the potential compounds include a number of azadirachtinoids, salannin, desacetyl salannin, nimbin, desacetyl nimbin, etc. The bioactivity related research on this plant has focussed on azadirachtin because of its abundance and unique mode of action. It does not knockdown or kill the insect instantaneously like most neurotoxic insecticides. Instead, it elicits physiological and behavioral responses in insects, which lead to their death. The azadirachtinoids are a mixture of twelve closely related meliacins, which constitute 0.3 to 0.6% of seed kernel. Several extraction techniques using either methanol, ethanol, methyl ethyl ketone, methyl tert-butyl ether or water, or their azeotropic mixtures as solvents, and separation techniques such as column chromatography, preparative thin layer chromatography, vacuum liquid chromatography and reverse phase medium or high pressure preparative liquid chromatography have been described for obtaining major azadirachtins such as A, Band H and other bioactive meliacins. Most of the processes have been patented. While liquid chromatographic and supercritical fluid chromatographic methods have been developed for their analysis, the structures have been established by IH NMR, 13C NMR and mass spectral techniques. A number of cyclic tri- and tetrasulfides, identified from the steam distillate of the fresh matured leaves and head space volatiles of crushed seeds, have been reported to possess insectrepellentandspermicidalaction[8,9,10].

Structure-activity relationship studies on the two fragments of azadirachtin, i.e., dihydrofuranoacetal and decalin moieties, revealed that the former imparted antifeedant activity and the latter caused disruption of insect growth and development. Azadirachtin is unstable to heat, light, water, pH, microbes, etc., because of which its effective life under field conditions is short. Several attempts have been made in the past to stabilize it either by structure modification or use of UV screens and other stabilizers. Its reduced derivatives, namely, dihydro- and tetrahydro-azadirachtin are more stable to light, heat, moisture, etc., and also retain the bioactivity [11,12]

For century's people all across the Asian continent have used different parts of the tree for various uses from;

- Medicine
- Oil and extracts for pest control
- Seed kernel cake for fertilisers
- branches and twigs for tooth-brush
- leaves as vegetables and tea.
- Slows Desertification
- Reforestation
- Shades
- Windbreaks
- Phytoremediation

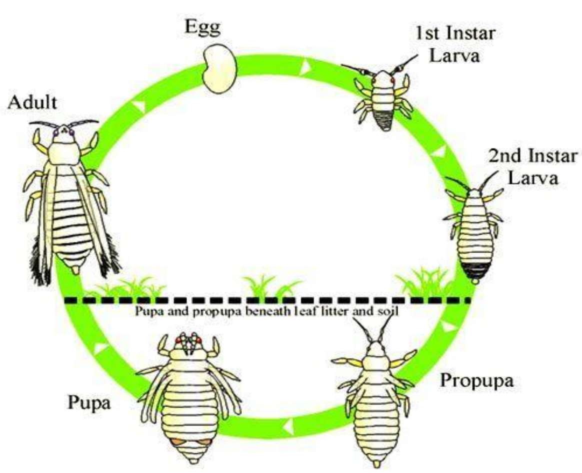
- Worship

Uses of Different Parts of the Neem Tree

- Seeds & Kernels- Extracts for bio-pesticide
- Cake- Fertilizer, Soil Manure, Animal fodder
- Wood- Furniture, Firewood, Construction, Insect repellent
- Bark- Medicine, Toothpaste
- Leaves- Vegetables, Tea, Medicine, Food preservatives, Fertilizers
- Fruits-Oil Extracts, Medicine
- Roots- Medicine
- Twigs- Toothbrush
- Oil- Soap production, Edible oil, Lubricants, Bio-pesticide, Insect repellent

Mode of Action

- Repels insects resulting in reduction of pest load in treated crop area
- Prevents insects from feeding on treated surfaces thereby preventing crop damage
- Weakens insect fitness resulting in greater susceptibility to pesticides, pathogens, and predators
- Exhibits low to moderate contact toxicity to soft-bodied insects
- Systemic activity upon root application
- Pure azadirachtin and addition of other emulsifiers and oils result in greater UV stability and increased shelf-life compared to first-generation azadirachtin products [13, 14].



Simple Domestic Preparation

1. Collect Neem seeds
2. Dry them in shadow
3. Grind it
4. Then prepare aqueous extract by

5. Dissolving 50g of grounded seed in 1 liter of water
6. Soak it overnight
7. Use that water for spraying to control pests.

CONCLUSION

In the past two decades, "Green Revolution Technologies" have more than doubled the yield potential of rice and wheat, especially in Asia. These high-input production systems requiring massive quantities of fertilizers, pesticides, irrigation, and machines. However, disregarding the ecological integrity of land, forests, and water resources, endanger the flora and fauna, and cannot be sustained over generations. Also, we cannot look to the sea in future as fishing stocks in many parts of the world are already in crisis due to over fishing or pollution. To a great extent, future food security and economic independence of developing countries would depend on improving the productivity of biophysical resources through the application of sustainable production methods, by improving tolerance of crops to adverse environmental conditions, and by reducing crop and post-harvest losses caused by pests and diseases.

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