



Botanicals in Integrated Pest Management



Outline

What are botanical insecticides

History of Botanicals in Pest Management

Important plant families

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Classifications of Botanical insecticides

Mechanism of action of pesticides of plant origin

Drawbacks and barriers to commercialization

What are botanical insecticides?

Naturally occurring chemicals (insect toxins) extracted or derived from plants or minerals. They are also called Natural insecticides.



History of Botanicals in Pest management

- **2000 B.C.:** The Hindu book, the Rig Veda, written in India mention of the use of poisonous plants for pest control.
- **Roman Empire:** Hellebore (*Ranunculaceae*) for control of rats, mice and insects.
- **1,200 B.C.:** Botanical insecticides are used for seed treatments and as fungicides in China.
- **600 B.C.:** Charaka regarded neem flowers, fruits, leaves, bark and roots as the 'Panchamrit'.
- **400 B.C:** Pyrethrum (*Tanacetum cinerariaefolium*) : delousing procedures for children by Persian King Xerxes' reign.

- **17th century:** Nicotine against plum beetles.
- **1690:** The tobacco extract was used as a plant spray in parts of Europe.
- **1763:** Ground tobacco recommended in France to kill aphids.
- **1809:** Nicotine discovered in France to kill aphids.
- **1848:** *Derris* (Rotenone) reported to be used in insect control in Asia.
- **1850:** Rotenone cause fish to start floating, later Sabadilla were used.



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- **1858:** Pyrethrum first used for insect control in the USA.
- **1910:** antifeedant effect of neem on locust was made by Carlothays.
- **1919:** first record of scientific study on protection of food grain by use of neem by Fletcher and Ghosh.
- **1980:** The interest in botanical pesticides revived and the First International conference on Neem was held at Rottach Egern Germany.

Important plant families having pesticidal properties

Family	Number of plants
Meliaceae	>500
Myrtaceae	72
Asteraceae	70
Euphorbiaceae	63
Leguminosae	60
Fabaceae	55

Properties of botanicals

- **Fast breakdown**
- **Fast action**
- **Selectivity**
- **Toxicity**
- **Phytotoxicity**
- **Cost and availability**



Classifications of Botanical insecticides

Based on the physiological activity 6 groups namely

1. Repellents:

Eg: DEET against Mosquitoes, flies, fleas

NSKE: Lepidopteran caterpillars, BPH

Basil (*Ocimum basilicum*), (*Mentha piperata*), and lemon eucalyptus (*Corymbia citriodora*)

2. Feeding deterrents/antifeedants:

Eg: Azadirachtin- Desert Locust, lepidopteran caterpillars

Pyrethrum-*Glossina* sp.

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3. Toxicants:

Nicotine, Anise, cumin, eucalyptus, oregano and rosemary were also reported as fumigants and caused 100% mortality of the eggs of *Tribolium confusum* and *Ephestia kuehniella*.

4. Natural grain protectants:

Annonaceae, Asteraceae, Canellaceae, Labiatae, Meliaceae, Rutaceae.

1 to 2 % Kernel powder or oil.

5. Chemosterilants/ Reproduction Inhibitors:

Pyrethrum: Cigarette beetle, house fly

Rotenone: House fly

Nicotine: House fly

6. Insect growth and development inhibitors:

Eg: neem-Lepidopteran and Coleopteran larvae.

Botanicals insecticides

Plant	Scientific name	Family	Active principle	Plant parts used
Neem	<i>Azadirachta indica</i>	Meliaceae	Azadirachtin	Seeds and leaves
Rotenone	<i>Derris elliptica</i> and <i>Lonchocarpus</i> spp.	Fabaceae	Rotenone, Related Isoflavones	Roots
Sabadilla	<i>Schoenocaulon officinale</i>	Liliaceae	Cevadine and vertridine	Seeds
Ryanodine	<i>Ryania speciosa</i>	Flacourtaceae	Ryanoids	Woody stems
Tobacco	<i>Nicotiana tobaccum</i> and <i>N. rustica</i>	Solanaceae	Nicotine	Plants
Pyrethrum	<i>Chrysanthemum cinerarifolium</i>	Asteraceae	Pyrethrin	Dried flowers
Citrus	<i>Citrus</i> spp	Rutaceae	Limonene and Linanool	Peel extracts

Botanical pesticides used to control different insect pests

Botanical pesticides	Insect pests
Nicotine	Aphids, thrips, caterpillars
Rotenone	Bugs, aphids, potato beetles, spider mites, carpenter ants
Ryania	Codling moths, potato aphids, onion thrips, corn earworms
Sabadilla	Grasshoppers, codling moths, armyworms, aphids, cabbage loopers, squash bugs
Pyrethrum	Caterpillars, aphids, leafhoppers, spider mites, bugs, cabbage worms, beetles
Essential oils	Caterpillars, cabbage worms, aphids, white flies
Neem products	Armyworms, cutworms, stem borers, bollworms, leaf miners, caterpillars, aphids, whiteflies, leafhoppers, psyllids, scales, mites and thrips