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Botanicals Role in Integrated Pest Management

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Naturally occurring chemicals (insect toxins) extracted or derived from plants or minerals. They are also called Natural insecticides. Botanicals degrade more rapidly than most chemical pesticides, and are, therefore, considered relatively environment friendly and less likely to kill beneficial pests than synthetic pesticides with longer environmental retention. Most of the botanical pesticides generally degrade with in few days and some times with in a few hours, these pesticides needs to be applied more frequently.

History of Botanicals in Pest management

2000 BC	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 BC	Botanical insecticides are used for seed treatments and as fungicides in China.
600 BC	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.
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

- **They fight premature aging.** Plant extracts are **rich in antioxidants**, which can protect the skin from the effects of harmful UV exposure.
- **They prevent inflammation.** Plant oils contain phospholipids, which exhibit **anti-inflammatory properties** that can help maintain homeostasis within our skin barrier.
- **They promote hydration.** Plant oils can also create a protective barrier and help our skin cells maintain the water needed for proper function.
- **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.

4. 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.*

5. Natural grain protectants: Annonaceae, Asteraceae, Canellaceae, Labiatae, Meliaceae, Rutaceae. 1 to 2 % Kernel powder or oil.

6. Chemosterilants/ Reproduction Inhibitors: Pyrethrum: Cigarette beetle, house fly Rotenone: House fly Nicotine: House fly.

7. Insect growth and development inhibitors: Eg: neem- Lepidopteran and Coleopteran larvae.

Botanicals insecticides

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

Botanical pesticides used to control different insect pests

Botanical pesticides	Against insect pests
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
Nicotine	Aphids, thrips, caterpillars
Rotenone	Bugs, aphids, potato beetles, spider mites, carpenter ants
Ryania	Codling moths, potato aphids, onion thrips, corn earworms

Factors Affecting Use of Botanical Pesticides

1. Raw Material Availability

Plants represent a vast store house of potentially useful chemical molecules. Many laboratories around the world are engaged in screening of plants not only for therapeutic purposes but also for useful natural products which have wider implications in the development of pest control agents for use in agriculture. These studies speak volume about the plant species possessing potential pest controlling activity under laboratory conditions but the step from the laboratory to field eliminates many contenders.

2. Standardization of Botanical Extracts Containing a Complex Mixture of Active Constituents

The crude plant extract contains a mixture of chemical molecules belonging to different chemical class of compounds and all may not possess biological activity. Therefore, for a botanical pesticide to be effective, there should be chemical standardization in order to concentrate the chemical molecules possessing biological activity.

3. Market Opportunities for Botanical Pesticides

Low market share of botanical pesticides in industrialized countries as compared to multimillion dollar regulatory costs prevent many botanical pesticides from reaching the market place. Furthermore, regulatory procedures presently in place are tailored specifically for synthetic chemicals. On the other hand complex mixtures of bioactive constituents in botanicals make their registration difficult. In India for instance applicants are allowed to market new products up to a period of five years before final registration.

Conclusion:

Application of synthetic pesticides is a regular practice to ward off infestation of insect pests and diseases from field crops. However, as these conventional chemicals are reported to cause environmental load and threat to public health, the world trends in pesticide research now a day calls for discovery of safer and eco-friendly chemicals for pest control. Plants are rich resource of chemicals that are toxic to pests.

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