

Botanical Pesticides: An Eco-friendly technique to control pests

*¹Bhanu Verma and Vinay Kumar Kardam²

¹Division of Seed Science and Technology, ICAR-Indian Agriculture Research Institute, New Delhi.

²Department of Plant Pathology, Swami Keshwanand Rajasthan Agricultural University Bikaner, Rajasthan

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Introduction

Botanical pesticides are substances that exist naturally in plants and are derived from plants. Natural pesticides can be used instead of synthetic chemical formulations, however they are not always less hazardous to humans.

Mode of Action

The specific biochemical interaction via which a pesticide generates its impact is referred to as mode of action. The affected enzyme, protein, or biological process is usually included in the method of action. While the majority of other classes pertain to the pests controlled, physical features, or chemical content, mode of action refers to the biological process that the pesticide inhibits.

Factor Affecting the Application of Botanical Pesticides:

1. Availability of raw materials
2. Standardization of botanical extracts with a complex combination of active ingredients
3. Types of solvents, plant species, and plant parts
4. Rapid decomposition
5. Registration with the state
6. Botanical pesticides' market prospects
7. The weather situation

Considerations for selecting a botanical for Seed Treatment:

- Persistence and conformity to treatment requirements
- Compatibility

- No influence on viability and plant ability

Potential botanicals for seed treatment

- *Azadirachta indica*
- *Acorus calamus*
- *Chenopodium album*
- *Eucalyptus sp.*
- *Mentha arvensis*
- *Piper nigrum*
- *Tetrademia*

Formulants for Botanicals - Carrier/Diluent, Stabilizers, Stickers and Colours

Resources of Botanical Pesticides There are now four primary types of botanical products used for pest control (pyrethrum, rotenone, neem, and essential oils), as well as three more that are only utilised in limited circumstances (ryania, nicotine, and sabadilla).

Current Botanicals in Use and Their Mode of Action

The botanical pesticides could be divided into two generations:

1st generation: - Nicotine, Rotenone, Sabadilla, Ryania, Pyrethrum.

2nd generation: - Synthetic Pyrethroids and Neem Products (Azadirachtin).

Potential new Botanicals: - *Annonaceous Acetogenins*, Sucrose Esters.

The first Generation of Botanical Pesticides



Nicotine:-

Tobacco plants (*Nicotiana tabacum*) produce an alkaloid called Nicotine.

Mode of Action

Nicotine is a very fast-acting nerve poison in both insects and humans. It competes with the neurotransmitter acetylcholine by binding to acetylcholine receptors at neuron synapses, producing unregulated nerve firing.

Affect on: Aphids, Thrips and Caterpillars

Rotenone:-

Rotenone is a type of isoflavonoids produced by the tropical legumes *Derris*, *Lonchocarpus*, and *Tephrosia* in their roots or rhizomes.

a) *Derris* sppb) *Lonchocarpus* sppc) *Tephrosia* spp

Mode of Action

Rotenone is a potent inhibitor of cellular respiration, which is the mechanism by which nutrients are converted into energy at the cellular level. Rotenone is a toxin that affects nerve and muscle cells of insects, forcing them to stop feeding quickly.

Affects on: Bugs, aphids, Potato beetles, spider mites

Sabadilla:-

Sabadilla is obtained from the seeds of the South American lily *Schoenocaulon officinale*.

Mode of Action

The poisonous alkaloids in sabadilla disrupt nerve cell membrane activity in insects, resulting in nerve cell membrane action loss, paralysis, and death.

Affects on: Thrips

Ryania:-

It is obtained by grinding the wood of the Caribbean shrub *Ryania speciosa* (Flacourtiaceae).

Mode of Action

Ryania is a slow-acting stomach poison. It does not induce instant knockout paralysis, but it does cause insects to cease eating shortly after consuming it.

Affects on: Potato Aphids, Onion Thrips, Corn Earworms, Silkworms

Pyrethrum:-

Pyrethrum is obtained from, crude extract of flower head *Chrysanthemum cinerariaefolium*

Mode of Action

Pyrethrins exert their toxic effects by disrupting the sodium and potassium ion exchange process in insect nerve fibers and interrupting the normal transmission of nerve impulses.

Pyrethrins insecticides are extremely fast acting and cause an immediate “knockdown” paralysis in insects.

Affects on- Caterpillars, Aphids, Leafhoppers, Spider mites, Bugs, Cabbage worms, Beetles



d) *Sabadilla*

e) *Ryania*

f) *Pyrethrum*

The Second Generation of Botanical Pesticides

Synthetic Pyrethroids:-

Pyrethroids are obtained from flower extract of *Chrysanthemum spp.*

Mode of Action

Synthetic pyrethroids are known to be neurotoxicants that act on excitable membranes directly.

Affects on: Caterpillars, Aphids, Thrips.

Neem Products (Azadirachtin):-

It is obtained from seed (fruit) of Indian neem tree [*Azadirachta indica*]

Mode of Action

Neem is most effective as a feeding deterrent in insects, although it can also operate as a repellent, growth regulator, oviposition (egg deposition) suppressor, sterilant, or poison in different forms.

Affects on: Stem borers, Bollworms, Leaf miners, Whiteflies and Leafhoppers

Potential new Botanicals

Annonaceous Acetogenins

It is prepared from the seeds of tropical *Annona* species, custard apple family (Annonaceae), sweetsop (*A. squamosa*) and soursop (*A. muricata*).

Mode of Action

It reduced the rate of oxygen consumption by fourth instar *Ostrinia nubilalis*.

Affects on: Lapidopterans and Colorado potato beetle

Sucrose Esters

Sugar esters found in wild tobacco leaf (*Nicotiana gossei*) were detected by the US Department of Agriculture.

Mode of Action

Suffocation (by blocking the spiracles) or rupture of cuticular waxes and membranes in the integument kills small insects and mites.

Affects on: Soft-bodies insects and Mites



g) Neem

h) *Annona* spp

i) *Nicotiana gossei*

Advantages of Botanical Pesticides

- The farmer is familiar with the plants that produce the above mentioned chemicals since they all grow in the same geographical region.
- These plants usually have additional purposes, such as insect repellents in the home or medicinal properties.
- The active product's rapid degradation may be advantageous since it decreases the possibility of residues on food.
- Many of these products work rapidly to stop insects from feeding, even if they don't kill them.
- The majority of these chemicals aren't harmful to plants.
- These chemicals do not acquire resistance as fast as synthetic pesticides.

Disadvantages of Botanical Pesticides

- UV radiation degrades them quickly, therefore their effectiveness is limited.
- They aren't always available throughout the year.
- There are no legislations that support their usage.
- There are no specified residue limits for the majority of them.

Future thrust



- Determine which botanicals could be useful.
- Toxicology and preliminary formulation.
- Evaluation on a large scale.
- Data on product registration.
- Recommendation for use.

