Natural Pesticides

Introduction of Natural Pesticides

Overview

- In Pharmacognosy, which is the study of crude drugs obtained from natural sources such as plants, animals, and minerals, the study of natural pesticides holds significant importance.
- Natural pesticides are substances derived from natural sources—primarily plants, but also microorganisms and minerals—that are used to control pests (insects, weeds, fungi, rodents, etc.) without synthetic chemical synthesis.
- Natural pesticides are known as biopesticides and offer an eco-friendly, biodegradable, and less toxic alternative to synthetic pesticides.



- In pharmaceutical sciences, particularly pharmacognosy, these agents are studied not just for pest control but also for their chemical constituents, mechanism of action, and potential therapeutic applications.
- Natural pesticides include botanical pesticides, microbial pesticides, and mineral-based pesticides.
- Among these, botanical pesticides are most studied in pharmacognosy due to their plant origin.

Importance of Studying Natural Pesticides

- Helps in identifying safe, sustainable, and biodegradable alternatives to synthetic pesticides.
- Promotes the use of ethnomedicinal knowledge where plants are traditionally used to repel insects or pests.
- Aids in pharmaceutical applications by isolating bioactive constituents that might have therapeutic potential.
- Encourages green chemistry and reduces toxic residue accumulation in ecosystems.

Examples of Natural Pesticides

Nicotine

- **Biological Name**: *Nicotiana tabacum*



- **Synonym**: Tobacco
- **Biological Source**: Leaves of *Nicotiana tabacum* (Family: Solanaceae)
- **Method of Preparation**:
  - Curing and drying of leaves
  - Extraction using acidified water or organic solvents
  - Concentration to obtain nicotine sulfate
- **Characteristics**:
  - Colorless to yellow-brown oily liquid
  - Strong odor and acrid taste
  - Highly volatile and hygroscopic
- **Chemical Constituents**:
  - Nicotine (alkaloid)
  - Nornicotine, anabasine (minor alkaloids)
- **Uses**:
  - Contact and fumigant insecticide
  - Effective against aphids and mites
  - Used in organic gardening (now limited due to toxicity)

Pyrethrum

- **Biological Name**: *Chrysanthemum cinerariifolium* or *Tanacetum cinerariifolium*



- **Synonym**: Dalmatian pyrethrum

- **Biological Source**: Dried flower heads of *Chrysanthemum cinerariifolium*, Family: Asteraceae
- **Method of Preparation**:
  - The flowers are harvested and dried.
  - The dried flowers are powdered and extracted using solvents (e.g., hexane or ethanol).
  - The extract is concentrated and formulated as pyrethrin-rich pesticide formulations.
- **Characteristics**:
  - Yellowish-brown powder.
  - Strong aromatic odor.
  - Light-sensitive and unstable in alkaline medium.
- **Chemical Constituents**:
  - Pyrethrins I and II, Cinerins I and II, and Jasmolins I and II
  - These are esters of chrysanthemic acid and pyrethric acid with alcohols like pyrethrolone.
- **Uses**:
  - Used as a natural insecticide for home and agricultural use.
  - Acts on the nervous system of insects, leading to paralysis and death.
  - Used in lice treatment shampoos and mosquito repellents.

Neem

- **Biological Name**: *Azadirachta indica* A. Juss.



- **Synonym**: Margosa tree, Indian lilac
- **Biological Source**: Seeds, leaves, and bark of the tree. Family: Meliaceae
- **Method of Preparation**:
  - **Neem oil** is extracted by cold pressing or solvent extraction of seeds.
  - Leaves are dried and powdered for aqueous extract.
  - Bark and seeds are decocted for bioactive compounds.
- **Characteristics**:

  - Bitter in taste.
  - Greenish-brown in color.
  - Strong pungent odor.
- **Chemical Constituents**:
  - **Azadirachtin** (main pesticidal compound)
  - Nimbin, Salannin, Nimbidin, Gedunin
  - Triterpenoids and limonoids
- **Uses**:
  - Used as an **antifeedant**, **growth regulator**, **repellent**, and **sterilant** for insects.
  - Controls over 200 species of pests including aphids, beetles, and caterpillars.
  - Also used in pharmaceuticals for **antifungal**, **antibacterial**, and **anti-inflammatory** properties.

Rotenone

- **Biological Name**: Derived from *Derris elliptica*, *Lonchocarpus spp.*



- **Synonym**: Cube root, Fish poison
- **Biological Source**: Roots of *Derris elliptica*, Family: Fabaceae
- **Method of Preparation**:
  - Roots are dried and ground into powder.
  - Rotenone is extracted using organic solvents like chloroform or ethanol.
  - Purified via crystallization or chromatography.
- **Characteristics**:
  - White to light yellow crystalline solid.
  - Practically insoluble in water, soluble in organic solvents.
- **Chemical Constituents**:
  - **Rotenone** (isoflavonoid compound)
  - Other rotenoids: deguelin, tephrosin

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