TYPES OF PESTICIDES AND THEIR USAGE

- Classification of pesticides can be based on many factors.
- They can be grouped as **inorganic**, **synthetic**, or **biopesticides**.
- Based on the **target organism**, **chemical structure**, and **physical status** too, pesticides can be classified.
- Biopesticides can be microbial and biochemical pesticides.
- Pyrethroids, rotenoids, nicotinoids, and a fourth group that includes strychnine and scilliroside can be placed under **plant-derived pesticides or botanicals**.
- Herbicides, insecticides, fungicides, rodenticides, pediculicides, and biocides are the subclasses of pesticides.

TYPES OF PESTICIDES AND THEIR USAGE

- Pesticides can also be classified in terms of chemical families, such as **organochlorines**, **organophosphates**, or **carbamates**.
- After the end of the **World War II**, aldrin and dieldrin, two cyclodiene **organochlorines**, were introduced, followed by endrin, endosulfan, and isobenzan.
  - These cyclodiene organochlorine insecticides affected an insect's nervous system, leading to malfunction, tremors, and death.
- **Organochlorines** have harmful effects on the ecology.
  - As they are relatively insoluble, their traces can be found in soils and aquatic sediments. They bioconcentrate in the tissues of invertebrates and vertebrates from their food, move up trophic chains, and affect top predators.

TYPES OF PESTICIDES AND THEIR USAGE

- As organochlorines possessed the properties of **persistence** and **bioaccumulation**, their use was banned in the industrialized nations from 1973 to late 1990s. Yet they continued to be used in the developing countries.
- **Organochlorines** were largely replaced by **organophosphates** and **carbamates**.
- These two types of pesticides act by inhibiting the enzyme **acetylcholinesterase**, allowing acetylcholine to transfer nerve impulses indefinitely and causing a variety of symptoms such as weakness or paralysis.

TYPES OF PESTICIDES AND THEIR USAGE

- **Organophosphate insecticides** were developed in Germany during World War II. Originating from compounds developed as nerve gases
  - E.g. Tetraethyl pyrophosphate, parathion, demeton, phorate, diazinon, disulphoton, dimethoate, trichlorophon, and mevinphos.
- Organophosphate insecticides have the same effect in mammals as in insects. They inhibit the **cholinesterase enzyme** that breaks down the neurotransmitter acetylcholine at the nerve synapse, thereby blocking impulses and causing **hyperactivity** and **paralysis** of the insect, followed by death.
- Some of the organophosphate insecticides are systemic in plants and animals. They do not have significant environmental impacts, and they are neither persistent nor bioaccumulate in animals

TYPES OF PESTICIDES AND THEIR USAGE

- In comparison to organophosphates, **carbamates** are less toxic
- In 1951, **Geigy** Chemical Company introduced carbamates insecticides are broad spectrum with moderate toxicity and persistence.
- They **neither generally bioaccumulate** nor have major environmental impacts.
  - Carbaryl was the first carbamate insecticide. Aldicarb, methiocarb, methomyl, carbofuran, bendiocarb, and oxamyl are the other examples of carbamates.
- Carbaryl affects the nervous transmissions in insects. It inhibits the cholinesterase activity by blocking acetylcholine receptors.

TYPES OF PESTICIDES AND THEIR USAGE

- In the last few decades, the emphasis has been on developing pesticides that neither bioaccumulate nor are persistent.
- These new classes of insecticides are of the following forms:
- **Juvenile hormone mimics**, synthetic versions of insect juvenile hormones that act by preventing immature stages of the insects from molting into an adult, avermectins, and natural products produced by soil microorganisms.
- ***Bacillus thuringiensis*** toxins are proteins produced by a bacterium that is pathogenic to insects. When they are activated in the insect gut, they destroy the selective permeability of the gut wall. The first strains were toxic only to ***Lepidoptera,*** but subsequently strains toxic to **flies and beetles** have been developed.
- *B. thuringiensis* was incorporated into plants genetically.

Table 1 Major classes of pesticides

Type of pesticide	*Target pest group*
Acaricide	Mites, ticks, spiders
Antimicrobial	Bacteria, viruses, other microbes
Attractant	Attracts pests for monitoring or killing
Avicide	Birds
Fungicide	Fungi
Herbicide	Weeds
Insecticide	Insects
Molluscicide	Snails and slugs
Nematicide	Nematodes
Piscicide	Fish
Predacide	Vertebrate predators
Repellant	Repel pests
Rodenticide	Rodents
Synergist	Improves performance of another pesticide

Source Delaplane (1996)