



FACULTY OF AGRICULTURAL SCIENCES & ALLIED INDUSTRIES

ENT-121: Fundamentals of Entomology

Lecture 24: Toxicology and Classification of Insecticides:

Insecticides offer many benefits such as improved health of humans and animals, increased agricultural productivity, and reduced worldwide hunger. The use and misuse of insecticides, however, have been associated with health risks, environmental contamination, and poisoning

Classification of Insecticides:

Substances which are used to kill insects are called insecticides. Insecticides have a wide application in the field of medicine, agriculture, and industry. They have the potential to alter ecosystem components majorly and are toxic to animals as well as humans. Some insecticides become concentrated as they spread in the food chain.

Classification of insecticide

- Based on chemical composition, it is classified as organic and inorganic.
- Based on the mode of entry in the insects, it is classified as contact poisons, fumigants poisons, stomach poisons, and systemic poisons.
- Based on the mode of action, it is classified as physical poisons, nerve poisons, respiratory poisons, protoplasmic poisons, general poisons, and chitin inhibitors.
- Based on toxicity, it is classified into four types:
 1. Extremely toxic – Colour: red, symbol: skull and poison, oral LD50: 1-50
 2. Moderately toxic – Colour: blue, symbol: danger, oral LD50: 501 – 5000
 3. Highly toxic – Colour: yellow, symbol: poison, oral LD50: 51 – 500
 4. Less toxic – Colour: green, symbol: caution, oral LD50: >500
- Based on the stage of specificity, it is classified as ovicides, pupicides, larvicides and Adulticides

Types of insecticides

There are three different types of insecticides. They are

Systemic – This type of insecticide is introduced into the soil for it to get absorbed by the plant roots. Once the insecticide enters the roots, it moves to external areas such as leaves, fruits, twigs, and branches. It forms a layer on the plant surface area and acts as a poison to any insect that comes to chew the plant. Eg. Thioprid, Imidacloprid

Contact – These types of insecticides act like bullets that aim only at a particular target to kill insects by its application. Usually, household insect spray works like contact insecticides as it must directly hit the insect. Pyrethrin, Cypermethrin etc

Fumigants: fog or vapor form and kill through spiracles. Eg. Phosphine, Methyl bromide

Stomach Poison: Kill insects followed by the ingestion. BT etc.

On the Basis of Chemical Nature:

Chlorinated hydrocarbons:

An organochloride, organochlorine compound, chlorocarbon, or chlorinated hydrocarbon is an organic compound containing at least one covalently bonded atom of chlorine that has an effect on the chemical behavior of the molecule. BHC, lindane, Chlorobenzilate, methoxychlor, and the cyclodienes (which include aldrin, dieldrin, chlordane, heptachlor, and endrin).

Organophosphate:

Organophosphates (also known as phosphate esters, or OPEs) are a class of organophosphorus compounds with the general structure $O=P(OR)_3$, a central phosphate molecule with alkyl or aromatic substituents.[1] They can be considered as esters of phosphoric acid. Eg. Ethoprop, Malathion.

Carbamates:

A carbamate is a category of organic compounds that is formally derived from carbamic acid (NH_2COOH). The term includes organic compounds (e.g., the ester ethyl carbamate), formally obtained by replacing one or more of the hydrogen atoms by other organic functional groups;

Neonicotinoids:

Neonicotinoids are a class of neuro-active insecticides chemically similar to nicotine. Eg. acetamiprid, clothianidin, imidacloprid, nitenpyram, nithiazine, thiacloprid and thiamethoxam. Imidacloprid is the most widely used insecticide in the world. Compared to organophosphate and carbamate insecticides.

Biorationals: Insecticides of Animal or Plant origin.

Botanicals are plant-derived materials and include pyrethrin, azadiractin and neem oil, garlic, capsaicin, and vegetable oil. Microbial like Bt etc.

Insecticide Toxicology:

- Abiotic and Biotic degradation Process in which a substance is converted to simpler products by physical or chemical mechanisms: examples include hydrolysis and photolysis.
- Lethal concentration (LC₅₀) Lowest concentration of a substance in an environmental medium which kills 50% of test organisms or species under defined conditions.
- Lethal dose (LD₅₀) Lowest amount of a substance that kills 50% of test animals under defined conditions.
- Acceptable daily intake (ADI) Estimate by JECFA of the amount of a food additive, expressed on a body weight basis that can be ingested daily over a lifetime without appreciable health risk.
- Active ingredient Component of a mixture responsible for the biological effects of the mixture. Poisoning is a condition or a process in which an organism becomes chemically intoxicated by an exogenous substance, usually by ingestion or external exposure.
- If a person is suspected to have been exposed or ingested a poison, medical assistance to determine an appropriate treatment is necessary. If a suspected poisoning has occurred but the person is awake and alert, it is recommended to call the local poison information Centre If the person has collapsed or is having difficulty breathing, emergency medical assistance is required.
- The treatment will depend on the substance to which the individual is exposed. Depending on the type of poisoning, some first aid measures may help. Treatments include activated charcoal, induction of vomiting and dilution or neutralizing of the poison
- Acute effect of finite duration occurring rapidly following a single dose or short exposure to a substance or radiation.
- Antidote Substance capable of specifically counteracting or reducing the effect of a potentially toxic substance in an organism by a relatively specific chemical or pharmacological action.
- Biomagnifications ecological magnification Sequence of processes in an ecosystem by which higher concentrations are attained in organisms at higher trophic levels (at higher levels in the food web); at its simplest, a process leading to a higher concentration of a substance in an organism than in its food.