

- (a) Insect attractants; e.g. methyl eugenol, gyplure, hexaplure etc.
- (b) Insect repellents; e.g. creosote, mercurous chloride, trichlorobenzene etc.
- (c) Insect growth regulators; example are as under

Chitin synthesis inhibitors: The group of insecticides which inhibit the synthesis of chitin (Buprofezin, Benzoyl phenyl urea).

Juvenile hormone mimics: This is the group of insecticides which mimic with the juvenile hormone and affect the hormonal balance. Ultimately the metamorphosis is disturbed (Fenoxycarb, Pyriproxyfen).

Ecdysone agonists: The insecticides bind the ecdysteroid receptors and affect the physiology and biochemical processes (RH5849, tebufenozide).

Hormones: The secretions which produced by organisms into their blood and act at a place different from their origin are called hormones.

Pheromones: The secretions which are thrown outside the body are called pheromones. Pheromones are used to communicate between individuals of same species.

Chemosterilants: A chemosterilant is a chemical used to cause temporary or permanent sterility of one or both of the sexes of insects. The mating of sterilized insects with fertile insects produces no offspring and if the number of sterile insects is kept constant, the percentage of sterile insects will increase and fewer off springs will be produced in each successive generation. Types of chemosterilants are antimetabolites and alkylating agents.

3.1.2.3 Chemical nature

On the basis of chemical nature, the insecticides are classified on following types.

3.1.2.3.1 Elements: e.g. Sulphur, Phosphorus, Mercury etc.

3.1.2.3.2 Inorganic insecticides: Some of the earlier insecticides ever used in this category are Arsenicals (lead arsenate, sodium arsenites), Fluorides (Sodium fluoride, barium fluosilicates) and Seleniums (Sodium selenate).

3.1.2.3.3 Organic insecticides

Natural organics

(a) Animal origin; e.g. fish oils, nereistoxin.

Action of oils is of physical nature. Spiracles of insects are filled by oils and blockage of air in tracheae cause suffocation which results in the death of insects.

(b) Plant origin; e.g. rotenone, nicotine, ryania, derris, pyrethrums, limonene, azadiractin etc.

Synthesized Organics

(a) Organo-chlorine insecticides (chlorinated hydrocarbons)

Chlorine is the important part of these chemicals. These insecticides take a long time to disappear from environment and accumulate slowly in the bodies of insects and even in the bodies of higher animals. It unstabilizes the peripheral nervous system. Ultimately there is hyper toxicity, paralysis and finally death of the insects. If sudden poisoning occurs in human being, atropine sulfate or raw egg and milk can be used (called as Antidotes). Examples are DDT family, HCH family, Aldrin, Dieldrin, Heptachlor etc.

(b) Organophosphates insecticides

Phosphorus is the important part of these chemicals. These are not as persistent as chlorinated hydrocarbons. It may be contact, stomach or fumigants in action. These insecticides less accumulate in fat bodies of animals. These insecticides inhibit the production of cholinesterase enzyme. This enzyme dissolves the acetylcholine (liquid) after passing a pulse from synapses. So inhibition of this enzyme results in continuous passage of pulse and disturb the insect continuously, finally death of insect occurs. Toxicity of these chemicals varies from extremely hazardous to slightly hazardous chemicals.

Organophosphates are further classified into following categories.

- a. Pyrophosphates (derivatives of pyrophosphoric acid e.g. Schradan)
- b. Phosphates (derivatives of phosphoric acid e.g. Dichlorvos, Monocrotophos)
- c. Phosphorothioates (derivatives of phosphorothioic acid e.g. Parathion, Chlorpyrifos, Profenofos)
- d. Dithiophosphates (derivatives of dithiophosphoric acid e.g. Phorate, Malathion)
- e. Phosphonates (derivatives of phosphonic acid e.g. Trichlorfon)
- f. Phosphoramidates (derivatives of phosphoramidic acid e.g. Methamidophos, Acephate)

(c) Carbamates

It is relatively new group of synthetic insecticides. The compounds are strong alkalis. These are the derivatives of carbonic acid. These are further classified into following categories.

- a. Heterocyclic carbamates (Pirimicarb, Carbofuran, Bendiocarb, Carbosulfan, Furathiocarb)
- b. Phenyl carbamates (Carbaryl, Propoxur, Isoprocarb, Fenobucarb, Methiocarb)
- c. Oxime Carbamates (Aldicarb, Aldoxycarb, Methomyl, Oxamyl, Thiodicarb)

(d) Synthetic Pyrethroids

These have low toxicity to man and other vertebrate animals. These are very effective against flying insects. These have a wide range of its effectiveness. These are further classified into following categories.

- a. Permethrin (Ambush, Coopex)
- b. Cypermethrin (Ripcord, Cymbush, Arrivo)
- c. Deltamethrin (Decis, Leopard, Perfect, Lajawab)
- d. Fenvalerate (Sumicidin, Fenstar)

3.1.2.4 Insecticide Formulations

Insecticides are also classified on the basis on their formulations. Few different formulations of insecticides are as under:

- EC Emulsifiable concentrate
- WP Wettable powder
- SL Soluble (liquid) concentrate
- SP Soluble powder
- GR Granules
- DP Dusts

3.2 Integrated Control of Pests (Integrated pest management)

It is also called pest management or integrated pest management or I.P.M. It is the control of insect pests by any combination of control methods which result in fewer hazards to man and his environment. Generally many methods of control (natural or artificial) are combined to control a particular insect pest. All the control measures are the elements of IPM.