

Toxicity caused by Agrochemicals

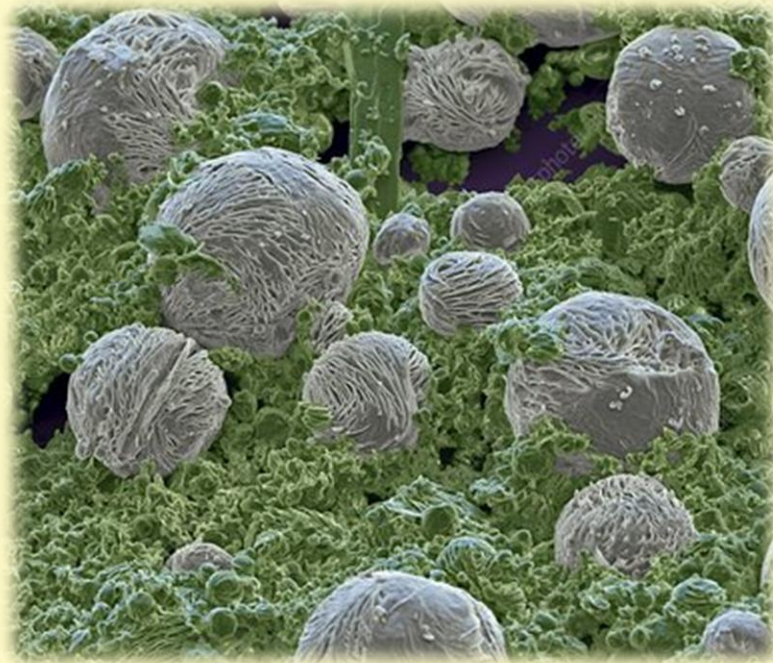


Introduction

- Various pests, fungi, weeds and rodents cause much harm to the production and storage of food grains.
- A large number of pesticides including insecticides, rodenticides, herbicides and fungicides are available in the market.
- They enable the farmers to control their crops, from being destroyed by insects, diseases and weeds.
- As a result, though the yields of food crops have reached new high levels.
- Extensive use by the agriculturists has resulted in poisoning of human beings, Animal, birds, plant and aquatic living things.

Fungicidal

- Fungicides preserve the seeds for seedling purposes.
- These are mainly mercurial compounds



Herbicidal or Weed Killers

- Since the growth of undesirable herbs and weeds in the field yields low production, the herbicides or weed killers are used to protect the field.
- These are:
 - (i) Sulphuric acid (1%); is a corrosive acid.
 - (ii) Sodium chlorate; is irritant.
 - (iii) Potassium cyanide; causes tissue anoxia
 - (iv) Paraquat.



Weed

Insecticides

■ Insecticides are the compounds that are employed for killing insects, are classified as:

(1) Organophosphorus compounds

(i) Alkyl phosphates

(ii) Aryl phosphates

2. Halogenated hydrocarbons

(i) Aldrine

(ii) Endrine

(iii) DDT



3. Miscellaneous compounds:

(i) Mercurial salts

(ii) Arsenic salts



Rodenticidal

(i) Inorganic compounds

- Aluminium phosphide
- Zinc phosphide
- Thallium
- Phosphorus



(ii) Organic compounds- Fluoro-acetate

(iii) Convulsants-Strychnine

(iv) Anticoagulant-Warfarin



Insecticides or herbicides are further classified according to their toxicity as:

1. Virtually Harmless

(i) Pheno-oxalic acid

(ii) Copper oxide—fungicide

(iii) Lime sulphur—orchard fungicide

(iv) Petroleum washes— orchard insecticide

2. Comparatively Harmless

- (i) Sulphuric acid 20%—weed killer
- (ii) Sodium chlorate—mass herbicide

3. Mildly toxic (25-60 gm)

- (i) Chlorinated hydrocarbons
- (ii) DDT
- (iii) Gammaxene
- (iv) Aldrin, dieldrin: used to control flies, louse, tick and as an agricultural insecticide.



Tick

4. Moderately toxic (10-25 gm)

- (i) Diazinon

5. Highly toxic

- (i) Sodium arsenite
- (ii) Lead and calcium arsenate
- (iii) Organic polyphosphates
- (iv) Organophosphorus compounds which include
 - (a) HETP (Hexa Ethyl tetra phosphate)
 - (b) TEPP (Tetra Ethyl pyro phosphate)
 - (c) Parathion

Toxicity mechanism of Action of Organophosphates

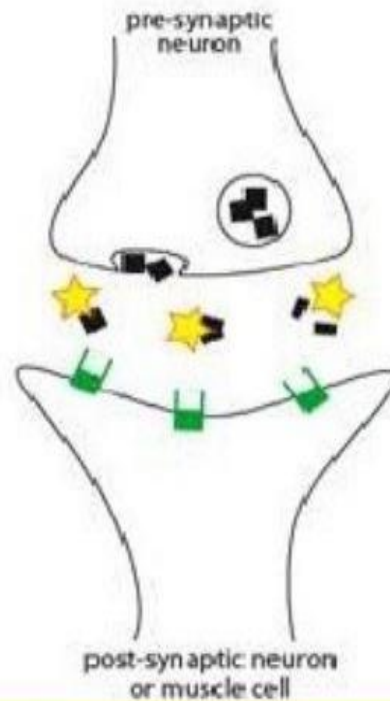
- Organophosphates inactivate Acetylcholinesterase (AChE) by phosphorylating (addition of a phosphate group) the serine hydroxyl group located at the active site of acetylcholinesterase.
- Once AChE has been inactivated.
- Acetylcholine accumulates throughout the nervous system.
- Resulting in excessive stimulation of cholinergic receptors (muscarinic and nicotinic receptors) at various organs.
- Resulting in acute cholinergic crisis.

Acetylcholine signaling at synapse



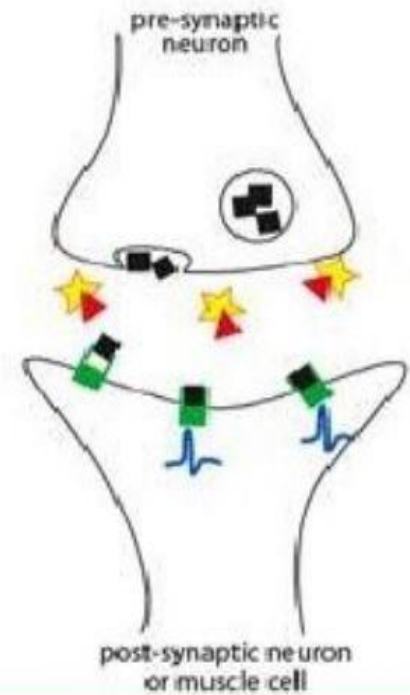
- Acetylcholine (ACh)
- U ACh Receptor
- Signal transmission

ACh Esterase STOPS signaling process



- ACh
- U ACh Receptor
- Signal transmission
- ★ ACh Esterase

OP's inhibit ACh Esterase



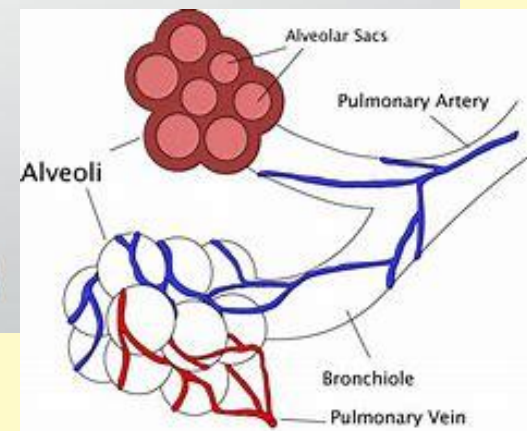
- ACh
- U ACh Receptor
- Signal transmission
- ★ ACh Esterase
- ▲ Organophosphate pesticide (OP)

Toxicity Effects of organophosphate (OP)

- The effects of organophosphate (OP) toxicity can be divided into 3 categories, including :
 1. Muscarinic effects
 2. Nicotinic effects and
 3. CNS effects

Muscarinic effects on organ systems include the following;

- a) Cardiovascular system: Bradycardia, Hypotension
- b) Respiratory: Rhinorrhea (runny nose), bronchorrhea (production of more than 100 mL per day of watery sputum), bronchospasm, cough, severe respiratory distress.
- c) Gastrointestinal: Hyper salivation, nausea and vomiting, abdominal pain, fecal incontinence
- d) Genitourinary: Urinary incontinence
- e) Ocular: Blurred vision, Miosis (pupil constriction)
- f) Glands: Increased lacrimation (tears), diaphoresis



- **Autonomic nicotinic effects include;**

- Muscle weakness and fasciculation,
- Tachycardia
- Cramping of skeletal muscle
- Hypertension
- Mydriasis, and pallor.

- **Central Nervous System (CNS) effects include;**

- anxiety, restlessness, confusion, ataxia, tremors, seizures, respiratory failure and coma.

Management

- In History taking: You have to find out;(Direct Answer Questions)
What, When, How much, and Why?
- Protect yourself using protective clothes and gloves and decontaminate the patient by removing contaminated clothes and washing the skin thoroughly with soap and water.
- Look for and Recognize signs and symptoms of organophosphate poisoning-
 - ✓ DIAPHORESIS
 - ✓ POOR AIR ENTRY or in severe cases, respiratory failure
 - ✓ BRADYCARDIA
 - ✓ HYPOTENSION

- Obtain IV access and give atrophine intravenously as soon as possible for a symptomatic patient.
- Perform gastric decontamination with gastric lavage once the patient is stabilized and within two hours of ingestion.
- Give activated charcoal while maintaining atrophine infusion
- Administer pralidoxime.

❖ ATROPINE

- Used as an antidote to counter the muscarinic effects of acetylcholine; only life saving antidote.

❖ PRALIDOXIME

- Oximes used as rejuvenators.
- The beneficial effect of oximes is exerted through the
- ✓ Reactivation of enzyme cholinesterase by cleavage of the phosphorylated site.
- ✓ Detoxifying effect on the unbounded organophosphorous compound.

Chlorinated Hydrocarbons

- The chlorinated hydrocarbons were developed beginning in the 1940s after the discovery (1939) of the insecticidal properties of DDT.
- Other examples of this series are
 - BHC, lindane, chlorobenzilate, methoxychlor,
 - Cyclodienes (aldrin, dieldrin, chlordane, heptachlor, and endrin).

Mechanism of Action

- **Neurotoxins**
 - Behavioral changes,
 - Involuntary muscle activity, and
 - Depression of the respiratory center.
- **Absorbed from the**
 - Gi tract,
 - Across the skin, and by
 - Inhalation.

Treatment

- Cholestyramine: 16g / day increase faecal excretion
- Calcium gluconate
- Diazepam