

Phytotoxins

- **Phytotoxin:** Toxin substances produce by plants is called phytotoxin.
- **Toxic plant:** Toxic plant may be defined as “one which detrimentally affects the health of man or animal when eaten in such amount as would be taken normally or under special circumstances like restriction of choice of diet orextremehunger”
- Plant toxins may be referred as secondary plant metabolites (SPM).
- SPM - defense mechanism / survival adaptations.
- Toxic plants are of 2 types •
 1. Plant containing toxic ingredients & are known to be toxic to animals.
 2. Plants which are normally not toxic to animals but becomes so under unfavorable conditions.

Toxic principles of various alkaloids and toxic plants

- Classification of toxic plants:
 1. Alkaloids
 2. Terpenes
 3. Glycosides
 4. Proteinaceous compounds
 5. Organic acids
 6. Resins & Resinoids

- **Tropane/atropine like alkaloids:**

- ✓ Datura (jimsonweed)
- ✓ Erythroxylum (coca tree)
- ✓ Hyoscyamus (henbane)
- ✓ Mandragora (mandrake)

- **Pyrrolizidinealkaloids:**

- ✓ Senecio (ragwort)
- ✓ Crotalaria sp.
- ✓ Heliotropium sp.
- ✓ Trichodesma sp.

- **Pyridine/Piperidine alkaloids:**

- ✓ Conium (Hemlock)

- ✓ Lobelia (Indian tobacco)

- **Pyrrolidine-pyridine alkaloids:**

- ✓ Nicotiana sp. (Tobacco)

- ✓ Equisetum sp. (Horse tail)

- **Purine alkaloids:**

- ✓ Coffea sp. (Coffee)

- ✓ Theobroma sp. (Cocoa)

- ✓ Camellia sp. (Tea)

- **Quinoline alkaloids:**
 - ✓ Cinchona sp. (Quinine tree)
 - ✓ Echinops sp. (Globe thistle)
- **Isoquinoline alkaloids:**
 - ✓ Papaver somniferum (opium)
 - ✓ Sanguinaria sp.
 - ✓ Dicentra (Blood root)
- **Indole/ indolizidinealkaloids:**
 - ✓ Strychnus (strychnine)
 - ✓ Claviceps (Ergot)
 - ✓ Psilocybe (Magic mushroom)
 - ✓ Astragalus sp. (locoweed)
 - ✓ Gelsemium sp.

Terpenes

- Biosynthesized by plants
- Contains the branched 5-carbon skeleton of isoprene.
- On the basis of number of isoprene units present in the structure of the molecule, terpenes are categorized as C-10 compounds
- monoterpenes C-15 compounds
- sesquiterpenes C-20 compounds
- diterpenes C-30 compounds
- triterpenes

Monoterpenes:

- ✓ Cantharidine an animal monoterpene from fly ash.
- ✓ Picrotoxin from *Anamirta cocculus* ((Fish berries).

Sesquiterpenes:

- ✓ Coromyrtin from *Coriaria myrtifolia*
- ✓ Geigerin from *Geigeria*
- ✓ Helenalin from *Helenium microcephalum*

Glycosides:

- Complex organic compounds having glycone attached to aglycone/geninmoiety by ether linkage
- Neutral in reaction
- Soluble in alcohol, less soluble in water & insoluble in ether
- They don't combine with acids to form salts
- Names ends with suffix –in. Eg: digitoxin, ouabin, scillarin, glycyrrhizin, senegin.

- **Cyanogenicglycosides:**
 - ✓ Amygdalin (Almond seed)
 - ✓ Linum (Linseed)
 - ✓ Prunus(Wild cherry)
 - ✓ Sorghum vulgare(Jowar)
 - ✓ Sorghum sudanese(Sudan grass)
 - ✓ Gossypol (cotton seed)

Proteinaceous compounds:

- Plant proteins = harmless + beneficial agents.
- Plant protein + seed reserve proteins
- important source of food.
- Ingestion
- protein hydrolysis
- enzymatic reactions in GIT
- absorption of amino acids
- protein biosynthesis in the body.
- However; there are no. of proteins, peptides/amines which are of toxicological importance. Eg: toxalbumins, polypeptides, amines.

- **Toxalbumins (proteins):**

- ✓ Abrin from *Abrus precatorius*
- ✓ Ricin from *Ricinus communis*

- **Polypeptides:**

- ✓ Amatoxins
- ✓ Phallotoxins
- ✓ phalloidin from *Amanita* sp.

- **Amines:**

- ✓ Aminotryptaline from seeds of *Sativus odoratus*
- ✓ Phoradendron sp. (Berries of mistletoe)
- ✓ Mimosine from *Mimosa pudica*
- ✓ Canavanine from *Canavalia ensiformis* (Jack beans)
- ✓ *Leucaena leucocephala* (Subabul).

Pathological effects

- **Specification of toxicants:**
- Receptor mediated, ionic channels, enzyme mediated, carrier molecules mediated events.
- **Non-specification of toxicants:**
- Physical toxicants, direct chemical injury, interference with body metabolism, impairment of O₂ transport, injury to vascular system, altered Ca⁺⁺ homeostasis, immunomodulations, carcinogenesis, non-specific action on enzymes & proteins, tissue residual effects.