

**Natural pesticide &  
insecticides  
RCPIPER, SHIRPUR**

**Second year B pharm  
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**Pest-** it is any animal, plant or microorganism that trouble, injures or cause destruction of crop.

**Methods of pest control-**

**They have two types-** natural and artificial pest control.

**Natural pest control-** they are prepared in nature due to prey- predator relationships.

Beneficial insects are those insects which prey on harmful insects or their larvae.

**Artificial pest control-** these are man med methods to control pest.

They have following types

**mechanical-** manual or mechanical method for collection or destruction of pest. Eg. handpicking, pruning, trapping, burning for destruction of eggs, larvae, pupae, insects

**Agriculture control-** these methods are used to destroy life cycle of pest eg deep ploughing for eradication of weeds, alternate crop rotation, hybrid pest resistance crop species

**Chemical control-** these are chemicals used to kill pest eg. insecticides, acaricides

**Biological control-** Living organisms are used to control pest. Eg microorganisms may be used to kill by causing fatal disease in insects

# **Classification of pesticides**

**Insecticides,**

**Herbicides,**

**fungicides,**

**rodenticides**

## ***Characteristics of ideal pesticide***

- should have high margin of safety for plants and animals
- easy to handle and apply
- should not be toxic for warm blooded animals
- should not be inflammable or explosive
- should be available easily at affordable cost

**Herbicides**, also commonly known as **weedkillers**,  
These are pesticides used to kill unwanted plants. Selective herbicides kill specific targets, while leaving the desired crop relatively unharmed. Some of these act by interfering with the growth of the weed and are often synthetic mimics of natural plant hormones.

Some plants produce natural herbicides, action of natural herbicides, and other related chemical interactions, is called allelopathy.

The most frequent application of herbicides occurs in row-crop farming, where they are applied before or during planting to maximize crop productivity by minimizing other vegetation(weed)

**Fungicides**- they are used to control fungal diseases of plants and food crops.

Fungi can cause serious damage in agriculture, resulting in critical losses of yield, quality, and profit

Fungicides can either be contact, translaminar or systemic. **Contact fungicides** are not taken up into the plant tissue, and protect only the plant where the spray is deposited; **translaminar fungicides**

redistribute the fungicide from the upper, sprayed leaf surface to the lower, unsprayed surface; **systemic**

**fungicides** are taken up and redistributed through the xylem vessels. Few fungicides move to all parts of a plant. Some are locally systemic, and some move upwardly

**Fumigation** is a method of pest control that completely fills an area with gaseous pesticides—or **fumigants**—to suffocate or poison the pests within. It is used to control pests in buildings (structural fumigation), soil, grain, and produce, and is also used during processing of goods to be imported or exported to prevent transfer of exotic organisms.

**Rodenticides, rat poison**, are pest control chemicals intended to kill rodents.

Rodenticides are controversial, due to secondary poisoning and their risks to children, pets and wildlife.

***Single feed baits*** are chemicals sufficiently dangerous that the first dose is sufficient to kill. rodents will eat a small bit of something and wait, and if they do not get sick, they continue. An effective rodenticide must be tasteless and odorless in lethal concentrations, and have a delayed effect.

# Tobacco



# Tobacco

## Synonym

Tobacco

## Biological source

Tobacco consist of dried leaves of

*Nicotiana tabacum*

## Family

**Solanaceae**

# Characteristics

**Tobacco mostly used for preparation of**

**cigarettes,**

**bidis,**

**cigar,**

**Cheroot,**

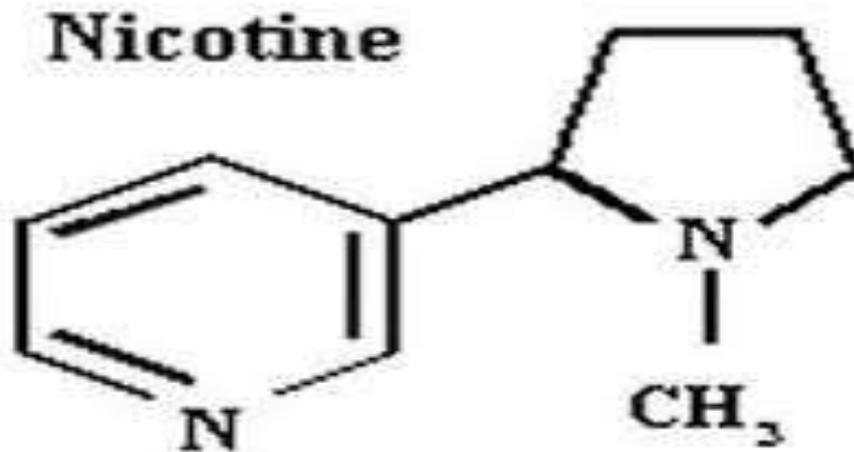
**snuff,**

**chewing tobacco**

# Chemical constituents

**alkaloid**

**1-10% nicotine,  
nornicotine,  
anabasine**



## **Isolation of nicotine from tobacco**

Tobacco waste material from industry is used for production of insecticidal nicotine.

nicotine is isolated by mixing tobacco waste with lime and extracting it with water. aqueous extract further extracted with kerosene and then kerosene extract is treated with sulphuric acid to obtain nicotine sulphate

# Uses

## **Insecticidal**

free base of nicotine is more toxic than sulphate,

Mostly effective against minute soft body insects like aphides, white flies, fruit tree borers, termites, cabbage butterfly larvae

Nicotine preparations are safer, easier to handle, less toxic to warm blooded animals

# pyrethrum



# Pyrethrum

## Synonym

Insect flowers, pyrethrum flowers

**BS**

It consist of dried flower heads of

*Chrysanthemum cinerariaefolium*

**family**

*Compositae*

# Characteristic

Open flowers are 9-12 mm diameter. Flower bears short, longitudinally striated peduncle (stem supporting an inflorescence)

**Colour**- cream or straw colour

**odour**- slight aromatic,

**Taste**- bitter acrid

Before drying flower heads are non toxic to insects

# Chemical constituents

## **Esters**

Pyrethrin- I,II,

Jasmolin,- I ,II

cinerin- I,II

**triterpine alcohol,**

pyrethrol

**lactone,** pyrethrocin.

## **other**

pyretol,pyrethrotoxic acid,chrysanthemine,

chrysanthemumic acid

# Uses

## Domestic and agriculture insecticidal

it act on nervous system of insects resulting in muscular excitation, convulsion, paralysis

Toxic effect of pyrethrum on human are irritation to eyes, mucosa.

maximum permissible atmospheric concentration is up to 5 mg per cubic meter

# ***Natural allergens and plant toxins.***

**allergen** is a type of antigen that produces an abnormally vigorous immune response in which the immune system fights off a perceived threat that would otherwise be harmless to the body. Such reactions are called allergies.

**Hypersensitivity or allergy-** when individual develops abnormal response to substance or condition that is generally tolerated by others called allergy.

Antigen that induce allergic reaction called **allergen**.

any substance of biological, chemical or synthetic origin may prove to be allergen.

Emotional factor, atmospheric factor , chronic infection may be responsible for allergic reaction.

s.

When body first time get exposed to allergen the condition is known as **primary exposure**.

During this , no symptoms of allergy are produced as no previous antibody formation occur in individual.

During second exposure allergens contact fixed antibodies and antigen- antibody reaction occurs.

this immune reaction causes liberation of histamine and other mediators of allergic symptoms.

Allergic reaction can be **localized or generalized** .

A set of common allergies which can be correlated with positive skin test of some specific allergens is called **atopy**. atopic diseases include allergic rhinitis( hay fever).allergic asthma, allergic urticaria(kind of skin rash notable for pale red, raised, itchy bumps), atopic dermatitis

# Classification of allergens

Classification is based on their mode of introduction in body

## **Inhalant plant allergen-**

Substances present in atmosphere are inhaled by nose and mouth. Symptoms are limited to nasal mucosa and manifested by sneezing, lacrimation, itching, swelling of nose and eye. E.g. sinusitis (hay fever)

## **ingestant allergens-**

allergens present in foodstuff are ingestant allergens, symptoms are gastrointestinal disturbances, skin rash, migraine.

## **Injectant allergens-**

Allergens in parenteral solution are injectant allergens. Antibiotic like penicillins, cephalosporins.

## **Contact allergens-**

Allergens come into direct contact with epithelium are contactant allergens.. E.g. poison ivy, poison oak. Causes severe dermatitis with watery blisters witch burst and spread across skin

## **Infestant allergen-**

parasitic microorganisms in or on the body are this type of allergens

## **Physical allergy-**

allergy caused by heat or cold

## **Environmental allergy-**

Cause due to change in climate conditions

# Inhalant allergens

These are airborne substances as chemicals which causes respiratory disease, inflammation in nose and lung.

nasal inflammation causes sneezing, lacrimation, itching, swelling of nose and eyes. this condition is called sinusitis or hay fever. Inflammation of lung causes asthma.

Allergens when lands on mucous membrane of nose chain reaction occurs that leads mast cells in these tissues to release histamine and other chemicals. These chemicals contract certain cells of some blood vessels in nose which allows fluid to escape causing nasal passage to swell resulting nasal congestion.

***E.g. of airborne allergens are pollens, dust, mites, mould spores, animal allergy ( epidermis, dander)***

# Pollen allergens

Pollens are male cells of flowering plants.

They required for plant fertilization.

Average pollen particle size is less than the width of average human hair.

Pollens are further classified in to two types

**1anemophilous( wind pollinated)**

**2entomophilous( insect pollinated)**

**Anemophilous**-they are small 15-45 micrometer in diameter, light, non adhesive and relatively smooth and are produced by plain looking plants eg. Trees, grasses and weeds

**Entomophilous**- they are larger in size , up to 200 micrometer in diameter, heavier, adhesive and may be somewhat spiny. Plants are scented with colored flowers such as clover, hollyhock, rose.

Most common allergic reaction are produced by wind pollinated pollens ( anemophilous) because thy are light Wight , dry and easily carried for long distance.

# **Ingestant allergens**

**These allergens present in food stuff and swallowed called ingestant ( food allergy).**

**food allergy is immune system response to food. Once immune system decides that particular food is harmful, it creates specific antibody to it.**

**Effect of food allergy are not localized to one organ or area of body but it may transfer to other organs by blood hence its symptoms are multiple like gastrointestinal or skin related.**

**common food allergens are milk, egg, peanut, tree nut, fish, , soy, wheat, orange juice, code liver oil, food additives and many other foodstuffs.**

**Method to combat food allergy is elimination of offending substances from diet**

# **Injectant allergens**

**Natural source** of injectant allergens are produced by sting of bees, hornets and wasps. Allergens are injected by sting of such insects can induce severe local and constitutional reaction sometimes causing death.

**Artificial source** is injection of various antibiotics in body e.g. penicillin, cephalosporin's. Liver extract, antitoxins.

symptoms are itching of palms of hands and soles of feet , erythema, peeling of skin, and in severe case anaphylactic shock may occur.

# Contact allergens

Contact allergy is caused by number of plants and their products e.g.. Poison ivy, oak, asparagus, ornamental dumb cane, catapla leaves, ginkgo leaves, lobelia.

# Infectant allergens

**Allergy caused by metabolic products of living microorganism in human body like continual presence of bacteria, protozoa's, moulds, helminthes and other parasites in human body are responsible to cause chronic infection.**

# Plant toxins

These are toxic secondary plant metabolites which naturally occur in food, weeds and ornamental plants. The chemical diversity is tremendous.

## Toxic constituents of plants

Plant toxins are produced by metabolic activity in plant, especially secondary metabolites can be toxic to humans and animals. Like alkaloids, glycosides, toxic proteins, bitter principles.

plants containing toxic substances which are capable to produce harmful effects are known as poisonous plants

**following are toxic constituents of plants**

***Vegetable base-*** nitrogenous vegetable bases like amines, purines, alkaloids.

E.g. of toxic alkaloids are aconitine ( aconite root),morphine( poppy capsule), emetine( ipecacuanha roots), strychnine( nux vomica), nicotine ( tobacco), curarine ( curare).

***Glycosides***-glycosides are combination of glycone and aglycone parts.

Cyanogenic glycosides are harmless but gives rise to toxic acids eg amygdalin found in bitter almonds, prunasin found in wild cherry  
some glycosides produce harmful compounds on hydrolysis e.g. sinigrin in black mustard seeds, sinalbin in white mustard seeds  
some glycosides have direct toxic action like digitoxine in digitalis, thevetin in thevetia, antiarin in antiaris.

***Saponins***- they are particularly toxic to cold blooded animals such as fishes, frogs, insects.

Poisonous saponins are called sapotoxines

**Bitter principles**-they have bitter taste and found in many plants.eg aloe bitter found in thicken juice of several species of aloe. These poisons have purgative action eg picrotoxin from anamirta cocculus

***toxic protiens-*** they are also called toxalbumines found in leguminosae and euphorbiaceae. E.g. abrin from *Abrus precatorius*, ricin from *Ricinus communis*, cortin from *Croton tiglium*. They are blood poisons and are characterized by their property of agglutinating and precipitating RBCs

***Fixed oils-*** some oils when heated gives rise to acrid acrolein vapors. They generally have laxative property. Croton oil from seeds of *Croton tiglium* produces irritation to skin, vesicant action of croton is due to resin dissolved in it

***Essential oils-*** these are odorous volatile principles of plants many of them have sharp burning taste and locally have irritating action. Large dose causes irritation to GIT with diarrhea, vomiting, pain. They may cause hemorrhage and abortion e.g. oil of juniper, rue, parsley

***Organic acids-*** oxalic acid.

Protoplasmic poison occurring in large number of plants in form of oxalates. Formic acid is irritant found in plants of utricaceae family.

# Argemone toxin- epidemic dropsy

**Epidemic dropsy** is a form of edema of extremities due to intoxication with *Argemone mexicana* (Mexican prickly poppy) **hindi- satyanashi**

Epidemic dropsy is a clinical state resulting from use of edible oils adulterated with *Argemone mexicana* seed oil.

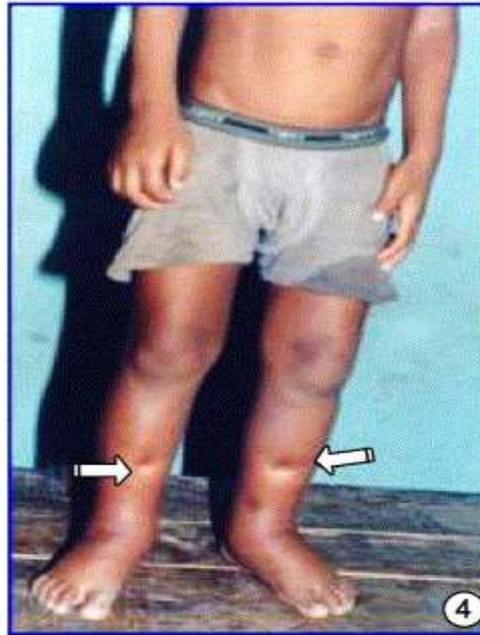
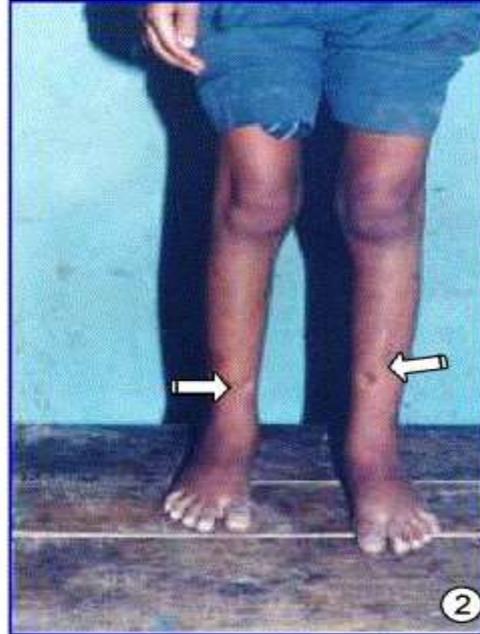
Sanguinarine and dihydrosanguinarine are two major toxic alkaloids of argemone oil, which cause widespread capillary dilatation, proliferation and increased capillary permeability. When mustard oil is adulterated deliberately (as in most cases) or accidentally with argemone oil, protienurea (specifically loss of albumin) occurs, with a resultant edema as would occur in nephrotic syndrom.

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Leakage of the protein-rich plasma component into the extracellular compartment leads to the formation of edema.

Illness begins with gastroenteric symptoms followed by cutaneous erythema and pigmentation. Respiratory symptoms such as cough, shortness of breath and shortness of breath, progressing to frank right-sided congestive cardiac failure, are seen.

Removal of the adulterated oil and symptomatic treatment of congestive cardiac failure and respiratory symptoms, along with administration of antioxidants and multivitamins, remain the mainstay of treatment



Epidemic dropsy patients with the characteristic bilateral pitting edema of the extremities (indicated by arrows)

# Castor toxin

**Ricin** is a highly toxic, naturally occurring lectin (a carbohydrate-binding protein) produced in the seeds of the castor oil plant, *Ricinus communis*.

. Oral exposure to ricin is far less toxic, and an estimated lethal dose in humans is approximately 1 milligram per kilogram.

It acts as a toxin by inhibiting protein synthesis.

By ingestion, the pathology of ricin is largely restricted to the gastrointestinal tract, where it may cause mucosal injuries.

With appropriate treatment, most patients will make a full recovery. Because the symptoms are caused by failure to make protein, they emerge only after a variable delay from a few hours to a full day after exposure.

Symptomatic and supportive treatments are available.

Survivors often develop long-term organ damage. Ricin causes severe diarrhea, and victims can die of circulatory shock. Death typically occurs within 3–5 days of exposure.

Deaths from ingesting castor plant seeds are rare, partly because of their indigestible capsule, and because the body can, only with difficulty, digest ricin.

The pulp from eight beans is considered dangerous to an adult

# Lathyrus toxins- lathyrism( paralysis in legs)

**Lathyrism** or **neurolathyrism** is a neurological disease of humans and domestic animals, caused by eating certain legumes of the genus *Lathyrus*. This problem is mainly associated with *Lathyrus sativus* (also known as *Grass pea*, *Kesari Dhal*, *Khesari Dhal* or *Almorta*)

The consumption of large quantities of *Lathyrus* grain containing high concentrations of the glutamate analogue neurotoxin  $\beta$ -oxalyl-L- $\alpha$ , $\beta$ -diaminopropionic acid (ODAP, also known as  $\beta$ -N-oxalyl-amino-L-alanine, or BOAA) causes paralysis, characterized by lack of strength in or inability to move the lower limbs,.. A unique symptom of lathyrism is the atrophy of gluteal muscles (buttocks). ODAP is a poison of mitochondria leading to excess cell death, especially in motor neurons

# Prevalence

This disease is prevalent in some areas of Bangladesh, Ethiopia, India and Nepal

# Causes

The toxicological cause of the disease has been attributed to the neurotoxin [ODAP](#) which acts as a structural analogue of the neurotransmitter glutamate. Ingestion of legumes containing the toxin results mostly from ignorance of their toxicity and usually occurs where the despair of poverty and malnutrition leaves few other food options. Lathyrism can also be caused by food adulteration.

# Cycad toxins- Iytico-bodig

Cycads have been a source of food and medicine for many people who live in proximity to these plants. These plants are well-known to be highly poisonous and must be carefully processed to remove toxins, before they are edible. If they are not properly processed they can cause vomiting, liver damage and even death, there is also evidence they have neurotoxic effects.

To remove the toxins, different methods of processing are used by different cultures. Cycads contain characteristic chemicals, which are unique to their order of plants.

Two compounds: [BMAA](#), and [Cycasin](#) are found universally in all genera of cycad .

## **Cassava toxins-konzo**

Cassava roots, peels and leaves should not be consumed raw because they contain two cyanogenic glucosides, **linamarin** and **lotaustralin**. These are decomposed by **linamarase**, a naturally occurring enzyme in cassava, liberating hydrogen cyanide (**HCN**).

Cassava varieties are often categorized as either sweet or bitter, signifying the absence or presence of toxic levels of cyanogenic glucosides, respectively. The so-called sweet (actually not bitter) cultivars can produce as little as 20 milligrams of cyanide (CN) per kilogram of fresh roots, whereas bitter ones may produce more than 50 times as much (1 g/kg)

Societies that traditionally eat cassava generally understand some processing (soaking, cooking, fermentation, etc.) is necessary to avoid getting sick

**Cassava** , **Brazilian arrowroot**, **manioc**, and **tapioca**, a woody SHRUB of the [Euphorbiaceae](#) (spurge) family native to SOUTH AMERICA, is extensively cultivated as an annual crop in tropical and subtropical regions for its edible starchy tuberous roots, a major source of carbohydrate.

Symptoms of acute cyanide intoxication appear four or more hours after ingesting *raw or poorly processed* cassava: **vertigo, vomiting, and collapse. In some cases, death may result within one or two hours.**

It can be treated easily with an injection of thiosulfate (which makes sulfur available for the patient's body to detoxify by converting the poisonous cyanide into thiocyanate).

**Unprocessed roots**



**Leaf**



# Ackee toxins-hypoglycaemia

The **ackee**, also known as **achee**, **ackee apple** or **akee** (*Blighia sapida*)

Ackee is the national fruit of Jamaica,

The unripened or inedible portions of the fruit contain **the toxins hypoglycin A and hypoglycin B**. Hypoglycin A is found in both the seeds and the arils, while hypoglycin B is found only in the seeds.

hypoglycin is converted in the body to [methylenecyclopropyl acetic acid](#) (MCPA). Hypoglycin and MCPA are both toxic. **MCPA inhibits several enzymes involved in the breakdown of [acyl CoA](#) compounds.**

consequently inhibiting beta oxidation of fatty acids. Beta oxidation normally provides the body with ATP, NADH, and acetyl CoA which is used to supplement the energy produced by glycolysis.

Glucose stores are consequently depleted **leading to HYPOGLYCEMIA**. ill effects occur only when the immature fruit is consumed.

Ackee pods should be allowed to ripen on the tree before picking. Prior to cooking, the ackee arils are cleaned and washed. The arils are then boiled for approximately 5 minutes and the water discarded.

**Fruit as it splits upon ripening.**



**Showing ripe fruit and seeds with their arils**



# Chemotaxonomy of medicinal plants

**Defination**-It is the method of biological classification based on similarities in the chemical structure of certain compounds among the organisms being classified.

It utilize chemical information to improve classification of plants.

**Taxonomy**-a branch of science that encompasses the description, identification, nomenclature, and classification of organisms

Plant taxonomy is fundamental to all biological sciences.

Chemotaxonomy is developed due to sophisticated techniques in chemical analysis which can detect even trace of chemical compounds

**Identification**-plants can be identified by using information from books or papers on given subject. then correct name of plant has to identified . Botanical nomenclature is based on Latin names of plants.

**Classification-** classification is grouping together plants whose similarity are greater than their differences. Simple system is dividing plants into groups like trees, shrubs and herbs. another way to divide them into ferns, conifers, dicots and monocots

**Herbarium** is Taxonomist record of flora .

The specimen is collected, pressed and dried to form herbarium.

**Flora** -Data about kind of plants are assembled into books and articles known as floras or manuals.

Flora briefly describes the plant of region and **manual** helps user in identifying plant of that area.

**Monograph** is comprehensive particular treatise ( written work)on taxonomy of natural group such as genus atropa.. as documented knowledge of flora is accumulates, the taxonomist can understand better the interrelationship of plants.. Other botanists like physiologist, ecologist, anatomist, cytogenesist, morphologist, **chemo taxonomist** depends on taxonomic finding to identify and name the plants with which they work.

## **Compounds used for chemotaxonomy**

**Mentzer** proposed biogenetic classification and recognize three classes of chemical compounds in plants

**1 primary metabolite**

**2 secondary metabolite**

**3 miscellaneous substances**

**Primary metabolite-** metabolite that is directly involved in normal growth, development, and reproduction. It usually performs a physiological function in the organism (i.e. an intrinsic function).they are part of vital metabolic pathways e.g. sconitic acid or citric acid in Krebs cycle are present in all aerobic organisms

**Secondary metabolites** are organic compounds that are not directly involved in the normal growth, development, or reproduction of an organism. Secondary metabolites often play an important role in plant defense against herbivore. Humans use secondary metabolites as medicines, flavorings, and recreational drugs.

**semantides**- these are information carrying molecules. DNA is primary semantide, RNA is secondary semantide, and proteins are tertiary semantides. Semantides with large polysaccharides are known as macromolecules and with primary, secondary metabolites as micromolecules.

Maximum chemicals which have been found very useful in taxonomy are secondary metabolites or semantides.

The red, purple, and blue colors found in many plants are due to two classes of water soluble pigments, anthocyanins and betacyanins. The anthocyanins are **flavonoids**, a class of phenolic molecules, and are synthesized via the shikimic acid pathway. They are widespread in the plant kingdom, even occasionally being found in mosses and gymnosperms, as well as the angiosperms

**Biological classification or scientific classification,** it is a method by which taxonomists group and categorize plants by biological type, such as **genus or species.**

The classification of plants by grouping data according to **morphological similarities** is probably **the oldest** and most **widely-used** of all the approaches .

However many approaches evolved over time towards the taxonomy of plants

# CHEMOTAXONOMY

The science of chemical taxonomy is used on the **classification of plants on the basis of their chemical constituents** which are deeply concerned with the molecular characteristics.

The method of chemical taxonomy is simple in principal and is based on the **investigations of the distribution of chemical compounds** or groups of biosynthetically related compounds **in series of related plants.**

Different plants sometimes contain substances which although belong to different chemical compounds appear to be biosynthetically analogous.

it is possible to identify many plants by their starch grains.

enzyme systems, and the compounds produced by such enzymes are indicative of the relationships that exist between the plants. However, the chemotaxonomic studies include the investigation of the patterns of the compounds existing in plant.

Climatic conditions have a major influence on the distribution of plants containing certain substances e.g. fats, volatile oils, alkaloids, flavonoids etc.

The other chemicals are also found specifically in particular orders or families of flowering plants e.g. Isoquinoline (Alkaloids) is found in the families of **Ranales**; retanone in the families of **leguminales**, biflavonoils in casuarinas equisetifolia (**casuarinaceae**).

The presence of such chemicals in different groups of plants has great taxonomic significance.

# ***FLAVONOIDS***

The term flavonoids refer to a class of plant secondary metabolite.

They are the largest group of naturally occurring **phenolic compounds**, which occur in different plants parts both in the free state and as glycosides .

The term flavonoids has been derived from a **Latin** word —**FLAVUS meaning yellow** as a large no of flavonoids are yellow in color.

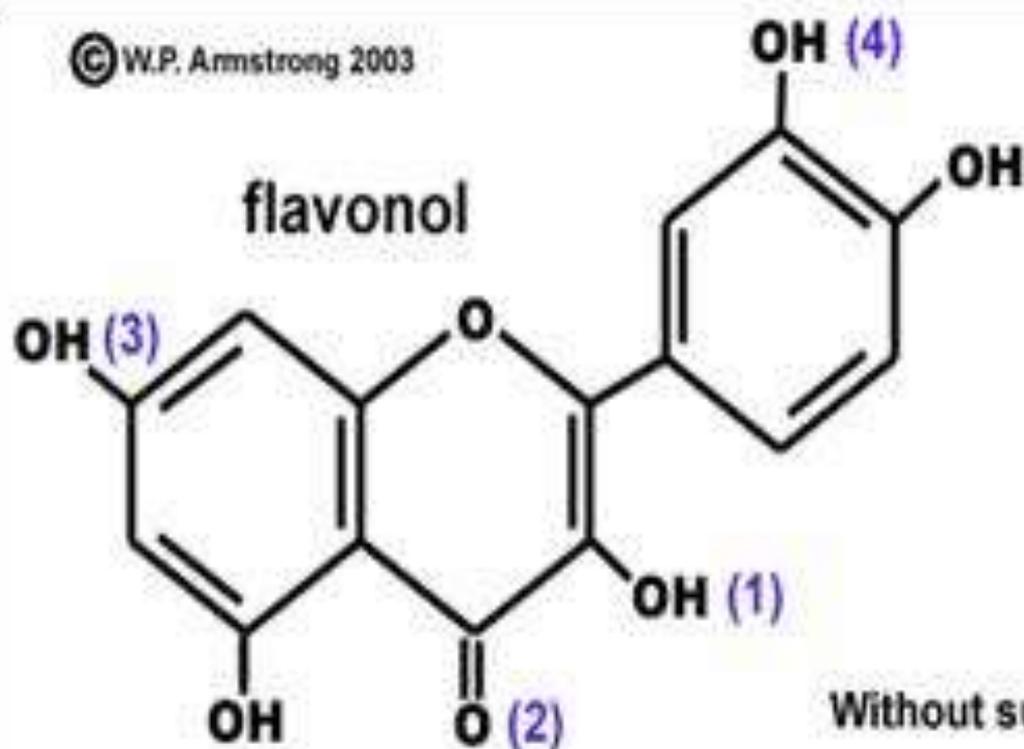
Flavonoids are also known as plant pigment or co pigment.

The presence of these pigments is responsible for color and combination of colors exhibited by bark, leaves, flower, fruits and seeds of plants.

**Flavonoids** are commonly referred to as **bioflavonoid** in the media; the terms are largely equivalent and interchangeable for most flavonoids are biological in origin .

They are **polyphenolic compounds** with general structure possessing 15 carbon atoms, two benzene rings joined by a linear three carbon chain.

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## The Structure Of A Flavonoid:

Phenolic compounds composed of three benzene rings with hydroxyl (OH) groups.

Without sugar, molecule called an aglycone.

1. Remove the OH at (1): flavone
2. Replace (OH) at (1) with 3rd ring: isoflavone
3. Replace the O at (2) with an H: anthocyanin
4. Replace the OH at (3) with glucose; remove OH at (4); remove OH at (1): glucoside (glycoside if exact sugar is not specified)



The major classes of Flavonoids are

**Flavone**

**Flavonol**

**Flavanone**

**Isoflavone**

**Anthocyanin**

## Studies on Flavonoids

Flavonoids first came into the spotlight in the 1930's when Szent-Gyorgyi and his colleagues extracted two flavonoids from citrus fruit.

They discovered that a crude form of vitamin C which contained a flavonoids fraction worked better for treating bleeding gums than did a more refined form of vitamin C.

They investigated the effects of the flavonoids and found they decreased the fragility and permeability of human capillaries.

This is why flavonoids were then called "**vitamin P**" [**P** for **permeability**] .

## Solanum Flavonoids

Many glycosides of quercetin, kaempferol and myricetin had been reported from various *Solanum* species .

Schilling (1984) isolated 10 flavonoids from leaf extract of 11 species belonging to the section *Solanum*; including coumarins (such as scopolin).

Flavonols and Anthocyanidins for *S. scabrum* in Nigeria and the anthocyanin pigments were also found in European samples of this species .

**Quercetin** is the most commonly occurring flavonol aglycone detected in *S. nigrum* Complex.

It forms many glycosides like quercitrin, isoquercitrin and rutin

together with rhamnose and glucose as sugar moieties attached in different patterns.

# **Bioactive Properties of Flavonoids**

flavonoids may have diverse benefits including

**antioxidant,**

**antiviral,**

**anti-allergic**

**antimicrobial,**

**anti-platelet,**

**anti-inflammatory,**

**and anti-tumor effects.**

Flavonoids are some of the most powerful and effective antioxidant compounds available to humans and since we are unable to produce flavonoids ourselves, we must get them from the food we eat and from supplements.

Flavonoids exert these antioxidant effects by neutralizing all types of oxidizing radicals including the superoxide and hydroxyl and by chelation.

Most flavonoids have antigerm activity.

While they are not considered essential nutrients, some flavonoids support health by strengthening capillaries and other connective tissue, and some function as antihistaminic and antiviral agents.

Rutin and several other flavonoids may also protect blood vessels.

Flavonoids have been referred to as —nature's biological response modifiers because of strong experimental evidence of their inherent ability to modify the body's reaction to allergens, viruses and carcinogens.

They show antimicrobial and anticancer activity .

Quercetin is found to be the most active of the Flavonoids and many medicinal plants have high quercetin content.

It has demonstrated significant **anti-inflammatory activity** because of direct inhibition of several initial processes of inflammation.

For example, Quercetin inhibits both the production and release of histamine and other allergic, inflammatory mediators.

# Terpenoids

An enormous range of plant substances are covered by the word 'terpenoid', a term which is used to indicate that all such substances have a common origin. They have units of isoprene ( $\text{CH}_2=\text{CCH}=\text{CH}_2$ ). They range from the essential oil components the volatile monoterpenes and sesquiterpenes (C10 and C15) through less volatile diterpenes (C20) to in volatile triterpenoids and sterols (C30) and carotenoid pigments (C40).

## Classification of volatile oils on the basis of number of isoprene units:

No. of isoprene units	Carbon No.	Name/Class	Main Types and Occurrence
1	C5	Isoprene	Detected in Hamamelis japonica leaf
2	C10	Monoterpene	Menthol from mint
3	C15	Sesquiterpene	In essential oils
4	C20	Diterpene	In plant resins
6	C30	Triterpene	Sterols (Sitosterol)
8	C40	Tetraterpene	Carotenoids (Beta-carotene)
N	Cn	Polyisoprene	Rubber,

## Properties of terpenoids

- They are present in **all volatile oils** they are colorless liquids or solids.
- They have a characteristic smell and most of them are optically active.
- They easily get oxidized.
- They are soluble in alcohol, chloroform, ether, acetone and carbon disulphide and insoluble in water

# Uses

analgesic,  
carminatives,  
anthelmintics,  
antiseptic,  
counter irritant.

They are also used in soaps, cosmetics,  
incense sticks, perfumery and food articles.  
They also play a major part in pesticides  
and insecticides industries

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# Terpenoids in Chemotaxonomy:

Terpenoids occur mostly in higher plants.

they are mostly found in

Myrtaceae,

Lauraceae,

Rutaceae,

Lamiaceae

, Asteraceae,

Apiaceae,

Poaceae,

and Cupressaceae.

