(Cont´d with Cardioactive Glycosides)

2. Strophanthus:

Is the dried ripe seeds of Strophanthus kombe or Strophanthus hispidus, F: Apocyanaceae.

Figure- 1: Strophanthus kombe

Constituents of Strophanthus:

K-strophanthoside, also known as strophoside. Is the main glycoside in both Strophanthus kombe and Strophanthus hispidus. It is composed of the genin strophanthidin coupled to a trisaccharide consisting of **cymarose, β-glucose and α- glucose.**

Strophanthin is used I.V. as a cardiotonic.

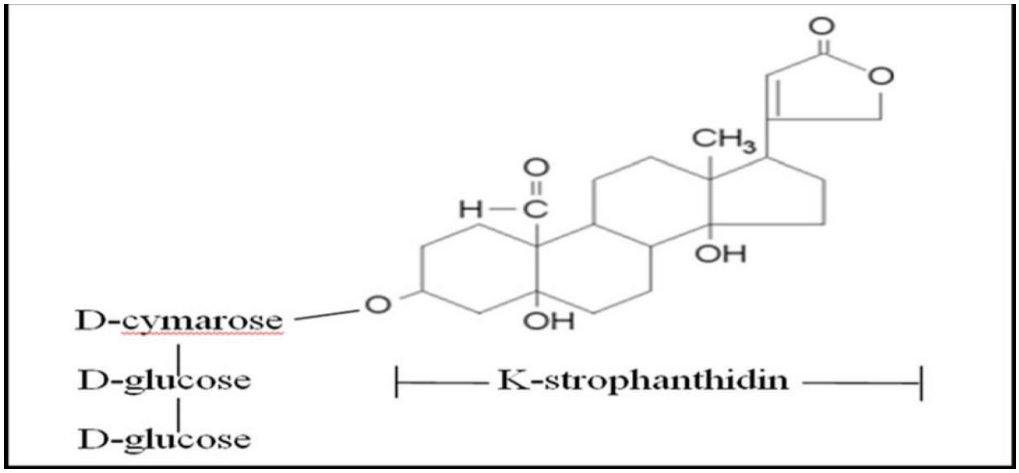


Figure- 2: Chemical structure of K-strophanthoside (K- strophanthidin+ trisaccharide)

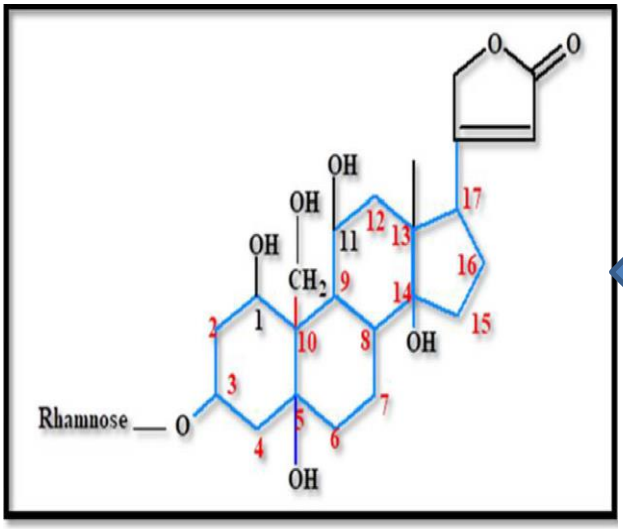
3. Ouabin (G-strophanthin):

It is obtained from Strophanthus grantus, F: Apocynaceae. **Uses:** it is a **cardiotonic. I. V** for prompt therapeutic effect. It is absorbed so slowly and

irregularly from the alimentary canal that the oral administration is not recommended and is even considered unsafe.

Figure- 3: Strophanthus grantus

Ouabagenin differs from **K-strophanthidin** in having 2 additional (OH) groups at C-1 and C-11 and having an alcoholic group at C-10 instead of the aldehydic group.



(Ouabagenin, the sugar is rhamnose)

Figure- 4: Chemical structure of ouabaine (ouabagenin+ rhamnose)

4- Oleander:

Is another plant that contains cardiac glycosides. The leaves of Nerium oleander, F: Apocyanaceae have been used to **treat cardiac insufficiency.** The main constituent is oleanderin (is a **promising agent for anticancer treatment**).

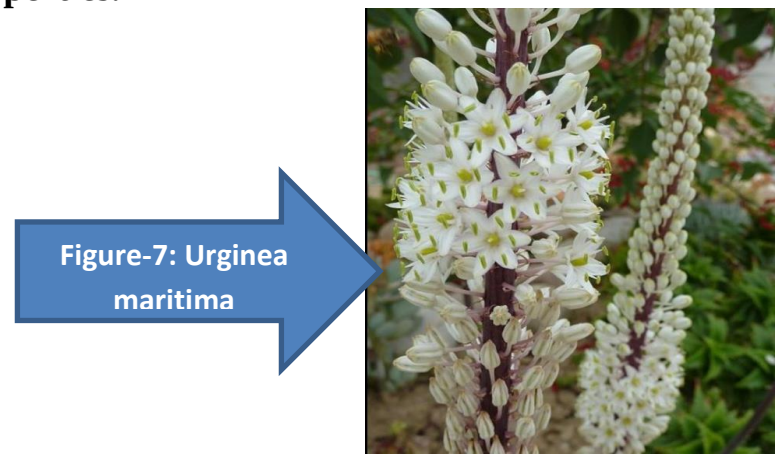
Figure- 6: Nerium oleander

5. Squill:

The squill bulb of the white variety of **Urginea maritima** known as white or Mediterranean squill, or of Urginea indica known in commerce as indian squill, F: liliaceae.

The principal glycoside- scillaren A- on hydrolysis it yields the aglycone **scillarenin** plus rhamnose and glucose.

Uses: as an expectorant but it also possesses emetic, cardiotonic and diuretic properties.



Red squill consists of the bulb of the red variety of Urginea maritima, which is mostly used as **rat poison.**

(Anthraquinone group of glycosides)

They are anthracene derivatives (anthracene = is the main nucleus for anthraquinone compounds. In the plant they biosynthesized from acetyl-CoA and malonyl-CoA.

Pharmacological activity:

They have **cathartic property (laxatives and purgative) but some of them have anti-inflammatory activity.**

Mechanism of action: The free anthraquirione aglvcones exhibit little therapeutic activity. The sugar residue facilitates absorption and translocation of the aglycone to the site of action.

The anthraquinone and related glycosides are stimulant cathartics and exert their action by increasing the tone of the smooth muscle in the wall of the large intestine. and stimulate the secretion of water and electrolytes ion to the large intestine.

Physicochemical properties:

1- Upon hydrolysis by acids or by enzymes they give aglycone part which is di,tri or tetra hydroxy anthracene derivatives. They are not hydrolyzed by alkalines.
2- They have orange or red color (most of them).
3- Soluble in water, insoluble in the organic solvents.
4- They have bitter taste and slightly characteristic odor.
5- Anthraquinone may be free state compounds (free from sugar) or anthraquinone glycoside.
6- With the exception of chrysarobin (which is too *ir*ritating), these drugs are employed as Cathartics.
7- The anthracene derivatives occur in these medicinal plant substances in various forms at different oxidation levels as derivatives of anthraquinone, **anthrone, or oxanthrone and of anthranol, as well as in a dimeric form (dianthrone)** in some cases.

Drugs containing reduced forms of anthraquinone glycosides should be stored for at least one year before use in order to change the reduced form which has drastic griping action into the corresponding oxidized form which has less griping action.

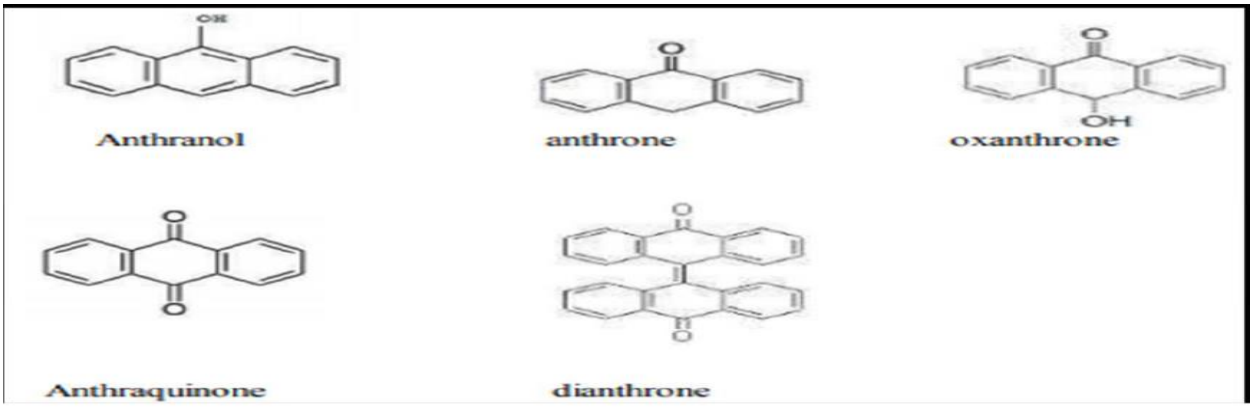


Figure- 8: Anthracene derivatives in medicinal plants

Cascara, frangula, and senna are the major plants that contain anthracene glycosides. **Aloe and rhubarb** are not recommended because they are irritant.

Plants containing anthraquinone glycosides:

1. Cascara Sagrada

Cascara sagrada or rhamnus purshiana is **the dried bark** of Rhamnus purshianus (F: Rhamnaceae).

It should be aged for at least one year before use in medicinal preparations to lose its griping properties.

Figure-9: Cascara sagrada

Active constituents:

1. Cascarosides A&B (glycosides of barbaloin).
2. Cascarosides C&D (glycosides of chrysaloin which is deoxy barbaloin).

Cascara sagrada is a cathartic, its principal use is in the correction of habitual constipation, where it is not only acts as a laxative but restore normal tone to the colon.

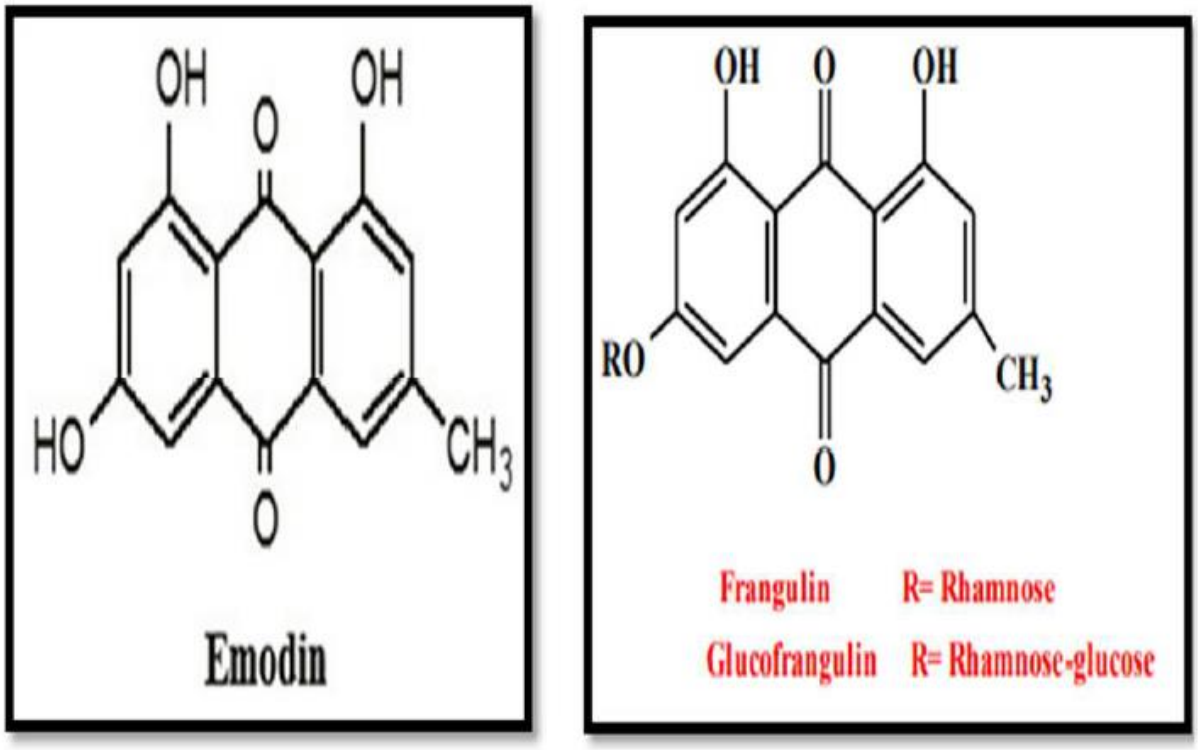
2. Frangula

Frangula **bark** is the dried bark of **Rhamnus frangula**. Its **laxative** effect is due to the presence of anthraquinone glycosides.

Active constituents:

1. **Frangulin** (emodin+ rhamnose).
2. **Glucofrangulin** (emodin+ glucorhamnoside).

Again like cascara , the bark should be aged a year or more before its use for medicinal preparations.



(Figure- 10)

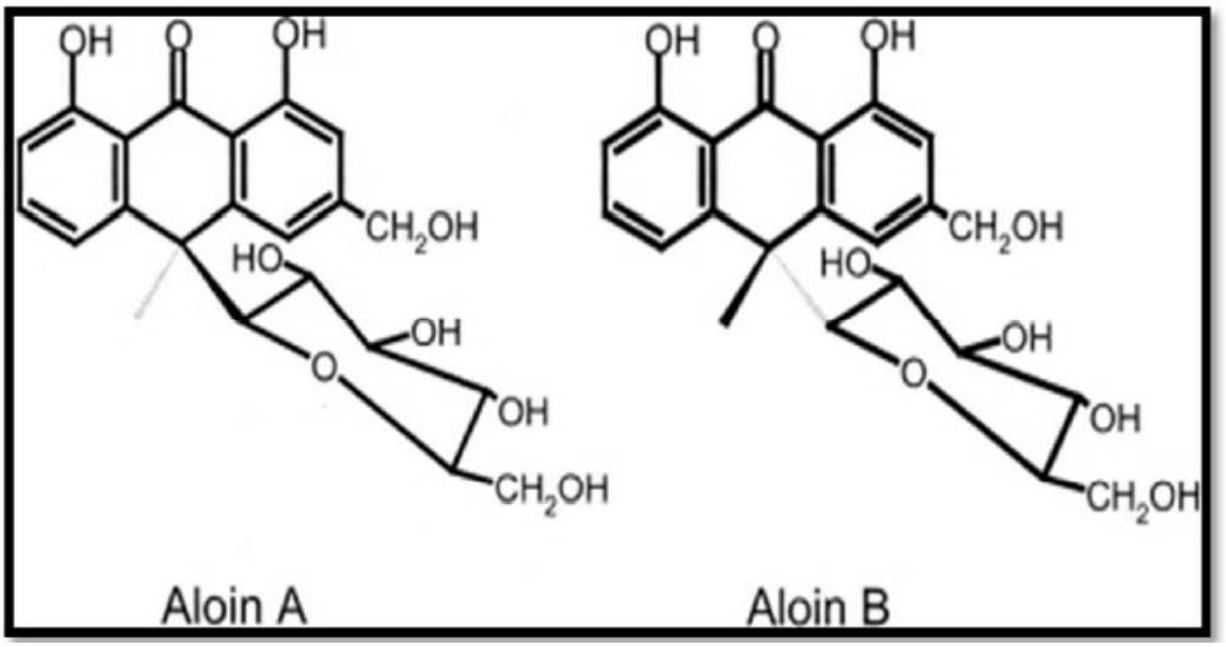
3. Aloe

Aloe or aloes is the dried juice of the **leaves of Aloe barbadensis** (F: Liliaceae).

Active constituents

Aloe contains a number of anthraquinone glycosides, the principal ones are **aloins A and B.**

The active constituents of aloe vary qualitatively and quantitatively **according to the species from which the drug is obtained.**



(Figure- 11)

Uses:

- As a cathartic by acting on the large intestine.
- The fresh juice has been used in the treatment of burns and other skin irritations.
- The extracted gel could be blended with a special lanolin base.
- The ointment is recommended for the treatment of sunburn, deep thermal burns and radiation burns.
- It can be used to relief pain, itching and tend to minimize keratosis and ulceration.

4. Rhubarb

Rhubarb, rheum or Chinese rhubarb consists of the dried **rhizome and root** of Rheum officinal (F: Polygonaceae).

Active constituents:

The principal constituents of medicinal rhubarbs are **rhein anthrones.**

Uses: Rhubarb has been used as **a cathartic.**

5. Senna

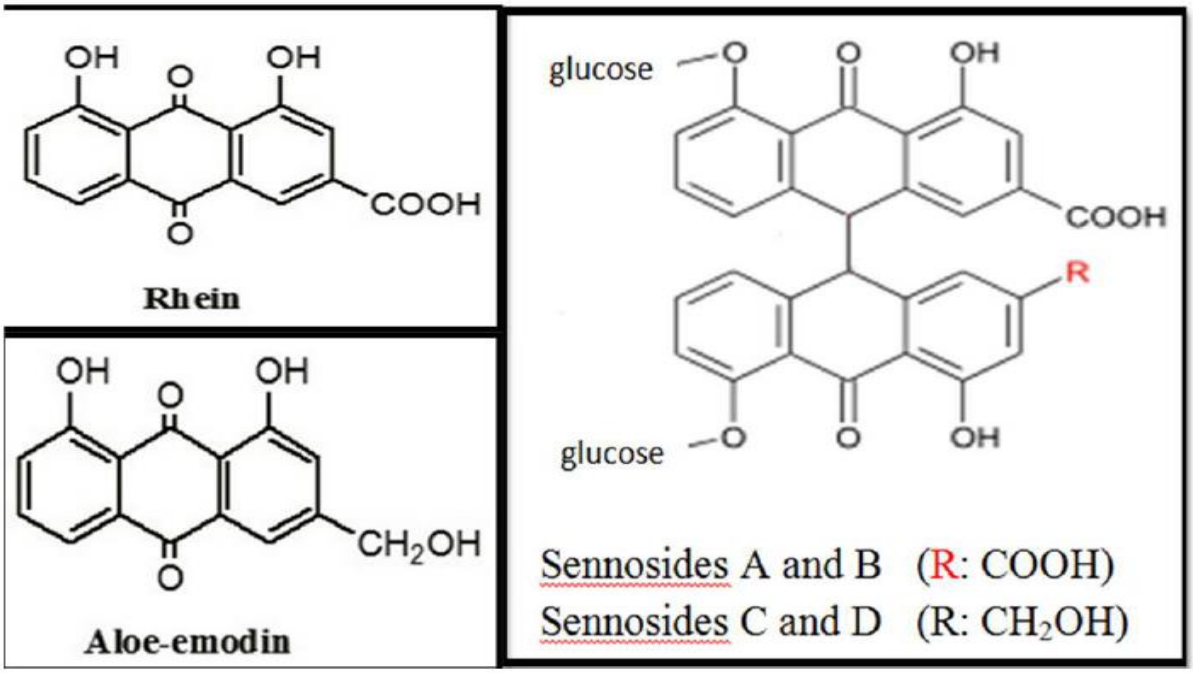
Senna or senna leaves consist of the **dried leaflets** of **Cassia acutifolia**, known in commerce as Alexandria senna (F: Fabaceae).

Active constituents:

Senna are dimeric glycosides whose aglycons are composed of aloe-emodin and/or rhein.

Those are sennosides A and sennosides B **(major constituents)** which are stereoisomers whose aglycones are rhein dianthrone while, sennosides C and D **(minor contents)** which composed of one molecule of rhein and one of aloe-emodin.

Uses: as a cathartic



(Figure- 12)

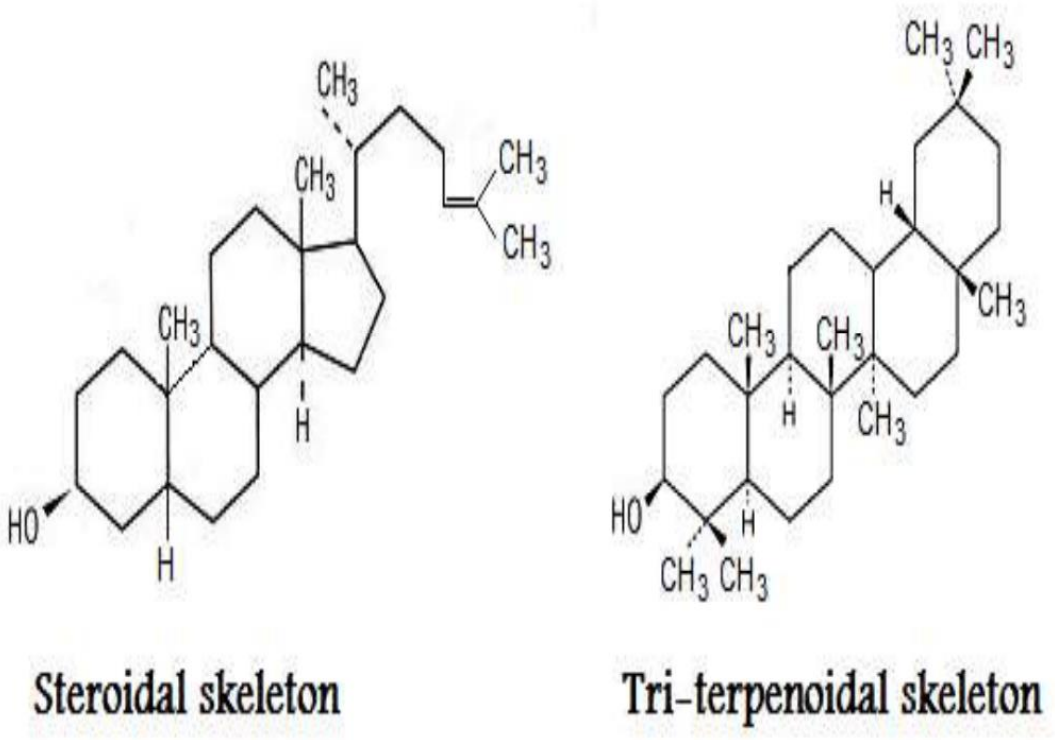
(Saponin glycosides)

This group of glycosides is widely distributed in the higher plants.

Physicochemical properties of saponins:

1. Saponins form colloidal solutions in water that foam upon shaking.
2. They have a bitter, acrid taste, and drugs containing them are usually sternutatory (causes sneezing) and otherwise irritating to the mucous membrane.
3. They destroy red blood corpuscles by hemolysis due to the formation of complex with the cholesterol or erythrocyte membrane causing its destruction (chief property of saponin, very rarely shown by any other plant product , so they toxic, especially to cold-blooded animals. Many saponins are used as **fish poisons.**
4. Upon hydrolysis they yield an aglycone known as a "sapogenin."that can be eithrt –triterpenoidal (C-30)[mainly in Dicotyledons] or –steroidal(C-

27)[mainly in Monocotyledons] **.** Steroidal sapogenins used in semisynthesis of cortisone & sexhormones.



(Figure- 13): Types of the aglycon part of saponin glycosides

Plants containing saponin glycosides:

1- Glycyrrhiza:

Glycyrrhiza is the dried rhizome and *roots of Glycyrrhiza glabra* Linné, known in commerce as Spanish licorice. F. Leguminosae.

Constituents: Glycyrrhiza contains a saponin glvcoside, named glvcvrrhizin (glycvrrhizic acid), *which* is 50 times as sweet as sugar.

Figure- 14: Glycyrrhiza

Uses:

1. Glycyrrhiza is considered to possess demulcent and expectorant properties.
2. Flavoring agent and is frequently employed to mask the taste of bitter drugs such as aloe. Commercially, licorice is added to chewing gums, chocolate candy, cigarettes,
3. smoking mixtures, chewing tobacco, and snuff;
4. The surfactant property of the saponins *may* also facilitate absorption of poorly absorbed drugs, such as the arithraquinone glycosides.
5. The presence of glycyrrhetinic acid exert mineralocorticoid activity and hence it is used in the treatment of inflamations, rhematoid arthritis and Addison's disease.

Note that Glycyrrhizin increases fluid and sodium retention and promotes potassium depletion, Persons with cardiac problems and hypertension should avoid consumption of significant quantities of licorice.

2- Dioscorea:

Saponin glycosides are found mainly in the roots of *Dioscorea composita and Discora deltoidea* . F. Discoreaceae.

Known commercially as yam or rheumatism root

Constitients: Botogenin and diosgenin glycosides (steroidal sapogenin that can be utilized as an **intermediate** in the production of cortisone).
Uses: Diosgenin, obtained upon hydrolysis of dioscin, is now the major precursor of glucocorticosteroids, and treatment of rheumatoid arithritis.

(Figure- 14)

(The flavonol glycosides or flavonoids)

Large number of different flavonoids Occur in nature, and these yellow pigments are widely distributed throughout the higher plants.
Rutin, quercitrin, and the citrus bioflavonoids (including hesperidin, hesperetin, diosmin, and naringen) are among the best-known flavonoid constituents.
Rutin and hesperidin have been called vitamin P or permeability factors. They have been used in the treatment of various conditions characterized by capillary

bleeding and increased capillary fragility, citrus flavonoids are particularly important in treatment of common cold.

(Figure- 15)