PHENYLPROPANOIDS AND FLAVONOIDS
TEA AND RUTA

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Phenylpropanoids

- The phenylpropanoids are a family of organic compounds with an aromatic ring and a three-carbon propene tail of coumaric acid, and are synthesized by plants from the amino acids phenylalanine and tyrosine via shikimic acid pathway.

- The phenylpropanoid pathway starts from the aromatic amino acid phenylalanine (Phe, with the phenylpropanoid moiety C_6–C_3) and leads to derivatives with one, two, or more aromatic rings (C_6), each ring with a characteristic substitution pattern, and with different modifications of the propane residue of Phe (C_3).

- Phenylpropanoid compounds constitute a broad range of structural cyclic substances. They are formed as a result of deamination of the amino acid phenylamine by the enzyme phenylalanine-ammonia lyase (PAL).

- Phenyl propanoids can be structurally different due to hydroxylation, glycosidation,alkylation, phenylation, sulfatation and methylation.

Functions:

1. Phenylpropanoid serve as essential components of a number of structural polymers.
2. They provide protection from ultraviolet light.
3. They protect plants, defend against herbivores and pathogens.
4. Phenylpropanoids mediate plant pollinator interactions as floral pigments and scent compounds.

Classification:

There is still no generally accepted classification of this group of compounds. Classification is based on current impressions of the biosynthesis of phenolic compounds. Phenylpropanoids can conveniently be treated as a large class of natural compounds consisting of the following groups;

I. Simple phenylpropanoids;

a. Cinnamyl alcohols and their derivatives (ethers, glycosides).

b. Cinnamic acids and their derivatives (esters, glycosides, other derivatives).

c. Cinnamides

d. Phenylpropanes.

II. Complex Phenylpropanoids;

a. Phenylpropanoid glycosides based on phenylethanes.

b. Oxidative coupling products (lignoids): flavolignans; xanthonolignans; coumarinolignans; alkaloidolignans; neolignans; lignans (dimers and oligomers of phenylpropanoids).

III. Biogenetically related phenylpropanoids (flavonoids, coumarins).

FLAVONOIDS

Flavonoids (Latin word flavus meaning yellow) are secondary metabolites of plants and fungus. Chemically, flavonoids contain 15-carbon skeleton, which consists of two phenyl rings (A and B) and a heterocyclic ring (a three carbon bridge, C). This carbon structure can be abbreviated C6-C3-C6.

Functions:

1. To attract pollinator animals flavonoids play important role as plant pigments for flower coloration, producing yellow or red/blue pigmentation in petals.
2. Flavonoids in higher plants involved in UV filtration, nitrogen fixation and floral pigmentation.
3. They may also act as chemical messengers, physiological regulators and cell cycle inhibitors.
4. Flavonoids in combination with Rhizobia living in soil can lead to root hair deformation and several cellular responses such as ion fluxes and the formation of a root nodule.

Classification:

I. **Flavones-** Ring A is substituted by two phenolic hydroxyl group at C-5, C-7. They have a double bond between positions 2 and 3 and a ketone in position 4 of the C ring. These represents majority of flavonoids. Flavones are widely present in leaves, flowers and fruits as glucosides. Celery, parsley, red peppers, chamomile, mint and ginkgo biloba are among the major sources of flavones. Examples: Apigenin, Luteolin, Parsley-Apin, Buchu-Diosmin.

II. **Flavonols**

Compared with flavones, flavonols have a hydroxyl group in position 3 of the C ring, which may also be glycosylated. Flavonols are flavonoids with a ketone group. They are building blocks of proanthocyanins. Examples; Buck wheat-Rutin, Ring (Crategus oxycantha)- Quereitrin.

III. **Flavanones**

Flavanones, also called dihydroflavones, have the C ring saturated; therefore, unlike flavones, the double bond between positions 2 and 3 is saturated and this is the only structural difference between the two subgroups of flavonoids. Example; Lemon, sweet orange-Hespiridin, Bitter orange.

IV. Flavanonols

Flavanonols, also called dihydroflavones, are the 3-hydroxy derivatives of flavanones; they are an highly multisubstituted subgroup. Examples: Taxifolin (dihydroquercetin), dihydrokaemferol.

V. Isoflavones

As anticipated, isoflavones are a subgroup of flavonoids in which the B ring is attached to position 3 of the C ring. Examples: Sharapunkha-Tephrosin.

VI. Flavanols

Flavnols are also referred as catechins as well flavan-3-ols. In flavanols hydroxyl group is almost always bound to position 3 of C ring. Examples: Catechin, Epicatechin.

VII. Anthocyanidins

Anthocyanidins are the aglycones of antocyanins; they ase the flavylium (2- phenylchromenyylium) cations. Sugar units are bound mostly to position 3 of the C ring and they are often conjugated with phenolic acids, such as ferulic acid. They are the onlygroup of flavonoids that gives color to plants (all other flavonoids are colorless). Examples: Pelargonium flower-Plargonidin, Petunia flower- Petunidin.

VII. Chalcones

Chalcones do not have central heterocyclic nucleus and are characterized by three carbon chain with a ketone function and α,β unsaturation. Chalcones are flavonoids with open structure; they are classifieds because they have similar synthetic pathways. Examples: Safflor red-Carthamin.

Chemical Tests

1. **Shinoda test-** To dry powder or extract, add 5 ml of 95% ethanol, few drops of concentrated hydrochloric acid and four pieces of magnesium turnings. A pink or red colour indicates the presence of flavonoid. Colours varying from orange to red indicated flavones, red to crimson indicated flavonoids, crimson to magenta indicated flavonones.
2. **Sodium hydroxide test-** About 5 mg of the compound is dissolved in water, warmed and filtered. 10% aqueous sodium hydroxide is added to 2 ml of this solution. This produces a yellow coloration. A change in colour from yellow to colorless on addition of dilute HCl is an indication for the presence of flavonoids.

TEA AND RUTA

TEA

Synonym- Tea plant, Tea Shrub, Camellia thea

Biological source- It consists of dried leaves and leaf bud of *Thea sinensis*, Family: Theaceae

Distribution- India, China, Shrilanka, Indonesia and Japan.

Black Tea (India and Shrilanka)

Green Tea (China and Japan)

Tea

Camellia sinensis
L . Kuntze

Family: Theaceae

Chemical Constituents- Polyphenols, Catechins (flavanols).

Major catechins are (-)-epicatechin gallate, (-)-epicatechin.

Other compounds are purine alkaloids viz., caffeine, theophylline and theobromine. Trace compounds present in tea are amino acids, carbohydrates, proteins, chlorophyll, volatile organic compounds, fluoride, aluminium, minerals, black and green tea are extremely good source of Vitamin C.

- Its documented use as a social drink dates from the 5th century in China. Therefore, tea was brought into cultivation in Southeast Asia, most probably in the region of southeastern China, former Indochina, or Assam in India.

An evergreen shrub to small tree that can only be grown where frost is totally absent and where the temperature never gets very high. This means that tea is best grown on tropical hills in China, India, Sri Lanka and Malaysia, where the annual rainfall is abundant. More than half of the world production comes from China, often from small plots, but tea is being grown around the world wherever the climate is right.

Tea is traditionally classified based on production techniques

White Tea

Young leaves (new growth buds) that have undergone no oxidation; the buds may be shielded from sunlight to prevent formation of chlorophyll. White tea is produced in lesser quantities than most other styles, and can be correspondingly more expensive than tea from the same plant processed by other methods. It is less well known in countries outside of China, though this is changing with increased western interest in organic or premium teas.

Green Tea

The oxidation process is stopped after a minimal amount of oxidation by application of heat, either with steam, a traditional Japanese method, or by dry cooking in hot pans, the traditional Chinese method. Tea leaves may be left to dry as separate leaves or they may be rolled into small pellets to make *gun-powder* tea. This process is time consuming and is typically done with pekoes of higher quality. The tea is processed within one to two days of harvesting.

Oolong

Oxidation is stopped somewhere between the standards for green tea and black tea. The oxidation process takes two to three days. In Chinese, semi-oxidized teas are collectively grouped as *blue tea* (青茶 , literally: blue-green tea), while the term "oolong" is used specifically as names for certain semi-oxidized teas.

Black Tea/Red Tea

- The tea leaves are allowed to completely oxidize. Black tea is the most common form of tea in southern Asia (Sri Lanka, India, Pakistan, Bangladesh, etc.) and in the last century many African countries including Kenya, Burundi, Rwanda, Malawi and Zimbabwe.
- The literal translation of the Chinese word is *red tea*, which is used by some tea lovers. The Chinese call it *red tea* because the actual tea liquid is red. Westerners call it *black tea* because the tea leaves used to brew it are usually black.

- However, *red tea* may also refer to rooibos, an increasingly popular South African tisane. The oxidation process will take between two weeks and one month.

- Black tea is further classified as either *orthodox* or as *CTC* (*Crush, Tear, Curl*, a production method developed about 1932). Unblended black teas are also identified by the estate they come from, their year and the flush (first, second or autumn flush).

Uses

1. Purine alkaloids (caffeine, theophylline and theobromine)are CNS stimulant and diuretic.

2. Catechins have antioxidant, anticancer and anti-ageing effects.

3. Green tea used in obesity and weight loss treatment.

RUTA

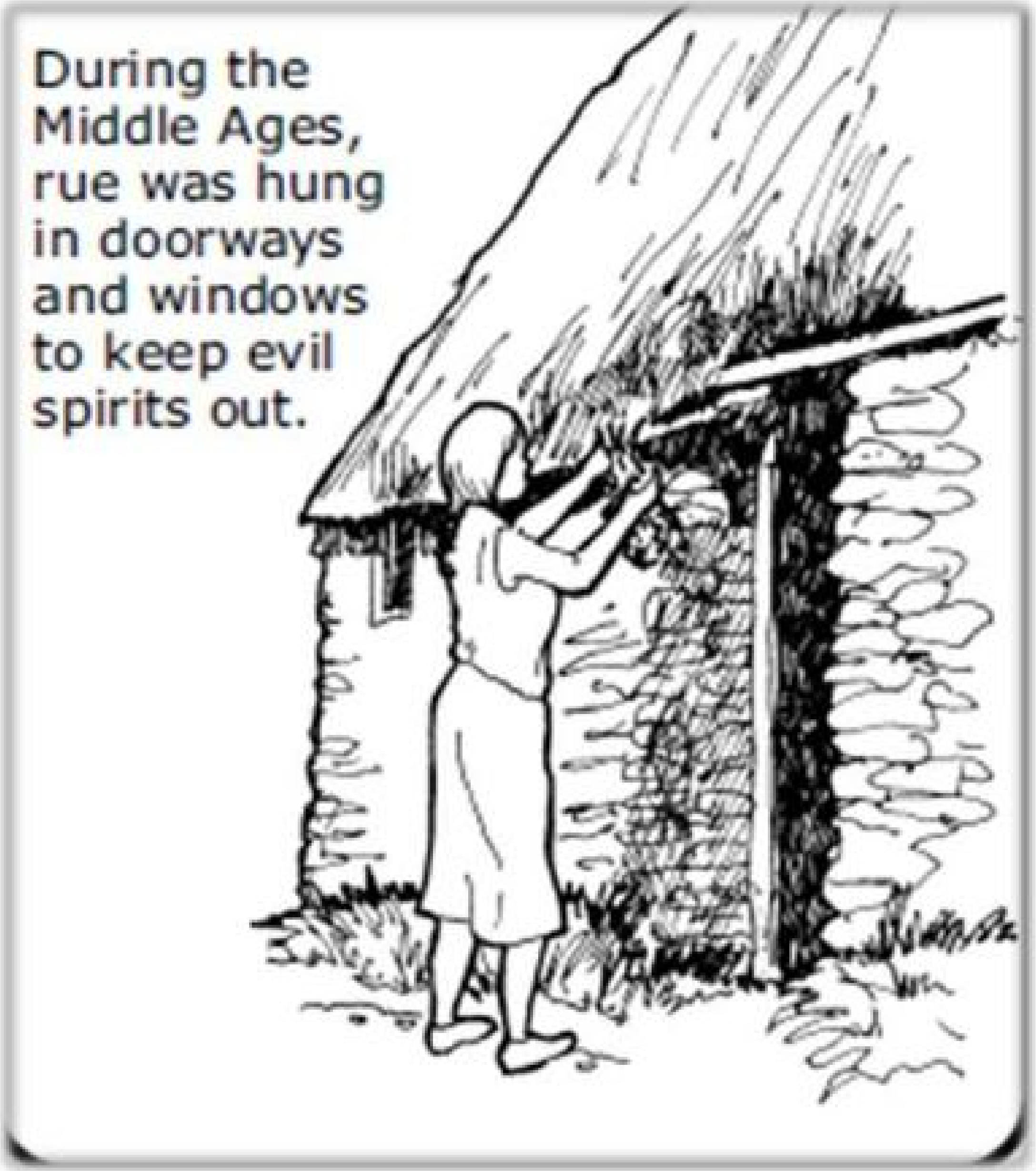
Synonym- Rue, Garden rue, German rue, Sadab.

Biological source- It consists of fresh and dried leaves of *Ruta graveolens* L., Family: Rutaceae

Distribution- It is native to the Balkan Peninsula. It is now grown throughout the world in gardens.


Rue
Benefits & Properties
Anti-inflammatory, Antithrombotic
Main Applications
Relieving inflammatory pain
Reducing the risk of thrombosis
Supportive Compounds
Rutin
Medicinal Actions
The antioxidant properties of rutin help prevent the formation of free radicals that cause cellular damage. Rutin also acts as an anti-inflammatory agent and a vasodilator, strengthening the walls of blood vessels and relieving edema, which prevents the formation of blood clots and reduce the risk of thrombosis. Additionally, rutin can help decrease cholesterol toxicity, which is thought to be a cause for atherosclerosis.
Source: herbazest.com - For informational purposes only.
HerbaZest


Rue
www.herbazest.com



Rue makes a refreshing eyewash when steeped in purified water overnight

(Heidi, 2010)

Chemical Constituents

Glycosides: Flavonoid rutin

Alkaloids: Coquisagenine, skimmianine and graveoline, furanocoumarins (psoralens), bergaptene and xanthotoxine.

Volatile oil: Methyl-nonyl-ketone, methyl-n-octyl-ketone and methyl-heptyl-ketone.

Alcohol: Methyl-ethyl-carbinol, pinene and limonenes.

Flavonoid: Rutin and Quercetin

Uses

- Rue is used for painful conditions including headache, arthritis, cramps and muscle spasms.
- In Chinese medicine rue is considered as an emmenagogue, hemostat, intestinal antispasmodic, sedative, uterine stimulant, vermifuge, rheumatism, cold and fever.
- In Poland it is used as an aphrodisiac and choleretic.
- Medicinally it is used as bitters, an aromatic stimulant, ecbolic and in suppression of the menses.


THANK YOU