



A REVIEW ON: ‘ETHNO-MEDICINAL PLANT USED AS TRADITIONAL MEDICINE- GYMNOSPORA SENEGALENSIS [LAM.] LOES’

AUTHOR - DIVYA DILIP PIMPALE¹, CO-AUTHOR - DR.PRAVIN CHOLKE²

Dharmaraj Shaikshanik Pratishthan College of Pharmacy, Walki, Ahmednagar, Maharashtra, India.

ABSTRACT :

A tree or shrub called *Gymnosporia Senegalensis* [Lam.] Loes with the common name Spikethorn, Red Spikethorn, Henkal or Bahuguni. Synonyms having *Maytenus Senegalensis* [Lam.] Excell or *Celastrus Senegalensis* Lam., Which belongs to *Celastraceae* family. For the treatments such as infectious and inflammatory diseases different parts of plants of this species are widely used in Traditional medicine. A Crude dichloromethane leaf extract of *Gymnosporia Senegalensis* and its six fractions were tested and was found to be anti-mycobacterial activity with the help of fluorescent microplate assay against the H37Rv strain of mycobacterium Tuberculosis and also antioxidant activity by DPPH method. By measuring tumor necrosis- alpha production in Raw 264.7 cells. The Anti-inflammatory potential of fraction was screened. The leaf extract contains compounds Alkaloids, Alkanes and alkanols, Maytansinoids, Phenolic compounds, Sugars, Monoterpenes, Triterpenes and Other constituents that shows chemical constituents such as Ephedrine, Norephedrine, Hexosan, Anthocyan, Ferula acid, Kaemferol etc which shows Properties such as anti-inflammatory, nasal decongestants, reduces hypertension due to anesthesia, allergic and bronchial asthma. As well as disinfectant, Antimicrobial, Antioxidant, Antibacterial and antiviral. The aim of this review article is to summarise the information about this ethno-medicinal plant used as traditional medicines. Such kind of data can be used in future studies and experimental work.

KEYWORDS:

Transitional medicine, *Gymnosporia Senegalensis*, Mycobacterium Tuberculosis, DPPH method, Antioxidant activity, anti-inflammatory activity, ethno-medicinal plant.

1. INTRODUCTION:

Gymnosporia Senegalensis [Lam.] Loes is a small tree or shrub it is largely distributed in India, Africa, Arabia and Afghanistan.[1] That undergoes the common Name Red Spikethorn, Spikethorn, Henkal; which belongs to the *celastraceae* family.[2] These are traditionally used as anti microbial and anti- inflammatory agents. The antimycobacterial activity of acetone and water leaf extracts of this plant against a resistant strain of mycobacterium tuberculosis was demonstrated by Lall and Meyer.[3,4,5] More specifically it is used for the treatment of respiratory ailments and inflammation. [6,7] This plant is used as anti-inflammatory herbal drugs in other African countries and leaves to treat toothaches in India.[6-9]



Fig.1 *Gymnosporia Senegalensis* [Lam.] Loes Plant [23]

Synonyms	<p><i>Celastrus senegalensis</i> Lam.</p> <p><i>Catha senegalensis</i> [Lam.] G. Don</p> <p><i>Gymnosporia senegalensis</i> [Lam.] Loes</p>
English names	<p>Red spike-thorn</p> <p>Rooipendoring</p>
Vernacular names	<p>Mozambique</p> <p>Chichanga, chicangua, xihlangua, xilangua [Maputo], chixangua, chilhaungua [Gaza], nhaquitoforofo [Inhambane], tambanzato, cungamacheze, tombanzato, mutumbotumbo, mutunga-macheche [Sofala], mutuluca [Manica], muia, tombassato, patchocolo [Zambézia], tsucamano, sucamano, tombatsato, tomatsatu [Tete], napidji, nacôtocôto, m'tocoma [Nampula], bobué, fogolia [Cabo Delgado]</p> <p>Zulu territories</p> <p>Ubuhlangwe, isihlangu, isihlangwane</p>
Traditional use	<p>Leaves macerated in water to be consumed twice a day for the treatment of tuberculosis.</p> <p>Leaf infusion considered to be very efficient in the treatment of amebic dysentery roots or leaves are used for various respiratory ailments, including pneumonia and tuberculosis.</p> <p>Roots or leaves used for snakebites</p>

Table 1. Different types of names and uses [6,7]

2. Botanical Description:

Gymnosporia Senegalensis is a shrub, tree which grows upto height 15m, it's spine upto length 7cm. Leaves are alternated, petiolated, fascicled mainly glaucous and cariceous. The lamina is pale green in color, petiole upto length 20mm. Margins ovated to oblong- elliptic upto 13cm * 6 cm, spathulated, Dichasial located on short axillary shoots or panicles. The flowers are dioecious, scented peduncle upto length 1-16 mm, pedicles upto length 6mm, ovate- triangular sepals upto length 1.2mm, with oblanceolate petals upto length 1-3.5mm The fruit is reddish globosoid, length 2-6mm ovary 2-3 Locular smooth. Reddish-brown 1-2 seeds glossy with a fleshy smooth

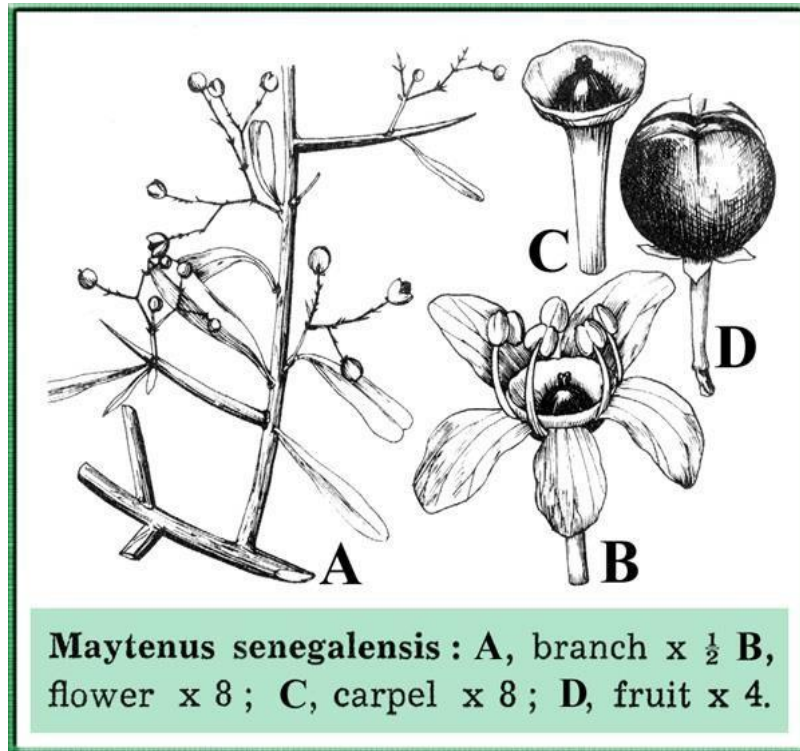


Fig 2. Botanical Description of the Plant [24]

3. MICROSCOPIC STUDIES:

For this leaf identification, the characteristics are the isobilateral organisation of the parenchyma on both epidermis, isolated or inserted into the palisade parenchyma calcium oxalate cluster crystal is present. Epidermal cells with sinuous walls, a smooth cuticle and paracytic stomata more specifically in lower epidermis. [12]

4. GEOGRAPHICAL DISTRIBUTION:

A large family *celastraceae* having trees, shrubs and woody lianas with a Gondwanan distribution. [11] Geographically, it has wide distribution in India, Africa as well as Afghanistan. It is widely found on River bank and swap margins. The habitat of these species is it occupies a large variety, from deciduous woodland, thickets, shrubs and wooded grassland.[10]



Fig 3. Geographical Distribution in India. [25]

5. BIOLOGICAL ACTIVITY:

Leaf extract against resistant strain of *P. Berghei* was observed.[13] Acetone extract of the aerial parts of this species has been observed to be active against resistant strain of *P. falciparum*. [14] It is used as traditional medicine to prepare infusion or decoction as anti-inflammatory and analgesic remedies as oral administration.[15] Recently, ethanol extract 70% showing anti-inflammatory activity were determined in wistar albino rats by the carrageenan- induced paw Edema method. Also exhibited anti-inflammatory activity [120mg /kg,os] reducing edema by 51% and 35% respectively.[16]

6. CHEMICAL CONSTITUENTS:

6.1 CHEMICAL PROPERTIES OF THE FAMILY

The Celastraceae family is important bio active secondary metabolites alkaloid amines such as cathine. They are commonly tanniferous, anthocyanins, saponiferous. Beta-Amyrin, Lupane and quinoid pigments are considered typical of these family. Ansa macrolide, Maytansine, normaytansine, Maytanprine and maytanbutine are the isolated compounds.[6]

6.2 COMPOUNDS, CHEMICAL CONSTITUENTS AND THEIR PROPERTIES.

COMPOUNDS	CHEMICALS	PROPERTIES
Alkaloids	Ephedrine Norephedrine l-stachidrine Wilforine	Reduces anesthesia, allergic, bronchial asthma caused due to hypertension, also treats cough, wheezing, fever and nasal congestion. Used in the treatment of urinary incontinence as well as used as a nasal decongestant and for weight control. Promotes blood circulation and dispel blood stasis. Prevent blood clots.
Alkanes and alkanols	Hexacosanol Hexosan Triacontanol	Help in reduction of chloraurate ions. As an antibacterial agent, disinfectant, fungicide, and acaricide; Topical antiinfective, veterinary medicine. Leads to better growth and development of metabolic activities.
Maytansinoids	Maytanbutine Maytanprin Maytanbutan	
Phenolic compounds	Anthocyanins epicatechin [4 β →8] epicatechin [-]-epicatechin [4 β →8] [-]-4'-methylepigallocatechin epicatechin [4 β →8]epigallocatechin [-]-epigallocatechin Ferula acid Kaempferol derivatives	Anthocyanins possess antidiabetic, anticancer, anti-inflammatory, antimicrobial, and anti-obesity effects, as well as prevention of cardiovascular diseases. Reduce blood glucose level in diabetic patients. Reduce inflammation, aid weight loss and prevent heart and brain diseases. As anti-inflammatory, antioxidant, antimicrobial activity, anticancer, and antidiabetic effect.

Research Through Innovation

	<p>Leucoanthocyanans</p> <p>[-]-4'-methylepigallocatechin</p> <p>[+]-4'-methylepigallocatechin 3'-O-βglucopyranoside</p> <p>[-]-4'-methylepigallocatechin 5-O-βglucopyranoside</p> <p>Phloroglucinol 1-O-β-Dglucopyranoside</p> <p>Prenyletin</p> <p>Quercetin derivatives Scopoletin</p> <p>Tannins Vanillic acid</p>	<p>As antioxidant, anti-inflammatory, antimicrobial, cardiovascular, and neuroprotective properties.</p> <p>Treat colic, spastic pain of digestive and biliary tract.</p> <p>Prevents cardiovascular disease and cancer. Used as dye.</p> <p>Inhibits inflammatory pain.</p>
Sugars	<p>Dulcitol Glucose Saccharose</p> <p>Xylose</p>	<p>Sugar alcohol.</p>
Monoterpenes	<p>Geraniol Linalool Terpineol</p>	<p>Antifungal, antibacterial, antioxidant, anticancer, antiarrhythmic, anti-aggregating, local anesthetic, antinociceptive, anti-inflammatory, antihistaminic and anti-spasmodic properties.</p>
Triterpenes	<p>3-O-acetyloleanol acids Epifriedelanol</p> <p>Epifriedelinol</p> <p>β-amyrin Betulin Friedelin Iguestrin</p> <p>3α-hydroxy-2-oxofriedelane-20α-carboxylic acid</p> <p>lup-20[29]-ene-1β,3β-diol Lupenone</p> <p>Maytenoic acid</p>	<p>Antifungal, antibacterial, antioxidant, anticancer, antiarrhythmic, anti-aggregating, local anesthetic, antinociceptive, anti-inflammatory, antihistaminic and anti-spasmodic properties.</p>

	Maytenonic acid Maytenfolic acid Pristimerin β-sitosterol β-sitosterol xyloside Tingenone	
Other constituents	Quinoid pigments	A diverse role in medicine, including anti-cancer agents and anti-aging and arteriosclerosis.

TABLE 2. COMPOUNDS, CHEMICAL CONSTITUENTS AND THEIR PROPERTIES. [6, 9,17,18,19,20]

6.2 SOME CHEMICAL CONSTITUENTS IN DETAILS:

6.2.1 EPHEDRINE

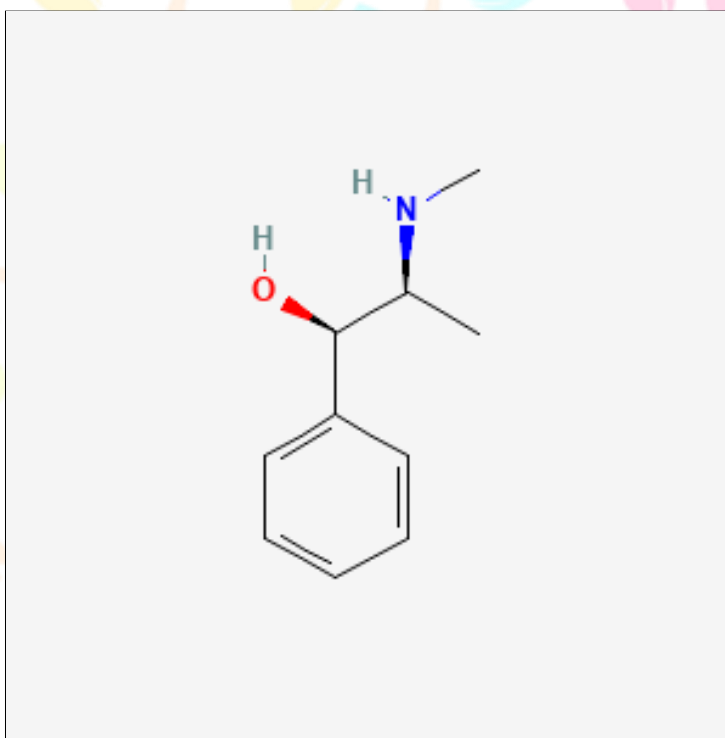


Fig 4. Structure of Ephedrine [21]

SYNONYM: 1-Ephedrine

IUPAC NAME: [1R,2S]-2-[methylamino]-1-phenylpropan-1-ol

MOLECULAR FORMULA: C₁₀H₁₅N₀

MOLECULAR WEIGHT: 165.23

COLOR/Form: Waxy solid, crystals or granules White to colorless granules, pieces, or crystals **MELTING POINT:** 34 °C

BOILING POINT : 255 °C

SOLUBILITY: It is soluble in water, alcohol, chloroform, ether, glycerol, olive oil and in liquid paraffin.

USES: Ephedra is the chief drug for treatment of asthma and bronchitis. It is used to treat bronchial asthma, cold and flu, cough and wheezing, fever, chills, lack of perspiration, headache, and nasal congestion. It is also used in Allergic condition and Anesthesia. It is mainly used as a bronchodilator, nasal decongestant as well as treatment of syndrome of Stokes-Adams as a mydriatic and hypertensor in the spinal anesthesia. It is also used as an herbal diet supplementary named Ma-huang as an anorectic and CNS stimulant.

DESCRIPTION: Ephedrine is an alkaloid that is an hydroxylated form of phenethylamine and sympathomimetic amine, with potential bronchodilatory and anti-hypotensive activities. Following administration, ephedrine activates post-synaptic noradrenergic receptors. Activation of alpha-adrenergic receptors and beta-adrenergic receptors in the vasculature induces vasoconstriction and in the lungs leads to bronchodilation respectively.

Ephedrine is a phenethylamine alkaloid which is 2-phenylethanamine substituted by a methyl group at the amino nitrogen and also a methyl and a hydroxy group at position 2 and 1 respectively. Its role is as a nasal decongestant, a sympathomimetic agent, a vasoconstrictor agent, a xenobiotic, an environmental contaminant, a plant metabolite and a bacterial metabolite. It is a alkaloid member of phenylethanolamines and phenethylamine. It is a conjugate base madeup of ephedrinium.[21]

6.2.2 NOREPHEDRINE

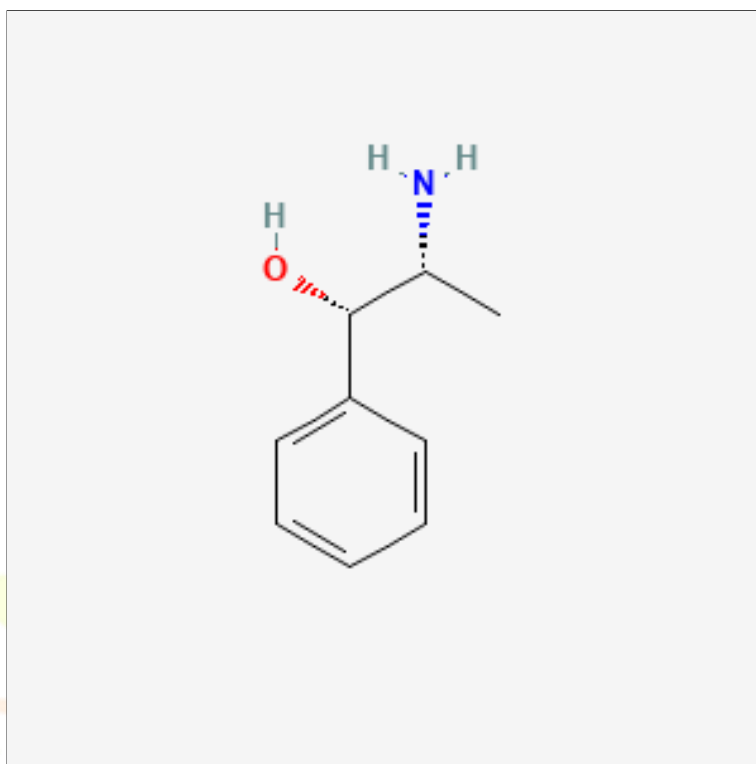


Fig 5. Structure of Norephedrine [21] SYNONYMS: Phenylpropanolamine

IUPAC NAME: [1S,2R]-2-amino-1-phenylpropan-1-ol **MOLECULAR FORMULA:** C₉H₁₃N₁O **MOLECULAR WEIGHT:** 151.21

COLOR/Form: White, crystalline powder

ODOR: Slight aromatic odour

MELTING POINT: 101-101.5 °C

SOLUBILITY: Freely soluble in water and alcohol.

USES: Used as a raw material in cold and diet tablets. Decongestant [nasal]; anorexic; in treatment of urinary incontinence. This drug is widely used as a nasal decongestant and for weight control.

DESCRIPTION: Norephedrine is an amphetamine that is propylbenzene substituted by a hydroxy group at position 1 and by an amino group at position 2 [the 1s,2r-stereoisomer]. It is a member of amphetamines and phenethylamine alkaloids.

Norephedrine is an alpha- and beta-adrenergic receptor agonist with sympathomimetic activity. Norephedrine binds to and activates alpha- and beta-adrenergic receptors in the mucosa of the respiratory tract resulting in vasoconstriction and reduction in swelling of nasal mucous membranes and reduction in tissue hyperemia, edema, and nasal congestion. This agent stimulates the release of norepinephrine from its storage sites which shows effects already described. Finally, Norephedrine indirectly stimulates beta-receptors producing tachycardia and a positive inotropic effect. A sympathomimetic that acts mainly caused due to release of NOREPINEPHRINE but also has direct agonist activity at some adrenergic receptors. It is mainly used as nasal vasoconstrictor and an appetite depressant.[21]

6.2.3 HEXOSAN

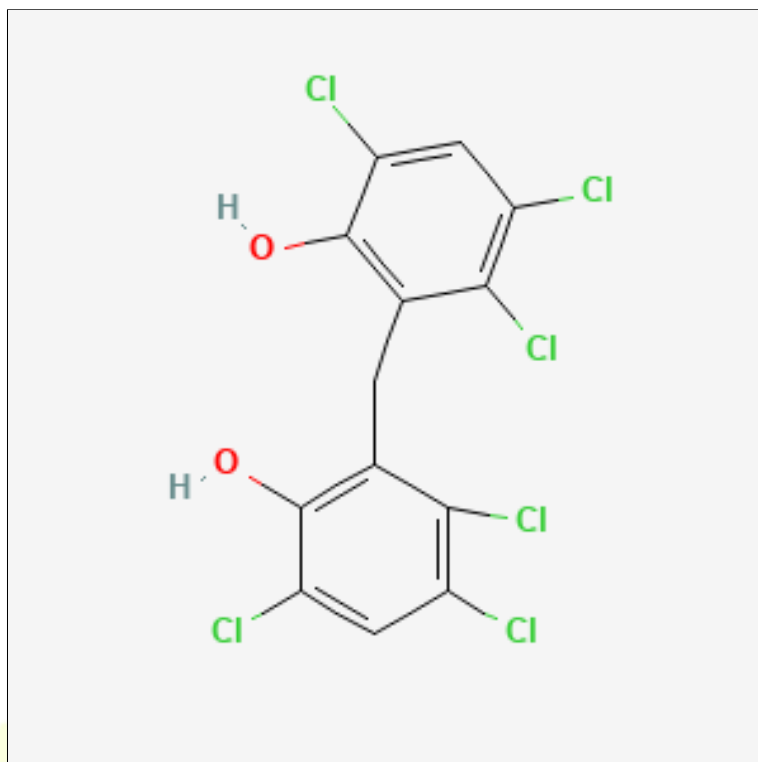


Fig 6. Structure of Hexosan [21]

SYNONYM: Hexachlorophene

IUPAC NAME: 3,4,6-trichloro-2-[[2,3,5-trichloro-6-hydroxyphenyl]methyl]phenol

MOLECULAR FORMULA: C₁₃H₆Cl₆O₂

MOLECULAR WEIGHT: 406.9

COLOR/ FORM: white to tan color free-flowing odorless powder.

ODOUR: Odourless white crystalline powder

SOLUBILITY: Soluble in chloroform, polyethylene glycols, propylene glycol, olive oil, cottonseed oil, dilute aqueous alkaline solutions and Insoluble in water and denser than water.

MELTING POINT: 322-333 °C

BOILING POINT: 479 °C

USES: Used as an antibacterial agent, disinfectant, fungicide, and acaricide; Topical antiinfective, veterinary medicine.

Description: Hexachlorophene is an organochlorine compound that is diphenylmethane in which each of the phenyl groups is substituted by chlorines at positions 2, 3, and 5, and by a hydroxy group at position 6. An antiseptic which is effective against Gram-positive organisms is used in soaps and creams which treats skin disorders. It is also used as an acaricide and fungicide. It shows properties such as antiseptic drug, an acaricide, an antibacterial agent and an antifungal agrochemical.[21]

6.2.4 ANTHOCYANINS

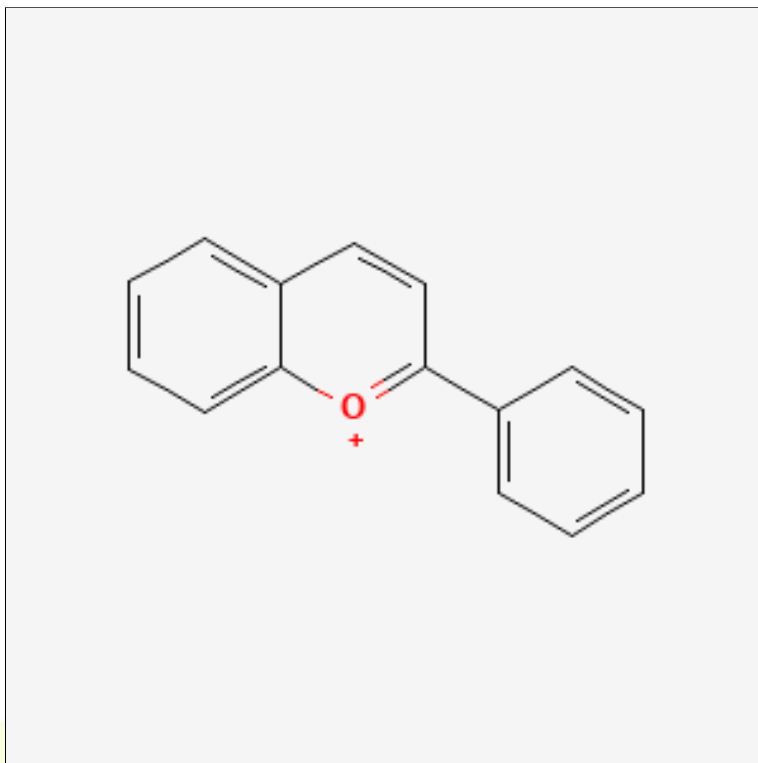


Fig 7. Structure of Anthocyanins [21]

SYNONYMS: Flavylium

IUPAC NAME: 2-phenylchromenylium **MOLECULAR FORMULA:** C₁₅H₁₁O⁺ **MOLECULAR WEIGHT:** 207.25

COLOR: Color is dependent on the pH of the solvent.

SOLUBILITY: They are water soluble.

USES: Anthocyanins possess antidiabetic, anticancer, anti-inflammatory, antimicrobial, and anti-obesity effects, as well as prevention of cardiovascular diseases.

DESCRIPTION: Anthocyanin is a member of the class of chromenyliums that is chromenylium with a phenyl substituent at position 2. Anthocyanin is a glycoside derivative of anthocyanidin which is flavonoid. This exhibits bright coloration because they are water-soluble plant pigments. These polyphenols are used as pH indicators because their color is dependent on the pH of the solvent. A group of FLAVONOIDS are derived from FLAVONOLS, which lack the ketone oxygen at position-4. They are glycosylated versions of cyanidin and pelargonidin. The conjugated bonds shows result in blue, red, and purple color in flowers of plants. [21]

6.2.5 FERULA ACID

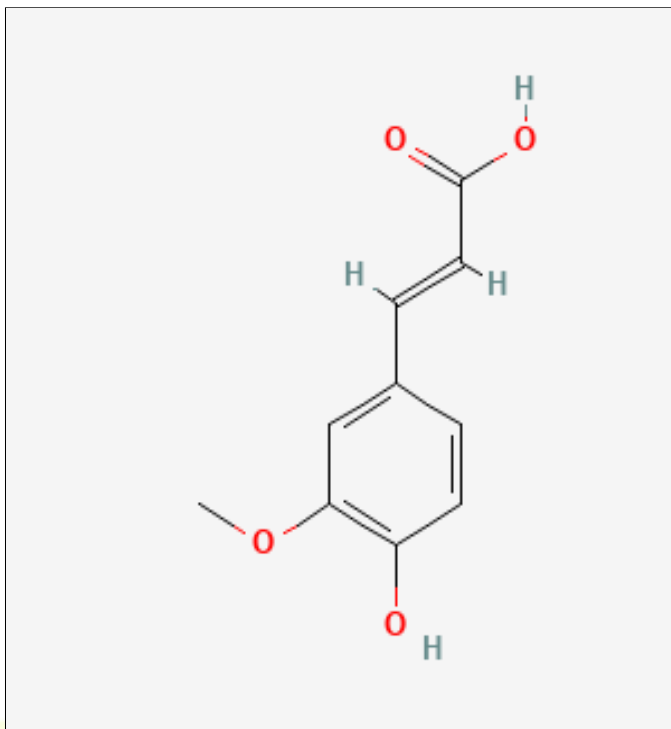


Fig 8. Structure of Ferula acid [21]

SYNONYMS: ferulic acid, trans-Ferulic Acid

IUPAC NAME: [E]-3-[4-hydroxy-3-methoxyphenyl] prop-2-enoic acid

MOLECULAR FORMULA: C₁₀H₁₀O₄

MOLECULAR WEIGHT: 194.18

COLOR/Form: Trans-Form yellow liquid; Trans-Form is a solid;

TRANS-ISOMER: Tan powder. **MELTING POINT:** 168-171 °C **BOILING POINT:** 372-373 °C

SOLUBILITY: In water, 5.97X10+3 mg/L at 25 °C [est]

USES: Ferulic acid has low toxicity and possesses many physiological functions such as anti-inflammatory, antioxidant, antimicrobial activity, anticancer, and antidiabetic effect. It has been widely used in the pharmaceutical, food, and cosmetics industry. Found in small amounts in many plants; Used as a food preservative.

DESCRIPTION: Ferulic acid is a acid consisting of trans-cinnamic acid bearing methoxy and hydroxy substituents at positions 3 and 4 respectively on the phenyl ring. It shows an antioxidant, a Maldi matrix material, metabolite, an anti-inflammatory activity, an apoptosis inhibitor and a cardioprotective agent . It is a acid which conjugates Ferulate.[21]

6.2.6 KAEMPFEROL

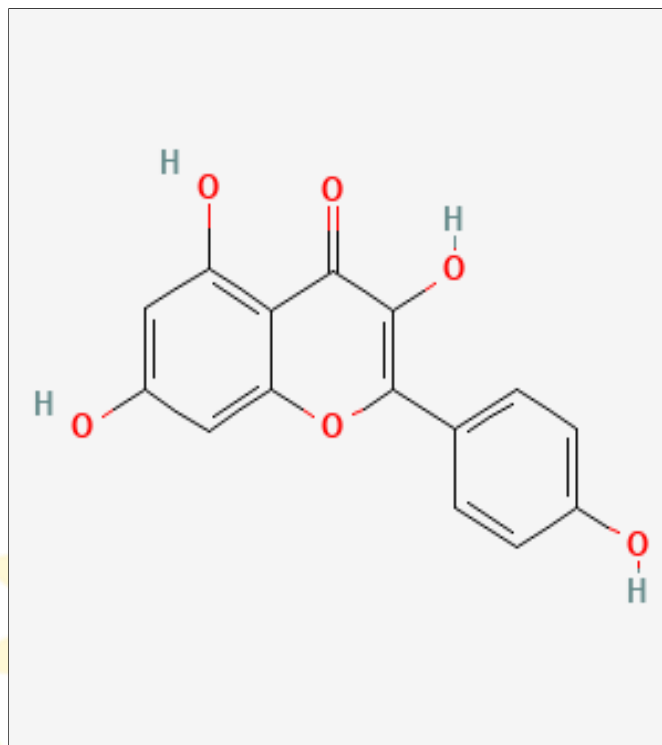


Fig 9. Structure of Kaempferol [21]

SYNONYMS: Kaempferol

IUPAC name: 3,5,7-trihydroxy-2-[4-hydroxyphenyl] chromen-4-one

Molecular Formula: C₁₅H₁₀O₆

Molecular Weight: 286.24

COLOUR/Form: Yellow needles from alcohol and water

MELTING POINT: 277 °C

BOILING POINT: 582.00 to 583.00 °C

SOLUBILITY: Soluble in hot alcohol, ether or alkalis. It is Insoluble in benzene, slightly soluble in chloroform and soluble in acetic acid, alkalis and more soluble in ethanol, ethyl ether and acetone.

USES: Kaempferol has antioxidant, anti-inflammatory, antimicrobial, cardiovascular, and neuroprotective properties. Kaempferol can be used for the therapy of cancers such as ovarian, breast, cervical, hepatocellular carcinoma, and leukemia.

DESCRIPTION: It is a tetrahydroxyflavone where the four hydroxy groups are located at positions 3, 5, 7 and 4. It acts as an antioxidant by reducing oxidative stress, it is considered as a possible cancer treatment. It's role is as an antibacterial agent, a plant metabolite, a human xenobiotic metabolite, a human urinary metabolite, a human blood serum metabolite and a geroprotector. 7-hydroxyflavonol and a tetrahydroxyflavone are the members of the flavonols. Kaempferol is a conjugate acid of a kaempferol oxoanion.[21]

7. MEDICINAL:

The leaves contains some dulcitate, tannins, wax which mainly esters of ceryl alcohol, sterol, flavenol, Slavonic glycoside, holoside and a rubber like substance. They are vermifuge and slight laxative activity. It is commonly used for the treatment of gastro-intestinal problems as well as vermifuge in dysentery .Also used for relieve blennorrhoea, schistosomiasis and combination with root decoction of cyperus papyrus for female sterility. A leaf decoction is used in mouthwash for toothaches, tooth-abscesses and mouth infections. Also to bathe new born infants. The leaves are pounded and used as plaster for sores. The Leaf-sap can be used while eye-trouble. [22]

8. USES:

- This is an important ethno-medicinal plant in traditional medicine.
- Traditional practitioners used its parts to treat malaria rheumatism, fever, chest pain, tuberculosis Bronchitis, wounds, chronic illness, dyspepsia eye infection, earache, headaches, epilepsy, diarrhoea, measles, abdominal pain, dusmenorrhoea, uterine cramps, venereal disease, snake bite and also an aphrodisiac, Also treat impotence and diarrhoea. [23]

9. TOXICITY:

Toxicity studies are important because the risks differ from the type of extract depends on the form and route of administration. Traditional medicines over generations commonly justify the activity and harmlessness of the herbal products. Therefore, pharmacological and toxicological assay are crucial to substantiate this knowledge and to assure that the extract have lack in toxicity. Acute and subacute toxicity screening of leaf Ethanol extracts [70%] was found to be in adult male CD-6 mice while it Indicated some toxicity at 1200mg/kg.[16]

10. DISCUSSION AND CONCLUSION :

It can be concluded that *Gymnosporia Senegalensis* has been used in Africa, India and some other Asian and African countries as traditional medicine for the treatment of numerous ailments, including respiratory diseases, inflammation and microbial affections. It also shows anti-mycobacterial activity against the H37Rv strain of mycobacterium Tuberculosis. Biological activity studies confirm most of the traditional uses of these herbal medicines, and toxicity studies support the safe use of *Gymnosporia senegalensis*. Detailed in vivo studies are needed. Some active compounds such as Ephedrine, Norephedrine, Hexosan, Anthocyanins, Ferula acid, Kaempferol have been isolated, but there is still many more to do. There are still many constituents of *Gymnosporia Senegalensis* with potential pharmacological activities that have not yet been studied. It is very likely that this species contains many beneficial pharmacological properties due to its wide spectrum of uses in African and Asian traditional medicine. Therefore, in vivo and clinical studies on their pharmacological effects may provide valuable evidence and insight into their potential utility for the future clinical management of many human diseases.

Abbreviations:

DPPH - diphenyl-1-picrylhydrazyl

CNS -Central Nervos System

PH -Potential Of Hydrogen

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