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A spy on costal plant - Mangrove: A review article

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Abstract
India has a rich heritage of knowledge on plant-based drugs for use in preventive and curative medicines. Among those mangrove plants have been used in folklore medicines and extracts from mangrove species have proven inhibitory and curative activity against different diseases including Anti-oxidant, Anti-viral, Anti-diabetic, Anti-cancer, Anti-microbial, Anti-inflammatory, Anti-ulcer activity. Along with different pharmacological activities this review also summarizes mangrove role in the prevention of soil erosion along with it plays a major role in curing Baldness.

Keywords: Mangroves, epiphytes, plant, antimicrobial, analgesic, Glycosides, Anti-viral

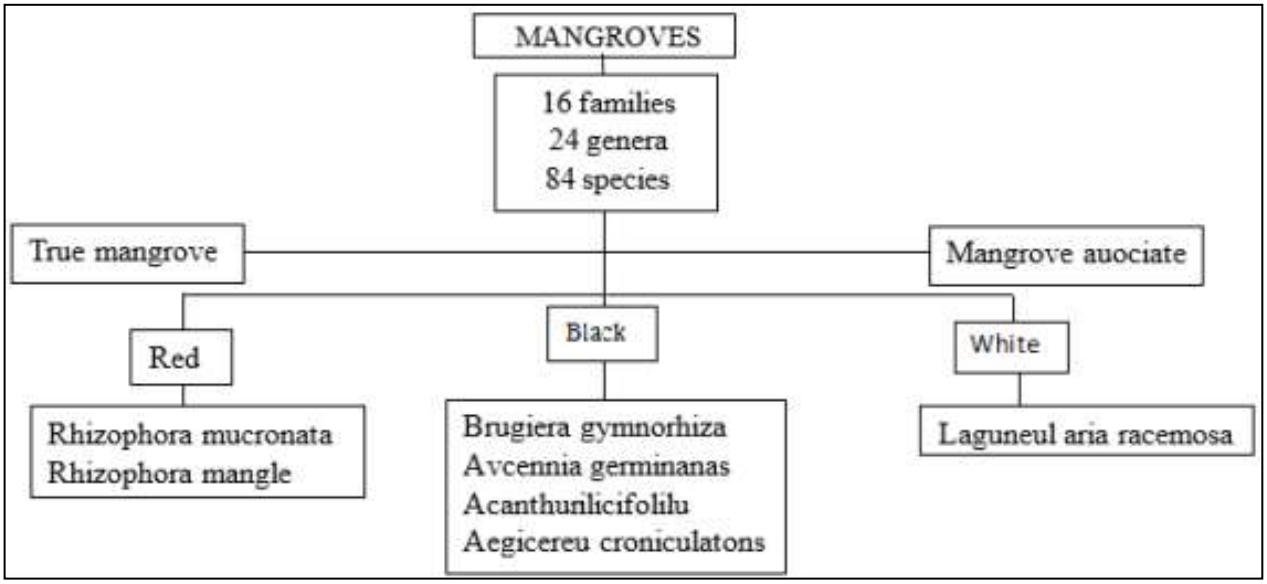
Introduction
Mangroves are epiphytes, palms, shrubs, ground ferns, grasses and trees which are connected in groves or stands and are halophytic, salt resistant ocean tidal forests and it is usually classified into 2 subgroups those are True mangrove and semi-mangrove [1]. Some of the best mangrove forests of the world in India harbours which are located in the alluvial deltas of major rivers such as Mahanadi, Ganga, Krishna, Cauvery, Godavari and also on the Nicobar and Andaman Islands [2]. From the mangrove species different types of Terpenoids, tannins, steroids, alkaloids, flavonoids and saponins were isolated and these are the main classes of phytochemicals [3]. Mangroves will grow in hostile environment of high salinity, in highly stressful, high and low tides of water, high temperature and moisture, strong winds and muddy anaerobic soil [3]. There is a rich species composition and 4000 of mangroves are present in srilanka and extracts from different mangroves plants are reported to possess diverse medicinal properties [5]. The mangroves contain neutraceuticals which are used as traditional food supplements and also widely used as folk medicines in some countries [6]. The advancements in phytochemical research of herbal products proved that the plant extracts are used as popular source for treatment of cancer [7]. Vincristine, vinblastine, etoposide, paclitaxes, camptothecin, topotecan and irinotecan are the bioactive and secondary metabolites are reported for treatment of cancer [7]. Avicennia germinans (L).L. showed anti-ulcer activity, whereas B. gymnorhiza shows a significant antioxidant, antidiabetic, and anti-inflammatory activities [8]. R.mucronata covered a broad spectrum of activities namely anti - inflammatory, antioxidant, antidiabetic, antimicrobial, analgesic, anti -HIV and anticholinergic activities [8]. Among the world wide diversity of mangrove flora includes around shrub species of 30 genera from 17 families included in 81 trees out of these Indian mangroves represent 46 true mangrove species (42 species and 4 natural hybrids) belonging to 14 families and 22 genes and are considered as safer, economical, effective [9-10].

Phytochemistry of mangrove plants
Mangrove plants consisting of various phytochemical constituents like phenols, tannins, triterpenes, steroids, lipids, carbohydrates, free fatty acids, pheromones hydrocarbons, amino acids, aliphatic alcohols, carotenoids [1]. In which Rhizophora mucronate bark assist in the treatment of diabetes and it will be containing a significant number of bioactive compounds like Glycosides, anthraquinone, phenolics compounds, sugar, protein, catechin, tannins [11].

Classification of mangroves (Botanical classification)
All types of the mangroves consisting of 16 families, 24 genera, 84 species with Rhizophoraceae being the dominant family and belonging to Malphigiales order.

Mangroves are classified as True mangroves and mangrove associates [7, 12].

Classification of mangroves [11]



Classification of mangroves [11]

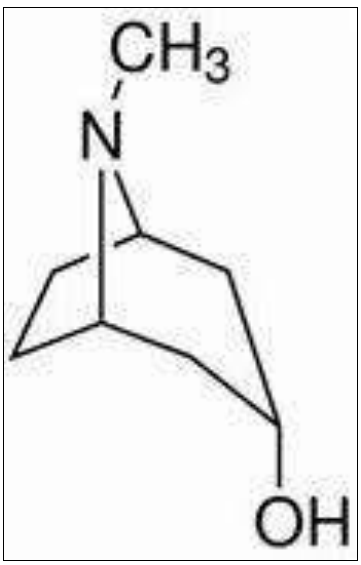
All the species from the Rhizophoraceae are not considered as true mangroves, only 24 species from the four genera Bruguiera, kandelia, ceriops and Rhizophora are called the "Mangrove trees". In concern to mangrove species "Rhizophoraceae" is considered as the richest family [8]. All the species from the Rhizophoraceae are not considered as true mangroves, only 24 species from the four genera Bruguiera, kandelia, ceriops and Rhizophora are called the "Mangrove trees ". In concern to mangrove species "Rhizophoraceae" is considered as the richest family [8].

Phytochemical constituents of some mangrove plants [1]

Botanical name	Part of plant	Phytochemicals
Avicennia alba	Leaves, bark, stem	Saponins, Flavonoids, Alkaloids, Steroids, Tannins
Bruguiera cylindrica	Leaves, bark, stem, and fruits	Triterpenes, Saponins, Flavonoids, Alkaloids, Steroids, Tannins
Bruguiera gymnorrhiza	Leaves and bark	Phenols, Triterpenes, Saponins, Flavonoids, Gums Alkaloids, Steroids, Tannins & Reducing sugars
Melaleuca Leucadendron	Leaves, bark, and fruits	Triterpenes, Saponins, Flavonoids, Alkaloids, Steroids, Tannins, Monoterpenes and Sesquiterpenes.

Chemistry of Mangroves

Antidiabetic metabolites from mangrove plants



Tropine [9]

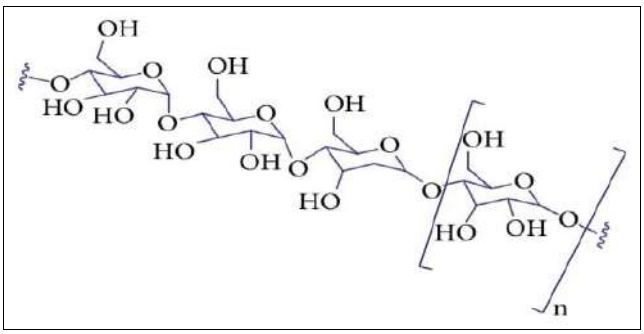
Source: B. sex angular (Stem and bark)

Mol.for: $C_8H_{15}NO$

Mol.Wt: 141.214

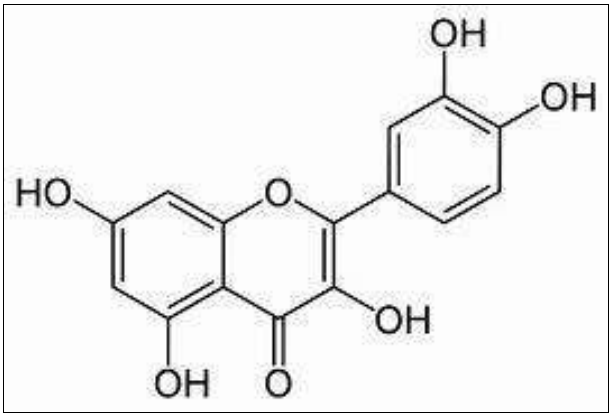
Biological action: Antidiuretic, anticancer

Complexo polysaccharide [9]

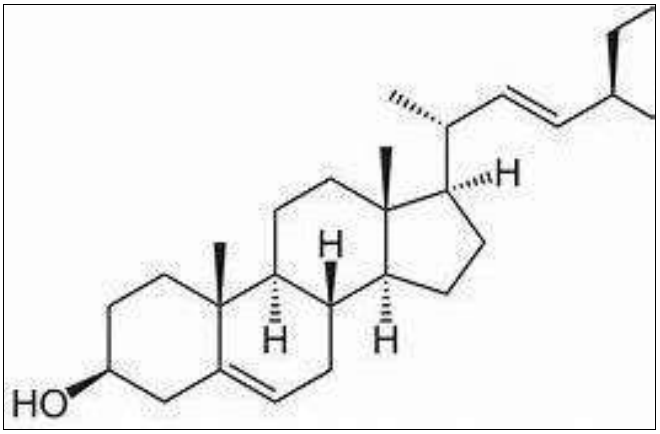


Mol. For: $C_x(H_2O)_y$
Mol.Wt: 213-277 kDa
Source: Sonneratia Alba
Biological activity: Antiviral, antimicrobial, antihyperglycemic agent, proliferation activity for fibroblasts.

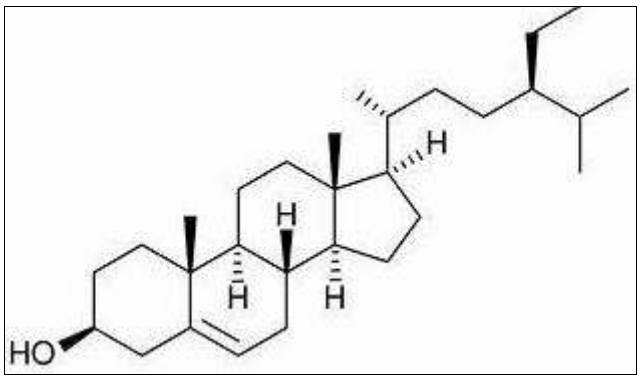
Quercetin [8]



Source: R.apiculata and A.ilicifolius and B.sexangula
Mol Foro: $C_{15}H_{10}O_7$
Mol.Wt: 302.328
IUPAC: 2-(3, 4-dihydroxyphenyl)-3,5,7-trihydroxychromen 4--one
Antifouling compounds in Ceriops tagal



Stigma sterol [13]
Synonym: Stigmasterin
Molecular formula: C29H48O
Molecular weight: 412.7
Biological activity: Antifouling activity
IUPAC:(3S,8S,9S,10R,13R,14S,17R)-17-[(E,2R,5S)-5-ethyl-6-methylhept-3-en-2-yl]-10,13-dimethyl-2,3,4,7,8,9,11,12,14,15,16,17-dodecahydro-1H-cyclopenta[a]phenanthrene-3-ol



β-sitosterol [13]
Synonym: Sitosterol
Molecular formula: C29H50O
Molecular weight: 414.7
Biological activity: Antifouling activity
IUPAC:(3S,8S,9S,10R,13R,14S,17R)-17-[(2R,5R)-5-ethyl-6-methylheptan-2-yl]-10,13-dimethyl-2,3,4,7,8,9,11,12,14,15,16,17-dodecahydro-1H-cyclopenta[a]phenanthrene-3-ol

Pharmacological activities of Mangrove Plants

Botanical Name	Parts of Plants	Pharmacological Activities
Avicenna marina	Fruits and leaves	Anticancer, Cytotoxic activity, Hepatoprotective, Antioxidant, Antifungal [1]
Ceriops decandra	Bark,fruit and leaves	Antiulcer, Antiseptic [14]
Sonnerata apetala	Leaves, barks, stem and fruits	Anthelmintic, Ant hepatitis, Anti-inflammatory [1]
Aegiceras majus	leaves, barks	Haematuria, antidiuretic [14]
Xylocarpus moluccensis	Barks, leaves and fruits	Elephantiasis, Scabies, Swelling of breast [1]
Aegialitis annulata	Bark, leaves and stem	Antiviral, anti-inflammatory, antidiuretic [14]

- Antibacterial activity of mature leaves, tender leaves and bark extracts of Avicennia officinalis and Bruguiera hexangular. Using agar diffusion technique the antibacterial activity was screened against pathogenic bacteria species of Staphylococcus so., Proteus so., Escherichia coli, shigella sp. and pseudomonas sp. A.marina, A. officinal is, and B. hexangular of twelve different plant extracts exhibited different degree of growth inhibition against tested bacterial strains [2].
- The antifungal activity measured by zone of inhibition against tested fungus in contrast to the negative control [15].
- Avicennia marina mangrove tree belonging to Acanthaceae family, considered as a very good example of mangrove have been widely used for antifungal properties [16].
- Mangrove plants, acanthus ilicifolius is useful in the inhibition of the inflammation, having Anti-inflammatory properties [17].
- Furthermore Acanthus Ebracteatus, Barleria Lupulina and Clinacanthus Nutans shows a significant Anti-inflammatory properties [18].

The extract from mangrove plants that can cure "BALDNESS"

Avicennia marin a substance contains the key chemical Avicequinon-C that is thought to reverse hair loss by interfering with enzymes which lead to elevated harmony levels that cause baldness [19] Researchers tested this on 50 people, male and female, who were balding, it was found to halt hair loss and promote growth in all participants [3].

"Hair loss and baldness" are causes for crisis and anxiety of confidence.

Chula's pharmaceutical science research team has just come up with a solution that can pattern baldness or cure androgenic alopecia and will bring back the joy to people live again. (20) It has many benefits that "First it stops the enzymes from producing hair loss hormones and second, it would also help produce the protein that stimulates hair growth ". (19) According to prof. Dr. Wanachai said that "In the plant, they imported synthetic drugs, both topical and oral, from abroad and only worked at 30'/, and 48'/, levels respectively and side effects were substantial. Therefore, extracts from the Mangrove trees, which are found in Thailand 's mangrove forests will not only help to reduce imports of these synthetic drugs but also can potentially be exported to other countries to create added market value for the country " [20].

Importance of mangrove plants

1. The complex mangrove roots systems filters phosphates, nitrates, and other pollutants from the water, and improving the water quality flowing from rivers and streams into the estuarine and ocean environment [21].
2. Play a significant role in coastal stabilization and promoting land accretion, fixation of mud banks, dissipation of winds, tidal and wave energy [22].
3. Mangrove protect shorelines from damaging storm and hurricane winds, floods, and waves. Mangroves also help prevent erosion by stabilizing sediments with their tangled root systems. They maintain water quality and clarity, filtering pollutants and trapping sediments originating from land [23].
4. Mangrove vegetation is more luxuriant in lower salinities and experimental evidence indicates that at high salinity, mangroves spend the increased energy to maintain water balance and ion concentration rather than for primary production and growth [24].
5. Mangroves are a natural coastal defense and they act as carbon sinks and provides livelihoods by encouraging ecotourism and they are rich in Biodiversity [25].

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