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Review Article

Therapeutic and Traditional Uses of Mangrove Plants

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ABSTRACT

Mangrove plants are specialized timbered plants growing in the swamps of tidal coastal areas and stream deltas of tropical and subtropical parts of the world. They have been utilized for medicinal and traditional purposes by the coastal folks over the years. A large number of mangrove plants grows natural and exploited especially, for use in indigenous pharmaceutical houses. Several mangroves genus produce expensive drugs which have high export potential. The utilization of plants and plant products as medicines could be traced as far back as the commencement of human civilization. Mangrove plants have been used in folklore medicines and extracts from mangrove species have prove inhibitory activity against human, animal and plant pathogens. Traditionally, the mangroves have been exploited for firewood and charcoal. Exploit has been found for mangroves in the manufacture of dwellings, furniture, boats and fishing gear, tannins for dyeing and leather production. The mangroves afford food and wide variety of traditional products and artefacts for the mangrove dwellers. The present review deals with the pharmacological activity, medicinal, traditional and produce bioactive compounds of mangrove medicinal plants.

Keywords: Mangroves, Medicinal, Pharmacological, Recourses, Traditional.

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Introduction

Historically, plants have provided a source of inspiration for novel drug compounds, as plant derived medicines have made large contributions to human health and well-being. Medicinal plants represent a rich source of antimicrobial agents³. Because of the side effects and the resistance that pathogenic microorganisms build against antibiotics, many scientists have recently paid attention to extracts and biologically active compounds isolated from plant species used in herbal medicine¹¹.

In developing countries, medicinal plants constitute a precious natural wealth and contribute a great contract to its health care programs. They play an important role in ensuring primary health care facilities and services to countryside people. They also serve as important healing agents as well as vital raw materials for the preparation of conventional and modern medicine¹⁶. They are biochemically unique in nature and considered as a source of novel natural products. Usually mangroves are rich in polyphenols and tannins⁹. Mangrove leaves contain phenols and flavonoids that serve as ultraviolet (UV) screen compounds. Substances in mangroves have long been used in folk medicines to treat diseases²⁴. Extracts of various parts of mangrove plants have significant activity against animal, human, and plant viruses including human immunodeficiency virus¹⁵. The comprehensive uses of

various mangrove plant species in human sufferings provide strong evidence of their healing power and demands further research⁸.

Mangrove plants contain specialized plant species that grow up at the edge between sea and land in subtropical and tropical regions of the world (Fig.1).Where they exist in high temperature, strong winds, extreme tides, high salinity and anaerobic soil¹⁶. Mangrove plant species are a typical from of common terrestrial plants in that they can tolerate high salt concentration and remain submerged in saline water⁴. The mangrove plants natural products, secondary metabolites produced by living organisms, present an alternative route to address the ever increasing need for new drugs, because of their low production costs, novelty and structural diversity. Plants and microbes have been viewed as the most promising sources of natural products¹. Mangroves are woody trees or shrubs and the salt marsh halophytes are herbs and sledges (Fig 2). The mangrove plants are distributed in 121 countries and Pichavaram mangrove forest is one of the coastal ecosystems of Tamil Nadu, India with rich vegetation. Mangroves are used in traditional and medicine for the treatment of many diseases¹². Mangrove forests are among one of the world's most productive tropical ecosystems and are highly potential. Because the ecosystem is always under stress which leads to the production of certain compounds for their survival¹⁸.

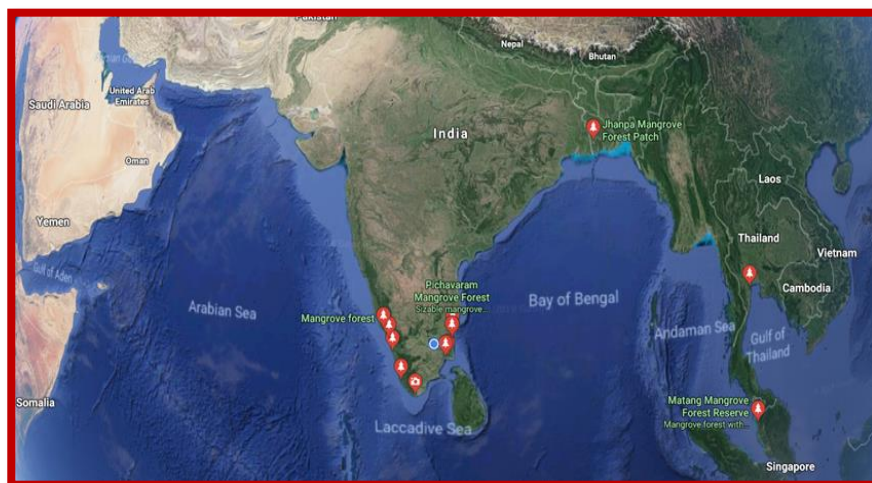


Fig.1: Map showing its satellite position in globe Asia- countries of mangrove forests.

Mangrove plants have been used in folklore medicines and extracts from mangrove species have proven inhibitory activity against human, animal and plant pathogens. Several species of mangrove produce bioactive compounds that may control microbial growth¹⁷. Secondary metabolites like alkaloids, phenolics, steroids and terpenoids have been characterized from extracts mangroves and have toxicological, pharmacological and of ecological importance. However, these studies are restricted to the mangroves of muddy region. Only few species like *Pemphisacidula* are growing only in coral sand substrates²¹. Traditionally, the mangroves have been exploited for firewood and charcoal and their uses include construction of dwellings, furniture, boats and fishing gear and production of tannins for dyeing and leather production. Mangroves provide food and a wide variety of traditional products and artefacts for mangrove dwellers. The mangrove leaves are useful contributors to the nutrient system of the mangrove environment. It is known that mangrove leaves contain amino acids, vitamins and minerals which helps in the growth and development of marine organisms¹⁹.

Bioactive compounds from mangroves

Mangroves are the richest source of phytochemicals, important chemical compounds present in mangroves are carbohydrates, alcohols, amino acids, different types of fatty acids, lipids, phenolic compounds, steroids, glycosides and triterpenes. Mangrove vegetation are an affluent source of steroids, saponins, flavonoids, alkaloids and tannins³. The additional newer components like gums, glues to alkaloids, saponins and other phytochemicals are also reported to present in mangroves. Products like amino acids, carbohydrates and proteins are primary metabolism and are essential for the maintenance of life processes, while others like alkaloids, phenolics, steroids, terpenoids, are substance of secondary metabolism and have toxicological, pharmacological and ecological importance. Several mangroves found in tropical and sub-tropical regions, their general chemical constituents, *in vitro* bioactivity are given in (Table 1).

Table 1: General Chemical composition of mangrove plants

Mangroves	General Chemical composition
<i>Acanthus ilicifolius</i>	Benzoxazoline, long chain alcohols, triterpenes, steroids, triterpenoidal saponins, alkaloid, acanthicifolin
<i>Aegiceras corniculatum</i>	Benzoquinones, carotenoids, tannins, coumarins, flavonoids, minerals; polyphenols, proteins, sugars, saponins, triterpenes
<i>Avicennia marina</i>	Terpenoids, steroids, naphthalene derivatives, flavones, glucosides
<i>Excoecaria agallocha</i>	Phorbol ester, flavanone, glycoside, lignin, pentosan, α -cellulose saponin, tannins, phenols, volatile oils
<i>Rhizophora apiculata</i>	Triterpenes, steroids, and a novel triterpenoid ester

Morphology of medicinally used mangrove plants



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)

Fig.2: (a) *Aegiceras corniculatum* Blanco. entire plant; (b) *A. corniculatum* fruit; (c) *A. corniculatum* flowers; (d) *Excoecaria agallocha* L. entire plant; (e) *E. agallocha* male flower; (f) *E. agallocha* male flower; (g) *E. agallocha* female fruit; (h) *Lumitzera recemosa* Willd. entire plant;

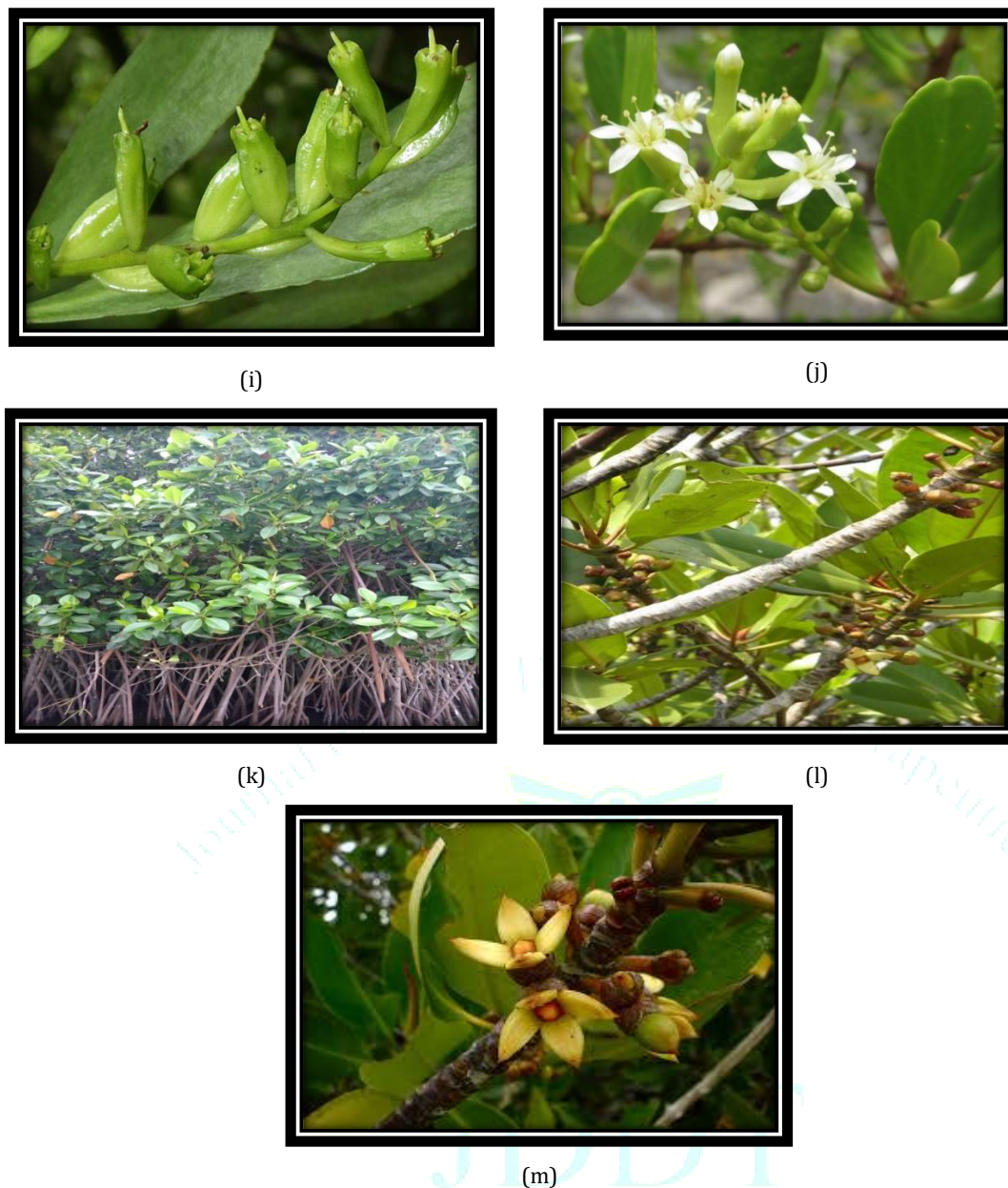


Fig.2: (i) *L. recemosa* fruit; (j) *L. recemosa* flower; (k) *Rhizophora apiculata* Blue. entire plant; (l) *R. apiculata* flowering stage; (m) *R. apiculata* flower.

Anti-diabetic Mangroves

Excoecaria agallocha

Traditionally it is used as uterotonic, in the treatment of epilepsy, conjunctivitis, dermatitis, hematuria, leprosy, toothache. Phytochemical screening shows the presence of phorbol ester, flavanone, glycoside, dichloromethane, lignin, pentosan, α cellulose saponin, tannins, phenols, volatile oils²⁷. Pharmacological investigation of the various extracts of the plant shows antibacterial, antioxidant, anti-diabetic, antibacterial, antinociceptive effects. It is also reported it has some impact on the treatment of mosquito borne diseases and pandemic diseases.

Rhizophora apiculata

Viviparous seeds are edible. Wood is a source of tannin and used as a substitute for petroleum coke. Tannin from bark is used as mosquito repellent. It is also used as astringent, for

the treatment of diarrhoea, nausea and vomiting, antiseptic, antihemorrhagic, cure for typhoid fever and also for the treatment of diabetics. The phytochemical screening shows the presence of triterpenes, steroids, and a novel triterpenoid ester.

Medicinal uses of mangroves

Acanthus ilicifolius are used in Ayurveda, the plant is known as Sahachara. According to Nadkarni the drug is astringent and makes a good nervine tonic, expectorant, and stimulant. The root is expectorant, and is used in coughs and asthma. The root, boiled in milk, is largely used in leucorrhoea and general debility. The Siamese and Indo-Chinese consider the roots to be cordial and attenuant, and useful in paralysis and asthma. The tender shoots and leaves are used in India for bite. In Goa, the leaves, which abound in mucilage, are used as an emollient fomentation in rheumatism and neuralgia (Table 2).

Table 2: Medicinal uses of mangroves and halophytes

Mangrove plant names	Medicinal uses
<i>Acanthus ilicifolius</i>	To treat paralysis, asthma, diuretic, dyspepsia, hepatitis, leprosy, rheumatic pains. analgesic, anti-inflammatory, leishmanicidal
<i>Aegiceras corniculatum</i>	Cure for asthma, diabetes, rheumatism, fish poison
<i>Avicennia marina</i>	Cure for skin diseases
<i>Avicennia officinalis</i>	Aphrodisiac, diuretic, hepatitis and leprosy.
<i>Bruguiera gymnorhiza</i>	Eye diseases
<i>Bruguiera parviflora</i>	Antitumor.
<i>Ceriops decandra</i>	Hepatitis and ulcers
<i>Lumnitzera racemosa</i>	Antifertility, asthma, diabetes and snake bite
<i>Rhizophora mangle</i>	Angina, boils and fungal infections, antiseptic, diarrhoea, dysentery, elephantiasis, fever, malaria, leprosy, minor bruises, plaster for fractured bones and tuberculosis.
<i>Rhizophora mucronata</i>	Elephantiasis, febrifuge, haematoma, hepatitis and ulcers.
<i>Salicornia brachiata</i>	Hepatitis
<i>Sesuvium portulacastrum</i>	Hepatitis
<i>Sueda maritima</i>	Hepatitis
<i>Sueda monoica</i>	Hepatitis

Antioxidant activity

Antioxidants are frequently originate in therapeutic plants, vegetables, and fruits. Antioxidants have been consider capable agents for the anticipation and treatment of reactive oxygen species correlated diseases such as cancer, cardiovascular disease, atherosclerosis, hypertension, ischemia/reperfusion injury, diabetes mellitus, neurodegenerative diseases, rheumatoid arthritis, and aging²³. Endophytic colonization of *Trichoderma* was initiate to be elevated in mangrove leaves of *Aegiceras corniculatum* than the other mangroves of Andaman and Nicobar Islands and was demonstrated to be with probable for antioxidant activity¹⁰.

Anticancer Activity

Phytochemical appraisal of the leaves concentrate of *Heritierafomes* announced the presence of saponins, diminishing sugars, alkaloids, glycosides, flavonoids, tannins, steroids, and gums¹⁴. What's more, proanthocyanidins (bioactive mixes, present in different restorative plants including *Heritierafomes*) supposedly have antiviral, antibacterial, protein hindering, cell reinforcement, and anticarcinogen properties²⁰. Numerous other mangrove species have been reported with anticancer potential. Antitumor activity of 3-chlorodeoxylapachol, a naphthoquinone obtain beginning *Avicennia germinans* has been demonstrated²⁵.

Traditional exploitation

In villages the entire encircling the world, folks are dependent on mangroves for timber and firewood, to build dwellings and lattice, furniture, studs for houses, rafters, joists, telegraph poles, fences, bridges, railway sleepers, poles for fish traps, paddles and rafts, canoes and boats^{26,5,6,13,7,22}. In Sri Lanka, straight stems of *Ceriops tagal*, *Rhizophora* and *Bruguiera* species are used to construct the frames of the thatched roofs and windowpane frames. The wattle of the mire walls of houses is prepared with timber from the exceeding species as well as *Sonneratia* and the timber since coconut trees is extensively used as rafters². In Malaysia the production of charcoal is now one of the most important forms of mangrove utilization. The best charcoal with highest caloric power, exceptional slow-burning properties and no smoke is that obtained from *Rhizophora* billets. For this reason, present day Pakistan, *Rhizophora*

wood is used to fuel the boilers of the locomotives. In Sri Lanka coconut shells are "combusted" in limited supply of air to produce an excellent charcoal and "activated" carbon which is used in various industries. It is still being used by the villagers to heat the "irons" to press clothes. In rural "cottage" industries, fuel wood or charcoal have viable and valuable economic uses, such as in drying coffee or curing fish. Large scale conversion of mangroves for wood chip production began in East Malaysia and Indonesia during the 1970s. In 1971 almost 50,000 ha were licensed in to produce wood chips, mainly for export to Japan. Malaysia halted the practice after 15 years, but mangrove woodchips are still a major export from Kalimantan accounting for the annual loss of thousands of hectares of mangroves²⁸.

Conclusion

Mangrove ecosystems present an exclusive and expensive assortment of resources, services and to confident extent products, but they have always been an undervalued resource. The pharmacological impending of the oceanic habitats of Indian coastline as well as mangrove forests still remains mostly un explored. Marine natural product bioprospecting has yield a amount of medicine in recent years. Endophytic microbes are also now being predictable as a new and defectively explored source of bioactive compounds. This review shows that many endophytes inhabiting the dissimilar mangrove forests of the world, essentially fungi, have proven themselves to be prosperous sources of recent bioactive metabolites. Traditionally the mangroves are used as firewood and charcoal and moreover used for manufacture of dwellings, furniture, boats and fishing gear and production of tannins for dyeing and leather production, solitary few species are used traditionally for therapeutic diseases. It is reported that various of the species originate in world has anti-diabetic activity, synthetic anti-diabetic agents had several disagreeable elevation effects therefore the screening and the development of newer and safer anti-diabetic representative commencing mangroves have immense scope in the natural products explore. These plants require instantaneous consideration for carrying out detailed chemical and pharmacological evaluations. Such investigations can lead to the finding of narrative bioactive compounds to facilitate determination assist to consider the efficiency of herbal remedies.

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