**World Journal of Pharmaceutical Sciences**
ISSN (Print): 2321-3310; ISSN (Online): 2321-3086
Published by Atom and Cell Publishers 
Available online at: http://www.wjpsonline.org/
**Review Article**

# Mangroves as a potential source of medicines

Ovees Ahmad Bhat and K. Sivakumar

Division of Algal Biotechnology, Department of Botany, Annamalai University, Annamalainagar-608002, Tamil Nadu, India

**Received: 21-06-2014 / Revised: 21-07-2014 / Accepted: 26-07-2014**

## ABSTRACT

Mangrove vegetation provides many ecological, environmental and socio-economic benefits. Mangroves give enough services to the humanity; people's ignorance and lack of care have caused degradation of mangroves. Mangrove forests have been utilized for many functions including wood production for timber, Firewood and charcoal. The importance in maintaining ecosystem diversity used as a source for chemical constituents, Extracts and chemicals from mangroves are used mainly in folkloric medicine, as insecticides and pisicides and these practices continue to this day. However the extraction of novel natural chemical compounds from mangroves, in addition to those already known to the pharmacopoeia of the people is in its infancy. People's participation is important for conservation and management of mangrove ecosystem. Protective measure of Eco - development, natural and artificial regeneration activities should be initiated in mangrove degraded areas.

Keywords: Mangroves, Conservation, Utilization, Medicinal value

## INTRODUCTION

The word mangrove has its origin from the Portuguese word "mange" or the Spanish word "mangle" which means trees or shrubs of the genus Rhizophora in association with English word for a stand of trees grove. They can be described as tropical tidal wet lands distributed generally between $20^0$N and $20^0$ S latitudes. Mangal and its associated abiotic factors constitute the mangrove ecosystem. Mangroves are salt-tolerant forest ecosystems found mainly in tropical and sub-tropical inter tidal regions of the world, they are associations of halophytic trees, shrubs or other plants that have common trait of growing in shallow and muddy salt water or brackish water, especially along quiet shorelines and in estuaries, typically they produce tangled masses of arching roots, they are exposed during low tides. Mangroves do not appear on sandy beaches and rocky shores. A muddy substratum of varying depth and consistency is necessary for their growth. mangrove forests are one of the most productive and biodiversity wetlands on earth and covers about 15.2 million hectares in 124 countries. The total area of mangroves in Indian Ocean region is 84,985km$^2$ equivalents to about 47% of the total area of the world mangroves (Kathiresan and Rajendran, 2005) yet; these unique coastal tropical forests are among the most threatened habitats in the world. The world has lost 35% of its mangrove forests over the last twenty years. The rate of loss of mangroves each year tops the loss of rainforest at 2.1%. At the current rate of destruction, all of the world's mangroves will disappear in 50 years. The mangrove wetland is a multiple use ecosystem that provides protective, productive and economic benefits to coastal communities.

The economic value of the mangrove wetland stems from:
i. availability of wood products ranging from timber, poles and posts to firewood
ii. Availability of non-wood produce such as fodder, honey, wax, tannin, dve and plant materials for thatching
iii. Availability of aquatic products such as fish, prawn, crab, mussel, clam and oyster

Apart from these, mangrove forests and associated wetlands provide a variety of amenities. Mangrove forests and associated wetlands together
i. act as a barrier against cyclones and prevent entry of saline water inland during storm surges
ii. Act as a buffer against floods and prevent coastal erosion

***Corresponding Author Address: Ovees Ahmad Bhat,** Department of Botany, Annamalai University, Annamalainagar 608002*
***Email;** drovees786@gmail.com, kshivam69@gmail.com*

iii. Provide nursery grounds for a number of commercially important fish, prawn, crabs and molluscs
iv. enhance the fishery production of nearby coastal waters by exporting nutrients and detritus
v. provide habitats for wildlife ranging from migratory birds to estuarine crocodiles

Because of such multiple uses, mangrove forests are considered sacred forests. A mangrove tree, viz. *Excoecan'a agallocha*, locally called Thaillai has been worshipped as a temple tree (thala riruksham) at the Lord Nataraja Temple at Chidambaram in Tamil Nadu. The images of the *Excoecaria agallocha* are seen carved in rock sculptures and being worshipped. These sculptures were made in the Nataraja Temple, probably in the 2nd century AD.

## AREA OF STUDY

**Pichavaram in Tamil Nadu:** Pichavaram is situated in the southeast coast of India in the Tamil Nadu State. It is located at about 225 km south of Chennai and 5 km north east of Chidambaram, Cuddalore district, Tamil Nadu, between latitude 11°20' to 11°30' north and longitudes 79°45' to 79°55' east. It is an estuarine mangrove situated at the confluence of Uppanar, a tributary of the Coleroon River. Fishing villages, croplands, and Aquaculture ponds surround the area. The Pichavaram mangrove wetland has 51 islets and the total area of the Vellar-Pichavaram-Coleroon estuarine complex is 2335.5 ha of which only 241 ha. is occupied by dense mangrove vegetation. Nearly 593 ha, of this wetland are occupied by helophytic vegetation like Suaeda, 262.5 ha. by barren mud flats and 1238.50 ha., by barren high saline soil. Of this, the mangrove wetland occupies only 1100 ha. Comprising the entire mangrove vegetation located in the middle portion of the Vellar-Pichavaram-Coleroon wetland which has been declared on 15th December 1987 as a reserved forest by the Department of Forest, Government of Tamil Nadu.Two major rivers viz. Vellar and Coleroon drain into the Bay of Bengal in this area. The area between the two rivers has brackish water with mangrove vegetation. The area is covered by alluvium in the western part and fluvial marine and beach sands in the eastern part. Tamil Nadu accounts 0.3% of total mangrove wetlands of the country. The major wetlands of Tamilnadu are located in the deltaic regions of the river Cauvery in Cuddalore and Nagapattinam districts. Bordered by Palk Strait in the east, a large patch of healthy mangrove occurs in Devipattinum area of Ramanathapuram district. In the Gulf of Mannar biosphere reserve islands, a few hundred hectares of mangroves are present. Down south, mangrove patches occur in the estuary of Tamiraparani River. According to the latest "Indian state of forest" published by forest survey of India (2011), the mangrove cover of Tamil nadu is estimated to be 39 sq.km.

**Global Mangroves**: Mangrove forests are distributed throughout the tropical and subtropical coasts of the world. They are particularly well developed in estuarine areas of the tropics, where they reach their greatest areal extent. The World's mangroves span over 30 countries with a total area of 99,300 sq. km. The largest mangrove `area occurs in Indonesia (30%), Brazil (10%), Australia (8%), India and Nigeria (7%, each). World-wide mangroves are disappearing at an alarming rate. In some developing countries about 80% of mangroves were lost in the last three decades. Mangroves occur in the coastal states and islands of India. The mangrove areas in India are generally categorized as deltaic, estuarine, backwater, sheltered and insular bay. As per 1987 data, the total mangrove area in India extended to 6740 sq.km. The largest extent of mangroves occur in West Bengal (Sundarbans) spread over 4200 sq.km, followed by Andaman and Nicobar Islands (1190 sq.km) (Source: MoEF, 1989). Small patches of mangroves are found in Gujarat, Maharashtra, Andhra Pradesh, Goa, Orissa, Tamil Nadu, Karnataka and Kerala. In Tamil Nadu, mangroves are well-developed in Pichavaram and Muthupet. The Pichavaram mangrove is a typical swamp, extending between Vellar and Coleroon estuaries. Along the Indian coastline about 45 species of mangroves have been reported. The most dominant genera to which they belong are *Rhizophora, Avicennia, Bruguiera, Sonneratia, Canocarpus, Heretiera, Xylocarpus, Ceriops and Excoecaria*.

## VEGETATIVE COVER AT PICHAVARAM

Six zones have been demarcated in Pichavaram; Avicennia marina is dominant in Zone-I; *Arthrocnemum indicum, Exoecaria agallocha, Salicornia brachiata, Sesuvium portulacastrum* and *Suaeda maritima* are sporadically distributed in the sandy region Zone II which includes the bank of three creeks lying parallel to the shore, the fringe of shoreward belt is occupied by *Salicornia brachiata* and the inward belt has *Avicennia apiculata, Rhizophora apiculata* and *R.stylosa*. The inner region is found to have mixed community of *Excocaria agallocha* and *Salicornia brachiata* and *Arthrocnemum indicum*. Luxuriant mangrove vegetation exists in zone III with maximum number of species. The channels fringes areas are bordered by *Rhizophora apiculata* and *R. muconata, Acanthus ilicifolins* and *Derris heterophylla* found in the zone IV and A continuous stretch of *Suaeda maritima* is observed in zone V. *Salicornia*

*brachiata* is dominant exists in zone VI near Coleroon estuary. But their distribution is restricted and they can be considered only as strand species. Among the 13 species of true mangroves Avicennia marina is the dominant species, constituting about 74% of the total population, followed by Rhizophora species (15%). Among the associated species, *Suaeda maritima* is the dominant species. The zonation or spatial distribution pattern of the mangrove flora indicates the microhabitat preference of different species in that particular mangrove wetland and thus this study is important with reference to the development of site-specific action plans for plantation activities. In the Pichavaram mangrove wetlands, the spatial distribution of the flora shows three different zones viz, the zone, the Avicennia zone and the Suaeda zone. The Rhizophora zone occurs as a narrow strip along the tidal creeks and channels and its breadth varies from 4 in to 10 m. It is interesting to note that out of the 13 mangrove species present in the Pichavaram

**THREAT TO MANGROVE ECOSYSTEM:**

The threats to the mangrove ecosystem could be broadly into two: Natural and Anthropogenic .These factors may affect the system as a whole or any one entity within the system, etc .the natural threats include: climatic changes, cyclones and physical processes. Diseases, deterioration, pollution, grazing, agriculture, aquaculture and human encroachment (including reclamation), etc., are considered as the anthropogenic threats to the ecosystem. Ten (10) species of mangroves representing 6 families and 4 species of salt marshes belonging to a single family have been reported from Pichavaram. According to IUCN categorization, out of 14 species, 10 are endangered, 3 are vulnerable *(E. agallocha, R. mucronata, A. indicum*) and 1 species (*S. brachiata*) is at lower risk of nearly threatened. The list of species in the order of relative dominance and the IUCN status is given below (Table 3).

**EXTINCT AND RARE SPECIES:**

*Kandelia candel* and *Bruguiera gymnorrhiza* reported from this mangrove in 19$^{th}$ century have become extinct. *Xylocarpus granatum* has also become extinct now .*Sonnertia apetala*, which was once abundant (carathini *et al*, 1973) and *Rhizophora lamarckii* (now *Rhizophora annamalayana* Kathiresan), a rare species, reported to be near extinction (Kannupandi and kanan, 1998)

**NEW SPECIES:**

*Rhizophora annamalayana*, a new species has been described as a hybrid between *R.apiculata* and *R. mucronata* (Katrisen 1995),previously this species was called as *R.lamarckii*, a hybrid between *R.stylosa* and *R.apiculata* (Muniyandi and Natarajan,1985) But *R.Stylosa* is not recorded in Pichavaram (Kathiresan,1995)

**BENEFITS OF MANGROVE ECOSYSTEM:**

Mangrove biodiversity and conservation has received significant importance in the recent past as research has increased the understanding the values, functions and attributes of mangrove ecosystems and the role they play in providing important ecological services and livelihoods for the mangrove associated communities. Mangrove forests are among one of the worlds productive tropical ecosystems. They are endowed with rich and diverse living resources that provide forestry and fishery products to a large human population .they sustain diverse flora and fauna species in large portion and provide many ecosystem services such as coastal protection from storm, reduction of shoreline and riverbank erosion, stabilizing sediments and absorption of pollutants. Presences of mangrove ecosystems on coastline save lives and property during natural hazards such as cyclones, storm surges and erosion, and provide food and shelter for a large number of commercially valuable fishes-and shell fishes. They are breeding, feeding and nursery grounds for many estuarine and marine organisms (Anonymous, 2006). However, the ecosystem has a very large unexplored potential for natural products useful for medicinal purposes and also for salt production, apiculture, fuel and fodder etc. Algae associated with mangroves have also high potential, besides the products agar, carrageenan, alginic acid and alginates, algae have numerous constituents which are attracting increased attention in pharmacy and other fields. Algal constituents include acids, alkaloids, and amines, antibacterial, antibiotic, antifungal and antiviral substances, cellulose, enzymes, Floridian starch, glycosides, inorganic substances, lipids, sterols, steroids, fatty acids, phenolic compounds, phytohormones, pigments, proteins, peptides, amino acids, sugar alcohols, vitamins, as well as volatile constituents and toxic substances. All of these constituents are used in pharmaceutical science.

**CONSERVATION**

People's participation is important for conservation and management of mangrove ecosystem. Ministry of environment and forests has set up a national committee on mangrove and prepared the management plan which includes (1) Afforestation (II). Regeneration of degraded mangroves areas. (III). Protective measures and (IV). Eco-development. natural and artificial regeneration activities should be initiated in mangrove degraded

areas. Natural regeneration involves the natural process of establishment of seeds of mangroves. Artificial regeneration involves planting of seeds or seedlings in areas where there is inadequate availability of planting materials. There is imperative need to formulate proper restoration practices for mangrove plantation in degraded coastal areas. For this, fast growing species such as *Avicennia* and *sonneratia* are preferable. To achieve successful mangrove plantation programmes, it is vital to develop nursery stocks for high quality species for their efficient performance in the field. mangroves are largely degraded in Tamil nadu and Andhra Pradesh due to high salinity of dry soil as a result of lack of regular tidal flushing. To overcome this situation canal-bank planting technique was suggested by MSSRF (MSSRF, 2002). In this technique, canals are formed so that high saline soil gets regular tidal inundation, leaches out salts and becomes suitable for regeneration of mangrove vegetation. this technique involves formation of the feeder canal, 3-m top, 1 m bottom and 1 m deep, and the distribution canals of 28x0.75x0.75m dimension in the mud flats and planting propagules directly in the inter-tidal zone of the canals. Along the banks of the canals, planting is made. Mangrove restoration activities involving fencing, removal of weeds, transportation of saplings, digging of channels, collection of propagules locally, planting, protection and maintenance. As Gujarat and west Bengal fall under the high tidal amplitude areas, it is suggested that the existing planting technique of direct seed sowing and planting seedlings in the mud flats should be continued. In a nutshell, wherever tidal amplitude is low, the preference for restoration should be the canal bank planting technique with fish bone design; and where ever tidal amplitude is high, the technology adopted should be seedling planting and direct seed sowing in the mud flats

## MANGROVE UTILIZATION

Mangrove forests have been utilized for many functions including wood production for lumber, Firewood and charcoal. However, it is now important that governments around the world adopt Rules to limit this utilization because of (a) the importance in maintaining ecosystem diversity and (b) the possible utilization for other purposes including as a source for chemical constituents With potential medicinal and agricultural value. In addition, certain mangrove plants can be used as fish poisons, animal food, food and drink for man, and for the production of methanol and Acetic acid.

## CONCLUSION

Mangrove forests occur in most tropical and subtropical regions of the world. They are degrading fast due to urbanization, Pollution and industrial development. Mangrove management should be an important component of the coastal zone management of the country. This group of plants that grows along the coastline is very important to the ecosystem diversity because they protect the coastline from destruction (maintain the ecosystem diversity) and provide many resources for utilization in the forestry, fisheries, food, agricultural and medicinal industries. for this community, industrial partnerships, coordinated projects and Regular monitoring is need to study the changes in mangrove cover.

## ACKNOWLEDGEMENT

The author expresses his deep sense of gratitude to Department of Botany Annamalai University for providing laboratory facilities to complete this investigation.

District wise mangrove area is under (area in $km^2$)

| S.No. | District | Very dense | Moderately dense | Open | total |
|---|---|---|---|---|---|
| 1 | Cuddalore | 0 | 0 | 7 | 7 |
| 2 | Nagapattinum | 0 | 9 | 10 | 19 |
| 3 | Ramanathapuram | 0 | 2 | 1 | 3 |
| 4 | Thanjavur | 0 | 5 | 3 | 8 |
| 5 | Thoothukudi | 0 | 0 | 2 | 2 |
| | Total | 0 | 16 | 23 | 39 |

An analysis of the mangrove wetlands from the remote sensing data of 1996 and their categorization into mangrove vegetation and the associated dry lands reveals the following distribution in Pichavaram and Muthupet (Selvam *et al*., 2002)

| Category | Pichavaram mangrove | | Muthupet mangrove | |
|---|---|---|---|---|
| | Area (ha) | % to total | Area (ha) | % to total |
| Healthy Mangrove | 399.42 | 27.1 | 1855.00 | 15.4 |
| Degraded Mangrove | 565.05 | 38.4 | 7178.00 | 59.7 |
| Water body | 308.37 | 21.0 | 1700.00 | 14.1 |
| Sand dune | 182.10 | 12.4 | | |
| Casuarina/prosopis and other vegetation | 16.39 | 1.1 | 375.00 | 3.2 |
| Salt pan | | - | 912 | 7.6 |
| Total | 1471.33 | 100.00 | 12020.00 | 100.00 |
| As per RF notification | 1358.00 | 3 RFs | 11818.00 | 6 RFs |

Direct benefits to the user communities by way of Non-timber Forest products like honey, harvest of firewood, small timber and other non-edible products from the mangrove wetlands of Pichavaram and Muthupet to the user communities are limited. However, they provide livelihood support to thousands of poor fisher folk living in the fishing hamlets.

Total mangrove area by regions (Spalding *et al,* 1997, world mangrove atlas)

| Region | Area | Global% |
|---|---|---|
| South and SE Asia | 75173 | 41.5 |
| Australia | 18789 | 10.4 |
| America | 49096 | 27.1 |
| West Africa | 27995 | 15.5 |
| East Africa and Middle east india | 10024 | 5.5 |

**Table 1 Indicates the utilization of several of the more than 30 species of mangrove Plants.**

| | |
|---|---|
| *Acanthus illicifolius and A. ebracteatus* | leaf juice used as hair preserver, fruit pulp as blood purifier, dressing for boils and snake bite, Leaf preparation used for rheumatism |
| *Aegiceras corniculatum and A. floridium* | bark and seed used as fish poison |
| *Ceriops tagal* | source of firewood and tannins, yields high quality dyes, bark stops hemorrhaging (source of anticoagulant) |
| *Derris trifoliata* | used to kill fish |
| *Excoecaria agallocha* | fish and arrowhead poison in Thailand skin it is known to cause blindness and eruptions in the Philippines it is used medication for toothache, in Malaysia bark extract is taken as a purgative |
| *Rhizophora species* | timber, fishing stakes, piles, firewood, charcoal, and tannins; |
| *R. mucronata* | Bark used to treat diarrhea, dysentery, and leprosy; fruit sap used as a mosquito repellent; wine is made from fruit and Honey from the nectar. |
| *Sonneratia caseolaris* | fruit is eatable, sap is used as a skin cosmetic, leaves are used for goat Food. |
| *Sonneratia ovate* | fruit is eatable and used to treat sprains fermented juice used as anticoagulant |
| *Xylocarpus species* | firewood, timber, and tannin; bark Extract is used to treat cholera. |

**Species composition and zonation**

The Pichavaram mangrove wetland is characterized by the presence of the 13 exclusive mangrove species listed in Table 2.2.

Table 2.2. Mangrove species present in the Pichavaram mangrove wetland

| Name of the species | Family |
|---|---|
| *Acanthus ilicifolius* L. | Acanthaceae |
| *Aegiceras corniculatum* (L.) Blanco | Myrsinaceae |
| *Avicennia marina* (Forsk.) Vierh. | Avicenniaceae |
| *Avicennia officinalis* L. | Avicenniaceae |
| *Bruguiera cylindrica* (L.) Blume | Rhizophoraceae |
| *Ceriops decandra* (Girff.) Ding Hou. | Rhizophoraceae |
| *Excoecaria agallocha* L. | Euphorbiaceae |
| *Lumnit.Zera racemosa* Wild | Combretaceae |
| *Rhizophora apiculata* Blume | Rhizophoraceae |
| *Rhizophora mucronata* Lam. | Rhizophoraceae |
| *Rhizophora lamarckii* | Rhizophoraceae |
| *Xylocarpus mekongensis* (Prain) Pierre | Meliaceae |
| *Sonneratia apetala* Buch-Ham | Meliaceae |

*Suaeda maritima, Suaeda monica* and *Salicornia bracbiata* are the important associated species of the mangrove wetlands. A number of terrestrial species are present in the sand dunes associated with the mangrove wetland

**Table -3**: **IUCN Species Status**

| Species | IUCN Status (Nationally) |
|---|---|
| *Avicennia marina* | Endangered |
| *Suaeda maritima* | Endangered |
| *Avicennia officinalis* | Endangered |
| *Suaeda monoica* | Endangered |
| *Rhizophora mucronata* | Vulnerable |
| *Rhizophora apiculata* | Endangered |
| *Excoecaria agallocha* | Vulnerable |
| *Bruguiera cylindrica* | Endangered |
| *Ceriops decandra* | Endangered |
| *Aegiceras corniculatum* | Endangered |
| *Acanthus ilicifolius* | Endangered |
| *Arthrocnemum indicum* | Vulnerable |
| *Lumnitzera racemosa* | Endangered |
| *Salicornia brachiata* | Lower risk-Near Threatened |

## REFERENCES


1. Kathiresan,K.and Rajendran, N. Biodiversity, ecosystem of the India Ocean Region. Indian J. Mar. Sci. 2005;34 (1): 104-113.
2. Caratini, C., F.Blasco and G.Thanikaimoni,. Relations between the pollen spectra and the vegetation of the south India mangroves. Pollen et spores 1973; 15:281-292.
3. Kanmupandi, T. and R. Kannan, . Hundred years of Pichavaram Mangrove forest.Seshaiyan 1998, 5(2):25-29.
4. Maniyandi, K. and R.Natarajan,. Incidence of seedling formation in *Rhizophora lamarkii* Montr. At Pichavaram mangrove, tamilnadu, India. J. Bombay Nat. His. Soc 1985; 82:441-442.
5. Kathiresan, K.,.Quo Vadis, mangroves. Seshaiyana, 1995; 3:25-28.
6. Anonymous. Conservation Benefits of mangroves .the world conservation union (IUCN) 2006 Srilanka
7. MSSRF The Mangrove: Decade and beyond –activities, lessons and challenges in mangrove construction and management 1990-2001,M.S. Swaminathan Research foundation,Chennai,India:41p.