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TAXONOMICAL AND MEDICINAL PROPERTIES AS WELL AS ADAPTATIONS OF *AVICENNIA MARINA* (GREY MANGROVE) AT MACHILIPATNAM SEACOAST, ANDHRA PRADESH, INDIA

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ABSTRACT

Mangroves are specialized ecosystems, known to tolerate high salinity, tidal extremes, and high fluctuations in wind, temperature and muddy anaerobic soil with the development of some adaptive morphological characteristics. Krishna vegetation is a fragile ecosystem changing rapidly due to natural calamities, deforestation, aquaculture, over-exploitation, absence of proper management, conservation etc. It is proved that mangroves with densely populated vegetation act as natural protectors to control the cyclonic winds and tsunami waves. Therefore, a detailed study of Krishna mangroves is very important in Gilakaladindi (Machilipatnam) and its nearby villages Pedapatnam, Polatitippa and Pallethummalapalem. As a part of this, in this review, *Avicennia marina* (grey mangrove) belongs to the family Verbenaceae, is studied for taxonomical and medicinal properties as well as adaptations). As with other mangroves, it occurs in the intertidal zones of estuarine areas. This species is used for food, fodder, fuel wood, construction materials and medicine in some areas within its range. Avicennia are generally considered pioneers of mangrove forests. They occupy a diversity of habitats within the tidal range and across salinity extremes of tropical and subtropical sheltered areas. In tropical regions, this often includes a select group of co-inhabitors, like Rhizophora.

KEYWORDS: Salinity, *Avicennia Marina,* Grey Mangrove, Taxonomical, Medicinal Properties.

INTRODUCTION

The word 'mangrove' is used for salt tolerant plants. Mangroves are specialized ecosystems, capable of living under the influence of salt water, along the estuarine sea coasts and river

mouths in the tropical and subtropical regions of the world, mainly in the intertidal zone. These plants are specialized to tolerate high salinity, tidal extremes, high fluctuations in wind, temperature and muddy anaerobic soil with the development of some adaptive morphological characteristics. No other groups of terrestrial plants survive well under such conditions. The research review was carried out to compare taxonomical and medicinal properties as well as adaptations of white, red and black mangroves in around Machilipatnam. The port at Gilakaladindi near Machilipatnam is going to be expanded and hence the study was carried out to identify the mangrove patches present in Gilakaladindi and its nearby villages Pedapatnam, Polatitippa and Pallethummalapalem.[2] Pedapatnam is a mid-sized village located at a distance of 23km from Machilipatnam, mandal head quarter in the district of Krishna. Gilakaladindi village is about 5km east to Machilipatnam. Polatitippa is a mid-sized village located nearly 14km away from Machilipatnam. Palletummalapalem is a mid- sized village located at a distance of 17km from Machilipatnam.

The mangrove vegetation of Machilipatnam sea coast has been broadly classified into three main categories. They, along with their composition of species and distribution pattern, are mentioned below. 1. The interior group of mangrove vegetation, which mainly consists of species of Avicenniaceae, Rhizophoraceae and Euphorbiaceae. 2. The mangrove vegetation of central area, which mainly consists of species of Sonneratiaceae, Combretaceae and Myrsinaceae. 3. Mangrove vegetation spread at peripheral or marginal areas, which consists of species of Acanthaceae, Verbenaceae, Chenopodiaceae, Fabeceae and Poaceae.[1]

Study area: Machilipatnam is between 16°10’N to 16.17°N latitudes and 81°09’E to 81.13°E longitudes on the southeast coast of India and in the east corner of Andhra Pradesh. Mangroves in this area lie between latitude 16° 0’ - 16° 15’N latitude and 81° 10’ - 81° 15’ E longitude. The northern distributary of Krishna river drains in this area near Hamsaladeevi. Machilipatnam sea coast is receiving a stream called Upputeru from Kolleru region at Pedapatnam. So, Pedapatnam is a riverine based mangrove region. The other field stations viz. Gilakaladindi, Polatitippa and Pallethummalapalem of the region are the mangrove areas receiving sea water by tidal effect. Hence these field stations gain significance in the study of mangroves.

Mangrove vegetation is a fragile ecosystem. Krishna mangroves are changing rapidly due to natural calamities, deforestation, aquaculture, over-exploitation, absence of proper management, conservation etc. Mangrove vegetation is a natural protector from natural

threats like cyclones, tsunamis etc. The cyclone in 1977 and the tsunami in 2004, which devastated Diviseema and Machilipatnam regions respectively, are examples of natural threats. It is proved that mangroves act as natural protectors to control the cyclonic winds and tsunami waves, with densely populated mangrove vegetation.[1] Therefore, a detailed study of Krishna mangroves is very important.

Avicennia marina (grey mangrove) belongs to the family Verbenaceae. A distinguishing feature of this *Avicennia marina* is the numerous spongy pencil-like pneumatophores (peg-like roots) that spread out from the base of the trunk. Pneumatophores originate from horizontal, underground lateral roots and grow vertically through the soil surface to enable the mangrove roots to breathe.

Taxonomical features of *Avicennia marina* (White mangrove)
Family: Acanthaceae (Avicenniaceae or Verbenaceae)
Avicennia marina (Forrsk.) Vierh. Synonym: *A. officinalis* L., *Sceura marina* Forssk., Local Name: Qurm, Gurm Arabic Name(s): Shorah, Qurm, Mangrove.
Common name: Mangrove, Grey mangrove, Tivar.

Description: Small evergreen tree, up to 10 m high, trunk to 40 cm in diameter, stem is erect with fine pale gray scales. Leaves are simple leathery, opposite, ovate, petiolate with entire margin and acute tip, dark glossy green on the upper surface, dull greyish on the lower surface with excreted salt crystals. Inflorescence (Fig 1) is cymose, in small terminal or axillary clusters on short stalks, flowers are bracteate, scented; calyx lobes 2-4 mm long, obtusish, fine fimbricate marginated; corolla dark yellow, exceeding the calyx with 4 unequal spreading lobes exceeding the tube. Fruit is 2-valved capsule, globose, pale green, 1.5-2.5cm long; Seeds 2-4 large. As Avicennia is growing in a specialized habitat, which is poorly aerated, it is adapted to life in this habitat by the presence of erect leafless outgrowths of the roots called pneumatophores or breathing roots up to 50 cm long, they stick out above water and absorb air, which thought to oxygenate the roots. Pneumatophores are numerous and upright of 10-15 cm high and 6 mm in diameter.

Fig. 1: Inflorescence of *Avicennia marina.*

Fig. 2: Fruit of *Avicennia marina.*

Traditional & Medicinal Uses: Bark is astringent and is used as aphrodisiac, for scabies, anti fertility agent and has tanning properties. Flowers are for perfumes. Leaves are aphrodisiac and used for toothache, Leaves and seeds forage for camels and animals. Wood was used as fuel and in traditional buildings. The plant is known for the quality of its honey and the charcoal has special uses.[2]

Edibility

In the Celebes, seeds, soaked in water overnight and boiled, used as famine food. In Celebes and Java, sometimes fruit is eaten by fishermen. Bitter fruits and seeds sometimes used as food eaten after baking or steaming.

Folkloric

Resin from the sapwood used locally for snake bites. Seeds boiled in water used as maturative poultices and cicatrizant of ulcers. Fruits plastered on boils and tumors. Used for leprosy and hepatitis. In Arabia, the roots are used as aphrodisiac, Unripe seeds used as poultice to hasten suppuration of boils and abscesses and in Chennai, used for small pox.

In Java, resin oozing from the bark used as contraceptive. Bark used as diuretic. In Indo-China, bark used for skin afflictions, especially scabies. In India, used for rheumatism, paralysis, asthma, snake-bites, skin disease and ulcers. Fruits are used as plaster for tumors. In Sundarban, India, warm juice extracted from the screen fruits of the Jat Baine tree used in the treatment of sores or blisters.

Chemical constituents: Contains betulic acid, taraxerol, taraxerone and hydrocarbon, sterols (β sitosterol & stigmasterol), triterpene alcohols, iridoid glycosides and high amount of carbohydrates, lipids and proteins.[3]

In vitro antimalarial activity and cytotoxicity of *A. marina* is reported. Biological activities detected in the plant crude extracts are related mainly to the presence of flavonoids and flavonoid glycosides in plant tissues; the latter have alreadybeen isolated from *A.marina*, and have preliminary anticancer activity. The presence of compounds such as flavonoids in plant tissues may be characteristic features of plant stress. The absence of toxic metabolites such as alkaloids and saponins from extracts of this plant may reflect its frequent usage as food for local people or feed for their animals.[5,6] India's mangrove plants have the potential in scavenging free radicals and can be a vital source of antioxidant phytochemicals. anti oxidant, tumor, microbial, inflammatory, allergic, ageing and artherosclerotic.[7]

Adaptations are required for physical stability, salt tolerance, anaerobic sediments and reproduction of mangroves. There are numerous spongy pencil-like pneumatophores (peg-like roots) that spread out from the base of the trunk. Pneumatophores originate from horizontal, underground lateral roots and grow vertically through the soil surface to enable the mangrove roots to breathe (Fig 3).

Fig. 3: Pneumatophores of *Avicennia marina.*

Physical Stability Adaptations

Root adaptations make it possible for mangroves to live in the soft sediments along the shoreline. Root adaptations increase stability of mangrove trees in the soft sediments along shore lines.

Salt Tolerance Adaptations

Mangroves are allowed to live for adaptations for salt exclusion or salt excretion where as other terrestrial plants cannot. Mangroves are able to live in harsh saline environments through physiological adaptations. The suitable soil salinity for white mangroves is over 90 ppt.

Salinities effectively limit competition from other plants, while mangroves have salt exclusion or salt excretion adaptations allowing survival in these environments. The ability to exclude salts occurs through filtration at the surface of the root.[4] Root membranes prevent salt from entering while allowing the water to pass through. This is effective at removing the majority of salt from seawater. On the other hand, salt excreters remove salt through glands located on each leaf. Black and white mangroves are both salt excreters.[8] White mangroves develop thickened succulent leaves, discarding salt as the leaves eventually drop.

Reproductive adaptations include vivipary and propagule dispersal that give mangroves an increased chance for survival. Similar to terrestrial plants, mangroves reproduce by flowering with pollination occurring via wind and insects. Once pollination occurs, the seeds remain attached to the parent tree. They germinate into propagules before dropping into the waters below. This ability is referred to as "viviparity". The propagules either take root in the sediments near the parent tree or are dispersed with the tides and currents to other shorelines.

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