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EXCOECARIA AGALLOCHA: PHYTOCHEMISTRY AND PHARMACOLOGICAL APPLICATIONS

Poonam M B Salve Institute of Science, Department of Biochemistry, Mumbai.

Dr Pratima S Jadhav* Institute of Science, Department of Biochemistry, Mumbai. *Corresponding Author

ABSTRACT *Excoecaria agallocha* a milky mangrove, blind your eye mangrove, or a river poison tree is widely distributed in Indian coastal regions. This article deals with the overview of *Excoecaria*, its phytochemical constituents pharmacological applications and its various medicinal uses. The extract of leaves and stems has different phytochemicals as polyphenols, terpenoids, flavonoids, alkaloids and volatile components. The ethanolic and methanolic extract of leaves isolate various compounds. There are antioxidant, antimicrobial, anti-inflammatory, analgesic, antiulcer, anticancer, antireverse transcriptase, antihistamine-release, antifilarial, DNA damage protective, antidiabetic, and antitumor protecting activities carried out on this plant. This review could help the researchers to undertake the further investigations in these directions.

KEYWORDS : Mangroves, phytochemicals, pharmacology.

Introduction:

Mangroves occur as tall forests through shrub lands in the intertidal zone along those parts of the coast subject to low wave energy[1]. Mangrove swamps form a type of coastal wetland founad in the tropics and subtropics. They act as a source of energy in coastal food chain and also protects against various natural calamities such as cyclone and tsunami[2]. Many drugs, dyes, and tannins are obtained from the mangroves. Within a mangrove forest, the most salt-tolerant species occur near the ocean. *Excoecaria agallocha*, known as a back mangrove, is found at higher elevations back away from the ocean where salinity is lower[3]. Common name of *Excoecaria agallocha*: Agallocha, blinding tree (General name); Thillai, Kampetti (in Tamil); Tilla, Tella and Chilla (in Telugu); Thelakiriya, Thalia (in Singhalese) It is widely distributed abundant in Pichavaram mangrove forest, Indian coastal regions, Australia from northern New South Wales, along the northern coastline around to Western Australia. According to Red list criteria it is a least concern position[4]. It is a much-branched tree up to 15 m tall. Its bark is greyish-brown, warty, with vertical fissures and lenticels. The shallow, surface-running roots are often knotted and covered with lenticels. The plant exudes white latex from any broken part. It is also deciduous, and usually sheds its leaves just before the onset of flowering. Its spirally arranged, stalked, simple leaves have papery and slightly fleshy leaf blades are usually oval to drop-shaped with shallowly toothed-margins, green above, light green below, 3.7–11 by 1.5–6 cm, and with 2–4 glands on each side of the base where the leaf blade joins the petiole (leaf stalk). It grows in muddy and sandy habitats, often in areas with a high input of freshwater or landward margins of mangrove forests. *E. agallocha* usually shed their leaves annually. Unlike most mangrove species, they do not have specialized aerial roots called pneumatophores that extend above the soil surface and supply the underground roots with oxygen[5].

This review article gives an overview of the mangrove plant *E. agallocha* L., highlighting its phytochemical constituents isolated, pharmacological studies and medicinal applications conducted on this plant.

Phytochemical constituents:

Excoecaria agallocha is a well-studied a mangrove plant, with reports on its chemical constituents[6]. Investigations on the presence of metabolites from the plant revealed the presence of diterpenoids[7], triterpenoids[8,9], flavonoids[10], glucosides[11] and polyphenols[12,13]. Secondary metabolites from plants are found to be effective in controlling many bacterial diseases[14,15]. Study of stems and twigs yielded six triterpenoids including taraxerone (1), beta-amyrin acetate (2), 3beta-[(2E,4E)-6-oxo-decadienoyloxy]-olean-12-ene (3), taraxerol (4), acetylaleuritolic acid (5), and cycloart-22-ene-3beta, 25-diol (6), and three steroids including beta-sitostenone (7), (24R)-24-ethylcholesta-4,22-dien-3-one (8), and beta-sitosterol(9)[16]. Novel Exoecarin D, E and F diterpenoid from Leaves of *E. agallocha*[17]. The concentrated fractions of the fresh leaves extracted with mixture of petroleum ether, diethyl ether and ethanol solvents analysed by GC-MS, howed the presence of dodecanediol, L-alanine-4-nitroanilide, benzene methanol, 1,1-diethoxyundecane, hexadecane, Metaraminol, 1,2-benzenediol, tetradecane, hexadecane, benzyl alcohol, benzenemethanol, 4-trifluoroacet benzyl alcohol, L-alanine -4-nitroanilide, alanine, 2,6-Octadiene-4, undecane, Pentanoic acid, hydroxybenzenepropanoic acid, diethyl methylphosphonate, acridine, trifluroacetic acid, triethyl (pentafluorophenyl)silane, Ngainone, N-1-Adanantyl-pmethylbenzalimine, pentachlorophenol, Isohumulone, Octadecanoic acid, decane, diethylphthalate, benzamide, pentanenitrile, diacetate, clivorine and 1,2,5-trimethylphyyole by comparing the spectral data with NBS and IDENT data base[18]. Alkaloids, carboxylic acid, Flavonoids, phenol, saponin, resins, steroids, tannin and sugars from seeds of *E. agallocha* exhibited anti-inflammatory and analgesic activity[19].

Pharmalogical uses:

E. agallocha encompass antioxidant activity as established by DPPH, NO and H2O2 scavenging assays[20]. The potent anti-HIV[21], anticancer[21,22], and antimicrobial[23,24] effects of the various extracts are also reported. Study showed EA was able to decrease the acidity and increase the mucosal defense in gastric areas, justifying its use as an antiulcerogenic agent[25]. Antibacterial activity against 12 microorganisms; the methanol extract showing more activity than the hexane and chloroform extracts. The leaves contain higher percentage of crude organic extracts with potential antibacterial and antifungal principle for chemotherapeutic application[26]. Hedgehog (Hh) signaling pathway inhibition has emerged as an anti-cancer strategy. Study yielded three flavonoid glycosides from *E. agallocha* A Hedgehog/GLI1-mediated transcriptional inhibitors and exhibited cytotoxicity against human pancreatic and prostate cancer cells[27]. Study of crude ethanolic extract of leaves in normal and alloxan-induced wistar albino mice showed significant hypoglycemic and anti-hyperglycemic activities[28]. Diterpenoids from stems and twigs showed 52.6% inhibition of IL-6 and other proinflammatory cytokines induced by lipopolysaccharide (LPS)[29]. Study evaluated an active fraction of stem ethanol extracts for anti-HIV and anticancer properties. Fraction showed significant anti-reverse transcriptase activity, as good as the standard synthetic inhibitor. Same fraction showed potent cytotoxicity against pancreatic cancer cell lines[30]. Apart from that, the review shows the promising potential of *E. agallocha* to develop a drug molecules for epidemic, pandemic and chronic diseases like diabetes mellitus.

Medicinal uses:

Traditional medical practitioners use various parts of this plant for treating/curing a vast variety of ailments like ulcers, leprosy, paralysis, *etc.* Sores and stings from marine animals can be cured with the sap from this plant. It could be used as purgative and emetic and also be used for curing rheumatism, dermatitis and conjunctivitis. The wound healing properties of the latex of *E. agallocha* were extensively studied using an animal model and in man. It revealed that the wound healing properties were comparable to the standard medicine, furacin ointment[31]. The timber is much used in some places for firewood and to

make small articles. It is tricky to cut down the tree as the spattering of the milky sap can blister bare skin and cause eye damage. Experienced wood cutters first remove the bark before felling the tree. The latex is used as a fish poison as well as in dart poison[32].

Various traditional medicinal uses are made of the bark, leaves and roots. According to Wee, the plant contains behenic acid. The Burmese used the leaves to treat epilepsy, in the Solomon Islands the latex is taken with coconut milk as a powerful purgative and an emetic, and oil distilled from the wood is used by the Malays to treat itching and skin infections. According to Giersen, it is not used as firewood as it produces an unpleasant smoke. But the wood is used to make matchsticks in the Philippines, also sold as aromatic wood, and is considered useful for carving. The roots are used to treat toothache and swellings.

Due to industrialization, the ground water and soil content are highly polluted by the heavy metals. A ursolic acid was also identified from *E. agallocha*[33]. In plant species, the zinc and copper metals played vital role in repiratory enzyme system activation phytohormones biosynthesis, photosynthetic process especially in photo system II and some protein, carbohydrates metabolities biosynthesis[34,35]. However those metals are required in minimal quantity for plant metabolism and biosynthesis process, but few mangrove species have the capacity to accumulate huge amount of heavy metals from the afftect areas. Recently, it was examined the bioaccumulation of zinc, copper and lead heavy metals in the various part of *E. agallocha* including leaf, stem and root[36]. As a result the root and stem part of *E. agallocha* showed significant level of dissolved heavy metals and it proved its bioindicator potential.

Conclusion:

Different parts of *E. agallocha L*., including the leaves, roots, woods, stems, bark, latex, and seeds have been reported to have therapeutic potential in treatment of various diseases. These include antioxidant, antimicrobial, anti-inflammatory, analgesic, antiulcer, anticancer, antireverse transcriptase, antihistamine-release, antifilarial, DNA damage protective, antidiabetic, and antitumor protecting activities. Various classes of phytochemicals such as flavonoids, limonoids, rotenoids, phenolic glycosides etc., have been isolated and characterized. These compounds and their derivatives might be useful in newer drug discovery process. This review highlights several pharmacological and phytochemical studies that have demonstrated the therapeutic potential and phytochemical constituents of *E. agallocha L*.

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