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Erythrina stricta Roxb: A Phytopharmacological Review

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Abstract
Plants have been the basis for medical treatments through much of human history and such traditional medicine is still widely practiced today. Plants are used to treat a wide range of disorders. *Erythrina stricta* belongs to Fabaceae family. It is a deciduous armed tree which is 15-20 m tall. It has been widely distributed in countries like India, Nepal, Burma, Thailand, Vietnam and China .The phytochemicals like carbohydrates, flavonoids, tannin, alkaloids and steroids have been reported. The pharmacological activities which are reported on *Erythrina stricta* are anti inflammatory activity, cardio protective activity, anti cataract activity, anti microbial activity, anti urolithic activity, *in vitro* xanthine oxidase inhibitory activity, anti plasmodial activity, anti mycobacterial activity and anti hyperuricemia activity. The present review is to have a bird's eye view which mainly summarizes on the traditional claims, phytochemistry and pharmacological activities reported on the various parts of the tree.

Keywords: *Erythrina stricta*, Fabaceae, Plant profile, Chemical constituents, Pharmacological activity

1. Introduction
Medicinal plants, since time immemorial, have been used virtually in all cultures as a source of medicine. The widespread use of herbal remedies and healthcare preparations are described in ancient texts such as Vedas.[1] Herbal therapies occupy a large section of alternative therapy.[2] Today, nearly 88% of the global population turns to plant derived medicines as their first line of defense for maintaining health and combating diseases. One hundred and nineteen secondary plant metabolites derived from plants are used globally as drugs.[3] Medicine, in several developing countries, using local traditions and beliefs, is still the mainstay of health care.[1] India is rich in a wide variety of medicinal plants and a large number of popular remedies many of which are in common use even today.[2]

Plant Profile
Plant information [4]
Biological name: Erythrina stricta Roxb
Family : Fabaceae/Papilonaceae
Synonym : Corallodendron strictum Kuntze
Micropteryx stricta Roxb

Taxonomy [5]
Kingdom : Plantae
Order : Fabales
Family : Fabaceae/Papilonaceae
Sub family : Faboideae
Tribe : Phaseoleae
Sub tribe : Erythrininae
Genus : Erythrina
Species : stricta

Vernacular name [6]
English : Indian coral tree
Malayalam : mullumurukku
Tamil : murukkai
Telugu : mullumoduga

Distribution : India, Nepal, Burma, Thailand, Vietnam, China

Parts used **:** Bark and flower

Plant Description [7, 8]

Habitat

It is a compactly armed, deciduous tree which is often planted. It is found in the plains and found up to an altitude of 1000m.

Morphology

The tree is 15-20 m tall, branchlets apically stellate, pubescent, basically glaberescent densely prickled.

Leaves: 10-30 cm long trifoliate leaflets, rhomboid-ovate, thin coriaceous, glaberescent, base deltoid or truncate, margin entire, apex sub acute petiole 10-13 cm, petiolate 0.6-1cm.

Racemes: 10cm long, peduncle 4-6cm, bracts ovate; bracteole-3mm, pedicels 3 in a cluster 8mm long.

Flowers: 5cm x 2 cm. Calyx: Spathaceous, 1.5cm, entire at the tip, split halfway down, erect, glaberescent. Corolla: deep red; standard oblong – lanceolate, 5x2cm; wing obovate, 5.5x3mm; keels – ovate 2x0.7cm. Staminal sheath 2.5 cm; anthers 2-3 mm, ovary 2cm, pubescent; style 1.5 cm, sub erect.

Fruit pod: Brownish 10 cm long; 3-4 seeded.

Ethno Medicinal Uses [9,6]

Bark- used in treatment of biliousness, rheumatism, asthma, leprosy, epilepsy, fever.
Flower - an antidote to poison.

Chemical Constituents [10-13]

Following are the various chemical constituents isolated from *Erythrina stricta*
Root: erythrabsysin II, erystagallin A, erythrabyssin I, 5-hydroxysophoranone, sandwicensin, sophoradiol, soyasapogenol, 8-oxoerythrinine, alkyl *trans* –ferulates and a mixture of *β*-sitosterol and stigmasterol.

Flower: 11-acetyl erysotrine, erythratidinone.
Bark: Hypaphorine, stigmasterol, *β*-sitosterol, erysodine, erysovine, hexacosanoic acid , octacosanoic acid, tetracosanoic acid, heptacosane, octadecane, tritriacontane, dotriacotanol, hexatriacotanol, heptatriacotanol, pentatriacotanol, octatriacotanol and alpinum isoflavone.

Pharmacological Activity

Following the ethno medicinal uses of the plant, it has been investigated scientifically in animal models validate the potential of the plant in cure of variety of ailments.

Anti inflammatory activity [14]

The anti inflammatory effect of the ethanolic extract of leaves of *Erythrina stricta* on albino rats was done using carrageenan induced paw oedema model, formalin induced paw oedema model and cotton pellet induced granuloma model. Study concluded that ethanolic extract of leaves of *Erythrina stricta* at a dose of 200mg/kg shows 78.79% and 86.8% inhibition of paw oedema in carrageenan induced paw oedema and formalin induced paw oedema respectively but less than the standard indomethacin which showed a 91.27% inhibition. In cotton pellet induced granuloma model, the ethanolic extract of leaves of *Erythrina stricta,* at a dose of 200mg/kg, showed a decreased formation of granuloma 60.05% but this was less than that of standard which showed a reduction of 65.6%. Thus these reports conclude that ethanolic extract of leaves of *Erythrina stricta* showed a significant reduction of inflammation in dose dependent manner but less when compared to standard.

Anti cataract activity[15]

The anti cataract activity of *Erythrina stricta* leaves against naphthalene induced cataractogenesis was studied in *Wistar* albino rats. The various fractions of the leaf extract like petroleum ether fraction, chloroform fraction, ethyl acetate fraction and residual fraction were administered orally (200 mg/kg) simultaneously with naphthalene (1 g/kg) for 28 days. At the end of the experiment, levels of malondialdehyde, lipid hydroperoxides, carbonyl and sulfhydryl content, enzymatic and non-enzymatic antioxidants in lens homogenate were measured. Administration of naphthalene produced a mature cataract and an increase in the opacity index. There was a significant increase in lipid peroxidation and a decrease in antioxidant enzymes when compared to normal control. Ophthalmoscopic observation indicated that simultaneous administration of the fractions delayed the onset and maturation of cataract. All the fractions (except the residual fraction) prevented the peroxidative damage caused by naphthalene. The leaves of *Erythrina stricta* protected the lens against naphthalene damage which may be due to its antioxidant activity.

Cardio protective activity [16]

The cardioprotective activity of *Erythrina stricta* leaves against isoproterenol induced myocardial infarction was studied. The *Erythrina stricta* leaves were extracted with ethanol. *Wistar* albino rats were pretreated with leaf extract (200 mg/kg) daily for 28 days. After treatment, isoproterenol (8.5 mg/kg body weight, orally) was injected to rats at an interval of 24 hours for two days to induce myocardial injury. Cardioprotection was investigated by estimating the activities of serum aminotransferase, lactate dehydrogenase and creatinine kinase. Antioxidant enzymes such as superoxide dismutase, catalase, glutathione peroxidase, and reduced glutathione and thiobarbituric acid reactive substances were determined. The activities of serum marker enzymes were increased in isoproterenol-induced rats. The animals treated with *Erythrina stricta* leaf extract showed a decrease in serum enzyme levels and increase of antioxidant status. Thus the study concludes that *Erythrina stricta* leaf extract has an ability to prevent myocardial infarction.

Anti microbial activity [17]

The crude *n*-hexane and ethyl acetate extract of the stem bark *Erythrina stricta* of were subjected to microbiological investigation and were found to be significantly inhibitory to microbial growth, with the average zone of inhibition 12–17 and 10–16 mm, respectively. In the cytotoxic observation, the *n*-hexane and ethyl acetate extracts were found to show LC_{50} of 2.1 and 0.316 mg/ml respectively.

Anti urolithic activity [18]

The anti-urolithiatic activity of aerial parts *Erythrina stricta* was evaluated by a calculi-producing diet model. Calcium oxalate nephrolithiasis was induced by injecting sodium oxalate (7 mg/100 g/day, i.p.) for 7 days. A significant increase in the serum ASAT, ALAT, ALP levels was observed in the control group receiving sodium oxalate. In

addition, animals of the control group showed a decrease in the level of serum enzymatic catalase and significant increase in the levels of thiobarbituric acid reactive substances (TBARS) in kidney homogenates. Oral administration of a 70% ethanol extract (500 mg/kg/day, b.w.) and ethyl acetate fraction (200 mg/kg/day, b.w.) along with sodium oxalate in treated groups, showed a significant dose dependent restoration of all altered serum and homogenate enzymatic parameters. Further, histological evaluation of kidneys showed that in treated groups there was a strong inhibition of growth of calculi within the tubule and reduced necrosis of tubular epithelial cell. The results indicate that the aerial parts of *Erythrina stricta* are endowed with anti-urolithiatic activity as evidenced by an inhibitory effect on crystal growth and the improvement of kidney function and architecture.

In vitro xanthine oxidase inhibition[19]

In the study the various fractions of hydro methanolic extract of the leaves of *Erythrina stricta* were evaluated for *in vitro* xanthine oxidase inhibitory activity spectrophotometrically by measuring the absorbance. This test was done under aerobic conditions and the degree of enzyme inhibition was determined by measuring the absorbance at a wavelength of 295 nm. Enzyme kinetics was carried out using Lineweaver-Burk plots using xanthine as the substrate. All the fractions were tested. Among all fractions tested chloroform fraction exhibited highest potency with an IC_{50} value of 21.2±1.6 µg/ml. The IC_{50} value of allopurinol which was used as the standard was 6.1±0.3µg/ml. The above results indicate that the use of *Erythrina stricta* for the treatment of gout could be credited to its xanthine oxidase inhibitory activity.

Anti plasmodial activity, antimycobacterial activity and cytotoxicity studies[10]

Erythrina stricta roots have isolated the following compounds from the hexane and dichloromethane extracts erythrabyssin II, erystagallin A, erythrabissin-1, 5-hydroxysophoranone, sandwicensin, sophoradiol, soyasapogenol, 8-oxoerythrinine, alkyl *trans* – ferulates and a mixture of *β*-sitosterol and stigmasterol. These isolated compounds were examined for anti plasmodial activity, antimycobacterial activity and cytotoxicity activity. The compounds which have antiplasmodial activity are erythrabyssin II which had an IC_{50} of 5.5, erystagallin A which had an IC_{50} of 3.8, 5-hydroxysophoranone which had an IC_{50} of 2.5, soyasapogenol which had an IC_{50} of 4.6. The compounds which had antimycobacterial activity were erythrabyssin II which had an IC_{50} of 50, erystagallin A which had an IC_{50} of 12.5, erythrabissin-1 which had an IC_{50} of 50, 5-hydroxysophoranone which had an IC_{50} of 12.5, sandwicensin which had an IC_{50} of 50, soyasapogenol which had an IC_{50} of 200. The cytotoxicity assay against oral human epidermal carcinoma (KB), human breast cancer (BC) and human small lung cancer (NCI-H187) were performed. The compounds which had activity were erythrabyssin II which was active against BC with an IC_{50} value of 13.9, erystagallin A which was active against KB, BC and NCI-H187 with IC_{50} values of 6.9, 4.2 and 4.1 respectively, erythrabissin-1 which was active against KB and BC with IC_{50} values of 11.1 and 13.7 respectively, 5-hydroxysophoranone which was active against KB, BC and NCI-H187 with IC_{50} values of 12.8, 14.2 and 5.0 respectively

Anti hyperuricemia[20]

In the study fractions of hydro methanolic of leaves of *Erythrina stricta* were evaluated for anti hyperuricemia using oxonate induced hyperuricemia model. They have concluded that the petroleum ether, chloroform and ethyl acetate fractions showed significant reduction in serum urate levels which though was less than that of allopurinol, was still comparable. They have suggested that phytochemicals such as tannins, flavonoids, alkaloids and terpenoids may be partly responsible for this activity.

Conclusion

This review gives some phytochemicals as well as the pharmacological information of E*rythrina stricta*. The main focus on the pharmacological potentials of *Erythrina stricta,* which is very helpful to researcher to add more about this plant. Apart from this still there are few options to investigate the unexplored potential of plant based on its uses. The active constituent needs to be isolate and should be considered for further in-vivo or in-vitro studies to confirm the traditional claims.

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