

OVERVIEW ON PLANT *LAGERSTROEMIA INDICA*

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Abstract: *Lagerstroemia* species belongs to the family of Lythraceae and generally used as medicine in Ayurvedic System of Indian Medicine. Being large in family it is distributed in areas of tropical and subtropical regions consisting of 32 genera and 600 species; *Lagerstroemia* comprises of more than 50 species which are either shrubs or trees with colourful flowers in an area of warm temperate regions ranging from South-Eastern Asia to Australia. Eighteen species of this genus are scattered in China and are well distributed. The plant of this family bears huge pharmacological activities which are used in treating various human disorders and ailments. The chemical constituents isolated from this plant are biologically active and are used in the treatment of diabetes, anti-inflammatory, anti-bacterial, anti-viral, antipyretic, analgesic, anti-hyperglycemic, antioxidants and many more. They also do possess xanthine oxidase inhibitors, antifungal, diuretic, anti-viral, decongestant, antineoplastic and osteoblastic activities in addition to the above ones. The components like phenolics, flavonoids, natural pigments obtained from these genus have been studied for its HPLC whereas compounds like ferullic acid, vanillic and cinnamic acids with p-hydroxy benzoic, p-aminobenzoic acid, p-coumaric and caffeic acids were identified for first time. The emphasis was much important to corosolic acid which showed better therapeutic effects with respect to antidiabetic activity. The effects of elements like sodium, iron, potassium, were clinically proven for its potentiality. Thus this review will be an insight to researchers on the chemical and pharmacological aspects of the plant species which can be explored to its best to develop a monograph or standards.

Keywords: *Lagerstroemia indica*, *Lagerstroemia speciosa*, Lythraceae, Chemical constituents

Introduction

Lythraceae is one of the biggest families in plant kingdom next to other families like Leguminosae and Compositae. It comprises of around 600 species with 32 sort which is situated in tropical and subtropical area. This family in its external appearance can be either bushes, trees and vivid blooms which is developed in south-eastern Asia and Australia grown better in warm climatic condition. ^[1] *Lagerstroemia* is one such types of this plant belonging to the family that is usually regularly known as crape myrtle. By and large, it is 20 m tall bearing flaky, smooth bark tree. Leaves are oval, deciduous, elliptic with 8-15 cm long in size and extensively 3-7cm in size containing pinnate intense in nature. The bloom containing 20-40 cm erect panicles in size with whitish to purple petals which are 2-3 cm long. ^[2] Different types of a similar family were *Lagerstroemia indica* L. (crape myrtle), and *Lagerstroemia speciosa* L. (Pers.) (Queen's crape myrtle, Pride of India). ^[3, 4] The traditionally use of this medicinal tree particularly leaf part have been used from thousands of years by Indians native as folkloric treatment for illness like lowering of blood sugar level and reduction in the weight loss. ^[5] The extracts of flower from this species shows biological properties like anti-microbial activities, antioxidant anti-nociceptive, cytotoxic activities and anti-diarrhoeal. Leaf extracts showed potent pharmacological activities like anti-bacterial, anti-inflammatory, anti-viral, anti-obesity, anti-diabetic, anti-fibrotic, xanthine oxidase inhibition, decongestant and diuretic activity. Roots have been used for treating mouth ulcers. ^[6] The plant containing stem bark is a febrifuge, stiptic and stimulant. The flower, barks, and leaves acting as a drastic purgative. ^[6] The root serves as an astringent, diuretic, detoxicant, were as the decoction of flowers are used in treating cold. Bark has been used to relieve the abdominal pains. The biological activities based on extraction with methanolic extract showed anti-inflammatory, analgesic, antipyretic, antioxidant, antihyperglycemic and hepatoprotective. ^{[7][8]} The different species of *Lagerstroemia* on the bases of studies have been reported the isolation and identification of condensed tannins, ellagitannins, triterpenoids, lignans, sterols, anthocyanins, labdane diterpenoids, fatty acids, alkaloids, sesquiterpenes and coumarins. ^{[9][10]} Earlier studies on different species of *Lagerstroemia* reported the isolation and identification of various phytoconstituents like ellagitannins, condensed tannins, triterpenoids and sterols. ^{[10][11]} Anthocyanins, lignans, labdane, diterpenoids, alkaloids, fatty acids, sesquiterpenes and coumarins. ^{[11][12]} Thus the principle goal is to have an insight about various therapeutic and biological activities of the plant for its highest potentiality and exploration of various phytoconstituents and activities associated with them.



Figure 1: Flowers of *Lagerstroemia indica*

Botanical description

Habitat : green cay wetlands,
 Plant type: Shrub or small tree
 Foliage : Oblong elliptic to rounded
 Roots: Aggressive and dense root
 Height: 10 to 30 feet
 Spread: 15 to 25 feet
 Growth rate: Medium
 Texture: Medium
 Crown uniformity: symmetrical canopy with a regular (or smooth) outline,
 Flower color: lavender, pink, purple, red, white
 Fruit shape: oval, round
 Soil tolerances: clay, loam, sand, acidic, alkaline, well-drained
 Trunk/bark/branches: thin bark

Chemical constituents

The constituents of *lagerstroemia indica* contains cardiac glycosides, alkaloids, saponins, triterpens, tannins, anthraquinones, phenolic glycosides and flavanoids. On the basis of mineral analysis it showed high contents of potassium, magnesium, calcium, sulphur, sodium and phosphorous. ^[13-14]

The phenolic derivatives isolated were neolignan, (2R,3S)-dihydrodehydroconiferyl alcohol, (2R,3S)-dihydrodehydroconiferyl alcohol, 7S,8R-dihydrodehydrodiconiferyl alcohol 4-O-β-D-glucopyranoside, hovetrichoside A, stroside A,B and C, 9,9'-dihydroxy-3,4-methoxylendioxy-3'-methoxy [7-O-4'-8-5'], pterospermin A, gochidioboside, 7S,8R-dihydrodehydrodiconiferyl alcohol 4-O-β-D-glucopyranoside, hovetrichoside A, carthamoside B5, hovetrichoside B, (1'S,2'R)-guaiacyl glycerol, D-threo-guaiacylglycerol 8-O-β-D-(6'-O-galloyl) glycol pyranoside, marphenol C, (+)-(7S,8S)-guaiacylglycerol 8-O-β-D- glucopyranoside, alatusol A and evofolin-B. ^{[14][16]}

The constituents containing triterpenes includes quadranoside, lagerindiside, 3b-acetoxyolean-12-en-28-acid, betulinic acid, hederagenin, oleanolic acid, arjunolic acid, 3b,23-dihydroxy-1-oxo-olean-12-en-28-oic acid and maslinic acid were obtained from the stems of *lagerstroemia* ^[17]. The category of pentacyclic triterpenoids includes 7-oxo-3 beta-hydroxy-5,20 lup20(29)-ene-1 beta,2 3 beta-triol, lagerflorin and 21-hydroxylupa-1,12-dien-3-one ^[18]

The useful ingredient Corosolic acid mainly found in medicine, cosmetics and health foods. It is a pentacyclic triterpene acid found in *Lagerstroemia speciosa* as chemical constituents that act as dietary supplements lowering glucose level and mimic the action as insulin. The structure are similar to 2-alpha-hydroxy attachment It also include ellagitannins and related compounds are also found in leaves and fruits. ^[19] The Leaves of this plant contain , new tannin-ale tannin , amyli liquor, lageracetal, ellagic corrosive, , beta sitosterol, and 3-O-methyl ellagic corrosive , 3, 3, 4-tri-O-methylellagic acid. Triterpinoids part explicitly maslinic corrosive consistently called as oleananes. Dry olive oil is the thing gotten from the extraction technique as the side-effect. ^[20]

Different metabolites of *lagerstroemia* has a place with the class contains 3- O- methyl ellagic acid , ellagic acids. ^{[21] [22]} Different constituents like 4- hydroxybenzoic acid, 3,3' di O methyl ellagic acid, 4 tri O methyl ellagic acid, caffeic acid , 3- O- methyl protocatechuric acid. The quercetin compound like isoquercetin, and other are ^{[23][24]} cyanidin 3-O glucoside, dimeric ellagitannins , virgatic corrosive, urosolic corrosive, β sitosterol glucoside , valoneic corrosive, dilactone, flosin A , reginin B,C,D. ^[25] L. indica oversaw demonstrates phytochemical evaluation of phenylquinolizidine alkaloids . The extraction of two alkaloids are 5-epi-dihydrolyfoline, biphenylquinolizidine and dihydrolyfoline, were evaluated. ^[26] The advancing examination of this plant with three new alkaloids containing N-Oxide withdrawn decamine N-oxide , lagerstroemine N-oxide , and lagerine N- ^[27] The inhibitory effects shows up on rat point of convergence aldose reductase (RLAR) which is the key protein for the polyol pathway. ^[28] In the Phytochemical assessment of ethanol and hexane separate the filtrates assessed with four example parts L. speciosa, L. indica, L. loudonii, and L. villosa that uncovered the higher measure of substance than other 13.5% squalene, 11.3% n-hexadecanoic corrosive, 11.2% linolenic corrosive, and 32.2% γ-sitosterol of L. indica. ^{[29][30]}

The two common items distinguished first time in the methanolic extract. ^{[31][32]} were brevifolin and decarboxy ellagic acid. The different polyphenolics group were Gallic acid, decarboxy ellagic acid, ^[33] p-methoxy gallic acid methyl ester, 3-O-methylgallate, Tellimagrandin, Nilocitin, 1,3-di-O-galloyl-4,6-hexahydroxydiphenyl- β -4C1-glucopyranose, 2,3 hexahydroxydiphenic acid α/β -glucoside, Vitexin, Isovitexin, Vitexin, Iso, Orientin, Astralagin, Rutin, Apigenin-7-O-4C1- β -D-glucoside, Catechin, Epicatechin, Luteolin-7-O-4C1- β -D-glucoside, 3-methoxyellagic acid, Ellagic acid, Apigenin, Kaempferol, Luteolin and Quercetin is the extraction item from the methanolic extraction.^[34]



Figure 2: Tree of *Lagerstroemia indica*

Pharmacological activity from the leaf extract

Analgesic Activity

The analgesic and anti-pyretic activity reported from the methanolic extract of *Lagerstroemia indica* in adult male albino rats exhibited analgesics and anti-pyretic activity using an electric current for the stimulation of noxious by using dipyrone metamizole as reference drug.

^[35]

Anti-diabetic and hypoglycemic activity

The water extract from the *Lagerstroemia speciosa* leaves showed hypoglycemic activity in rat through normal or streptozotocin (STZ) induced diabetic rat model. Result shows the significant reduction in the fasting blood glucose level. ^[36]

It has been reported that hot water extract from the leaves of *Lagerstroemia speciosa* showed significant hypoglycemic effect through chemically induced in diabetic rats. The activity followed by the mechanism of glucose oxidation through pentose phosphate pathway that shows suppression in the gluconeogenesis and shows prominent result in the hypoglycemic activity on the diabetic rat. ^[37]

Anti-oxidant Activity:

The methanolic extract from the leaves and bark of *Lagerstroemia* were evaluated for the anti-oxidant activity. The result from the extract showed the significant anti-oxidant activity. ^[38]

The screening of antioxidant activity from the extract of methanol from the *Lagerstroemia speciosa* dried leaves. The result observed showed the anti-oxidant activity from the dried seed of *lagerstroemia speciosa*. ^[39]

The anti-oxidant activity were evaluated from the methanolic extract of *Lagerstroemia speciosa* flower through DPPH scavenging model. The model shows the potential activity from the extract of *Lagerstroemia speciosa*. ^[40]

Anti-Alzheimer activity

The investigated of promising effect from 80% ethanolic extract of *L. indica* as an anti-Alzheimer's agent. The experiment was conducted in vivo using rats animal model by inducing AD using aluminium chloride ($AlCl_3$) which indicate disturbances in the level of neurotransmitter including norepinephrine, dopamine, acetylcholine esterase, and serotonin. The result shows elevation in oxidative stress protein carbonyl and an apoptotic markers caspase -3 showed neuro-modulating effect. ^[41]

Anti-inflammatory effects

The ethanolic extract from *Lagerstroemia indica* shows significant anti-inflammatory activity. The *Lagerstroemia indica* extracts inhibited increase in the mucus secretion of goblet cells, blocked the reactive oxygen species production in BAL fluid cells, and protein expression in BAL fluid of IL-5 was also blocked. In BAL fluid of ovalbumin-specific IgE concentration inhibited weakly by *lagerstroemia indica* and also acting as agent for allergic treatment. ^[42]

The leaf extract of *Lagerstroemia parviflora* were evaluated for anti-tussive activity in mice. The cough was induced through sulphur dioxide gas in which the result shows maximum inhibition for cough reflex at the minimum interval of 90 minutes.

Anti-microbial

The screening of anti-microbial activity were evaluated from the methanolic extract of *Lagerstroemia indica* leaves. The extract were tested for 124 extract of plant against pathogenic bacteria and yeast candid albicans that shows antimicrobial activity^[43]

Anti nociceptive Activity:

The chloroform extract from the bark of *Lagerstroemia speciosa*, were evaluated for anti-nociceptive activity through acetic acid-induced gastric pain model on swiss albino mice. The results shows potent activity^[44]

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