A REVIEW ON FAMILY LAMIACEAE WITH EMPHASIS ON SOME MEDICINALLY IMPORTANT PLANTS OF THE GENUS CLERODENDRUM

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KEYWORDS:
Lamiaceae, Clerodendrum, Phytochemistry, traditional use, pharmacological activity.

ABSTRACT

Clerodendrum is a genus consisting of flowering plants belonging to the family Lamiaceae. This genus is native to tropical and warm temperate regions. Some of the important plants belonging to this family are C. inerme, C. seratum, C. Infortunatum, C. indicum, and C. viscosum. Traditionally these plants have been used in various indigenous systems of medicines. These plants are a rich source of plant phyto constituents like terpenes, alkaloids, phenols, phenolic acids, tannins, steroids, flavonoids, which are useful as anti-oxidant, anthelmintic, antibacterial, hypolipidemic, hypoglycemic, anticancer, anti-oxidant etc. Aim of this review is to compile the exhaustive literature on the above mentioned plants from the Clerodendrum species and to create the awareness of these plants which have been reported to have potent activities which when exploited and appropriately used can be a boon to the mankind.
INTRODUCTION:
The genus *Clerodendrum* L. belonging to the family Lamiaceae is very widely distributed in tropical and subtropical regions of the world. It includes over 450 species. The plants belonging to Lamiaceae family are well known for constituents having important bio-active properties. These plants have been used in various indigenous systems of medicines, specifically in Chinese, Indian, Japanese, and Korean systems of medicine for the treatment of various diseases such as skin diseases, typhoid, cancer, jaundice and hypertension. The plant parts used for treatment included whole plant, leaves, root, stem, bark, flower, fruit, and seeds. Along with biological studies, isolation and characterization of chemical constituents and its correlation with the biological activities have also been reported. The major chemical components reported from the genus are phenolics, steroids, terpenes, flavonoids, volatile oils, etc. The family is closely related to the verbinaceae. The main difference between the two families is the ovary. Verbenaceae have an unlobed ovary and a terminal style while Lamiaceae have a deeply four-lobed ovary with gynobasic style. The name *Clerodendrum* is derived from the Greek kleros - chance or fate, and Dendron-meaning tree.

**Taxonomy**:
- Kingdom: Plantae
- (unranked): Angiosperms
- (unranked): Eudicots
- (unranked): Asterids
- Order: Lamiales
- Family: Lamiaceae
- Subfamily: Teucrioideae
- Genus: Clerodendrum
- Species: 1) *Clerodendrum inerme*
  2) *Clerodendrum seratum*
  3) *Clerodendrum infortunatum*
  4) *Clerodendrum indicum*
  5) *Clerodendrum viscosum*
Morphology:

*Clerodendrum inerme* is a shrub distributed in South and South-east Asia, Australia, and Pacific islands which are branched and colored bark pale brown. Leaves are simple, opposite, obovate, apex is rounded, glabrous, and with petioles. It has as axillary pedunculate inflorescence with 3 to 5 flowered cymes. The flower are small, bisexual, calyx five lobed. It has a funnel shaped corolla which is five lobed. The filaments are purplish red, the ovary is 4 celled, and the stigma is bifid. The fruit is a purple drupe.

*Clerodendrum serratum* is a perennial shrub which grows to a height of 2.4 m. Stem is not much branched, young parts are usually glabrous. Leaves are sessile measuring 12.5-15 by 5.7-6.3 cm, oblong or sub-elliptic shape with an acute base and acuminate tip. Petioles are 6 cm long. It consist of numerous flowers are pubescent dichotomous cymes with a pair of acute bracts. It has a pyramidal erect penicle which is 15-25 cm long; the pedicels are twisted to make the large lower corolla. It consists of bracts which are ovate or sometimes lanceolate. Fruit is drupe succulent and dark purple when ripened.

*Clerodendrum infortunatum* is a terrestrial shrub with blackish erect stem which grows to about 4 mts high, with no branches and produce circular leaves with 6 inch diameter, opposite, petiolate, exstipulate, hairy leaves with a characteristic disagreeable odor. The stem is hollow and the leaves are 6-8 inch long. The inflorescence is terminal, few-flowered cyme flowers are bluish-purple with pyramid shaped terminal panicles. Leaves are opposite oblong or elliptic, serrate, and the fruits are berries four lobed purple drupe, the seeds may be with or without endosperm.

*Clerodendrum indicum* is a semiwoody shrub, perennial; 6-9 ft tall slightly branched. The stem is hollow and the leaves are elliptic and 15-20 cm long, borne in whorls of four on very short petioles. It has a huge inflorescence which consists of many tubular white flowers in a terminal cluster up to 0.6 m long. The tubes of the flowers are about 10 cm long which droop downward, and the expanded corollas are about 5 cm across. The fruits are attractive dark metallic blue drupes.

*Clerodendrum viscosum* is a perennial woody shrub. It consists of 4-angled stem. Leaves are in whorls, sessile, and glabrous. Leaves usually three at a node, sometimes opposite oblong or elliptic, serrate. Flowers are purple with white pyramid shaped terminal panicles. Fruits are 4 lobed purple drupe, somewhat succulent.
1. Clerodendrum inerme  
2. Clerodendrum serratum  
3. Clerodendrum infortunatum  

4. Clerodendrum indicum  
5. Clerodendrum viscosum

**Phytochemistry:**

Several phytoconstituents have been reported from the different parts of *Clerodendrum inerme* β-sitosterol, stigmasta-5,22,25-trien-3-β-ol, B-friedoolean-5-ene-3-β-ol, 5-hydroxy-6,7,4′-trimethoxyflavone and betulinic acid have been isolate from the aerial parts. The leaves have been reported to contain triterpenicglucoside, lup-1, 5, 20(29)-trien-3-O-β-D-glucopyranoside, n-octacosane, friedelin and β-amyrin. The plant also contains 3-Iridoid Glycosides Ethylcholesta-5-9 [11], 22E-trien-3β-ol, Sterols, Inerminoside, InerminosideA, Inerminoside-C, Inerminoside-D, and Sammangaosides A and B, verbascoside, isoverbascoside, Neolignans (I-III), 3-epicaryoptin, neolignan11, (3-methoxy-4-hydroxyl phenyl) ethyl-O-2”, 3”-diacetyl-α-rhanopyranosyl-(1-3)-4-O-(E)-fernloyl-β-D, glucopyranoside, cynaroside, luteolin, acacetin, cosmosin, Apigenin, salvigenin, 5-hydroxy--7-dimethoxy-6-flavone, cleroinermin, 4-methylscutellarein and pectolinarigenin Megastigmane. It also contains sugars like, galactose, sucrose and protiens like lysine, arginine, serine, proline, threonine and glutamic acid 11-20. *Clerodendrum Serratum* has been reported to contain oleanolic acid, serratogenic acid, queretarolic acid, ferulic acid, clerodermic acid, betulinic acid, γ-sitosterol, β-sitosterol.
Stigmasterol, α-spinosterol, Clerosterol, cholestanol, campesterol and 24-ethyl cholesterol, Clerodone, Lupeol, Catchin, Luteoline, clerodin, Ethycholesta-5, 24 25-trine 3β-o hispidulin and 7-o-gluconoids of hispidulin, C ruteuarein, cleroflavone, apigenin, 7-hydroxy flavanone, scutellarein and pectolinarigenin have also been isolated from this plant. The other constituents reported are acteoside, indolizinoverbascoside, betulin, friedelin and monomelittoside.

*Clerodendrum infortunatum* leaves were reported to contain clerodin, fixed oil consisting of Glycerides of oleic, lenoleic, lignoceric and stearic acid. Lupeol β-sitosterol, Clerosterol which has been identified as 5, 25-sigmatadien_3β-ol, clerodolone as lup_20(30)-en-3β-diol-12-one and clerodone identified as 3β-hydroxylupan-12-one, 2, -(3, 4-dehydroxyphenyl) ethanol 1-O-α-2, rhamnopyranosyl-(1→3)-β-D-(4-O-caffeoyl)glycopyranoside (acteoside) and 24α- and 24β-epimers of 24-ethylcholesta-5,22-dien-3β-ol. Benzoic acid, cabsurin, and quercetin have been reported from the aerial parts of the plant. Lupeol Apigenin, acacetin and methyl esters of acacetin-7-O-glucuronide, cabruvin, scutellarein, scutellarein-7-O-β-D-glucuronide, Hispidulin Acetoside, fumaric acid, methyl and ethyl esters of caffeic acid, Clerodolone, Clerodol, Clerodin are the other constituents isolated and reported from this plant. It has also been reported to contain carbohydrates like Raffinose, lactose, maltose, sucrose, glucose, and fructose.

*Clerodendrum indicum* has been reported to contain Cleroidicin A, Hispidulin, scutellarein, scutellarein-7-O-β-D-glucuronide 3, 4-dihydroxyphenylethanol, hispidulin 7-O-glucuronide, roseoside, scutellarein, eupafolin, clerodendrol, lariсiresino, l 9-O-beta-D-glucoside, Clerodendrone, cleroidicins, 17-hydroxyteuvincenone G and 17-hydroxyteuvincen-5(6)-ene G. The phytoconstituents reported from *Clerodendrum viscosum* are Viscose Squalene, monoterpenes, p-cymene, α-pinene, β-pinene, limonene, myrcene and sesquiterpenes flavonoids Viscosene. Literature review also revealed the presence of N, N-carbonylbis-, 4-Pyranone, 2,3-dihydro-, alpha-D-Galactofuranoside, methyl 2,3,5,6-tetra-O-methyl-, N, N-Dimethylglycine, 2,3-dihydro-, 5-Hydroxymethylfurfural, 2(1H)Pyrimidinone, 1-methyl-, 2,4-Dihydroxy-5,6-dimethylpyrimidine, 1,3-Methylened-arabitol, Glycerin, Xylitol, 3-Deoxy-d-mannoic lactone Hexadecanoic acid, Phenol, 4,4’-(1-methyl ethylidene) and Orcinol.

**Traditional uses:**

The genus *Clerodendrum* has been used traditionally for treatment of various diseases and disorders; some of them include Night blindness, pneumonia, rheumatoid arthritis, pain, inflammation, rheumatism, respiratory disorders, malaria, asthma, bronchitis, cholera, snakebite,
tuberculosis, wounds, hepatoprotective and antimicrobial activities. It has also been used for venereal infections, elephantiasis, as a vermifuge, febrifuge, sedative, in the treatment of cancer, diabetes, excessive menstrual bleeding, Gastrointestinal problems, diabetes, as aphrodisiac, helminthiasis, insect repellent, spinal pain, diabetes, stimulation of appetite, gonorrhea, low semen count, leucorrhea etc.

**Pharmacological activities**

*Clerodendrum Inerme* has been investigated and reported for various activities like hepatoprotective Activity, anti-bacterial, Antinematidalcidal effects, anti-oxidant, anti-viral , antinociceptive ,insecticidal ,anti-cancer, Anti-hemolytic, anti-fungal and Antihypertensive Activity. *Clerodendrum Serratum* has been reported to possess activities like anti-allergic ,protective ,anti-infertility, Antioxidant, wound healing ,hepatoprotective , antiinociceptive, anti-inflammatory and antipyretic , Anti-cancer, asthma , anti-histaminic, Bronchodilator activity, vasorelaxant and wound healing activity. The pharmacological activites reported from the plant *Clerodendrum infortunatum* are Anthelmintic, Hepatoprotective, Antimicrobial, Analgesic and anticonvulsant, Wound healing, anti-oxidant, anticancer, anti-diabetic, antinociceptive, anti-inflammatory ,insecticidal ,anti-malarial. *Clerodendrumindicum* is been reported for its anti nociceptive, anthelmintic, antidiarrheal, antibacterial. The activities reported from *Clerodendrum viscosum* are Antioxidant , Antinociceptive, analgesic ,anti-inflammatory, central nervous system depressant activity, anti-bacterial Diuretic, anthelmintic, anti-cancerous, antifungal, anti-hemolytic.

**CONCLUSION:**

This review of literature highlights the importance of some plants of genus *Clerodendrum* belonging to the family lamiaceae. It reports the Phytochemistry, pharmacological activities and traditional uses of five plants i.e. *C. inerme, C. seratum, C. Infortunatum, C. indicum, and C. viscosum*. Several reports referring to their use in diseases like cancer, diabetes, as analgesics, anthelmintic, anti-oxidant, diuretic etc, are published which justifies their use in the traditional medicine. The most common constituents found in this species were Clerodolone, Clerodone, Clerodol Clerosterol along with some proteins and carbohydrates. An initiative is necessary to systematically evaluate these plants for unexplored activities and phytoconstituents so that they can be commercially exploited.
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