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Medicinal Plants of Acanthaceae family

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Justicia

Albata

Medicinal Plants of Acanthaceae Family



Acanthaceae are among the most taxonomically diverse, geographically widespread, and morphologically and ecologically variable lineages of flowering plants. Most modern workers have estimated more than 4000 species and potentially more than 5000 species worldwide, thus placing Acanthaceae among the 12 or so most diverse families of angiosperms.

- This diversity is marked by exceptional morphological variation, particularly with respect to floral forms, growth forms, and pollen types. The present work represents a synthesis of knowledge generated over the past two decades on the taxonomy and systematics of this complex plant family
- Acanthaceae family is derived from the Scrophulariaceae or stocks ancestral to them. Hutchinson considered it as the most advanced family of his Personales.
- The family includes large number of ornamentals and has high therapeutic applications mainly due to alkaloids present in the leaves. Taxonomic Considerations (Phylogeny): Acanthaceae is divided into two subfamilies depending upon the presence or absence of jaculators, i.e. the curved retinacula which support the seeds. *Justicia adhatoda* (L.) Nees (family Acanthaceae) is a shrub widespread throughout the tropical regions of Southeast Asia. This plant has great medicinal value.



Verbena molle



Amegonia

INTRODUCTION :-

The Acanthaceae consist of terrestrial or aquatic herbs, shrubs or rarely trees. The leaves are opposite (usually) and simple. The inflorescence is a cyme, raceme, or of solitary flowers. The flowers are bisexual, zygomorphic, bracteates and bracteolate (the bracts often coloured), and hypogynous.

- Acanthaceae, one of 24 families in the mint order (lamiales) of flowering plants, containing approximately 220 genera and nearly 4,000 species distributed predominantly in tropical and subtropical regions of the world.
 - The greater part of the Acanthaceae family are herbs or shrubs, but vines and trees occurs as well. The range of habitats extends from marshes and estuaries to extremely dry situations, but most of these plants are found in damp tropical forests.
 - A diverse family, Acanthaceae has few universal characteristics among its members. Most have simple leaves arranged in opposite pairs, with cystoliths (enlarged cells containing crystals of calcium carbonate) in streaks or protuberances in the vegetative plants.
 - The group is mainly of horticultural interest and includes such or namentals as *beer's-breech*.
(Acanthus mollis), clockvine (*Thunbergia*), shrimp plants (*Justicia brandegeana*), and caricature plant [*Groptophyllum pictum*].
 - The largest genera include *Justicia* (600 species, now comprising former segregate genera such as *Jacobinia* and *Beloperone*), *Reullia* (355), *Strobilanthes* (350), *Barleria* (300), *Aphelandra* (170), *Staurogyne* (140), *Dicliptera* (150), *Blepharis* (130), *Lepidagathis* (100), *Hygrophila* (100), *Thunbergia* (90) and *Dyschoriste* (80).
- The Small genus *Avicenia* contains at least eight species of ecologically important mangroves....



Strobilanthes kuthiana (Nees)



Bonania puberula

- Conversely, the family is noticeably absent or species-poor in several regions at seemingly suitable latitudes including Australia, Mediterranean climate zones worldwide. These patterns may in part be driven by nutrient-poor edaphic conditions and/or climatic conditions of these regions (e.g., winter rainfall, summer aridity).

As is frequently observed in tropical ecosystems characterized by high alpha diversity, populations of species of Acanthaceae tend to be small, with many consisting of one to several (often fewer than 20) plants. However, exceptions exist: notable areas where species of Acanthaceae comprise some of if not the most abundant and ecologically dominant plants across the landscape include the Namib Desert and surrounding drylands of Namibia and portions of northeastern tropical Africa such as the Acacia-Commiphora woodlands of southern Ethiopia and northern Kenya, and monodominant stands of the Indian species *Strobilanthes kunthiana* (Nees) and *Barleria* :

General Information about the family Acanthaceae & its worldwide distribution:-

- **Taxonomy:-**
Lamiales an order of ~ 23,000 species includes Acanthaceae family which has around 4,000 species in some 230 genera. Fossils of Acanthaceae are substantially older than the lower creatacous estimate for Angiosperms..

- **Taxonomic Considerations:-**
The family Acanthaceae is divided into two subfamilies. Depending upon the presence or absence of jaculators. The curved retinacula which support the seeds.

Subfamily – *Thunbergioideae* – seeds without jaculators.
Subfamily - *Acanthoideae* - seeds with jaculators.

• **Systematic position of Acanthaceae family:-**

[According to Benham & Hooker(1862-1883)]

Kingdom :- Plantae
Division :- Spermatophyta
Sub-Div :- Angiosperms
Class :- Dicotyledonae
Sub-Class :- Gramopetalae
Series :- Bicarpelatae
Order :- Personales
Family :- Acanthaceae
Genus

:- Adathoda (Shrubs),

Thunbergia (lianas/Climbers),

Cardentha (Aquatic herbs), Barleria (Spiny) etc...

🌿 **FAMILY ACANTHACEAE**

Family Acanthaceae is a large family. Comprising, according to 4,300 species in 346 genera. Acanthaceae is a large cosmopolitan family distributed mostly in the tropical & subtropical areas of the world. They are found in the equinoctial regions of both the Old and New world, with a few species extending north into the south of Europe, Pennsylvania and Japan and South words to the Cape of Good Hope and the southern coast of NewHolland. The plants of Acanthaceae are centered on Indo- Malaysia, Asia, Africa, Brazil and and central America . In New Zealand region members. of Acanthaceae entirely absent.

- They are common in plants and also at considerable elevations in the mountains of central, south, north, east and west India. They are found in moist and shady habitats in waste lands in the forest, among the grassy localities.

Psoralea hypoleuca



Polyphorbia edulis



- "Many of the genera of the family ascend the mountains, at as great an elevations as between 7,000 and 8,000 feet, in 30°N latitude In Rajasthan this family is represented by 30 genera and 81 species (1993).
- Members of the Acanthaceae are distributed throughout Rajasthan in arid, semi-arid, rocky region as well as burical and marshy places.
- All the genera of the family are shrub, undershrub and annual or perennial herbs, including only one perennial climbing herbs. *Thunbergia leavis* Nees.

• Characters of Acanthaceae :-

• Habits:-

- plants of this family or represented by herbs, shrubs, climbers or [ianas – In *Thunbergia* family].

- Rarely aquatic or spiny plants (*Xerophytic – Barleria, Blepharis, Acanthus*)
- 250 Genera and about 2500 species.
- An upright (i.e erect) and long lived (i.e perennial) herbaecous plant with several stems growing up to 1m tall (*Ruellia*).
- Species of *Avicennia* display adaptations saline environments, such as the presence of pneumatophores.

- Other unusual growth forms include that of African *Dischistocalyx*, which is reported to initiate developmentally as a terrestrial herb before producing climbing shoots that anchor to tree trunks or on boulders and then produce epiphytic or lithophytic flowering shoots.

• Habitats :-

- Most are tropical plants . Only a few species are distributed in temperate .

- The four main centres of distribution are Indonesia , Malaysia , Africa , Brazil and Central America .
- It can be found in variety of habitats , including forests , seru blands , wet fields and valleys , see coast and marine areas , swamps and mangrove forests .

Vegetative Characters:-

- Root :- The Representatives of this family mostly have branched top root system.

(*) Stem :- Arial, erect, underground (*Ruellia tuberosa*), herbaceous or woody, branched, cylindrical, node swollen, climbing or twinning (*Thunbergia*), spinous (*Barleria*).

(*) Harbeceous above, woody below, branched, branches Swellon at the nodes, erect, solid, green (*Adhatoda vasika*).

- Leaves :-

- Simple, opposite, ex-tipulate, petiole small, uncostate reticulate, entire, ovate green herbaceous.
- Usually entire or sometime pinnately lobed, opposite decussated leaves white entire [toothed, lobed, spiny, margins] acute, apex, hairy, cystoliths are present in the epidermal cells of stem and leaves.
- The Occurrence of cystoliths which appear as protuberances or streaks when the leaf is held against light is characteristic feature of most of the taxa.
- However they may be lacking insome of the taxa .

• Reproductive characters:-

• Inflorescence :-

- The inflorescence is built upon a basically cymose plant. In the floral magion, the bracts are arranged in opposite - decussate pairs.
- The internodes are comparatively much shorter .
- Solitary axillary (*Thunbergia*), spike (*Blepharis*), racemes, dichasial or monochasial chymes.

• Flower :-

- Flowers are perfect , zygomorphic actinomorphic.
- Tropically , colorful bract subtends each flower.

Bracteate , bracteolate , bracts and bracteoles conspicuous , pedicellate or sessile and brightly coloured, hermaphrodite, complete pent amenuous or tetramerous , hypogynous , nectariferous disc present below the ovary wall.

- The presence of two or more bracteoles is a very characteristic feature of the family.

Calyx :- = Sepals 4 or 5 gamosepalous, variously coloured , imbricate or twisted, inferior...

- Corolla :- Petals 2 to 5, bilipped gamopetalous variously coloured , imbricate or twisted, inferior.

• Androecium :-

- Stamens number either two or four, arranged in pairs and inserted on the corolla.
- Generally 4, rarely 5, 2 staminodes, epipetalous, filaments free dithecous, dorsifixed, alternate with corolla may be smaller than the other and unequally placed, anthers, sometimes spurred.

• Gynoecium :-

- Ovary is superior and bicarpellated, with axile placentation. Syncarpous, biloculars, carpels median, one or few ovules. loculus, style simple, stigma.
- bilobed, disc prevent below the Ovary.

Primitive characters :-

- Herbs and Shrubs, few are free.
- Roots :- top root,
- Stem :- Aerial
- Leaves :- simple
- Flower :- Lemnaphrodite, hypogynous.
- Gynoecium :- Superiors.
- pollination :- by insect
- Seed :- Non Endospermic.
- Fruit Type :- The fruit is a loculicidal capsule [two-celled] which, splits almost up to the base. In the family subfamily Acanthoideae, the funicle forms a hook like projection known as the jaculator or retinaculum which presses the seed like a leaf - spring. As the fruit dehisces, the seed break from the funicles and is thrown to a

considerable distance by by the hook-like jaculator pollination is by insects cross pollination is favoured by protandry .

- Medicinal Importance :-

The family is of considerable medicinal importance including well known medicinal plants such as *Andrographis paniculata* , *Adhatoda vasica* etc.

👉 A General account of a few medicinally important plants of

Acanthaceae are depicted in the following table :-

<u>CommonName</u>	<u>SpeciesName</u>	<u>Part used</u>	<u>Chemical Constituents</u>	<u>Diseases Cured</u>
1. Beer's breeches	<u>Acanthus mollis</u>	Flower , Leaf	verbascoside, and its derivative, as well as benzoxazinoids, ¹⁶	Treatment for dislocated joints and for burrs .
2. Barleria	<u>Barleria cristata</u>	Leaf,stem, root,bark, flower	steroids ,triterpenes, alkaloids, phenols, flavonoids, saponins, tannins,proteins and amino acids in leaves of Barleria ² .	Reduce inflammations Cure for toothache
3.Malabar Nuts	<u>Justicia adhatoda</u>	Leaf,root, bark,	Vasicine,vasichnone, Quinazoline alkaloids,Anisotine.	Antibacterial, Antifungal,anti-ulcer,anti-inflammatory.
4. Justicial[Benth]	<u>Justicia californica</u>	flowers	Secondary metabolites like alkaloids, vasicine,oxvasicine ,vasichnone,tannins,glycosides flavonoids,apegenin,astragalin	Diabetes, Menstrual pain, Asthma.
5. Avicennia (Black Mangrove)	<u>Avicennia germinans</u>	Bark resin	Carbohydrates, tannins, flavonoids, terpenoids, steroids alkaloids and phenolic compounds	To treat tumors, diarrhoea, hemorrhage, swelling

					throat sore
6. Diptera	<u>Dictyoptera chinensis</u>	Whole herb	Polysaccharides, organic acids, amino acids and other substances.	Stomachache, Detoxification, clearing liver, improving eyesight.	
7. Asystasia	Asystasia gangetica	Leaves, roots	Flavonoids, terpenoids, steroids, alkaloids, amino acids, sugars, saponins, quinone and carbohydrates, phenolics.	Athelmintics, stomachache and snake bites.	
8. Hygrophila	<u>Hygrophila auriculata</u>	Roots, seeds oedema, gout	flavonoids, terpenoids, lupenol, butelin and fatty acids.	Rheumatic arthritis, kidney infection, jaundice	
9. Ruellia	<u>Ruellia tuberosa</u>	Leaves, roots	Alkaloids, benzoxazinoids, flavonoids, lignans, phenolic compounds, triterpenoids, Sterols.	Anti-diabetic, antihypertensive, eczema, diabetes, high blood pressure, flu, Asthma, fever.	
10. Stroblanthus	<u>Stroblanthus kunthiana</u>	Flowers, leaves	Alkaloids, flavonoids, saponins, tannins, glycosides, terpenoids, phenols in the methanolic extract.	Antioxidant, antimicrobial, anti-inflammatory.	
11. Blepharis	<u>Blepharis maderaspantensis</u>	Whole herb	Alkaloids, flavonoids, saponins, tannins, terpenoid s, phenols, steroids and anthraquinones.	anti-inflammatory, analgesic, aphrodisiac.	
12. Eranthemum (blue sage)	<u>Eranthemum pulchellum</u>	anti-inflammatory Yanalgesic, aphrodisiac	B-amylin 20-amy-min, lupenol, β -sitostendol Apigenin, Kaempferol, Benhoic acid, siringin.	Anti-microbial, Ant-septic	
13. Crossandra	<u>Crossandra infundibuliformis</u>	flowers	. Alkaloids, flavonoids, saponins, tannins, terpenoid s, phenols, steroids and anthraquinones.	anti-inflammatory, analgesic, aphrodisiac	
14. Clockvines	<u>Thunbergia laurifolia</u>	flowers	Iridoid glucosides, grandifloric acid, glucopyranosides and derivatives of apigenin.	Used as antidote for poison, treatment of drug	

					addiction, Antioxidant, Anti-diabetic, antiinflammatory, antipyretic.
15. Magenta plant	<u>Peristrophe bivalvis</u>	Leaves	Phenoxazine alkaloids, flavonoids, phytochemicals, anthocyanin, a natural colorant	Cough, dysenteric, diarrhoea, bronchitis, antismaculicidal, cytotoxicity haemoptysis, liver disease, kidney failure, jaundice.	
16. Graptophyllum	<u>Graptophyllum pictum</u>	flowers ,leaves	Alkaloids, flavonoids, saponins, tannins, terpenoid s, phenols, steroids, chlorophyll, and anthocyanin.	Folklore medicine in enhancing fertility, wound s, abscesses, constipation, urinary infections, scabies, hepato megaly, ear diseases	
17. Acanthus	<u>Acanthus ilicifolius</u>	flowers ,leaves	Tetrazolium salts, thiazoles, collagen, alkaline phosphatase, calcium, Acanthofoluside.	Asthma, diabetes, leprosy, hepatitis, paralysis, antioxidant, anticancer, antileishmanial.	
18. Hemigraphis	<u>Strobilanthes alternata</u>	Whole herb	terpenoids, phytostrerols, Alkaloids, proteins, glucosides, phenolics, fixed oils etc...	Wounds, bloody diarrhoea, Excessive menstruation, s, kindiseases	
19. Fittonia [Nerve Plant]	<u>Fittonia albivenis</u>	Leaves, Roots, stem	flavonoids ,phytochemicals, phenolic, polyphenols.	Headache, muscular pain, menstrual period, diarrhoea, insomnia, hysteria,	
20. Barleria	<u>Barleria prionitis</u>	Whole herb	Glutathione S-transferase, acetylcholine sterase, iridoid glycosides, phenylethanoid	Toothache, whooping cough, inflammation, jaundice, fever, gastr	

				glycoside.	ointestinal disorders as diuretic tonic, urinaryinfection s.
21. [Snake jasmine] Rhinacanthus	<u>Rhinacanthus nasutus</u>	Leaves, Roots, seeds	Flavonoids, quinine, anthroquinone, glycosides, sterols carbohydrates, naphthoquinone.	Scabies, eczema, snakebites, anti allergic, antiinflammatory, Antidiabetic	
22. Green chiretta	<u>Andrographis paniculata</u>	The arial parts, roots & whole herb.	Diterpinoids, diterpenoids, Flavonoids, polyphenols, β -sitosterol, Stigmastanol, lupreal, stigmasterol and androograpfolide.	Fever, respirator y infections, herpiss, sore throat other chronicl infectious diseases.	
23. Hygrophila	<u>Hygrophila spinosa</u>	Leaves, Roots, seeds ,stem	Alkaloids, flavonoids, carbohydrate, amino acids, terpenoids ,glycosides, mucilage, polyphenols, minerals, phytosterols.	Treatment of jaundice, malar a, anemia, urinary infection, gout & gastric diseases.	
24. Pachystachys	<u>Pachystachys lutea</u>	flowers ,Leaves	Alkaloids, flavonoids, carbohydrate, epicatechin.	Fever, coughs, colds, hair loss diarrhea, antifungal, antibacteri al test.	
25. Odontonema	<u>Odontonema cuspidatum</u>	whole herb.	Alkaloids, flavonoids, saponins, tannins, terpenoid s glycosides, steroids, Iridoid glucosides.	,antifungal, antibacterial, antiinflammatory, Antiviral, antiviral, antioxidant, Hypertension, liver ailments.	
26. Shrimp plant	<u>Justica brandegeana</u>	Leaves, ,stem	Coumarins, phenolics, volatile oils, Alkaloids, flavonoids, saponins, tannins, terpenoid s glycosides, carbohydrates.	Dysentery, gastrointestinal disorder, wound s, liver diseases, anemia, arthritis, respiratory, antibacterial.	
27. Justicia	<u>Justicia gendarussa</u>	Leaves	Alkaloids, flavonoids, saponins, tannins, terpenoid	Fever, coughs, chronic	

[Willow-leaved]				5.	rheumatism.
28. Comb Rungia	Rungia pectinata	Leaves, Roots, stem	Petroleum ether, phyto steroids, terpenes, tannins, flavonoids, carbohydrates, ydrates.	antiinflammatory, diuretic, antimicrobial, small pox, Pain, swelling & cough, fever, v ermifungal.	
29. Staurogyne	<u>Staurogyne argentea</u> <u>Wall</u>	whole herb	Naphthoquinone, amides, gums, Alkaloids, flavonoids, saponins, tannins, terpenoid s.	Hepatoprotective, anti-inflammatory, hypoglycemic, antipyretic, antioxidant, analgesic.	
30. Clockvines [black-eyed susamine]	<u>Thunbergia alata</u>	Leaves, Roots, seeds , aerial parts.	Grandifloric acid, delphinidin, phenolic acid, chroogenic, gallic, phloeoctatechuc.	anti-inflammatory, cough, fever, diarr hea.	
31. Barleria	<u>Barleria lupulina</u>	Flowers , Leaves	Coumarins, phenolics, volatile oils, Alkaloids, flavonoids, saponins, tannins, terpenoid s.	Reduce inflammation caused by insect bites, snake bites, boils, and rheumatism.	
32. Blepharis [Bhangari]	<u>Blepharis sindica</u>	Leaves	Alkaloids, phenolic acid, phyto steroids, hydroxamic acid.	given to cattle to increase milk production and its roots are used for urinary discharge & dysmenorrhoea	
33. Fittonia [Nerve plant]	<u>Fittonia gigantea</u>	Flowers , Leaves, stem	Steroids alkaloids, amides, quinone, enzymes, flavonoids.	Headaches, stomachaches, fever.	
34. Elytaria [purple scalystem]	<u>Elytaria imbricata</u>	Leaves, shoots, flowers.	Calcium, magnesium, zinc, iron, Cu.	Cure pimples.	
35. Eranthemum [Shooting Star]	<u>Eranthemum</u> <u>laxiflorum</u>	flowers	steroids, alkaloids, tannins, saponins, carbohydrates, glycosides, amino acids and proteins.	antipyretic antibiotic antihistaminic obal larvicidal, ovicidal and purpocidal against Anopheles stephensi gastroprotective	

36. Blepharis [Dakhi chappar or Utargani]	<u>Blepharis edulis</u>	Leaves	Phenolic compounds, flavinoids, alkaloid, saponins, tannins, glycosides, phytosterols.	and antiinflammatory fevers, urinary discharges, leucoderma, nasal haemorrhage, asthma, cough and inflammation of throat, and mental derangements, wounds and ulcers.
37. Carlowrightia [Arizona Wrightwort]	<u>Carlwrightia arizonica</u>	Flowers, whole herb.	gallic acid, collagen and geraniin flavonoid, glycoflavones-iso-orientin, and phenolic acids, vincristine and vinblastine.	antiinflammatory, diuretic, antimicrobial, antioxidant.
38. Acanthopis	Acanthopis harv	Leaves	isocoumarin, acanthaminoside, yonresinol, beta-glucopyranoside, yonresin ol and alpha-amyrin.	Antiinflammatory, insectidal, hepatoprotective, immunomodulatory, anti-platelet aggregation and anti-viral potential
39. Hypoestes [Ribbon Bush or Purple Haze]	<u>Hypoestes aristata</u>	Flowers, leaves.	diterpenoids, alkaloids, lignans, terpenes.	puddice for sore eyes.
40. Carlwrightia (Heath wrightwort)	<u>Carlwrightia linearifolia</u>	Leaves.	Naphthoquinone, amides, gums, alkaloids, flavonoids, saponins, tannins, terpenoid s.	fungal skin diseases, antibacterial

Discussion

- The family includes several plants of considerable medicinal importance.
- The largest genus *Justicia* (with ca. 600 members) includes several medicinally important species, such as *J. adhatoda*, *J. gendarussa*, *J. californica*, *J. secunda*, *J. americana*, *J. brandegeana*, etc.
- The leaves, roots, flowers and bark of *J. adhatoda* are used as antibacterial, antifungal, anti-ulcer and anti-inflammatory agent while the flowers of *J. californica* are used to cure diabetes and asthma and reduce menstrual pain. Leaves of *J. gendarussa* are used in the treatment of fever, headache, arthritis, respiratory disorders and muscular pain. The entire plant body of *J. secunda* is used for healing wounds and for curing anemia and relieving abdominal pain. Leaves of *J. americana* are used as an antioxidant and as an antibacterial and an antifungal agent. *J. brandegeana*, a plant with showy flowers, is also of no less medicinal importance. Its roots, leaves and flowers are used in the treatment of dysentery, wounds and gastro-intestinal disorders.
- Similarly, several species of *Barleria* such as *B. cristata*, *B. prionitis*, *B. lupulina*, etc. are also of no less medicinal importance. Leaves, stem, roots, bark and flowers of *B. cristata* reduce inflammation and toothache. *B. prionitis* helps to cure whooping cough, urinary infections, gastro-intestinal disorders and in reducing toothache because its leaves, stem, roots and flowers contain bioactive compounds. Leaves of *B. lupulina* are used in the treatment of snake-bites, dog-bites, inflammation, bleeding wounds and also rheumatism.
- Even the common herb *Ruellia tuberosa* deserves special mention as a medicinally important plant as its leaves and roots show anti-diabetic and anti-hypertensive properties.
- To conclude, one may say that the family has tremendous potential to be commercially exploited for the preparation of herbal drugs. More detailed study is required for the purpose.

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