# A Review on Pharmacological and Phytochemical Spectrum of "*Traditional Medicinal plant Adina Cordifolia*" Family- *Rubiaceae*

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***Abstract:*** ***Adina cordifolia*** **is the Yellow, Saffron Teak, Belonging to subfamily** ***Cinchonoideae*****, family** ***Rubiaceae*** **is found in Southern Asia, from India and Srilanka east to southern China and Vietnam. It is a substantial, deciduous tree, hinge disintegrated in deciduous forests all through the significant part of India, levitate up to an altitude, 900 m in the sub-himalayan stretch.** ***Adina cordifolia*** **was used by historical healers as the remedy of chronic cough, and in jaundice, stomach ache, fodder and swelling in stomach, The Roots are astringent and constipating, and are useful in diarrhea and dysentery. The bark is bitter, acrid, refrigerant, astringent, vulnery, demulcent, diuretic, aphrodisiac and tonic. It is efficacious in deprave conditions of pitta, wounds and ulcers, skin disease, straangury, gastropathy, fever and burning sensation. The buds are antidote to snake venom, flowers used in headache, leaves are antiseptic utilized in dressing wounds. These are also used in cuts, boils and to cure hemicrania.** ***Adina cordifolia*** **have extensive array of medicinal applications. It has been used as Antiamoebic, Antiinflammatory, Anti-aging, Antinociceptive, and Antifertility. In the present review compassed on plant** ***Adina cordifolia*****, more prominence was given on literature review, chemical composition, pharmacological and biological studies on** ***Adina cordifolia*** **plants. This dissertation will be benevolent to push scientist for co-ordinating their studies because it's disputable kind of drug having sparse research.**

***Keywords*****: Adina Cordifolia, Phytochemistry, Pharmacology, Medicinal uses.**

## INTRODUCTION:

Nature has provided a complete storehouse of remedies to cure all ailments of mankind. The knowledge of drugs has accumulated over thousands of years as a result of man's inquisitive nature so that today we possess many effective means of ensuring health care. The human being appears to be afflicted with more diseases than any other animal species. In past, almost all the medicines used were from the plants, the plants being man's only chemist for ages. Today, a vast store of knowledge concerning therapeutic properties of different plants has accumulated. All phyla of plants viz. Thallophyta, Bryophyta, Pteridophyta, Spermatophyta, contain species that yield official and unofficial products of medicinal importance. By far, the greatest number of these are derived from plants and include three hundred or more recognised families of spermatophyte.[1]

Medicinal plants contain some organic compounds which provide definite physiological action on the human body and these bioactive substances include tannins, alkaloids, carbohydrates, terpenoids, steroids and flavonoids.[2] Awareness of medicinal plants usage is a result of the many years of struggles against illnesses due to which man learned to pursue drugs in barks, seeds, fruit bodies, and other parts of the plants.[3] The knowledge of the development of ideas related to the usage of medicinal plants as well as the evolution of Awareness has increased the ability of pharmacists and physicians to respond to the challenges that have emerged with the spreading of professional services in facilitation of man's life.[4] Among the 7,000 species of medicinal plants recognized all over the world. The medicinal value of plants lies in some chemical substances that produce a definite physiologic action on the human body.[5] The most important of these bioactive compounds of plants are alkaloids, flavonoids, tannins and phenolic compounds. The phytochemical research based on ethno-pharmacological information is generally considered an effective approach in the discovery of new anti-infective agents from higher plant.[6] Scientists estimate that there may be as many as 10,000 different phytochemicals having the potential to affect diseases such as cancer, stroke metabolic syndrome.[7] Plants are rich in a wide variety of secondary metabolite such as tannins, terpenoids, alkaloids, and flavonoids which have been proved *in vitro* to have anti-microbial properties. The use of plant extracts and phytochemical, both with known antimicrobial properties, can be of great significance in Therapeutic treatments.[8]

Herbal and Medicinal plants are source of various alkaloids, flavonoids, terpenoids and other chemical substances essential for mankind. Use of indigenous drugs from plant origin forms a major part of complementary, alternative and traditional medicine, and the total global herbal drug market is estimated to be US$ 62 billion and is expected to grow up to US$ 5 trillion by the year 2050. India has a great wealth of traditional knowledge and wisdom, and the value of medicinal plants related trade in India is estimated at ₹5000 crores per annum. As the demand for the plant-derived pharmaceutical compounds is increasing, possibilities for mass production need to be explored. Plant tissue culture techniques offer the rare opportunity to tailor the chemical profile of a phytochemical product by manipulation of the chemical or physical microenvironment, to produce a compound of potentially more value for human use. Availability of the plant is subjected to seasonal variation, leading to uncertainty in stable supply throughout the year. Plant production under controlled conditions of *in vitro* system can eliminate these problems. Therefore, establishing a

suitable micropropagation protocol for the high-yielding lines will have the potential of providing a better source for continuous supply of plants in the field of drug research as well as manufacturing of drugs.[9,10]

**HISTORY OF MEDICINAL PLANTS**

The history of herbal medicine and plants is as old as human civilization. The documents, many of which are of great antiquity, revealed that plants were used medicinally in China, Egypt and Greece long before the beginning of the Christian era. The text of documented by more then 800 formulae and 700 different drugs. The drugs such as acacia, castor oil and fennel are mentioned along with apparent references to such compounds as iron oxide, sodium chloride, sodium carbonate and sulphur. Most of the medicinally active substances identified in nineteen and the twentieth centuries were used in the form of crude extract.[1]

Plants have been used for medicinal purposes from 5000 BC with the emergence of the Indus Valley Civilization. The oldest known herbal is *Pen-t'sao*writte by Emperor **ShenNung** around 3000 B.C. It contains 365drugs, one for each day of the year.[1]The indigenous system of medicine, viz.-Ayurvedic, Siddha and Unani, have been in existence for several centuries. The country has 45,000 different plant species and 15000 medicinal plants that include 2000 plants used in Ayurveda, 700 in Unani, 600 in Siddha, 450 in Homoeopathy and 30 in modern medicine. The drugs are derived either from the whole plant or from different parts like leaves, stem, bark, root, flower, seed etc. Some drugs are prepared medicines.(from excretory plant product such as gum, resins and latex)[11]

**SIGNIFICANCE OF MEDICINAL PLANTS IN HUMAN LIFE:**[1,3,8,10]

- Medicinal plants & plant-derived medicines widely used in traditional cultures.
- At least 7,000 medical compounds in the modern pharmacopoeia are derived from plants.
- In Africa and Asia, 80% of the population still uses traditional remedies.
- Annual worldwide market for traditional herbal medicine approaches 60 billion US$.
- Medicinal plants are resources of new drugs. It is estimated there are more than 250, 000 flower plant species.
- Many of the modern medicines are produced indirectly from medicinal plants, for example aspirin.
- Plants are directly used as medicines by a majority of cultures around the world, for example Chinese medicine and Indian medicine.
- Many food crops have medicinal effects, for example garlic.

A number of herbal traditions have come to dominate the practice of alternative medicine. These include the western herbal tradition based on Greek, Roman and medieval sources, the essentially Ayurvedic tradition of India and the Chinese herbal medicine. The traditional Chinese medicine continues as a distinct branch of modern medical practice. The traditional herbal remedies as alternative medicine plays a significant role in South Africa also, where it forms a part of the culture and beliefs of the indigenous population and also features significantly in primary health care. Botanicals or phytomedicines have always been a major component of traditional systems of healing in developing countries, which have also been an integral part of their history and culture. In the ancient Indian system of medicine, Ayurveda and Siddha are such examples.[9]

The widespread use of herbs in traditional medicine has also prompted demands that herbal remedies be regulated as drugs to ensure quality standards and to prove its scientific basis. Herbs hold promise not only for prevention but also for the treatment of various types of diseases. The drugs of natural origin constitute very important and valuable segments of modern medicine. Traditional medical practitioners and scientists are turning towards medicinal plants for curing ailments such as inflammation, rheumatoid arthritis, cancer, diabetes and many more because of the fact that they possess lesser side effects owing to their natural origin. These extracts are formulated into different formulations for ease of administration. The novel formulations are reported to have remarkable advantages over conventional formulations of plant actives and extracts which include enhancement of solubility, bioavailability, protection from toxicity, enhancement of pharmacological activity, enhancement of stability, improved tissue macrophages distribution, sustained delivery, andprotection from physical and chemical degradation.[15]

**HERBAL DRUG RESEARCH TODAY**

The goal of herbal drug research and development program is to discover single entity and multi component bioactive natural products that may serve as leads for the development of new pharmaceuticals which address unmet therapeutic needs. Traditional knowledge-driven drug discovery will serve as a powerful search engine and most importantly, will greatly facilitate the focused and safe natural products research to rediscover the drug discovery process. There are over 750,000 plants on earth. Relatively speaking, only a very few of the healing herbs have been studied scientifically. Of these, only about 6% have been screened for biologic activity, and a reported 15% have been evaluated phytochemically.[16]

**REVIVAL OF TRADITIONAL MEDICINE**

There is currently a rising recognition of the value of experience and historical knowledge gathered by indigenous cultures with medicinal plants. The revival of interest in herbal medicines is firstly due to increased awareness of the limited horizon of synthetic pharmaceutical products to control major diseases and secondly due to the current widespread belief that 'green medicine' is safe and more accessible and affordable than the costly synthetic drug many of which have adverse side effects. The past decade has witnessed a tremendous resurgence in the interest and use of medicinal plant products especially from developed countries. According to a WHO estimate, about 80% of the world population relies on traditional systems of medicines for primary health care, where plants form the dominant component over other natural resources.[17]

**PLANT PROFILE:**

**Figure No.1: Leave with seeds.**

**Figure No.2: Leave with flower.**

**Figure No.3: Adina cordifolia Tree.**

**Figure No.4: Seeds of Adina cordifolia.**

- *Adina cordifolia* is a large deciduous tree, under good conditions grows, over 30 m., but is normally about 14-20 m tall.[12,18,19]
- Leaves up to 25 cm or more across, broadly oval or circular in shape, acute at the apex, heart-shaped at the base, slightly hairy especially when young, green or tinged with red or pink; nerves a strong one running from the base to the tip of the leaf and 5-6 pairs of lateral ones, which unite in a wavy line near the margin of the leaf. Leaves come out in pairs, one on either side of a branch, their stalks connected by a pair of stipules. These are two leaf-like structures, up to 2.5 cm. long, enclosing and protecting the very young leaves and shoot apex; when the stipules fall away, they leave two clear lines, each encircling half of the branch. Leaf stalks are 5-10 cm, long.[19,20]
- Flowers are insignificant individually, being very small; but they come out in balls 2-3 cm. across; the tiny flowers are yellow or yellowish in color, often tinged with pink. When the little flowers open out, the most prominent parts are the styles, which form a sort of halo round the floral ball.[18-22]
- Fruits are minute, forming an almost solid ball, which when ripe is black or nearly black. Fruits are capsules like, splitting into two dehiscent cocci.[18,20,21]
- Seeds are many, narrow, small, and tailed.[19-21]
- Leaves are shed about February, and the tree remains leafless until about may-june; the stipules covering the buds are than very conspicuous. Flower balls are at their best from June to August. After the fruit proper has been shed at about the beginning of June of the following year, the fruit-heads appear black and are about 12 mm. across: the rains of the monsoon may bring them down and prepare the tree for the new flower balls.[21-25]

**HISTORY OF ADINA CORDIFOLIA:**

History of *Adina cordifolia* can be traced back to Vedas, Puranas and Samhita. There is a reference of root and branches of Adina cordifolia in different books of vedic period. It was used for dantadhavana. In paraskaraGuhyasutra 1/21, Atharvaparishista 26/5/1-4, Yajnavalkyashiksha 34, Mandukishiksha 4/1 etc., Adina has been mentioned. It is mentioned as Nipa in PanineeyaAsthadhyayi, PathanjaliMahabhashya, Gubhilagruhya sutra and Shulwa Prathishakhya.[18-25]

**DISTRIBUTION:**

It is a South East Asian species. It is distributed throughout India, Burma, Srilanka, Bangladesh, Nepal, Thailand, South China, Bhutan, Vietnam, Myanmar and Malaysia. It is found scattered in deciduous forests throughout the greater part of India, (except in arid regions of Rajasthan) ascending to an altitude of 900 m in the sub-Himalayan tract. It is also common in the forests of South India. It grows well under 300-1000m altitude and prefers well-drained soil. Suitable soil pH range between 5.5 to 6.5. The annual temperature requirement is within the range of 250C-350C and prefers a mean annual rainfall between 1000-2000mm. It is not frost

tolerant. The tree grows in various geological formations such as granite, gneiss, schist, quartzite, trap and laterite up to an elevation of 1000 MSL.[12,18-25]

**TABLE NO.1: TAXONOMIC CLASSIFICATION:**[18-25]

| | |
|---|---|
| **Kingdom** | ***Plantae*** |
| **Class** | ***Magnoliopsida*** |
| **Sub-class** | ***Asteridae*** |
| **Super order** | ***Gentiananae*** |
| **Order** | ***Gentianales*** |
| **Family** | ***Rubiaceae*** |
| **Subfamily** | ***Cinchonoideae*** |
| **Genus** | ***Adina*** |
| **Specific epithet** | ***Cordifolia*** |
| **Botanical name** | ***Adina cordifolia*(Roxb.) Benth& Hook. F.** |
| **Synonym** | ***HaldinaCordifolia*(Roxb.)** |

**Family: Rubiaceae** family includes plants which have medicinal use and contain the secondary metabolites.Rubiaceae is by far the substantial family in the flowering plants order-sgentianales. It is also the oldest family that branched off on the gentianales family tree. The family Rubiaceae comprises about 450 genera and 6500 species and includes trees, thousand infrequently herbs7-10. Among the many plants *Adina Cordifolia* is one from Rubiaceae family.[12,18-25]

**Genus:** Adina cordifolia, is the sole species in the genus Haldina.[12,18-25]

**TABLE NO.2: CLASSICAL CATEGORIZATION OF *ADINA CORDIFOLIA:***

| S. No. | Classical texts | Gana&Varga |
|---|---|---|
| ***1.*** | ***Bhavprakash Nighantu.***[26] | ***PushpaVarga*** |
| ***2.*** | ***MadanpalaNighantu.***[27] | ***VatadiVarga*** |
| ***3.*** | ***NighantuAdrash.***[28] | ***ManjisthadiVarga*** |
| ***4.*** | ***Raja Nighantu.***[29] | ***PrabhadradiVarga*** |
| ***5.*** | ***Dravyaguna Vijanam.***[30] | ***JwarghnadiVarga*** |

**TABLE NO.3: VERNACULAR NAMES OF *HARIDRU:***[30,31]

| S. No. | Language | Names |
|---|---|---|
| **1.** | **Sanskrit** | **Haridru** |
| **2.** | **Hindi** | **Haldina** |
| **3.** | **Bengali** | **Kelikadamba** |
| **4.** | **Marathi** | **Hed** |
| **5.** | **Gujarati** | **Haldarvo** |
| **6.** | **Tamil** | **Manjkadamba** |
| **7.** | **Urdu** | **Halnd** |
| **8.** | **English Name** | **Yellow Teak, Saffron Teak** |

**USES:**[23-25,30-33]

- Fresh bark is ground with brown sugar and taken internally for stomach-ache.
- Bark and leaves are used for cholera, cold cough, fever, headache, Scars and skin yellowish of body, urine complaints.
- Laves are used on cough and cold.
- Fresh stem bark juice is taken in rheumatism.
- Latex is applied on aching tooth.
- Stem bark used on fever.
- Leaves are applied over swollen portion to remove pain and swelling.
- Bark is used as a antibacterial, eczema, Scabies, Bark paste is applied to eczema, Scabies, or bacterial infections on the skin

**CHEMICAL COMPOSITION OF *"Adina cordifolia":***

A yellow colouring matter adinin, belonging to naphthaquinone group of pigments, wasisolated along with tannins from the heartwood.[23,34]In a detailed examination of the heartwood, confirmed the occurrence of a compound agreeingin physical properties with adinin which was however, shown to be an alkaloid of the Bcarbolineseries and renamed the compound as adifoline. The other constituents identified werecordifoline;[35] benzoic acid, B- sitosterol and umbelliferone. The flavanones isolated from theheartwood

were identified as 7,4-dimethoxy-5-hydroxyflavanone and 5,7-dimethoxy-4-hydroxyflavanone. The heartwood also yielded saturated aliphatic hydrocarbons viz. nheneicosane,n-tricosane, n-pentacosane and n-pentatriacontane, besides b-sitosterol**.** Theoleoresin obtained by the incision of the trunk yield 5.2-6.8 per cent of essential oil.[24,36] In apreliminary chemical study, the stem bark was found to contain alkaloids. The ethanolicextractof the root bark was found to contain a new coumarin glycoside adicardin, characterized as 7-apiglucoside of umbelliferone.[35,36]

**PHYTOCOMPOUND IN "A*dina cordifolia*":**

Identification of phytocompounds was based on the principles of molecular weight (MW), retention time (RT), molecular formula (MF) and concentration (peak area%).

A total of 66 constituentswere identified in the study contributing:[37,38]

- 61.74% of the chloroform extract,
- 80.42% of the ethyl acetate extract,
- 60.88% of the acetonic extract,
- 45.59% of the methanolicextracts.

The dominating constituents in respective leaves extracts of "*Adina cordifolia"* were:

- Transsqualene (15.4-42.1%),
- Vitamin E (2.9-5.8%),
- Phytol (1.1-9.42%),
- Neophytadiene (2.0-2.4%).

**TABLE NO.3: THE PHYTOCOMPOUNDS IDENTIFIED IN LEAF OF "*A. CORDIFOLIA"* IN DIFFERENT SOLVENTS:*[37,38]***

| **Chloroform extract** | **Ethyl acetate extract** | **Acetonic extract** | **Methanolic extracts** |
|---|---|---|---|
| Tetradecanal (0.93%) | Tetradecanal (1.09%) | Phenol (7.33%) | Phenol (1.14%) |
| Neophytadiene(2.46%) | Neophytadiene (2.05 %) | Neophytadiene (2.09%) | Naphthalene (1.16%) |
| Trans-squalene(42.13%) | Trans-squalene (15.42 %) | Trans-squalene (27.44%) | Epiglobulol (3.23%) |
| Phytol isomer (2%) | Phytol isomer (9.42%) | Trimethylsilylpalmitate (3.36%) | Caryophyllenoxide (4.14%) |
| Ergost-5-en-3-ol (3.38%) | Gamma.-sitosterol (4.11%) | Phytol isomer (1.18%) | Loliolide (1.32%) |
| Vitamin E (4.22%) | Vitamin E (5.84%) | Vitamin E (2.99%) | Pentyloctanoate (3.44%) |
| Campesterol (1.71%) | Hexadecanoic acid methyl ester (1.10%) | Campesterol (1.05%) | Behenylbehenate (6.53%) |
| Naphthalene (3.48 %) | | Tetradecanal (0.68%) | |
| | | Naphthalene (3.77%) | |

**PHARMACOLOGICAL AND BIOLOGICAL STUDIES:**

**Anti-ulcer-** *A. cordifolia*had been also evaluated for its anti-ulcer potential active constituent showed interesting H+/K+ ATPase inhibitory activity. Four compounds isolated from the stem of *Adina cordifolia*were identified as stigmasta-5, 22-diene-3P-O-a-rhamnopyranosyl-(1-4)-P-Dxylopyranoside, a-amyrin, octacosanol and naringenin-7-methyl ether-4'-O-a-rhamnopyranoside on the basis of spectral and chemical evidence.[21,37,45]

**Antimicrobial** -The crude extract of the bark showed antibacterial activity against Bacillus anthracis, Bacmycoides, Bacsubtilis, Pseudomonas sp., Salmonella paratyphi, staphylococcus albus, Xanthomonascampestris and Xanthmalvacearum. [20,39,44]
Flavone isolated from the heartwood exhibited broad spectrum antibacterial activity against Vibrio cholerae, Neisseria gonorrhoea, mild activity against Escherichia coli and moderate antifungal activity against Aspergillusfumigatus and Cryptococcus neoformans. [20,44]

**Hepato-protective Action-**The acetone (*AEAC*) and aqueous extracts (*AQEAC*)of *Adina cordifolia*were studied for hepatoprotective activity against Wister rats with liverdamage induced by ethanol. It was found that *AEAC* and *AQEAC*, at a dose of 500 mg/kg bodyweight revealed hepatoprotective effect by diminishing the Serum Glutamate PyruvateTransaminase (SGPT), Serum Glutamate Oxaloacetate Transaminase (SGOT), alkalinephosphate and total bilirubin to a remarkable extent and also significantly increased the levelsof total protein. The hepatoprotective activity was also mounted by histopathological studiesof liver tissue. The effects of *AEAC* and *AQEAC* were comparable with standard drugsilymarin.[40,44]

**Antimalarial-**The alcoholic extract of the stem bark screened for in vivo and in vitro antimalarial activity against the NK 65 strain of plasmodium Bergheim was found inactive.[41,44]

**Anti-oxidant Property**- Percentage of DPPH radicals' inhibition and IC50 values (µg/ml) was expressed as antioxidant activity of extracts. IC50 values ranged from 20.39 to 38.96µg/ml. The total phenolic content ranged from 17.48 to 20.83 mg/g of dry weight of extract, expressed as gallic acid equivalents. The total flavonoid concentrations varied from 17.49 to22.48 mg/g, expressed as quercetin equivalents. The significant linear correlation was confirmed between the values for the total phenolic content and

antioxidant activity of plant extracts. *Adina cordifolia*(Roxb.) can be estimated as auspicious candidates for natural plantsources of antioxidants with high value.[42,44]

**Antifertility-**The ethanolic extract of the dried leaves administered to female rats for 5d after mating did not reveal antifertility activity (anti-implantation and abortifacient) as observed on the 10 d of pregnancy.[22,44]

**Antidiabetic -** The hydro-alcoholic extract of *Adina cordifolia*(Roxb.) leaves in alloxan induced diabetic rats at 250 and 500 mg/kg doses showed antidiabetic activity.Glibenclamide (10 mg/kg, s.c.) was used as the standard which produced a notable decrease in blood glucose levels. The blood glucose levels of experimental animals were examine at 0, 2,4and 6 h after giving plant extract by using glu-oxidase peroxidise reactive strips and glucometer. Treatment with hydro-alcoholic extract of *Adina cordifolia*(Roxb.) leaves at 500 mg/kg dose reduced the blood glucose level significantly. However, the lower doses (250 mg/kg) of hydro-alcoholic extract of *Adina cordifolia*(Roxb.) leaves produced a little decrease in blood glucose level. It was demonstrated that there was a dose dependent decrease in blood glucose level in the alloxan induced diabetic rats as compared to the control group. This study revealed that hydro-alcoholic extract of *Adina cordifolia*(Roxb.) leaves possessed significant antidiabetic activity.[44]

**Anti-proliferative-**Anti-proliferative activity of methanolic extract of *Adina cordifolia,* was determined using cell lines. Cells (5 × 103) were seeded in 12-well plates containing respective medium at 370C with 5% CO2 and 95% air and in 100% relative humidity. After 24 hrs, various concentrations of *Adina cordifolia,* extracts (0-100 µg/ml) were added. At the end of 72 hrs incubation, the medium in each cell was replaced by fresh medium containing 5 mg/ml of MTT. 3 hours later, the Formosan product of MTT reduction was dissolved in DMSO, and absorbance was measured using a multi-plate reader. The IC50 values were calculated by plotting the percentage survival versus the concentration of extract.[46]

## CONCLUSION

The present work was carried out on plant *Adina cordifolia* family: Rubiaceae here more emphasis was given on literature reviews of Phytochemical & Pharmacological of *Adina cordifolia Plants.* After thorough investigation and literature search it was observed that less work has been done on this plant especially on its leaves. Traditionally the plant *Adina cordifolia* has a large demand due to its treatment of many chronic and acute diseases with great benefits. This study attempts to high lighten the Therapeutic potential of *Adina cordifolia* and their constituents in the prevention or therapy of disease. From this study we can conclude that the results reviewed in the study are aimed at attracting the attention of researcher's seeking new drugs from *Adina cordifolia* and its chemical compounds. The isolated compounds can hopefully be considered in future for more clinical evaluations and possible applications and as adjuvant to current medications. We should maintain our efforts in considering and valorizing our natural patrimony as well as conducting more research in *Adina Cordifolia* and its Pharmacological aspects.

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