

Ethnomedical, pharmacological and phytochemical updates on *Adina cordifolia*

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Abstract

Adina cordifolia is a deciduous tree belonging to family Rubiaceae having various medicinal properties. It is used as wound healing, diabetic control, antimalarial, hepatoprotective, antifertility, antioxidants, anticancer and antiulcer drug. This study reveals several ethno medical and traditional uses of different parts of *A. cordifolia*.

Keywords: *Adina cordifolia*, rubiaceae, chemical constituents, pharmacological activities

Introduction

Adina cordifolia is a deciduous tree belonging to family Rubiaceae. It has a huge top, generally rising from 18 - 30 metres tall, cases up to 45 metres have been documented. The buttresses are sometimes of asymmetrical and fanciful forms. When developing in more isolated locations it produces a dense bole and huge branches with a bulky spreading crown. The plant is reaped from the wild for its beneficial timber and for local medicinal use. It is found in China, India, Sri Lanka, Assam, Bangladesh, Myanmar, Thailand, Cambodia and Malaysia. [1]

Taxonomical classification [2]

Domain: Eukaryota

Kingdom: Plantae

Phylum: Tracheophyta

Subphylum: Angiosperma

Class: Mangnoliopsida

Order: Gentianales

Family: Rubiaceae

Genus: Haldina, Ridsdale

Species: *Adina cordifolia*

Other scientific names: *Adina cordifolia* (Roxb.) Hook. f. ex Brandis, *Nauclea cordifolia* Roxb., *Haldina cordifolia* (Roxb.) Ridsdale.

Botanical Description and Organoleptic Characteristics

Adina cordifolia is a deciduous tree that can raise well over 20 metres high. The flowers may be inconsequential independently but can be realized as good-looking when they blossom organized in inflorescences with a bounds of 20–30 mm. flowers are yellow colored with a pink shade and are blossoms in winter season. [3] Leaves and barks are used in jaundice, wounds healing, cholera and in stomach-ache. [4] Flowers are used in headache. Bark has antipyretic and antiseptic properties. Roots are useful in dysentery and diarrhoea. [5]

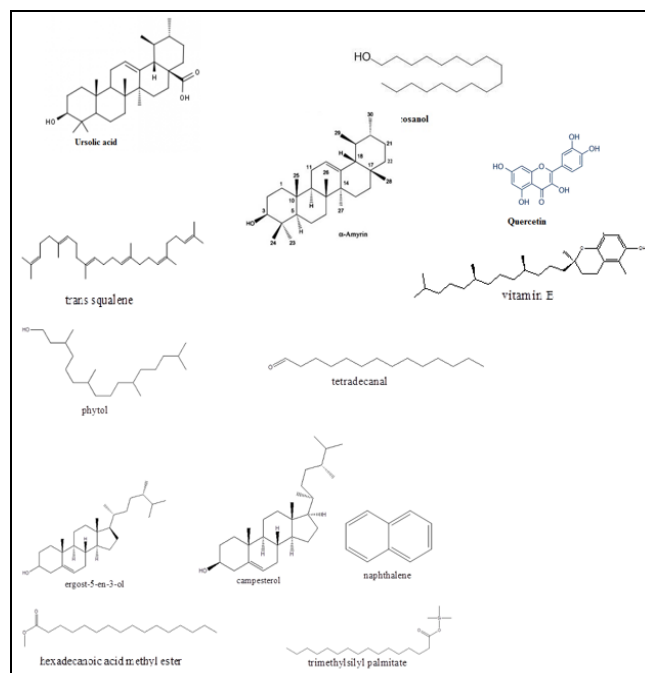
Identification of Chemical constituents

Stem of *Adina* consist of stigmasta-5, 22 – diene -3 β - O-rhamnopyranosyl-(1D-xylopyranoside, α -amyrin, octacosanol, and naringenin-7-methylether-4'- α - L4) – β O- α -L-rhamnopyranoside. [6] Plant also contain indole alkaloids, tannin, ursolic acid and quercetin. [7]

Leaves of *Adina* consist of trans squalene, vitamin E, phytol, tetradecanal, ergost-5-en-3-ol, campesterol, naphthalene, hexadecanoic acid methyl ester, trimethylsilyl palmitate, phenol, phenyloctanoate, behenylbehenate, neophytadine, gamma-sitosterol, epiglobulol, caryophyllenoxide, loliolide. [8]

Roots and bark of *Adina* consist of Oleoresin, essential oil, cellulose, β sitosterol. [9]

Chemical constituents of *Adina cordifolia*



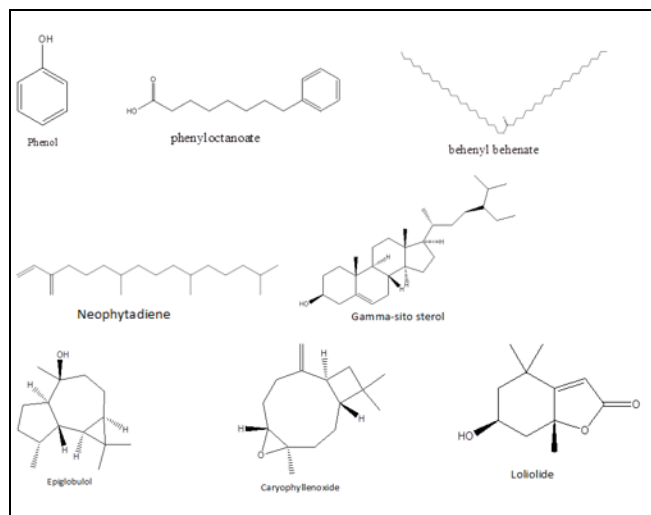


Fig 1

Pharmacological activities

Antioxidant activity

An antioxidant study was performed using DPPH radical scavenging. n-hexane, ethyl acetate, ethanol and methanolic extract of *Adina cordifolia* was used at concentration of 50, 25, 12.5, 6.25, 3.125 $\mu\text{g/ml}$ and compared with Ascorbic acid as a standard antioxidant. IC_{50} was found to be 31.36 \pm 0.048, 22.49 \pm 0.023, 38.96 \pm 0.076 and 20.39 \pm 0.054 $\mu\text{g/ml}$ showed by n-hexane, ethyl acetate, ethanol and methanolic extract respectively compared to 3.125 \pm 0.052 $\mu\text{g/ml}$ by standard drug. This study shows that ethyl acetate and ethanolic extract shows better antioxidant activity than other extracts. ^[10]

Another antioxidant study was performed using DPPH radical and nitrous oxide scavenging activity using methanolic extract of *Adina cordifolia* leaf, bark and root at 20, 40, 60, 80 and 100 $\mu\text{g/ml}$ and compared with Ascorbic acid as a standard antioxidant. In DPPH scavenging activity, leaf extract shows better inhibition of DPPH, IC_{50} value was found to be 48.4, 56.1 and 63.4 $\mu\text{g/ml}$ by leaf, bark and root extract respectively. In Nitrous oxide scavenging activity, IC_{50} value was found to be 110.5, 125.7 and 163.2 $\mu\text{g/ml}$ for leaf, bark and root respectively compared to 30.75 $\mu\text{g/ml}$ by standard ascorbic acid. This study reveals that leaf extract of *Adina cordifolia* possess high antioxidant activity than other bark and root extracts. ^[11]

Anticancer activity

In an *in-vitro* anticancer activity, petroleum ether, chloroform, ethanol, acetone and aqueous extract of leaves of *Adina cordifolia* were used at 200 $\mu\text{g/ml}$ by MTT and Neutral red uptake cytotoxic assay using Ehrlich Ascites Carcinoma (EAC) cell lines. Results for MTT assay was found to be 19.56 \pm 3.16, 19.94 \pm 1.31, 91.34 \pm 4.56, 89.11 \pm 2.97, 14.03 \pm 2.74 % inhibition by petroleum ether, chloroform, ethanol, acetone and aqueous extract respectively. Percentage inhibition in NR uptake assay was found to be 18.68 \pm 4.13, 08.42 \pm 3.79, 93.36 \pm 4.56, 90.00 \pm 3.64 and 33.68 \pm 1.96% respectively by petroleum ether, chloroform, ethanol, acetone and aqueous extracts. This study shows that acetone and ethanolic extracts of *Adina cordifolia* was found to be more potent than other extracts. ^[12] In an another anticancer *in-vivo* study, acetone and ethanolic extracts of *Adina cordifolia* at 500mg/kg dose were used to treat Ehrlich Ascites Carcinoma bearing swiss

albino mice. Factors like mean survival time, peritoneal cell count, hematological studies, tumor volume, tumor weight, tumor cell count, body weight and *In vitro* cytotoxicity were studied. Results show that, mean survival time for control group was 21.50 \pm 2.73 days, as compare to 34.33 \pm 3.2, 34.83 \pm 3.9 and 40.16 \pm 2.13 days for the AEAC and EEAC (500 mg/kg/day, p.o.) and 5-FU (20 mg/kg/day, i.p.) treated groups. Tumor volume and tumor weight were also decreased by treating animals with extracts and standard drug. 6.70 \pm 0.16ml tumor volume was found for control animals whereas 2.55 \pm 0.11, 2.25 \pm 0.09 and 1.01 \pm 0.10 ml was found for groups treated with AEAC and EEAC (500 mg/kg/day, p.o.) and 5-FU (20 mg/kg/day, i.p.) respectively. ^[13]

Antidiabetic activity

Alloxan induced diabetic model was used to study antidiabetic effect of hydroalcoholic extract (HAEACL) of *Adina* leaves. Diabetes was induced in wistar rats by administration of alloxan at 120mg/Kg i.p. by body weight. Then HAEACL were given orally to rats at 250 and 500mg/kg and glibenclamide as a standard drug (10 mg/kg of body weight). Blood glucose levels of diabetic control was found to be 259.551 \pm 0.752mg/dL whereas by HAEACL treatment on 6 hours of the study were found to be 213.68 \pm 2.142 and 210.415 \pm 3.31 mg/dL at 250 and 500mg/kg dose compared to 188.21 \pm 0.699 by glibenclamide. ^[14]

Analgesic and anti-inflammatory activity

Methanolic extract of *Adina cordifolia* was used to determine analgesic activity using acetic acid-induced abdominal constriction test in mice model. An intraperitoneal injection of 0.6% acetic acid was given to mice for induction of writhes. 200 and 400mg/kg of extract were used to check reduction in writhes and compared with diclofenac sodium as standard drug at 10mg/kg. Results shows that standard drug inhibit writhes to about 77.21% compared to 78.48 and 47.73% by 200 and 400mg/kg extracts respectively. Results reveals that plant extract possess potent analgesic activity. ^[15]

A carrageenan induced inflammation model was used to evaluate anti-inflammatory activity by using albino rats. 0.1 ml of carrageenan injected to induce oedema, paw volume was measured. 100, 200 and 400mg/kg of ethyl acetate and petroleum ether extracts was used to evaluate anti-inflammatory responses. Among both extracts petroleum ether extract show more significant activity. ^[16]

Hepatoprotective

Hepatotoxicity was induced by ethanol in Wistar albino rats. Effect of acetone and aqueous extracts of *Adina cordifolia* at 500mg/kg body weight was determined by factors like SGOT, SGPT alkaline phosphatase and total bilirubin. SGPT levels for control animals was 98.75 \pm 8.86 $\mu\text{min/l}$ whereas 63.76 \pm 4.63, 79.88 \pm 8.22 and 68.28 \pm 6.76 $\mu\text{min/l}$ were found for Silymarin (25mg/kg), acetone and aqueous extracts respectively. SGOT for control animals was 258.42 \pm 4.24 $\mu\text{min/l}$ whereas 176.28 \pm 8.47, 196.28 \pm 4.24 and 186.84 \pm 4.26 $\mu\text{min/l}$ was found for Silymarin (25mg/kg), acetone and aqueous extracts respectively. AKP and bilirubin levels were also found to be reduced in treated animals which shows that *Adina* has hepatoprotective activity. ^[17]

Anti-bacterial activity

Agar well diffusion method was used to determine antibacterial activity of n-butanol, ethyl acetate and aqueous fractions of leaves of *Adina cordifolia* at 25, 50, 100, 200 and 400 µg/ml against *S. aureus*, *P. aeruginosa*, *E. coli* and *B. subtilis* species. Results shows that, only n-butanol and ethyl acetate shows inhibition of 7.3±0.11, 8.5±0.14 mm and 6.1±0.09, 6.6±0.11mm at 200 and 400 µg/ml concentration against *S. aureus*.^[18]

Disc diffusion method was used to determine antibacterial activity of Methanolic crude extract (ME), Petroluemether soluble fraction (PESF), Carbon tetrachloride soluble fraction (CTCSF), Chloroform soluble fraction (CSF), Aqueous soluble fraction (AQSF) of leaves of *Adina cordifolia* at 400 µg/disc against five species of gram positive bacteria i.e. *B. cereus*, *B. megaterium*, *S. aureus*, *S. lutea* and *B. subtilis* and eight gram negative bacteria i.e. *E. coli*, *P. aeruginosa*, *S. paratyphi*, *S. typhi*, *S. boydii*, *S. dysenteriae*, *V. mimicus* and *V. parahemolyticus*. Results shows that, zone of inhibition was found to be in range of 8.0-26.0mm. Methanolic crude extract show maximum inhibition against *S. typhi* of 26.0mm comparing to 30.0mm by standard drug ciprofloxacin.^[19]

Anti-ulcer activity

Diclofenac sodium induced ulcer on rat was used to determine the antiulcer effect of both hot and cold methanolic extract of leaves of *Adina cordifolia* at 55.5 and 120mg/kg body weight. Ulcer was induced by giving 100mg/kg of body weight and omeprazole at 25mg/kg was used as standard antiulcer agent. Resultantly, control group shows 2.45±0.38 ulcer index, both cold and hot extract at low and high dose were significantly reduce the ulcer index. At low dose, 1.342±0.378 and 1.20±0.258 ulcer index were found for cold and hot extract. And at high dose, 1.170±0.35 and 1.015±0.205 ulcer index were found for cold and hot extract compare to 0.735±0.185 by standard drug.⁽²⁰⁾

Conclusion

The plant extracts of *A. cordifolia* have the rapeutic values and having potential toratify research. This has delivered an outstanding organic source for drug research. Although the plant has marked traditional worth and several natural activities, but the detailed phytochemical study so far has not been explored properly. Thus, there is a need of phytochemical analysis of *A. cordifolia* plant.

Summary

The preliminary phytochemical screening of extracts of *A. cordifolia* confirmed leaf and bark as rich resource of active constituents like alkaloids, tannins, saponins, glycosides and flavonoids. The various *in-vivo* and *in-vitro* studies of *A. cordifolia* extract possess various biological activities such as antioxidant, anti-diabetic, antimicrobial, anti-inflammatory, anticancer, hepatoprotective, anti-microbial etc.

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