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## **ACALYPHA INDICA: PHYTOCHEMICAL CONSTITUENTS, TRADITIONAL USES AND PHARMACOLOGICAL PROPERTIES: A REVIEW**

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**ABSTRACT:** Plants have been the major source of drugs in Ayurveda and other ancient system in world. The Ayurveda, Siddha, Unani, Homeopathy systems have evidenced the use of plants for various disorders. Medicinal constituents from plants play a vital role in traditional as well as western medicine. *Acalypha indica* L. belongs to family Euphorbiaceae and is a common weed found in Asia, including India, Pakistan, Yemen, Srilanka and is well distributed in tropical areas of Africa and South America. Plant has emetic, expectorant, laxative and diuretic property, useful in bronchitis, pneumonia, pulmonary TB, Asthma, leaves are laxative, anti-parasiticide and possess antifungal activities. The plant possesses various pharmacological activities such as anti-inflammatory, antimicrobial, anti-ulcer, analgesic, anti-arthritis, HIV-1 reverse transcriptase inhibitory, antiurolithiatic, cytotoxic, anthelmintic, anticonvulsant, antianxiety, anti-malarial, lipid lowering, anti-venom and kidney protective activity. The present review gives a detailed survey of the literature on its phytochemistry, pharmacognosy, traditional uses and pharmacological properties.

**INTRODUCTION:** Ayurveda, Siddha, Unani and Homeopathy systems are largely plant based and are the local heritage with global importance, world is enriched with large number of medicinal plants. Most of the plants have proven to be the richest source of medicinal compounds. Medicinal plants are recognized as richest source of bioactive compounds<sup>2</sup>. More than 80% of modern drugs are derived directly from sources of plants. Natural products derived from medicinal plants have wide range of pharmacological activities.

Now a day the scientists are exploring the causative factors of the diseases and also the mode of action of Ayurvedic medicine. Hence medicinal plants have been playing a very vital role in the research of pharmaceutical science<sup>4</sup>.

*Acalypha indica* has been widely used in Ayurvedic system of medicine for different disorders. It is a weed plant that occurs throughout the India, China and South Africa. It belongs to the family Euphorbiaceae. *Acalypha indica* has been used traditionally for treating many diseases such as Infertility, Antivenom, Wound healing, Antioxidant, Inflammation, Diuretic effects, Bacterial infections and Cancer. It contains phytoconstituents such as Polyphenols, Flavonoids, Alkaloids, Saponins, Terpenoids and Tannins. These components are usually found in several parts of plants like root, leaf and shoot<sup>2, 3, 4</sup>.

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**Taxonomy:****Kingdom:** Plantae**Order:** Malpighiales**Family:** Euphorbiaceae**Subtribe:** Acalyphinae**Genus:** Acalypha**Species:** *A. indica***Binomial name:** *Acalypha indica* L.**Plant Description:****FIG. 1: ACALYPHA INDICA L. PLANT**

It is an erect annual herb with 1.2 m height and has catkin-like inflorescence.

**FIG. 2: INFLORESCENCE OF ACALYPHA INDICA**

The leaves are broad ovate. The leaf margin is basally 5-nerves. The petiole is 1.5–5.5 cm long<sup>5</sup>.

**Geographic Distribution:** *Acalypha indica* occurs extensively throughout the world. In Africa, it found in Nigeria in West Africa and further widely throughout tropical Africa and the Indian Ocean islands. It also found in India, South East Asia, Yemen<sup>2,3</sup>.

**Effect on Domestic Cats:** *Acalypha indica* is widely known for its effect on domestic cats.

**TABLE 1: PHYTOCHEMICAL SCREENING OF DIFFERENT EXTRACTS OF LEAF, STEM BARK AND ROOT OF ACALYPHA INDICA<sup>6,7,8</sup>**

Phytochemical compound	Leaf				Stem bark				Root			
	C	EA	E	M	C	EA	E	M	C	EA	E	M
Alkaloids	+	-	+	-	+	-	+	+	-	-	+	+
Saponins	+	-	+	-	+	-	+	-	+	-	-	-
Terpenoids	+	-	+	-	+	-	+	-	-	-	-	-
Tannins	+	-	+	+	+	-	+	-	-	-	+	-
Phenolic compounds	+	+	+	+	+	+	+	-	-	-	+	-
Flavonoids	-	-	+	-	-	-	+	-	-	-	+	-
Glycosides	+	+	+	+	+	-	-	+	-	+	-	-

+ = Presence, - = Absence, C= Chloroform, EA= Ethyl acetate, E= Ethanol & M= Methanol.

**PHYTOCONSTITUENTS REPORTED IN VARIOUS PARTS OF ACALYPHA INDICA<sup>7,8</sup>**

Parts of a Plant	Phytoconstituents
Leaf	Squalene dl-alphaTocopherol beta-curcumene, Cysteine, Kaempferol, Campesterol gamma-Sitosterol 2-Methoxy-4- vinylphenol, Lupeol Benzoic acid, n-Hexadecanoic acid, Resibufogenin, Cyclopropaneoctanoic acid, 2-[2-[2- ethylcyclopropyl)m ethyl]cyclopropyl] methyl, Phytol, Cyclopentaneundecanoic acid, E-2-Hexenyl benzoate 3',5'- Dimethoxyacetophenone, 2Hydroxymethyl-5- (1-hydroxy-1- isopropyl)-2- cyclohexen-1-one 1,6,10-Dodecatriene,7,11- dimethyl-3- methylene, BIS(2-Ethylhexyl) phthalate, 4-Amino-3- methoxypyrazolo[3,4- d]pyrimidine
Root	octadecanoic acid, Oxtriphyllyne, Indospicine, Mycophenolic Acid, Retusoquinone, Ramipril glucuronide, Antimycin A propionylglycine methyl ester swietenine quinine, Oxymorphone, Diamorphine, Strychnine, C16 Sphinganine, Disopyramide oxprenolol choline bumetanide fenofibrate piperidine-2,5-dione, Mimosine, Dimethylglycine, Phendimetrazine, Mexiletine, Peucenin, Dehydrovariabilin, Normeperidine, Chloramphenicol alcohol 12-Aminododecanoic acid, Edrophonium, Quinine, Penbutolol, Evoxine, Harderoporphyrin, Deoxykhivorin, Anandamide, Zearalenone, 25-Hydroxycholesterol, N Acetylsphingosine, Phytosphingosine, Dihydrodeoxystreptomycin

**Traditional Uses of *Acalypha indica*:****TABLE 2: TRADITIONAL USES OF ACALYPHA INDICA L. PLANT IN AYURVEDA, UNANI AND AUSTRIAN MEDICINAL SYSTEMS**<sup>11, 12, 13</sup>

Part of a plant	Traditional uses
Leaves	<ul style="list-style-type: none"> <li>• The essence of leaves mixed with salt, or a decoction of plant, is used for scabies and other skin problems.</li> <li>• The leaf essence is used as an emetic and also used for eye infections.</li> <li>• A leaf extract is also used as a purgative and vermifuge.</li> <li>• The powder of leaves used for maggot-infested wounds.</li> <li>• In India used as an expectorant to treat asthma and pneumonia.</li> <li>• The leaf extract is used as a purgative.</li> <li>• infusion of the leaves of plant used to control glycaemic level in people having type-2 Diabetes.</li> <li>• In India the leaves extract is used to treat Rheumatism.</li> <li>• Leaf extract is used as an antidote to snake venom.</li> </ul>
Root	<ul style="list-style-type: none"> <li>• Root extract is used to treat asthma, and also to clean the liver and kidneys.</li> <li>• The root decoction is also used for intestinal worms and to treat stomach ache.</li> <li>• The root of this plant used as purgative.</li> <li>• In ayurveda the roots are used in chest pain, joint pain, and migraine and blood dysentery and lowering blood sugar.</li> <li>• In ayurveda the root is useful in fever, heart diseases, retained excretions and biliousness.</li> </ul>
Seed	<ul style="list-style-type: none"> <li>• The seed is used as laxative, carminative and to improve the appetite.</li> <li>• Seed powder is used for treatment of amoebiasis.</li> </ul>
Whole plant	<ul style="list-style-type: none"> <li>• Used for treatment of arthritis and gout.</li> <li>• This herb is used to control vomiting.</li> <li>• In traditional Austrian medicine, this plant is used for the treatment of various ailments such as urinary tract, kidney problems, gastrointestinal tract, cardiovascular system, haemorrhage, gout, rheumatism and skin problems.</li> </ul>

**Pharmacological Activities of *Acalypha indica*:**

**Antimicrobial Activity:** The antimicrobial activity of methanol, ethanol acetone and chloroform extract (100mg/kg) of *Acalypha indica* were evaluated. Methanol, ethanol and acetone extract were more effective against *Staphylococcus aureus* and *Escherichia coli*, whereas Chloroform extract was more effective against *Escherichia coli* and *Klebsiella pneumonia*<sup>13</sup>.

Methanol extract was more effective against *Candida tropicalis* and *Candida albicans*. Ethanol extract was more effective against *Candida albicans* and *Aspergillus niger*. Acetone extract was more effective against *Candida tropicalis*, *Candida albicans* and *Candida kefyr*. Chloroform extract was more effective against *Candida kefyr*. All the four extracts showed anti-fungal activity<sup>13</sup>.

**Anti-ulcer Activity:** The anti-ulcer activity of ethanolic extract of root and leaf were evaluated at dose of 100mg/kg and 200mg /kg. The ethanolic root extract at 200 mg/kg dose was effective in protecting peptic ulcer induced by aspirin, cold stress, pylorus ligation and ethanol induced models

than ethanolic leaf extract. The ethanolic root extract at 200 mg/kg b.w. treated animals significantly inhibited the formation of ulcers in the pylorus ligated rats, it is suggested that ethanolic root extract suppress gastric damage induced by aggressive factors.<sup>14</sup>

**Anti-inflammatory Activity:** The anti-inflammatory activity of methanolic root extract of *Acalypha indica* at dose of 150mg/kg and 300mg/kg were evaluated by using carrageenan induced paw oedema method. *Acalypha indica* root methanolic extract pre-treatment reduced the carrageenan induced paw oedema, and decreased WBC, platelets and CRP levels in rats. The extract was more efficient at 300mg/kg than 150mg/kg<sup>15</sup>.

**Analgesic Activity:** Analgesic activity of the methanol extract was studied in mice by acetic acid induced writhing reflex method. The extract showed the inhibition of writhing reflexes by 51.1% and 57.2% at doses of 200 mg/kg and 400 mg/kg body weight, respectively within 10 minutes of administration of acetic acid<sup>15</sup>.

**Anti-arthritic Activity:** The anti-arthritic activity of whole plant of *Acalypha indica* was studied on type II collagen induced arthritic rat model, using 200mg/kg and 400 mg/kg dose. The study demonstrates that hydroalcoholic extract of whole plant of *Acalypha indica* exerts inhibitory effect on Type II Collagen induced Arthritic rat model. The whole plant extract of *Acalypha indica* has shown significant decrease in WBC count, ESR levels and serum levels of IL-6, RF and CRP with reference to standard drug Methotrexate. Higher dose of extract (400mg/kg) has shown better significant effect on various parameters than the lower dose (200mg/kg). From the results it may be concluded that hydroalcoholic extract of *Acalypha indica* possess Anti -Arthritic activity<sup>16</sup>.

**HIV-1 Reverse Transcriptase Inhibitory Activity:** The study was performed to test the HIV-1 reverse transcriptase inhibitory efficiency of *Acalypha indica* leaves extract. The HIV reverse transcriptase enzyme inhibition due to each extract was determined by HIV-1 RT inhibition assay by using of Retro Sys HIV-1 RT activity kit. At 50 µg/mL n-hexane extract presented the uppermost percentage of HIV-1 RT enzyme inhibition (88.26%) followed by methanol (75%), chloroform (67.3%), ethyl acetate (67.3%) and acetone (63.4%)<sup>17</sup>.

**Antiuro lithiatic Activity:** The *in-vitro* Anti-Urolithiatic activity was performed in ethanolic and methanolic extracts of leaves of *Acalypha indica*. The inhibitory potency of the *Acalypha indica* was tested on the growth of the most commonly occurring kidney stones, calcium oxalate monohydrate. A concentration dependent inhibition was observed using *Acalypha indica*. A result obtained showed that the methanolic extract of leaf has the higher capacity to inhibit the crystal formation and aggregation as compared to ethanolic extract of leaf<sup>18</sup>.

**Kidney Protective Effect:** The kidney protective effects of captopril, AI root extract, and its combination was evaluated in high-fructose and high-cholesterol diet fed rats. In this study, renal damage was evaluated by using two biochemistry parameters, serum urea and creatinine levels. The serum urea and creatinine level were decreased in AI root extract treated rats and in captopril treated

rats. The study showed that AI possess kidney protective effect<sup>19</sup>.

**Cytotoxic Activity:** The cytotoxic activity of hexane leaf crude extract of *Acalypha indica* Linn. was evaluated on mcf-7 cell lines by MTT (3-(4, 5-Dimethylthiazol - 2) - 2, 5- Diphenyltetrazolium Bromide) assay method using Cisplatin as a positive control. The cell lines were treated with Hexane leaf extract of different concentrations (10µg/ml, 25µg/ml, 50µg/ml and 100µg/ml), Out of these concentrations 50µg/ml showed maximum inhibitory effect. It was observed that this plant has anti-cancer properties<sup>20</sup>.

**Anthelmintic Activity:** The study was performed to determine the effect of leaf extract of *Acalypha indica* as an anthelmintic to the time of death of pork roundworms (*Ascaris suum* Goeze). The results are assessed using the Kolmogorov-Smirnov test, then the Kruskal-Wallis's test was then continued using a post-hoc test to determine the difference in anthelmintic power of leaf extract of each concentration over the time of worm death. The average time of *Ascaris suum* worm death at a concentration of a concentration of 60% for 228.5 minutes, a concentration of 80% for 174 minutes, and a concentration of 100% for 92 minutes. The study showed that the leaf extract of AI has an anthelmintic effect on the *Ascaris suum* worm<sup>21</sup>.

**Anticonvulsant Activity:** The methanolic whole plant extract of *Acalypha indica* was screened for its Antiepileptic activity in rodent by using MES and PTZ induced convulsion method. Methanolic extract of *Acalypha indica* showed a significant reduction in various phases of convulsions at 30 and 60 minutes in MES model. In PTZ, MEAI at a dose of 200 mg/kg and 400 mg/kg protected the mice against seizures. Hence, the plant possesses anticonvulsant properties<sup>22</sup>.

**Antianxiety Activity:** *In-vivo* anti-anxiety activity of methanolic extract of AI at a dose of 200 and 400 mg/kg was evaluated in elevated plus maze apparatus. At both the doses plant shows increase in number of entries and time spent in open arm<sup>23</sup>. The antianxiety activity of leaves extracts of Petroleum ether, Chloroform, Methanol and water was evaluated using elevated plus maze model in Swiss albino mice at different doses such as

100,200,400mg/kg. Results shows that methanol extract at a dose of 100mg/kg shows significant antianxiety activity comparable to diazepam, where the Petroleum ether extract, chloroform extracts, and aqueous extracts devoid of antianxiety activity because their values are very less as compared to diazepam<sup>23</sup>.

**Anti-malarial Activity:** The Antimalarial activity of different plant parts of *Acalypha indica* i.e., leaf, stem bark and root of different extracts such as chloroform, ethyl acetate and methanol extracts were evaluated against *P. falciparum*. Results showed that, the leaf chloroform and ethyl acetate extracts of *A. indica* have shown antimalarial activity against 3D7 and K1 strains of *P. falciparum*<sup>5</sup>.

**Lipid Lowering Activity:** The AI extract shows decrease in free fatty acid level and serum glucose level in diabetic rats. The effect of AI extract for pancreatic fat formation in rats induced with 4-weeks of high-fructose and high-cholesterol diet were evaluated. The study showed that the AI decreases the lipid level in blood<sup>24</sup>.

**CONCLUSION:** The present literature review reveals the phytochemical screening of the plant, phytoconstituents present in the different parts of the plant and therapeutic uses of plant. *Acalypha indica* is a common weed found in Asia, including India, Pakistan, Yemen, Sri Lanka and is well distributed in tropical areas of Africa and South America.

The plant is used for various diseases in Ayurveda, Siddha and Unani. It is found that *Acalypha indica* L. shows various pharmacological activities such as Anti-inflammatory activity, antimicrobial activity, Anti-ulcer Activity, Analgesic Activity, Anti-arthritis Activity, HIV-1 reverse transcriptase inhibitory activity, Antiuro lithiatic Activity, Kidney protective effect, Cytotoxic Activity, Anthelmintic Activity, Anticonvulsant activity, Antianxiety activity, Anti-malarial activity, Lipid lowering activity and Anti-venom Activity.

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