

Traditional uses, phytochemistry and pharmacology of *Acalypha hispida* burm: A systematic review

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Abstract

Acalypha hispida belongs to the family Euphorbiaceae, it is a tropical shrub and an annual plant commonly known as 'chenille plant', 'Red hot cat tail'. It is native to the south pacific, new guinea, the malay archipelago and other islands in the east indies. It is commonly used as an ornamental plant in the garden and house. Traditionally the leaves are laxative, diuretic and used in the treatment of leprosy and gonorrhoea. Different part of the plant is also used in infectious diarrhoea, pulmonary problems and as an expectorant in asthma. Phytochemical studies revealed the presence of many compounds like alkaloids, tannins, saponins, flavonoids, glycosides, phenols, steroids, hydroxyanthraquinones etc. *Acalypha hispida* have been reported to have various pharmacological activities such as anti-inflammatory, anti-oxidant, hypoglycemic, anti-microbial, anti-fungal activity, trypanocidal effect, cytotoxic activities etc. The current reviews of *Acalypha hispida* summarizes information about the pharmacology, chemical constituents, biological activities and toxicological study. This review summarizes the research work carried out on this plant to provide updated information for future work.

Keywords: *Acalypha hispida*; Phytochemicals; Pharmacological activities; Chemical constituents

1. Introduction

Across the world traditional medicine either is the main stay of health care delivery or serves as a complement to it. Traditional medicine is an important part in low-income countries. It is used as singularly or in combination to treat, diagnose and prevent illness or maintain well-being. Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources, based on their uses in traditional medicine. Various medicinal plants are used to treat daily life diseases all over the world¹². The medicinal values of these plants based on some chemical substance that will produce a definite physiological action in the human body³.

Acalypha hispida is a species native to south pacific. It belongs to the family Euphorbiaceae. It is locally recognized as sibjota or jota mangshi in bangladesh and also known as shibjhul in bengali⁴. It is an erect, sparsely branched shrub and it is commonly used as an ornamental plant in the garden and house¹⁰. In *Acalypha* around 570 species are there. A large proportion of which are weeds while other are ornamental plants. Some of the species are well known in traditional medicine and few have appeared in homeopathic pharmacopoeia³. Its shrub growing to a height of 1-3 meters. Leaves are alternate, petioled 2-11 cm long, broad -ovate, bright green a top, pale green underneath, with crenulate - serrate margins. Inflorescence is axillary, solitary, in long pendant spikes, up to 14-15cm long. Flowers are bright red.

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Phyto chemical screening showed that all leaves contain phenolics, flavonoids, saponins, hydroxyl anthraquinones, alkaloids, tannins, glycosides. These are known to exhibit the medicinal physiological activity. Leaves of this plants serves as a part of supplying the body with minerals, protein and energy with human diet. These are due to the presence of secondary metabolite³. Increased resistance to synthetic drugs, usage of medicinal plants to treat a disease is increased. The plant has been reported to have various pharmacological activities such as anti-microbial and cytotoxic activities, anti-oxidant & hypoglycemic, trypanocidal effect, anti-fungal activity, anti-inflammatory, free radical scavenging activities¹⁰, phytochemical constituents, in-vitro anti-oxidant & anti-inflammatory potential, anti-microbial, toxicity activities etc. The review aimed to summarize different studies on this plant and evaluates its activities.

2. Plant profile

- Scientific name: *Acalypha hispida*
- Family: Euphorbiaceae
- Common name: Chenille plant, Red cat tail, Red hot cat tail.
- Kingdom: Plantae
- Order: Malpighiales
- Genus: *Acalypha*
- Species: *hispida*
- Parts utilized: Bark, Flower, Root, and Stem.
- Constituents: Saponins, Flavonoids, Phenols, Steroids, Carbohydrates etc....

2.1. Phyto constituents

Acalypha hispida is well known in traditional medicine and its phytochemical screening of aqueous & methanolic extracts shows the presence of phenolics, flavonoids, glycosides, steroids, saponins, phlobatannins and hydroxyanthraquinones, alkaloids, triterpenes¹¹. Gallic acid, corilagin, cycloartane - type triterpenoids, flavonoids like quercetin and kaempferol derivatives have been isolated from the plant¹². These constituents exhibit different medicinal & physiological activities. Mainly flavonoids shown to have anti-bacterial, ant-inflammatory, anti - neoplastic, anti-thrombotic and vasodilatory activity. Saponins and flavonoids from this plant contributes to its medicinal value thus they can be potential sources of usefull drugs³. Ellagic acid present in the leaves exhibit anti-inflammatory activity¹⁰. The anti-bacterial activity of *Acalypha hispida* leaves due to the presence of flavonoids and saponins present it⁸. These secondary metabolites have the property to inhibit the growth of fungus *candida albicans*⁵.

Proximate composition of leaves showed moisture [11. 02%], crude fat [6. 15%], ash [10. 32%], crude protein[13. 78%], crude fiber[10. 25%] and carbohydrate[44. 48%]. 14 compounds were identified in the oils [0. 06% & 0. 11% yield w/w], representing 97. 26% and 99. 91% of the essential constituents. Essential oil from *Acalyphahispida* contained Three monoterpenoides [citral(12. 87%) neral (11. 04%), nonanal(5. 20%)], Three sesquiterpenoides α [geranyl acetone(3. 41%),z-2-bisabolene(3. 25%) and 6,10,14 trimethyl-2-penta decanone(13. 43%)]. One fatty acid [n-hexadecanoic acid (14. 69%)]¹⁴.

Table 1 Phytochemical constituents of different extracts of *Acalypha hispida*

Constituents	Solvents/Extracts				
	Hexane	Benzene	Chloroform	Ethanol	Water
Saponins	-	-	-	++	+
Flavonoids	++	++	+++	+++	-
Protein	-	-	-	++	++
Carbohydrate	-	-	-	+++	+
Terpenes	++	++	-	+	-

['+' sign indicates constituent present , '-' sign indicates constituent absent) , more number of '+' sign indicates more amount of constituents present in that solvent.]

Table 2 Phytochemical constituents of Aqueous and methanolic extract of *Acalypha hispida*

Constituents	Solvents/Extracts	
	Aqueous	Methanol
Alkaloid	-	-
Tannins	-	-
Phenolic	+	+
Glycosides	+	+
Steroids	+	+
Phlobatanins	+	+

['+' sign indicates constituent present, '-' sign indicates constituent absent]

2.2. Traditional uses

Different part of the *Acalypha hispida* used to treat different disease condition. It act as diuretic (leaves & flowers), laxative (leaves & flowers), expectorant in asthma, in the treatment of leprosy (leaves & poultice) and kidney ailments. The leaves of the *Acalypha hispida* possess the activities like cytotoxic, antibacterial, antileprotic, antimicrobial and antifungal properties¹⁰. The leaves extract of *Acalypha hispida* shows activity against *staphylococcus aureus* & *Escheriachia coli bacteria*. It posses activity against white patches on the skin [vitiligo], coughs, mouth sores, dysentery and nose bleeds⁵. Ethanol extract of *Acalypha hispida* shows anti-inflammatory and anti-oxidant activity⁷. Its leaf extract contain phenols found to be active against *Rhizopus* sp, *Penicillium* sp, *Sclerotiumrolfsii*, *Fusarium* sp and *Aspergillus niger*⁷. Bark root of *Acalypha hispida* used for pulmonary problems. The decoction made from its aerial parts is used in infectious diarrhoea and dysentery⁸.

The plant has been reported to have various pharmacological activities such as anti-microbial and cytotoxic activities⁸, anti-oxidant & hypoglycemic⁷, trypanocidal effect⁹, anti-fungal activity⁵, anti-inflammatory¹⁰, free radical scavenging activities¹², phytochemical constituents³, in-vitro anti-oxidant & anti-inflammatory potential⁴, anti-microbial⁶, toxicity activities etc.

2.3. Pharmacological activities

2.3.1. Trypanocidal activity⁹

This study evaluated the trypanocidal activity of aqueous extract of *Acalyphahispida* leaves with all regimens and routes of administration its shows the activity.

2.3.2. Anti-microbial and cytotoxic activities of leaves^{8,26,27}.

It evaluate ethanolic extract of leaves for cytotoxic and antimicrobial activities. Anti-bacterial activity of *Acalypha hispida* due to the presence of saponins and flavonoids in it. Cytotoxicity measured by brine shrimp test.

2.3.3. Anti-oxidant and hypoglycemic, poly phenols^{7,25}.

This study evaluate the ethanol extract of *Acalypha hispida* leaves have an effect of hypoglycemic activity through α -glucosidase and α -amylase.

2.3.4. Phytochemical analysis and Antifungal activity^{5,22,2}

It shows that methanol extract of *Acalyphahispida* flower provides antifungal activity through inhibiting growth of *candida albicans*. This extract shows the presence alkaloids, steroids, saponins, flavanoids etc.

2.3.5. Antimicrobial – leaves^{6,24}

Studies of leaf extracts. It shows isolated gallic acid, corilagin, geranin, and it is responsible for antimicrobial activity.

2.3.6. Anti-inflammatory and Anti-oxidant activity^{10,28,30}

This study evaluate the anti-inflammatory, anti-oxidant activity and bioactive plant poly phenols of ethanol and aqueous extracts of leaves. Both extracts showed statistically significant inhibition carrageenan and histamine induced paw volume. Both extracts showed DPPH scavenging, Fe+2 iron chelating, NO scavenging and concentration dependent reducing power ability. The anti-inflammatory activity may be due to the high presence of ellagic acid, contributed too, by other phenolic contents.

2.3.7. Anti -diarrheal / combined effects³⁷

Study evaluated the antidiarrheal potential of combined 70% hydro ethanolic extracts of *Acalypha hispida*, *Acalypha nervosa* and *Acalypha fruticosa* in castor oil-induced diarrhea in wistar rats. Results showed dose dependent delay in the onset of induced diarrhea and also significant reduction in the number of diarrheal episodes and number of animals exhibiting diarrhea. Loperamide was used as standard drug.

2.3.8. In vitro anti-oxidant and Anti-inflammatory^{4,20,21}

It assessed with DPPH assay. There is an excellent anti-oxidant activity in the methanolic extract. But also moderate anti-inflammatory activity in the methanolic extract of leaves.

2.3.9. UV-Visible investigation of anti-oxidant and toxicity activities¹¹

It evaluate in-vitro assessment of the fractions to scavenge the DPPH radical and there by its anti-oxidant activity. Toxicity test is based on the brine shrimp assay. It shows 95% non- toxic level. Investigation of the anti-oxidant and toxicity activities of *Acalypha hispida* has proven that the semi pure compounds present in the fractions are use full potential sources of anti-oxidants.

2.3.10. Anti-ulcer / Anti-tumor

Studies yielded geranin and dehydroellagitannins which suggest diverse biological properties including anti-ulcer and anti-tumor effects, anti-bacterial activity against helicobacter pylori and antifungal activity.

2.3.11. Anti -bacterial – Leaves³⁶

Study evaluated the antibacterial properties of ethanol, methanol, chloroform and water extracts of leaves against *E. coli*, *S. aureus*, *P. aeruginosa*, and *S. typhi*. The test organisms were susceptible to the extracts in varying degree, with the methanol extract showed more antibacterial activity.

2.3.12. Anti-leishmanial³⁹

In a study of three *Acalypha* species, only *Acalyphahispida* showed to have anti-leishmanial activity with an IC50 of 71. 75µg/ml.

2.4. Other studies are

2.4.1. Phytochemical^{1,15}

It shows the presence of alkaloids, tannins, glycosides, phenols, saponins, flavonoids, phlobatannins, steroids, hydroxyanthraquinones.

2.4.2. Anthocyanins³⁸

Study isolated of three anthocyanins from the red flowers of the chenille plant.

2.4.3. Essential oil / Larvicidal^{14,32,33}

Study of leaves for essential oil yielded main constituents of neral (11. 04%), citral (12. 87%), 6,10,14, trimethyl-2-pentadecanone (13. 43%) and n-hexadecanoic acid (14. 69%). On toxicity for brine shrimps larvae (*Artemiasalina*), IC50 value was 122. 28µg/ml, while activity against *Anopheles gambiae* showed an IC50 of 125µg/ml.

2.4.4. *Phytochemical investigation, cytotoxicity, free radical scavenging activities of non-polar fractions (leaves and twigs)*¹²

Investigating the antioxidant and cytotoxicity activities of *Acalypha hispida* has proven that the semi-pure compounds present in the fractions are useful potential sources of antioxidants and can be used in the therapy of diseases like cancer, coronary heart disease, ageing and any other diseases related to oxidative stress. Study establish the presence of phytochemicals in different extracts.

2.4.5. *Chemical information of Acalypha hispida*^{3,17,16,18}

Chemical analysis of plant leaves are done to know their proximate, trace metals, heavy metal, mineral, phytochemical, vitamins, antioxidant, toxicants and other anti-nutritional factors. Proximate analysis shows content of moisture, carbohydrate, protein, ash, fat and oil. Plant leaf contain moisture (11.02%), crude fat (6.15%), ash (10.32%), crude protein (13.8%), crude fiber (10.25%), carbohydrate (44.48%).

2.4.6. *Comparative epidermal morphology and petiole anatomical study of Acalypha hispida*^{12,29,31,34,35}

Detailed epidermal morphology and petiole anatomy studied.

Epidermal morphology

Epidermal cells are irregular to polygonal. Walls size ranges from 4.00-6.75µm long 1.25-4.00µm broad, costal cells are rectangular, size ranges 7.25-13.00µm long and 1.78-4.00µm broad. Stomata anisocytic, laterocytic and parallelocytic, multicellular, uniseriate, hooked, non-glandular trichomes present. Anomocytic stomata were present in adaxial surface. Mean stomata index is 48.07%. Prismatic crystals are present.

Petiole anatomy

Petiole outline is oval in proximal section with thin cuticle. Collenchyma angular, 4-6 layers in proximal, 4-8 and 6-9 in medial and distal section. Parenchyma polyhedral, 6-9 layers in proximal, 5-7 in median and 4-7 in distal. Vascular bundle collateral. Medullary bundle present between two vascular bundle in distal region.

3. Conclusion

The objective of this review is to evaluate recent advances in medicinal purposes of the plant *Acalypha hispida*. The information as presented in this review is based on biological and pharmacological properties of the plant. That will provide detailed evidence for the use of this plant in various diseases. This review contain summarized details of different studies. The plant is reported to contain different phytochemical constituents. Example are saponins, flavonoids, glycosides, alkaloids, phenols, steroids etc. which might be useful in the production of different new drugs that will be use full in various diseases. It is based on their different constituents and their pharmacological activities. This review is mainly focused on the all studies of *Acalypha hispida* plant and its uses in different diseases see in now days.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest.

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