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Activities of*Acalypha indica Linn* (Euphorbiaceae): A Concise Review of its Phytochemical Constituents and Ethnomedicinal Uses

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ABSTRACT

Acalypha indica Linn belonging to Euphorbiaceae family is used practically as an herbal medicine by the Europe, American, Asian, Africa and other continents. The extracts of the plant have been reported to contain many a chemical constituent with potential activities such as epilepsy, anti-cancer, emetic, anti-bacterial, parasiticide, cough, anthelmintic, analgesic, haemorrhoid, anti-diabetic, anti-oxidant, fungal infection, anti-venom, anti-viral and wound healing activity, it is also known as a rich spring of glycosides, flavonoids and tannins. The principal aim of this review study was to explore the activities of *Acalypha indica Linn* with a special emphasis on its chemical components and ethnomedicinal uses. Data on this study were assembled from electronic books, Google Scholar, PubMed, Science Direct and Research entryway. By bringing together these facts, we concisely reviewed about the medicinal properties and therapeutic activities establish its importance as a valuable medicinal plant.

Keywords:*Acalypha indica*, Phytochemical constituents, Ethnomedicine, Uses, Activity.

INTRODUCTION

Medicinal plants comprise a natural reservoir for medication system in human wellbeing both in developing and least developed countries nationwide (Ahmed, 2012). Medicinal plants may be described as any kind of plants that contain bioactive ingredients for curative purposes and which are precursors for the synthesis of useful drugs (Sofowora, 1982). Plants are natural products and vital sources of potentially valuable substances for the development of novel curative agents. They are easily accessible and possess ability to work synergically to affect a wide-range of diseases with fewer undesirable effects compared with conventional ones. Despite all the advancement in synthetic chemistry and biotechnology, plants still remain as one of the best reservoirs of new compounds for both preventive and healing.

Acalypha indica Linn is a small herbaceous plant of Euphorbiaceae family believed by traditional communities in many countries as a medicinal plant efficacious for treating various diseases. The extracts of the whole plants, stems, leaves, roots and flowers parts are used for medicinal purposes to treat various diseases such bronchitis, snake bites, rheumatism, pneumonia, asthma (Singh, 2006), scabies, anti-parasiticide, eye infections, respiratory problems, lowering of blood sugar level and as well as in the

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treatment of scabies and other skin diseases (Chopra, 1996).

Acalypha indica Linn develops well in most wet, tropical and temperate countries in Asia, Europe and both North and South American regions. It can also be found in most parts of west and south of Africa. It grows as a weed in bushes, backyards, alongside roads and other places such as home and crop premises (Dineshkumar*et al*., 2010).

Several comprehensive articles on *Acalypha indica* were issued from Indian province as this plant has a close link with Ayurveda medicinal practices conducted by ancient Indian age groups. The numerous medicinal properties and therapeutic uses of *Acalypha indica* as well as its photochemical analyses prove its importance as a valuable medicinal plant. In English it is known as Indian Copperleaf, Indian Mercury, Indian Nettle or Three-seeded Mercury and as well synonymous to Acalypha chnensis Benth (Sivasankari*et al*.,2014).

Many pharmacological activity researches have been efficiently taken to show the efficiency of *Acalypha indica* in treating diseases including anti-inflammatory, anti-viral, antihelminthic, post-coital anti-fertility, molluscicide activity, antihypertensive, anti-inflammatory, antipyretic, analgesic, antibacterial, antituberculosis, antioxidant, anti-bacterial and anti- fungal (Soruba *et al*., 2015; Ali *et al*., 1996; Rajsekhar, 2011), antioxidant, stomach-ache, liver and kidney cleaning, Bronchitis (Schmelzer, 2008). and other pharmacological activities. The results are also supported the fact that this plant contains phytochemical compounds responsible for pharmacological activities.

Morphological Characteristics

Acalypha indica is an herbaceous annual plant with inflorescences like catkin and involucres of cup-shaped surrounding the minute. Its root is known for being eye-catching to domestic cats, and for its a variety of medicinal benefits. It is generally found in the Tropics (Schmelzer and Gurib-Fakim). *Acalypha indica* plant possesses few branches, which are angled and pubescent; the foliages are largely ovate, extend beyond 3-5 cm with serrate edges and arranged pinnately; stipules are very tiny; flowers are sessile, present on erect axillary spikes and grow longer than the leaf; male flowers are small, full and distally arranged; the stamens of female flowers are scattered along with inflorescence axis, where each one is subtended by a conspicuous semicircular foliaceous toothed green bract; the capsules are hispid and about 1 mm wide with 3-locular (Stone, 1970).

Figure 1: *Acalypha indica Linn* in natural habitat

Taxonomic Rank of *Acalypha indica* (Cardiel*et al*. 2017).
Kingdom:*Plantae* - Plants
SubKingdom: *Tracheobionta* - Vascular plants
SuperDivision: *Spermatophyta* - Seed plants
Division: *Magnoliophyta* - Flowering plants
Class: *Magnoliopsida* - Dicotyledons

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SubClass: *Rosidae*
Order: *Euphorbiales*
Family: *Euphorbiaceae* Juss. - Spurge family
Genus:*Acalypha* L. - Copperleaf
Species: *Acalyphaindica Linn.*

Geographical Distribution

Acalypha indica is found in the Arabia Gulf region based on the report that they consumed this plant as a food (Marwah*et al*., 2007). It is also a common weed found in the Southern region of Nigeria and West Africa (Burkill, 1994). Schmelzer (2008) reports ranks of lofty distribution mainly in Africa from the central part of equator down to the southern of Africa through Kenya, Ethiopia, Democratic Republic of Congo, Sudan, Somalia, South Africa, Zambia, Tanzania, Mozambique, Nigeria and many others (Sudhakar*et al*., 2020). The Indians have the majority of documentation of plant utilization for their traditional medicines (Martin, 1995; Savithramma*et al.,* 2007). Meanwhile, many Australians recognized this plant in their area but are less inclined to consume.

Phytochemical Constituents in *Acalypha indica*

Acalypha indica Linn has a broad range of nutrients such as proteins, carbohydrates, lipids, and vitamins. It also contains certain group of heavy metals and high quantity of copper, zinc, nickel, iron and chromium which are valuable for people with mineral deficiencies problems. This plant has a high moisture content of up to 90% and a total ashes value of 18% suitable for body hydration (Takle *et al*., 2011).

The various phenolic compounds derived from this plant such as corilagin, geraniin, glucogallin and chebulagic acid were useful as antioxidants. (Joy *et al*, 2012) stated that there were five compounds from the ethanolic leaf extract of the leaves which acted as antioxidants. Ellagic acid, gallic acid, 16 α, 17-dihyroxy-entkauran 19-oic-acid, 4,4′,5,5′,6,6′ hexahydroxydiphenic acid and kauren- 18-oic-acid can be found inside this plant (Sanseera *et al.*, 2012). Active inhibition of anti-cancer activity against small cell lung and breast cancer by the quebrachitol compound was found in the leaves. This compound is responsible for healing respiratory problems such as bronchitis and asthma. The phytochemical constituents of the whole plant was reported to contain Acaindinin and Acetonylgeraniin (Ma *et al*., 1997); leaf extract contained Corilagin (Ma *et al*., 1997) Ferulicacid (Rajsekhar and Azhar, 2011) and Aurantiamide (Raj *et al*., 2000) while the root was reported to have contained Stigmasterol (Raj *et al*., 2000), 3,3' Methylene bis (4-hydroxyl coumarin and Syringic acid (Rajsekhar and Azhar, 2011).

Some earlier study on this plant revealed that ethanolic extract of *Acalypha indica* has identified the following phytocomponents; 4-Amino-3-methoxypyrazolo[3,4-d]pyrimidine ($C_6H_7N_5O$), Propanenitrile,3-(5-diethylamino-1-methoxy-3-pentynyloxy)-, 3,8-Nanodiene-2-one,(E)- ($C_9H_{14}O$), 1H-Pyrrole-2,5-dione,1-ethenyl- ($C_{13}H_{22}N_2O$), 1H-Pyrrole-2,5-dione,1-ethenyl- ($C_6H_5NO_2$), Proline,3,4-didehydro- ($C_5H_7NO_2$) compounds (Chandra Mohan *et al*., 2012).

Acalypha indica has great potential as it has been used empirically to treat diseases and is scientifically proven to possess biological activities related to its utilization in traditional medicine. Scientific efforts have been made for further new formulation development from this plant to cure various disease condition (Table 1).

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Table 1: Some Phytochemical compounds isolated in *Acalyphaindica*

Compound	Type	Plant part	Biological Property	References
3,8-Nanodiene-2-one,(E)-	Acetyl	Whole plant	-	Hussain and Kumaresan, 2013
2-methyl tricosane	Acyclic Alkane	Whole plant	-	Suri *et al., 2004.*
Rescinnamine	Alkaloid	Leaf	Antihypertensive action	Schmitt, 1968
Pergolide sulfone	Alkaloid	Leaf	Acted as dopamine receptor inhibitor	Wong *et al.,* 1993
Pergolide sulfone	Alkaloid	Leaf	Acted as dopamine receptor inhibitor	Usmanova, 1980
Lupinine	Alkaloid	Leaf	Anti coagulant in the form of artificial polymer. Binds to the nicotinic and muscarine acetylcholine receptors	Usmanova, 1980
Ambelline	Alkaloid	Leaf	Antiproliferative	Ravi S *et al*., 2017
Acalyphin	Alkaloid	Leaf, flower		Nahrstedt*et al., 1993*
Emedastine	Benzimidazole	Leaf	Anti-histamine and H1 receptor inhibitor	Murota, 2009
2,4-bis(1,1-dimethylethyl) phenol	Alkylated phenol	Leaf		Teklani*et al*., 2017
Dihydroxyaluminumaminoacetate	Aluminiumglycinate	Leaf	Used in the treatment of stomach ulcers and gastritis	Kokot, 1989
Traumatic acid	Dicarboxylic acid	Leaf	Antioxidant; Enhances collagen biosynthesis; Growth factor for algae	Van Overbeek J. Traumatic, 1940
3,3' Methylene bis (4-hydroxyl	Coumarin	Leaf	Anticancer	Zhang W *et al*., 2017

Ethnomedicinal Uses

A number of earlier study on *Acalypha indica* showed that it is of immense significance and has been made use of by the local indigenous people in many continents to treat a variety of diseases and ailments. The followings are the ethnomedicinal uses as reported by earlier studies(Table2).

Table 1: Ethnomedicinal uses of *Acalypha indica Linn* from different parts of the plant

Diseases	Part of plant part utilized	References
Anthelmintic	(i). Paste from the leaf and lime juice (ii). Dry leaves powder (iii). Decoction with garlic	Chandra*et al*., 2012
Utricaria	Decoctions from the whole plant and seed oil from *Ricinus communis* are mixed together and rubbed over the affected part.	Sunil and Lalit, 2021
Epilepsy	Grinded leaves with garlic, pepper and leaves of Leucas aspera, extract given orally and leaves mixed *Cardiospermumhalicacabum* and boiled in *Azadirachtaindica* oil. Extract is consumed	Reddy *et al*., 2010.
Vomiting	About 2-3ml extract from fresh leaf is taken 2 times daily	Sunil and Lalit, 2021.
Diarrhoea	Leaves, roots and seeds are used	Das *et al*., 2012.
Dental problem	Stem is used as chewing stick	Sunil and Lalit, 2021
Muscular strain	Leaf paste is made into a ball-shape. The paste is then applied	Saha and Ahmed, 2011.

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	on to the rectum to relax the sphincter to give relief motions.	
Dermatology ailment	Leaf juice, Paste is prepared by using leaves and black Cuminum, it is then applied as a balm	Paindla and Mamidala, 2014.
Asthma	50ml of the leaf's decoction is taken daily, for a week by mouth.	Savithrammaet *al*., 2007.
Anti-parasite	Mix the blended leaves with either table salt, lime juice or quicklime and applied externally.	Mohan *et al*., 2012
Hemorrhoids	blended leaves and leaf decoction	Ribeiro *et al*., 2010
Expectorant	Total plant	Jayaprakasam and Ravi, 2013.
Wound healing	Blended leaves with *Ficus benghalensis*, *Morus alba* and *Tridax procumbens*	Basha and Sudarshanam, 2011
Joint pains	Leaf decoction used as massage cream or Poultice of leaves and stem.	Schmelzeret *al*, 2008
Purgative	Tea from boiled plant is taken	Colley, 1978
Dog bite	Paste of leaf with lime is applied on bitten area two times daily for 3-4 days	Mahishiet *al*., 2005
Emetic	Juice from leaf	Sinhababu and Banerjee, 2016
Bronchitis	Combined leaf infusion with tuber infusion of *Jumellea fragrans* (Thouars) Schltr. were sweetened with honey; leaf juice.	Sinhababu and Banerjee, 2016
Toothache	Extract from leaf is applied on the affected area.	Sunil and Lalit, 2021
Paralysis	Root paste (5 gm) is taken two. times in a day	Sunil and Lalit, 2021
Pneumonia	Leaf juice	Sinhababu and Banerjee, 2016
Laxative	Crushed leaves applied topically and infusion of leaves taken orally	Sinhababu and Banerjee, 2016
Itch, Scabies and Ringworm	Leaf paste and lime or table salt are mixed together and applied on the affected area.	Sunil and Lalit, 2021
Flatulence	Decoction of root mixed with ginger, pepper and honey	Neamsuvanet *al*., 2017
Hook worms, tape worms in children	Root decoction with ginger, honey and pepper.	Pushpangadan and Atal, 1984
Wound healing of animals and humans	(i) Grinded leaves are applied on wound; (ii) Paste from leaves with table salt is applied on wounded area; (iii) Leaves of *Acalypha indica*, *Mimosa pudica*, *Azadirachta indica* and flowers of *Albizzia lebbeck* made into paste and then taken orally once a day for 3 days; (ii) Leaf pastes prepared and then taken orally.	Ayyanar and Ignacimuthu, 2009
Parasiticide	Plant leaf mixed with quicklime or lime juice or table salt and then applied externally	Jayaprakasam and Ravi 2012
Ear ache	Juice of leaves is applied on to the affected side.	Jayaprakasam and Ravi 2012
Asthma and cough	Leaf extract (5 ml) is taken two times in a day.	Sunil and Lalit, 2021
Wound healing	Whole plant decoction or powder	Basha and Sudarshanam, 2011
Arthritis	Root extract (3-5 ml) is taken two times in a day.	Sunil and Lalit, 2021

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CONCLUSION

The information presented in this review study signify that *Acalypha indica* plants possess high probability to be transformed into herbal medicines. Further research on the improvement of extraction procedures for the plant concerning yield upgrading with green extraction practices increases its possibility of being manufactured on bulky scale. By Combining the accurate extraction procedure with on hand information on the activity, phytochemical constituents and traditional uses of *Acalypha indica* could augment the economic importance of this plant to a commercial herbal medicinal produce. Additionally, using this plant as an herbal medicine, aside from increasing self-reliance in terms of drug supply, it can also develop the economy of the agriculturalists in the future as well as enhance the value of the plant.

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