

# A updated review of *Acalypha indica* L. as traditional/ Ethnomedicinal plant and its pharmacological activities

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**Abstract**— *Acalypha indica* L., is an vital Indian medicinal plant and is broadly used in Traditional/Ethnomedicinal, Ayurveda, and Siddha to manage various diseases. It has a wide range of chemical constituents, pharmacological and medicinal applications. Various pharmacological tests have been carried out both in vitro and in vivo and phytoconstituents of medical importance have been identified. Many biological components in good yield and some mainly belonging to cyanogenic glucoside (acalyphin), tannins, flavonoids, pyranoquinolinone alkaloid (flindersin) have been shown to have beneficial biological activities. The extracts and chemical constituents of this plant have useful pharmacological activities. The key pharmacological activities of *Acalypha indica* are antivenom property and antiobesity activity. Several pharmacological studies of *Acalypha indica* have demonstrated their antioxidant, antimicrobial, antidiabetic, and antivenom in support of its traditional uses. Suggest a wide range of medicinal uses for cathartic, diuretic, anthelmintic, emetic, expectorant treatment. Therefore, this review contributes to the knowledge of *Acalypha indica* plant and their Traditional and ethnomedicinal use..

**Keywords**—Ethnomedicine, Antivenom, Antiobesity, *Acalypha indica*, Phytoconstituents.

## 1.INTRODUCTION

Before modern drugs began to take shape in the medical care industry, people were highly dependent on natural resources for treatment. However, civilization has changed and with it has come the introduction of more advanced methods, leading the next generations to tend to choose modern treatment over conventional treatments<sup>[1]</sup>. The knowledge and information related to conventional treatments are gradually vanishing since the previous generations are getting older and dying without successors. Most plants have been proven to be a rich source of phytocomponent. Herbal plants are recognized as a rich source of bioactive compounds<sup>[2]</sup>. More than 80% of modern drugs are derived directly from plant sources. Natural products derived from medicinal plants have a broad range of pharmacological activities. This knowledge is passed on to the upcoming generation via observation and oral teaching<sup>[3]</sup>. Hence, since traditional/Ethnomedicine therapies are an alternative way to treat human diseases, it is very important to have proper documentation from existing practitioners<sup>[4]</sup>. Conventional or traditional or Ethnomedical practices based on natural plants are recognized alongwith the World Health Organization as reliable sources of medical treatment<sup>[5]</sup>. Medicinal plants have been available around spreading along roads, settlements, backyards and in house compounds. They can be collected from the wild or some people can be seen growing them around their homes for personal use.

*Acalypha indica* is a traditional/ethnomedicinal plant that is well known by the older generation in various countries, especially in Asia and Africa. It is an annual herb, which has numerous long, angular branches, covered with soft hairs. It has thin ovate leaves with smooth surface. *Acalypha indica* is bitter to the taste. *Acalypha indica* has been traditionally used to treat several diseases like antivenom, infertility, wound healing, antioxidant, diuretic effects, bacterial infections, anti-inflammatory and cancer<sup>[6]</sup>. There is immense interest in this plant, which is evidenced by a huge research work. Therefore, a modern and comprehensive review of *Acalypha indica* covering its traditional and folk medicinal uses, phytochemistry and pharmacology<sup>[6]</sup> is presented.

## 2. Ethnomedicinal activity of *Acalypha indica*

The processing of *Acalypha indica* plant for ethnomedicinal purposes can be divided into three main parts; the whole plant, leaves and roots. The method of using this plant for treatment as a single application or in combination with other substances also plays an important role and needs to be discussed. Most of the practices come from people in Asian and African countries. Some in India are regular consumers of this plant as it is part of Ayurvedic practice. Meanwhile, other countries use this plant as part of their treatment, but the usage is limited. The state of the plant at the time of treatment, whether fresh or dried, may be a major factor in its therapeutic efficacy. Although the plant is known for its medicinal uses, some people consume the plant as a fresh leafy vegetable or as a fried flour snack<sup>[7]</sup>. The leaves are more abundant and easier to separate compared to the seeds, root, stem and flowers. There are two oral methods of consuming the leaves, either as a decoction or raw. Apart from that, this plant can also be used for external therapeutic applications such as constipation, dermatology ailment insect bites, pimples, antivenom<sup>[8-15]</sup>.

## 3. Phytochemical Constituent of *Acalypha indica*

The fresh *Acalypha indica* plant contains a variety of nutrients such as carbohydrates, proteins, vitamins and lipids. They decided to prepare its documentation by observing the content of essential and non-essential heavy metals in detail as part of the herbal standardization preparation. *Acalypha indica* is high in iron, followed by copper, nickel zinc and chromium, which are beneficial for patients with mineral deficiencies. The plant has a high moisture content of up to 90% and a total ash value of 18%<sup>[16]</sup>, which is suitable for body hydration. As a leafy low-cost vegetable, this plant can provide a high balance of nutrients at a low cost. The researchers studied and listed the secondary metabolites in *Acalypha indica* plant parts. These studies show the relationship between the ethnomedicinal practices and the respective parts of the plant. The list of phenolic compounds obtained from this plant included geranin, glucogalin, corylagin, and sepulagic acid which were effective as antioxidants. Meanwhile,<sup>[17-26]</sup> reported that five compounds from the ethanolic leaf extract of the leaves acted as antioxidants. Ellagic acid, gallic acid, 16  $\alpha$ , 17-dihydroxy-endkauren 19-oic acid, 4,4',5,5',6,6' hexahydroxydiphenic acid and kauren-18-oic acid were found in this plant<sup>[27]</sup>. The compound quebrachitol compound found in the leaves has been shown to have anticancer activity against small cell lung and breast cancer. This compound is responsible for the treatment of respiratory problems such as bronchitis and asthma.

## 4. Antimicrobial activity of *Acalypha indica*

Most of the therapeutic studies conducted on *Acalypha indica* are related to antibacterial activities. There are discrepancies in the identification of the inhibition method, protocol, positive and negative controls and test preparation because the studies differ from each other. The classification to determine whether the extract is active or inactive requires justification. One of the classification methods is to measure the diameter of the inhibition zone. From the diameter, a smaller number indicates inactive or slightly active activity, while a higher number indicates more active<sup>[28]</sup>. Then, the results are expressed in the form of percentage inhibition, where 0% to 40% is considered weak, 41-70% is active and more than 71% inhibition is highly active. The specific phytochemical compounds in *Acalypha indica* responsible for bacterial inhibition have not really been discussed by most researchers. They have only discussed a specific group of phytochemicals in the plant that are responsible for antibacterial activities and have not explained the mechanism of inhibition. However, they have narrowed down the specific phytochemical groups involved in bacterial inhibition as explained<sup>[29]</sup>. Besides, tannin, flavonoids, polyphenol, saponin and protein play a vital role in inhibiting and delaying bacterial growth<sup>[30-44]</sup>. Eight types of fungi (*Aspergillus fumigatus*, *Aspergillus flavus*, *Aspergillus niger*, *Candida glabrata*, *Candida albican*, *Microsporum canis* *Candida tropicalis*, and *Penicillium chrysogenum*) were used to test whether *Acalypha indica* has

antimicrobial properties; these experiments were conducted<sup>[45,46]</sup>. Nine solvents including hexane, diethyl ether, petroleum ether, chloroform, acetone, ethyl acetate, methanol, ethanol and water were used to extract the compounds inside *Acalypha indica*.

### 5. Anti-cancer activity of *Acalypha indica*

As reported<sup>[47,48]</sup>, *Acalypha indica* extracts were tested against four types of cancer cell lines including KB-oral cancer, MCF7-breast cancer. The anticancer activity was determined by Resazurin and MTT assay. Two standards were used in the assay to compare ellipsin and doxorubicin. KB-oral cavity cancer and MCF7-breast cancer were considered inactive with the methanolic extract because the inhibitory concentration exceeded 0.05 mg/ml<sup>[47]</sup>. Sanseera et al.,<sup>[47]</sup> reported that quebrachitol isolated from *Acalypha indica* was the phytochemical responsible for its anticancer activity against NCI-H187-small cell lung cancer. The similar phytochemical content in methanolic and ethanolic extracts led to both extracts having anticancer properties. These results indicate that *Acalypha indica* may be applicable as a natural anticancer drug for some types of cancer.

### 6. Antidiabetic activity of *Acalypha indica*

Furthermore, the whole plant of *Acalypha indica* has potential as an antidiabetic agent when used therapeutically. Phytochemicals from hexane, acetone, petroleum ether, chloroform, and a mixture of methanol and acetone extracts showed some significant activities in relevant assays. Nandakumar et al.,<sup>[49]</sup> found that hexane and chloroform extract inhibited alpha amylase activity by 84.51% and 75.32%, respectively. Amylase is an enzyme that catalyzes and hydrolyzes starch into sugar. If the sugar level increases, it can cause diabetic problems in humans. The continuation of the study was carried out by<sup>[8,9]</sup> through in vivo tests on rats. Both used a diabetes induction method in rats before the plant extract was orally administered, and blood sugar levels decreased by at least 25% after the plant extract was administered, followed by a decrease in cholesterol, urea, and triglycerides levels after five hours. Streptozotocin was used to rapidly destroy pancreatic  $\beta$  cells, which led to a decrease in glucose-stimulated insulin release and resistance. These are relevant features for type II diabetes studies in rats. The ability of the plant extract to prevent the destruction of pancreatic  $\beta$  cells will determine whether the herb is effective or not. In this case, the entire *Acalypha indica* can be used as an herb for anti-diabetic activity. These data support the use of *Acalypha indica* as a blood sugar lowering agent by some people in India<sup>[50]</sup>. In their practice, only the root is used to treat high blood sugar levels, but in studies, the whole plant has been shown to be more effective. This may be owing to the root containing a smaller amount of cyanogenic phytochemicals compared to the aerial part<sup>[51]</sup>.

### 7. Antiobesity activity of *Acalypha indica*

Two types of experiments have been conducted to study the anti-obesity properties of *Acalypha indica*<sup>[52,53]</sup>. Sathya et al.,<sup>[53]</sup> conducted a study on albino Wistar rats using different concentrations of ethanolic extract for 28 days as assessed by weight. They reported that there was no significant increase in the weight of the rats during the experiment. Rajasekaran et al.,<sup>[52]</sup> improved the study by using ethanolic extract on albino Wistar rats fed a high-fat diet. The mean body weight of rats on the tenth day was measured to compare the standard (simvastatin) and 400 mg ethanolic extract. Both groups increased by 24.14% and 24.61% after feeding the atherogenic-induced diet, while the group of rats fed the atherogenic-induced diet alone had a higher value of mean body weight percentage (29.56%). The ethanolic extract exhibited similar results to the standard drug used in the experiment. The flavonoid in *Acalypha indica*, such as quercetin, also played a role as an anti-obesity drug<sup>[54]</sup>.

### 8. Antioxidant activity of *Acalypha indica*

The 2,2'-Acino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), 2,2-diphenylpicrylhydrazyl (DPPH) and xanthine oxidase assays are used to test the antioxidant activities of various *Acalypha indica* extracts from a specific plant part. As a result, these antioxidant studies are highly inconsistent and questionable. For example, hexane extraction results showed antioxidant values ranging from zero to very strong activities<sup>[55-74]</sup>. The data are not reliable, but still noteworthy as a reference for future studies. The entire plant has antioxidant activities, especially the phytochemicals of semi-polar and polar groups. Further studies are required to improve the antioxidant activity results of non-polar phytochemicals. Antioxidant phytochemicals play an important role in the treatment of some diseases such as wound healing, rheumatoid arthritis, diarrhea which are practiced by most people.

### 9. Antivenom activity of *Acalypha indica*

Shirwaikar et al.,<sup>[75]</sup> found that antivenom derived from *Acalypha indica* can treat *Daboia russelli* venom (Kannaadi viriyan). By studying venom-induced death, necrotizing, hemorrhage, and mast cell lysis in mice, 750 mg/kg ethanolic extract increased the survival rate by up to 100%, more than antivenom. Later, Rajendran et al.,<sup>[76]</sup> studied other extracts from benzene, chloroform, petroleum ether and acetone against similar snake venoms. The results showed that 500 mg/kg increased the survival rate of Swiss albino mice. The more polar phytochemicals were extracted, the higher the survival rate. Meantime, petroleum ether, benzene, chloroform and acetone increased the survival rate to 25%, 37%, 37% and 87% respectively. The antioxidant activity of the extract is one of the mechanisms for inactivating and blocking the venom<sup>[77]</sup>. The *Daboia russelli* snake is found in Asian countries, especially India, Nepal, Bangladesh, Sri Lanka, Myanmar and other countries in this region<sup>[78]</sup>. From the studies conducted<sup>[75,76]</sup>, people living in the area can use emergency antivenom before taking the patient to the hospital. Since the plant grows as a weed, it is easily found in most communities and cities.

### 10. CONCLUSION

This review updates the information of *Acalypha indica* studies from the whole parts from numerous aspects like as Traditional/ ethnomedicinal practice, phytochemical content, and pharmacological activities. The use of *Acalypha indica* as an ethnomedicinal herb has been discussed and identified along with the relevant pharmacological studies and phytochemical contents. The plant is applicable for treatment depending on the therapeutic activities. The preferred part of the plant for ethnomedicinal practice is its leaves and root. Antioxidant, Anticancer, antimicrobial, antidiabetic, antiobesity and antivenom properties are the most potential therapeutic treatments. The present review shows the pharmacological study of *Acalypha indica* and the various phytochemical compounds attributed to it. The whole plant of *Acalypha indica* has been used in traditional medicine and ethnomedicine for decades and the studies carried out have recognized the medicinal practices. However, more clinical and pathological studies need to be antivenom activity conducted to explore the unexploited potential of the plant.

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