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Phytomorphological, chemical and pharmacological discussions about *Commelina benghalensis* Linn. (Commelinaceae): A review

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Abstract

Now a day's herbal medicines are taking the leading positions in the healthcare system. It was the essential driving force for better treatment from ancient time. *Commelina benghalensis* Linn. belongs to Commelinaceae family is an annual herbaceous weed commonly known as Bengal Dayflower. These plants are found in tropical and temperate parts of the world along with India. The plant is a herbaceous weed with typical morphological characteristics features. The main phytochemicals found in this plant are polyphenols, flavonoids, tannins, and alkaloids. Review of the literature suggested that the various parts of the plant are reported to have some significant therapeutic activities like anti-microbial, anti-cancer, anti-inflammatory, anti-oxidant, anti-diarrheal, anthelmintic, fertility inducing, anti-viral, anxiolytic, hepato-protective, anti-urolithiasis, analgesic, thrombolytic, sedative and larvicidal properties. The present review study deals with the morphological, phytochemical, pharmacological, therapeutic, nutritional and some other biological aspects of *Commelina benghalensis*. This review work may help get overview ideas about the studied plant.

Keywords: *Commelina benghalensis*, medicinal weed, phytochemical, pharmacological

Introduction

Traditional medicines play a crucial role in treatment services all around the world. From the ancient era of human civilization all over the globe relies on plants for curing different health issues. Scientists and medical professionals showed increased interest in this field as they established the real health benefits of these treatments. The herb *Commelina benghalensis* (Figure 1) from the Commelinaceae family is one of the essential folkloric medicinal plants that have been used for a long time. This plant is being used as a part of the traditional medicinal system for different diseases. It has been used for the treatment of pain, constipation, headache, leprosy, fever, snake bite and jaundice [1-3]. The broad range of therapeutic and nutritional values of the plant has also been reported [4]. The plant is native to tropical Asia and Africa. In the Indian subcontinent, it is used as an herbal medicine for the treatment of a variety of diseases. This plant is used for mouth thrush inflammations, psychosis, epilepsy, nose blockage, insanity and exophthalmia [5-7]. In Chinese treatment system, *Commelina benghalensis* is used medicinally as a diuretic, febrifuge, laxative and anti-inflammatory agent [8, 9]. Some important phytochemicals such as n-octacosanol, n-triocosanol, stigmaterol, campesterol, hydrocyanic acid have been isolated from both the vegetative and flowering parts of the whole plant. The plant has been proved to be a potential source for pharma phytochemistry study for industrial purposes as well [10, 11].



Fig 1: The Plant of *Commelina benghalensis* Linn

Taxonomical Classification

| | |
|------------|-------------------------------|
| Domain: | Eukaryota |
| Kingdom: | Plantae |
| Phylum: | Spermatophyta |
| Subphylum: | Angiospermae |
| Class: | Monocotyledonae |
| Order: | Commelinales |
| Family: | Commelinaceae |
| Genus: | <i>Commelina</i> |
| Species: | <i>Commelina benghalensis</i> |

Botanical Name: *Commelina benghalensis* Linn.

Common Name: Bengal Dayflower/ Tropical Spiderwort/
Wandering Jew

Vernacular Names

| | |
|------------|--------------------------------|
| Bengali: | Kanshira/ Kanaibashi/ Dholpata |
| Hindi: | Kana/ Kankawa |
| Kannada: | Hittangani |
| Malayalam: | Kanankoai/ Kanchatam |
| Manipuri: | Wangdenkhoibi |
| Marathi: | Kena |
| Nepali: | Kane |
| Sanskrit: | Kanchata/ Kosapuspi |
| Telugu: | Neerukaassuvu |

Synonyms: *Commelina kilimandscharica*, *Commelina obscura*, *Commelina pyrrohoblepharis*, *Commelina rufociliata*, *Commelina uncata*.

Botanical Morphology

Habitat

Commelina benghalensis is an annual or perennial medicinal herbaceous weed that has been found on forest edges, roadsides, waste places, settled areas, crop fields and home gardens or lawn (Figure 2). Vegetation, growth, and flowering occur optimally between 20-40 °C.



Fig 2: Natural Habitat of *Commelina benghalensis* Linn.

Growth

Commelina benghalensis is an erect or prostrate herbaceous weed. It is large and meanders herb that appears once every year and reaches a height up to 50 cm long and has a firm root (Figure 3) with basal nodes. The stem is glossy or hairy.



Fig 3: Stem and Root

Foliage

Leaves (Figure 4) are ovate to lanceolate or elliptic, 3-8 cm long, 2-5 cm wide, with parallel venation, entire margins, and pubescence on top and bottom. The leaf sheath is covered with red color and often white hairs at the apex which is a primary identification characteristic for this plant species.



Fig 4: Leaves

Flowers

This plant species is characterized by attractive and small bluish-violet flowers (Figure 5). Flowers are produced in spathes or clusters, funnel-shaped, fused, 8-22 mm long, 9-16 mm wide, and peduncles 1.5-4 mm in length. Aerial flowers are staminate, with three petals 2-5 mm long. Upper two petals are blue or lilac, and lower petal lighter or white and less prominent.



Fig 5: Flower

Seeds

Seeds are rectangular, 1.5-3.5 mm in length, 1.5-2 mm wide, brown or black, and have a netted [12-18].

Genetics

Chromosome number of *Commelina benghalensis* Linn. is reported to have $2n=22$ [19].

Agricultural and Chemical Impact

Commelina benghalensis occurs as a weed in agricultural sites in 25 different crops in 28 countries [20]. This weed has gained high importance in peanut and cotton cultivation in the Southern United States and the North China Plain in crops such as potato (*Solanum tuberosum*) and summer corn (*Zea mays*) [21-25]. It is also commonly associated with wet locations. Two commonly used herbicides, which are used in the USA, also gave excellent residual activity on this plant. The most effective herbicide control strategies for the weed involve combinations of both pre-emergence and post-emergence conventional herbicides [26-28].

Traditional Applications

Commelina benghalensis is reported to have well known

therapeutic properties. Phytochemical constituents obtained from the extracts of this plant have shown critical pharmacological activities, and hence the plant decoctions are used for the treatment of various diseases. The plant is used for the treatment of night blindness, headaches, toothaches, cataracts, conjunctivitis. The extracts of the plant also used in the various skin diseases such as acne, scabies, eczema, warts, sleep disorders and mental illness in many areas of the world. The stem extract of the plant is used for wound healing, and it is also used as a laxative, diuretic, anti-inflammatory, and febrifuge. This plant is also found to be used as a folk medicine for treating infertility in women, in Lesotho and Cameroon. The plant has reported to possess anti-microbial, anti-diabetic, sedative, anti-oxidants, anti-fertility, anti-cancer, and hepato-protective activities [29, 30].

Phytoconstituents

Commelina benghalensis showed the presence of polyphenols, salicylic acid, p-coumaric acid, 8-hydroxyquinoline, caffeic acid, quinolones, catechol, resorcinol, tannic acid, chlorogenic acid, flavonoids, astringents, saponins. While the flower showed the presence of the highest amount of anthocyanin is cyanidin 3, 7, 3-triglucoside which is acylated with caffeic acid. Hydroxycinnamic acids, the flavones C- glycosides, flavonol O-glycosides are present in the plants. Quercetin is being the most frequent aglycone in the plant [31- 33].

In previous research investigation revealed the presence of an alkanol and sterol with a mixture of n-octacosanol, n-triacontanol, and n-doctriacontanol in the alkanol and stigmasterol, beta-sitosterol and campesterol in sterol. Lutein and zeaxanthin pigments contents were also reported in another study. High concentrations of carotenoids were also found in this plant. The presence of nutraceuticals like vitamin C, proteins, calcium, and iron are also present. Phytoconstituents such as alkaloids, carbohydrates, phytosterols, saponins, polyphenols, tannins, flavonoids, and glycosides were also reported in some research investigations [34- 36].

In a previous research study, the pigments of *Commelina benghalensis* along with some other traditionally used medicinal plants were estimated. The study showed that total chlorophyll content was 2.142 ± 0.024 mg/g tissue and total carotenoids content was 0.978 ± 0.015 mg/g tissue in this ethnomedicinal plant. From other plant pigment research studies concluded that the plant pigments content might differ due to several environmental or other biogeochemical or ecological factors such as effects of air pollution and it can be varied with seasonal changes as well. The bioactive contents may fluctuate due to different solvents and plant parts also [37- 40].

Physico-Chemical Parameters

Commelina benghalensis leave exhibits following proximate characteristics such as total ash 25.02%, acid insoluble ash 9.03%, and water soluble ash 12.14% w/w. The leaves showed various extractive values in hot extraction such as petroleum ether soluble extractive 2.99%, ethanol soluble extractive 12.56% and water-soluble extractive 22.33% w/w and moisture content is 13.33% w/w (Loss on drying at 105 °C) [17].

Pharmacological and Therapeutic Activity Analgesic and Anti-inflammatory Activity

An ethanolic decoction of *Commelina benghalensis* roots was pharmacologically investigated to evaluate analgesic activity

by acetic acid-induced writhing and by hot-plate and tail-flick tests in animal models. Anti-inflammatory properties were also investigated by using the carrageenan-induced mice paw edema model. The experimental results concluded that the ethanolic decoction possesses significant analgesic and anti-inflammatory properties [1].

Anti-bacterial Activity

In a research study, the plant was shown the potential anti-bacterial property of ethanol, petroleum etheric, diethyl ether, and methanol and water decoctions. It was observed that the plant possess the highest activity against strains like *Staphylococcus saprophyticus*, *Staphylococcus aureus*, *Enterococcus faecalis*, *Staphylococcus pyogenes*, *Streptococcus agalactiae*, *Salmonella typhi*, *Escherichia coli*, *Shigella boydii*, *Shigella dysenteriae*, and *Pseudomonas aeruginosa*. The zone of inhibition was shown with almost all bacterial strains with some specific exceptions. Minimum inhibitory concentrations of the decoctions were found to be significant [41].

Anti-cancer Activity

A research study was carried out to demonstrate the anti-cancer properties of the plant decoctions. The decoctions exhibited a dose and time-dependent inhibition of cell proliferation, followed by a decrease in cell viability. Real-time quantitative polymerase chain reactions and western blot analyses of Bax, Bcl-2, and p53 showed aberrant expression of these genes under different treatment situations. The data concluded that the crude methanol decoctions of the plant contain biomolecules that can be beneficial in the treatment of malignant growths [42].

Hepato-protective Activity

It was observed that alcohol consumption could result in hepatic diseases and it is established that several medicinal plants are used to treat such health disorders. From a research study, it was observed that both alcohol and water decoctions showed prominent hepato-protective properties against paracetamol-induced hepatic tissue damage. Both water and alcoholic decoctions of the plant showed significant hepato-protective property against paracetamol-induced hepatic damage. Alcohol decoctions appear more effective than water decoctions [43].

Anti-oxidant Activity

In a research study, the anti-oxidant property of *Commelina benghalensis* found a positive correlation with total polyphenols. This plant is the vital source of dietary anti-oxidants and possesses high anti-oxidant properties which prevent oxidative damages, reduces the process of cell aging, and slows down the chances of cancer and other cardiovascular or neurological diseases. In another experiment, methanol decoctions from the leaves show to be rich in anti-oxidants due to the presence of polyphenols which neutralize free radicals and for this reason, it can be used in pharmaceutical and nutritional industries [44, 45].

In a study, aerial parts extracted with acetone and methanol showed potential anti-oxidant properties. Reactive oxidative species and oxidative stress increase the chances of diseases like diabetes, cancer, heart diseases, autoimmune diseases, cell aging, and neurological diseases. The anti-oxidative potentiality of this plant prevents such diseases. Presence of polyphenols, flavonoids, protocatechuic acid, vanillic acid,

ferulic acid, apigenin, and kaempferol suggests that this plant have significant anti-oxidant properties [46-48].

Larvicidal Activity

Dengue fever is a significant health disorder in several parts of the world which spreads to people from vector *Aedes aegypti*. Petroleum ether decoctions of *Commelina benghalensis* showed a mortality of 80% mosquito larvae in 24 hrs due to the presence of polyphenol, flavonoids, resins, and other bioactive metabolites [49].

Anti-urolithiasis Activity

Urolithiasis is one of the universal health ailments in present day's scenario. In this disorder, calculi are produced in the urinary system. In the future, it turns to form stone in the kidney, bladder, and urethra and the gall bladder. Water and alcohol decoctions of leaves showed significant anti-urolithiasis activity against the reference standard cystone by *in vitro* model. In the study, water decoctions showed a higher percentage of dissolution than alcohol decoctions [50].

Anti-diarrheal and Anthelmintic Activity

In study methanol decoctions of the plant, parts were investigated for anti-diarrheal and anthelmintic activities. It was observed that a dose-dependent methanol decoction took a maximum of 22 min for doing the paralysis and an hour for total death of the parasites. The methanol decoctions smothered the propulsive movement of charcoal through the gastrointestinal tract, which provides high chances to prevent diarrheal situations [51].

Fertility-Inducing Activity

Commelina benghalensis is being used as an ethnomedicine for the treatment of female infertility. From a research study, it was observed that the leaves decoction of this plant appears to possess properties that can be cure infertility in women [52]. Another study showed that decoction could prevent testicular toxicity induced by environmental toxic substances and so it is a potential source for the treatment of male infertility as well as [53].

Thrombolytic Activity

Thrombosis is an important health, and thrombolytic therapy is used to dissolve the blood clot. A research study was carried out to evaluate the thrombolytic activity of the plant by using methanol decoction which showed to have significance at 40.94% taking standard streptokinase which is about 75% of thrombolytic activity [54].

Sedative and Anxiolytic Activity

From a research investigation it was concluded that among four different fractions like chloroform, pet ether, *n*-butanol and hydromethanol of the aerial parts of *Commelina benghalensis*, chloroform and pet ether soluble fractions possesses strong sedative and anxiolytic potential. These fractions could have critical therapeutic applications for the treatment of anxiety along with related neuropsychiatric ailments [55]. The substantiation obtained from that study may justify the use of this plant in folkloric medicine for the treatment of excited mental disorders like psychosis, insanity, epilepsy [56]. The plant also contains alkaloid and flavonoid, and it is thought that the sedative and anxiolytic properties are due to the interaction of flavonoids with the GABA or benzodiazepine receptor complex in brain [2].

Anti-viral Activity

The inhibitory effects of *Commelina benghalensis* against dengue virus serotype 2 using five different fractions extracted by methanol, ethanol, chloroform, *n*-hexane, and benzene was carried out, and fractions showed significant prophylactic activities against the virus [57].

Anti-diabetic Activity

In a previous research study, methanol decoction of the whole plant showed significant anti-diabetic property in an animal model. The tested biochemical parameters also reduced in the experimental animals due to applications of plant decoctions. The significance of the research investigations was shown in a treatment of 21 days [58].

Toxicity Studies

Toxicity of a plant is an essential area of medical and biological science and for medical practitioners as well. The acute toxicity study of the plant was carried out as per the Organisation for Economic Cooperation and Development (OECD) guidelines. The cytotoxic assay was carried out to determine the toxicity properties of this plant by using the Brine Shrimp lethality test for 24 h. The result of the study showed the median lethal concentration (LC₅₀) that is the 50% mortality was observed [54, 59].

The methanolic decoction showed significant cytotoxic effects against the brine shrimp test at a concentration of 278.68 µg/ml where vincristine sulphate was used as the positive control and DMSO was used as the negative control in this assay. Sub-acute toxicity study was performed according to the standard protocol [60, 61]. Three groups were used for the study, and each was containing six female rats (130-150 g). Group I was used as control and groups II and III received 200 mg/kg and 400 mg/kg of the decoctions, respectively. Single daily dosing was given for 14 days. Initial and final body weights, water and food consumptions, state of fecal matter, body temperatures and mortality rate were continuously examined. The animals were sacrificed on the 15th day. Hematological and serum biochemical parameters were also investigated using automated cell counter and automated vet analyzer, respectively. In another research study, hydroalcoholic decoctions of leaves did not show any toxic reactions and mortality even with a high dose of 2000/kg of body weight [62].

Conclusion

Commelina benghalensis Linn. showed a bit of genetic variability as the plant contains a small number of chromosomes and closed breeding system [4, 19, 63]. Several species of the plant are also widely available in tropical Asia, Africa, and China [22]. Different research studies were carried out on this medicinal herbaceous weedy plant, and it was having showed high pharmacological and therapeutic properties with tremendous pharmaceutical and nutraceutical values. It has been observed in earlier studies that whole part of the plants specifically the leaves and the stem contains many different active and non-active phytochemical constituents that have a wide range of therapeutic values [64, 65]. The review study also overviews on the various ethnomedicinal, biological, taxonomical and other prominent biological or biochemical features of *Commelina benghalensis*. The phytochemical, ethnomedicinal and pharmacological study showed the usefulness of the plant in clinical studies and for the commercial drug development

prospects for healthcare and pharmaceutical industries.

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Conflict of Interest

The author declares no conflict of interest.

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