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A COMPREHENSIVE REVIEW ON *COMMELINA BENGHALENSIS* L. (COMMELINACEAE)

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ABSTRACT: For a very long time, plants have been used worldwide as a natural medicine to treat human diseases, and it has been in many parts of the world, plants are used as a safe source of drugs to cure several diseases and conditions through complementary medicine system. In tropical Asia and Africa, *Commelina benghalensis* is a native plant and is known to have significant pharmacological activities. This plant has different groups of active biological compounds which provide *C. benghalensis* with such a wide range of pharmacological activities. *C. benghalensis* has been traditionally used for the treatment of many different diseases such as burns, leprosy, sore throat, pain and inflammations and also uses as an emollient, demulcent and laxative. Several research papers on the pharmacological, biological and isolation of metabolites and biologically active compounds of this plant have already been done worldwide. However, many areas of study for the complete evaluation of the therapeutic values of this plant still need to be conducted. This paper briefly reviews the pharmacological status of *C. benghalensis*. Furthermore, this review paper is the first and most updated literature review on the plant- *Commelina benghalensis*.

INTRODUCTION: Traditional medicines play a vital role in health-care services all around the world. From decades, a person all over the globe relies on plants and plants extracts for the treatment of various health issues. *C. benghalensis* is being used as a part of the traditional medicinal system to cure different diseases. It has been used for the treatment of pain, constipation, headache, leprosy, fever, snake bite and jaundice ^{1, 2, 3}. It has also been used in the treatment of mouth thrush ⁴, epilepsy ⁵, insanity ⁶, and psychosis ⁷.

In many parts of tropical Asia, it is used to treat infertility in women and India, it is used as bitter, demulcent, laxative, emollient, as an anti-inflammatory and depressant ⁸. In China, *C. benghalensis* is used as diuretic and febrifuge ⁹. In Africa, Pakistan and other parts of Asia, it is common nutritional vegetation ¹⁰.

In many parts of India, this plant is a widely used ethnomedicinal plant for various diseases ²¹. In Nepal, the paste of the *Commelina benghalensis* is being utilized to treat smolders, and the root-juice is used for the treating acid reflux ¹¹. This plant is also used to feed domestic animals, and in many parts of southern Asia, it is also eaten by humans. In Malaysia, Philippines and India, *C. benghalensis* is considered as a refrigerant and astringent and is being used for strangury ³⁰. In Bangladesh, this plant is used as an anti-dote for snakebites, burns

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and swelling³⁰. This plant is reported to possess remarkable therapeutic properties. Chemical constituents and extracts obtained from this plant have shown important pharmacological properties which are used for the treatment of various diseases. Literature also shows that *C. benghalensis* is used for the treatment of night blindness, pain including headaches, toothaches, cataracts, conjunctivitis; several skin diseases such as acne, scabies, eczema, warts, sleep disorders and mental illness³⁰. This plant is also found to be used as a folk medicine for treating infertility in women, in Lesotho and Cameroon, the stem extract of *Commelina benghalensis* is used for wound healing, as a laxative, diuretic, anti-inflammatory and febrifuge^{30, 61, 62}.

Plant Description: *Commelina benghalensis* Linn. belongs to the family Commelinaceae is a perennial native herb found in most parts of tropical Asia and Africa. This plant is commonly known as Benghal dayflower or dew flower¹². It is large, meander herbs that appears once every year and reaches a height up to 40 cm long and have roots with basal nodes. This plant can be characterized by its attractive and little bluish-violet flowers. Leaves are oval and elliptic or in some plants; it appears oblong, slightly triangular, dark-bright green in color and almost about 4-7 cm in length. The spathe are, funnel-shaped, green, compressed and about 1.5 cm long. The capsules of this plants are broadly ovoid-oblong and are about 4-5 mm long. Seeds are ovoid.

TABLE 1: PLANT DESCRIPTION

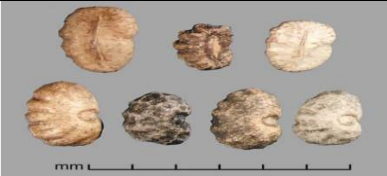





Picture	Name	Description
	Seed	The seeds are slightly oval and come in few sizes
	Seedling	<i>C. benghalensis</i> seedling
	Growing Plant	Leaves ovate or elliptical, acuminate, 3-7 cm long, 1-2.5 cm wide with base narrowed into a petiole
	Leaves and blue-flower	<i>Commelina benghalensis</i> has bright purple-bluish flower
	Flowering shoot	Shoot showing flower-bearing stolons and this plant can form new roots when leaf nodes are planted or come in contact with soil
	Root system	<i>C. benghalensis</i> root system with nodes



FIG. 1: BRIGHT BLUE COLORED FLOWER AND THE WHOLE PLANT

Distribution: The species is native to tropical and subtropical Asia and Africa¹³. *C. benghalensis* is also found in Yemen, Saudi Arabia, Bhutan, India, Nepal, China, Japan, Myanmar, Thailand, Cambodia, Viet Nam, Indonesia, Malaysia, the Philippines, and Pakistan. The plant has also been widely introduced beyond its range to North and South America, the Indian and Pacific Ocean Islands and Australia. Later, this plant is introduced in Cuba, Jamaica, Puerto Rico, United States and Barbados¹⁴. The species is a perennial and annual growing and is cultivated or disturbed in places such as roadsides, waste ground as well as in moist grassland, thickets and bushland, woodland, tree plantations and along watercourses; in the forest, forest margins and riverine forest¹⁴.

Taxonomical Classification:

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

Synonyms: *Commelina cucullata* L., *Commelina delicatula* Schldl, *Commelina hirsuta* R. Br, *Commelina mollis* Jacq, *Commelina nervosa* Burm. f., *Commelina poligama* Fern. -Vill., *Commelina procurrens* Schldl., *Commelina prostrata* Regel, *Commelina radicyflora* R. Br. ex C. B. Clarke, *Commelina rhizocarpa* Afzel. ex C. B. Clarke, *Commelina senegalensis* Ten, *Commelina turbinata* Vahl, *Commelina turbinata* Valh, *Commelina uncatata* C. B. Clarke, *Commelina villosiuscula* Sol. ex C. B. Clarke¹⁵.

Vernacular Names: English: Day flower, Bengali: Kanaibashi, Japan: Tsuyukusa, Myanmar: Myetcho, Philippines: Alikbangon, bias-bias, Hindi: Kanchara, India: Kanasiri, kanchara, kankaua. Sanskrit: Kanchata, Nepal: Kane, Arab: Hadaib, China: Fàn bāo cǎo, Finland: Intiansoljo, France: Commélyne du Bengale, Malayalam: Adukka-vettilla, Marathi: Kena, Sundanese: Gèwor, Tamil: Aduthinnathalai, Portugal: Trapoeraba, Sudah: Rekondo; Awowa, Vietnam: Dau-rieu Laos: Nya Kabpi Hyai, Thailand: Phak plaap, Indonesia: Brambangan.

Phytoconstituents: Various studies have shown that ethanol and aqueous extract of different parts of *Commelina benghalensis* contains chemical groups such as oils and fats, alkaloids, lactones and coumarins, triterpenoids and steroids, resins, reducing agents, phenols and tannins, amino acids, quinones, flavonoids, astringents, saponins¹⁶. Then again, in other studies, *C. benghalensis* also showed the presence of salicylic acid, P-coumarins, resorcinol, tannic acid, chlorogenic acid, 8-hydroxyquinoline, caffeic acid, tannic acid, quinol, resorcinol, catechol and anthocyanin^{17, 18, 19}. The flower showed the presence of dominant anthocyanin is cyanidin 3,7,3'-triglucoside, acylated with caffeic acid. Other hydroxycinnamic acids are also present.

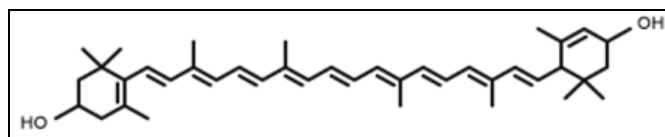


FIG. 2: LUTEIN

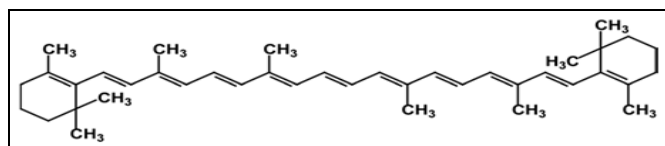


FIG. 3: β - CAROTENE

It has been seen that the flavones. C-glycosides are the dominant compounds, found in the majority of the species of this plant. Ravonol O-glycosides are present in few of the species where quercetin being the most frequent aglycone^{17, 18, 19}. An extensive phytochemical investigation revealed the presence of an alkanol and sterol with a mixture of n-octacosanol, n-triacontanol, n-doctriacontanol in the alkanol and stigmasterol, beta-sitosterol and campesterol in sterol in the ratio 2:1:1⁶³. Lutein and zeaxanthin contents were also reported in another

study conducted by Lakshminarayan (2007)⁶⁴. The high concentration of carotenoids was also found in this plant⁶⁵. Lyimo (2003), reported the presence of nutraceuticals that includes vitamin C, proteins, calcium, iron and many more⁶⁶. The table below summarizes all the reported phytochemical constituents in *Commelina benghalensis*⁶³⁻⁶⁷.

TABLE 2: REPORTED PHYTOCHEMICAL CONSTITUENTS IN COMMELINA BENGHALENSIS

Compounds / Groups	Plant part
Alkaloids	Whole plant
Alkanol: n-octacosanol, ntriacontanol, n-doctriacontanol	Whole plant
Ascorbic Acid	Aerial parts
Baeuenol	Whole plant
β -amyrin	Whole plant
Caffeine	Whole plant
Lutein	Leaves
Carotenoids: α -carotene, β -carotene	Leaves
Sterols: stigmasterol, β -sitosterol and campesterol	Whole plant
Shikimic acid (3, 4, 5-trihydroxy-1-cyclohexene-1-carboxylic acid)	Stems
Violaxanthin	Leaves
Volatile oil	Whole plant
Zeaxanthin	Leaves
Wax	Whole plant

Pharmacological Activities:

Analgesic Activity: To determine analgesic activities of *Commelina benghalensis* and justify traditional medicinal uses of this plant, a study was carried out of the ethanol extract with the plant's root sample²⁰. The ethanol root extracts showed good analgesic activities by inhibiting the release of pain receptors and assumed to have a similar mechanism of action like other NSAIDs²⁰. Extracts from aerial parts of *C. benghalensis* were evaluated for determining centrally acting analgesic activities, and the results show *Commelina benghalensis* to have significant analgesic properties which are comparable to the drug Nalbuphine¹. In another study, *Commelina benghalensis*, a perennial herb also showed analgesic effect in Swiss Albino mice in a dose-dependent manner⁴⁴.

Anti-Inflammatory Activity: In a study conducted *in-vivo* experimental models, showed *Commelina benghalensis* roots extract to possess significant anti-inflammatory activity which is due to the presence of resins, balsams, flavonoids, and tannins²⁰. Preliminary phytochemical evaluation of *C. benghalensis* shows the presence of saponins,

tannins, carbohydrates, flavonoids and alkaloids^{21, 46}. The extract of this plant shows promising anti-inflammatory activities due to the presence of mainly saponins, tannins and flavonoids.

It is also suggested that *C. benghalensis* could be a potent and safe drug for acute and long term use inflammations²¹. Asthma is characterized by the inflammation of airways and other symptoms like cough, chest tightness, shortness of breath; wheezing, etc.²² The dried leaf of *C. benghalensis* in methanol extracts showed to give 33.61% inhibition against the 15-lipoxygenase enzyme that is responsible for asthma²². Aqueous and alcoholic extracts of roots of *Commelina benghalensis* showed significant wound-healing properties when compared with a control group⁴⁶.

Anti-microbial Properties: From ancient period, plants constituents are being used as folk medicine and natural therapies for most of the world's population, and in order to evaluate the pharmacological activities of plants, a study was conducted taking 10 medicinal plant extracts against gram +(ve) and gram (-)ve bacterial strain *in-vitro*. This study included *C. benghalensis*, and its crude leaf showed potential inhibition zone against *Streptococcus lactis* and *Enterobacter aerogenes*²⁹.

Radical Scavenging Activities: A study investigating the anti-oxidant activity of *C. benghalensis* found a positive correlation between total polyphenols and antioxidant properties of the plant²⁵. This plant also provides a great source of dietary antioxidants and possess high antioxidant activities which prevent oxidative damage, slows down the process of aging, reducing the chances of cancer and other cardiovascular and neurological diseases²⁵.

In another experiment, methanolic extracts from the leaves of *C. benghalensis* shows to be rich in antioxidants due to the presence of mainly phenolic groups which neutralize free radical²⁶ and thus can be successfully used in pharmaceutical industries²⁶. Fresh aerial parts of *C. benghalensis* extracted with acetone and methanol shows good anti-oxidant properties showing the inhibitory ability of free radicals²⁷. Reactive oxidative species and oxidative stress increases the chances of diseases

like diabetes, cancer heart-diseases, autoimmune diseases, aging and neurological diseases and anti-oxidative property of this plant prevent such diseases²⁷. Presence of flavonoids suggests that this plant have anti-oxidant properties^{28, 29}. The free-radical scavenging ability of *C. benghalensis* has been found in a study due to the presence of phenolics³⁰. The author developed a simple, rapid and sensitive method for the quantification of protocatechuic acid, vanillic acid, ferulic acid, apigenin, and kaempferol in the tuber of this plant and additionally the anti-oxidant potential of the plant's extract was examined and confirmed³⁰.

Diuretic Properties: A study suggests that *Commelina benghalensis* might possess diuretic properties as this plant is rich in secondary metabolites³¹.

Larvicidal Activity: Dengue fever is a major health problem mainly in tropical countries which spreads to people mainly from vectors *A. aegypti*³². Petroleum ether extract of *C. benghalensis* seemed to cause mortality of 80% in 24 h on the mosquito larvae due to the presence of phytochemicals such as phenol, flavonoids resins, etc.³²

Antidiarrheal and Anthelmintic Activity: Methanol extract of *C. benghalensis* was tested for plants antidiarrheal and anthelmintic properties where it was found that a dose-dependent methanolic extract took maximum 22.17 min for the paralysis and almost an hour for complete death of the parasite³³. Then again, the methanol extract of this plant smothered the propulsive movement of charcoal through the GIT, which provides great chances to prevent diarrheal conditions³³.

Fertility-Inducing Property: For a long time, *C. benghalensis* is as a folk medicine for the treatment of female infertility³⁴. In a study conducted, leaves extract of this plant seem to possess properties that treat infertility in women³⁴. Another study showed that extract of *C. benghalensis* could successfully prevent testicular toxicity induced by environmental toxic substances and hence is a potential candidate for the treatment of male infertility³⁶.

Thrombolytic Activity: Thrombosis is a major health problem and thrombolytic therapy is normally used to dissolve the blood clot, but there

are shortcomings of the available thrombolytic drugs in the market³⁷. A study conducted to investigate the thrombolytic property of *Commelina benghalensis* using methanol extract showed to have a significant thrombolytic activity of 40.94% taking standard streptokinase which is about 75%³⁷.

Hepatoprotective Activity: Alcohol consumption can result in degenerative fibrotic hepatic diseases, and it is known that several medicinal plants are used to treat such condition²⁴. A study conducted indicated that both alcohol and water extracts of this plants showed to have great hepatoprotective activity against paracetamol-induced hepatic tissue damage whereas the alcoholic extracts seemed to have shown the better result in contrast with alcoholic extract²³. Both water and alcoholic extracts of *Commelina benghalensis* (200 mg/kg, b.w.) showed significant hepatoprotective activity against paracetamol (2 gm/kg b.w in 1% CMC) induced hepatic injury. Alcoholic extract emerges more efficiency than aqueous extract³⁸.

Anti-cancer Activity: *C. benghalensis* is reported to contain flavonoids, alkaloids, steroids, triterpenes, lactones, coumarins, resins, phenols, reducing agents, tannins and has many pharmacological importance as well as have anticancer activities³⁹. The methanol extract of *Commelina benghalensis* significantly reduced tumor volume in Albino mice and also have normalized Hb level and further increase the lifespan of mice³⁹.

In another study, the anticancer property of MECB was assessed by their capacity to repress malignancy cell development in an ascetic liquid of Swiss albino mice³⁹. The rate hindrance of aggregate cell tally (% TCI), rate restraint of feasible cell includes, rate increment life expectancy (% ILS), and enhanced hematological parameters were viewed as the intensity of the anticancer property of MECB³⁹. The LD₅₀ estimation of the methanol leaf concentrates of CB. was done according to the OECD rule; however, no mortality of the mice was watched even at a measurement of 2000 mg/kg body weight and was, along these lines, considered as sheltered³⁹. The study of the histological perception of test bunches proposed typical design of liver tissue, less thick

divider CV, twisted corruption of tissue (N) and core, parenchyma, and hepatic cells were recovered, which was harmed in EAC treated control groups (I-V) ⁴⁰. These parameters and perceptions show that MECB has noteworthy anticancer action. Semi-pure extracts of *Commelina benghalensis* shows future hope for the treatment of cancerous skin outgrowth and can lead to the development of an effective anti-neoplastic drug ⁴⁰. The crude methanolic extract of *Commelina benghalensis* contains bioactive compounds that are beneficial in the treatment of malignant growths of p53 tumor protein and Bcl-2 family of proteins (Bax and Bcl- 2). Furthermore, this apparent antineoplastic activity is a consequence of dysregulated expression of apoptosis-responsive genes ⁴¹.

Sedative and Anxiolytic Properties: Among the four different fractions (chloroform, pet ether, *n*-butanol, and hydromethanol soluble fractions, coded as CFCB, PECB, NBCB, and HMCB, respectively) of the aerial parts of *Commelina benghalensis*, chloroform (CFCB) and pet ether (PECB) soluble fractions possess strong sedative and anxiolytic potential ⁴³. Therefore, these fractions could have significant therapeutic efficacy for the treatment of anxiety along with related neuropsychiatric disorders ⁴³. In addition, substantiation obtained from the present study may justify the use of this plant in traditional medicine for the treatment of excited mental disorders such as psychosis, insanity, epilepsy, etc. ⁵³ Addition of *Commelina benghalensis* in *S. alnum* based diets enhanced growth and DM intake of the wethers, representing their potentiality as supplements for ruminants ⁴³.

C. benghalensis (200 mg/kg and 400 mg/kg) shows strong sedative and antianxiety properties ^{2, 44}. Sedation or hypnosis is induced by potentiating GABA mediated postsynaptic inhibition through allosteric modification of GABA receptors due to the presence of sleep-inducing properties in the aerial parts of the plant. *C. benghalensis* also contains alkaloid and flavonoid ⁴⁴. It is thought that the sedative and anxiolytic is due to the interaction of flavonoids with the GABA/benzodiazepine receptor complex in the brain. So it can be used as a treatment of anxiety and related neuropsychiatric disorders ⁴⁴.

Anti-viral Activity: Investigation on the inhibitory effects of *C. benghalensis* against dengue virus serotype 2 using five different fractions extracted by methanol, ethanol, chloroform, *n*-hexane, and benzene was done, and all different fractions showed significant prophylactic effects against the virus ⁴⁵. Thus, *Commelina benghalensis* seemed to possess good anti-viral properties by prophylactic treatment ⁴⁵.

Toxicity: Toxicity of a plant is an important concern to science and medical practitioners and thus in a study, a cytotoxic assay of *Commelina benghalensis* was carried out to determine the toxicity properties of this plant through the Brine Shrimp lethality test (LC₅₀) for 24 h ³⁷. This cytotoxicity test was important as this data would help for better evaluation of the plant's anti-neoplastic properties and can further help to determine new anticancer compounds. The result of the study showed the median lethal concentration that is the concentration at which 50% mortality of the brine shrimp nauplii were observed ³⁷. The methanol extract of this plant demonstrated significant cytotoxic properties against the brine shrimp at a concentration of 278.68 µg/ml where vincristine sulfate was used as the positive control and DMSO as the negative control ^{37, 50}. Then again in another study, hydroethanolic extracts of leaves of *C. benghalensis* did not show any toxic reactions and mortality even with a high dose of 2000/kg, and thus LD₅₀ of hydroethanolic extracts of *Commelina benghalensis* must be greater than 2000 mg/kg ²¹.

CONCLUSION: *C. benghalensis* generates little genetic variability as it contains fewer chromosomes and closed breeding system ^{47, 52}. Several species of *Commelina* are widely available in tropical Asia and Africa ⁴⁹. Studies conducted on this plant have shown its extensive pharmacological properties with high medicinal values. It has been seen in previous studies that almost all parts of the plants mainly the leaf and the bark contains many different active and non-active chemical compounds that possess a wide range of therapeutic values ^{35, 48}. Different chemical compounds isolated from the extracts of *Commelina benghalensis* showed different pharmacological properties and have been widely for centuries as traditional or folk medicine.

The plant's crude extracts showed significant therapeutic activities including analgesic, anti-inflammatory, anti-cancer, anti-oxidant, anti-thrombolytic, antiplasmodial, anti-diarrheal, anti-helminthic, anti-larvicidal, anti-viral, anti-microbial, sedative, anxiolytic, fertility-inducing and hepatoprotective properties. Thus, further extensive studies need to be done for its better use in cosmetic, agrochemical and pharmaceutical sector.

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CONFLICT OF INTEREST: Authors declare no conflict of interest.

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