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# ETHNOPHARMACOLOGICAL REVIEW OF *COMMELINA BENGHALENSIS*: TRADITIONAL APPLICATIONS, PHARMACOLOGICAL ACTIVITY, AND THERAPEUTIC PROMISE

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## ABSTRACT

The *Commelina benghalensis* species, also designated as Benghal dayflower, has been extensively utilized throughout the ages to alleviate fever, inflammation, wounds, and disorders associated with the digestive and respiratory systems. Based on ethnobotanical literature, the species *C. benghalensis* has been documented to be used in many ways alongside other plant components. There have been many studies showing that certain compounds derived from these plants, such as flavonoids, phenolic compounds, and alkaloids, contribute to their ability to act as an antioxidant, anti-inflammatory agent, antimicrobial agent, and analgesic. This makes it possible to use these types of plants (e.g., Commelineae) for making traditional remedies for medical conditions that are commonly treated in the local area. In addition to this, the pharmaceutical qualities of these plants may give rise to new drugs used in the treatment of chronic inflammatory conditions, infections, and other illnesses that result from oxidative stress such as neurodegeneration and

cancer. The *C. benghalensis* is known to be a common weed in various tropical regions and has been traditionally used in the treatment of cancer. There is also some evidence that the usage of this particular weed in the treatment of medical problems as an immune modulator. Further confirmation of this along with the establishment of appropriate extraction methods and doses is needed before proceeding with further clinical tests on humans. Due to various ethnopharmacological capabilities, future research should focus on the discovery of additional unique phytochemicals found in *C. bengalensis*.

**Keywords: *Commelina benghalensis*, traditional medicine, phytochemical constituents, antioxidant, anti-inflammatory, antimicrobial benefits**

## 1. INTRODUCTION

An ethnopharmacological survey was conducted and correlated with their traditional uses and folk medicine lead to evolution of medicinal plants with potential health benefits. In addition to several other plant species, the whole plant of *C. benghalensis* (dayflower) has been used as for variable health benefits. A creeping or spreading perennial herb of tropical and subtropical parts of Asia and Africa, this species is considered an invasive weed; however, the medicinal importance of the species is well established in the folk medicine of various regions. The plant parts of *C. benghalensis*, such as leaves, stem, roots are used by local communities to treat various health problems like wounds, inflammation, digestive, respiratory, genitourinary, reproductive, and skin diseases. According to research, this weed has the capability of causing death of cancer cells in the form of apoptosis, thus indicating its potential use in cancer therapy. Although the plant has been in use for a long time, the plant needs to be pharmacologically validated. *C. benghalensis* (sweets of healing) in Ayurvedic literature has been described as a preventive medicine for many ailments. The phytochemical studies reveal the presence of many volatile oil components, flavonoids, alkaloids, phenolics, tannins, and glycosides. Modern pharmacological studies and clinical trials have demonstrated the activity of various traditional remedies of *C. benghalensis*, including anxiolytic, analgesic, sedative, and antidepressant activity as well as antioxidant, antimicrobial, anti-inflammatory, anticancer, and antidiabetic effects. In view of these findings, it may be concluded that *C. benghalensis* could be an ideal drug for discovery and development as well as investigation of bioactive compounds from natural resources. Despite its purported

medicinal value, much remains to be clarified regarding *C. benghalensis*. Available studies lack closure in terms of clinical data and in-depth pharmacological analysis, and therefore traditional uses are not fully recognized in terms of medicinal potential. The closing of this gap is thus the aim of present ethnopharmacological of *C. benghalensis*. The therapeutic potential of the plant is discussed within the context of other globally significant medicinal plants **[1-22]**.

### 1.1 Botanical description

*Commelina benghalensis (Linn.)* is a long-live plant belonging to the Commelinaceae family, which can be found in the tropics of Africa and southern Asia. The Benghal dayflower or dew flower or *C. benghalensis*, attains heights of 40 cm or less, with roots emanating from the base of the plant. It is recognized for its small blue and purple flowers; while the leaves are usually either oval or elliptical in shape, they are often elongated and slightly triangular. The leaves are dark, vibrant green, typically 4 to 7 cm long. The spathes are green, funnel-shaped, and approximately 1.5 cm long. The capsules are oblong and approximately 4-5 mm in length with oval-shaped seeds.

**Table 1: Taxonomical Classification**

| | |
|---|---|
| **Domain** | **Eukaryota** |
| **Kingdom** | **Plantae** |
| **phylum** | **Sparmatophyta** |
| **Subphylum** | **Angiospermae** |
| **Class** | **Monocotyledonae** |
| **Order** | **Commalinles** |
| **Family** | **Commalinaceae** |
| **Genus** | **Commelina** |
| **Species** | ***Commelina benghalensis*** |

### 1.2 Morphology and Microscopy

The perennial herb, *C. benghalensis*, grows as a single stem like a sucker or annual in different climates. Spreading along ground with nodes forming roots or becoming upright (10-30 cm) or climbing when supported. Branches are thick, pale green, and hairy. Seeds are rectangular in shape (1.6 mm x 3 mm or 3 mm x 1.8 mm), brown or black with a netted surface. Leaves in spiral positions or paired vary in shape from lanceolate to ovate-elliptic or ovate (1.5-7.5 cm long x 0.7-3.5 cm wide, medium-sized); parallel veins, and entire margins. Hair may occur on either surface; it assists in maintaining water and perhaps protecting the leaf surface or in deterring herbivores. Leaf sheath medium length (1-2.3 cm), fine hairs; possesses rusty or white coarse hair on apex, extending onto petiole or base of blade. White or yellowish,

hairy spathes are funicular in shape, 1-2.3 cm long x 0.7-1.1 cm wide. Flowers are solitary or in clusters; they have three petals and are either bisexual or male, 1-1.3 cm wide; upper two are blue or lilac and brighter than the lower white or pale petal. Roots are thin and fibrous and permit plants to obtain nutrients and water from various soils, becoming established at nodes.

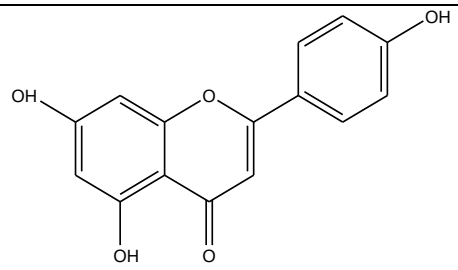
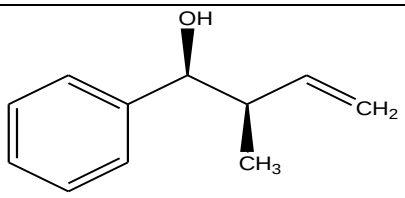
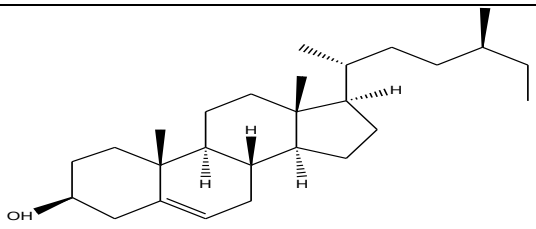
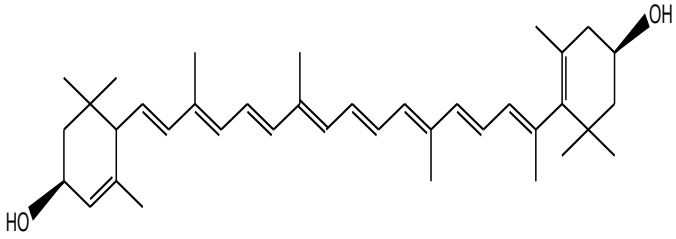
**1.3 Ethnomedicinal uses**

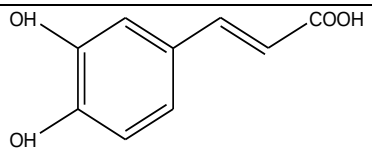
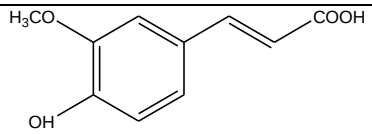
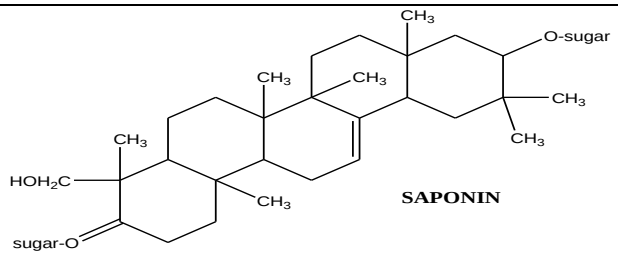
Indian people turn to certain herbal remedies for ailments like headaches, fever, constipation, leprosy, snake bites, jaundice, epilepsy, and mental disorders using C. Bengalensis. Meanwhile, in China, a similar approach exists where this plant is used for treatments such as diuretics and helps to reduce fever. In Addition, the drug has been used in Pakistan, as a vegetable and to counteract inflammation. While in Nepal, locals apply plant paste on burns and consume root juice for digestive issues. In Bangladesh, drug is found helpful to people with sleep loss and eye problems. Also, the drug is used to heal wounds/burns & decrease swelling. In addition, the Traditional Healing System of Lesotho (A) includes these same solutions in their medical procedures, which are used to treat many ailments. Due to its high level of phytochemical diversity, *C. benghalensis* contains numerous different classes of phytochemicals that exhibit extensive pharmacological activity including antioxidant, anti-inflammatory, antimicrobial, anticancer, wound-healing, neuroprotective, and eye-protective. This further supports the ethnomedicinal significance of this plant as well as demonstrates the potential of *C. benghalensis* to serve as a valuable source of phytopharmaceuticals.

**Table 2: Phytochemicals and Therapeutic Significance**

| Class | Compounds | Plant part | Therapeutic significance |
|---|---|---|---|
| Flavonoids | Quercetin, Kaempferol, Apigenin, Luteolin | Leaves, Flowers | Anti-inflammatory, antioxidant, and anti-cancer |
| Alkaloids | Undifferentiated alkaloids | Roots, stems | Analgesic and antimicrobial effects |
| Sterols | b-sitosterol, stigma sterol, campesterol | Whole plant | Anti-arthritic and anti-inflammatory effects |
| Carotonoids | Lutein, beta-carotene, violaxanthin, zeaxanthin | Leaves | Eye health, UV protection |
| Phenolic acid | Caffeic acid, ferulic acid, shikimic acid | Stems, leaves | Antibacterial and antioxidant activity.anti-cancer activity. |
| Saponins | Saponin glycosides | Roots (highly) | Wound healing and traditional use of laxative |
| Fatty alcohols | n-octacosanol, n-triacontanol | Whole plant | Potential neuroprotective and ergogenic effects |
| Anthocyanins | Cyanidin3,7,3'-triglucoside | Flowers | Provide pigment; act a as potent antioxidant |

**Table 3: Structures and biological activities**

| Structures | Uses |
|---|---|
|  **APIGENIN** | **Anti-inflammatory, antioxidant, and anti-cancer activity [34]** |
|  **ALKALOID** | **Analgesic and antimicrobial effects** |
|  **CAMPESTEROL** | **Anti-arthritic and anti-inflammatory effects [32]** |
|  **LUTEIN** | **Anti-cataract activity and protection of eye [40]** |

| | |
|---|---|
|  **CAFFEIC ACID** | **Caffeic acid can inhibit the synthesis of some of them, e.g., PhIP(2-amino-1-methyl-6-phenyl-imidazo[4,5b] pyridine) [33]** |
|  **FERULIC ACID** | **Anti-oxidant, anti-cancer and anti-microbial activity [35]** |
|  **SAPONIN** | **Wound healing, and anti-inflammatory activity [36, 37]** |

## 2. Pharmacological Activity

### 2.1 Anti-inflammatory Activity

The study indicates that, the ethanol extract of *C. benghalensis* roots was pharmacologically tested to evaluate the peripheral-acting analgesic effect via acetic acid-induced writhing in Swiss albino mice, and the centrally appearing analgesic effect by means of warm plate and tail-flick exams in mice. The anti-inflammatory impact becomes further assessed using the carrageenan-induced mice paw edema version. In all experimental fashions, the extract becomes administered orally at doses of 250 and 500 mg/kg body weight. The ethanol root extract proved significant ($P < 0.0001$) inhibition of writhing compared to the management institution in the acetic acid-induced writhing take a look at in mice. The extract additionally proved a significant ($P < 0.0001$) increase in ache threshold stage in each warm plate and tail-flick exam in mice. The analgesic effect turned into in dose-dependent manner in all experimental models. The extract proved significant (PO. 0001) inhibition of paw edema at each doses following carrageenan administration, which indicated capability of anti-inflammatory effect of the extract in dose-dependent manner **[24]**.

### 2.2 Antioxidant Activity

*C. benghalensis* has provided a clear relationship between the total amount of

polyphenolics present in the plant and its known antioxidant capabilities **[25]**. This indicates that *C. benghalensis* would be a significant contributor to dietary intake of antioxidants and would also provide high levels of antioxidant activity to reduce oxidative damage, decrease the aging process, and lower the risk of certain cancers, as well as other cardiovascular and neurological diseases. The study on methanolic extracts of leaves of *C. benghalensis* determined to have abundant antioxidant potential **[26]**. The majority of the antioxidant properties are derived from phenolic compounds, which possess the capacity to neutralize free radicals **[26]**. As a result of the presence of antioxidant compounds, extracts made from the fresh aerial portion of the plant using methanol and acetone demonstrated excellent free radical inhibitory activity **[27]**. Increased levels of oxidative stress and reactive oxygen species from the environment contribute to disease susceptibility.

**2.3 Anti-Microbial Activity**

The ethanolic extracts from this plant appear to have anti-microbial activity against many infectious disease-causing pathogens such as *Staphylococcus aureus*, *E. coli*, and *Pseudomonas aeruginosa*. Since, ancient times, plant components have been employed as folk medicines and traditional therapies by the majority of the global population. To examine the pharmacological actions of plants, an experiment was carried out using extracts from 10 medicinal plants against gram positive and gram-negative bacteria strains in vitro. Among those plants, *C. benghalensis* was used, and its crude leaf extract showed promising results for Streptococcus lactis and Enterobacter aerogenes **[28]**.

**2.4 Thrombolytic Activity**

The ethanolic extract was analyzed for its thrombolytic and cytotoxic properties. Cytotoxic properties were studied by the brine shrimp lethality bioassay method, while thrombolytic properties were analyzed by studying the effect on human blood. The results obtained by performing the brine shrimp lethality bioassay were LC50 = 278.69 µg/mL compared to normal vincristine sulfate (LC50 = 0.512 µg/mL). It shows large thrombolytic properties (45.94%) compared to normal streptokinase (75%) **[29]**.

**2.5 Hepatoprotective Activity**

Study was carried out to evaluate the hepatoprotective activity of different root extracts of *C. benghalensis* L. against liver damage induced through paracetamol in wistar rats. Liver injury was induced using paracetamol (2 g/kg body weight, oral). Plant extracts (200 mg/kg p. o.) in 1% CMC daily

for 7 days while control animals received N acetyl L-cysteine. At the end of the experiment, enzymatic levels in serum and histopathological studies were conducted. It was observed that both aqueous and alcohol extracts exhibited good hepatoprotective activity, and hepatoprotective activity of the alcohol extract was almost comparable to that of N-acetyl L-cysteine **[23]**.

**2.6 Anticancer and Cytotoxic Activity**

An independent study examined the anticancer properties of methanol extract of *C. benghalensis* by assessing its ability to reduce cancer cell proliferation in the ascitic fluid of Swiss albino mice. Four determinations were used to evaluate the anticancer efficacy of the extract from the whole plant of *C. benghalensis*; TGI (% total growth inhibition), percent decrease in cell number, % increase in lifespan (% (IL S), and parameters of hematological improvement. Though assessment of the LD50 of methanol leaf extracts of CB followed OECD recommendations, there were no animal deaths at the highest dose tested (2000 mg/kg body weight); thus, CB was considered a safe product **[30]**. Histopathological evaluations demonstrated that liver biopsies from animals in the EAC- treated control showed evidence of reduced vascularization (CV) and severe degeneration of morphologic architecture (N) and cellular architecture (H) in both EAC-treated and EAC control groups; therefore, these findings suggest that methanol extracts of *Commelina benghalensis* exhibit marked anticancer activity. The semi-synthetic derivative of this plant may have promise for treating malignant dermal lesions and the development of a new class of anticancer agents; thus, Commelina methanol extracts could also have similar potential **[31]**.

**2.7 Wound healing activity**

The MRC-5 (human embryonic lung fibroblast) cell line can be made resistant to reactive oxygen species (ROS) like hydrogen peroxide ($H_2O_2$) via antioxidant action or biological molecules that mitigate the oxidative stress effect and inhibit apoptosis to ensure cell survival. Research has proved the ability of some natural proteins and antioxidants to be cytoprotective due to their ROS mitigation action **[36, 37]**.

**2.8 Central Nervous System Effects**

Chloroform and petroleum ether extract from *C. benghalensis* has very high therapeutic efficacy for the treatment of anxiety, in addition to other neuropsychiatric conditions. The aerial part of *C. benghalensis* has alkaloids and flavonoids that exhibit strong sedative and anxiolytic properties **[38]**. The research project was conducted to investigate the action of methanol extract of *C.*

*benghalensis* on signs of depressive illness. The methanol extract of *C. benghalensis* was obtained from the leaves; the forced swimming test (FST) and tail suspension test (TST) were utilized as predicted animal models of action in treating depressed symptoms, as shown by the length of time that each animal remained immobile. For the tests in vivo, doses were used (200 mg/kg BW and 400 mg/kg BW). The extract produced significant reduction in the duration of immobility in FST and TST, with the immobility time for FST being reduced to 131.17 (± 2.75) and 108.70 (± 1.14), respectively (N=10; $p<0.001$) when compared to the control at 194.27. There was also a significant reduction in the TST for the MECB-treated animals, at 133.07 (± 1.87) and 109.08 (± 1.38) (N=10; $p<0.001$) compared to the control (205.9±1.01) **[39]**.

**2.9 Antiviral activity**

Using the DENV-2 virus, it was determined that the Rumex dentatus methanol extract is the most potent antiviral agent, exhibiting IC50 values of 0.154 µg/mL and 0.234 µg/mL when tested in pre-treatment groups of 45 and 90 PFU of virus, respectively. In contrast, the much weaker anti-DENV-2 activity exhibited by Gallic acid was demonstrated by IC50 values of 0.191 µg /mL and 0.522 µg /mL for pre- incubation groups of 45 PFU and 90 PFU, respectively **[41]**.

**2.10 Diuretic**

Studies indicate that the drug is responsible to increased urine production.[45] In the mentioned investigation, [36] Wistar rats were divided randomly into six equal- sized groups, with the rats receiving *C. benghalensis* extract in groups 1 - 3, standard diuretics in groups 4 (amiloride) and 5 (furosemide), and distilled water in group 6. Urine volume was measured in all of the rats at 0.25, 0.5, 1, 1.5, 2, 3, 4, 5, 6, 8, 10, 12, and 24 hours after drug administration, and total urine volumes were calculated. After euthanasia of the rats, plasma and urine samples were analyzed for diuretic activity and other biochemical parameters. Analysis of the aqueous leaf extract of *C. benghalensis* indicated the presence of phenolic compounds, anthraquinones, flavonoids, and glycosides. In addition, the *C. benghalensis* extract demonstrated a dose-dependent diuretic effect in both female and male. Wistar rats, similar to that from furosemide. Furthermore, *C. benghalensis* extract caused a significant increase in sodium excretion and a modest preservation of potassium excretion with no excretion of either albumin or glucose in the urine of any of the animals **[46]**.

**2.11 Fertility-Inducing**

The *C. benghalensis* has been used as folklore

medicine in treating infertility in men and women. An experiment conducted on the leaf extract of *C. benghalensis* was found to have the ability to cure infertility in females. From another experiment, it was discovered that *C. benghalensis* extracts could protect the testis from toxic materials in the environment, thus curing male infertility **[42, 43]**.

**2.12 Anthelmintic and Antidiarrheal**

Good for intestinal worms and diarrhea prevention the methanol extract was tested for its anti-diarrheal and anthelmintic properties. It was found out that based on the dosage of the methanol extract, it would take between 22.17 minutes and one hour before the worm becomes paralyzed and dies. Nevertheless, the methanol extract of *C. benghalensis* was able to inhibit the movement of the charcoal particles in the GIT **[44-46]**.

**CONCLUSION**

*C. benghalensis* is an herbal medicine of high value with demonstrated biological activities like antioxidative, anti-inflammatory, antimicrobial, anticancer, hepatoprotective, and wound healing properties. The herb's biochemical composition facilitates its biological functions, indicating its potential as a source of drugs. Nevertheless, more investigations on its standardization, safety, and clinical use are necessary to convert the underexploited weed into a phytopharmaceutical.

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**Conflicts of Interest**

All authors declare that they have no conflicts of interest regarding the publication of this paper.

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