Chapter 2

Phytochemical Composition and Therapeutic Potential of Commelina benghalensis Linn

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Abstract

Medicinal plants are valuable sources of bioactive compounds that contribute to the discovery of novel therapeutic agents. *Commelina benghalensis* Linn commonly known as Benghal dayflower, is a perennial herb widely distributed in tropical and subtropical regions. Traditionally, the plant has been used in various indigenous medicinal systems to treat several ailments such as inflammation, infections, wounds, and metabolic disorders. Phytochemical investigations have revealed that the plant contains several secondary metabolites including flavonoids, tannins, glycosides, saponins, sterols, and terpenoids. These phytochemicals are responsible for the diverse pharmacological activities exhibited by the plant. Recent studies have demonstrated antimicrobial, antioxidant, antidiabetic, anti-inflammatory, anticancer, and hepatoprotective properties of the plant extracts. In addition, certain bioactive compounds such as stigmasterol, campesterol, n-octacosanol, and phenolic constituents have been isolated and characterized from

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different parts of the plant. The presence of these compounds suggests the potential use of *C. benghalensis* as a natural source for drug development. This chapter reviews the phytochemical composition, traditional uses, pharmacological activities, and therapeutic potential of *Commelina benghalensis*. Furthermore, it highlights the importance of further research in isolating novel bioactive molecules and understanding their mechanisms of action for pharmaceutical applications.

Keywords: Commelina benghalensis, phytochemicals, medicinal plants, antimicrobial, antioxidant, pharmacological activities.

1. Introduction

Medicinal plants have been utilized by humans for centuries as natural remedies for various diseases. These plants contain diverse phytochemicals that exhibit significant biological and pharmacological activities. Among such medicinal plants, *Commelina benghalensis* Linn belonging to the family Commelinaceae, has gained attention due to its rich phytochemical profile and therapeutic properties [1].

Commelina benghalensis, commonly referred to as Benghal dayflower, is a creeping herb widely distributed across Asia, Africa, and tropical regions. Although it is often considered a weed in agricultural fields, the plant has been traditionally used in folk medicine for treating several health conditions including sore throat, wounds, eye infections, skin diseases, and gastrointestinal disorders. In many traditional systems, leaf extracts or decoctions of the plant are used as demulcent, emollient, laxative, and anti-inflammatory remedies [2].

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The therapeutic properties of this plant are largely attributed to the presence of bioactive phytochemicals such as flavonoids, sterols, phenolic compounds, and terpenoids. These compounds have been shown to possess antimicrobial, antioxidant, antidiabetic, and anticancer activities. As interest in plant-based pharmaceuticals continues to grow, *C. benghalensis* has emerged as a promising candidate for drug discovery and development [3].

2. Botanical Description and Distribution

Commelina benghalensis Linn is a perennial creeping herb belonging to the family Commelinaceae. The plant typically grows in moist and fertile soils and is commonly found in agricultural fields, gardens, and roadside habitats [4].

2.1 Botanical Characteristics

- **Habit:** Creeping or ascending herb
- **Leaves:** Broad, ovate to lanceolate with smooth margins
- **Flowers:** Small, blue or purple colored flowers
- **Stem:** Succulent and branched
- **Root system:** Fibrous roots

The plant is widely distributed in tropical and subtropical regions including India, Africa, Southeast Asia, and South America. It thrives in humid environments and can grow rapidly, often forming dense colonies [5].

3. Phytochemical Constituents

Phytochemical screening of *Commelina benghalensis* extracts has revealed the presence of several important secondary metabolites.

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These compounds contribute significantly to the plant's biological activities [6].

Major Phytochemical Classes

Phytochemical Group	Biological Importance
Flavonoids	Antioxidant and anti-inflammatory
Tannins	Antimicrobial and astringent
Saponins	Antimicrobial and immune modulation
Glycosides	Cardioprotective and therapeutic activities
Sterols	Anti-inflammatory and cholesterol-lowering
Terpenoids	Anticancer and antimicrobial
Phenolic compounds	Antioxidant activity

Phytochemical analyses have identified compounds such as stigmasterol, campesterol, n-octacosanol, and n-triacontanol, along with phenolic acids and carotenoids including lutein and β-carotene. Studies also report the presence of tannins, flavonoids, saponins, glycosides, volatile oils, and resins, indicating that the plant is rich in pharmacologically active constituents [7].

Table 1. Major Phytochemical Constituents of Commelina benghalensis

Phytochemical Group	Major Compounds Reported	Biological Role
Flavonoids	Quercetin, Kaempferol	Antioxidant, anti-inflammatory
Phenolic compounds	Phenolic acids, polyphenols	Free radical scavenging activity

Phytochemical Group	Major Compounds Reported	Biological Role
Tannins	Hydrolysable and condensed tannins	Antimicrobial, astringent
Saponins	Triterpenoid saponins	Immune modulation, antimicrobial
Sterols	Stigmasterol, Campesterol	Anti-inflammatory, cholesterol regulation
Terpenoids	Various terpenoid derivatives	Anticancer, antimicrobial
Glycosides	Cardiac and phenolic glycosides	Cardioprotective and therapeutic activity
Alkaloids	Nitrogen-containing compounds	Pharmacological and antimicrobial effects

4. Traditional and Ethnomedicinal Uses

Commelina benghalensis has been widely used in traditional medicine across different cultures.

4.1 Traditional Applications

- Treatment of **wounds and burns**
- Management of **skin diseases** such as eczema and scabies
- Treatment of **sore throat and eye infections**
- Relief from **gastrointestinal disorders**
- Used as **laxative and diuretic**
- Treatment of **infertility and hypertension**
- Used as **anti-inflammatory and febrifuge**

In some African and Asian regions, leaf extracts are applied externally for wound healing and skin infections. The plant is also consumed as a vegetable in certain cultures due to its nutritional value [8].

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Table 2. Traditional Medicinal Uses of Commelina benghalensis

Plant Part	Traditional Use	Mode of Application
Leaves	Treatment of wounds and skin infections	Crushed paste applied externally
Leaves	Anti-inflammatory remedy	Leaf extract or decoction
Whole plant	Treatment of fever and infections	Herbal decoction
Roots	Gastrointestinal disorders	Powder or decoction
Leaves	Eye infections	Fresh juice applied locally

5. Pharmacological Activities

5.1 Antimicrobial Activity

Extracts of *Commelina benghalensis* have been widely investigated for their antimicrobial properties against various pathogenic microorganisms. Different solvent extracts such as methanol, ethanol, aqueous, and chloroform extracts obtained from the leaves, stems, and roots have demonstrated inhibitory activity against both Gram-positive and Gram-negative bacteria. Studies have reported significant antibacterial effects against pathogens including *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*, which are commonly associated with wound infections, urinary tract infections, and gastrointestinal diseases [9]. The antimicrobial activity is largely attributed to the presence of phytochemicals such as flavonoids, tannins, phenolic compounds, saponins, and terpenoids present in the plant. These bioactive compounds exert their antimicrobial effects through several mechanisms, including disruption of microbial cell membranes, inhibition of nucleic acid synthesis, interference with enzyme activity,

and alteration of cellular metabolic pathways. Additionally, phenolic compounds present in the plant extracts can cause protein denaturation and cell wall damage in microbial cells, ultimately leading to cell death. Due to these properties, *C. benghalensis* has gained attention as a potential natural source of antimicrobial agents for the treatment of infectious diseases and for the development of plant-based antimicrobial formulations [10].

5.2 Antioxidant Activity

Oxidative stress caused by the excessive generation of reactive oxygen species (ROS) is associated with the development of numerous chronic diseases, including cancer, cardiovascular disorders, and neurodegenerative conditions. *Commelina benghalensis* has been reported to possess strong antioxidant activity due to the presence of phenolic compounds, flavonoids, and other secondary metabolites [11]. These compounds play a crucial role in neutralizing free radicals and protecting biological systems from oxidative damage. Experimental studies using in vitro antioxidant assays such as DPPH radical scavenging activity, reducing power assay, and hydrogen peroxide scavenging activity have demonstrated that extracts of *C. benghalensis* exhibit significant free radical scavenging potential. Flavonoids and phenolic compounds present in the plant act as hydrogen or electron donors, thereby stabilizing free radicals and preventing oxidative damage to cellular components such as lipids, proteins, and DNA. The antioxidant properties of the plant suggest that it may serve as a natural alternative to synthetic antioxidants and could be utilized in pharmaceutical, nutraceutical, and food preservation applications [12].

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5.3 Antidiabetic Activity

Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels due to impaired insulin secretion or insulin resistance. Several studies have explored the antidiabetic potential of *Commelina benghalensis*, particularly the methanolic and aqueous extracts of its leaves. Experimental investigations conducted on diabetic animal models have demonstrated that administration of *C. benghalensis* extracts significantly reduces blood glucose levels. The plant extract has also been shown to improve lipid profiles by decreasing total cholesterol, triglycerides, and low-density lipoprotein levels while increasing high-density lipoprotein levels [13]. In addition, treatment with the plant extract has been reported to increase total protein levels and improve overall metabolic function in diabetic animals. The antidiabetic activity of the plant may be attributed to its phytochemical constituents such as flavonoids, alkaloids, and saponins, which may enhance insulin secretion, improve glucose uptake by peripheral tissues, and inhibit carbohydrate-digesting enzymes such as α-amylase and α-glucosidase. These findings indicate that *C. benghalensis* may have potential as a natural therapeutic agent for the management of diabetes and related metabolic disorders [14].

5.4 Anti-inflammatory Activity

Inflammation is a complex biological response triggered by infection, injury, or irritation and is often associated with pain, swelling, and tissue damage. Extracts of *Commelina benghalensis* have demonstrated notable anti-inflammatory activity in experimental studies. The plant extracts have been shown to reduce inflammation in animal models by inhibiting the production of inflammatory

mediators such as prostaglandins, cytokines, and nitric oxide. The anti-inflammatory properties of the plant are primarily attributed to the presence of flavonoids, sterols, and phenolic compounds, which possess the ability to modulate inflammatory pathways [15]. These compounds may inhibit enzymes such as cyclooxygenase (COX) and lipoxygenase (LOX), which are involved in the synthesis of pro-inflammatory mediators. Additionally, the antioxidant properties of the plant may further contribute to its anti-inflammatory effects by reducing oxidative stress associated with inflammatory responses. Due to these properties, *C. benghalensis* may be beneficial in the treatment of inflammatory conditions such as arthritis, skin inflammation, and other inflammatory disorders [16].

5.5 Anticancer Potential

Recent research has suggested that *Commelina benghalensis* may possess potential anticancer properties. Various plant-derived phytochemicals such as flavonoids, phenolic compounds, and terpenoids have been reported to exhibit cytotoxic activity against different cancer cell lines. Preliminary studies indicate that extracts of *C. benghalensis* can inhibit the proliferation of cancer cells and may induce apoptosis, a programmed cell death mechanism that prevents the uncontrolled growth of malignant cells. The anticancer effects of the plant are believed to involve multiple mechanisms, including inhibition of cell cycle progression, suppression of tumor growth, and induction of oxidative stress within cancer cells leading to their destruction [17]. In addition, certain phytochemicals present in the plant may interfere with signaling pathways that regulate cell survival and proliferation. Although these findings are promising, further studies involving advanced molecular techniques and clinical investigations are necessary to validate the anticancer potential of *C.*

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benghalensis and to identify the specific compounds responsible for these activities [18].

6. Therapeutic Potential

The diverse pharmacological activities exhibited by *Commelina benghalensis* highlight its considerable therapeutic potential in the field of natural medicine and pharmaceutical research. The presence of various bioactive phytochemicals, including flavonoids, tannins, sterols, saponins, and phenolic compounds, contributes to the plant's wide range of biological activities such as antimicrobial, antioxidant, antidiabetic, anti-inflammatory, and anticancer effects. These properties suggest that the plant may serve as an important natural source for the development of new therapeutic agents. In addition to its medicinal properties, the plant may also have potential applications in nutraceuticals and functional foods due to its antioxidant capacity [19]. Furthermore, the development of plant-based formulations derived from *C. benghalensis* could provide safer and more affordable alternatives to synthetic drugs [20].

Future research should focus on the isolation, purification, and structural characterization of the active compounds responsible for these pharmacological activities. Advanced analytical techniques such as gas chromatography–mass spectrometry (GC–MS), liquid chromatography–mass spectrometry (LC–MS), and nuclear magnetic resonance (NMR) spectroscopy can be employed to identify novel bioactive molecules present in the plant [21]. Additionally, further pharmacological and clinical studies are necessary to understand the mechanisms of action of these compounds and to evaluate their safety and efficacy for therapeutic use. Such investigations may contribute significantly to the development of new plant-derived

drugs and promote the utilization of *Commelina benghalensis* as a valuable medicinal resource [22].

7. Future Perspectives

Although numerous studies have demonstrated the pharmacological significance of *Commelina benghalensis*, comprehensive scientific investigations are still necessary to fully explore its medicinal potential and to translate laboratory findings into practical therapeutic applications. The plant contains a wide variety of phytochemicals such as flavonoids, phenolic compounds, tannins, saponins, and sterols, which are believed to contribute to its diverse biological activities. However, many of these compounds remain insufficiently characterized, and their exact roles in producing specific pharmacological effects are not yet fully understood [23]. Therefore, future research should focus on the systematic isolation, purification, and structural characterization of bioactive compounds present in different parts of the plant using advanced analytical techniques such as gas chromatography–mass spectrometry (GC–MS), liquid chromatography–mass spectrometry (LC–MS), and nuclear magnetic resonance (NMR) spectroscopy. These techniques will help identify novel phytochemicals and provide deeper insights into their chemical structures and biological functions [24].

Another important area for future investigation involves detailed mechanistic studies to understand how the phytochemicals of *C. benghalensis* exert their pharmacological effects at the molecular and cellular levels. Such studies may include evaluating their influence on cellular signaling pathways, enzyme inhibition, gene expression, and oxidative stress mechanisms. Understanding these mechanisms will provide scientific validation for the traditional medicinal uses of

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the plant and may help identify specific targets for drug development [25].

Furthermore, although several in vitro and in vivo experimental studies have reported promising biological activities, there is a significant need for clinical trials and toxicity studies to evaluate the safety, efficacy, and dosage of plant-derived compounds in humans. Clinical validation is essential for the successful integration of plant-based medicines into modern healthcare systems. Additionally, long-term toxicity and pharmacokinetic studies should be conducted to ensure that the compounds derived from *C. benghalensis* are safe for therapeutic use [26].

Future research should also emphasize the development of plant-based pharmaceutical formulations, including herbal extracts, standardized phytochemical preparations, and novel drug delivery systems. Incorporating the bioactive compounds of *C. benghalensis* into formulations such as capsules, tablets, topical creams, and nanoparticles could enhance their bioavailability and therapeutic effectiveness. Such advancements may pave the way for the commercialization of plant-derived drugs and promote the use of natural products as alternatives to synthetic pharmaceuticals.

Overall, continued research on *Commelina benghalensis* will not only deepen our understanding of its phytochemistry and pharmacology but also contribute significantly to the discovery and development of novel natural therapeutic agents for the treatment of various human diseases.

8. Conclusion

Commelina benghalensis Linn is recognized as an important medicinal plant possessing a wide range of pharmacologically active

constituents and notable therapeutic potential. The plant is rich in diverse phytochemical compounds such as flavonoids, tannins, glycosides, phenolic compounds, sterols, and terpenoids, which are known to contribute significantly to its biological activities. These secondary metabolites play a crucial role in providing protective and therapeutic effects, making the plant a valuable resource in traditional and modern medicine. For many years, *C. benghalensis* has been utilized in various traditional medicinal systems for the treatment of several health conditions, including infections, inflammatory disorders, wounds, skin diseases, and metabolic abnormalities. Such traditional knowledge has prompted scientific investigations into the pharmacological properties of this plant.

Recent experimental studies have provided substantial evidence supporting the antimicrobial, antioxidant, antidiabetic, anti-inflammatory, and anticancer properties of extracts derived from different parts of the plant. These pharmacological activities are largely attributed to the synergistic effects of the plant's bioactive compounds, which can modulate various biochemical and physiological pathways in the body. The antioxidant compounds present in the plant help protect cells from oxidative damage, while antimicrobial phytochemicals inhibit the growth of pathogenic microorganisms. Similarly, certain phytoconstituents have demonstrated the ability to regulate blood glucose levels and reduce inflammation, highlighting the plant's potential role in the management of chronic diseases.

Despite these promising findings, the therapeutic potential of *C. benghalensis* remains underexplored, and several aspects require further investigation. Advanced phytochemical studies are needed to isolate, identify, and characterize the specific bioactive molecules

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responsible for its pharmacological effects. Additionally, detailed toxicological evaluations and well-designed clinical trials are essential to determine the safety, efficacy, and appropriate dosage of plant-derived compounds for human use.

In conclusion, *Commelina benghalensis* represents a valuable natural resource with considerable potential for the development of new plant-based therapeutic agents. Continued research integrating phytochemistry, pharmacology, and clinical studies may facilitate the discovery of novel drugs derived from this plant and contribute to the advancement of natural product-based medicine.

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