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Exploring the Pharmacological and Antioxidant Potential of *Commelina communis* by Phytochemical and GC-MS Analysis

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Abstract

Commellina communis is a widely distributed medicinal plant known for its various therapeutic properties. The common name of *C. communis* is "Dayflower" or "Commelina." It is also sometimes referred to as "Widow's Tear" in certain regions.It has been traditionally used in folk medicine for its antioxidant, anti-inflammatory, and antimicrobial activities.The ethanol extract of *C. communis* demonstrated a rich presence of alkaloids, terpenoids, flavonoids, and phenols, highlighting its strong pharmacological potential. Moderate levels of carbohydrates, tannins, and steroids were also detected, suggesting the presence of additional bioactive compounds with possible therapeutic effects, while saponins and glycosides were absent. The GC-MS analysis revealed several biologically significant compounds, including hexadecanoic acid, ethyl ester, 9,12,15-octadecatrienoic acid, ethyl ester, and squalene, known for their antioxidant, anti-inflammatory, antimicrobial, and anti-cancer properties. Other notable compounds such as Mitotane, 9,12-octadecadien-1-ol (Z,Z), and E,E,Z-1,3,12-nonadecatriene-5,14-diol also indicate promising bioactive and industrial applications. These findings underscore the therapeutic, nutraceutical, and industrial potential of *C. communis*.

Keywords: *Commelina communis*, Dayflower, Phytochemical analysis, GC-MS, Bioactive compounds, Pharmacological potential.

Introduction

The diverse pharmacological properties of plants have been utilized as a form of medication since ancient times. In recent years, there has been a significant increase in the use of plants as an herbal medication in daily life, which is a form of ethno pharmacology. The new era of pharmacology is characterized by the biologically active molecules that are present in various sections of the plants. These molecules are used to treat a variety of diseases and for pest control. The elementary compounds of the plants have been adopted as a repellent and a medication in fields. In developed countries, both traditional and

ornamental plants are subjected to numerous scientific methodologies for confirmation of conventional applications and quality control (Houghton and peter, 1995). The introduction of new remedies and ailments through the development of new methodologies from plant extracts is a critical component of the global health maintenance, which is facilitated by plants that have been used for medicinal purposes.

The enormous range of pharmacological chemicals that inherent in plants has led to a significant increase in the popularity of plant-based applications. The genus Commelina, belonging to the family Commelinaceae, consists of more than 500-600 plant species (Oppong et al., 1998). These plants are extensively utilized for the treatment of many diseases and have been shown to enhance therapeutic outcomes worldwide (Bezerra et al., 2019). The enhanced pharmacological effectiveness of Commelina is attributed to the inclusion of diverse phytochemicals, including alkaloids, phenols, flavonoids, glycosides, tannins, anthocyanins, sterols, and saponins, as secondary metabolites (Ezeabara et al., 2019). In the body, these chemicals have been shown to have anti-diabetic and anti-diarrheal properties (Riaz et al., 2018). Moreover, they possess chemicals that stimulate fertility and demonstrate to be an excellent hepato-protective component, and as diuretics. They function as antioxidants and anti-cancer agents. In addition, it works as a sedative and analgesic (Dash et al., 2015). Crucially, it specifically targets parasites such as helminthes. The widespread popularity of Commelina species as herbal medicine and for other purposes may be attributed to its safety, affordability, and easy availability.

The species of Commelina have been extensively exploited worldwide due to their widespread availability and the presence of enriched phytochemicals in each species (Dagne et al., 2024). Consequently, across the globe, their applications differ in each country. For the treatment of snake bites, epilepsy, mental problems, fever, jaundice, headache, leprosy, and constipation, the *Commelina sp*. has been utilized in India (Sivakumar, 2024). It is frequently used in China as an antipyretic and antifungal agent (Khan et al., 2011). It is highly prescribed as a sedative in Pakistan for relieving inflammation and leprosy (Kansagara et al., 2019). In Cameroon, the stem of the plant is often used for wound healing. Utilizing the botanical extract of the Commelina genus in Lesotho effectively reverses female infertility (Ibrahim et al., 2010). It serves as an effective remedy for eye injuries, throat pain, and painful feet in Ghana (Mokgotho and Matlou, 2009). The oil extracted from the flower in Zanzibar is used for the treatment of certain ocular ailments. In East Africa, the plant fluid is employed for easing wounds and throat disturbances (Ibrahim et al., 2010). The wound healing process in Uganda is accelerated by pulverizing the whole plant and encasing it around the wound with a thin fabric or plant leaves (Cuellar et al., 2010). The crushed leaves of this plant are used in China to treat urinary tract infections, swellings, and diarrhea. To treat tonsillitis, pharyngitis, and laryngitis, the juice of the stem is utilized in the same nation. Nepalese women get relief from menstruation issues, rheumatoid arthritis, and mumps. The practice in ancient Egypt included the treatment of abdominal and groin disorders (Vu et al., 2023). In Mexico, it is used to alleviate diarrhea (Zavala et al., 1998). In Bangladesh, the whole plant is employed for the treatment of cat and dog attacks (Dash et al., 2018). In Brazil, the stems and leaves are utilized for the cure of hypertension, female infertility, and dermatological conditions. The macerated leaves are used for the purpose of treating the stings caused by insects that specifically invade Congo (Cavichi et al., 2023).

Materials and Methods

Sample preparation and Extraction:

The plant material of *C. communis* was collected, shade-dried for 10 days, and ground into fine powder using a mechanical grinder. The extract was prepared using the Soxhlet extraction method with methanol as the solvent. Approximately 35 g of the powdered sample was placed in the extraction chamber of a Soxhlet extractor,

maintaining a temperature of 70°C for 48 hours. The resulting extract was concentrated in an oven at 35°C to obtain a dried sample for GC-MS analysis (Igwe et al., 2015).

Qualitative Phytochemical Analysis:

Phytochemical analysis of *C. communis* was conducted using various qualitative tests to identify bioactive compounds, which resulted in observable color changes or precipitate formation. The primary and secondary metabolites detected included carbohydrates, tannins, saponins, flavonoids, alkaloids, quinones, glycosides, terpenoids, phenols, coumarins, steroids, phytosteroids, phlobatannins, and anthraquinones. The presence of these compounds was confirmed through specific reactions: carbohydrates formed a purple or reddish color with Molisch's reagent; tannins showed a dark blue or greenish-black color with Folin-Denis reagent; saponins produced foam after shaking; flavonoids turned yellow with sodium hydroxide; alkaloids formed a green color or precipitate with Mayer's reagent; glycosides formed a pink color with ammonia; terpenoids showed a red-brown color with sulfuric acid; phenols produced a blue or green color with Phenol-Denis reagent; and steroids/phytosteroids formed characteristic rings with chloroform and sulfuric acid. These tests were carried out following protocols established by Santhi & Sengottuvel (2016), Mumtaz et al. (2014), and Dimri et al. (2024).

GC-MS Analysis:

The phytochemical profiling of *C. communis* was conducted using a Shimadzu GC-MS QP2010 Plus system equipped with a Restek XTI-5 capillary column (0.25 mm, 60 m). The column temperature was programmed to start at 80°C for 1 minute, followed by a linear increase of 70°C/min to 220°C (held for 3 minutes) and then 10°C/min to 290°C (held for 10 minutes). The injection port and GC-MS interface were maintained at 290°C. Helium was used as the carrier gas at a flow rate of 1.2 ml/min. The sample was introduced via an all-glass injector in split mode, with ionization performed at 70 eV.

Phytochemical compounds were identified by comparing their retention indices, peak areas, and mass spectra with reference databases such as NIST08.LIB (Stein, 1990) and WILEY8.LIB (Mc. Lafferty, 1986), as well as published literature. Information on molecular weight, formula, structure, and bioactivity of the identified compounds was documented for further analysis.

Results

Qualitative phytochemical analysis:

Table 1 shows the qualitative phytochemical analysis

Phytochemical Compound	Result
Carbohydrates	++
Tannins	+
Saponins	-
Flavonoids	+++
Alkaloids	+++
Glycosides	-
Terpenoids	+++
Phenols	+++
Steroids	+

+ = Present slightly; ++ = Moderately present; +++ = Highly Present; - = Absent

The ethanol extract of *C. communis* exhibited a rich presence of alkaloids, terpenoids, flavonoids, and phenols, indicating its strong pharmacological potential. Moderate levels of carbohydrates, tannins, and steroids were also detected, suggesting the presence of additional bioactive compounds with possible therapeutic effects. Saponins and glycosides were absent. This diverse phytochemical profile highlights the plant's promising antioxidant, anti-inflammatory, and antimicrobial properties.

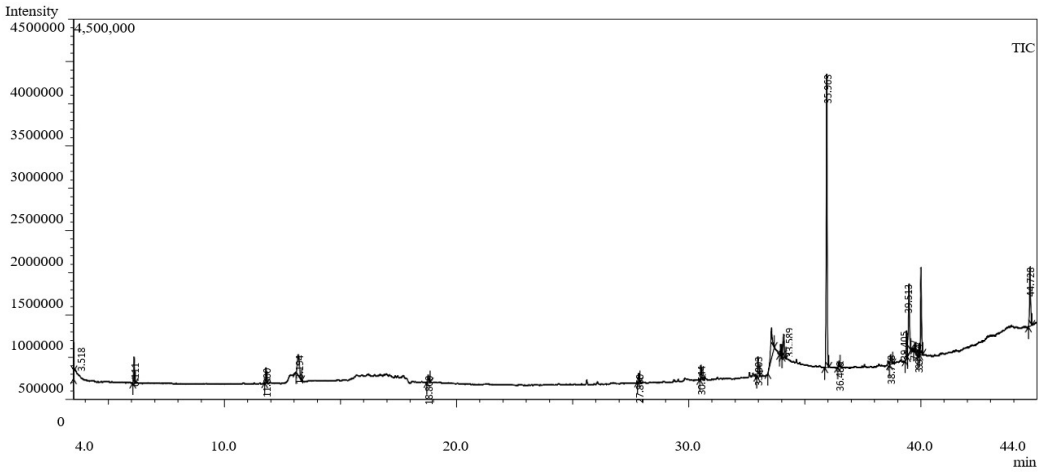

Fig 1 Shows GCMS chromatogram of ethanolic extract of *C. communis*

Table 2 shows the Peak Report the bioactive phyto-compounds present in *C. communis*

Peak#	R.Time	Area	Area%	Name
1	3.518	276331	0.97	3-Tetradecyn-1-ol
2	6.111	673891	2.35	Tetradecane
3	11.800	514464	1.80	Tetradecane
4	13.194	1512288	5.28	DiethylPhthalate
5	18.800	337751	1.18	Heneicosane
6	27.860	321202	1.12	Acetamide,2-(Diethylamino)-N-(2,
7	30.544	466895	1.63	HexadecanoicAcid,EthylEster
8	33.003	711024	2.48	2-Hexadecen-1-ol,3,7,11,15-Tetram
9	33.589	2198303	7.68	E,E,Z-1,3,12-Nonadecatriene-5,14-diol
10	33.984	329539	1.15	Ethyl (9z,12z)-9,12-Octadecadieno
11	34.104	998872	3.49	9,12,15-Octadecatrienoicacid,ethylester,(Z
12	35.963	10109760	35.33	Mitotane
13	36.486	201884	0.71	Triarachine
14	38.718	405765	1.42	9,17-Octadecadienal,(Z)-
15	39.405	915634	3.20	9,12-Octadecadien-1-ol,(Z,Z)-
16	39.513	2903091	10.14	NonanoicAcid,9-(3-Hexenylidene
17	39.757	263413	0.92	Ethyl (9z,12z)-9,12-Octadecadieno
18	39.934	369102	1.29	Glycidolstearate
19	40.027	2885227	10.08	Benzyldiethyl-(2,6-xylylcarbamoylmethyl)-a
20	44.728	2223726	7.77	Squalene

Discussion

The GC-MS analysis of *C. communis* revealed several biologically significant compounds with diverse applications. Hexadecanoic acid, ethyl ester, is known for its antioxidant, anti-inflammatory, and antimicrobial properties, making it valuable in pharmaceuticals and cosmetics. The presence of 9,12,15-octadecatrienoic acid, ethyl ester (a linolenic acid derivative) highlights its potential as an omega-3 fatty acid with anti-inflammatory and cardioprotective effects. Squalene, a natural antioxidant, offers anti-cancer and skin-protective benefits, while Mitotane is a cytotoxic compound used in the treatment of adrenal cortex carcinoma. Other noteworthy compounds include 9,12-octadecadien-1-ol (Z,Z), which exhibits antioxidant and antimicrobial activity, and E,E,Z-1,3,12-nonadecatriene-5,14-diol with promising bioactive properties. Additionally, Tetradecane and Diethyl Phthalate suggest potential industrial and antimicrobial applications. These findings underline the therapeutic, nutraceutical, and industrial potential of *C. communis*.

Further the leaves of the species *C. communis* is used to treat the Diabetes milletes in Korea. Whereas, in China, it is used in the treatment of cold, sore throat, fever, obesity, dysentery, malaria, and intestinal enteritis (Youn et al., 2004). These enhancing properties of the *Commelina communis* are believed to be because of the metabolites produced by them which includes notable alkaloids like α-homonojirimycin and 7-O-β-D glucopyranosyl-α-homonojirimycin, which is a glycosidase inhibitor (Kim et al., 1999). It has rich purine nucleotide called adenosine which enhances cell signaling and is involved in plant stress response mechanism (Darwin et al., 2018). The aqueous extract of the *C. communis* demonstrated dose-dependent inhibition of alpha glycosidase via *In vitro* experimental study. It alleviated the hyperglycemic state induced by the high maltose diet. It also regulates the condition by reducing the breakdown of carbohydrates and the absorption of glucose. It has been shown to be the most effective therapy for eliminating non-insulin dependent diabetes. Furthermore, it demonstrated no cytotoxic effects, therefore establishing it as the most effective therapy without any adverse effects (Youn et al., 2004). No prior studies have specifically examined the insecticidal properties of *C. communis*, therefore opening up a new paradigm for exploring its insect-repellent action.

Conclusion

The GC-MS analysis of *C. communis* has revealed a diverse range of bioactive compounds with significant therapeutic and industrial potential. Key compounds such as hexadecanoic acid, ethyl ester, 9,12,15-octadecatrienoic acid, ethyl ester, and squalene highlight the plant's antioxidant, anti-inflammatory, and antimicrobial properties, while Mitotane underscores its potential in cancer therapy. The presence of other biologically important compounds further demonstrates the multifaceted applications of *C. communis* in pharmaceuticals, nutraceuticals, and industrial sectors. These findings provide a strong foundation for future research on the plant's bioactive compounds and their mechanisms of action, paving the way for its development into valuable therapeutic agents and functional products.

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Conflict of interest statement

Authors declares no conflict of interest.

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