A Review on Phytochemical Investigation of Colebrookea Oppositifolia

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***Abstract*—Colebrookea oppositifolia is an aromatic and wild growing shrub, commonly known as Bhaman. Plant is a traditionally used for its medicinal properties. The plant has an ethnopharmacological importance in the treatment of various ailments by traditional healers. was investigated for its phytochemical constituents using different solvent extracts. The aerial parts of the plant were shade-dried, powdered, and subjected to sequential extraction using n-hexane, ethyl acetate, and methanol. Preliminary phytochemical screening revealed a wide distribution of secondary as well as multidrug resistance. The results provide a scientific basis for the plant's traditional therapeutic applications and point to its potential as a source of bioactive compounds for future pharmacological research. Further studies, including compound isolation and bioactivity assays, are recommended to explore its full medicinal potential.**

***Index Terms*—Medicinal plant, Lamiaceae, Bhaman, Phytochemicals.**

I. INTRODUCTION

Plants are gift of the earth to the human being. Plants are used in medicine from thousands of years. Many medicinal plant species worldwide are used in traditional medicine for treating different diseases. The world health organization (WHO) has estimated that about 80% of the population living in the developing countries depends tremendously on traditional medicine for their primary health needs. More than half of the world's population still depends exclusively on medicinal plants, and plants offer the active ingredients of most traditional medical products. The plant kingdom has contributed and is still contributing immensely to human health.

Colebrookea oppositifolia is a monotypic genus of Lamiaceae, contains 236 genera and 6,900 to 7,200 species, out of which about 400 species are reported from India. The members of this family are well known as aromatic species. It is a perennial shrub commonly called as Bhaman or Dosul in local and also known as Indian Squirrel Tail in English Due to the resemblance of the characteristic hairy flower spikes to a squirrel's tail. The plant is evergreen, densely woolly shrubs or small tree, that grows up to 3 meters tall at moderate altitude. The plant produces various minute white flowers in 6-12 cm long spike inflorescence, whereas, oppositely arranged leaves are crowded at the branch ends. (Lal et.al). The plant distributed mostly in subtropical regions. Plant is mainly used in the traditional system of Indian medicine for the treatment of various ailments such as headache, fever, dysentery, peptic ulcer, dermatitis, wounds, haemostatic, antifungal, as anti-fertility agent. Various parts of C. oppositifolia have been shown to possesses pharmacological activities such as antioxidant, antiulcer, antimicrobial, cardioprotective and anti-fertility activities. (Yadav 2019).

Phytochemicals are categorised into primary and secondary metabolites. proteins, carbohydrates, and nucleic acids are the primary metabolites which are vital for the basic metabolic processes of plants. In contrast, secondary metabolites such as phenolics, flavonoids, and terpenoids are synthesized through specialized pathways and are often linked to protective functions, including antibacterial, antifungal, and antiviral activities. These secondary compounds are of significant interest in research due to their ability to compete with various diseases and the defence mechanism. (Bimal G. C. et.al. 2025). Phytochemicals

such as phenolics and flavonoids are secondary plant metabolites known for their potent antioxidant, anti-inflammatory, antimicrobial, and anticancer activities. These compounds scavenge reactive oxygen species (ROS), reduce oxidative stress, and modulate cellular signalling pathways involved in inflammation and carcinogenesis. In plants like C. oppositifolia, which are used traditionally for treating inflammatory and infectious conditions, it is likely that these metabolites are key contributors to bioactivity. However, such assumptions require validation through systematic phytochemical analysis and quantification. (Singh et.al. 2025).

This plant is also known for essential oil and their potential synergistic effect and used as antibiotics, antimicrobial property, oil extracted from various parts of plant- leaves, flower and stem. essential oils are primarily attributed to their high content of bioactive compounds such as terpenes, terpenoids, phenolics, and aldehydes. These compounds can disrupt bacterial cell membranes, interfere with enzyme activity, and inhibit biofilm formation, making essential oils potent antimicrobial agents. Specifically, terpenes can cause cell membrane destabilization, leading to increased permeability and cell lysis, while phenolic compounds can inhibit key enzymatic processes in bacterial metabolism. (Shang et.al. 2024).

The present study was designed to address existing gaps in the phytochemical evaluation of Colebrookea oppositifolia. The main objectives are to- qualitatively identify the major phytochemical classes present in different solvent extracts of the plant and compare the phytochemical richness across solvents to suggest the most suitable extract for further biological investigation.

II. CLASSIFICATION

Kingdom: Plantae
Phylum: Eudicots
Class: Asterids
Order: Lamiales
Family: Lamiaceae
Genus: Colebrookea
Species: oppositifolia

III. MATERIAL AND METHODS

Collection and preparation of plant material:

Leaves of C. oppositifolia were collected from Chikhaldara region. Collected leaves were shade dried in room temperature (25^0c to 28^0c approx.), this process continued for 15 days until the plant material was dried completely. Then dried plant material was finely ground into powder for estimation of bioactive constituents.

Phytochemical Screening:

The preliminary phytochemical analysis of C. oppositifolia in various solvent to identify major classes of secondary metabolites present in plants. Qualitative screening is done in three different solvent- methanol, n-hexane and ethyl acetate.

Test for alkaloids:

Mayer's test- To test for alkaloids, small portions of extract were treated with Mayer's reagent, cream colour precipitate indicates the presence of alkaloids in the sample.

Test for flavonoids:

Alkaline reagent test- A yellow coloration that turned colourless upon the addition of dil. acid confirmed flavonoid presence.

Test for Tannins:

Ferric chloride test- Extract treated with 1 ml of 5% ferric chloride solution, The greenish black precipitate shows the presence of tannins.

Saponins:

Froth test- Extract was diluted with distilled water and vigorously shaken. Persistent frothing lasting more than 15 minutes suggested saponins.

Test for terpenoids:

Salkowski test- Extract was dissolved in chloroform and few drops of sulphuric acid was added to it. The chloroform layer if shows reddish colour then it is presence of terpenoids.

Test for steroids:

Liebermann Burchard reaction- A greenish-blue colour change following the addition of acetic anhydride and concentrated sulfuric acid was considered positive.

Phenolic Compounds: Ferric chloride and lead acetate tests- A deep blue or green coloration with ferric chloride and white precipitate with lead acetate indicated the presence of phenolics.

IV. RESULT AND DISCUSSION

Table1. Phytochemical screening of Colebrookea oppositifolia.

Phytochemical Group	Methanol	Ethyl acetate	n-hexane
Alkaloids	+	+	-
Flavanoids	+	+	-
Tannins	+	+	-
Saponins	+	-	-
Terpenoids	-	+	+
Steroids	-	-	+
Phenolics	+	+	-

Phytochemical screening of C. oppositifolia in three different solvent methanol, ethyl acetate and n-hexane stated that Alkaloids were detected in the methanol and ethyl acetate extract, while being absent in n hexane. Flavonoids were present in the methanol and ethyl acetate. In contrast, the n-hexane had a trace or no flavonoid content. Tannins were observed in the methanol and ethyl acetate extract, n-hexane extracts did not show noticeable tannin presence. methanol extract showed a significant froth layer, indicating the presence of saponins, while the other fractions were negative. Terpenoid absent in methanol extract while present in both ethyl acetate and n-hexane. Steroids absent in both methanol and ethyl acetate extract and present in n-hexane. Phenolic compounds were present in the methanol and ethyl acetate extract. No reaction was observed in n-hexane.

V. CONCLUSION

These solvent based extraction and screening of C. oppositifolia provides the valuable information and understanding about phytochemical composition of this medicinal plant. Result shows that phytochemicals like alkaloid, flavonoids, tannins, saponins, terpenoids, steroids and phenolics present significantly. This suggests that methanolic extracts of C. oppositifolia may hold considerable pharmacological potential, particularly for antioxidant, antimicrobial, and anti-inflammatory activities, which are commonly associated with these phytochemical groups. n-hexane extracts, while less diverse, were rich in terpenoids and steroids compounds often linked with antimicrobial and anticancer properties.

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