

Review

Botanical Description of *Coleus forskohlii*: A Review

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Natural products continue to play a significant role in the detection and advancement of new pharmaceuticals as clinically useful drugs and as raw materials to produce synthetic drugs, or as lead compound from which a totally synthetic drug is designed. *Coleus* is a member of the mint family and native to India and grows in the subtropical temperate climates of India, Nepal, Thailand and Sri Lanka and is a popular ornamental plant. *Coleus* plant have reputed medicinal uses including antiaggregant, anticancer, antidepressant, antidiuretic, antiglaucomic, antimetastatic, antispasmodic and bronchodilator. This article gives a comprehensive look on *Coleus* as a natural product and aims to present it in a brief manner for the researchers, botanists, pharmacognosists and herbalists to refresh their knowledge about *Coleus*.

Key words: *Coleus*, ornamental plant, mint family.

INTRODUCTION

Coleus is an aromatic perennial, with an erect stem and tuber like roots, reaching 60 cm. (Prajapati et al., 2003). *Coleus* is a member of the mint family and native to India, and grows in the subtropical temperate climates of India, Nepal, Thailand and Sri Lanka. *Coleus* is 1 to 2 feet tall having teardrop striking leaves, shimmering green framing a bright purple center; leaf color differs with the amount of shade. Flowers are of pale purple or blue color (Figure 1).

The rootstock is thick, fibrous, rapidly spreading and typically golden brown (Thorne Research, 2006). The whole plant of *Coleus* is important; however, we used, normally, root and leaves of this plant. It is propagated by seeds and vegetative method (Prajapati et al., 2003). *Coleus* has been used since ancient times in Hindu and Ayurvedic medicine. *Coleus* plant have reputed medicinal uses, which includes antiaggregant, anticancer, antidepressant, antidiuretic, antiglaucomic, antimetastatic, antispasmodic, bronchodilator, bronchospasmolytic, cAMP-genic, cardiogenic, CNS-

depressant, gastrostimulant, gluconeogenic, glycogenolytic, hypotensive, immunosuppressant, lipolytic, myorelaxant, neurogenic, pancreatostimulant, positive inotropic, secretagogue, sialagogue, thyrotropic and vasodilator (Duke et al., 2002). *Coleus* also finds application in the treatment of eczema and psoriasis (Alternative Medicine Review, 2006). The leaf extracts of this plant have significantly high amounts of polyphenols, flavones and flavonols and high antioxidative activity (Rasineni et al., 2008). This antioxidative activity provides the basis of this plant for cosmetic use.

TAXONOMICAL CLASSIFICATION

Taxonomical classification of this plant has always provided better contribution to conserve existing plant names, for the benefit of researchers, botanists, taxonomists, pharmacognosists and other users. A concise taxonomical classification of *Coleus forskohlii* is presented in Table 1.

Plant morphology

Coleus plants are aromatic perennial and have tuber like

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Figure 1. *C. forskohlii* plant.

Table 1. Taxonomical classification of *C. forskohlii*.

Kingdom	<i>Plantae</i>
Phylum	<i>Angiospermae</i>
Class	<i>Dicotyledoneae</i>
Order	<i>Tubiflorae</i>
Family	<i>Lamiaceae</i>
Genus	<i>Coleus</i>
Species	<i>forskohlii</i>



Figure 2. *Coleus* leaves purple from center and greenish on margins.

roots and an erect stem, reaching 2 feet (Sammbamurty, 2006). *Coleus* is a member of mint family. It grows in the temperate climates. *Coleus* height is approximately 1 to 2 feet and the leaves are teardrop shaped, shimmering green framing with a bright purple center (Figure 2). The leaf color varies with the amount of shade. A cluster of stalked blue or pale purple flowers branches off a stem. The rootstock is thick, fibrous, radially spreading and

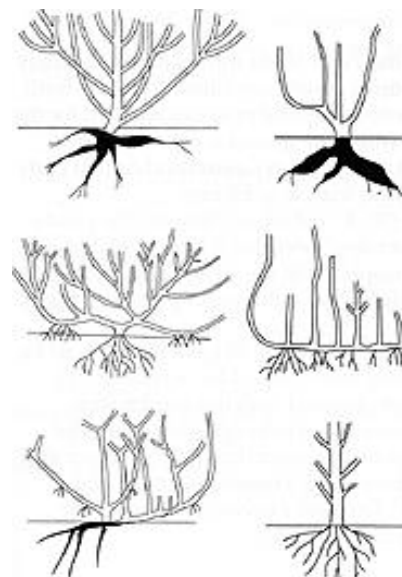


Figure 3. Diverse growth forms of *C. forskohlii*.

typically golden brown in colour. *C. forskohlii* has diverse growth forms as shown in Figure 3 and the roots are harvested in the fall season when the color is bright and the roots are most concentrated in forskolin (Alternative Medicine Review, 2006). *Coleus* is warm temperate and subtropical plant species naturally growing at 600 to 1800 m altitude.

Plant grows on sunny hill slopes and plateaus in arid and semi-arid climates. *Coleus* inhabits sandy-loam or loamy soil with 6.4 to 7.9 pH. Plant is herbaceous with perennial rootstock and annual stems. Plants from different ecogeographic areas differ greatly in their morphology. Growth habit is strikingly variable, being procumbent, decumbent or erect. Shoot height ranges from 15.0 to 120 cm. Lamina length differs from 1.5 to 15.5 cm². Inflorescence length varies from 3 to 40 cm. Morphology of root differs in different populations being fibrous, tuberous or semi-tuberous. Fresh root yield in different populations differs from 1 to 500 g/plant. Forskolin (Figure 4) content in roots ranges from 0.07 to 0.58% of dry matter (Virbala and Kalakoti, 1994).

Common names of *Coleus*

Some common names of *C. forskohlii* are presented in Table 2.

Composition of *Coleus*

1. The key constituents of *coleus* are volatile oils and diterpenes, but the most important is forskolin

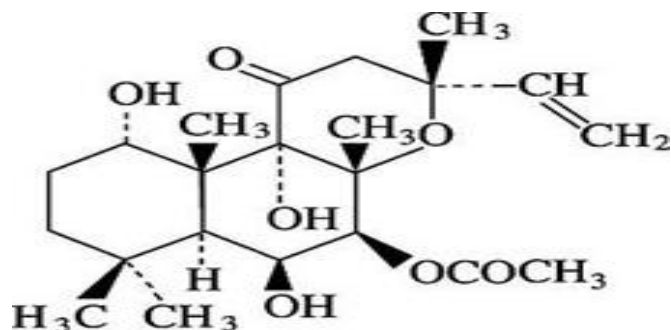


Figure 4. Chemical structure of forskolin.

Table 2. Some common names of *C. forskohlii*.

Coleus	English and Urdu
<i>C. forskohlii</i>	Latin
Makandi	Sanskrit

(Sammbamurty, 2006).

2. The diterpene forskolin is the primary constituent of *Coleus* which is derived from the root portion of the plant. Other plant constituents are volatile oil, diterpenoids and coleonols. There are approximately 20 constituents in different parts of *Coleus* plant, but forskolin and coleonols are found in the root part of the plant (Alternative Medicine Review, 2006).

3. The leaf extract of *Coleus* have significantly high amount of polyphenols, flavonols and flavones and high antioxidant activity. HPLC studies of leaf and stem tissues prove the presence of standard antioxidative polyphenols and more potent antioxidative polyphenols which demonstrate that the *Coleus* can be used as an important source of phenolic compounds having high antioxidant activity. Tannins are also present in the leaf and stem portion of the *Coleus* plant (Rasineni et al., 2008).

4. Two diterpenoid quinones were isolated from the chloroform extract of the *Coleus* leaves which are coleon S and coleon (Yao and Xu, 2001).

EXTRACTION OF *Coleus*

Coleus is usually extracted with ethanol or methanol. Different researchers used different techniques for the extraction of different constituents from the leaves of *Coleus*. Rasineni et al. (2008) used 80% ethanol for extraction for the purpose of total phenolics estimation, while they used 95% ethanol for extraction for the purpose of estimation of flavones and flavonols. They also used distilled water extraction for the estimation of tannins.

Zakaria et al. (2008) used 100 g of dried and powdered leaves and extracted with 500 ml of methanol at room temperature with constant shaking for 24 h. They also used this method to compare three species of mint family for their antioxidant activity (Zakaria et al., 2008).

Yao and Xu (2001) used 2.5 kg of dried leaves of *Coleus* extracted with 6 L of 95% ethyl alcohol at room temperature for 15 days. Leaf extract was decoloured with active charcoal, and solvent was removed in vacuum. Residue dissolved in water-methanol mixture (3:1) and evaporates the methanol. The aqueous solution extracted with CDCl_3 extract evaporated to give residues. This method is used for the isolation of diterpenoid quinones from *Coleus* leaves (Yao and Xu, 2001).

USES OF *Coleus*

Coleus is a plant that has been used since ancient times in Ayurvedic and Hindu traditional medicine. The root portion has been traditionally used to treat colic, congestive heart failure, convulsions, eczema, hypertension, insomnia, painful urination and respiratory disorders. Use of *Coleus* also provides therapeutic benefit in angina, asthma, psoriasis and prevention of cancer metastases (Alternative Medicine Review, 2006).

Cosmetic uses

Forskolin extracted from *Coleus* plant increases isoform selectivity via acting on adenylyl cyclase to enhance the intracellular levels of cyclic adenosine monophosphate (AMP). The mechanism of increasing and maintaining lean body mass is link to the availability of cyclic AMP. By facilitating hormonal action, cyclic AMP may control the thermogenic response of the body to food, increase the utilization of body fat and enhance the metabolic rate of the body. Forskohlin in combination with hydroxycitric acid (HCA) can be use for body fat and body shape management (Gupta, 2004).

For skin problems

Coleus oil is useful in topical preparations, due to its antimicrobial properties. *Coleus* oil is particularly effective against propionibacterium acnes, the microorganism responsible for acne, and it has been found active against other microorganism known to be responsible for skin infections and eruptions. Laboratory studies suggest that *Coleus* oil inhibit the growth of different skin pathogens. It has also been found effective against yeast culture (Majeed and Prakash, 2007).

Antioxidant activity

Plant extract of *C. forskohlii* shows high amount of

polyphenols and higher antioxidant activity in comparison to other *Coleus* species. Leaf extract of this plant exhibited significantly high amount of total polyphenols, flavonols and flavones and high antioxidant activity. High performance liquid chromatography (HPLC) profiling of stem and leaf tissues exhibited the presence of standard antioxidative polyphenols and more potent polyphenols. Rasineni et al. (2008) suggest that *Coleus* can be used as an important source of phenolic compounds with significantly high antioxidant activity (Rasineni et al., 2008). *Coleus* is a rich source of diterpenoids with different oxygen patterns, and six diterpenoids are isolated from whole plant up to the year 2001. Yao and Xu (2001) isolated two new diterpenoid quinones and named them coleon S and T.

Perfumery uses

Over forty compounds belonging to four different classes of aroma compounds have been isolated from oils obtained from different indigenous genotypes of *C. forskohlii*. These include monoterpenoids, diterpenoids, sesquiterpenes and sesquiterpenes alcohol. The presence of compounds like 3-decanone, bornyl acetate and g-eudesmol were identified in experimental studies (Majeed and Prakash, 2007).

Miscellaneous uses

Coleus also works well in treating asthma, cancer, cardiopathy, congestive heart failure, convulsions, cramp, depression, dermatosis, dyspepsia, dysuria, eczema, glaucoma, high blood pressure, hypothyroidism, infertility, insomnia, ischemia, myocardosis, obesity, psoriasis, respirosis, thrombosis and water retention (Duke et al., 2002).

CONCLUSION

Worldwide medicinal plants are being investigated because products are safe, cheaper and efficacious in overall. *Coleus* is an ornamental plant with many medicinal components and medicinal properties. It is a valuable addition in medicinal plants biodiversity. It has been investigated in colic, congestive heart failure, convulsions, eczema, hypertension, insomnia, painful urination and respiratory disorders. Further exploration of this antioxidant plant is necessary to investigate this plant at molecular and cellular level so that certain conclusions could be drawn about this valuable plant.

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