

Coleus forskohlii and its forskolin: A review

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Abstract

Coleus forskohlii is an important medicinal plant native to India. The herbaceous species grows in sub tropical warm climate of India, Nepal, Myanmar and Sri Lanka. In India it grows in the Himalayan Region, extending from Shimla to Kumaon and Garhwal hills at an altitude ranging from 600 to 2300mts. Currently it is been cultivated in some part of south and central India. It is the member of had been mint family and described in Ayurveda for its medicinal properties. The plant has very high medicinal value. In Uttrakhand the plant has been reported to be used by Bhotias of the district Pitthoragarh for the treatments of ailments like psoriasis, eczema and cardiac diseases. In the past the plant

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has been analyzed medicinal properties of by various researchers for the presence of phytochemicals and other properties, roots of *C. forskohlii* known to contain a labdane diterpenoid forskolin. Forskolin have high pharmaceutical value as it is said to be cAMP genic and other the plant. In recent past many researchers have worked upon the cultivated variety of the plant, to determine the biochemical pathway involved in the forskolin biosynthesis. While many researchers have been working on the molecular biology of the important terpenoids, involving its biosynthesis, enzymes involved in the pathway and the important genes involved. It has been found that GGPP synthase is the main enzyme involved in this pathway and hence GGPP synthase gene has been studied. Forskolin has very high medicinal value and researchers are unable to synthesize it in laboratory till now. So, it becomes important for the scientist to develop high forskolin producing varieties of *C. forskohlii*. The present article focuses on the medicinal value of *C. forskohlii* and its forskolin.

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Introduction

Coleus forskohlii Briq., is an important medicinal plant of family Lamiaceae, growing wild in the sub tropical climate of India, Nepal, Bhutan, Thailand, Burma and Sri Lanka. India is considered to be native place of the plant ((Valdes *et al.* 1987; Patil *et al.* 2001). In India the plant grows in the Himalayan region extending from Shimla to Kumaon and Garhwal hills (600-2300 altitude). Kurian and Sankar (2007) have reported it from South India, Andaman Nicobar and North eastern state also. The plant has been described in Ayurveda by the name 'Mayani' or 'Makandi' (Shah, 1996). Generally the plant is found in agricultural fields, wastelands, dry and barren hills. *Coleus* is a perennial herb with a height up to 45-60cm. with four angled branched stem having hairy nodes. The roots are radially spreading, thick, fibrous and golden brown in colour (Thorne research article 2003). *C. forskohlii* is the only species having fasciculated roots. The root morphology is quite variable in different populations (Kavitha *et al.* 2010). In Uttarakhand the plant grows in the arid and semi arid areas of Himalayan Region. Locally it is known as 'fiwain'. The plant has been used by the tribal population of this region since old times for the treatments of various treatments like psoriasis, eczema, skin infections, leucorrhoea and asthma. In general the roots and the leaves of the plant are used. The tuberous roots are found to be rich source of the labdane diterpenoid forskolin. However the whole plant has been a rich source of various phytochemicals as roots also contains Coleonol and Coleosol while the leaves contain barbatusin, cyclobarbatusin, methylene quinine and coleon. The diterpenoids are found in almost

all parts of the plant but the roots are major source (Chandel and Sharma, 1997). Many other phytochemicals also found in the plant as terpenoids, monoterpenes, sesquiterpenes glycosides and phenolic glycosides. The plant has been used in treatment of various diseases worldwide, in Egypt and Africa leaves are used as emmenagogue and diuretic. In Brazil it is used in treatment of intestinal disorders (Valdes *et al.*, 1987). In Central India the plant roots are used as condiments and for making pickles also. The plant is used for veterinary purposes also (De Souza and Shah, 1988). The decoction of the plant is given with honey for the treatment of asthma and leucorrhoea. Powdered roots are given for cardiac complaints, piles and urinary complaints.

Taxonomic Position

The plant belongs to family Lamiaceae and the genus *Coleus*. Commonly known as the mint family, Lamiaceae includes a number of potent medicinal plants. It consists of 236 genera and 7000 species, the largest family of the order Lamiales. The plants are generally aromatic with colorful leaves, and have been used since ancient times for their pharmaceutical properties (Hirasa and Takemasa 1998, Bais *et al.*, 2002). The genus *coleus* was first described by Loureiro in 1790; from the Greek word 'COLEOS' meaning sheath. There 150 species belonging to this genus, having showy, colorful leaves and been used as ornamentals. The major medicinal species of *Coleus* in India are tuberous *C. forskohlii*, *C. scutellaroides*, *C. malabaricus*, *C. zeylanicus* and *C.amboinicus*, other species are mainly used to treat dysentery and digestive disorders (De Souza *et al.* 1983; Kurian and Sankar 2007). The

taxonomis position of *Coleus forskohlii* is as follows:

Kingdom - Plantae

Division - Magnolophyta

Class - Magnoliopsid

Order - Lamiales

Family - Lamiaceae

Genus - *Coleus*

Species – *forskohlii*



Fig. A. Flower of *C. forskohlii*

B. Leaves of *C. forskohlii*

Medicinal Uses of *Coleus forskohlii*

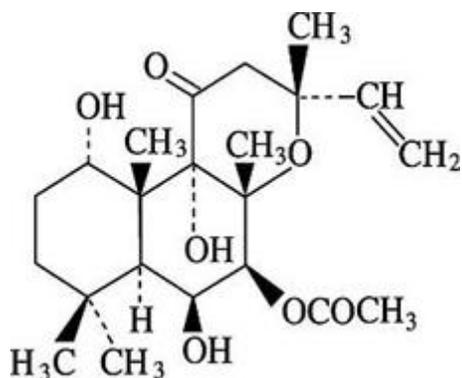
C. forskohlii is used as a tonic in South India. The roots are also used in treatment of worms. The root paste allays burning in festering boils. Root is ground in mustard oil and the paste is applied on eczema and skin infections. It is also used as antiaging and antioxidant agent and as a remedy for heart, abdominal and respiratory disorders (Srivastava *et al.*, 2002). In Uttarakhand it has been used by the tribal population (Bhotias) in the treatment of various ailments like psoriasis, skin infections, wound healing, stomach and other ulcers and cardiac disorders. The diterpenoids are important constituents among the phytochemicals that has been isolated from the plant. Forskolin, is an important labdane diterpenoid that is extracted from the roots of the plant, found to be cAMP

geic and hypotensive. Due to its cAMP stimulating properties forskolin have been used in cosmetic industry to prepare drugs and tonics for weight loss and body shape management (Gupta, 2004). HPLC profiling of the plant stem and leaves have shown the presence of high amount of phenols and some diterpenoids that shows high antioxidant activity. It has been suggested that *C. forskohlii* can be used as source of antioxidants (Rasineni *et al.*, 2008). *C. forskohlii* can be used in making perfumes also, many volatile oils with aromatic properties have also been extracted from the plant including monoterpenes, sesquiterpenes and sesquiterpene alcohols. Majeed and Prakash (2007) identified the presence of 3-decanone, bornyl acetate and g-eudesmol in their study.

Forskolin

Forskolin was found to be the main active constituent of the roots. It is a labdane diterpenoid assumed to be synthesized via non-mevalonate pathway in the root cork cells of the plant. It reduces blood pressure. Forskolin activates an enzyme, adenylate cyclase, which increases cyclic adenosine monophosphate (cAMP) levels in cells, which is the most important cell-regulating compound (Lindner *et al.*, 1978; Seamon and Daly, 1981; Dubey *et al.*, 1981). Activation of cAMP results in inhibition of platelet activation, increased force of contraction of heart muscle, relaxation of smooth muscle, increased insulin secretion and increased thyroid function. The compound is generally extracted from the root tubers of the plant. Kavitha *et al.*,(2010) observed that the 0.5cm thick slices of the root tubers dried at 40 °C when kept in gummy polythene bag yield a high amount of forskolin. The major hurdle

faced at present is that the level of forskolin is very low and it seems difficult to produce economically. Moreover, the growth rhythm of the plant is comparatively slow and the alkaloid accumulation pattern is influenced by environmental and/or geographical conditions (Chandel and Sharma 1997).



Chemical Structure of forskolin

Coleus forskohlii in Uttarakhand

C. forskohlii is found in the sub tropical climate of lower Himalayan region of Uttarakhand. Ethnomedicinally *C. forskohlii* is known with the name 'Bander-jadi' in Pauri Garhwal (Kotia et al., 2014). In Chamoli district it is known as 'Fiwain' while in Pitthoragarh it is named as 'Chhyanglang Jari'. While, it is an important medicinal and pharmaceutically plant all over the world, and is being cultivated and sold in Southern India, the plant is still to be explored from Uttarakhand. It has been used by Bhotias of Pitthoragarh Region for as a medicine, but in other areas local people don't have the knowledge about the medicinal properties of the plant. Its application and efficacy in the treatment of cancer and its usefulness in treatment of other diseases reported in Dharchula area needs to be investigated to find out its potential in development of new drugs. Extensive and increased collection for tuber for medicinal purpose may make this species rare in wild.

Cultivation in abandoned fields is the best conservation strategy for this species.

Conclusion

C. forskohlii is potent medicinal vegetation for future as its medicinal properties have been investigated recently. The plant is still to be explored from other regions of India including north east, Uttarakhand Himalayan. Looking at the variation pattern in morphology and phytochemistry of the plant it can be assumed that many different varieties of the plant with different and effective properties may be found. In Uttarakhand especially the plant needs attention of the research as it may become new source for antioxidants and other drugs.

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