Exploration of Phytochemistry and Ethnobotanical uses of *Cedrus deodara:* A Review

ABSTRACT

Cedrus deodara is one of the most useful tree species. Almost every part of the plant has good properties. *Cedrus deodara* has been an important tree due to its Ethnobotanical uses, Traditional uses, Phytochemistry and Pharmacology. From last decade, there has been a great progress in the medicinal perspectives of Deodara. Deodara has its utility in folklore medicines. Phytochemistry studies showed the presence of various useful compounds in the Deodara tree. Also, the oil of *Cedrus deodara* has a characteristic fragrance. *C.deodara* is also having traditional and ethnobotanical uses. Since Vedic period, various parts of this plant are being used for medicinal purposes.It is also believed that various respiratory diseases can be just cured by just sitting under this tree. In present, Deodara is seen as an important tree in point of view of research. It has its applications in Timber too [1]. This paper is focussed on the traditional and medicinal aspects of *Cedrus deodara*.

Keywords: *Cedrus deodara*, Deodara, ethnobotanical, Traditional, phytochemistry, Pharmacology.

INTRODUCTION

In developing countries, plant based natural resources are still important in traditional medicinal uses. Western countries are also showing interest towards herbal medicine as an alternative for drugs. In this context, *Cedrus deodara* beholds utmost significance.

Cedrus deodara belongs to family Pinaceae. The word 'Cedrus' is derived from a Greek name for the coniferous tree and the word 'Deodara' is taken from Sanskrit word Devadaru which means Timber of God. During ancient times, Deodar forests were best places to living for sages who were fully devoted to God Shiva. *Cedrus deodara* is distributed over the Mediterranean and Western Himalayas. In India, it is distributed from Kashmir to Garhwal. Not only in India, but it has also been found in some high-altitude areas of Pakistan, Afghanistan, Tibet and Nepal. Total area covered by Deodar Forest in India is 2,03,263 ha.

Deodara is an evergreen tree which extends up to 60m in height. Leaves of this tree are needle shaped and occur as tufts. Deodar consists of barrel shaped cones and seeds are triangular. This tree is of great ethnobotanical, traditional, phytochemistry and pharmacological value.

Classification of *Cedrus deodara*:

Kingdom: Plantae

Class: Pinopsida

Order: Pinales

Family: Pinaceae

Genus: Cedrus

Species: deodara

PHYTOCHEMISTRY

Investiagtions are being carried on *Cedrus deodara formedicinal aspe* and researchers have found various chemical constituents. Chemical composition of this plant is organic carbon (83.50%), calcium (2.60%), Potassium (0.06%), Nitrogen (0.28%).

Bark of stem of *Cedrus deodara* contains deodarin (Dihydroflavonol). Chemical name of deodarin is e 3', 4', 5, 6- tetrahydroxy-8- methyl-dihydroflavonol [4]. Deodarin is having an antioxidant potential.

Wood of this tree contains sesquiterpene **himachalol**. This compound (himachalol) shows spasmolytic activity. Centradol is another compound found in the wood of this tree. **Himaphenolone** and **atlantone-2, 3-diol** etc. are the important chemical compounds found in *Cedrus deodara*. Both these compounds show strong antioxidant capacities [5].

Chemical compounds such as 10-nonacosanol, protocatechuic acid, ethyl laurate, ethyl stearate is extracted from the needles of the tree. Monoterpene hydrocarbons are found in majority in essential oil part of needles.

Flavonoids such as cedrin, cedrusone, e, 3',5'-Di-O-methylmyricetin-3-O-(6"- O-acetyl)-α-D-glucopyranoside are also found in this tree [6][7].

PHARAMCOLOGICAL ACTIVITY

Extract of stem bark shows various properties such as anti-arthritic, anti-inflammatory etc.

Antihyperlipidemic activity is shown by the ethanolic, and acetone extracts of *Cedrus deodara*. This activity is shown in monosodium glutamate induced obesity in neonatal rats. Treatment of rats with ethanolic extract shows many satisfactory results. This treatment leads to decrease in their body weight, increase in locomotion activity [8].

Sesquiterpenes obtains from deodara shows anti-fungal properties. It was observed that these sesquiterpenes inhibits various species of *Aspergillus*.

Cedrus also shows various anti-bacterial properties. Extract obtained from tree shows antibacterial properties mainly against bacteria such as *Escherichia coli, Bacillus cereus, Bacillus subtilis* etc. Shikimic acid obtains from needles of plant also shows anti-bacterial activity mainly against *S. aureus*.

This tree also shows antihelmintic and larvicidal activities. Extracts obtained from this tree leads the paralysis of worms such as *Pheretimaposthuma*[9]. The essential oil obtained from *Cedrus* shows larvicidal activities [10]. Apart from these properties, compounds found in deodara also show important properties such as anti-cancer, anti-diabetic and antiapoptotic activities.

ETHNOBOTANICAL USES

Cedrus deodara is a very useful tree. This tree is having many important applications. People living in high-altitude regions are heavily dependent on this tree. Deodara is an important tree from the point of view of timber. People of Himalayan region utilise its timber in many purposes. Wood of deodara is used in construction of houses, furniture etc [11]. This tree is also having ethnomedicinal applications. Wood is used as diuretic, diaphoretic, carminative. It is used in the preparation of antiseptics such as V gel. It is used in the treatment of fever, diabetes, sinusitis etc. Deodara also shows diuretic properties. Resin of this tree contains many useful properties such as larvicidal activity. People also use this tree for curing joint pain, insomnia, body ache. Tribal people also used the leaves of *deodara* extract massage.

TRADITIONAL USES

This plant is deeply linked with the culture and traditions of the people. And used by people in all daily purposes. In few parts of Himalayan region, the fumes of this plant are used as snake repellents. Bark powder is used in body ache. From ancient times, the oil of this plant is used in skin itching. *Cedrus deodara* is used for the treatment of piles, bowel, plumbago, rheumatic arthritis and urticaria.

This tree has also become an important plant in Ayurveda. According to Ayurveda, this plant possesses significant magical and important features like: Gunna (properties) - laghu (light) and snigdh (slimy), Rasa (taste)- tickt (bitter), Virya (potency)-ushan (hot). People since ancient times using this plant in various purposes. People see this tree as timber of God. They worship this tree. Hence deodara is of immense traditional importance. [12][13]

CONCLUSION

Devadaru is a common tree species in Western Himalayas. Currently world health organisation recognised 21000 plants as medicinal plants out of them 2500 plant species are found in India. That is why in this context India is also known as "botanical garden of the world" [14]. currently 80% of world population is dependent on plant-based healthcare [15]. In the higher altitude of Indian subcontinent, gymnosperms are of great importance for local people. In this context Devadaru becomes an important gymnosperm tree. Nowadays, traditional and herbal medicines are very famous because of their fewer side effects and low cost. *Cedrus deodara* has its applications in Ayurveda since ancient times. Hence this plant is of great herbal use. Plant is used by people for treating many diseases.

In present scenario, pharmacological studies of this plant contributed to the formation of number of drugs. Antioxidant nature of this plant shows its potential in medicinal purposes. Still various activities of this plant are needed to be explored further.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. The Ayurvedic Pharmacopoeia of India, Ministry of health and family welfare Ed.-I, New Delhi. 2004; 1(4):23-34
2. Sharma BM & Kachru P, Vegetation in flora of Jammu, (Shiva Printers, Dehradun).1981: 16-17.
3. Kirtikar KR, Basu BD. Indian Medicinal Plants. Lalit Mohan Basu, Allahabad, India. 1933: 2390–2392.
4. Willey, Sherwood, Wolverton, Precott, Harley and Klein's Microbiolog, Mcgraw Hill Companies, Singapore. 2006:pp 835.
5. Adinarayana D, Seshadri TR. *Tetrahedron*. 2001; 21: 3727-3730.

6. Adinarayana D, Seshadri TR. Chemical investigations of the stem bark of *Cedrus deodara*. Tetrahedron 1965; 21:3727-30.
7. Singh AP. Promising Phytochemicals from Indian Medicinal Plants. Ethnobotanical Leaflets. 2005; 9:15-23
8. Chaudhary AK, Ahmad S, Mazumder A. Isolation, structural elucidationi and in vitro antioxidant activity of compounds of chloroform extract of Cedrus deodara (Roxb.) Loud. Nat Prod Res. 2015, 29:268-73.
9. Shankaranarayan R, Krishnappa S, Bisarya SC, Dev S. Tetrahedron. 1977; 33:1201-1205.
10. Gulati BC. Regional Research Laboratory, Jammu-Tawi, India. 640: 1977.
11. Yan-qiu C, Xin-hong C, Z. Yi, Qun Z, Peng N. Bioinformatics and Biomedical Engineering. 2008:4573-4577.
12. Makhaik M, Naik SN, Tewary DK. J. Sci. Ind. Res., 2005; 64:129-133.
13. Agrawal PK, Agrawal SK, Rastogi RP. Dihydroflavonols from *Cedrus deodara*. Phytochemistry 1980; 19:893-6.
14. Liu DY, Shi XF, Wang DD, He FJ, Ma QH, Fan B. Two new myrecetin glycosides from Pine needles of *Cedrus deodara*. Chem Nat Compd. 2011; 47:704-707.
15. Patil S, Prakash T, Kotresha D, Rao NR, Pandy N. Antihyperlipidemic potential of *Cedrus deodara* extracts in monosodium glutamate induced obesity in neonatal rats. Indian J Pharmacol. 2011; 43:644-647.
16. Sharma A, Parashar B, Vatsa E, Chandel S, Sharma S. Phytochemical screening and antihelminthic activity of *Cedrus deodara* (Roxb). World J Pharm Pharm Sci. 2016; 5:1618-1628.
17. Chaudhary A, Sharma P, Nadda G, Tewary DK, Singh B. Chemical composition and larvicidal activities of the Himalayan Cedar, *Cedrus deodara* essential oil and its fractions against the diamond black moth, *Plutella xylostella*. J Insect Sci. 2011:1-10.
18. Parihar P. Antibacterial potential of *Cedrus deodara*. Adv Plant Sci. 2003; 16: 479-482.
19. Tandan SK, Chandra S, Gupta S, Lal J. Pharmacodynamic effects of *Cedrus deodara* wood essential oil. Indian J. Pharm. Sci. 1998; 60(1): 20-23.
20. Tiwari AK, Srinivas PK, Kumar SP, Rao JM: Free Radical Scavenging Active Components from *Cedrus deodara*. J Agric Food Chem. 2001; 49: 4642-4645.
21. Makhaik M, Naik SN, Tewary DK. Evaluation of Anti-mosquito properties of essential oil. J Sci Ind Res. 2005; 64: 129-133.
22. Chauhan PP, Nigam A, Santvan VK. Ethnobotanical survey of tree of Pabbar Valley, district Shimla, Himachal Pradesh. Life Sci Leaf. 2014; 24-39.

23. Wang J and Xie P. Antioxidant enzyme activities of *Microcystis aeruginosa* in response to nonylphenols and degradation of nonylphenols by *M. aeruginosa*. Environ Geochem Health. 2007; 29(5): 375-83.
24. Nautiyal CS, Dasila S, Rao L, KS and Maikhuri, RK.: Ethnobotanical plant uses in small tribal community in a part of Central Himalaya, India. J. Hum. Ecol. 2002: 23-31.
25. Maikhuri VS, R.K. and Vashishtha, DP. Traditional healthcare practices among the villages of Rawain valley, Uttarkashi, Uttarakhand, India. Indian J. Tradit. Know. 2011;10: 533- 537.
26. Coppen JJW. Cedarwood Oils In: Flavours and Fragrances of Plant Origin. Food and Agriculture Organization of the United Nations, 1995.
27. Modak M, Dixit P, Londhe J, Ghaskadbi S, Devasagayam TP. Indian herbs, and herbal drugs used for the treatment of diabetes. J Clin Biochem Nutr. 2007:163-73.
28. Uniyal SK, Singh KN, Jamwal P, Lal B. Traditional use of medicinal plants among the tribal communities of Chhota Bhangal, Western Himalaya. J Ethnobiol Ethnomed. 2006: 2-14.
29. Muhammad H S and Muhammad S. 2005. The use of /owsonia rnermr's linn. (henna) in the management of burn wound infections. Afr. 4 (91): 934-937.
30. Prajapati P. A handbook of medicinal plants, a complete source book, Jodhpur, Agrobios. 2003: 94-95.