Cedrus Deodara: A Comprehensive Review

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Abstract:

It's the loud *Cedrus deodara (roxb).* This cedar species, which goes by the name "*deodar,"* is native to the western Himalayas, which comprise eastern Afghanistan, northern Pakistan, north-central India, south-western Tibet, or western Nepal. The tenet of Ayurveda is to preserve health in those who are well and to relieve problems in those who are ill, according to one of its famous preceptors, Charaka. The Rugveda and Atharvaveda contain references to the therapeutic applications of plants. As a medicinal tree,it has historically been used to cure a wide range of illnesses, including kidney, skin, and microbial infections joint disorders, and asthma. stone, stomach ulcers, inflammatory diseases, and brain illnesses Many pharmaceutical companies are researching plant materials with great potential usefulness in-depth. A valuable plant in the Pinaceae family, *Cedrus deodara* is also known as *cedar.*

Keywords: *Cedrus deodara*, Pharmacognosy, phytochemistry, pharmacology

Introduction:

Herbal Remedies in the Past Herbal remedies have been utilised for centuries all throughout the world. whose long and well-recorded past extends back to the primordial era. Chinese, Greek, Egyptian, and Indian civilisations are just a few of the societies whose medical practices have long included the use of herbal treatments [1]. Herbs were also used therapeutically by Native American and African American groups, as they are essential to their cultural rituals Inside the Herbal treatments from the Indian Ayurvedic system are known to be powerful healers and are recorded in old books such as the Samhitas and the Vedas.[2] The development of chemical analysis techniques in the early 19th century brought about a dramatic change in the field of herbal medicine [3]. As active chemicals from plants were extracted and modified, the usage of raw herbs gave way to the creation of synthetic medicines.[4] Numerous medications have been introduced into the global market by means of investigation of Traditional medicine combined with ethnopharmacology. Therefore, work must be done to develop and verify data pertaining to the use of Ayurvedic medications.

Known by most as "deodar," *Cedrus deodara (Roxb.*) Loudis a species of *cedar* that is indigenous to the Western Himalayas, including Eastern Afghanistan, Northern Pakistan, North-Central India, South Western Tibet, and Western Nepal. According to the World Health Organisation

(WHO), 4 billion people, or 80% of the global population, already utilise herbal remedies for some type of primary medical attention. Currently, a large number of pharmaceutical companies are thoroughly evaluating plant material that has been obtained from rain forests and other locations that may have therapeutic significance. Many pharmaceuticals made from plants are utilised in modern medicine in a manner that is closely akin to how native societies have traditionally used plants as medicine. These herbal remedies have been utilised from the beginning of indigenous peoples' traditional medicine, and they are frequently found in traditional oriental, homoeopathic, naturopathic, and Native American Indian medicine [5,6,7,8] The majority of the genus is made up of trees that are grown, either for functional or decorative purposes. Typically, seeds drop during the winter. The lifespan of *deodara* trees is 600 years. September to October is when flowers bloom. For these trees to develop, well-drained soil is essential. High levels of wetness are ideal for plant growth. Young trees may sustain damage from frosts and cold winds [9] The various medical systems that are used in India, Numerous plants are used in Ayurveda, Siddha, Unani, and regional health practices to treat human illnesses. Different writers have been reported, recognised these therapeutic plants [10,11]

Ayurveda, Siddha, Unani, and regional medical customs offer a solid foundation for the use of several plants in general medicine and the relief of common illnesses in humans. In this day and age, allopathic medicine is displaying serious adverse effects, it's critical to always search for fresh herbal remedies to treat illnesses. Our aim is to provide an overview of pharmaceutical activities that the general population can adopt in their daily lives, taking into account the data that has been presented. For fever, diarrhoea, and dysentery, *C. deodar* is typically recommended. In both acute and chronic inflammations, alcohol bark extract dramatically decreases inflammation. The diaphoretic, diuretic, and carminative properties of the wood make it advantageous for lung and urinary diseases. As the ingredients of the well-known Ayurvedic treatments "mondooravataka," "bhardradarvadi," and "Taila," which are advised for anorexia, edoema, piles, diabetes, leprosy, and sciatica, include cedar wood powder [12]

The nutritional and therapeutic qualities of *C. deodara*, also referred to as Himalayan cedar, have made it a popular ingredient in Chinese herbal medicine and beverages. It is well known that *C. deodara* pine needles are a nutrient-dense food source high in protein, vitamins, and minerals Compounds that are rich in beneficial bioactivities, such as antioxidant, anti-inflammatory, antitumor, antimutagenic, anticarcinogenic, antibacterial, and antiviral properties, can be found in medicinal plants in good quantities. These compounds include phenolic compounds, nitrogen compounds, vitamins, terpenoids, and some other secondary metabolites. Pharmaceutics, biochemists, and chemists are now primarily interested in medicinal plants. Their work is crucial to the discovery and development of novel medications, which should prove to be more efficacious and freer of side effects, unlike the majority of contemporary medications.

Additionally, these plants are used for non-medical purposes, including food flavouring, garnishes, spices, and fumigants [13,14]

Classfication:

Biological name – *Cedrus deodara*

Family – Pinaceae

Genus—Cedrus

Species—Deodara

Kingdom—Plantae

Subkingdom—Trachibionta

Division—Conoferophyta

Class—Dinopsida

Order—Pinale

[15,16]

Synonyms:

synonyms of this plant of *Cedrus deodara*,1] Himalaya cedar (english),2] devdaar, diar, diyar (hindi),3] devdaru, amara, devahvaya (sanskrit),4] devdaar (gujrati),5] deodar (marathi),6]devadaru, devadaram, devataram (malyalam),7]gunduguragi (kannad),8]burada deodar, deodar (urdu),9]than sin, than-sin (tibetan) ,10]devadaram, tevataram, tunumaram (tamil),11[devadaru (nepali).

According to Ayurveda plant *Cedrus deodara* is having various essential magical and important features like:

1]Gunna (properties)-laghu (light) and snigdh (slimy),

2]Rasa (taste)-tickt (bitter),

3]Virya (potency)-ushan (hot).

fig. *cedrus deodara*{fruit,leaf}

Phytochemical constituent:

Sesquiterpene, or α-himachalene (12.5%) and β himachalene (43%) is the primary component of cedrus oil. Sesquiterpene alcohols, such as cedrin (6-methyldihydromyricetin), isocentdarol, himadarol, and allohimachalol, are linked to them[18,19]Himachalene β- Himachalene H H α-Himachalene Terpenoids, phenols, and alcohol were detected in the volatile oil of C. deodara by phytochemical examination. and ketone. Additional major components in various sections Wikstromal, matairesinol, dibenzylbutyrolactol, 1,4-diaryl butane, benzofuranoid neo lingam [20], cedrin (6-methyldihydromyricetin), taxifolin, cedeodarin (6-methyltaxifolin), dihydromyricetin, cedrinoside [21], deodardione, diosphenol, limonenecarboxylic acid [22], (–)-matairesinol, (–)-nortrachelogenin, and a dibenzylbutyrolactollignan (4,4',9-trihydroxy-3,3'-dimethoxy-9,9'-epoxylignan) [23]. From the stem, a novel dihydroflavonol known as deodarin (3,4,5,6-tetrahydroxy-8-methyl dihydroflavonol) has been extracted. bark [24]. Numerous chemicals were detected in the *C. deodara* needle ethanolic extract, including 10-nonacosanol, dibutyl phthalate, protocatechuic acid, and phthalic acid bis-(2-ethylhexyl) ester (E)beta-sitosterol, shikimic acid, methylconiferin, 5-p-trans-coumaroylguinic acid, 9-hydroxy-deodarin acid, ethyl laurate, ethyl stearate, 3-betahydroxy-oleanolic acid methyl ester, and ferulic acid beta-glucoside [25,26]. Isohemacholone and sesquiterpenes-L II are present in wood essential oil. L III: atlantone, deodarone [33], α-himacholone, β-himacholone [27,28], myrcene himachalene, γ-pinene, β-pinene, cis-atlantone, ά-atlantone [29].

Phytochemistry of Cedrus deodara:

Terpenoids:

Cedrus deodara contains various terpenoids such as himachalol, β-himachalene, and sesquiterpenes, which are known for their insecticidal and antimicrobial properties. These compounds are primarily found in the essential oils of the tree and have demonstrated activity

against fungal species like Aspergillus and bacterial species like Escherichia coli and Bacillus subtilis.

Flavonoids:

Flavonoids such as myricetin glycosides have been isolated from the needles of *Cedrus deodara.* These compounds contribute to the plant's antioxidant properties and potential therapeutic effects against chronic diseases like diabetes and cancer

Tannins and Alkaloids:

Tannins and alkaloids are present in the heartwood and other parts of the plant. These compounds are involved in a range of activities such as reducing inflammation, acting as diuretics, and having antiseptic properties.

Pharmacognostic account:

Foliage Type:

Simple leaves arranged in a spiral are characteristic of the plant *Cedrus deodara*. With parallel leaf venation, the entire leaf border is covered in filiform or needle-like leaves. These are needle-like evergreen leaves with a leaf blade that is roughly less than two inches long and needle-like at the leaf margins. The colour of its leaves ranges from silver to green.

Fruit:

The oval-shaped fruit of *Cedrus deodara* has an approximate length of three to six inches. The fruit cover is dry, somewhat firm, and has a brownish tint. Fruit does not draw in wildlife, and compared to other fruits, it can stay on trees for a comparatively longer time.

Trunk and Branches:

As the tree matures, its branches, bark, or trunk gradually droop, necessitating ongoing pruning to keep both pedestrians and cars safe. This plant has unshowy branches and trunks that are known to show clearing beneath the canopy. For good structural growth, the branches should be grown with a single leader that is free of thorns and requires minimal pruning. A tree's trunk offers robust protection against breaking, and for healthy growth and development, it needs full sunshine. Although this plant can tolerate somewhat alkaline, sandy, loamy, or clay-type soil, it occasionally drains its acidic contents. Because surface roots have a long-term resilience to possible pests, they are typically not a concern.[30]

Effect of Pests and Diseases:

Goat overgrazing, heavy fire, and an abundance of snow all damage deodar trees. Bears, porcupines, and monkeys are the three wild species that cause the most damage to the vegetation. Young trees of this species are smothered by Rosa moschata, which climbs into their crowns. Among the harmful parasitic growths, Fomes annosus and Peridermium cedri cause death and encourage the growth of witches' sweepers on the trees. On young trees, the Pestalotiopsis cryptomeriae organism causes leaf scourge; nevertheless, Ploioderma cedri causes foliar disease and premature defoliation in ranches [31]. The wood of *Cedrus deodara* is resistant to termite attacks and is fairly robust and durable. Some studies on plants, especially *Cedrus deodara*, have been conducted in an attempt to find plant mimics of teenage hormones [32].

Color and Odour:

The oil from *Cedrus deodara* is yellow-brown to reddish-brown in colour, slightly viscous, and has a little filthy, woodsy, and fragrant resinous smell. It has a limonene/citrus appearance, is somewhat urinic, and is lighter than *Cedar* wood oil Atlas. Aromatherapists are familiar with *cedar* wood oil, even though the Ayurvedic system of treatment has long used it. [33]

Ts of *cedrus deoadra:*

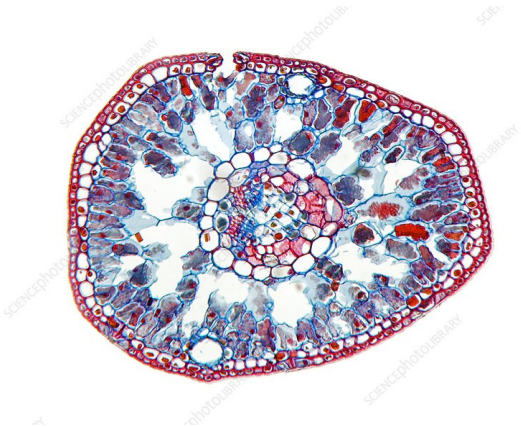

Fig . *cedrus deodara* leaf:

PHARMACOLOGICAL ACTIVITIES OF *CEDRUS DEODARA:*

Anti-bacterial activity:

Using acetone, methanol, and chloroform, the plant *(C. deodara*) was stripped of its leaves and cones. In the broth dilution assay, acetone and methanol extracts of leaves showed 12 and 14 mm, respectively, while chloroform and acetone extracts of cones showed 13 and 14mm zones of inhibition. The positive control, ampicillin (10g/disc), showed 14 mm or more zones of inhibition. Using a gas chromatograph and mass spectroscopy analysis, the chemical composition of *C.*

deodara and the volatile oils extracted from the leaves using steam distillation were examined (GCMS). All volatile oils were tested against both Gram-positive and Gram-negative bacteria in order to assess their in vitro antibacterial efficacy. α- and β-pinene, along with volatile oil, exhibit strong antibacterial properties. Plant extract and oil derived from the roots, stems, and leaves plant were tested against E. coli. Both the oil and extract shows significant inhibition of the test organism.[34]

Insecticidal activity:

Prior research on the insecticidal qualities of natural products revealed that Himalayan cedarwood oil exhibited cidal activities at low concentrations (KD50 0.4452% in acetone) against adult Indian mosquitoes, Anopheles slephensis. The plant is enhanced by attributes such as its attractive smell, inexpensive cost, plentiful raw material availability, and strong anti-mosquito properties. These findings prompt us to look into the insecticidal properties of Himalayan cedarwood oil in more detail. The Himalayan Cedarwood oil's chromatographic fractions were bioastested against the housefly (Mucus domestica L.) and pulse beetle (Callosobruchus analis F.). Insecticidal activity was demonstrated by nearly all fractions against both test species. [35]

Anti-fungal activity:

The plant's essential oils have a longer duration of fungicidal activity [36]. In 2000, Essien JP and EP Previous research has examined the anti-fungal properties of *Cedrus deodara* Roxb. essential oil and some of its active ingredients against Capsicum annuum L. storage moulds [37]. Praveen R. and others (2010) The antifungal properties of root oil and its separated components were assessed in relation to Aspergillus fumigatus and Candida albicans. At 150 µg/disc, dose. *cedrus deodara* oil exhibited a zone of inhibition against A. fumigatus, but no antifungal activity was observed against C. albicans at the same Additionally, the oil's trans-atlantone and allo-himachalol have not demonstrated any antifungal activity, while himachalol at the at the concentration of 150 µg/disc showed zone of inhibition against A. Fumigates [38].

Mollusicidal activity:

Lymnea acuminate was combated with mixtures of three herbs. Embelia ribes fruit powder combined with Azadirachta indica and *Cedrus deodara* oil in binary and tertiary combinations to synergistically effect MGK-264 and piperonyl butoxide (PB). In comparison to the single treatment of the plant-dervied molluscides, the combination of these three was more harmful. The Lawsonia inermis seed + *Cedrus deodara* + Embelia ribes combination was the most poisonous to Lymnaea acuminata when combined tertiaryly, followed by Lawsonia inermis seed + Azadirachta indica + Embelia ribes > Lawsonia inermis seed + Polianthes tuberosa + Embelia ribes > Lawsonia inermis seed + Allium sativum + Embelia ribes. Maximum inhibition against

Lymnaea acuminate was found when Lawsonia inermis seed powder, *Cedrus deodora* oil, and Embelia ribes fruit powder were combined in a 1:1:1 ratio [39].

Anti-tubercular activity:

Good anti-tubercular activity against mycobacterium TB in the tuberculosis gland is demonstrated by chloroform and acetone extract extracted from the plant's leaves and cone. The zone of inhibition on the cone was 13 and 14 mm, whereas the leaf displayed 12 and 14 mm of inhibition. The ampicillin used as a positive control showed 14 mm of zone inhibition, and the methodology used was the broth dilution method [40].

Neuroleptic activity:

The heartwood of the *C. deodara* plant has historically been used to strengthen the brain, regulate the mind-body relationship, and improve cerebral performance. It was noted to have neuroleptic and CNS depressive properties [41].

Antioxidant activity:

Since the brain and nervous system contain large amounts of lipid and iron— both of which are known to play a significant role in the production of free radical species—they are more vulnerable to the damaging effects of free radicals than other bodily tissues. Good antioxidant properties of *C. deodara* have also been discovered [42]. To determine *Cedrus deodara's* antioxidant components, two procedures were used. Dried C. deodara heartwood powder was fractionated and purified by first defatting it with petroleum ether and then extracting it with chloroform. The Strong antioxidant activity was demonstrated by chloroform extract against the 1, 1- diphenyl-2-picrylhydrazyl (DPPH) free radical. This fraction was then sent to silica gel column chromatography for separation and purification. Three substances that may have antioxidant properties. were detected using spectroscopic techniques (1H NMR, 13C NMR, IR, and MS) and separated in notable yields. They were recognised as dibenzylbutyrolactollignan (4, 4', 9-trihydroxy-3, 3'-dimethoxy-9, and 9'-epoxylignan), (-)-matairesinol, and (-)-nortrachelogenin.

Antispasmodic activity:

One important component of plant wood with antispasmodic properties is himachalol. The pharmacological investigations conducted on a range of isolated smooth muscles, including the rat uterus, guinea pig seminal vesicle, guinea pig ileum, and rabbit jejunum, in addition to testing the drug against several agonists, including acetylcholine, histamine, serotonin, nicotine, and barium chloride, revealed spasmolytic activity akin to that of papaverine. It is less effective than papaverine in treating guinea pig ileum spasm caused by barium chloride, although it has no calming effect when used alone. Within The conscious immobilised cat received intragastric

injections of either himachalol or papaverine (100 mg/kg) at the same rate of inhibition of the intestinal spasm caused by carbachol, which lasted for approximately two hours. However, the beginning of action of himachalol was significantly faster than that of papaverine. While himachalol had no spasmolytic impact on the guinea pig's bronchial musculature, papaverine was less effective than himachalol in opposing the constriction of the seminal vesicle generated by adrenaline. When cats received an intravenous infusion of himachalol (3–10 mg/kg), their blood pressure decreasedin a dose-dependent manner and their femoral blood flow increased [43].

Wound healing property:

There have been reports of anti-inflammatory and antimicrobial properties in *cedrus* oil. Additionally, the plant has demonstrated wound-healing qualities; it is especially helpful for infectious wounds. [44]

Immunomodulatory activity:

The arthus reaction, which is caused by methylated bovine serum albumin, is significantly inhibited by *cedrus deodara* volatile oil at doses of 50 and 100 mg/kg. Additionally, sheep erythrocytes and the delayed type hypersensitive reaction induced by oxazolone are also inhibited [45].

Cytotoxic activity:

The " CD lignin mixture," which was extracted from the stem wood of *Cedrus deodara*, was composed of benzylbutyrolactol (7–11%), (-)-matairesinol (9–13%), and (-)-wikstromal (75–79%). The in vitro antitumor activity of this combination was assessed. The Ehrlich ascites carcinoma and colon carcinoma (CA-51) mouse models were used to investigate the in vivo anticancer efficacy of CD lignan combination. To learn more about the mechanism of action, the effect was further investigated with regard to annexin V binding, intracellular caspases, and DNA fragmentation. This lignin combination demonstrated substantial dose-dependent effects against numerous cancer cell lines such as cervix, colon, liver, prostate and neuroblastoma at 10, 30 and 100 mg/mL [46]

Anti – malarial activity:

To extract essential oil, the bioactivity of the *C. deodara* essential oil was assessed. The plant's crushed wood chips were processed into essential oil using a device similar to Clevenger's. A. aegypti adults showed no sensitivity to *C. deodara* oil under the conditions range and one hour of exposure, while the reported LC50 against C. quinuefasciatus was 2.48%, indicating low efficacy. Against these two mosquitoes, the plant exhibits moderate activity [47].

Anti-allergic activity:

A phytochemical analysis reveals that the existence of some significant therapeutic elements in plants is what allows for the treatment of a variety of illnesses. Similarly, one of the main ingredients, himachalol, is said to have strong anti-allergic properties. [48]

Anti hyperglycemic:

In streptozotocin-induced diabetic rats, the ethanolic extract of *C. deodara* wood has antihyperglycemic properties. In a single-dose study, streptozotocin-induced diabetic rats had 6% lower blood glucose levels after taking *C. deodara*.[49] The wood extract of C. deodara was mixed with a number of pharmaceutical excipients. 190 mg of crude extract, 159 mg of microcrystalline cellulose, 71.4 mg of di-calcium phosphate, 6.6 mg of methyl-paraben sodium, 5 mg of propyl paraben sodium, 11 mg of magnesium stearate, and 7 mg of talc are contained in each capsule, compared to the other formulations. Research on the antidiabetic effects of the wood extract capsule from this plant in vivo indicated that it was a significant player in the treatment of diabetes [50]

Anxiolytic activity:

The raised plus maze model, light-dark model, and actophotometer were applied to assess the anxiolytic activity of the alcoholic heart wood extract (50, 100, and 200 mg/kg body weight) of *Cedrus deodara*. According to the findings, alcoholic extract exhibited dose-dependent anxiolytic action and decreased aversion fear. GABA levels in the rat brain were estimated, and the results indicated a considerable modification following extract administration. According to these results, the heartwood of *Cedrus deodara*, when extracted alcoholically, has a strong anxiolytic effect by modifying GABA levels in the brain [51]

Acute toxicity studies:

Using female, nulliparous, non-pregnant mice weighing 18–22 g, the acute oral toxicity of an alcoholic extract of *Cedrus deodara* " heart wood was ascertained. Before the trial, the animals were fasted for three hours. For toxicity tests, OECD guideline No. 425—the "Up and down procedure —was used. Animals received a single dosage of extract, and over the 48-hour research period (short term toxicity), their mortality was monitored. LD50 was determined using AOT 425 software in accordance with OECD guidelines 425 [52].

Diuretic and Anti- Urolithiatic Activity:

Researchers looked at the diuretic and anti-urolithiatic effects of the petroleum ether extract of *Cedrus deodara* heart wood. In one experiment, sodium oxalate (70 mg/kg, i.p.) was used for ten days to develop urolithiasis. Under a light microscope, crystals were discovered in the urine of rats given sodium oxalate treatment, and increased serum levels indicated the development of

nephrolithiasis in the control group. By using PECD for ten days in addition to sodium oxalate, the triggering agent, elevated blood biochemical levels that were brought on by these being removed in urine were avoided. Based on a histology
research, PECD treatment avoided sodium oxalate-induced nephrolithiasis. As a result, the previously described investigation revealed that the plant had outstanding [53]

DISCUSSION AND FUTURE PROSPECTS:

Despite certain distinctions between herbal and conventional pharmaceutical therapies, herbal medicine has gained popularity as a means of healthcare. Strong immune-suppressive, anti-inflammatory, anti-cancer, antiapoptotic, antibacterial, analgesic, antispasmodic, antioxidant, anti-malarial, anti-allergic, insecticidal, anti-hyperglycemic, anti-sarcoptic mange activity, and anti-convulsant properties are found in various parts of this plant, which is why it is used to treat numerous illnesses, including high fevers, lung infections, gas, urological problems, kidney stones, rheumatism, sleeplessness, piles, and diabetes. It works well as a snake bite antidote as well. *Cedrus deodara* is a plant that may also be helpful in treating neurological or mental conditions like epilepsy, anxiety, and depression. In addition, phthisis, skin eruptions, bronchitis, and blennorrhagia can all be successfully treated with this plant. In addition to the more traditional tuberculosis illness, it is also useful for bruises, skin infections, joint injuries, dysentery, and diarrhoea.

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