

Devadaru (*Cedrus deodara* Sarg.): Ancient Tree with Significant Medicinal Benefits

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Abstract: Background: Many plants are essential in human health care, both in self-medication and in national services. India has a great wealth of various naturally occurring plant drugs which have great potential pharmacological activities. A number of medicinal plants are used as rejuvenators as well as for treating various disease conditions. *Cedrus deodara*, the common cedar is an important plant belonging to the family Pinaceae. *C. deodara* has been proven to have great pharmacological potential with a great utility and usage as folklore medicine. This review summarized the plant characteristics with chemical composition and their pharmacological activities. Methods: Regarding the Plant reviewed from scientific journals, books, and reports via electronic search tools (Medline, PubMed etc.) Results: This review summarizes the existing information of *Cedrus* in relation to their pharmacognostic properties, phytochemistry, ethnobotany and pharmacological activities, apart from heartwoods and other part. Conclusion: The current review focused on new finding on *Cedrus deodara* heartwood like oil extraction, micrometry, microscopical, macroscopical character. The detailed review of *Devadaru* (*Cedrus deodara*) was compiled from ancient as well as recent texts and various researches on pharmacological, phytochemical & pharmacological actions of *Devadaru* so it was concluded that the *Devadaru* (*Cedrus deodara*) had many properties and it is very useful in many diseases as it reviewed in detailed in many researches. The wood *Devadaru* used as diuretic, carminative, expectorant, useful in alleviating piles, rheumatism, palsy, epilepsy, stones in the kidney and bladder and prolapsus recti. The bark is astringent and useful for fevers, diarrhoea and dysentery.

Keywords: Pharmacognosy, *Cedrus deodara*, Phyto-chemistry, ethnopharmacology, Ethnobotany.

1. Introduction

Cedrus deodara (Roxb. ex D. Don) G. Don (Family: Pinaceae) is a medicinal tree traditionally important and well mentioned in traditional system of medicine of India, Pakistan, China, Korea etc. *Devadaru* also called as *Deodar* or Himalayan Cedar is popular known as the 'Wood of Gods'. is a temperate species and found at an altitude of 1500 - 3500m of Jammu & Kashmir, Himachal Pradesh, Sikkim etc. [1] [2] It is distributed in other Central Asian countries also. All parts of this plant are used for various medicinal benefits. According to historical facts, the medicinal properties of *C. deodara* were first documented in two classical literatures of Ayurveda i. e., *Sushruta Samhita* and *Charaka Samhita* which were written around 1000 B. C.

Devadaru helps to relieve cough by removing mucus from the respiratory tract due to its expectorant property. It might also be beneficial in managing asthma by increasing the movements of the respiratory tract due to its antispasmodic activity. *Devadaru* might be good for diabetics as it helps manage the blood sugar levels by stimulating insulin secretion.

It also helps to calm the mind and improve sleep pattern thereby managing insomnia.

Devadaru oil obtained from *Devadaru* trees has many benefits. This oil can be applied on the body to manage fever by increasing sweating due to its diaphoretic (sweat-inducing) property. *Cedrus deodara* finds extensive use among people of Himalayan region. The plant is deeply assimilated in the culture and tradition of the people and are used actively in all daily purpose including thatching, shelter, timber, fuel and construction purposes. The resin

from wood and leaves are also used as medicinal purpose. It also has antifungal properties and has some potential for control of fungal deterioration of spices during storage [3]. Because of its antifungal and insect repellent properties, rooms made of deodar cedar wood are used to store meat and food grains like oats and wheat in Shimla, Kullu, and Kinnaur district of Himachal Pradesh. All parts of plant useful in curing diseases like inflammation, insomnia, cough, fever, urinary discharges, itching, tuberculosis, ophthalmic disorders, disorders of mind, diseases of the skin and of the blood. The leaves of these plant help in reducing inflammation. The wood act as expectorant and useful in curing piles, epilepsy, stones in the kidney and bladder, useful in fevers and in many other disorders. The oil is antiseptic in nature and helpful in curing skin diseases, wounds, urogenital diseases, diaphoretic as well as insecticide. It may also cure fungal diseases and act as sedative and cardio tonic too. [4]

Pharmacognosy: *Cedrus deodara*

Habitat and morphology

Cedrus deodara is an evergreen tree (conifer) with an height of 85 m, almost rough black, bark and spreading branches, shoots with dimorphic leaves 2 - 8 cm needle like with sharp pointed, flowers are monoecious, but some branches Bear flowers with one sex. All the parts of the flower are bitter, pungent, in nature. *Cedrus* is a genus of Pinacea with tropical as well as subtropical distribution. The genus is mainly comprised of trees which are cultivated may be for their usefulness for their ornamental purposes. Seeds usually shed in winter season. Deodara trees live up to 600 years. Flowers come in September to October. Drained soil is well for the growth of these trees. High moisture is favorable for the growth of the plant. Cold wind and frosts may cause

injury to young trees⁵. It is a very large and tall ever green tree, upto 75m in height and ranging from 2.4m to 3.6m in girth, occasionally even upto 13.5m in girth, found in North western Himalayas from Kashmir to garhwal between 1200m to 3000m and also cultivated in Kumaon. [6]

Synonyms:

Latin - *Cedrus deodara*

English - deodar, Himalaya cedar Hindi - devdaar, diar, diyar

Sanskrit - devdaru, amara, devahvaya Gujarati - devdaar

Marathi - deoda

Malayalam - devadaru, devadaram, devataram Kannada - bhadradaaru, daevadaaru, gunduguragi Marathi - devadaru, ewadar

Urdu - burada deodar, deodar

Tibetan - than sin, than - sin

Tamil - devadaram, tevataram, tunu maram Nepali - devadaru

Taxonomical classification: Division: Pinophyta Kingdom: Plantae

Class: Pinopsida Order: Pinales Family: Pinaceae Genus: *Cedrus* S Species: *C. deodara*

Flowering & Fruiting: April - september

Classical Categorization: [7]

Charaka has extensively prescribed *Devadaru* in the management of many disorders. *Bhavamishra* advocated administration of *Devadaru* along with *Shunthi* to relieve *Haridgata Vedana* (pain in the cardiac region). *Vangasena* suggested it in both *Gandamala* and *sleepada*. *Bhavamishra* classified *Devadaru* under *Karpuradi varga*. *Rsdahridayatantra - kara* has suggested *Devadaru taila* in *Peenasadi rogas* along with *ghrita* as an internal medication. *Sarala Devadaru* with synonyms like *Peetavriksha* and *Surabhidaruka* is different from *devadaru*.

Gana

Charaka: Sthanyashodhana, Anuvasanopaga Rasa: Tikta, kashaya

Guna: Laghu, Snigdha Virya: Ushna

Vipaka: Katu

Effect on Tridosha: Vata - kaphahara

Part used: Oil, Heart - wood

Preparation & Dosage: Powder 3 - 6g, Oil - 20 - 40 drops

Specific formulation: *Devadarvadi kwatha, Devadarvadi churna*.

Chemical constituents

Cedrus deodara has been studied by lot of researcher and they concluded that there are lot of essential constituents of high range of structure are seen in figure 2. The chemicals in wood are wikstromal, matairesinol, dibenzylbutyrolactol, 1, 4 diaryl butane, benzofuranoid neo lingam⁸, cedrin (6 - methyl dihydromyricetin), taxifolin, cedeodarin (6 - methyltaxifolin), dihydromyricetin, cedrin⁹, deodardione, diosphenol, limonenecarboxylic acid

(Krishnappa, 1978), (-) - matairesinol, (-) - nortrachelogenin, and a dibenzylbutyrolactollignan (4, 4', 9 - trihydroxy - 3, 3' - dimethoxy - 9, 9' - epoxy lignan) 10. A new dihydroflavonol named deodarin (3, 4, 5, 6 - tetrahydroxy - 8 - methyl dihydroflavonol) has been isolated from the stem bark¹¹. The extract of *Cedrus deodara* needle (ethanolic extract) showed the presence of lot of compounds viz. 10 - nonacosanol, dibutyl phthalate, protocatechuic acid, phthalic acid bis - (2 - ethylhexyl) ester, (E) - 1 - O - p - coumaroyl beta - D - glucopyranoside and 5 - p - trans - coumaroyl guinic acid, 9 - hydroxy - dodecanoic acid, ethyl laurate, ethyl stearate, 3 - beta hydroxy - oleanolic acid methyl ester, beta - sitosterol, shikimic acid, methylconiferin and ferulic acid beta - glucoside¹². The essential oil of wood contain a sesquiterpenes - L II: isohemacholone and sesquiterpenes L III: deodaron, atlantone 13, α - himacholone, β himacholone [14] [15], α - pinene, β - pinene, myrcene [16], himachalene, cis - atlantone, α atlantone

Many pharmacological activities of *Cedrus deodara* have been reported in - vivo and in - vitro. Various parts of this plant bear anti - inflammatory, immuno modulatory, antispasmodic, anti - cancer, anti - apoptotic, anti - bacterial as well as other activities. [17]

Phytochemical analysis [18]

Test for Flavonoids (Ammonia test)

1 ml of the extract was taken in the test tube and ammonia solution was added (1: 5) followed by the addition of conc. sulphuric acid. Appearance of yellow color and its disappearance on standing indicates the positive test for flavonoids.

Test for Glycosides (Keller Kilian Test)

5 ml of each extract was added with 2 ml of glacial acetic acid which was followed by the addition of few drops of ferric chloride solution and 1 ml of conc. sulphuric acid. Formation of brown ring at interface confirms the presence of glycosides.

Test for Phenols (Ferric Chloride Test)

0.5 ml of the extract was added with few drops of neutral ferric chloride (0.5%) solution. Formation of dark green color indicates the presence of the phenolic compounds.

Test For Saponins (Froth Test)

1 ml of the extract was taken in a test tube and distilled water (2 ml) was added to it. The test tube was then kept in boiling water bath for boiling and was shaken vigorously. Existence of froth formation during warming confirms the presence of saponins.

Test For Tannins (Ferric Chloride Test)

1 ml of the extract was added with 5 ml of distilled water and kept for boiling in hot water bath. After boiling, sample was cooled down and to this 0.1

Phytochemical Screening of Deodar Cedar (Leaves, Bark, Resins) [19]

Six phytochemicals were screened for this research work (tannins, phenolic, terpenoids, glycosides, saponins and

flavonoids) as seen in Table 1, from the crude extracts obtained from marine species exhibiting bioactivity. Cedar leaves methanol crude extract tested positive for the presence of Flavonoids, terpenoids, phenol, tannins and glycosides. Similarly, cedar bark showed the presence of phytochemicals Flavonoids, phenol, tannins and glycosides. But, in case of Cedar methanol crude extract did not test positive for the existence of any of the other mentioned phytochemicals, except terpenoids, which are tested positive (Table 1).

S. No.	Phytochemicals	Cedar Leaves Methanolic Extract	Cedar Resins Methanolic Extract	Cedar Bark Methanolic Extract
1	Flavonoids	+	-	+
2	Glycosides	+	-	+
3	Phenol	+	-	+
4	Saponins	-	-	-
5	Tannins	+	-	+
6	Terpenoids	+	+	-

Anti - inflammatory activity

The oil extract of wood was used for its oral anti - inflammatory activity. The extract showed significant result in induced rat paw edema process. The oil extract (Volatile) was also studied for its anti - inflammatory activity by the process of induced arthritis. The extract showed significant result here too. [20]

Analgesic activity

The oil of wood of *Cedrus deodara* was studied for its analgesic potential by acetic acid induced writhing response. There is an apparatus use to crush wood chips to get essential oils is Clevenger's. Adults of *A. aegypti* were mostly insensitive to essential oil of *Cedrus deodara*. Plants showed moderate activity [21]

Anti - allergic activity

Various Phytochemical investigations proved that various medicinal as well as essential constituents of the plant are responsible for curing different diseases e. g. himachalol is one of the best constituent with anti - allergic property. [22]

Insecticidal activity

Himalayan cedar wood oil fractions and chromatograph were bio assayed against the pulse beetle (*Callosobruchus analis* F.) and the housefly (*Musca domestica* L.). All fractions showed insecticidal activity. Evaluation of fractions I and V and β - himachalene (naturally occurring) sesquiterpenes indicated mortality against the pulse beetle. These natural products of plant serve suitable for the development of commercial insecticides [23]

Anti - hyperglycemic activity

The ethanolic extract of wood of *Cedrus deodara* possesses antihyperglycemic activity mainly on streptozotocin - induced diabetic rats from 1 to 7 h. Lowering of blood pressure was found at 7 h treatment [24]. Plant shows 6% fall in blood glucose profile in single dose experiment on streptozotocin - induced diabetic rats [25], [26], [27]. Antihyperglycemic preparation was also obtained and evaluated from the ethanolic extract of *Cedrus deodara*. [28]

Antisarcoptic mange activity

Cedrus deodara proved to contain two commonly acaricidal drugs that are OCD and benzyl benzoate (BB), respectively, which are used to cure infection of Sarcoptesmites. These drugs are applied on effected part in alternative days and recoveries in skin lesions were observed. Blood samples were also collected and analyzed after every 10 days of Post treatment (PT). *Cedrus deodara* oil was more effective in controlling sarcoptic mange in sheep [29]

Anticonvulsant activity

Alcoholic extract of heart wood of plant *Cedrus deodara* was studied for its highly anticonvulsant activity by Pentylentetrazole (PTZ) induced and maximal electro shock (MES) induced in mice. The alcoholic extract showed increase in the onset of tonic seizures in PTZ and also decrease in the time of tonic extensor phase in MES. Modulation of GABA level were estimated when administered in rat brain and showed significant result. This proves that alcoholic extract of *Cedrus deodara* have significant anticonvulsant activity through GABA levels in brain [30] [31]

Immunomodulatory activity

Models like neutrophil adhesion test in rats were used for studying volatile oil of wood of *Cedrus deodara* in immunomodulatory activity [32]. Reaction of Arthus reaction in mice [33] SRBC - induced delay type hypersensitivity (DTH) in mice [34] [35] and oxazolone - induced contact hypersensitivity in mice [36]. *Cedrus deodara* oil of wood helps in inhibiting the adhesion of neutrophils to nylon fibers which are responsible for the simulation of blood vessels in the cells (margination). This shows that the *Cedrus deodara* wood oil lessens the amount of neutrophils in turn decreasing phagocytosis action and also the release of various enzymes that make inflammation even more worse [37].

Cedrus deodara wood oil significantly shows the inhibition for Arthus reaction due to inhibitory effect characterized in the following reaction: Formation of precipitation of an immune complex at the site of injection, Activation of compliment system, neutrophil aggregation, release of lysosomal enzymes etc [38]. In the early event hypersensitivity reaction to oxazolone, mast cell degranulation has been reported [39]. It is due to mast cell stabilization. This proved that *Cedrus deodara* oil manly of wood produces and inhibitory effects on humoral as well as cell - mediated immune responses and hence shows lot of usefulness in curing inflammatory diseases.

Antispasmodic Activity

Himachalol is one of the chief constituent of wood of *Cedrus deodara*, which likely to have antispasmodic activity. The pharmacological studies of himachalol on different isolated smooth muscles (rat uterus, pig ileum and rabbit jejunum) and against various other agonists histamine, serotonin, nicotine, acetylcholine etc proved spasmolytic activity. This antagonist activity had no relaxing effect when given alone. Himachalol had much faster and better action as compare to papaverine which compared to Himachalol. Intravenous injection of Himachalol when given to cat produces a dose dependent fall in blood pressure and also

causes an increased femoral blood flow [40]

Antioxidant Activity

Brain and nervous system are mainly the two parts of our body which are highly prone to free radical damage as our nervous system and brain are rich in lipid and iron. *Cedrus deodara* was known and also evaluated to have high antioxidant property [41]. Fractionation and purification are the two processes which are involved in the identification of antioxidant components mainly from dried heart wood powder of *Cedrus deodara*.

Economic Importance: [42]

It is the strongest Indian coniferous wood owing to its anti-fungal, insect-repellent and anti-bacterial properties. It is used as valuable construction material. The primary uses of deodar are for railway sleepers, beams, floor-boards, posts, door and window frames and shingles. It is also used for bridge construction, carriage and wagon building, furniture, packing cases, electric poles, battery separators and second grade pencils.

Traditional Uses:

The aromatic oil, extracted from cedar wood is used in alleviating tension, fear and anger, in reconnecting to spiritual awareness and in balancing mental instability since long. In Kangra, the wood is ground with water and the paste is applied to relieve headache. Since very early time, because of its lofty, awe-inspiring height, deodar is considered as the abode of gods. In Western Himalayas, particularly in Kumaon Hills and Kullu Valley, people considered the tree sacred and offer iron pieces as their offering to the Gods dwelling in the trees.

Medicinal Uses:

In Ayurveda, whole plants are used in belching inflammation, dyspepsia, insomnia, cough and cold, fever, urinary discharges, bronchitis, itching, elephantiasis, tuberculosis glands, leucoderma, piles, ophthalmia, mind disorder, skin diseases and diseases of blood. In Yunani, the wood is used as diuretic, carminative, expectorant, useful in alleviating piles, rheumatism, palsy, epilepsy, stones in the kidney and bladder and prolapsus recti. The bark is astringent and useful for fevers, diarrhoea and dysentery. The oleoresin of deodar and the dark-coloured oil extracted from the wood are valued as an application for ulcers and skin diseases. They are also useful in curing of sore-feet of cattle.

2. Discussion and Conclusion

Herbal medicines are considered as a rich source of medicines which can be used in drug development and synthesis. These herbal medicines play an important role in the development of human culture around the whole world. Herbal medicines have been proved better and even best against allopathic medicines. From the present review it is clear that *Cedrus deodara* have many qualities and features including anti-inflammatory, antitumor, anti-bacterial, antifungal and various other and possesses great influence on nervous system. Various studies can be conducted in multiple animal based models for understanding their mechanism of action. The detailed review of *Devadaru*

(*Cedrus deodara*) was compiled from ancient as well as recent texts and various researches on pharmacological, phytochemical & pharmacological actions of *Devadaru* so it was concluded that the *Devadaru (Cedrus deodara)* had many properties and it is very useful in many diseases as it reviewed in detailed in many researches. The wood *Devadaru* used as diuretic, carminative, expectorant, useful in alleviating piles, rheumatism, palsy, epilepsy, stones in the kidney and bladder and prolapsus recti. The bark is astringent and useful for fevers, diarrhoea and dysentery. This review article helpful for all research scholar because all the references are used in this review article from API, Nighnatu, Samhita, text book of dravyaguna, pharmacognosy, pharmacology and some of previous review and research article.

References

- [1] McGowan JC, Majestic Conifers from the Himalayas Los Angeles Times: Home 1982; 56: 5.
- [2] The Ayurvedic pharmacopoeia of India, part - 1, vol - 4, appendix, test and determination, Edition - 1, Government of India, Ministry of Family and Welfare, New Delhi, 2004; 23 - s24.
- [3] *Flavours and fragrances of plant origin*. Food and Agriculture Organization of the United Nations.1995.
- [4] Sharma A, Parashar B, Vatsal E, Chandel S and Sharma S.2016. Phytochemical Screening and anthelmintic activity of leaves of *cedrus deodara* (roxb.) Department of Pharmacy, ManavBharti University, Solan, Himachal Pradesh. *Guru Nanak Dev University, Amritsar, Punjab. World Journal Of Pharmacy And Pharmaceutical Sciences* 5 (8): 1618 - 1628.
- [5] Mukherjee PK.2003. Exploring botanicals in Indian systems of medicine - regulatory perspectives. *Clinical Research and Regulatory Affairs*.20: 249 - 264.
- [6] Dar AR, Dar GH. The wealth of Kashmir Himalaya gymnosperm. *Asian J plant Sci*.2006; 5 pp 251 - 259.
- [7] Prof. K. Nishteswar, Dravyaguna vijyana; chowkhamba Sanskrit Pratishtan; pp 166 - 167
- [8] Agrawal PK, Rastogi RP.1982. Two lignans from *Cedrus deodara*. *Phytochemistry* 21: 149 - 146.
- [9] Agrawal PK, Agarwal SK, Rasgi RP.1980. Dihydroflavonoids from *Cedrus deodara*. *Phytochemistry* 19: 893 - 896.
- [10] Tiwari AK, Srinivas PV, Kumar SP, Rao JM.2001. Free Radical Scavenging Active Components from *Cedrus deodara*. *Journal of Agricultural and Food Chemistry* 49; 10: 4642 - 4645.
- [11] Adinarayana D, Seshadri TR. Chemical investigation of the stem - bark of *Cedrus deodara*: Isolation of a new dihydroflavonol, deodarin. *Tetrahedron* 21: 3727 - 30, 2001.
- [12] Zhang JM, Shi XF, Li C, Fan B, Wang DD, Liu DY.2010. Study on the chemical constituents from pine needles of *Cedrus deodara*. *Zhong Yao Cai* 33; 2: 215 - 8.
- [13] Shankaranarayan R, Krishnappa S, Bisarya SC, Dev S.1977. Studies in sesquiterpenes - LIII: Deodorone and atlantolone, new sesquiterpenoids from the wood of *Cedrus deodara* Loud. *Tetrahedron* 33: 1201 - 1205
- [14] Gulati BC.1977. Oil of *Cedrus deodara*, cultivation and

- utilization of aromatic plants. Regional Research Laboratory, Jammu - Tawi, India; 640.
- [15] Kar K, Puri VN, Patnaik GK, Rabindra N, Sur Dhawan BN, Kulshrestha DK, Rastogi RP.1975. Spasmolytic constituents of Cedrus deodara (Roxb.) Loud: Pharmacological evaluation of himachalol. *Journal of Pharmaceutical Sciences* 64: 258 - 262.
- [16] Yan - qiu C, Xin - hong C, Yi Z, Qun Z, Peng N.2008. Chemical Composition and Antimicrobial Activity of Volatile Oil of Six Gymnosperm Species Leaves from Shanghai. *Bioinformatics and Biomedical Engineering* 4573 - 4577.
- [17] Makhaik M, Naik SN, Tewary DK.2005. Evaluation of Anti - mosquito properties of essential oil. *Journal of Scientific & Industrial Research*.64: 129 - 133.
- [18] Vibha Bhardwaj, Deodar Cedar (Cedrus Deodara): Efficacy for Potential of Secondary Metabolites and Antibacterial Activity, 2022.
- [19] Vibha Bhardwaj, Deodar Cedar (Cedrus Deodara): Efficacy for Potential of Secondary Metabolites and Antibacterial Activity, 2022.
- [20] Winter CA, Risley EA, Nuss GW. Carrageenan - induced edemas in hind paw of the rat as an assay for anti - inflammatory drugs. *Proceedings forthe Society Experimental Biology and Medicine* 11: 544 - 547, 1962.
- [21] Makhaik M, Naik SN, Tewary DK.2005. Evaluation of Anti - mosquito properties of essential oil. *Journal of Scientific & Industrial Research*.64: 129 - 133.
- [22] Singh D, Agrawal SK.1988. Himachalol and β - himachalene: Insecticidal principles of himalayan cedar wood oil. *J Chem Ecology* 14: 1145 - 1151.
- [23] Singh D, Agrawal SK.1988. Himachalol and β - himachalene: Insecticidal principles of himalayan cedar wood oil. *J Chem Ecology* 14: 1145 - 1151.
- [24] Ahmad R, Srivastava PS, Maurya R, Rajendran SM, Aryan KR, Srivastava AK.2008. Mild antihyperglycaemic activity in Eclipta alba, Berberisaristata, Betulautilis, Cedrusdeodara, Myristicafragrans and TerminaliachebulaIndian. *Journal of Science and Technology* 5: 1 - 6.
- [25] Gupta RK, Kesari AN, Murthy PS, Chandra R, Tandon V, Watal G.2005. Hypoglycemic and hypoglycemic effect of ethanolic extract of leaves of Annonasquamosa L. in experimental animals. *J. Ethnopharmacol* 99: 75 - 81.
- [26] Rajasekaran S, Sivagnanam K, Ravi K, Subramanian S.2004. Hypoglycemic effect of Aloe vera gel on streptozotocin - induced diabetes in experimental rats. *Journal of Medicinal Food* 7: 61 - 66.
- [27] Upadhy S, Shanbhag KK, Suneetha G, Balachandra Naidu.2004. A study of hypoglycemic and antioxidant activity of Aeglemarmelos in alloxan induced diabetic rats. *Indian J. Physiol. Pharmacol* 48: 476 - 480.
- [28] Shivanand, P, Viral D, Goyani M, Vaghani S, Jaganathan K.2009. Formulation and evaluation of Cedrus deodara Loud. Extract. *International Journal of ChemTech Research* 1; 4: 1145 - 1152.
- [29] Sharma DK, Saxena VK, Sanil NK, Singh N.1997. Evaluation of oil of Cedrus deodura and benzyl benzoate insarcoptic mange in sheep. *Small Ruminant Research* 26: 81 - 85,
- [30] Dhayabaran D, Jeyaseeli FE, Nanda K, 2010. Puratchikody A. Anxiolytic and anticonvulsant activity of alcoholic extract of heart wood of Cedrus deodara Roxb. in rodents. *Journal of Medicinal Plants Research* 4; 14: 1374 - 1381.
- [31] Viswanatha GL, Kumar KN, Shylaja H, Ramesh C, Rajesh S, Srinath R.2009.
- [32] Wilkonson PC, Vane JK, Ferreria SH.1962. Handbook of experimental pharmacology. Berlin: Springer - Verlag.109.
- [33] Goldlust MB, Harrity TW, Palmer I, Numonde DC, Jasani MK.1978. The recognition of anti - rheumatic drugs. Lancaster: MTP Press.119.
- [34] Saraf MN, Ghooi RB, Patwardhan BK.1989. Studies on the mechanism of action of Semecarpusanacardium in rheumatoid arthritis. *J. Ethnopharmacol* 25: 159 - 164.
- [35] Ray A, Mediratta PK, Puri S, Sen P.1991. Effect of stress on immune reponsiveness, gastric ulcerogenesis and plasma corticosterone in rats: modulation by diazepam and naltrexone. *Indian Journal Experimental Biology* 29: 233.
- [36] West GB.1982. Effects of levamisole and D - penicillamine on contact sensitivity to oxazolone inrats. *Int Archs Aller Appl Immunol* 67: 184 - 186.
- [37] Ray A, Mediratta PK, Puri S, Sen P.1991. Effect of stress on immune reponsiveness, gastric ulcerogenesis and plasma corticosterone in rats: modulation by diazepam and naltrexone. *Indian Journal Experimental Biology* 29: 233.
- [38] Rodnan GP, Schumacher HR.1989. Role of immunologic mechanisms in the pathogenesis of rheumatic diseases. *The Arthritis Foundation*, Atlanta, GA.38.
- [39] Thomas WR, Vardinon N, Walkins MC, Ashershon GL.1980. Antigen - specific mast cell degranulation in contact sensitivity to picryl chloride, An early event. *Immunology* 29: 331.
- [40] Kar K, Puri VN, Patnaik GK, Rabindra N, Sur Dhawan BN, Kulshrestha DK, Rastogi RP.1975. Spasmolytic constituents of Cedrus deodara (Roxb.) Loud: Pharmacological evaluation of himachalol. *Journal of Pharmaceutical Sciences* 64: 258 - 262.
- [41] Halliwell B, Gutteridge JMC.1989. Free Radicals in Biology and Medicine. Clarendon Press. Oxford.96-98.
- [42] Manas Ranjan Debta, Debasmitra Dutta – Pramanick & S. K. Srivastava Northern Regional Centre, Botanical Survey of India, Dehra Dun.