

A Comprehensive Review on Medicinally Important Gymnosperms Mentioned in Siddha

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ABSTRACT

Introduction: Gymnosperms – a group of Spermatophytes are well renowned for their characteristic therapeutically roles in various medicinal systems such as modern medicine, folk and traditional medicinal systems. The present review describes the medicinal importance of gymnosperms used in Siddha System of medicine. **Method:** Literature survey has been done to document the application of gymnosperm species along with ethno-medicinal uses. The medicinal plants are enumerated with their local name, Siddha name and therapeutically actions mentioned in Siddha literatures along with ethno-medicinal properties for various diseases. **Results:** Gymnosperms have been performed a role in various medicinal systems such as modern medicine, folk and traditional medicinal systems. It has been found that, four species reviewed in the present papers are medicinally useful in the ailments such as asthma, cough, sore throat, diarrhoea, hypertension, rheumatism, fever, aphrodisiac, ulcer, diuretic, diabetes, kidney stone problems, bronchitis etc. **Conclusion:** The present study provides a comprehensive review on the medicinally important Gymnosperms with their therapeutic role in traditional system of Indian medicine. This may be helpful to know and conserve these plants for future perspectives.

KEY WORDS

Cedrus, Cycas, Gymnosperms, Medicinal uses, Siddha, Taxus

1. INTRODUCTION

Traditional medicinal systems are mostly relied on the plants and their various parts. As when compared with angiosperms, the contribution of lower plant groups such as bryophytes, fungi and Pteridophytes towards the TMS (Traditional Medicinal System) were found to be less or almost negligible. However, medicinal properties of some member of Pteridophytes reported are *Actinopteris radiata* (Sw.) Link, *Drynaria quercifolia* (L.) Sm. and *Selaginella bryopteris* (L.) Baker etc.^[1] Thus, in the spermatophytes, other than angiosperms some

of the Gymnosperms are also used as a medicine in the distinguished TMS.

Gymnosperms constitute the naked seeded plant groups that were surviving since Mesozoic era (300-350 MYA). They have drawn a great attention owing to their beautiful appearance as well as their application in Wood Industry (Eg. *Agathis australis* (D.Don) Lindl., *Cedrus deodara* (Roxb. ex D.Don) G.Don), Horticulture and landscape (Eg. Conifers, Cycad), Essential Oils (*Cedrus deodara* (Roxb. ex D.Don) G.Don, *Juniperus virginiana* L.) Food - *Cycas*, *Pinus*, *Araucaria*, *Ginkgo* etc) and also as a

medicine (*Cycas*, *Cedrus*, *Taxus*, *Abies* *Ephedra*) etc.^[2]

Indian gymnosperms are represented by 14 genera and about 75 species.^[3] In Indian TMS, *Cycas*, *Cedrus*, *Abies* and *Taxus* are mentioned in the Siddha literatures, along with this *Pinus* and *Ephedra* are mentioned in the Ayurvedic and Unani literatures. Himalayas are the major house for the Indian Gymnosperms like *Abies*, *Araucaria*, *Cedrus*, *Juniperus*, *Cupressus*, *Pinus* etc. A number of studies have been done in these regions to document the ethno-medicinal values, pharmacological and phytochemical analysis of the Indian Gymnosperms. Bark of *Abies pindrow* Royle. is used in the treatment of rheumatism, cough and bronchitis; resin is used for the quick healing of cuts and wounds; leaf powder is given with juice of *Adhatoda vasica* Nees and honey in cough, asthma and other respiratory disorders.^[4] Berries and wood oil of *Juniperus communis* L. are applied to cure various ailments such as, gonorrhoea, leucorrhoea, polyps, tumor and warts.^[4,5] Fruits and wood of *Cupressus sempervirens* L. is used as an anthelmintic and astringent.^[4] Oil extracted from the stem and bark of *Cedrus deodara* (Roxb. ex. D. Don) G. Don. is used in the treatment of skin rashes and external ulcers. *Pinus wallichiana* Jackson (Resin) young sapling is used to treat cuts and wounds.^[6,7] *Abies webbiana* Lindl. dried leaf powder is given twice a day to treat asthma.^[8] *Gnetum* species are used as folk medicines for the treatment of arthritis, bronchitis and asthma. *Gnetum africanum* Welw. (Gnetaceae) leaves are chewed or cooked as soup to cure sore throat, diarrhoea and hypertension. Leaves and young inflorescence of *Gnetum gnemon* L. are boiled and flavored with coconut cream are also used as cuisine in Southern Thailand. Antibacterial, antioxidant, antimicrobial and anti-aging activities of *Gnetum gnemon* has been reported.^[9-11] Therapeutic uses of three different pine species such as *Pinus roxburghii* Sarg., *Pinus wallichiana* A.B.Jacks. and *Pinus gerardiana* Wall.

ex D. Don have been proved by phytochemical and Pharmacological studies.^[12] *Pinus wallichiana* A. B. Jackson (Resin) young sapling is used to treat healing of cuts and wounds. Mostly, *Pinus brutia* Ten., *Pinus nigra* J.F. Arnold and *Pinus sylvestris* L. were used to treat human illnesses like skin diseases, respiratory disorder, urinary disease and asthma etc.^[11,13] Species of *Podocarpus falcatus* (Thunb.) Endl. is used to treat jaundice.^[14] Decoction of *Ephedra* stem and root is used to cure rheumatism, asthma, syphilis and juice of berry is used in the treatment of respiratory system disorder.^[9,15] The present review aimed to describe the medicinal/ethnobotanical uses of three Indian gymnosperms Talisapatri, Devatharam (Devadaru) and Madhanakamapoo used in the Siddha formulations.

Three important Indian Gymnosperms which are used in Siddha medicine are *Talisapatri*, *Devadaru* and *Madhanakamapoo*. Literature related to the ethno medicinal uses were collected using scientific search engines such as PubMed, Scopus, Google Scholar and other information collected from Siddha literature etc. Details of the plants were enumerated with Siddha Name, Botanical Name, family, part used, principle chemical components, Siddha formulations in which they have been used. Conservation, adulterant and substitute for the studied plants were briefly discussed. The accepted name and nomenclature of the species were checked in the international standard website. ^[16]

2. OBSERVATIONS

2.1 Talisapatri

Talisapatri is an important drug used in many formulations of Ayurveda and Siddha. Three plants are used in the name of Talisa/Talisapatra/Talisapatri in above said TMS. The first one is an Angiosperm member, *Flacourtia cataphracta* Roxb. ex. Willd. (Flacourtiaceae), mentioned as Talisapatri.^[17-20]

At present *Abies spectabilis* (D.Don) Mirb. (Pinaceae) is mentioned as Talisa in Ayurveda and Siddha;^[21] however, it has been noted that most of the folk practitioners are using *Taxus buccata* L. (Taxaceae) as talisapatri. But *Taxus* is mentioned as Sthauneyaka / Talisa bhedham in Ayurveda and accepted as the substitute for *Abies spectabilis*.^[22,23] The other adulterants recorded from the market sample of the Talisapatri are leaves of *Abies* and *Taxus* species (Figure1B).

Scientific Name: *Abies spectabilis* (D.Don) Mirb.

Synonym: *Abies webbiana* (Wall. ex D.Don) Lindl.

Family: Pinaceae

Used part: Leaves

Abies spectabilis (D.Don) Mirb., Indian Silver Fir, distributed in the Western Himalaya of Kashmir to Assam at an altitude of 1,000-4000m. Generally it is used as bronchial sedative, decongestant, antiseptic and carminative.

Leaves of *Abies* have been used as medicine by inhabitants of India and adjacent countries. The folk healers of Kedarnath valley using leaves and bark extract, mixed with honey were used in the treatment of fever, asthma, bronchitis and cough. ^[7] Resin and bark extract with honey in the form of syrup is used to treat ulcers and cough. In the treatment of rheumatism, stem bark paste is applied externally and used to make tea to cure cough and bronchitis. Resin is used to cure quick healing of cuts and wounds^[6], dried leaf powder eaten two times per day to treat asthma.^[8] Leaves are anti-microbial, anti-tumor, anti-inflammation, anti-spasmodic, hyperglycemia, rheumatism and CNS depression action. ^[24] A comparative study of talisapatri (*A. webbiana*) and sthauneyaka (*T. baccata*) revealed that, sthauneyaka did not show any statistically significant difference from Talisapatri and sthauneyaka can be used for a substitute for Talisapatri.^[22]

The major phytochemical constituents are monoterpenes, biflavonoid, glycosides,

phytosterols, saponin, 1-(4-methoxyphenyl)-aziridine and Abiesin.^[24]

The medicinal properties of Talisapatri have been written in old Tamil literature^[34,35] etc as follows:

நாசிக ளப்பிணிகள் நாட்பட்ட
காசஞ்சு
வாசம் அருசி வமனங்கால் -
வீசிவரு
மேகமந்தம் அஸ்திசுரம் விட்டேகுந்
தாளிசத்தால்
ஆகுஞ் சுகப்பிரசவம்
தேக்குப்பத்திரி சிறந்த
சீந்திலொடு
தாக்கு காஞ்சொரி தக்க மதுரமாம்
நோக்கும் நன்னாரி
நுவலுந்ததாளீசமாம்
பாக்குஞ்சரக்கு பகருமுத்தக்
காசே”

In Siddha, Talisam/Talisapatri is used to cure fever, cough, wheezing, vomiting, gas trouble, indigestion, headache, toothache and cold also it help for normal delivery.^[36] Leaf powder mixed with *Adhatoda vasica* leaf juice is given for respiratory disorders. Leaves of *Abies spectabilis* (D.Don) Mirb. (8Nos), *Piper nigrum* L. (4 nos), dried *Zingiber officinale* Roscoe (2 nos) *Piper cubeba* Bojer (1) and sugar (15 part) is powdered finely and mixed together. Oral intake of 3 gm of this powder is used as an appetizer and to treat stomach disorders. For infants leaf juice 5 to 10 drops is given with water or breast milk to treat fever. Stem bark decoction is used to gargle in conditions of mouth ulcer and throat infections. ^[17]

Talisapatri is one of the important plant used in many Siddha formulations such as Sarvasura kudineer, Kiranick Kudineer, Ilavangaadhi Chooranam, Sanjeevi Chooranam, Suvasakudori Chooranam, Narasimha Chooranam, Talisapatri Chooranam, Adathodai Chooranam, Elathi Chooranam, Kandatri Chooranam, Talisapatri vadagam, Seviya

Vadagam, Sukku Vadagam, Kandangathiri Nei, Thudhuvali Nei, Tippili Irasayanam, Kandhadhi Lehiyam, Manmadhasinthamani, Kakkuvan Lehiyam, Kadukkai Ilagam, Kabaada Ilagam, Kaaya Ilagam, Pooranadhi Ilagam, Inji Ilagam, Mahavilvaadhi Ilagam, Sutthavalladhi Enney, Megarasaangath Enney, Rasagandhi Melugu, Annapodi, Athisaram grahani Nivarani, and which are used widely in the treatment of various ailments such as leucorrhoea, PCOD, Urethral obstruction, rheumatoid arthritis, Pitham (Bilious disorders), scabies, skin diseases, leprosy, anaemia, paralysis, fistula jaundice, tuberculosis, scabies, gas-trouble, wounds, hiccough, kidney stone, wheezing, giddiness, piles, venereal diseases, inflammation, bronchial asthma, tonsillitis, vomiting, indigestion, stomach pain, paralysis, hemiplegia, cancer, leprosy, sinusitis, baldness, syphilis, belching and diarrhoea diseases.^[17,36-39]

In Ayurveda, stem bark and leaves are used in the treatment of cough, hiccough, worm infestation, tuberculosis, diseases of mouth, asthma, lump in abdomen, emesis and anorexia, also used as a good appetizer. The drug used in the formulations of Drakshadi churna, Talisadi churna, Bhaskaralavana churna, Pranada Gutika, Jatiphaladi churna, Puga khanda, Talisadi modaka. Also stated that, *Abies pindrow*, *Rhododendron anthopogn* and leaves of *Taxus baccata* are used as a substitute for *Abies spectabilis*. Resin is extracted from the stem and it is intoxicant when taken orally.^[21,31]

2.2 *Talisa bedham*

Scientific Name: *Taxus baccata* L.

Family: Taxaceae

Tamil name: Talisa bedham

Used parts: Leaves, Bark, Seeds

Commercially sound *talisapatri* is *Taxus baccata* L. (Family – Taxaceae) a commonly known as yew, it is a small size conifer reported with eleven species from the high altitude of temperate region of the World.^[25,26] In India, distribution of *Taxus* occurs in the Himalayas

crossing the States Himachal Pradesh, Uttaranchal, Arunachal Pradesh, Assam and Manipur. Except fleshy red aril, all parts of this plant are toxic to animals and human but it is often used as a medicine in TMS.^[25] The main therapeutic activity is found to be CNS depressant, analgesic, anti-rheumatic, anti-catarthal etc.^[18]

The medicinal importance of leaves and barks are well documented in India as well as in China.^[27] Taxol is an important anti-cancerous compound found in the bark and leaves of *Taxus wallichiana* and also used for fish poisoning.^[11] Stem bark is used to cure cold, cough, cancer, hypertension in the form of herbal tea and juice by the tribal communities in Garwal, Himalayas.^[28] Bark and leaves are used in steam bath to treat rheumatism. It is also a sedative, aphrodisiac and antidote for poisonous bite.^[29] The ethnobotanical studies were carried out among the indigenous people of Kedarnath valley of Western Himalaya. They have been using decoction and paste of leaves, fruits/stem bark to cure cancer, asthma and bone fractures and further as an antiseptic.^[7] Anticancer property of extract from the needles and twigs of *Taxus cuspidata* have been reported its synergistic effect as a cocktail with 5-fluorouracil.^[30] Talisapatri has been used to cure cardiac diseases and bronchial congestion in Siddha system^[31] and also in the treatment of diarrhoea, dysentery, vomiting, indigestion, chest pain and cough.^[32] External application of the leaves is used to treat toothache, headache, colic and sore throat. Leaf powder with *Adhatoda vasica* leaf juice is used to cure wounds and wheezing. Infusion of the bark is used as mouth wash to treat stomatitis. *Taxus baccata* is a suitable alternative to American Yew (*Taxus brevifolia*) and the source of plant for Taxol possessing anticancer property.^[33]

The major phytochemical constituents reported are: Taxine, Hydrocyanic acid, resins, and tannins from leaves, bark, seeds and heart wood. The major components are Taxane (10-

Deacetybadscacatin III, Baccatin III, taxol and Cephalomannine).^[28]

2.3 Devadaru

Cedrus is an important genus of the family Pinaceae distributed in the tropical and subtropical regions of the world and it is locally known as Cedar. It comprises about 4 species such as *Cedrus deodara*, *C. libani*, *C. brevifolia* and *C. atlantica* (Figure1A). Devadaru (*Cedrus deodara*) and Sarala Devadaru (*Pinus longifolia*) are commonly used varieties in TMS.

Scientific Name: *Cedrus deodara* (Roxb.) Loud.

(Pinaceae)

Trade Name: Deodar

Tamil Name: Devatharu maram

Used part: Heart wood, Stem bark

The Himalayan Cedar is called as Devadaru (Tree of Gods). *Cedrus* is a large, evergreen tree with dark green needles commonly seen across north-western Himalayan belt from Kashmir to Garwal. It grows at an altitude of 4,000-10,000 feet and is the dominant conifer between 5,500 and 8,000 feet. Deodar tree forests are considered as the favorite abode of ancient Indian Sages who were devoted to Hindu God Shiva. It has been reported that the parts of this plant is used in various ailments such as fever, pain, ulcer, cancer, insomnia, hyperglycemia etc.^[11,40]

Essential oil extracted from the leaves and wood of *Cedrus* is used by locals from different parts of Nepal to cure scabies and rheumatic pain. In Jammu, Oil is extracted from stem and bark is locally known as Kilo used in the treatment of foot and mouth diseases common in cattle's and is the best remedy for lice and ticks; bark is used as a diuretic in urinary trouble and for its carminative and anti-inflammatory property.^[6] In Uttarakhand, fumes from bark is used as a snake repellent. Locals of Nanda Devi Park, uses the decoction of the bark to treat fever and dysentery. Indigenous people from the Himachal Pradesh, prepares *Cedrus* oil locally by burning the wood in earthen pots to be used as an insect repellent especially in

sheep and goats.^[41] It is applied to the foul ulcers and wounds of the cattle.^[42] The indigenous people of Kedarnath Valley of Western Himalayas, uses the bark to treat bowel complaints, piles, lumbago, rheumatic pain, arthritis, urinary disorder, diabetes, Kidney stone and urticaria. ^[7,43] Tar is prepared from wood and it is used for chronic skin disease and leprosy. Root decoction is used as diaphoretic, anti-rheumatic and antidote for snakebite.^[5,44-45]

Important chemical components reported from wood, stem bark, leaves are gama-himachalene, sesquiterpene, Limasecolore, α -himachalone, β -himachalone, sesquiterpenes himachalol and allo himachalol, resin, Terpentine, Dihydrodehydrodiconiferyl alcohol, lariciresinol, isolariciresinol, taxifolin 3-glucoside, fatty acid, ethyl ester, deodarin, sesquiterpene-himassedone in addition to isoprimary acid, cedodaria, cedrin, cedrinoside, cedrusin, cedrusinin, δ -himachalone etc.^[39-40,46-47]

The medicinal properties of Devatharu maram have been written in old Tamil literature^[34,35] as follows:

**தேவதா ரக்குணந்தான் சேர்ந்துவளர்
பீநசத்தைக்**

காவகத்தி லோட்டுங் கரப்பலவே -

மாவலவர்

சொல்லும் புராண சுரமொடுநீ

ரேற்றத்தை

வெல்லு மணற்றணிக்கு மெய்.

Devadaru bark, leaf and wood is used in Siddha to treat chronic fevers and common cold. Heart wood, i.e., devadaru kattai is used as the ingredient in most of the formulations. Wood possesses carminative, diuretic and diaphoretic properties, tender leaves are used as a refrigerant.

Some Siddha formulations, in which *Cedrus* is used as an ingredient, are Mudithaila Chooranam, Aavarai Chooranam, Mandoora vadagam, Sidhadhi Ilagam, Nagaraadhi thailam, Adhimadhura maathirai, Mandoora Mathirai and Thaenkai Kuzhambu.^[17,37] Stem and stem bark is

used to treat fever, dysentery, blood dysentery, diarrhoea, flatulence, pulmonary disorders, rheumatism, piles, urinary calculi and skin diseases. The heart wood is grounded with milk and boiled to prepare the paste this is externally

applied on the head to treat giddiness and sleeplessness. Heart wood and stem powder with dried ginger and salt is used to treat skin inflammation and oil is used for ulcers, skin diseases and intermittent fever.

Figure 1. Gymnosperms tree species used in the Siddha Medicinal System with medicinally important parts



1.1 *Cedrus deodara* (Roxb. Ex Lamb.) G.Don



1.2 *Taxus baccata* L.



1.3 *Cycas circinalis* L.



1.4 Cycas male cone and kernel

Black coloured oil extracted from the stem is used to treat wounds, and to heal cracks and eczema (Karappan) and the decoction is given to improve the body strength. [17,32]

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In Ayurveda the wood is used in the preparation of many formulations such as Khadirarishta, Dashamularishta, Devadarudarishta, Mristasanjivanisura, Karpuradyarka taila, Prudarantuka Lauha, candanadi curna, sudarsana curna, narayana taila, pradarrantaka lauha, vataraktantaka lauha, mahavisagarbha taila in certain ayurvedic formulations in the management of Vyanabala vaisamya are used in the treatment of joint pain, Oedema disorders, skin diseases, wounds, rheumatism, Sciatica, headache, constipation, worm infestation, heart diseases, blood disorders, goiter, elephantiasis, hiccup, polyuria and obesity; Oil is extracted from the heartwood and used as medicine.^[31,46,48]

2.4 Madhanakaamapoo/ Madhanakameshwarapoo

Scientific Name: *Cycas circinalis* L.

Family: Cycadaceae

Used Part: Stem, Male cone

The genus *Cycas* solely represents the Indian Cycads with more than ten accepted species. The distribution of *Cycas* species in India extends from the Western Ghats, Eastern Ghats, North East, Andaman and Nicobar Islands.^[49] (Figure1C&D)

Cycas has been used by the locals for many purposes such as young leaves are eaten

as vegetable in Assam; roasted and processed Kernels are used as source of starch in many parts of India. As a medicine, *Cycas* male cones, mucilage, kernel and cataphylls are used in the treatment of ulcer and stomach pain. Male cone (Madhanakamapoo) is used as an aphrodisiac and insect repellent. Stem of the endemic species *Cycas beddomei* Dyer of Eastern Ghats are hacked for its pith and bark, which is believed to have medicinal properties. The starchy pith of *Cycas* is used as an adulterant for vidari kanda (*Puraria tuberosa* (Willd.) DC. Small pieces of stems and bark are sold in the local markets of Andhra Pradesh by the name of Vidari-Kanda along with stems of other angiosperm plant (*Ipomoea digitata* L.) This is used as an aphrodisiac popularly known as 'Indian ginseng'. In Assam, the bounded stem of *C. pectinata* Ham. is used as hair-wash for diseased hair roots. The gum of *Cycas* extracted from stem is used as an antidote for snakebite. Bark and seeds are grounded into paste and mixed with coconut oil, and used as poultice to relieve nephritic pains.^[49-51]

Cycas is rich in secondary metabolites such as Oligosaccharide, benzoic acid, cinnamic acid, methylazoxy methanol, glycoside, cycasin and β -N-methyl, Amino-L-alanine.^[52]

In Siddha, *Cycas* male cone is mentioned as Madhanakameshwarapoo/ Madhanakama poo. However, there are many formulations and literatures are written this name which would not have the *Cycas* as an ingredient like Madhanasanjeevi and Madhanapal formulations.^[37] Flower (Male cone) powder with other medicines is taken orally in the morning and night to strengthen the body and used as aphrodisiac. Flower powder boiled with milk is taken orally during bedtime, helps to induce good sleep. Paste of mature flowers is applied on the body to reduce body pain. Seed powder is used as a food.^[17] Male cone, nuts and stem are used to cure various diseases. Flower powder is used as narcotic, stimulant, aphrodisiac and spermatogenic. Seeds are used

in the powder form.^[32] Decoction is prepared from the flower (Male cone) is given orally in the morning and night to treat fever during pox diseases. Flower is used in the following siddha formulations such as Madhanakameshwara Lehiyam, Madhanakameshwara Kuligai, Madhanakameshwara Nei, Manmadha chinthamani and Madhanakameshwara Enney indicated in different ailments such as pitham, gastric complaints, diarrhoea, chronic diarrhoea and moreover it improves the sexual vitality and body strength.^[38] Juices of tender leaves are given in flatulence. It is an accepted source of vidari i.e., the root tuber of *Pueraria tuberosa*.^[18,19,46]

Male flower is not in use; however, the stem pith is used as an adulterant for the renowned ayurvedha drug Vidari. Decorticated stem is used to cure urinary disorders, emaciation, bronchial asthma, and intermittent fever, haemorrhage, burning sensation, tonic, aphrodisiac and rejuvenator.^[53] The angiosperm species *Stereospermum colais* flower also called as Madhanakameshwarapoo.^[17]

The present review article reveals the contribution of conifers and cycads in TMS. The part used for medicines are leaves, Heart wood, Stem bark, Stem pith, Male cone of Talisapatri (*A.spectabilis/T.baccata*), Devadaru (*C.deodara*) and Madhanakamapoo (*C.circinalis*) respectively. Among these three drugs, Talisapatri is being used in more number of Siddha formulations as compared to others. Most of the market samples of Talisapatri is nothing but the leaves of *Taxus baccata*.^[22,54, 55] Heart wood of various *Pinus* species are found as an adulterant in the market sample of Devatharam. However, the shining texture with characteristics aroma helps us to distinguish the original drug from adulterants. *Pinus longifolia* Salisb. which is known as Sarala/Surul devatharam is an adulterant and is recommended as a substitute.^[53] Madhanakamapoo/madhakameswara poo, the young male flower of *C. circinalis* L., is used in many Siddha

formulations not in Ayurveda. In Ayurveda formulations, the pith of the stem is used as adulterant of Vidari i.e., *Pueria tuberosa* (Willd.) DC., which is an important drug used in Ayurveda and folk medicine. The pith of *Cycas* species of respected States are marketed as "Vidari" For example, in Assam *Cycas pectinata* Ham. is sold in that name.^[18,19,50]

3. Conclusion

Although a few numbers of gymnosperms are used in TMS, their role as a medicine is highly appreciable. Apart from medicinal uses, the trees are harvested for various purposes, thus conservation status of these tree species are in alarming rate. In most of the wild habitats, these trees seems to be the source of sustainable uses, also all these four trees are found to be slow growing with narrow distribution. These make the urge to conserve and cultivate these plants through *in-situ* and *ex-situ* conservation programs that enables us to meet the requirement of raw drugs.

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