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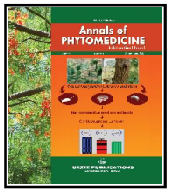

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The medicinal world of Gymnosperms: A review with special reference to Homeopathy

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Abstract

Medicinal plants have played an indispensable role in promoting human health throughout the globe since humans started to recognize the importance of floral wealth as willingly accessible and inexpensive resource for primary healthcare to treat various ailments. Usually, angiosperms are the preferred choices for herbal formulations, but the non-flowering plants, such as gymnosperms which also have great potential as medicinal plants with limited diversity and distribution. Consequently, till date there are numerous reports have been published on the phytochemistry of angiosperms; however, in context of gymnosperms a scarcity exists. Therefore, in this review, the importance of different taxa of gymnosperms with special reference to homeopathy has been complied with a believe that this attempt will attracts the future researchers to work with gymnosperms to develop novel remedies.

1. Introduction

Natural plant derived products have been used as herbal remedies since time immortal for different purposes (Alam, 2019; Alam *et al*., 2019). These natural bioactive compounds are intricate chemical molecules that exist in different plant parts and have medicinally important biological activities, hence used for the cure and prevention of numerous diseases including cancer, inflammation, infections, anti-ageing, *etc*. (Chandra *et al*., 2019; Sheikh *et al*., 2020). Like angiosperms, the non-flowering plants, gymnosperms are found worldwide and have conventionally been used for healing applications (Ghaffari *et al*., 2021). In this review, the therapeutic value of this group of plants has been highlighted.

1.1 Diversity of gymnosperms

Gymnosperms includes the naked seeded plants which are enduring since the Mesozoic era (300-350 MYA). These plants have various uses along with the ecological importance. Many of the plants are preferred ornamental flora due to their sparking appearance and evergreen nature, *viz*., species of *Thuja*, *Araucaria*, *Cryptomeria*, *Cycas*, *Pinus*, *etc*. Some of them are timber yielding plants, *viz*., *Pinus wallichiana* A. B. Jacks, *Cedrus deodara* (Roxb. ex D.Don) G.Don, *Agathis australis* (D. Don) Lindl., *etc*. hence have economic advantages too (Christenhusz *et al*., 2011). Likewise, many of the conifers and cycads are being used in horticulture and for landscaping. In terms of oil yielding capabilities, taxa like *Juniperus virginiana* L., *Cedrus deodara* (Roxb. ex D.Don) G.Don and *Pinus* spp. are considered as a good source of essential oils. While species of *Araucaria*, *Cycas*, *Ginkgo*, *Pinus*, *etc*., disbursed as food.

While, in terms of their medicinal/therapeutic value, species of *Ephedra*, *Abies*, *Taxus*, *Thuja*, *Cedrus*, *Juniperus*, *Ginkgo*, *etc*., have shown great potential as hoard of bioactive phytochemicals.

Globally, gymnosperms are represented by 1026 species in 84 genera. While in India, the gymnosperms are represented by 146 species and 46 genera, belonging to 12 families (Singh and Srivastava, 2013; http://www.bsienvis.nic.in/Database/Gymnosperms-In-India_23431.aspx).

In Indian traditional medicinal systems, the species of *Cycas*, *Cedrus*, *Abies* and *Taxus* are well considered as medicinal plants in the Siddha literatures, while *Pinus* and *Ephedra* are mentioned in the Ayurvedic and Unani literatures. The Himalayan range and Nilgiri hills are the major geographical regions where taxa like *Abies*, *Araucaria*, *Cedrus*, *Cycas*, *Juniperus*, *Cryptomeria*, *Cupressus*, *Pinus*, *Thuja*, *etc*., are growing lavishly (Hussain *et al*., 2006).

1.2 Medicinal uses of gymnosperms

A few studies have been done in past related to their ethnomedicinal values, pharmacological potential and phytochemical analysis. Interesting results have been documented, *viz*., bark of *Abies pindrow* Royle is used in the cure of rheumatism, cough and chronic bronchitis; resin of this plant is used for the rapid healing of wounds; leaf powder with juice of *Adhatoda vasica* Nees and honey is found useful in the treatment of cough, asthma and other respiratory problems (Rajalakshmi *et al*., 2016).

Species of *Gnetum* are known as folk medicines and being used in the cure and treatment rheumatic arthritis, asthma and chronic bronchitis.

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The leaves of *Gnetum africanum* Welw. are taken either fresh or as decoction as medication for sore throat, hypertension and stomach disorders such as diarrhea. The boiled tender leaves and young inflorescence of *Gnetum gnemon* L. mixed with coconut cream are used as nutritive cuisine in Asian countries as the populace believes that it has antioxidant, antimicrobial and anti-ageing activities (Ali *et al.*, 2003; Baburaj and Gupta, 2009).

The berries and oil obtained from the wood of *Juniperus communis* L. have been reported helpful to cure various ailments, *viz*., polyps, tumors, warts, gonorrhea and leucorrhoea (Bais *et al.*, 2014). Fruits and wood of *Cupressus sempervirens* L. are used as an anthelmintic and astringent.The extracted essential oil from the bark and stem of *Cedrus deodara* (Roxb. ex. D. Don) G. Don. was found curative for skin eruptions and external sores (Bisht *et al.*, 2021). Species of *Pinus*, especially *P. wallichiana* Jackson are good source of resin which has remedial properties and frequently used to treat cuts and wounds (Sharma *et al.*, 2016).The dried powder obtained from the leaves of *Abies webbiana* Lindl. is used to treat respiratory problems including asthma (Ghosh *et al.*, 2010).

Medicinal uses of *Pinus* species, *viz*., *P. wallichiana* A. B. Jacks, *P. roxburghii* Sarg., and *P. gerardiana* Wall. ex D.Don have been recently validated by phytochemical and pharmacological studies (Sharma *et al.*, 2016). The young saplings of *P. wallichiana* are used to heal theskin cuts and sores. Likewise, *P. brutia* Ten., *P. nigra* J.F.Arnold, and *P. sylvestris* L. have remedial potential against several human ailments, *viz*., skin infections, respiratory problems, urinary tract infections, *etc*. (Kaushik *et al.*, 2012).

Another conifer, *Podocarpus falcatus* (Thunb.) Endl. has shown beneficial effects in the treatment of jaundice (Abdillahi *et al.*, 2010).

Stem and root decoction of *Ephedra* spp. is used to cure rheumatism, arthritis, respiratory disorders, syphilis, *etc.*, while the juice of its berries is found curative against common respiratory problems (Zhang *et al.*, 2018).

The present review is aimed to provide an insight related to the curative usages of gymnosperms in the Homeopathic formulations. The important gymnosperms which are used in homeopathic medicines are *Thuja*, *Ginkgo*, *Taxus*, *Pinus*, *Juniperus*, *Cedrus*, *Ephedra*, *Cycas* and *Abies* have been discussed here.

2. Methodology

Literature related to the medicinal uses were collected using scientific search engines such as PubMed, Scopus, Google Scholar and other information collected from Homeopathic literature available at the websites of homeopathic manufactures, *viz*., Dr. Reckeweg, Willmar Schwabe, SBL, Bakson, *etc*. Details of the plants were enumerated along with their homeopathic names, botanical names, family, part used, principle chemical components and Homeopathic formulations in which they have been used. The scientific nomenclature of the species was checked in the international standard websites.The photographs used here are available free online and taken from google image.

2.2 Noteworthy Gymnosperms used as Homeopathic remedy

2.2.1 *Thuja occidentalis* L. (Family Cupressaceae: Figure 1)

Thuja occidentalis L. is a small tree. The leaves and leaf oil of this evergreen plant are used as a medication for lungs related problems such as bronchitis, microbial skin infections, and cold sores. It is also used for getting rid of throbbing conditions of osteoarthritis and a nerve disorder that affects the face called 'trigeminal neuralgia' (Zhang *et al.*, 2014). Often, this plant is also used as an expectorant to loosen the phlegm. The decoction of leaf and oil also known to boost the immune system, as diuretic and sometimes as an abortive agent.

Thuja is occasionally applied topically to the skin for joint ache, osteoarthritis, and muscle aching. Thuja oil is also used as cure for skin diseases, warts, and cancer; and as an insect repellent.

Thuja contains phytochemicals that have antiviral properties. A chemical called thujone is also extracted from this plant which is known to cause neurological problems. The sap of this plant is also used in case of Leukopenia (shortened WBCs count). Initial research proposes that preparation of vitamin C, extracts of *Thuja*, *Echinacea* and wild indigo which is administered orally known to improve WBCs counts in individuals with low count of white blood cells who undergone chemotherapy for 6 months or less. The same combination along with the antibiotic erythromycin is found to reduce the symptoms of throat infections in people and they recover better than taking erythromycin alone (Caruntu *et al.*, 2020).

Side effects

Thuja sp. is considered usually harmless when taken orally in small amounts, but then there is not enough data available to know about its safety when used in typical therapeutic amounts. An overdose of *Thuja* can cause low blood pressure, nausea, heaving, aching diarrhea, asthma, seizures, and death due to a chemical called thujone.

In homeopathy

Mother tincture of *Thuja occidentalis* is an exceptional homeopathic remedy for the treatment of numerous health problems. It is chiefly used to treat rheumatic and arthritic pains and known to improve flexibility. It is also frequently used to treat skin contagions and wart formation and aching swelling on the skin.

Figure 1: *Thuja occidentalis* L. and extracted homeopathic drug.

2.2.2 *Taxus baccata* L. (family Taxaceae: Figure 2)

Taxus baccata L. (Yew) is a medium-sized evergreen tree having 12-18 m height and 1.5 to 2 m girth. Bark is thin, scaly, and reddish brown. Branches are arranged erratically. Branchlets are slim and orange brown. Leaves are 2 to 4 cm long, stringy, linear with recurved margins, waxy coated. Flowers are dioecious, male and female strobili are sessile and solitary. Seeds are ovoid, hard, with 4 to 5 mm fleshy cups.

The bark, branch tips, and needles have been used in various curative purposes. Diseases like diphtheria, tonsillitis, epilepsy, muscular and bone joints pain (rheumatism), urinary tract infections, tapeworm's infestation and liver ailments are being treated using this plant. Beside these, females also utilize the extract of plant/plant parts for starting menstruation and causing abortions (Benham *et al.*, 2016).

Due to impetuous and widespread irrational collection of this plant for medicinal and other requirements, the plant is now under endangered category. The other issue related to its availability is its very slow growing nature, hence its regeneration is only possible through vegetative propagation (Singh, 2007; Juyal*et al.*, 2014). The plant is known by diverse designations depending on the regions and language, *i.e.*, in English, it is known as Yew; in Hindi and Sanskrit, it is termed as Talispatra; in Arabic, it is called talisfar, while, its Urdu name is Zarnab. In Himalayan regions, it is prevalently known as Himalayan yew.

The plant is imperative for the general populace and the researchers to understand the importance of the phytoconstituents present in this plant in the form of alkaloids, flavonoids, and essential oils. Beside ethnobotanical uses, a famous drug, taxol (paclitaxel) is being extracted by pharmaceutical companies from the bark of plant as a drug for the cure of ovarian and breast cancer (Sharma *et al.*, 2022). Taxol was first found in *Taxus brevifolia*, since then its multiple forms have been isolated from other species also like, *Taxus wallichiana* and *T. baccata*.

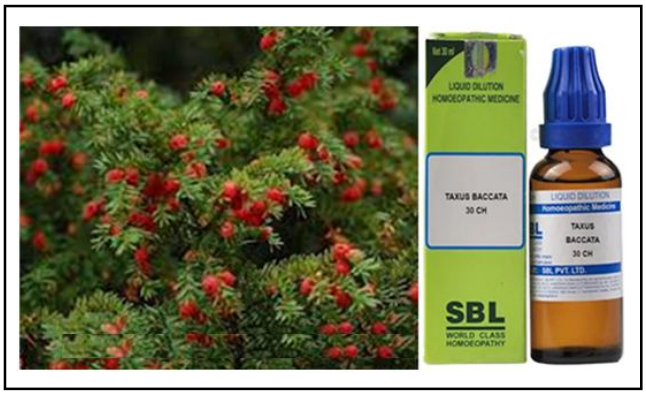

Figure 2: A portion of *Taxus baccata* L. and extracted homeopathi drug.

In Homeopathy

The mother tincture obtained by berries has clinical indications and used in the treatment of gout, ciliary neuralgia, hair fall, cystitis, imperfect and rapid digestion, dysuria, eruptions and polyps of ear and nose, frequent fainting, headache due to intense light, heart and kidneys problems, abscess, lachrymation, rheumatism, dim vision problem, purpura, spermatorrhoea, *etc.*

2.2.3 *Cedrus deodara* (Roxb.) G. Don (Family Pinaceae; Figure 3)

Cedrus deodara (Roxb.) G. Don is a coniferous evergreen tree with a height of about 75-80mc with somewhat coarse black bark. Branching is robust and spreading, shoots contain dimorphic, 2-8 cm needle like leaves with acute end, usually monoecious. It is spread in tropical and subtropical regions. The tree is mainly of ornamental value, with some medicinal properties. The plant is considered sacred in India by Hindus (Tiwari 1994). There are several vernacular names are known for this plant in different regions and languages in India, *viz.*, deodar, devdaar, diyar (Hindi), devahvaya (Sanskrit), devataram (Malyalam), gunduguragi (Kannad), than-sin (Tibetan), tevataram (Tamil), burada deodar (Urdu), *etc.*

In Ayurveda, this plant having numerous vital magical and imperative charactersitics, *viz.*, gunna (possessions), laghu (light), snigdh (slimy), rasa (perception), tickt (bitter), virya (power), ushan (hot).

All parts of *Cedrus* are beneficial in curing ailments like swelling, sleeplessness, cough, temperature, urinary expulsions, burning, tuberculosis, ophthalmic complaints, disorders of cognizance, diseases of the skin and of the body fluid. The leaves are found helpful in dropping tenderness. The extract of wood is good expectorant and beneficial in curing the conditions of piles, epilepsy, kidney and bladder stones, beneficial in fevers, *etc.* The essential oil is antiseptic and supportive in curing various types skin problems, injuries, urogenital illnesses, diaphoretic, *etc.* It is also fond useful to treat fungal diseases and act as tranquiller and cardio tonic (Chaudhary *et al.*, 2011).

C. deodara has been studied extensively by the researchers worldwide and as a result a lot of essential constituents were reported. The wood is known to produce phytochemicals like are matairesinol, wikstromal, benzofuranoid neo lingam, dibenzylbutyrolactol,1,4-diaryl butane, taxifolin, cedrin (6-methyldihydromyricetin), dihydromyricetin, cedrinoside, cedeodarin (6-methyltaxifolin), limonenecarboxylic acid, diosphenol, deodardione, (–)-nortrachelogenin, (–)-matairesinol, and a dibenzylbutyrolactollignan (4,4',9-trihydroxy-3,3'-dimethoxy-9,9'- epoxylignan) (Bailly, 2022).

A dihydroflavonol, deodarin has been isolated from the stem bark. While the ethanolic extract of needles showed the presence numerous compounds, *viz.*, dibutyl phthalate, 10-nonacosanol, protocatechuic acid, (E)-1-O-p-coumaroylbeta-D-glucopyranoside phthalic acid bis-(2-ethylhexyl) ester and 5-p-trans-coumaroylguinic acid, ethyl laurate, 3-betahydroxy-oleanolic acid methyl ester, 9- hydroxy-dodecanoic acid, ethyl stearate, shikimic acid, beta-sitosterol, ferulic acid beta-glucoside and methylconiferin. Likewise, the essential oil obtained from wood possesses sesquiterpenes-L II: Isohemacholone and sesquiterpenes L III: α-himacholone, α himacholone, deodarone, atlantone, himachalene, Ü-pinene, α-pinene, myrcene, cis-atlantone, Ü-atlantone (Sinha, 2019).

Several pharmacological actions of this tree have been described *in vivo* and *in vitro*. Different parts of this plant bear immuno-modulatory, anti-inflammatory, anticancer, antiapoptotic, antibacterial, antispasmodic, *etc.*

In homeopathy

In homeopathy, the parts and their extracts are known to cure cough and cold, asthma, osteoarthritis, obesity, the oil is used in various types of skin problems.

Figure 3: A twig of Cedrus sp. and extracted homeopathis drug.

2.2.4 *Juniperus communis* L. (Family Pinaceae: Figure 4)

Juniperus communis L. has been used as medicine for treating various diseases by most of the civilizations since time immortal. *J. communis* is an evergreen shrub with aromatic properties of high healing potential. The plant is not only rich in aromatic oils, but also contains alkaloids, flavonoids, sugars, resins, terpenic acids, catechin, leucoanthocyanidin, organic acid, tannins, lignins, gums, wax, *etc.* (Bais *et al.,* 2014). The berries or plant extract has conventionally been used as potential antiarthritis, diuretic, antidiabetes, antiseptic agent as well as used for the cure against auto immune disorders and gastrointestinal. The plant extracts and essential oil have been found to contain antioxidant, antiviral, antimicrobial activities. Recently, it has been revealed that the phytochemicals of berries have cytotoxic, anti-inflammatory, hypolipidemic and hypoglycemic effects of berries (Singh *et al.,* 2015). The plant is a good source of antioxidants which can be used as a potential substitute of synthetic antioxidant for various purposes. The plant is a very potent reservoir of aromatic oils, the concentration of these is variable in different parts of the plant, *viz.*, aerial parts, leaves, berries, and root (Martin *et al.,* 2006). Apart from essential oils, flavonoids like biflavonoids, flavones, flavonols and vitamin C have also been reported in berries. However, the phytochemical profiling of essential oils showed majorly a terpenoid content (Raina *et al.,* 2019).

High amounts of germacrene, sabinene, limoene, β-pinene and mycrcenein oil have also been testified (Orav *et al.,* 2010). Similarly, essential oils from foliage and wood were found to have good amount of sesquiterpenes particularly those bearing a tricyclic skelton (longoifolane and cedrane), while monoterpenes were existing at very low amounts (Bruno *et al.,* 2006).

Figure 4: A twig of *Junipersu communis* L. and extracted homeopathic medicine.

Major uses of plant

The plant and plant parts have been used as antioxidant. The anti-radical activity hinge on biochemistry of oil. The extracts had shown defensive effect on nervous tissue and improve working memory, therefore, it can be a probable substitute remedy for Alzheimer, Parkinson and other chronic neurological ailments. Likewise, the extract was also testified to have note worthy neuroprotective effect counter to chlorpromazine-induced Parkinson like indications. The decoction of berries produced significant hypoglycemia in streptozotocin-induced diabetic rats and can be used in future as antidiabetic agent (Orhan *et al*., 2012). Likewise, the hepatoprotective activity was determined in carbon tetrachloride-induced hepatotoxic prototype. Consumption of ethanolic or aqueous extracts of berries reduces the raised serum levels of hepatic damage biomarkers, *viz.* alanine and aspartate aminotransferase, alkaline phosphatase and bilirubin. Earlier, Filipowicz *et al*. (2003) have reported growth inhibitory activity of essential oil obtained from berries toward multiple bacterial species including *Bacillus cereus*; *Staphylococcus aureus*. *Escherichia coli*; *Corynebacterium* species and *Listeria monocytogenes*. Similarly, the essential oil of this plant has shown inhibitory action on yeast and other related fungi. Leaf extracts in organic solvents were screened against aflatoxigenic *Aspergillis flavous* and positive results were noted (Ghasemnezhad *et al.,* 2020).

The extract has an antifertility effect due to its anti-progestagenic activity (Pathak *et al.,* 1990). The plant has been reported to be useful in lessening numerous gastrointestinal disorders due to its digestive, carminative, antispasmodic and antibacterial action (Gumral *et al.,* 2013). The berries are best to be used for digestive action. Depending on the plant material and solvent used for the extraction researchers have reported average to very good anti-inflammatory potential in this plant (Mascolo *et al*. 1987). The anti-arthritic consequence of amentoflavone isolated from this gymnosperm has been studied against Freud's adjuvant-induced arthritis and it was reported that it has useful antiarthritic activity as it controls inflammation (Bais *et al.,* 2014).

Analgesic activity of methanolic extract using different nociceptive tests in rodents has been reported. Zhao *et al*. (2018) have also revealed that α-pinene, linalool and 1-octanol contribute to the topical anti-inflammatory and analgesic activities by inhibiting the activities of cyclooxygenase-2. Juniper plant is identified as urinary antiseptic and diuretic among other effects in folk medicine. Few studies have also substantiated the claim of folk medicine of it being diuretic and urinary antiseptic. The aqueous berry extract was observed to have a significant inhibition in the growth of MCF-7/AZ mammary carcinoma cells (Abdel-Kader *et al.,* 2017).

In homeopathy

The mother tincture Q of *J. communis* is a homoeopathic remedy which has various health benefits. It was formulated with the natural plant extracts and is useful in treating ailments of the kidneys. It is also beneficial in treating urinary and respiratory disorders.

The key benefits include in treatment of chronic kidney disorders, helping in improving digestion in old people, useful in case of scanty and painful urination, effective in treating chronic pyelitis, helps in relieving cough with scanty urine and also useful in treating conditions of prostatic discharge and renal hyperemia.

2.2.5 *Ephedra vulgaris* Rich (Family Ephedraceae: Figure 5)

Ephedra vulgaris Rich is an annual herb with yellow flowers and red fruits. Typically, the young branches and their apex are used to make medicine, nevertheless the roots or entire plant can also be used for remedial purposes. In United States in June 1997, the FDA planned ban on the ephedrine owing to safety concerns. Ephedra use is also banned by the National Collegiate Athletic Association, International Olympic Committee, and National Football League. Ephedra is sometimes sold as an amusing drug and consequently banned.

E. vulgaris is used for obesity and weight loss and to improve athletic act. It is also used for respiratory tract circumstances such as bronchospasm, nasal congestion, allergies and hay fever, bronchitis and asthma. It is also used for swine flu, flu, common colds, fever, headache, chills, failure to sweat, joint and bone aching, and as diuretic. The ephedrine is known to excite the cardiac, respiratory, and the nervous systems (Miao *et al.*, 2020).

The uncontrolled, random and long-term use of *Ephedra* is likely unsafe as it can cause deadly or in capacitating situations in some people. Its use is related to high blood pressure, heart attacks, irregular heartbeat, seizures, muscle disorders, loss of consciousness, strokes, and death. The other harmful effects include anxiety, heart pounding, dizziness, restlessness, irritability, headache, nausea, loss of appetite, vomiting, *etc*. (Ibragic and Sofiæ, 2015). The use of *Ephedra* in combination with other stimulants such as caffeine can be life-threatening.

Figure 5: A portion of *Ephedra vulgaris* Rich and its homeopathi preparation.

In homeopathy

In homeopathy, *Ephedra* has been an established medication in situations of risky apathy, stiff-neck, and backward pulling of whole body on turning the head. The drug is also found active on the ganglions of the sympathetic nerve that caused cramming of the spinal cord. The drug is regularly used in various cases that include, extreme apathy, nausea, violent headache, overall weakness, slow pulse, left side hemicrania with coldness of entire left arm, heavy eyes which starting from their orbits, moderate pain in region of spleen, early morning fatigue, retention of the urine, dropping of pulse, augmented quickness of heart action; strong heart-beat with weakening of pulse, accelerated breathing, rigorousness of neck and backward heaving of all the body on turning head and a moderate pain in region of spleen, evening heaviness in all the limbs, *etc*.

2.2.6 *Ginkgo biloba* L. (Family Ginkgoaceae: Figure 6)

Ginkgo biloba L. also known as maiden hair tree is a tree innate to China where it has been grown for thousands of years for a range of uses. Since, this plant is the only persisting affiliate of an ancient group of plants hence occasionally mentioned to as a 'living fossil' (Tang *et al.*, 2012). The leaves and seeds of this plant are being used in old Chinese medication system. But, in contemporary research leaf extract is mostly focuses for medicinal purposes. It is claimed that the extract obtained from leaves improves blood circulation and functioning.

The extract of *G. biloba* contains effective antioxidants, which neutralize the destructive effects of free radicals and improves the overall metabolism. Beside this, *G. biloba* holds high contents of flavonoids and terpenoids which help in generating strong antioxidant effects.

Antioxidants combat or neutralize the damaging effects of free radicals. Hence, this plant is invariably used to retard aging and disease development. However, it remains uncertain precisely in what way it works and how it treats specific age-related diseases. This plant has the capability to lessen tenderness caused by numerous ailments. Some specific conditions in which *G. biloba* extract has shown to reduce inflammation include: Arthritis, irritable bowel disease (IBD), cancer, cardiac disease and strokes. Woelkart *et al*. (2010) have confirmed that *G. biloba* has defensive effects on heart health, brain health and stroke inhibition because it can upsurge blood flow by helping the dilation process of blood vessels.

G. biloba has been frequently assessed for its capability to lessen anxiety, stress and other symptoms associated with Alzheimer's disease and cognitive decline associated with ageing. Mohanta *et al.* (2014) have claimed that leaf extract is useful in mitigating the rate of cognitive weakening in patients with dementia.Likewise, there is some assumption that *G. biloba* may improve brain function in vigorous people. It is also useful in improving memory, duration of focus and attention, *etc*.

Kuribara *et al*. (2003) showed that *G. biloba* may help to treat anxiety and can treat depression due to its antioxidant potential. It is also observed that *G. biloba* has anti-inflammatory and useful in delaying the age-related macular degeneration. Further, owing to its capability to increase blood movement and reduce swelling, *G. biloba* may be an effective remedy for headaches. It is also claimed that this plant can be used to improve indications of asthma and other respiratory diseases such as COPD (Tao *et al*., 2019). It may also use to reduce premenstrual syndrome (PMS) and also use to treat sexual dysfunction, such as low libido or erectile dysfunction because it has the ability to recover blood levels of nitric oxide, which expands circulation *via* the dilation of blood vessels. Hence, this plant may be used for treating numerous symptoms of sexual dysfunction by improving blood flow to sex related organs of the body. *G. biloba* has investigated for the possible treatment of sexual dysfunction which was caused using antidepressant drugs (SSRIs) and findings indicated that it is not more effective than a placebo in these cases (Yu *et al.*, 2020).

Usually, the risk associated with taking Ginkgo is relatively low, but there are some cases in which serious harm is possible such as allergic

tendency to plants that hold alkylphenols. The minor side effects include: nausea, diarrhea, dizziness, headaches, stomach pain, rash/ allergic reaction, *etc.*

Figure 6: *Ginkgo bilaba* L. and extracted homeopathic remedy.

In homeopathy

G. biloba mother tincture is an effective homoeopathic medicine that is widely sold by various companies and recommended for complications related to ageing. Other than this, mother tincture has anti-inflammatory, antispasmodic, antiallergic and antiasthmatic properties. This drug is beneficial for treating muscular weakness, skin related problems, urinary problems and neurological problems such as Alzheimer's disease and, dementia. The mother tincture in alcohol is being frequently prescribed for the treatment of usual weakness, excessive talking, muscular weakness, multiple-sclerosis and reduces Platelet Activating Factors (PAF) and also helps in concentrating and several indications of autoimmune diseases

2.2.7 *Pinus* spp. (Family Pinaceae: Figure 7)

Pinus is one of the most known plants among gymnosperms with frequent distribution. It is an evergreen tree with conical canopy and primarily known for timber. However, like other plants, this plant also has remarkable medicinal properties and useful in prevention and cure of many diseases including cancer. Researchers have evaluated *Pinus strobus* (Eastern white pine) for its medicinal potential and found that it contains a compound pinostrobin which is useful in the treatment of cancer, inflammations, microbial infections and has antioxidant potential. Another species *Pinus pinaster* (French Maritime Pine) contains pinocembrin and pycnogenol which possesses anticancer, antimicrobial, anti-inflammatory potential along with antioxidants. Pinocembrin also showed to be useful in reducing blood clotting and LDL cholesterol-lowering effects. *P. radiata* (Monterey pine) contains enzogenol which showed anticancer, anti-inflammatory, cardioprotective and neuroprotective effects (Ghaffari *et al.*, 2021). Likewise, *P. lambertiana*, *P. roxburghii* and *P. wallichiana* contain quercetin, resin acid, taxifolin, catechin, kaempferol, pinosylvin 3-methly ether, pinoresinol, b-sitosterol, rhamnetin, *etc*., that have bioactive potential (Dziedzinski *et al.*, 2021).

In homeopathy

The mother tincture of *Pinus* spp. has been used in problems related with female reproductive system as it promotes abortion during pregnancy. It also induces menstruation with amenorrhea and restores menses when blocked. It has gentle cathartic and laxative action too. Beside this, the remedy prepared by *Pinus* spp. is found useful in cases of ankle's weakness, itching in anus, constipation, diarrhea, bronchitis, dysuria, emaciation of lower limbs, swollen glands, gout, hemorrhoids, heart palpitation, stiff Joints, kidney pains, liver enlargement, rheumatism, tinnitus, excessive urination, vertigo, late walking in kids, *etc*.

Figure 7: *Pinus* and its homeopathic preparation.

2.2.8 *Abies pindrow* Royle. (Family Pinaceae: Figure 8)

This evergreen tree of Himalayan region is popularly known as Himalayan silver fir. This plant is usually found at an altitude of ca. 2130 to 3190 msl. The tribal populace of these high altitudinal zones uses leaves, young branches, cone, bark and trunk for remedial purposes. For instance, the decoction of dried leaves is given to patients suffering with asthma, cough, chronic bronchitis, phthisis and catarrh of the bladder and pulmonary ailments. Young leaves are given to children during dentition and to treat chest infections.

Plants contain several bioactive compounds that have been evaluated for their medicinal properties. The phytochemistry profile of this plant reveals the presence polyphenols, carotenoids, alkaloids, minerals and vitamins. The phenolic compounds, *viz*., phenolic acids and flavonoids showed antioxidant possessions which are useful in free radicals scavenging that are responsible for numerous degenerative diseases such as cardiovascular disease, cancer, Alzheimer's disease, cognitive weakening, cataracts, immune dysfunction, and macular deterioration (Gupta *et al.*, 2011).

In homeopathy

The dilution of plant extract as homeopathy remedy is proven as a long acting drug for various problems related to stomach. It is found supportive in gastric disorders and a known formulation for the removal of constipation and dyspepsia in elderly individuals. Other digestion related problems such as pain after intake of food at the pit of the gastrointestinal tract and feeling of no appetite in the pre-lunchtime and food desire at noontime and late night is also treated by this formulation in homeopathy. It also relieves stomach restlessness at night.

Figure 8: A twig of *Abies* and its homeopathic preparation.

3. Discussion

Conventional medicinal systems are habitually trusted on the plants and their various parts/preparations. However, in comparison to flowering plants, the share of non-flowering plants is still insignificant. However, medicinal properties of many species of bryophytes (Alam, 2021), pteridophytes and gymnosperms have been reported in recent past and the remarkable potential of these plant groups has been recognized. As a result, due attention was given to these non-flowering plants and encouraging results have been obtained. In the spermatophytes, excluding angiosperms, some of the gymnosperms are also used in traditional medicinal system that have been described in this review for their medicinal value. This study shows that there is a great scope in future exploration regarding medicinal impending.

4. Conclusion

Every plant has its own phytochemistry which on careful evaluation can provide great assistance in future formulations either alone or in combination. Till date, thousands of plants have been analyzed for their medicinal value but most of them belong to angiosperms (Sharma *et al.,* 2021) and other plant groups including gymnosperms are somewhat neglected due to their lesser diversity, difficulty in collection and identification and slower growth rate compared to angiosperms. However, these gymnosperms are older than angiosperms as terrestrial plants and undergone a longer series of adaptative adjustments in their metabolism compared to angiosperms. Therefore, they have unique photochemistry and should be explored more to get some useful and novel drugs in future. This review encompasses only a few gymnosperms whose homeopathic and as well as ayurvedic preparations are being used to treat a variety of diseases, but still the majority of plants are unexplored for their remedial impending and there is a urgent need to get the phytochemical profiles so that those plant can also be used in future herbal formulations along with the development of conservation strategies for these slow growing plants.

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Authors' contribution

Both the authors have contributed equally and finally read and approved the manuscript.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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