Important Medicinal Plants of Punjab — A Review

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ABSTRACT

Punjab houses a rich, though increasingly threatened, set of medicinal plants that support traditional healthcare, rural livelihoods and a growing herbal industry. This review synthesizes ethnobotanical records, regional agricultural assessments, and pharmacological literature to present an overview of the most important medicinal species cultivated or collected in Punjab (India), their traditional uses, phytochemistry, therapeutic evidence, cultivation/adoption status, and conservation/marketing challenges. Major focal species are *Withania somnifera* (ashwagandha), *Tinosporacordifolia* (giloy), *Azadirachtaindica* (neem), *Ocimum sanctum* (tulsi), *Phyllanthus emblica* (amla) and *Aloe vera* — all of which feature in Punjab's agro-ecology, markets and traditional medicine. Recommendations include targeted agronomic extension, value-chain linkages between farmers and herbal processors, germplasm conservation, and research priorities to standardize quality and ensure sustainable use.

Keywords: Punjab, medicinal plants, ethnobotany

INTRODUCTION

According to World Health Organization (WHO), 80 per cent of the world population of most developing nations depends on natural (ayurvedic) medicines (Pala *et al*., 2010). Out of 4, 22,000 flower plants species reported from the around world and more than 50,000 are used for medicinal purposes (Uniyal *et al*., 2006). In India more than 43 per cent of total flower plants are reported for medicinal importance. Knowledge on uses of different plants has been gathered by people over millennia and transfer orally from one generation to other generation (Ignacimuthu *et al*., 2006). Medicinal plants play a dual role in Punjab they are part of traditional health practices (folk/Ayurvedic/Unani) and an emerging agricultural/industrial commodity.

The study highlights that *Aloe vera* has Indian Rupee (₹) 92,876 (1127.55 USD) profit per one-acre area, *Curcuma longa* has. 73,725 (895.05 USD) profit per acre area, while *Ocimum sanctum* have ₹35,515 (431.16 USD) return over variable cost which is comparatively higher than wheat and paddy in Punjab (Singh *et al*., 2023). Regional surveys list more than a hundred medicinal species used by rural communities, while state assessments highlight both opportunities for crop diversification and market/linkage constraints for farmers interested in medicinal-plant cultivation. This review compiles published ethnobotanical inventories and recent pharmacological reviews to identify high-priority species for research, cultivation and conservation in Punjab (Kaur *et al*., 2020).

METHODOLOGY

Literature was collected from peer-reviewed reviews, ethnobotanical surveys and regional reports available online (PubMed/PMC, Science Direct, Research Gate and institutional PDFs). Priority was given to: (a) regional inventories documenting plant use in Punjab, (b) comprehensive phytochemical/pharmacological reviews for each species, and (c) state/industry reports on cultivation and marketing (Hani *et al*., 2022).

Base maps

As agro-climatic zones are classified on the basis of common ecological parameters, so the temperature range corresponding to the research station present in the specific zone was considered the temperature of the whole agro-climatic zone. The annual average maximum and minimum temperature ranged between 29 to 32°C and 15-20°C respectively in Punjab. The mean annual rainfall in the state and different locations ranged from 400 to more than 1000 mm. The base maps of temperature and rainfall are represented in the Figs. 1 and 2. The base

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maps for the soil highlighted that the agro-ecological zone-I comprised of sandy skeleton, loamy sand and sandy loamy soil with pH ranging from 7.5 to 8.2. The zone-II represented sand to loamy sand, to calcareous soils with pH 6.8 to 8.3; zone-III represented sandy loam to clay loam to calcareous soil with pH 7.5 to 9.3; and zone-IV and V corresponded to sandy loamy soils to loam and calcareous soils with pH 8.1 to 8.5. The base maps corresponding to the soil texture are represented in the Fig. 3.

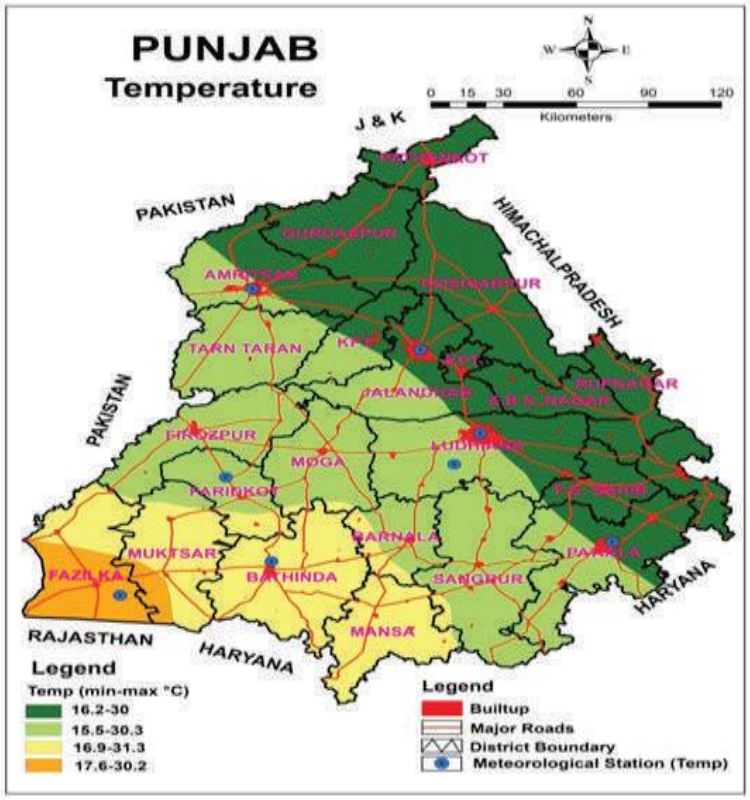

Fig. 1: Average maximum and minimum temperature ranges in Punjab

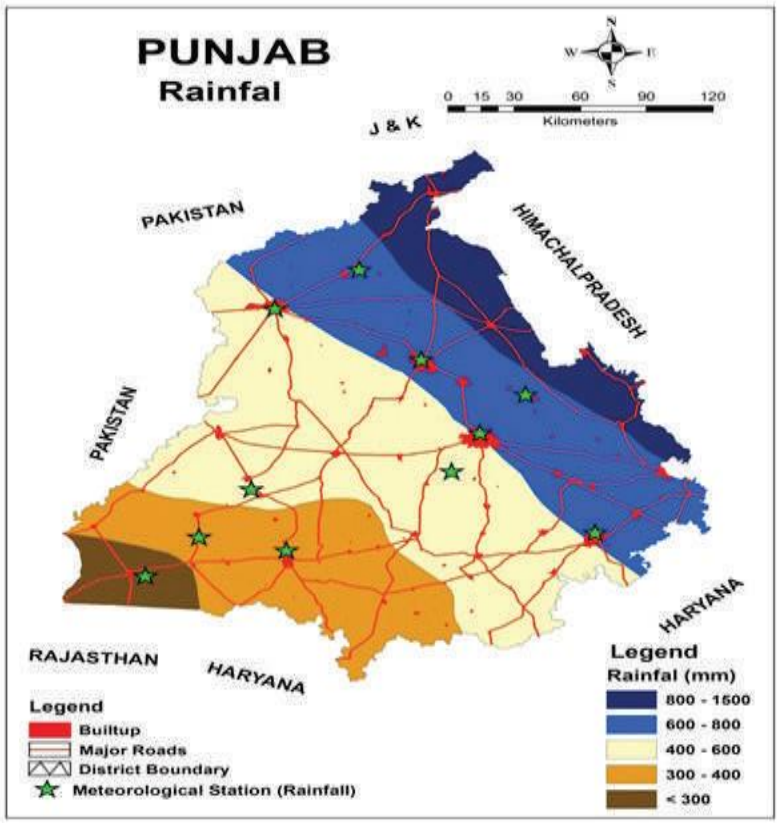

Fig. 2: Distribution of rainfall ranges in Punjab

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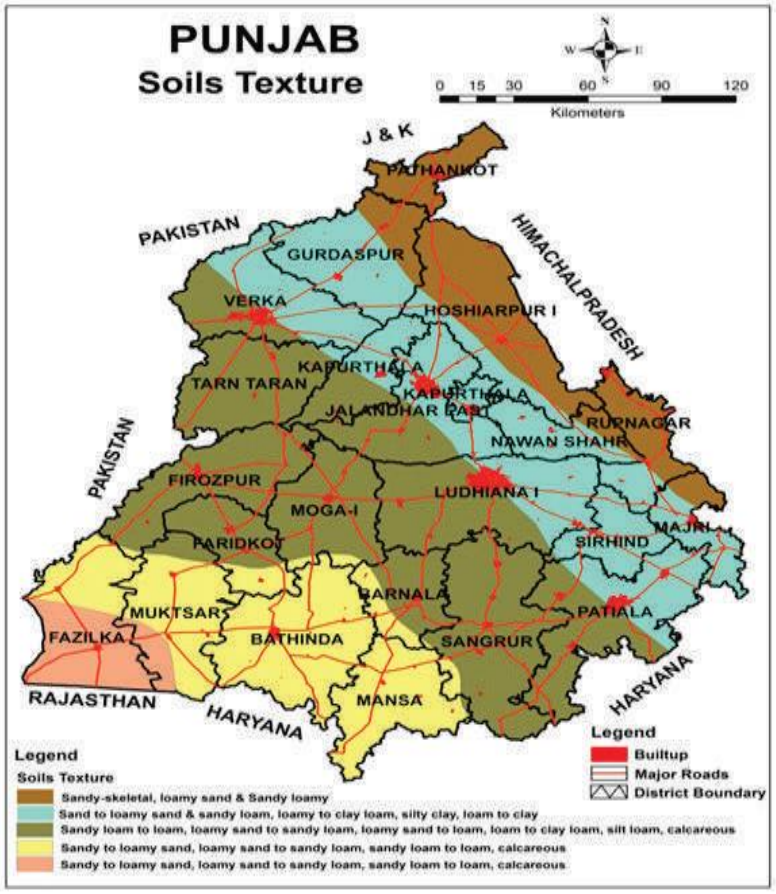

Fig. 3: Soil texture present in Punjab

Table 1: Standard ecological conditions of selected medicinal plants

Name of the Plant	Average annual temp (°C)	Average annual rainfall (mm)	Soil texture	Soil pH	References
Withania Somnifera	20-35	20-35	Sandy loamy	7.5-8	(Kumar *et al*. 2012; Jat *et al.* 2015)
Tinospora cordifolia	25-35	1000-1200	sandy to clay soil	6-7.5	Sohani *et al*., 2022
Azadirachta indica	30-40	800-900	sandy to clay soil	6.2	Mayavel *et al*., 2024
Ocimum sanctum	15-35	700-7600	Sandy loamy	5-8.5	(Makri and Kintzios, 2008; Jat *et al.* 2014; FAO, 2007)
Phyllanthus emblica	30-40	630–800	clay to sandy loam	6-8	Khedikar and Chaudhari, 2024
Aloe vera	20-40	350-400	Loam to coarse sandy soil	Up to 8.5	(Cousins and Witkowski, 2012; Jat *et al.* 2015; Bahmani *et al.* 2016)

Focal species — botanical notes, traditional uses and scientific evidence

Withania somnifera (Ashwagandha)

Botanical note: A xerophytic shrub in Solanaceae with roots and leaves used medicinally. Traditional uses in the region include general tonic, adaptogen, anti-inflammatory and neurotonic preparations. Modern phytochemical studies show withanolides (steroidal lactones) as major active constituents; pharmacological research supports adaptogenic, anxiolytic, anti-inflammatory and possible anticancer activities. Given its demand and suitability for semi-arid cultivation, *W. somnifera* is a high-priority crop for Punjab farmers seeking crop diversification (Saleem *et al*., 2020)

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Medicinal Uses of Ashwagandha

External Uses: *Withania somnifera* leaf and root paste is used on enlarged cervical glands or swelling of other glands as it reduces pain and oedema, oil massage is also useful in weakness and vata diseases. In ear discharge the juice of Ashwagandha leaves is used as eardrops. For blisters healing, black ashes of the roots are applied. The dried leaf grind in a powder from which a paste is made and used in the treatment of wounds and burns and also used as a sunscreen for women's faces.

Internal uses: Nervous system: Ashwagandha roots are sedative, nervine tonic, tranquilizing and, hence helps in tonic nerves and useful in fainting, giddiness and insomnia. The species name somnifera means "sleep-inducing" in Latin (Stearn, 1995). It is also used as an “adaptogen” to help the body cope with daily stress, as a common tonic and for improving mental ability. It also increases the mental memory functions like concentration and attention, hence helping with the symptoms of Parkinson’s, Alzheimer’s and other neuro-degenerative diseases. It enables the body to reserve and sustain vital energy in whole day while promoting sound, calm sleep at night. Ashwagandha benefits, strengthens and tones all muscle tissues including the lungs and heart. It increases muscle tone while concurrently soothing muscular inflammation. It is a very good remedy for muscular aches, pains, and stiffness, weakness and increase body weight.

Digestive system: The fine powder of bark of Ashwagandha is appetizer, carminative and anthelmintic and hence is used in constipation, abdominal pain, and worms.

Circulatory system: *Withania somnifera* has good effect on the heart, reduces oedema and purifies the blood. So it is cured weakness of heart, blood disorders and oedema. The decoction is used in rheumatoid arthritis.

Respiratory system: *Withania somnifera* is an expectorant and has anti asthmatic property, due to which it is useful in cough. Ashwagandha ash along with honey and ghee is effective in asthma disease. If phlegm is thin, it is used in the form of ash or its alkaline extract is used. Decoction of bark should be given in low dose for asthma and cough. It is also used as a tonic in the above conditions (Meher *et al*., 2016).

Reproductive system: Ashwagandha is considered as sukrala *i.e*. semenogogue which increases semen. It is a very good medicine for its aphrodisiac property and is used in semen disorders. A mixture of 5 gms of Ashwagandha powder, 10 gms of ghee and 250 ml milk along with sugar is a good tonic, nutritious and aphrodisiac. It completely cures leucorrhoea and puerperal backache caused due to endometritis.

Urinary system: Ashwagandha is a diuretic and used in oliguria or an-urea.

Skin: Ashwagandhadi powder is indicated in premature ageing and wrinkle skin and premature graying of hair. It is used in vitiligo and other skin diseases.

Satmilkaran: It enhance the body weight, improves immunity and is an aphrodisiac. Used in marasmus and debilitation diseases in children (Meher *et al*., 2016).

Tinospora cordifolia (Giloy / Guduchi)

Botanical note: A perennial climbing shrub (Menispermaceae) widely used in Ayurveda. Ethnomedical use includes antipyretic, immunomodulatory, anti-diabetic and hepato protective applications. Reviews summarize diverse phytochemicals (alkaloids, terpenoids, glycosides) and robust preclinical evidence for immunomodulation and anti-inflammatory effects; clinical data are emerging but heterogeneous. *T. cordifolia* occurs in many parts of North India and is frequently reported in Punjab ethnobotanical lists (Upadhyay *et al*., 2010).

Medicinal Uses Giloy

Anti-Diabetic Activity

Pharmacological studies have proven in vivo antidiabetic properties of various extracts of *T. cordifolia*. It has been reported to mediate its antidiabetic potential through myriad of biologically active phytoconstituents

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isolated from different plant parts, including alkaloids, cardiac glycosides, tannins, saponins, flavanoids, and steroids (Sharma *et al*., 2015).

Anti-Cancer Activity

The extraction of alkaloid palmatine from *Tinospora cordifolia* by using response surface methodology (RSM) clearly indicate the anticancer potential in dimethylbenz (a) anthracene DMBA induced skin cancer model in mice (Ali and Dixit, 2013).

This plant is well known for its immunomodulatory response. Active compounds 11 hydroxymustakone, N-methyl-2- pyrrolidone, Nformylannonain, cordifolioside A, magnoflorine, tinocordiside and syringin has been reported to have potential immune modulatory and cytotoxic effects (Sharma *et al*., 2012).

Anti-Oxidant Activity

The plant has potential application in food systems as an antioxidant and probably in biological systems as a nutraceutical. Ethanolic, methanolic and water extracts of *Tinospora cordifolia* showed significant antioxidant potential compared to other solvents and also possess metal chelation and reducing power activity (Bhawya and Anilakumar, 2010).

Anti-Microbial Activity

The anti-bacterial activity of giloy extracts has been assayed against *Escherichia coli, Staphylococcus aureus, Proteus vulgaris, Klebsiella pneumoniae, Salmonella typhi, Shigella flexneri, Salmonella typhimurium, Salmonella paratyphi, Pseudomonas aeruginosa, Serratia marcesenses,* and *Enterobacter aerogene* (Narayanan *et al*., 2011).

Anti-Toxic Activity

The gold standard drug for the treatment of Parkinson's disease is L-DOPA, but various studies have revealed that the treatment with L-DOPA leads to the death of surviving dopaminergic neurons in the CNS. The co-administration of *Tinospora cordifolia* crude powder protected the dopaminergic neurons when compared with Sham operated control group. The treatment with *Tinospora cordifolia* crude powder could reduce the toxicities of L-DOPA therapy for Parkinson's disease (Anatony *et al*., 2010).

Azadirachta indica (Neem)

Botanical note: A multipurpose tree commonly planted across Punjab. Traditional uses include antiseptic, antipyretic, anti-parasitic and dermatological remedies; leaves, bark, oil and seed extracts are used. The phyto-chemistry is complex (limonoids such as azadirachtin) and evidence supports antimicrobial, insecticidal and anti-inflammatory properties. Neem's role in rural phyto-medicine and agro-ecology (shade, boundary trees) makes it important from both health and environmental perspectives (Sindhu and Chauhan, 2025).

Medicinal Uses of Neem

Different parts of Neem (*Azadirachta indica*) prove antimicrobial role through inhibitory effect on microbial growth/potentiality of cell wall breakdown. Azadirachtin, a complex tetranortriterpenoid limonoid present in neem seed, is the main constituent responsible for both toxic effects and antifeedant for pests (Mordue and Nisbet, 2000) and results suggest that the ethanol extract of neem leaves showed *in vitro* antibacterial activity against both MRSA and *Staphylococcus aureus* with a large zones of inhibition noted at 100 per cent concentration (Sarmiento *et al*., 2011).

Neem plays role as free radical scavenging properties due to rich source of antioxidant. Azadirachtin and nimbolide showed concentration-dependent antiradical scavenging activity and reductive potential in the following order: nimbolide > azadirachtin > ascorbate (Hossain *et al*., 2013).

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Ingredient of neem showed effective role to manage the of cancer through the regulation of cell signaling pathways. Neem modulates the activity of various tumour suppressor genes (e.g., p53, pTEN), transcription factors (e.g., NF-κB), angiogenesis (VEGF), and apoptosis (e.g., bcl2, bax).

Neem also plays an important role as anti-inflammatory via regulation of prion flammatory enzyme activities including lipoxygenase (LOX) and cyclooxygenase (COX) enzyme (Alzohairy, 2016).

Ocimum sanctum (Tulsi)

Botanical note: An aromatic herb central to Indian ethno-medicine and household gardens. Traditional uses include respiratory disorders, fever, stress relief and as a common medicine. Phytochemical and pharmacological literature demonstrate antimicrobial, antioxidant and adaptogenic properties; tulsi is commonly cultivated in Punjab gardens and small farms (Singh and Chaudhary, 2018).

Properties of Tulsi

Tulsi, possesses advantageous compounds like cineole, camphene, and eugenol that contribute to the alleviation of symptoms related to cough, cold, respiratory disorders and anti-carcinogenic properties, as supported by various research. According to Santwani *et al*. (2023), Tulsi, also known as holy basil, has been shown to enhance the immune system. It is rich in vitamin C and zinc, which act as natural immune boosters, aiding in the prevention of infections. Its antioxidant properties and help reduce oxidative stress, which is known to contribute to complications associated with diabetes. It has been observed that Tulsi treatment leads to a notable decrease in fasting and post-prandial blood cholesterol levels, as well as mean total cholesterol levels (Grover *et al*., 2002). Tulsi also have antiemetic property and reduce the blood sugar and blood pressure level. It is an anti-stress agent and possess anti-carcinogenic property (Majumdar *et al*., 2023).

Phyllanthus emblica (Amla)

Botanical note: A fruit tree valued for high vitamin C and polyphenolic content; used as a rejuvenator, digestive aid and in Rasayana formulations. Phytochemical studies support antioxidant, hypo-lipidemic and hepato-protective actions. Punjab cultivation exists in orchards and home gardens; it is also a commercially important processed product *viz*., churnas, jams, amla candy (Kumari and Sing, 2017).

Different Properties of Amla

P. emblica is an important home grown medication utilized in Unani and Ayurvedic frameworks of medication. It is utilized for the treatment of jaundice, diarrhea, and inflammation. In system, the fresh fruit is utilized in treatment of inflammation of the lung. The juice obtained from the fruit is mixed with honey and pipit added is given to stop hiccough and also in painful respiration, asthma (Rehaily *et al*., 2002). For the treatment of gonorrhoea, the juice of the bark combined with honey and turmeric may well be a remedy for Gonorrhoea (Vasudevan and Parle, 2007). For curing nausea, amla powder is mixed with red sandalwood and prepared in honey to alleviate nausea and vomiting (Perianayagam *et al*., 2004). In skin sores and wounds, the milky juice of the leaves may well be a decent application to sores (Nadkarni and Nadkarni, 1999). Memory enhancing effect of amla churna may persuade be a useful remedy for the management of Alzheimers disease due to its multifarious beneficial effects like memory important and reversal of memory deficit (Nosalova *et al*., 2003).

Cardio protective activity the results of chronic oral administration of fresh fruit homogenate of Amla on myocardial antioxidant system and oxidative stress induced by ischemic-reaper fusion injury were investigated on heart (Nadkarni and Nadkarni, 1999). Spermato-toxicity Sperm count, viability and motility were inhanced in rat and in human sperm with ripe emblica fruit juice (Chakraborty and Verma, 2009). Emblica extracts in Ophthacare Emblica is one component of a mixed natural eye drop formulation (Ophthacare) (Biswas *et al*., 2001). As a fruit decoction it's mixed with sour milk and given by the natives in cases of dysentery (Vasudevan and Parle, 2007). Amla affective in Anti-ulcer activity, metabolic extract of Emblicaofficinalis was studied against ulcer (Scartezzini and Speroni, 2000). Phyllanthus emblica also useful for Asthma, cough, Bronchitis, Anemia, Jaundice, Dyspensia, Eye disorder, Ageing, Antidepressant activity, Radioprotective activity, Anticancer activity, and also helps within the upkeep of liver function (Singh *et al*., 2011).

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Aloe vera (Ghrit kumari)

Botanical note: Widely cultivated succulent with gel used in wound healing, skin care and as a mild laxative. Scientific literature supports wound-healing, anti-inflammatory and cosmetic properties; *Aloe* is suited to Punjab's irrigated conditions in small plots/greenhouses and features in small-scale agro-enterprises.

Medicinal Uses of Aloe Vera

Aloe vera plays an important role in maintaining the healthy functioning of the major organs, and preventing diseases. *Aloe vera* releases pepsin, which aids digestion, soothes digestive tract irritations, colic pain and ulcers (Kumar *et al*., 2010). It also heals heart burns. This has come down from the traditions of folk medicine of Europe, and proved in recent clinical trials in Japan. *Aloe vera* acts as a general tonic, raises immunity and fights diseases. Research reveals its efficacy in conditions like HIV and cancer (Holliday and Speirs, 2011), especially leukemia, due to its ability to produce hite blood cells. Consequently, it can minimize the side effects of chemotherapy and radiation (George and Sharma, 2015). It boosts circulation, and thus increases the supply of oxygen to the cells. Therefore, it could play a major role in alleviating the condition of thalasemmia patients. *Aloe vera* is also beneficial for Asthma patients. It helps to maintains healthy joints and muscles, and thus, prevents arthritis. *Aloe vera* detoxifies the body (Yadav *et al*., 2025), and is considered the best colon cleanser. It prevents constipation; therefore, it is an effective blood purifier. It is beneficial in kidney and liver problems, like jaundice. *Aloe vera* also reduces blood sugar, and controls diabetes. It reduces cholesterol and triglycerides, leading to a healthy heart, and preventing cardiac problems. *Aloe vera* reduces inflammation and infection of the eye and ear. Finally, it provides energy, and acts as a restorative.

Many other species are important regionally — e.g., *Asparagus racemosus* (shatavari), *Rauvolfia serpentina* (sarpgandha), various *Mentha* species — and are documented in Punjab inventories. A comprehensive list of 150+ herbs appears in regional compilations (Maurya *et al*., 2022).

Cultivation, adoption and value-chain issues in Punjab

State and project reports identify both opportunity and constraint: medicinal plants such as turmeric, aloe, tulsi, amla and sarpgandha may offer higher returns than traditional cereals, but farmers face market uncertainty, lack of assured buyers, and limited agronomic extension tailored to medicinal crops (Chaudhary and Trehan, 2025). Although Punjab hosts licensed herbal industries, backward linkages (farmer → industry) are weak; improving transparent trade practices and contracts is essential to scale cultivation. Successful adoption will depend on demonstration plots, seed/germplasm availability, and price discovery mechanisms (Goraya and Ved, 2017).

Conservation, quality control and safety

Overharvesting of wild medicinal populations, habitat loss and spread of invasive species threaten native medicinal flora. Quality and standardization are additional concerns: phytochemical content varies with genotype, growth conditions and post-harvest handling. For safe and efficacious products, Good Agricultural and Collection Practices (GACP), pharma-copeial standards, and traceability (seed-to-product) must be promoted (Prajapati and Pandey). Research on cultivation protocols, propagation and varietal selection is a priority to reduce pressure on wild stocks and deliver consistent raw material to industry.

Research gaps and recommendations

1. **Germplasm and cultivation trials:** Punjab should prioritize on-farm trials for key species (e.g., *W. somnifera, T. cordifolia, A. vera*) to identify high-yielding, high-constituent varieties and best agronomic practices (Saleem *et al*., 2020).

2. **Value-chain development:** Establish forward contracts or farmer-industry aggregation models to reduce price risk and create assured markets for growers.

3. **Quality standards & certification:** Implement GACP training, post-harvest handling protocols and laboratory testing to meet pharmacopeial standards (Singh, 2023).

4. **Conservation action:** Protect wild populations, rehabilitate degraded groves and manage invasive species that threaten native medicinal flora.

5. **Clinical research & safety monitoring:** Encourage rigorously designed clinical trials and pharmacovigilance for widely used herbal products to build evidence for safe therapeutic use (Upadhyay *et al*., 2010).

CONCLUSION

Punjab possesses a valuable medicinal-plant resource that can contribute to rural incomes, traditional healthcare and the herbal industry — provided cultivation, market linkages and quality control are improved. Prioritizing a handful of high-value, regionally appropriate species (ashwagandha, giloy, neem, tulsi, amla, aloe) for agronomic research and supply-chain strengthening offers a pragmatic pathway to sustainable use and economic benefit for farmers while safeguarding plant biodiversity.

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