

## Phytodiversity and Conservation with Special Reference to Rare Medicinal Plants of Himalayas Region, Pakistan

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### Abstract

Pakistan is gifted with peculiar resources of rich and diversified plant heritage. Mountainous regions (Northern part) of Pakistan have more than 700 plants of economic importance. Of which 10% plant species are reflected to be of medicinal value. Active chemical constituents present either with in stem, bark, leaves, flowers, fruits, seeds or roots are used for different ailments. These are chemically balanced, effective and least injurious for human health with fewer side effects. The increasing human and livestock's population change in climatic condition, habitat loss through housing, construction of roads, promotion of tourism, deforestation, terracing of land for agriculture, overgrazing and excessive collection of plants has exerted pressure on the existence of rare medicinal plants. The herbal medicines are mostly being used in the form of crude extract and their standardization and quality has remained one of the key challenges. The convenient standardization of bioactive compounds present in medicinal plants is becoming trendy at present. There is a terrible need of conservation of medicinally important plants via modern biotechnological approaches for their long-term sustainable utilization.

**Keywords:** Micropropagation; Rare; Vulnerable; Medicinal plants; Conservation

### Introduction

The Himalayas are the world's youngest, highest and leading mountain range and possess a great plant biodiversity. The name of the array was derived from the Sanskrit, "dwelling of Snow". These are currently famous as the "Himalaya Mountains", generally abridged to the "Himalayas". The Himalayan series typically consist of enriched sedimentary and metamorphic rock. The Himalayan range is fabricated of three equivalent ranges repeatedly referred to as the Greater Himalayas, the Lesser Himalayas, and the Outer Himalayas. The Hindu Kush range has several high snow-capped peaks, with the highest top in the Hindu Kush being Tirich Mir at 7,708 meters (25,289 ft) located in the Chitral District of Khyber Pakhtunkhwa, Pakistan. To the north, close to its north-eastern end, the Hindu Kush ramparts the Pamir Mountains in the neighborhood of China, Pakistan and Afghanistan borders. It is extended to southwest through Pakistan and into Afghanistan close to their boundary. The eastern ending of the Hindu Kush in the north meets with the Karakoram Range. Towards its southern end, it connects with the Spin Ghar Range near the Kabul River. The Karakoram Highway runs through the mountains to connect Pakistan with Western China. Azad Kashmir encompasses the lesser part of the Himalayas which is well thought-out one of the most attractive part of Himalayas with luxuriant green and beautiful valleys. The western and northern parts which includes the minor part of the Himalayas are an exemption which provide charming and lovely landscape and extraordinary magnificence.

Rare plants are giving impression not to ideal for habitat. Rarity of any plant for specific habitat depends on geographic range, habitat and local population size. Rare species are locally abundant and constantly sparse in several and specific habitats. Rare species are hard to find. Various climatic ranges in northern part of Pakistan which have rich herbal legacy covers chief slice of northern areas. The Endangered Species Act of 1973 states an "endangered" species as "an animal or plant species in danger of loss in all or an important part of its range". The "threatened" species as "an animal or plant species expected to turn

into in hazard of extinction within the predictable future during all or a major percentage of its range" [1]. 400-600 plants are reflected to be medicinally essential although nature has gifted 6000 species of wild type.

The criteria for IPA require some modification when IPAs (important plant area) are recognized with reference only to medicinal plants namely a site should be marked by the: (1) Presence of threatened species of medicinal plants of global or regional concern; (2) Exceptional richness in medicinal plants for its biogeographic zone; or (3) Presence of threatened habitats for medicinal plants. There are 75 basic herbals drugs which are broadly carried across and out of those twenty-eight are prominent. Greco-Arabic, Ayurvedic and Homeopathic manufacturing industries are consuming medicinal plants for producing different product formulae [2].

Due to inappropriate utilization of eco-resources, many plant and tree species are endangered and may become scarce due to lack of proper arrangement for their protection and growth. With the help of tissue culture techniques, it is period to protect this endangered plant (*Citrullus colocynthis*) [3]. Rapid agricultural development, population growth, urbanization and the ruthless collection of medicinal plants for drugs has resulted in decline of their number [4].

Medicinal plants are significantly a crucial health and economic part of biodiversity. To protect the medicinal plants from genetic

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erosion, their indigenous knowledge is equally important. These local forgotten treasures are totally ignored and are endangered. These plants can impose a sustainable socio-economic and environmental impact when preserved and utilized by the local community. Therefore, it is important to propagate and conserve them to meet the future demands. The widespread medicine fulfils near about 80% demand in Pakistan [5]. Many major and minor diseases are cured by using medicinal plants. Collection for local village use is not generally a problem. Such collection tends to be on a small scale and collectors can be careful to avoid undue damage. Usual systems of drug have changed an attention of international rank during the past decade. Various developing countries have great fraction of the inhabitants depending on timeworn practitioners and medicinal plants used for health care. Modern drugs are available in developing countries, but traditional medicines have their value because of ancient and traditional reasons. Medicinal plants have alkaloids, glycoside alkaloids, resins and other secondary metabolites for which they have been badly browbeaten to achieve the daily drug requirement of public (Tables 1-3).

Bioactive compounds are called secondary metabolites which have pharmacological and toxicological effects. These compounds are helpful for growth and development, protection, attraction and signaling to plants. Antioxidant is responsible for balancing oxidation in human body.

Pakistan is rich in biodiversity and at least 10% of the flora has medicinal value. Threatened or endangered plant species are mainly

due to Overutilization, loss of natural environment and population blast employs stress on the country's natural source base. Moreover, rural people have to abuse biodiversity at indefensible rates due to disturbing poverty [6-8].

Various developing countries have great fraction of the inhabitants depend on timeworn practitioners and medicinal plants to happen for health care. Modern drug available in developing countries but traditional medicines have fame for ancient and folk reasons.

Secondary metabolites are specialized compounds, not involved directly in growth and development of plants. Primary metabolite in comparison to secondary governs all basic physiological activities. Secondary metabolism provides most of the prime pharmacological active natural products. The key modules comprising polyketides and fatty acids, Terpenoids and steroids, Phenylpropanoids, Alkaloids, Others (focus on amino acids and carbohydrates) plant derived alkaloids have strong medicinal potential including morphine and codeine (Opium species), Vincristine and vinblastine (from periwinkle species) are inhibitors of cell division and treatment for cancers (blood and lymphatic) [9].

The investigations proved that medicinal plants are becoming rare in Pakistan due to certain natural reasons beside anthropogenic activities. Such cultural reasons include weak reproductive system, poor seed setting and seed germination, patchy drought, change in climate conditions and over grazing. Further, indiscriminate and

	Plant Name	Medicinal Value	Occurrence/ Status
1	<i>Asparagus adscendens (asparagaceae)</i>	Rhizome is used as galactagogue, demulcent, tonic and aphrodisiac useful in diarrhoea, dysentery.	Rare/ Vulnerable
2	<i>Acacia catechu (mimosaceae)</i>	Used as astringent in diarrhoea and applied over spongy gums.	Rare/ Vulnerable
3	<i>Berberis lycium (berberideaceae)</i>	Root power is used in bone fracture, skin diseases chronic diarrhoea, diabetes and piles, also used as blood purifier and tonic. Bark is used for pharyngitis, also used for improvement of internal wounds and throat pain. Fruit is cooling agent and laxative.	Rare/ Vulnerable
4	<i>Buxus papilosa(boxaceae)</i>	Used for cure of recurring fever (malaria), gout, rheumatism, urinary tract infections chronic skin diseases and haemorrhoids.	Rare/ Vulnerable
5	<i>Holarrhena pubescens (apocynaceae)</i>	Seeds are used in dysentery; root powder is used as anthelmintic. Leaves are used chronic bronchitis, boils and ulcers. Leaves powder stops nose bleeding	Rare/ Vulnerable
6	<i>Centella asiatica(umbelliferae)</i>	Used as tonic, diuretic, antiphlogistic and for skin diseases. Leprosy, nervous disorder and improves memory. Used in boils, sores and fish bite. Also, as anodyne and anti-spasmodic.	Rare/ Vulnerable
7	<i>Datura stramonium (solanaceae)</i>	Leaves used into cigarettes. Juice of flower is useful for earache. Seeds and leaves are smoked for their narcotic action. Root powder is taken internally to keep hair black	Rare/ Vulnerable
8	<i>Incarvillea emodi (begnonaceae)</i>	It is used as febrifuge to relieve fever as a substitute for Chiretta (swertia species)	Rare
9	<i>Lantana indica (verbenaceae)</i>	Used to cure snake bite.	Rare
10	<i>Viola canescens (violaceae)</i>	It is used as astringent, purgative, diaphoretic, demulcent, antipyretic, febrifuge and anticancer. Decoction of whole plant is taken as blood purifier. It is useful in constipation, colic and stomach problems. Decoction of dried leaves and flowers is used for sore throat, cough, diarrhoea, tuberculosis and allergies, reported to improve vision.	Rare
11	<i>Albizia lebbbeck(mimosaceae)</i>	Used to strengthen gums and for astringents, diarrhoea, dysentery and gonorrhoea, piles and skin disease	Rare
12	<i>Bergenia ciliate(saxifragaceae)</i>	It is used as diuretic, emmenagogue, antimenorrhagic, removes kidney stones, relieves pain in chest	Rare
13	<i>Colchium luteum(colchicaceae)</i>	It is laxative, aphrodisiac, carminative, good for spleen, liver and gout, reduce inflammation and pain	Rare
14	<i>Digera muicata(amaranthaceae)</i>	It is laxative and good for urinary disorders.	Rare
15	<i>Evolvulus alsinoides(convulvulaceae)</i>	Used for tonic, asthma, promoting hair growth. vermifuge and febrifuge.	Rare
16	<i>Rubus sanctus (rosaceae)</i>	Used as astringent, looseness of bowels, diarrhoea, for bleeding, dysentery, constipation and whooping cough.	Rare
17	<i>Psammogeton bilernatum (umbelliferae)</i>	Used as stomachic	
18	<i>Mirabilis jalapa (nyctaginaceae)</i>	Used as polticeon wounds, blood purifier, purgative, useful in dropsy, and in menstrual disorders	Rare
19	<i>Kydia caycina (malvaceae)</i>	Used for rheumatic, joints and lumbago	Rare
20	<i>Fagonia indica (zygophyllaceae)</i>	Used as antiseptic, astringent, febrifuge, stimulant, antipyretic for snake bite, tumours, typhoid, diuretic, dysentery	Rare

**Table 1:** Few important plants of Himalayan region, their medicinal value, occurrence and status.

Threat Category	No of IPAS impacted	% of IPAS impacted	% of Total threats to IPAS	No of IPAS impacted at high level	Countries where threat is more Significant
Development and Construction (recreation/tourism)	595	40.2	9.7	136	Ukraine, Solvenia, Montenegro, Estonia, Lebanon, Romania
Agriculture intensification/expansion (grazing)	402	27.2	6.5	65	Morocco, Albania, Syria, Algeria, Tunisia, Israel
Land abandonment/reduced management	426	28.8	6.9	152	Croatia, Ukraine, Estonia, Slovenia, United Kingdom, Slovakia
Inappropriate forest management (intensified forest management)	310	20.9	5.0	71	Macedonia, Estonia, Slovakia, Poland, Bulgaria, Czech Republic
Inappropriate forest management (deforestation)	269	18.2	4.4	67	Morocco, Albania, Montenegro, Macedonia, Lebanon, Romania
Development and construction (urbanisation)	265	17.9	4.3	46	Israel, Lebanon, Slovenia, Montenegro, Croatia, Poland
Habitat fragmentation	264	17.8	4.3	71	Israel, Slovakia, United Kingdom, Albania, Czech Republic, Macedonia
Development and construction (infrastructure/transport)	251	17.0	4.1	40	Poland, Montenegro, Slovenia, Estonia, Egypt, Macedonia
Invasive species (plants)	251	17.0	4.1	55	United Kingdom, Czech Republic, Slovakia, Ukraine, Montenegro, Croatia
Inappropriate forest management (afforestation)	248	16.8	4.0	41	Ukraine, Slovakia, Estonia, Turkey, Romania, Czech Republic

**Table 2:** Impact of threat categories on IPAS in European and Mediterranean Countries.

Family	Common Family Name	Total Number of Species	Number of Medicinal Species in MPNS	Medicinal Species as % of total	Key Class of Compounds found in many Medicinal Species in each family
<i>Fabaceae</i>	Pea and Bean	20,856	2,334	11.2	Alkaloids
<i>Lamiaceae</i>	Mint	7,756	1,059	13.7	Terpenes
<i>Euphorbiaceae</i>	Spurge	6,407	863	13.5	Diterpenoids
<i>Apocynaceae</i>	Dogbane	6,341	858	13.5	Cardiac glycosides
<i>Malvaceae</i>	Mallow	5,329	621	11.7	Organic acids
<i>Apiaceae</i>	Parseley or Carrot	4,079	586	14.4	Coumarins
<i>Ranunculaceae</i>	Buttercup	3,640	434	11.9	Alkaloids

**Table 3:** Medicinal plant families and their characteristic compounds.

excessive plant collection for medicinal purposes is another cause of its rapid disappearance in nature. There seems desperate need to conserve the germplasm of these medicinal plants for future generations. Conventional propagation of medicinal plants has certain limitations and is not being cultivated in a proper way. For the defense of rare and endangered taxon, reproducing and conservation of plants with the use of micropropagation methods is the only option. Further it is important to identify and explore the constituent/secondary metabolites through different scientific methods (Figures 1-5).

Global market to herbal based drugs is expected to increase on account of socio-economic and consumer preference of natural products. Botanical and plant-derivative medicines were appreciated at \$23.2 billion in 2013 and \$24.4 billion in 2014 in global market. This amount touched \$25.6 billion in 2015 and will likely be \$35.4 billion in 2020 in total market, with a compound annual growth rate (CAGR) of 6.6% from 2015 to 2020 [10].

Medicinal plants have much diverse in Pakistan. More than 50% of all the medicines used today in daily life are taken from plant sources. According to WHO (world health organization) the customary medicinal plants are utilized 80% people of world for their health care requirements. Medicinal plants are regularly used in health [5]. It is for centuries that humans are extracting, processing and using medicinal plants in their daily life for economic benefits, uplift of local community and for animal use [11].

People of the area (Cholistan desert) use plants as a whole or plant parts including leaves, stems or roots for medicinal purpose [12].

Allopathic medicines are away from the range of poor inhabitants while herbal drugs are utilized frequently having low price and used with fewer side effects [2]. Medicinal plants are the main source of income for local people who help traders and exporters in collection system. Beside all collection activities, no planned crop growth pattern for medicinal plants is yet discovered in Pakistan. The medicinal plants signify a crucial health and economic part of biodiversity.

There is an active chemical compound in stem, leaves root, bark and seeds plants which are used to cure diseases. Available plant material often varies on quality and composition and this can hamper the assessment of its therapeutic claims. Atanasov et al. has reported that plants population converts threatened when excessive rough making and unmaintainable collecting techniques of medicinal plants. The chemical constituents of herbal medicines are commercialized by manufacturing of pharmaceutical drugs. At least 28,187 plant species are currently recorded as being of medicinal use (KEW gardens report, 2018). This is especially true for many rural communities in Africa, parts of Asia, and Central and South America, where plants and knowledge of their traditional use are accessible and affordable. In other countries, many of these traditional plant-based medicines are being integrated through regulations into mainstream health systems [13].

Maintenance of quality control and proper dosage of herbal medicine is one of the major challenges of herbal medicine. Bioassay techniques offers special advantage to differentiate mixture of plants based chemical compounds. The study was conducted on *Maringa citrifolia* leaf and fruit and found most chronic toxicity.



Figure 1: A view of Margalla hills national park Islamabad, Pakistan.

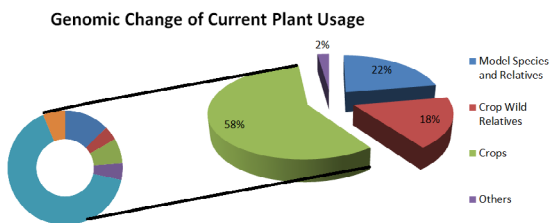


Figure 2: Genomic Change of Current Plant Usage.

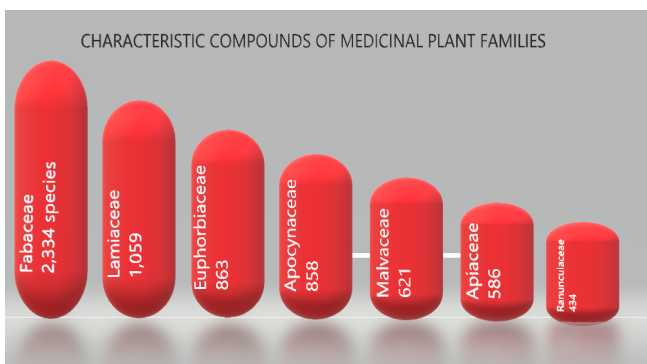


Figure 3: Characteristics compound of Medicinal Plant Families.

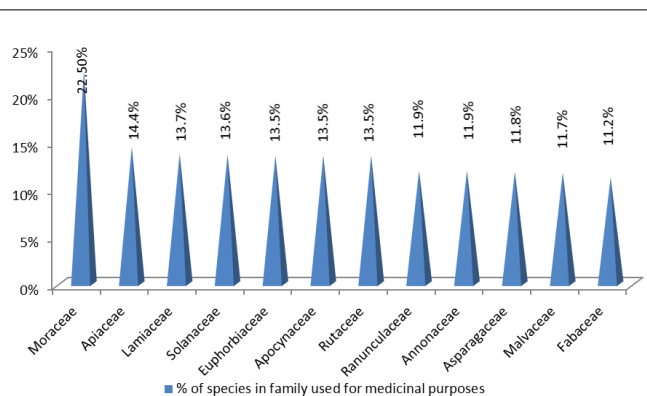


Figure 4: Higher Proportion of Medicinal Plants in 12 Important Families.

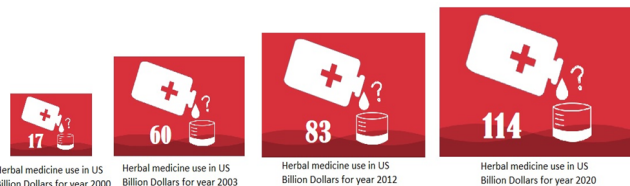


Figure 5: An indication of the growing value of international trade in herbal medicines.

The *Persicaria orientalis* (ornamental medicinal plant) reported to possess pharmacological important compounds and being used as a traditional medicine. Biological assaying (for phytochemical analysis and pharmaceutical value of medicinal plants) conducted to evaluate the anti-inflammatory, anti-diarrhea and cytotoxic effect. Biological resources are being abused because some people those with the greatest economic stake in development are making money out of depleting wildlife and habitat. They are making money because they are harvesting the benefits of nature without paying the environmental costs for either production or replacement. Most people in Pakistan are curing minor or major diseases by medicinal plants. Allopathic system of medicine exerts several side effects; therefore, it is necessary to supervise the herbal and Unani system to produce less side effects and sustainable efficacy. Allopathic and herbal medicines industry is the main user of medicinal plants. It has been investigated that selected plants are becoming rare in Pakistan. Therefore, it is necessary to conserve selected rare and vulnerable medicinal plants via advanced Biotechnological techniques (micropropagation and Biological activities). Twelve of the 20 largest plant families have a significantly higher proportion of medicinal plants than would be anticipated if distribution across families were even. Here is a more detailed look at the top seven.

### Major Threats

- Development and construction (recreation/tourism),
- Land abandonment/reduced management,
- Agriculture intensification/expansion (grazing),
- Inappropriate forest management (intensified forest management),
- Inappropriate forest management (deforestation),
- Development and construction (urbanization),
- Habitat fragmentation,
- Development and construction (infrastructure/transport),
- Invasive species (plants),
- Inappropriate forest management (afforestation),
- Excessive collection of medicinal plants,
- Climate change.

### Recommendations to Conserve Medicinal Plants

- Naming and counting the world's medicinal plant families,
- Control on invasive species,
- Start and supervise Ethnobotany subject at BSc, MSc and MPhil level in our local universities,

- Compile a record of rare and vulnerable medicinal plants,
- Projects on medicinal plants conservation at Government level,
- Seminars and conferences for awareness of medicinal plants value proper identification and treatment of ailments through plants,
- Spread getting benefits from medicinal plants by publishing articles in journals and in newspapers,
- Grazing must be controlled,
- Control on ruthless collection of medicinal plants by local inhabitants,
- Some plants have poor seed setting and weak reproductive system so keep in mind for their improved growing way by using modern Biotechnologies techniques (tissue culture, nanotechnology etc.),
- Control on habitat loss,
- Strict policies on trade and harvesting excessive amount of medicinal plants,
- Tourism strategies must be stricter that not effected medicinal plants,
- Mining and construction must be done in favor of conserving medicinal assets,
- Increase in population shouldn't consequence on medicinal plants,
- Expected outcomes,
- By using optimization of micropropagation protocols,
- Balance in biodiversity,
- Conservation of rare and vulnerable selected species,
- Socioeconomic benefits,
- Prevention of genetic erosion,
- By determining phytochemical analysis and biological evaluation activities we can cultivate and harvest secondary metabolites on large scale,
- By comparing callus cultured plants to normal plants,
- Can screen out better medicinal plants,
- Work closely with groups of traditional medicine practitioners and consumers,
- Promote the development of techniques, including the application of forensic science, for identifying parts derivatives used in traditional medicines,
- Strengthen synergies between CITES and IUCN and other conservation bodies.

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