

A CASE STUDY OF MEDICINAL PLANT CONSERVATION IN THE JABALPUR DISTRICT, INDIA

ZAREEN BAKSH¹, MOHD KAFEEL AHMAD ANSARI^{2*}

¹*Department of Education, St. Aloysius College, Rani Durgavati University, Jabalpur*

²*Department of Biology, Faculty of Natural Sciences, University of Guyana, Georgetown, South America*

Corresponding author's Email: mohammad.ansari@uog.edu.gy

Abstract

Medicinal plants are world's most important resource of herbal products, but they are fading fast. The purpose of this article intends to provide a reliable source for the sustainability, preservation and usage of medicinal plant resources by reviewing global trends, advancements, as well as possibilities for the techniques and approaches. We highlighted the need for sufficient consideration of resource management and conservation techniques for the long-term sustainable usage of medicinal plant resources. In situ, ex situ conservation and cultivation practices are included in conservation strategy while resource management depends on good agriculture practice and sustainable use solution. Biodiversity is vanishing at a frightening rate. It is our duty to safeguard biodiversity as effectively as we can. In recent years, a lot of attention has been placed on proving that biodiversity loss is one of the major issues, if not addressed, could endanger the existence of human on Earth. It is the time to figure out the reasons behind this great loss of variety of species from Erath. Introduction of invasive species, pollution, loss of habitat, overhunting, climatic changes, over exploitation of species and natural catastrophes are the major issues responsible for loss of biodiversity and discussed in this review article.

Key words: Biodiversity, Medicinal plant, In-Situ and Ex-Situ conservation.

Introduction

India is one of the biologically diverse countries and is extremely rich in medicinal plants (Nautiyal, 2013, Parveen et al. 2020), even though it hardly covers 2% of the earth's land area. Different regions in India have varied climatic conditions and ecological habitats, ranging from temperate alpine to deserts, which provide suitable environments for a wide range of species to exist, grow and reproduce (Parveen et al. 2020). Thus, India's diverse agro-climatic environments and large geographical area have made it a great botanical garden with abundant plant genetic resources (Nautiyal, 2013). More than 9,000 different

species of plants are included in India's herbal heritage, which makes up over 50% of flowering plant species there (Parveen et al. 2020a). In moist forests of western Ghats 80 % of medicinal plants are distributed there. At least 1,900 species are known to be used by the Indian systems of medicine. According to estimates, the majority (95%) of medicinal plants utilized in the Indian herbal market today are gathered from rural areas (Nautiyal, 2013). In India 8000 medicinal plants are being used by different communities with various ecosystems. Only 880 species which constitutes only 11% of 8000 medicinal plants are used in active trading. The rapid loss of plant

biodiversity is also a danger to the availability and use of medicinal plants (Zhu et al. 2019).

With a total area of 3, 08,245 km², Madhya Pradesh is the 2nd largest state in the India and accounts for 9. 4% of the nation's total land area. It situated in the heart of India b/w the latitudes of 210.17' and 260.52' N and longitudes of 740.08' and 820.49, E and has the 2nd largest forest area in India (Verma et al., 2009).

Biodiversity is the variety of flora and fauna in a system, abundance of species genera and families biodiversity. The world's biodiversity is currently being rapidly destroyed (Zhu et al. 2019). Quantification of loss of biodiversity helps to understand and to determine that how much human interventions in addressing biodiversity loss are successful and effective (Parveen et al., 2020). Like many plant types decreases in biodiversity also

threaten the availability and use of medicinal plants (Verma et al., 2009).

Nearly 42 species are exported as raw medicines and extracts and about 48 species are imported (Verma et al., 2009). Almost 100 traded species are considered as threatened due to great loss in wild population. This is how the raw drug trade scenario in India is developing (Parveen et al., 2020). Before stressing to know about the reason causes of this great decline, consider to find out the “what”, “where” and “how much” of these untreated medicines. The majority of these are herbaceous and are evenly distributed across the many life types. Herbs, including grasses, make up the majority of plants (44%) followed by trees (35%) shrubs (25%) and climbers (17%). (Table1) (Verma et al., 2009).

Table-1
GROUP WISE DISTRIBUTIONS OF HERBS, SHRUBS CLIMBERS AND TREES

Herbs	Shrubs	Climbers	Trees
44	25	17	35

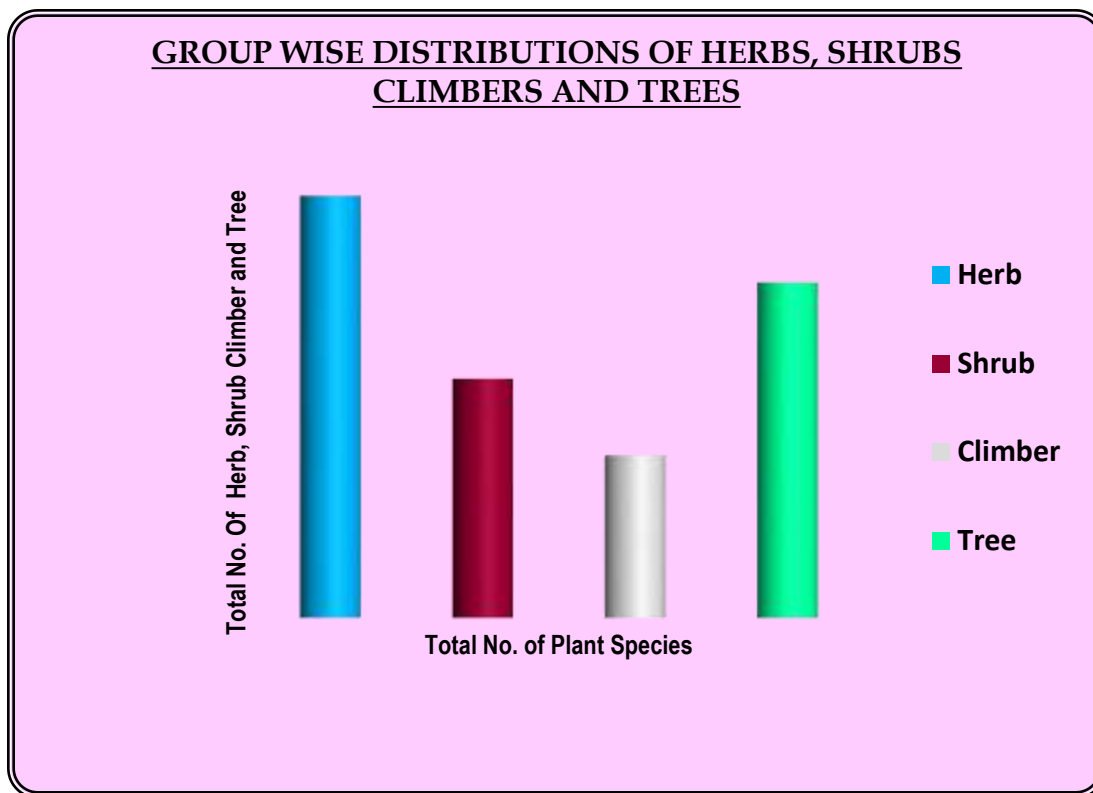


Figure 1: Group wise distributions of herbs, shrubs, climbers and trees

Losses in medicinal plant biodiversity

Some of the more common environmental factors influencing biodiversity include rainfall. Deforestation, siltation and decreases in pollinators

Rainfall

Annual rainfall has steadily decreased over the past few years during the months of summer and thus the vitality of many herbaceous species has been declined (Verma et al., 2009).

Deforestations

Deforestations in India has increased over the last two decades (Reference) due to increases in logging, overgrazing, agriculture, much wood collection and fire where as a consequence numerous wild medicinal plants are either eliminated or

reduced annually due to deforestation (Verma et al., 2009).

Siltation of water bodies

Siltation of forest waterbodies has decreased the capacity of the forest to hold water, which has led to the depletion of subsurface water sources (Verma et al., 2009).

Submersion

Due to submersion many medicinal plant species from forest has been lost. For example, in the Bargi forest which is within the catchments of Bargilake the main lake of Madhya Pradesh is used both for irrigation and power generation (Verma et al., 2009).

Infrastructure

Medicinal plants and forests are damaged due to construction of buildings, expansion of roads and installation of power lines (Verma et al., 2009).

Agriculture and forestry methods

Monoculture

Monoculture plantation of commercially significant medicinal plant species and exotic species have grown steadily in forest (Verma et al., 2009). Organic productivity along with stability, variability and complexity of due to this, forests have lost their sources of herbal drugs monoculture plantation which results in lack of herbal drugs for example, *Acacia* and *Eucalyptus* species.

For utilizing the complete ecological and biological advantages and functions of forests, a sustainable stand pattern with mixed planting is required. The extensive and consecutive monoculture plantation of *Eucalyptus* have been revealed to be unstable and susceptible particularly in typhoon-prone areas and also contributed in various ecological issues like reduction on soil nutrients and biodiversity (Zhu et al. 2019).

Eucalyptus is a rapidly-growing tree that has promoted and introduced genetic potential in different areas and generate significant amount of timber for economic growth (Zhou et al. 2020). Commercial plantation of *Eucalyptus* and extensive ongoing rotation of trees have led to a number of issues, including lack of nutrients in and biodiversity, which endangers regional and global wood security (Zhu et al. 2019).

The rate of preservation is a significant marker of both resistance and allover sustainable stands, as well as the general sustainability and

protection of stands. The ability of the forest to survive on its own and its capacity to adapt to its surroundings are reflected in the preservation rate, which serves as the quantity foundation for preserving the reasonable structure of the stand (Xing et al. 2014).

Encroachments

Encroachments into native forestlands has increased alarming. In spite of clearing the native vegetation, felling of trees and the cultivation practices which typically follow occur on highly sloped lands which caused an increase loss of wealth of natural medicinal plants and soil erosion (Zhu et al. 2019).

Over-exploitation

Widespread of herbal drugs from the natural forests is increasing day by day. Collection is typically by poorly organized forest collectors sell the plants they have gathered to a contractor for a specified price. While illegal gathering of medicinal plants is in control up to a certain level because of the awareness that the "Local Traditional Medical Practitioners Association" members have raised (Verma et al., 2009).

Botanical base

India has ten bio geographic regions including 2 of the world's 8 highest biodiversity hotspots, and is one among the 12 mega diversity countries (Parveen et al., 2020). The extreme climate and altitudinal deviations in India, combined with a wide range of ecological habitats, have helped to establish an incredibly rich range of substantial source of medicinal raw materials is vegetation with particularly wide variety of medicinal plants in both

domestic and international pharmaceutical industries (Parveen et al., 2020).

2100 plant species are listed by WHO (The World Health Organization) that has been used for medicinal purpose. Conventional medicine system involves the usage of almost 2500 medicinal herbs in India (Parveen et al., 2020). 527 medicinal plants of India are endangered species, 78 are extinct, 91 rare and 75 insufficiently known according to the record of red data book (Table-2).

Table 2: Family wise botanical representation of imported medicinal plants.

S.NO.	FAMILIES	SPECIES
1	Fabaceae	77
2	Asteraceae	65
3	Euphorbiaceae	58
4	Caesalpinaceae	51
5	Apiaceae	47
6	Lamiaceae	48
7	Solanaceae	45
8	Cucurbitaceae	48
9	Rubiaceae	40
10	Malvaceae	48
	TOTAL	527

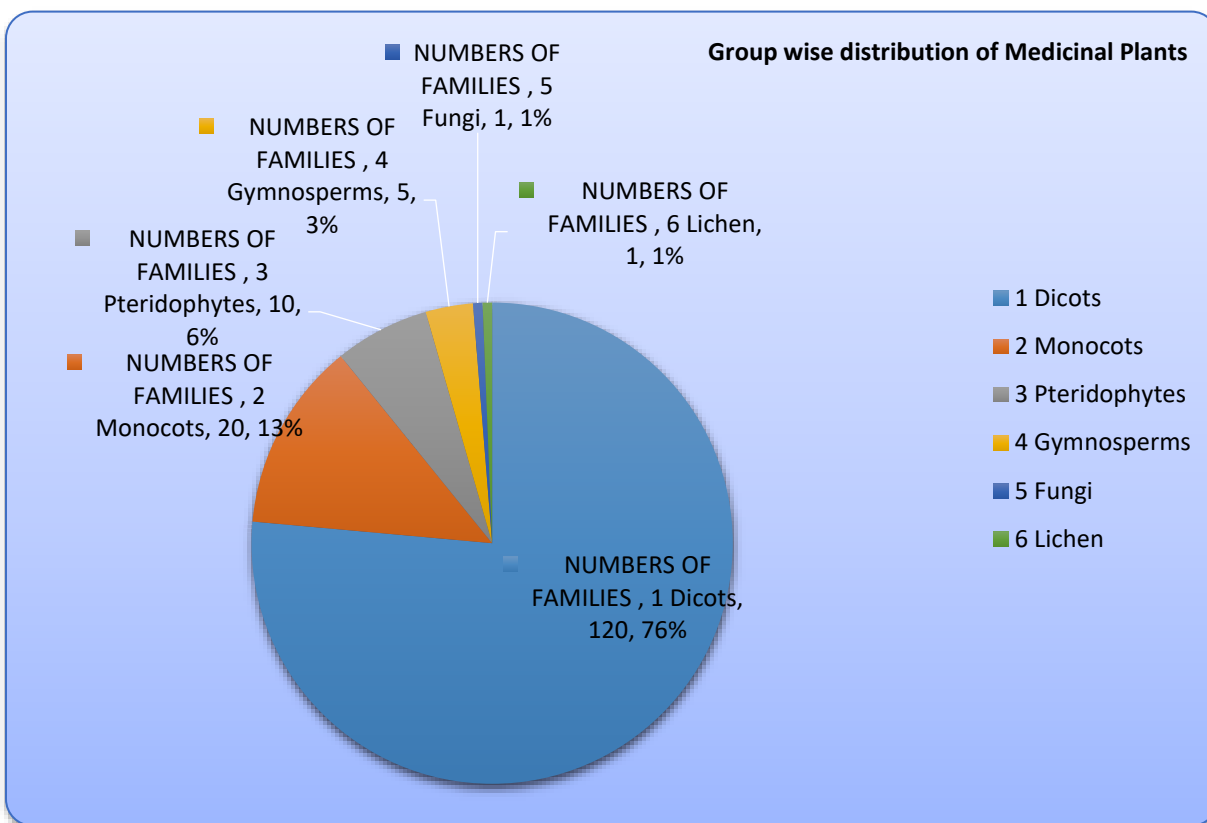


Figure 2: Group wise distribution of medicinal plants

Geographic distribution

India has ten bio geographic regions including 2 of the world’s 8 highest biodiversity hotspots, and is one among the 12 mega diversity countries (Parveen et al., 2020). The extreme climate and altitudinal deviations in India, combined with a wide range of ecological habitats, have helped to establish an incredibly rich range of vegetation with a unique diversity in medicinal plants, which serves as a significant source of medicinal raw materials for both domestic and international pharmaceutical industries (Parveen et al., 2020). 2100 plant species are listed by WHO (The World Health Organization) that has been used for medicinal purpose. Conventional medicine system involves the usage of almost 2500 medicinal herbs in

India (Parveen et al., 2020). 527 medicinal plants of India are endangered species, 78 are extinct, 91 rare and 75 insufficiently known according to the record of red data book (Table-3).

Table 3: Botanical representation of imported Medicinal Plants (Family wise)

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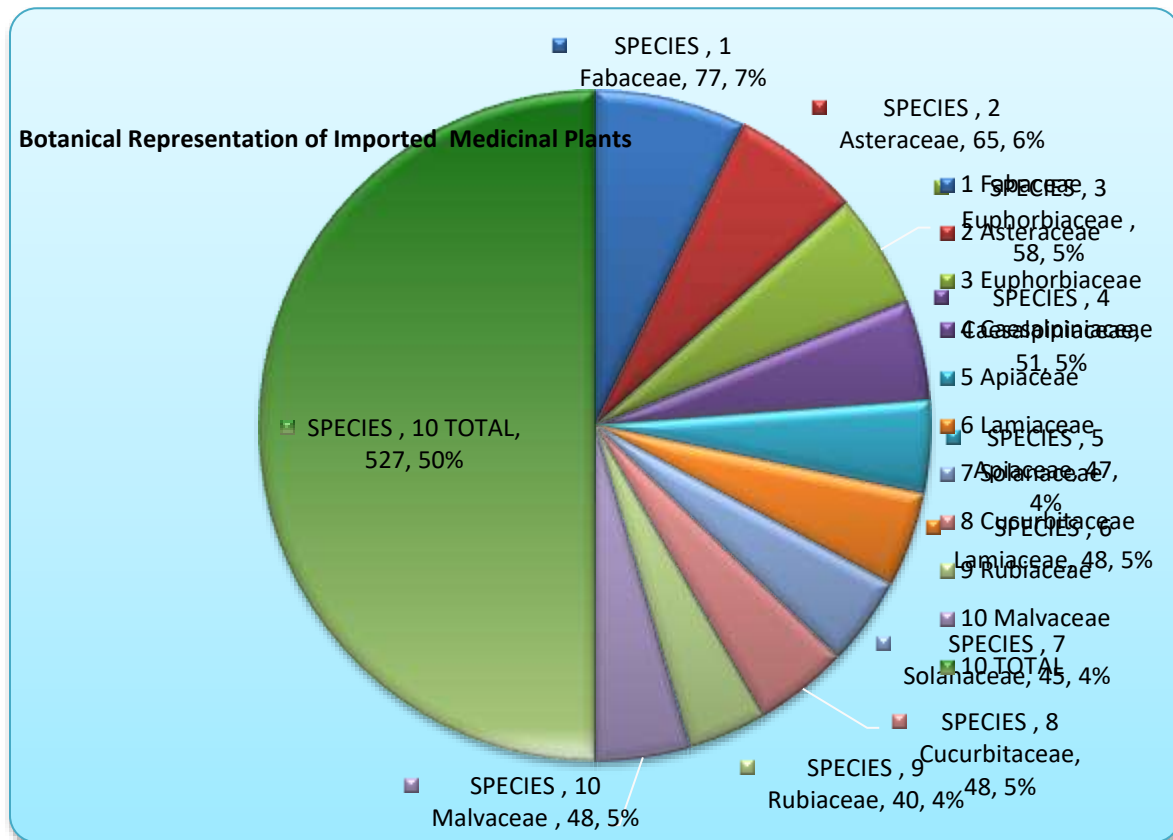


Figure 3: Botanical representation of imported medicinal plants

Ethnomedicine

The ethnobotany of medicinal plants is also well-known as 'Ethnomedicine'. The terms "medicinal plants" and "ethno-pharmacology" refer to plant species employed in traditional medicine that have active components that can treat human and/or animal ailments (Parveen et al. 2020). Various natural products or herbal medicines that are obtained from plants demonstrated a remarkable inter relationship between man and his environment and these products are being used for treatment of various ailments.

Most herbalists and plant scientists who are currently in practice are the only ones with knowledge of effective herbal medications for treating ailments (Parveen et al. 2020). Despite the potential medical usefulness of some plants, the medication itself occasionally has undesirable side effects. In light of this, the current study focuses on the value of medicinal plants by getting more knowledge about the plant medicinal uses and by doing the scientific research. The utilization of medicinal plants has become increasingly important to the world's health system. Ethnomedicine studies there are relevant in the search for new herbal medicines. Our major objectives here were-

- 1) To explore the potential of medicinal plant resources,
- 2) To understand the challenges and opportunities within the medicinal plant sector, and 3) Based upon current knowledge a recommend measures capable of establishing the smooth functioning of a medicinal plant which can improve the living standard of the underprivileged communities which

current support the sector. The knowledge of Indian medicinal plants and their uses have led to many scientific investigations globally (Verma et al., 2009).

JABALPUR GEOGRPHY

Soil Texture of Jabalpur

In region of Mahakoshal, between the Narmada and Son watersheds, on the valley side of Narmada passing through the gorge known as Marble rocks of 30 ft there is the Jabalpur over the Dhuandhar (rocky ledge) (Verma et al., 2009). The highlands encircle the both sides of narrow and long plain path that runs north-east to south-east and also thick alluvial sediments of black cotton soil surrounds this plain.

Vegetation of Jabalpur

Jabalpur is renowned for having some of the greatest natural forests and variety of animals. Kanha, Pench, Shivpuri and Bandhavgarh National parks are located near to fairly close to Jabalpur. Mixed forests, Khair, Teak, Medicinal plants and seal are few significant forest formations that are found in Jabalpur.

Geographical Details of Jabalpur

Country: India

State: Madhya Pradesh

Region: Mahakoshal

Altitude: 1,348 ft above sea level

Location: 23°10'N 79°56'E

Climate: Humid Sub tropical

Precipitation: 1386 mm (55 inches)

Summer Temperature: maximum 47°C, minimum 21°C

Winter Temperature: maximum 27°C, minimum 8°C

Conservation of medicinal and aromatic plants

The concept of conservation is "the function of human utilization of biodiversity to create the most sustainable and long lasting benefit to the modern generation while maintaining its potential to satisfy the expectations and aspirations of future generations." (WWF, UNEP & IUCW 1980) (Mishra, 2002).

Strategies and priorities: The World Conservation Approach predicts that the following are the main areas of biodiversity conservation:

- i. Survival of humans and economic activities depends on preservation of vital ecological processes and system that supports life.
- ii. Viable use of species and ecosystem that feeds various rural communities and major industries are depended on the species conservation, variety of genes.

Strategies for conservation of medicinal plants

Scientific methods and social actions can both be used to address the conservation of medicinal plants or endangered species (Vijayalatha, 2004).

The genetic diversity of plants are maintained by 3 scientific methods, which are as follows

- i. Regulation (Legislation)
- ii. *In-situ* conservation
- iii. *Ex-situ* conservation

Regulation

For especially preserving the medicinal plants that thrive in India's woods, there are presently no specific policies or laws. Under current forestry

legislation, conservation is more fully covered (Singh S., 2005). The Indian government has created the following six regulations to preserve forests, which either directly or indirectly protect wild herbal flora (Verma et al., 2009).

- i. Forest Act, 1927
- ii. Wildlife (Protection) Act 1972 and Wildlife (Protection) Amendment Act 1991
- iii. Forest (Conservation) Act, 1980
- iv. Environment Protection Act, 1986
- v. National forest policy, 1988
- vi. National biodiversity act, 2002

Conservation process for use, knowledge and preservation of biological resources for bio surveillance and bio utilization that occurs in India for research projects and of commercial use are covered under these Acts (Verma et al, 2009). These Acts also provide system for sharing the benefits of both using and having access to biodiversity. The sharing of research findings and the applications for intellectual property rights (IPRs) belonging to Indian natural resource are also highlighted under the Act.

The Act is applied on everyone either incorporated in India or Not incorporated in India like non-resident Indians, foreigners, body association/ organization or corporates having non-Indian participation in there share management or capital. When these people either for research purposes or for commercial use access to biological resources or knowledge that are associated to it either for bio utilization or bio survey needs an improvement from National Biodiversity Authority (Parveen et al., 2020).

***In-situ* conservation**

When a species is being conserved or protected within its geographic range or natural habitat this is termed as *in-situ* conservation (Verma et al.,

2009). This can be done by various ways like biosphere reserves, national parks, Gene sanction or gene banking, and in sacred grooves and sites etc.

Plant diversity can be preserved at long term at species, eco-system, genetic and species (Verma et al., 2009).

Outlines for *in-situ* management

A. For the utilization and conservation of medicinal plants in protected areas, the Parks Department should establish a policy at the national level (Verma et al., 2009).

The policy should include:

1. Protected regions that are crucial for the medicinal plants should be identified.
2. Techniques and procedures for classifying and monitoring and recording the medicinal plants in protected areas
3. How much protected areas covers the plants of medicinal value are being evaluated by Parks Department. For the conservation of medicinal plants at larger scale the Plant department should extend the existing protected areas and create the new ones. For the maintenance of wild species and natural habitats, Parks Department should provide social and economic incentives.
4. The preservation and use of medicinal plants should be included in site management plans, according to park administrators.

Ex-situ conservation

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Off-site protection or conservation of species or conservation of species outside their geographic range is known as *ex-situ* conservation. These can be conserved either in the form of genetic diversity or genetic resources. Preservation, maintenance and collection of selected genetic resources are included in it (Parveen et al., 2020). The main aim of *ex-situ* conservation is to reduce the pressure on wild habitats, to conserve the genetic variability, and analyzing the availability of raw material. Wild populations or community of some species are at great risk so for those *ex-situ* conservation is not possible. It can assist the stakeholders for cultivation and regrowth of medicinal plants and serve as field gene banks (Parveen et al., 2020).

Ex-situ conservation is to reduce the pressure on wild habitats, to conserve the genetic variability, and analyzing the availability of raw material. The population of some species are declined to extreme level and most of the species are not viable and available for *in-situ* conservation (Zhu et al. 2019). For such species *ex-situ* plantation and conservation of medicinal plants act as a gene bank and great source of seed. Additionally, this will assist in involving more stakeholders in the development and renewal of significant medicinal and aromatic plant species that have therapeutic potential (Parveen et al., 2020).

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