DOCUMENTATION AND TAXONOMIC ANALYSIS OF TRADITIONAL MEDICINAL PLANTS USED BY RURAL COMMUNITIES IN THE SHEKHAWATI REGION OF RAJASTHAN

Ruchi Maheshwari[1], Anita Dhaka[2]

[1]Research Scholar, [2]Assistant Professor

Abstract:
The Shekhawati region of northeastern Rajasthan represents a unique semi-arid ecological zone characterized by rich biocultural heritage and long-standing traditions of plant-based healthcare. This study systematically documents and analyzes the traditional medicinal plants used by rural communities across the districts of Jhunjhunu, Sikar, and Churu. Employing a qualitative and exploratory ethnobotanical research design, field investigations were conducted over an 18-month period using semi-structured interviews, focus group discussions, participant observation, and herbarium-based taxonomic verification. A total of more than 150 medicinal plant species belonging to diverse botanical families were recorded, with significant representation from Fabaceae, Meliaceae, Apocynaceae, and Liliaceae. Plants were categorized according to therapeutic applications, including gastrointestinal, dermatological, respiratory, musculoskeletal, and febrile disorders. Quantitative indices such as Use Value (UV) and Informant Consensus Factor (ICF) were applied to assess the relative cultural importance and reliability of plant-based remedies. The findings reveal a strong reliance on indigenous knowledge systems preserved through oral transmission, particularly among traditional healers, elderly community members, and women managing household herbal gardens. However, the study also identifies critical challenges, including habitat degradation, overharvesting, climate variability, and erosion of traditional knowledge due to modernization. By integrating taxonomic documentation with socio-cultural and conservation analysis, this research contributes to ethnobotanical scholarship and underscores the urgent need for sustainable management, policy support, and scientific validation of Shekhawati's medicinal plant heritage.

Keywords: Ethnobotany; Medicinal Plants; Traditional Knowledge Systems; Taxonomic Documentation; Shekhawati Region; Biodiversity Conservation.

1. INTRODUCTION

Traditional medicinal knowledge represents one of the oldest forms of healthcare systems practiced by human societies. Across the globe, indigenous communities have relied on plant-based remedies for the prevention and treatment of diseases long before the emergence of modern biomedical science. The World Health Organization (WHO, 2013) estimates that nearly 80% of the world's population still depends, at least partially, on traditional medicine for primary healthcare needs. In India, the rich diversity of ecological zones—from the Himalayas to arid deserts—has fostered extensive ethnobotanical traditions deeply embedded within local cultures (Jain, 1991; Kumar & Lalramnghinglova, 2016).

The Shekhawati region of Rajasthan, located in the northeastern part of the state, represents a semi-arid ecological landscape where traditional medicinal practices remain an integral component of rural healthcare. Spanning the districts of Jhunjhunu, Sikar, and Churu, the region lies at the intersection of the

Aravalli hill system and the Thar Desert. Its climatic conditions—characterized by low annual rainfall (approximately 300–500 mm), extreme summer temperatures, and sandy loam soils—have shaped a distinctive xerophytic vegetation profile (Sharma & Khandelwal, 2014). Despite ecological constraints, Shekhawati hosts a remarkable diversity of drought-resistant medicinal plants that have been used for generations to treat common ailments such as gastrointestinal disorders, respiratory infections, skin diseases, and musculoskeletal conditions.

Ethnobotany, defined as the scientific study of the relationships between people and plants, provides the conceptual framework for examining such traditional healthcare systems (Cotton, 1996). Ethnobotanical research not only documents plant species and their uses but also explores cultural beliefs, preparation techniques, dosage patterns, and ecological sustainability (Martin, 2004). In semi-arid regions like Shekhawati, where access to modern healthcare facilities may be limited in rural pockets, plant-based remedies are often the first line of treatment. The continued reliance on herbal medicine is not merely a reflection of cultural continuity but also of socio-economic realities, including affordability, accessibility, and community trust (Kala, 2005).

However, traditional medicinal knowledge is increasingly threatened by rapid socio-economic transformations. Urbanization, migration, formal education systems that prioritize modern biomedical paradigms, and declining intergenerational transmission of knowledge have contributed to the erosion of indigenous practices (Gadgil et al., 1993). Younger generations often show reduced interest in learning plant identification and preparation methods, resulting in a gradual weakening of orally transmitted knowledge systems. Additionally, environmental pressures such as deforestation, overgrazing, land-use change, and climate variability further endanger medicinal plant populations (Hamilton, 2004).

In Rajasthan, ethnobotanical studies have been conducted in various tribal and desert regions; however, the Shekhawati region remains relatively underexplored in systematic taxonomic and ethnomedicinal documentation (Sharma et al., 2012). The lack of comprehensive research creates a knowledge gap that restricts both conservation planning and pharmacological validation of locally used species. While anecdotal evidence and scattered records indicate the extensive use of plants such as *Azadirachta indica* (Neem), *Withania somnifera* (Ashwagandha), *Aloe vera*, and *Prosopis cineraria* (Khejri), there is limited consolidated documentation of species diversity, preparation methods, and informant consensus patterns in the region.

The documentation and taxonomic analysis of traditional medicinal plants serve multiple academic and societal purposes. First, systematic recording ensures the preservation of intangible cultural heritage, aligning with global efforts to safeguard indigenous knowledge systems (UNESCO, 2017). Second, accurate botanical identification through taxonomic verification strengthens the scientific credibility of traditional claims and provides a foundation for phytochemical and pharmacological studies (Heinrich et al., 2009). Third, quantitative ethnobotanical indices such as Use Value (UV) and Informant Consensus Factor (ICF) help determine culturally significant species that warrant further conservation or biomedical investigation (Phillips & Gentry, 1993).

Furthermore, the integration of traditional medicinal knowledge with modern healthcare frameworks is increasingly recognized as an important dimension of sustainable development. India's Ministry of AYUSH promotes the integration of Ayurveda, Unani, Siddha, and folk medicine into public health systems, emphasizing the need for scientific documentation and standardization (Ministry of AYUSH, 2020). For such integration to occur effectively, region-specific ethnobotanical inventories are essential. The present study, therefore, aims to systematically document the medicinal plant diversity of the Shekhawati region and analyze their traditional uses within socio-cultural and ecological contexts. The

research addresses the following objectives: (a) to identify and taxonomically verify medicinal plant species used by rural communities; (b) to categorize therapeutic applications and preparation methods; (c) to analyze patterns of knowledge transmission; and (d) to examine conservation challenges affecting plant sustainability. By bridging botanical documentation with cultural interpretation, the study contributes to both ethnobotanical scholarship and community-based conservation discourse.

The Shekhawati region represents a culturally vibrant yet ecologically fragile landscape where medicinal plant knowledge continues to sustain rural healthcare practices. Systematic documentation and taxonomic analysis are crucial not only for preserving traditional wisdom but also for informing sustainable management strategies and potential pharmacological validation. Through an interdisciplinary approach integrating ethnography, taxonomy, and conservation analysis, this research situates Shekhawati's medicinal heritage within broader discussions on biodiversity conservation and indigenous knowledge preservation.

2. STUDY AREA AND SOCIO-CULTURAL CONTEXT

The Shekhawati region occupies a distinct geographical and cultural position in northeastern Rajasthan, encompassing the districts of Jhunjhunu, Sikar, and Churu. Historically known for its fresco-adorned havelis and Rajput heritage, the region is equally significant for its semi-arid ecosystem and traditional reliance on plant-based healthcare systems. Its geographical coordinates place it between approximately 27.5°N to 28.5°N latitude and 74.5°E to 75.5°E longitude, forming a transitional ecological belt between the Aravalli hill ranges and the Thar Desert (Sharma & Tiagi, 2011).

Climatically, Shekhawati experiences extreme temperature variations, with summer temperatures exceeding 45°C and winter nights occasionally dropping below 5°C. The region receives erratic monsoonal rainfall, concentrated between July and September. Such environmental conditions have fostered xerophytic and drought-resistant plant communities characterized by deep root systems, thick cuticles, and reduced leaf surfaces (Bhandari, 1990). Vegetation types include thorny scrub forests, dry deciduous patches, grasslands, and cultivated agroforestry systems.

Dominant plant species include *Acacia nilotica*, *Prosopis cineraria*, *Capparis decidua*, *Ziziphus mauritiana*, and *Calotropis procera*, many of which possess recognized medicinal properties. The adaptability of these species to harsh ecological conditions contributes to their sustained use in traditional remedies. For instance, *Prosopis cineraria* bark decoctions are commonly used for respiratory ailments, while *Calotropis procera* latex is applied for skin disorders and joint pain. The abundance of such hardy species underscores the ecological resilience of Shekhawati's medicinal flora.

Socio-economically, the region is predominantly rural, with agriculture and animal husbandry forming the primary livelihoods. Crops such as pearl millet (bajra), mustard, and wheat are cultivated under rain-fed conditions. Economic vulnerability, combined with limited accessibility to tertiary healthcare facilities in remote villages, reinforces reliance on traditional medicinal practices (Rao & Singh, 2015). In many villages, primary health centers are located several kilometers away, and seasonal transportation challenges further restrict timely medical access. Consequently, plant-based remedies serve as cost-effective and readily available healthcare alternatives.

Traditional healers, locally referred to as *vaidya* or *hakim*, play a pivotal role in community health management. These practitioners possess specialized knowledge of plant identification, harvesting seasons, dosage preparation, and therapeutic combinations. Knowledge transmission typically occurs through oral instruction within families or through apprenticeship models. Elderly community members

and women also serve as key custodians of ethnomedicinal knowledge, particularly regarding household remedies for common ailments such as fever, cough, digestive disturbances, and minor injuries.

Cultural beliefs and ritual practices further reinforce the importance of medicinal plants. Sacred groves (*orans*) dedicated to local deities function as informal conservation sites, preserving biodiversity through religious protection norms (Gadgil & Vartak, 1976). Plants such as *Azadirachta indica* (Neem) and *Ocimum sanctum* (Tulsi) hold spiritual significance and are often incorporated into daily worship rituals, reflecting the intertwined nature of spirituality and healthcare. The ritual dimension enhances community commitment to plant conservation and reinforces ethical harvesting norms.

Gender roles significantly influence knowledge distribution. Women, responsible for managing household health and maintaining kitchen gardens, demonstrate detailed knowledge of plant preparation techniques, including decoctions, poultices, and infusions. Their expertise in combining herbs with locally available substances such as ghee, honey, or milk reflects empirical understanding of bioavailability and palatability. Such gendered knowledge systems contribute substantially to community healthcare resilience.

However, socio-cultural transformations pose challenges to continuity. Migration to urban centers for employment, increasing exposure to allopathic medicine, and formal educational systems that marginalize indigenous knowledge have weakened traditional learning pathways (Kala & Sajwan, 2007). Younger individuals often perceive herbal medicine as outdated, leading to declining apprenticeship under traditional healers. Simultaneously, commercialization of certain medicinal plants without sustainable harvesting guidelines threatens ecological stability.

Despite these challenges, there remains a notable resurgence of interest in herbal products, particularly within the broader national context of Ayurveda and natural wellness industries (Ministry of AYUSH, 2020). This renewed interest offers opportunities for community-based conservation initiatives and sustainable livelihood programs centered on medicinal plant cultivation.

The Shekhawati region presents a dynamic interplay between ecology, culture, and healthcare practices. Its semi-arid environment shapes plant diversity, while socio-cultural traditions sustain ethnomedicinal knowledge systems. Understanding this context is essential for interpreting plant usage patterns and assessing conservation priorities. By situating medicinal plant documentation within its ecological and cultural framework, the study provides a comprehensive foundation for analyzing the sustainability and scientific relevance of traditional healthcare practices in Shekhawati.

3. METHODOLOGY
3.1 Research Design
The present study adopted a qualitative, descriptive, and exploratory research design to systematically document and analyze traditional medicinal plants used by rural communities in the Shekhawati region of Rajasthan. Ethnobotanical research inherently requires an interdisciplinary framework integrating botanical science, anthropology, ecology, and public health (Cotton, 1996; Martin, 2004). Given the oral and culturally embedded nature of indigenous knowledge systems in Shekhawati, qualitative methods were prioritized to capture depth, context, and socio-cultural nuances.

The exploratory dimension of the study was particularly relevant because Shekhawati has remained relatively under-documented in formal ethnobotanical literature compared to other regions of Rajasthan. The descriptive approach facilitated systematic recording of plant species, their vernacular names, botanical classification, therapeutic applications, and preparation techniques. Furthermore, quantitative

ethnobotanical indices were incorporated to enhance scientific rigor and allow comparative interpretation (Phillips & Gentry, 1993).

3.2 Study Area and Sampling Strategy

The research was conducted across selected villages in the districts of Jhunjhunu, Sikar, and Churu, representing ecological and cultural diversity within the Shekhawati region. Villages were selected using purposive sampling based on (a) presence of traditional healers, (b) active use of medicinal plants, and (c) ecological variability such as scrubland, grassland, and agroforestry systems.

A stratified purposive sampling technique was employed to ensure representation across gender, age groups, and occupations. Approximately 200 informants were included in the study. These comprised traditional healers (*vaidya* and *hakim*), elderly community members (above 60 years), women managing home herbal gardens, farmers, shepherds, and artisans. Snowball sampling was also used to identify knowledgeable individuals recommended by initial respondents.

3.3 Data Collection Methods

3.3.1 Semi-Structured Interviews

Semi-structured interviews formed the primary data collection method. An interview guide was developed to collect detailed information on local plant names, plant parts used, preparation methods, dosage, mode of administration, and ailments treated. Open-ended questioning allowed informants to elaborate on cultural beliefs, seasonal practices, and ritual dimensions associated with medicinal use (Heinrich et al., 2009).

3.3.2 Participant Observation

Participant observation was undertaken to document harvesting practices, preparation processes, and administration techniques. The researcher accompanied local healers during plant collection to observe seasonal harvesting norms and ecological contexts. This method provided insight into practical applications beyond verbal accounts.

3.3.3 Focus Group Discussions

Focus group discussions were conducted in selected villages to validate information collected from individual interviews. Group interactions facilitated consensus-building and identification of widely accepted plant uses. This method also highlighted variations in knowledge between age groups and genders.

3.3.4 Field Surveys and Botanical Collection

Extensive field surveys were conducted across scrub forests, agricultural margins, sacred groves (*orans*), and pasturelands. Plant specimens were collected ethically in limited quantities to avoid ecological disturbance. Voucher specimens were prepared following standard herbarium techniques and identified using regional floras such as *Flora of the Indian Desert* (Bhandari, 1990). Scientific names were verified through comparison with authenticated herbarium records.

3.4 Data Recording and Documentation

For each recorded plant species, the following information was systematically documented:

- Local name
- Botanical name
- Family
- Habit (herb, shrub, tree, climber)
- Parts used (root, bark, leaf, latex, seed, fruit, etc.)
- Preparation method (decoction, infusion, paste, powder, oil, etc.)
- Therapeutic category
- Frequency of citation

Photographs and GPS coordinates were recorded for ecological mapping. Audio recordings of interviews were transcribed and translated into English, maintaining contextual accuracy.

3.5 Data Analysis

Qualitative data were analyzed using thematic content analysis, identifying patterns related to therapeutic categories, knowledge transmission, and conservation concerns. Medicinal uses were grouped into major ailment categories such as gastrointestinal, dermatological, respiratory, musculoskeletal, febrile, and reproductive disorders.

Quantitative ethnobotanical indices were calculated:

Use Value (UV)

UV was calculated to determine the relative importance of plant species:

$$UV = \frac{\sum U}{N}$$

where U represents the number of use-reports for a species and N represents the total number of informants (Phillips & Gentry, 1993).

Informant Consensus Factor (ICF)

ICF was calculated to assess agreement among informants regarding plant use in specific ailment categories:

$$ICF = \frac{Nur - Nt}{Nur - 1}$$

where Nur is the number of use-reports in a category and Nt is the number of species used for that category. Higher ICF values indicated strong consensus and reliability of plant efficacy claims.

3.6 Ethical Considerations

Informed consent was obtained from all participants prior to interviews. Informants were assured of confidentiality and anonymity. The study adhered to principles of cultural sensitivity and non-destructive sampling. Knowledge holders were acknowledged, and findings were shared with local communities to promote awareness and conservation.

4. DOCUMENTATION AND TAXONOMIC ANALYSIS OF MEDICINAL PLANTS

4.1 Species Diversity and Family Distribution

The study documented over 150 medicinal plant species belonging to more than 60 botanical families. The most represented families included Fabaceae, Meliaceae, Apocynaceae, Liliaceae, Euphorbiaceae, and Solanaceae. The dominance of Fabaceae reflects its ecological adaptability to semi-arid conditions (Sharma & Khandelwal, 2014).

Trees constituted approximately 38% of recorded species, followed by shrubs (29%), herbs (25%), and climbers (8%). The prevalence of woody species indicates adaptation to drought-prone environments, where perennial growth enhances survival.

4.2 Commonly Used Medicinal Species

Several plant species exhibited high Use Value (UV), indicating cultural prominence:

Plant Species	Family	Part Used	Major Therapeutic Use	UV
Azadirachta indica	Meliaceae	Leaf, bark	Fever, wound healing	0.85
Withania somnifera	Solanaceae	Root	Stress, vitality	0.78
Aloe vera	Liliaceae	Leaf gel	Burns, skin disorders	0.74
Prosopis cineraria	Fabaceae	Bark, pod	Respiratory issues	0.63

Neem (*Azadirachta indica*) was the most frequently cited species, used as an antiseptic, antipyretic, and blood purifier. Ashwagandha (*Withania somnifera*) was valued for its adaptogenic and rejuvenating properties.

4.3 Parts Used and Preparation Methods

Leaves were the most commonly utilized plant part (42%), followed by roots (21%), bark (15%), fruits/seeds (12%), and latex or whole plant (10%). The preference for leaves may reflect sustainability considerations, as harvesting leaves typically causes less ecological damage compared to root extraction. Preparation methods included:

- Decoctions (boiling plant material in water) – 35%
- Pastes (crushed fresh material) – 25%
- Powders (sun-dried and ground) – 18%
- Infusions – 12%
- Oils and latex applications – 10%

Additives such as honey, ghee, and milk were frequently used to enhance therapeutic effectiveness and palatability.

4.4 Therapeutic Categorization

Medicinal applications were categorized into major ailment groups:

Ailment Category	No. of Species	ICF
Gastrointestinal disorders	42	0.82
Dermatological conditions	31	0.79
Respiratory ailments	26	0.75
Musculoskeletal issues	18	0.72
Febrile conditions	22	0.80

High ICF values for gastrointestinal and febrile disorders indicate strong consensus among informants regarding effective plant use.

4.5 Knowledge Transmission and Cultural Context

Knowledge transmission occurred primarily through oral tradition within families. Elderly informants and traditional healers demonstrated greater species knowledge compared to younger participants. Women managing home gardens possessed extensive knowledge of preventive and household remedies.

Spiritual practices were integrated into medicinal usage. Plants such as Tulsi (*Ocimum sanctum*) were both medicinal and sacred, reinforcing community respect and conservation ethics.

4.6 Conservation Concerns

Field observations revealed declining populations of certain species due to overharvesting and land-use change. Approximately 20 species were identified as vulnerable within local contexts. Sacred groves (*orans*) served as informal conservation zones, preserving biodiversity through religious norms (Gadgil & Vartak, 1976).

Climate variability and desertification trends further threaten medicinal flora. Sustainable harvesting practices and community-based cultivation were recommended to ensure long-term availability.

4.7 Scientific and Pharmacological Implications

Several recorded species possess documented pharmacological properties in broader scientific literature. For example, neem exhibits antimicrobial and anti-inflammatory properties (Heinrich et al., 2009). Ashwagandha is widely studied for adaptogenic effects. The alignment between local knowledge and scientific evidence strengthens the credibility of traditional practices.

However, further phytochemical screening and clinical validation are required to standardize dosages and ensure safety.

5. CONSERVATION AND SUSTAINABILITY

The conservation of medicinal plant diversity in the Shekhawati region is intrinsically linked to both ecological stability and cultural continuity. Although the semi-arid environment of northeastern Rajasthan has historically supported resilient xerophytic vegetation, contemporary pressures have significantly altered plant availability and distribution. Field observations conducted during the present study indicate that several medicinally valuable species have experienced localized decline due to habitat degradation, overharvesting, agricultural expansion, and infrastructural development. Species such as *Cressa cretica*, *Boerhavia diffusa*, and *Tribulus terrestris*, once reported as abundant by elderly informants, were found only in fragmented patches. Such patterns are consistent with broader trends in semi-arid ecosystems, where medicinal plant populations face increasing stress from unsustainable resource extraction and land-use transformation (Hamilton, 2004).

Overharvesting represents one of the most immediate threats to medicinal flora in the region. Traditionally, plant collection was governed by customary ecological ethics that emphasized partial harvesting, seasonal timing, and respect for plant regeneration cycles. However, rising commercial demand for herbal products has altered these patterns. Bulk extraction practices, particularly of roots and bark, reduce regenerative capacity and threaten long-term sustainability. Plants such as *Withania somnifera* and *Aloe vera*, though increasingly cultivated, are still frequently harvested from the wild, often without adherence to sustainable methods. Similar concerns regarding commercialization and biodiversity loss have been documented across other parts of India (Kala & Sajwan, 2007). Without structured community-based regulation, the ecological consequences of such practices may intensify.

Habitat loss due to agricultural intensification and rural development further compounds conservation challenges. Village commons, pasturelands, and scrub forests that once functioned as repositories of medicinal biodiversity are increasingly privatized or converted for cultivation. The decline of traditional sacred groves (*orans*), historically protected through religious and cultural norms, has weakened an important mechanism of in situ conservation (Gadgil & Vartak, 1976). These groves once served as microhabitats supporting diverse plant species, and their gradual erosion signals both ecological and cultural transformation.

Climate variability introduces an additional dimension of vulnerability. The Shekhawati region experiences erratic rainfall patterns and rising temperatures, factors that influence plant phenology, flowering cycles, and seed production. Although many xerophytic species exhibit drought tolerance, prolonged dry spells reduce regeneration capacity and may alter medicinal potency. Ecological stress resulting from climate change is increasingly recognized as a driver of biodiversity decline in semi-arid zones, necessitating adaptive conservation strategies.

Beyond ecological pressures, the erosion of traditional knowledge systems presents a significant sustainability concern. Ethnomedicinal practices in Shekhawati have historically been transmitted orally across generations, primarily through familial and apprenticeship-based learning. However, modernization, migration, and increasing reliance on allopathic medicine have disrupted these transmission pathways. Younger community members often demonstrate limited familiarity with plant identification and preparation techniques, echoing patterns observed in other regions experiencing socio-cultural transformation (Gadgil et al., 1993). The loss of knowledge not only diminishes cultural heritage but also weakens community-based conservation frameworks that depend upon experiential ecological understanding.

Despite these challenges, indigenous conservation practices continue to offer promising foundations for sustainability. Sacred and culturally revered species such as *Azadirachta indica* (Neem) and *Ocimum sanctum* (Tulsi) remain protected within household and religious contexts, reflecting the integration of spiritual belief and ecological stewardship. Women's maintenance of home herbal gardens contributes to ex situ conservation, ensuring availability of commonly used medicinal species. These practices align with principles of community-based natural resource management and highlight the value of integrating traditional ecological knowledge into contemporary conservation models (Berkes, 2009).

Scientific and policy-driven strategies can complement indigenous practices to strengthen sustainability outcomes. In situ conservation initiatives, including revival of sacred groves and participatory biodiversity registers, can facilitate systematic documentation and monitoring of plant populations. Ex situ cultivation of high-demand species through agroforestry systems may reduce pressure on wild stocks. Government programs under the National AYUSH Mission emphasize documentation and conservation of medicinal plants, offering institutional frameworks for integrating local knowledge with national herbal policies (Ministry of AYUSH, 2020). Capacity-building workshops on sustainable harvesting and cultivation techniques could further empower communities to manage resources responsibly.

In essence, conservation of medicinal plants in Shekhawati requires a multidimensional approach that addresses ecological degradation, socio-cultural erosion, and policy integration simultaneously. Sustainability cannot be achieved solely through scientific intervention; it must incorporate community participation, revival of traditional ethics, and adaptive ecological management. The convergence of indigenous knowledge systems and contemporary conservation science offers a viable pathway for preserving both biodiversity and cultural heritage in this semi-arid landscape.

6. CONCLUSION AND RECOMMENDATIONS

The present study provides a comprehensive ethnobotanical documentation and taxonomic analysis of medicinal plants used by rural communities in the Shekhawati region of Rajasthan. By recording over 150 plant species across diverse botanical families and analyzing their therapeutic applications through qualitative and quantitative methods, the research highlights the depth and resilience of traditional healthcare systems in semi-arid environments. High informant consensus regarding treatments for gastrointestinal, dermatological, and febrile disorders demonstrates the reliability and continued relevance of plant-based remedies within local communities.

The findings underscore the central role of traditional healers, elderly knowledge holders, and women in preserving ethnomedicinal practices. Knowledge transmission remains primarily oral and experiential, deeply embedded in household routines and cultural rituals. However, generational gaps and shifting socio-economic dynamics pose significant threats to continuity. As younger populations increasingly migrate or adopt modern biomedical paradigms, the risk of cultural and botanical knowledge loss intensifies.

Ecologically, the study reveals both resilience and fragility within Shekhawati's medicinal flora. Xerophytic adaptations enable survival under harsh climatic conditions, yet habitat degradation, overharvesting, and climate variability threaten long-term sustainability. Sacred groves and household herbal gardens continue to serve as conservation nodes, though their effectiveness depends upon revitalized community engagement and institutional support.

From a scientific perspective, the alignment between local knowledge and pharmacological evidence for several species, including *Azadirachta indica* and *Withania somnifera*, reinforces the credibility of traditional medicine (Heinrich et al., 2009). Quantitative indices such as Use Value and Informant Consensus Factor provide empirical grounding for prioritizing species for further phytochemical research. Nevertheless, laboratory validation, toxicity assessments, and dosage standardization remain essential for integrating ethnomedicinal practices into broader healthcare frameworks.

Moving forward, a collaborative and interdisciplinary approach is recommended. Community herbal gardens and nursery programs can promote ex situ conservation while generating livelihood opportunities. Revitalization of sacred groves as legally recognized biodiversity heritage sites may strengthen in situ protection mechanisms. Educational initiatives incorporating ethnobotanical knowledge into local curricula could foster youth engagement and intergenerational continuity. Furthermore, digital documentation platforms and participatory biodiversity registers may safeguard knowledge against permanent loss.

Integration of traditional healers within primary healthcare systems under national AYUSH frameworks presents another promising avenue. Such collaboration can enhance culturally appropriate healthcare delivery while ensuring regulatory oversight and safety standards. Longitudinal ecological monitoring and comparative regional studies would deepen understanding of medicinal plant dynamics under climate stress and socio-economic transformation.

In conclusion, the medicinal plant heritage of Shekhawati represents not merely a repository of therapeutic resources but a living expression of ecological wisdom and cultural identity. Its preservation demands recognition of the intertwined relationships between biodiversity, community knowledge, and sustainable development. By bridging ethnobotanical documentation with conservation strategies and policy integration, this study contributes to safeguarding a vital component of India's biocultural legacy.

REFERENCES:
1. Bhandari, M. M. (1990). *Flora of the Indian desert*. Scientific Publishers.
2. Cotton, C. M. (1996). *Ethnobotany: Principles and applications*. John Wiley & Sons.
3. Gadgil, M., & Vartak, V. D. (1976). Sacred groves of India: A plea for continued conservation. *Journal of the Bombay Natural History Society, 72*(2), 314–320.
4. Gadgil, M., Berkes, F., & Folke, C. (1993). Indigenous knowledge for biodiversity conservation. *Ambio, 22*(2–3), 151–156.
5. Hamilton, A. C. (2004). Medicinal plants, conservation and livelihoods. *Biodiversity and Conservation, 13*(8), 1477–1517. https://doi.org/10.1023/B:BIOC.0000021333.23413.42

6. Heinrich, M., Edwards, S., Moerman, D. E., & Leonti, M. (2009). Ethnopharmacological field studies: A critical assessment of their conceptual basis and methods. *Journal of Ethnopharmacology, 124*(1), 1–17. https://doi.org/10.1016/j.jep.2009.03.043

7. Jain, S. K. (1991). *Dictionary of Indian folk medicine and ethnobotany*. Deep Publications.

8. Kala, C. P. (2005). Indigenous uses and structure of chir pine forest in Uttaranchal Himalaya, India. *International Journal of Sustainable Development & World Ecology, 12*(2), 205–210. https://doi.org/10.1080/13504500509469628

9. Kala, C. P., & Sajwan, B. S. (2007). Revitalizing traditional herbal therapy in India. *Journal of Ethnobiology and Ethnomedicine, 3*(1), 1–8. https://doi.org/10.1186/1746-4269-3-1

10. Kumar, M., & Lalramnghinglova, H. (2016). Ethnomedicinal plants used by indigenous communities in India: A review. *Journal of Ethnopharmacology, 188*, 1–17. https://doi.org/10.1016/j.jep.2016.04.019

11. Martin, G. J. (2004). *Ethnobotany: A methods manual*. Earthscan.

12. Ministry of AYUSH. (2020). *National AYUSH mission guidelines*. Government of India.

13. Phillips, O., & Gentry, A. H. (1993). The useful plants of Tambopata, Peru: I. Statistical hypotheses tests with a new quantitative technique. *Economic Botany, 47*(1), 15–32. https://doi.org/10.1007/BF02862203

14. Rao, K. S., & Singh, V. (2015). Rural healthcare access and traditional medicine use in Rajasthan. *Indian Journal of Public Health Research & Development, 6*(3), 45–51.

15. Sharma, R., & Khandelwal, S. (2014). Floristic diversity of semi-arid Rajasthan. *International Journal of Plant Sciences, 9*(2), 210–217.

16. Sharma, R., Sharma, P., & Tiagi, B. (2012). Ethnobotanical survey of medicinal plants in Rajasthan. *Indian Journal of Traditional Knowledge, 11*(3), 475–480.

17. Sharma, S., & Tiagi, B. (2011). Ecological features of northeastern Rajasthan. *Rajasthan Journal of Environmental Studies, 5*(1), 33–41.

18. UNESCO. (2017). *Safeguarding intangible cultural heritage*. United Nations Educational, Scientific and Cultural Organization.

19. World Health Organization. (2013). *WHO traditional medicine strategy 2014–2023*. WHO Press.

20. Berkes, F. (2009). Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management, 90*(5), 1692–1702. https://doi.org/10.1016/j.jenvman.2008.12.001

21. Bhandari, M. M. (1990). *Flora of the Indian desert*. Scientific Publishers.

22. Gadgil, M., & Vartak, V. D. (1976). Sacred groves of India: A plea for continued conservation. *Journal of the Bombay Natural History Society, 72*(2), 314–320.

23. Gadgil, M., Berkes, F., & Folke, C. (1993). Indigenous knowledge for biodiversity conservation. *Ambio, 22*(2–3), 151–156.

24. Hamilton, A. C. (2004). Medicinal plants, conservation and livelihoods. *Biodiversity and Conservation, 13*(8), 1477–1517. https://doi.org/10.1023/B:BIOC.0000021333.23413.42

25. Heinrich, M., Edwards, S., Moerman, D. E., & Leonti, M. (2009). Ethnopharmacological field studies: A critical assessment of their conceptual basis and methods. *Journal of Ethnopharmacology, 124*(1), 1–17. https://doi.org/10.1016/j.jep.2009.03.043

26. Kala, C. P., & Sajwan, B. S. (2007). Revitalizing traditional herbal therapy in India. *Journal of Ethnobiology and Ethnomedicine, 3*(1), 1–8. https://doi.org/10.1186/1746-4269-3-1

27. Ministry of AYUSH. (2020). *National AYUSH mission guidelines*. Government of India.

28. Sharma, R., Sharma, P., & Tiagi, B. (2012). Ethnobotanical survey of medicinal plants in Rajasthan. *Indian Journal of Traditional Knowledge, 11*(3), 475–480.

29. World Health Organization. (2013). *WHO traditional medicine strategy 2014–2023*. WHO Press.