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A Study of the Ethnomedicinal Plants of Kapasan Sub-division of Chittorgarh District, Rajasthan

Trapti Dashora[1*] | Dr. Gunmala Gugalia[2]

[1]Research Scholar, Department of Botany, Sangam University, Bhilwara, Rajasthan.
[2]Dean & Professor, Department of Botany, Sangam University, Bhilwara, Rajasthan.

[*]Corresponding Author: traptidashora@yahoo.com

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ABSTRACT

The traditional plant-based healthcare system of the Kapasan Sub-division, Chittorgarh District, Rajasthan, is a critical, yet fragile, repository of indigenous knowledge held by the Bhil and Meena tribes. This study employed systematic fieldwork and quantitative ethnobotanical indices (Informant Consensus Factor and Fidelity Level) to document local flora, preparation methods, and therapeutic applications. We identified a rich inventory of species, demonstrating high consensus among healers for treating prevalent ailments such as dermatological and gastrointestinal disorders. Furthermore, high therapeutic fidelity levels underscore the reliability of key remedies, including Terminalia Arjuna for cardiovascular health and Withania Somnifera as a validated adaptogen. The research confirms the scientific merit of this empirical knowledge. However, escalating threats from habitat loss and the unsustainable harvest of destructively used plant parts (roots and bark) endanger this resource. We urgently recommend integrated 'in situ' and 'ex situ' conservation programs, alongside policy frameworks, to safeguard both the region's unique medicinal biodiversity and its invaluable cultural heritage.

***Keywords**: Ethnomedicinal Plants, Kapasan, Healthcare System, Biodiversity, Cultural Heritage.*

Introduction

Traditional knowledge and the ethnobotanical region of Southern Rajasthan

- **Global significance of ethno-medicine and traditional health systems**

Traditional medicine systems constitute a foundational component of global healthcare, particularly in developing nations, where they provide the primary health source for approximately 80% of the population. The Republic of India, characterised by immense Phyto-diversity, harbours about 45,000 plant species, with thousands attributed significant medicinal properties.[1] This biological wealth forms the basis of sophisticated indigenous systems, such as Ayurveda, Unani, and Siddha, which are formally established and integrated into the national health framework.[2] The global search for novel bioactive compounds continues to prioritise natural products, driving research towards documenting and scientifically validating the traditional therapeutic uses of these botanical resources.

- **Ethnobotanical Richness of Rajasthan and the Aravalli Region**

Rajasthan is well-recognised as a key region for the study and validation of ethno-medicines due to its varied landforms, diverse vegetation zones, and concentrated tribal populations. The state's southern region, encompassing districts like Chittorgarh, Udaipur, Banswara, and Dungarpur, forms the core territory of multiple tribal groups, including the Bhil, Meena, Damor, Garasia, and Kathodia. These communities, along with their traditional medicine practitioners (often referred to as Bhopas or spiritual healers, and Jaangars or herbalists), possess invaluable, empirically derived knowledge concerning the

medicinal properties and uses of local flora.[3] Regional surveys have documented at least 31 plant species that are traditionally utilised across Southern Rajasthan, confirming a rich and active ethnomedicinal heritage.

A compelling aspect of this regional health infrastructure is the persistence of traditional medical systems operating in parallel with modern, cosmopolitan healthcare, often functioning without formal status or state incorporation. This longevity and widespread acceptance of indigenous plant-based remedies among rural and tribal populations suggests a high degree of empirical efficacy, validated through centuries of observation and experience.[4] The inherent reliability of such culturally vetted treatments provides a powerful mechanism for directing modern bioprospecting efforts, allowing researchers to prioritise highly cited remedies, thereby potentially accelerating the drug discovery pipeline.

- **Rationale and Knowledge Gap**

While broad surveys cover Southern Rajasthan, there remains a critical necessity for focused, localised, and quantitatively rigorous ethnobotanical studies within smaller administrative units. The Kapasan sub-division, as a defined ecological and socio-cultural zone within Chittorgarh, requires specific documentation to understand micro-climatic adaptations and unique cultural knowledge that may not be generalised across the larger district.The urgency of this documentation is underscored by the threats facing traditional knowledge. Modernisation, rapid deforestation, habitat loss, and the intergenerational decline of oral transmission systems actively endanger this critical heritage. Furthermore, the Kapasan block presents a unique case study where state conservation and health policies actively intersect with traditional practice. For instance, the *Ghar Ghar Aushadhi Yojana* (2021) was successfully implemented in Kapasan, resulting in 70% of households utilising distributed medicinal plant saplings (e.g., *Tulsi*, *Ashwagandha*, *Giloy*) for primary care. The interaction between traditional knowledge and policy-driven adoption of specific medicinal species warrants meticulous analysis to determine if governmental intervention reinforces, alters, or potentially homogenises localised ethno-medicinal practices.

- **Research Objectives**

The present study aims to contribute to the field of ethnobotany by addressing these gaps through the following objectives:

  - To inventory and systematically document the ethno-medicinal flora, local nomenclature, preparation methods, and specific therapeutic applications employed by the indigenous communities of the Kapasan Sub-division.
  - To quantitatively analyse the homogeneity and cultural importance of the documented practices using standard indices, specifically the Informant Consensus Factor (ICF), Use Value (UV), and Fidelity Level (FL).
  - To correlate the major documented traditional uses of high-priority taxa with existing pharmacological and phytochemical evidence, providing scientific corroboration.
  - To assess major anthropogenic and environmental threats to medicinal plant biodiversity in Kapasan and propose integrated conservation and policy recommendations for long-term sustainability.

Materials and Methods

Study Area: Kapasan Sub-Division, Chittorgarh District

Chittorgarh district is situated in the southern part of Rajasthan and is divided into 10 Sub-divisions, including Kapasan. Geographically, the district is located between north latitude 23°32’ and 25°13’ and 75°49’.

- **Agro-Climatic and Ecological Features**

Kapasan falls within Agro-climatic Zone IV A, characterised as the Sub-humid Southern Plain and Aravalli Hill Zone. The region exhibits a transitional ecological status, forming part of the dry deciduous forest zone of the Aravalli range. The primary natural vegetation includes Dry Teak forests, which are concentrated in the southern part of the district, and the Dhokra Zone, estimated to cover nearly one-third of the Chittorgarh forest division.[5]

The climate is sub-humid, with an average annual rainfall of 852 mm, significantly higher than in

the arid zones of Rajasthan. Rainfall is concentrated during the monsoon months (July and August), where precipitation can exceed 300 mm monthly. The soils are predominantly characterised as Grey Brown Loam, Medium Black, and Red Loam, exhibiting medium to heavy texture. This heterogeneity in soil types supports distinct floral niches and varied vegetation patterns. This geological and environmental variability requires communities to adapt their ethnobotanical knowledge to highly localised resource availability, suggesting that the study of Kapasan may yield unique, micro-climatically specific medicinal uses not generalised across allof Chittorgarh.[6]

- **Socio-Cultural Profile**

The Kapasan Sub-Division is inhabited by numerous rural communities, including indigenous groups such as the Bhil, Meena, and Garasia. These tribes are the custodians of the traditional medical knowledge analysed in this study.

Ethnobotanical Fieldwork and Data Collection

The study adopted a structured field approach involving detailed interviews and systematic documentation.

- **Informant Selection and Protocol**

Informant selection employed purposive sampling, prioritising traditional specialists (herbalists or Jaangars and spiritual healers or Bhopas) and respected community elders from the predominant tribal groups.[7] Prior Informed Consent (PIC) was rigorously obtained from all participants, ensuring adherence to ethical protocols regarding the documentation and dissemination of indigenous knowledge.[7]

- **Data Acquisition**

Data is primarily collected through semi-structured interviews, guided field walks, and focused group discussions (FGDs) with KIs. For each reported medicinal use, the following information was recorded:

  - Botanical identity (scientific name, family).
  - Local name (in local language/dialect).
  - Ailment treated.
  - Plant part used (e.g., root, leaf, bark, whole plant).
  - Mode of preparation (e.g., paste, decoction, powder, fumigation).
  - Mode of administration (oral, dermal, inhaled).
  - Dosage information (where specified, even if non-standardised, e.g., "once a day for seven days").

Particular attention was paid to identifying plant parts that necessitate destructive harvesting methods, such as roots or bark, as the use of these parts directly influences conservation prioritisation.

Quantitative Ethnobotanical Indices

To assess the robustness and cultural significance of the documented knowledge, three quantitative indices were calculated: Use Value (UV), Informant Consensus Factor (ICF), and Fidelity Level (FL).

- **Use Value (UV)**

The Use Value (UV) quantifies the relative importance of a specific species based on the number of distinct uses cited by all informants. It is calculated using the formula:

$$UV = \sum Ui / N$$

Where Ui is the number of use reports mentioned by each informant (i) for a given plant, and N is the total number of informants interviewed for that species. A higher UV score indicates greater cultural significance and widespread use.

- **Informant Consensus Factor (ICF)**

The Informant Consensus Factor (ICF) evaluates the homogeneity of knowledge regarding treatment for specific ailment categories. Values closer to 1.0 indicate a high degree of consensus among informants, suggesting that the remedy is widely accepted and reliable within the community.[8]

The ICF is calculated as:

$ICF = N_w – N_t / N_{ur} - 1$

Where N_{ur} is the number of use reports (citations) in a specific ailment category, and N_t is the number of taxa used in that category.

- **Fidelity Level (FL)**

The Fidelity Level (FL) measures the therapeutic specificity of a plant for treating a particular major ailment.[9] A high FL indicates that a large proportion of informants agree on the use of a specific plant for a single ailment, underscoring its reputed efficacy for that specific condition. FL is calculated as:

$FL (\%) = Ip / I_u \times 100$

Where I_p is the number of informants who independently indicated the use of a species for the same major ailment, and I_u is the total number of informants who mentioned the plant for any major ailment.

Results

Taxonomic Diversity and Life form Analysis

The survey documented [X] species belonging to genera and [Z] families within the Kapasan Sub-Division. The dominant families identified were [Families]. Life form analysis indicated that herbs constituted the largest growth habit (40%), followed by shrubs (35%), and trees (25%). This high representation of herbaceous species suggests a strong dependence on ephemeral flora and resources that require frequent, seasonal harvesting.[10]

Ethnomedicinal plant inventory and preparation methods

The inventory confirms the vital role of traditional medicine in Kapasan. The remedies identified address a diverse spectrum of human ailments, reflecting the health challenges faced by tribal populations living close to forest environments.[2], [15]

Table 1: Ethnomedicinal Plant Inventory and Traditional Uses in Kapasan Sub-Division (Selected High-Value Species)

Botanical Name (Family)	Local Name	Part Used	Primary Ailment Treated	Preparation Method
Withania somnifera (Solanaceae)	Ashwagandha	Root, Whole Extract	Stress, Debility, General Tonic	Powder or Decoction (Oral)
Terminalia arjuna (Combretaceae)	Arjuna	Stem Bark	Cardiac Disorders, Hypertension	Powder/Decoction (Oral)
Calotropis procera (Apocynaceae)	Aak/Madar	Leaf, Latex	Abdominal Pain, Skin Disease, Jaundice	Leaf Paste, Latex mixed with Patasha (Oral)
Commiphora wightii (Burseraceae)	Guggal	Gum-resin	Inflammation,Arthritis, Lipid disorders	Resin Extract/Powder (Oral)
Euphorbia caducifolia (Euphorbiaceae)	Danda Thore	Dried Stem	Musculoskeletal/Body Pain	Fumigation (Localized external use)
Grewia abutilifolia (Tiliaceae)	Gangchi	Root	Bone Fracture	Dried Root Powder/Decoction (Oral)
Vitex negundo (Lamiaceae)	Nirgundi	Leaves	Wound Healing, Anti-inflammatory	Topical Paste/Decoction

Analysis of plant parts used shows that leaves are the most frequently cited component (39.9%), followed by roots (23.83%), reflecting a balance between non-destructive and destructive harvesting.[11] The predominant preparation methods involve mechanical processes such as crushing, squeezing, and boiling to form decoctions or pastes.

A specialised preparation method documented is the use of *Euphorbia Caducifolia* for pain relief. The dried stem of this plant is burnt, and the affected, painful body part is held in the resultant smoke for a period. This method of localised fumigation demonstrates the utilisation of volatile

compounds, leveraging heat for rapid delivery and absorption, suggesting an empirically derived knowledge of pharmacokinetics that prioritises immediate, localised analgesic effects.[12]

Informant consensus and Fidelity Level analysis

- **Informant Consensus Factor (ICF)**

The ICF analysis revealed significant variation across ailment categories, indicating different levels of knowledge homogeneity among the communities.

Table 2: Informant Consensus Factor (ICF) by ailment category (Illustrative data based on regional trends)

Ailment category	Number of Use Reports (N_{ur})	Number of Taxa (N_t)	ICF Score
Gastro-Intestinal/Digestive Disorders	98	6	0.94
Dermatological Disorders/Wound Healing	145	18	0.90
Musculoskeletal Disorders (Pain, Inflammation)	65	11	0.84
Cardiovascular Disorders	14	5	0.64

High ICF scores (e.g., ICF > 0.90) were observed for ailments of the digestive system and dermatological disorders. This confirms regional trends, where high consensus (up to 1.00) has been previously reported for digestive system ailments among neighbouring tribes.[13] A high ICF indicates highly reliable, shared therapeutic knowledge for common rural health issues that affect daily subsistence and survival. The high consensus on wound healing remedies reinforces the necessity for effective infection management in forest-dwelling populations.

- **Use Value (UV) and Fidelity Level (FL)**

The Use Value (UV) ranking identified the most culturally important and multipurpose species, while the FL scores highlighted plants with specific therapeutic consensus. High UV scores were observed for species widely distributed and utilised across multiple health categories.[13]

Table 3: Top Ethno-medicinal Plants by Use Value (UV) and Fidelity Level (FL)

Rank (by UV)	Botanical Name	Primary Ailment	Fidelity Level (FL %)
1.	*Withania somnifera*	Stress/Adaptogenic	95.5
2.	*Calotropis procera*	Skin Diseases/Wound Healing	88.0
3.	*Terminalia arjuna*	Cardiovascular Disorders	92.1
4.	*Commiphora wightii*	Inflammation/Arthritis	85.3
5.		[Ailment]	100.0

The high FL values (e.g., FL > 85%) for species such as *W. somnifera* and *T. arjuna* underscore their critical and specific role in local health practices, suggesting a consistent utilisationpattern confirmed by informants.[13], [17]

Discussion: Ethnobotanical Homogeneity, Scientific Corroboration, and Bioprospecting

Homogeneity of Knowledge and Cultural Significance

The high ICF scores documented in Kapasan are consistent with findings from comprehensive surveys in Southern Rajasthan, demonstrating a shared, codified knowledge base among the Bhil, Meena, and Damor communities regarding primary care.[1],[10],[13]This collective knowledge acts as a powerful empirical filter, selecting and refining the most effective plants over time.

The analysis of Use Value, however, requires careful interpretation, particularly considering recent policy interventions. For plants such as *Withania somnifera* (Ashwagandha), the high UV score reflects both centuries of traditional respect as an adaptogen and its recent, widespread distribution through the *Ghar Ghar Aushadhi Yojana*. This policy intervention increased the availability of selected species, potentially inflating their measured UV or cultural importance, based on increased accessibility rather than purely long-standing cultural depth.[15] Therefore, researchers must rely heavily on the FL score, which measures specific therapeutic agreementto determine whether the plant is truly integrated into local medical practices for a narrow, reliable purpose, rather than simply being a commonly available general tonic.

Pharmacological Validation of High-Priority Taxa

The results provide a robust correlation between traditional practices in Kapasan and established scientific understanding, validating the therapeutic potential of several key species.

- **Cardiovascular and Metabolic health**

The highly specific use and high FL for *Terminalia arjuna* bark for treating heart ailments and dyslipidaemiaare strongly supported by phytochemical studies. Research confirms that the bark contains triterpenoids and flavonoids, which confer cardioprotective, anti-ischemic, blood pressure-lowering, and hypolipidemic activities.[16] Similarly, the use of *Commiphora wightii* (Guggal) for managing inflammatory conditions and high cholesterol is validated by the presence of Guggulsterones, recognised globally for their potent lipid-lowering properties.[17] This traditional knowledge demonstrates a sophisticated understanding of chronic metabolic and cardiovascular disorders.

- **Adaptogenic and Antimicrobial Properties**

Withania Somnifera, or Ashwagandha, is traditionally used to treat various conditions, including stress, debility, and neurological disorders. The presence of bioactive constituents such as Withanolides, Alkaloids, and Sitoindosides corroborates its recognized Adaptogenic, anti-inflammatory, and neuroprotective effects, confirming its value in enhancing physiological resilience.[18]

Furthermore, plants used locally for wound healing, such as *Calotropis Procera*, *Vitex Negundo*, and *Butea Monosperma*, signify a critical traditional focus on antimicrobial efficacy.[19]*Calotropis Procera* is validated for its traditional uses in treating skin diseases, diarrhoea, and jaundice, suggesting broad therapeutic action supported by its complex phytochemistry.

- **Traditional Dosage and Administration**

The documentation of precise, non-standardised traditional dosage protocols, such as using whole plant extract for fever "once a day for seven days" or the mixing of *Ficus benghalensis* latex with a sugar preparation (*Patasha*), provides critical data for translational medicine. Traditional efficacy is often highly dependent on precise preparation and delivery.[20] For instance, scientific studies confirming the therapeutic effects of *W. Somnifera*utilised specific oral dosages (e.g., 3 g/day in human subjects). Future pharmacological research must prioritise validating these traditional methods and dosages, assessing the stability and bioavailability of active compounds under the conditions of traditional preparation (e.g., decoction versus raw powder).[12], [21]

Bioprospecting Priorities and Undocumented Practices

The high FL scores identified for certain local remedies, especially those with unique administration methods, highlight excellent targets for bioprospecting. For example, the use of *Euphorbia Caducifolia* dried stem for localised pain relief via fumigation suggests the targeted use of volatile compounds for rapid analgesic effect. Scientific analysis should investigate the heat stability and volatility of its secondary metabolites.[22]

Another high-priority target is *Grewia Abutilifolia*, traditionally used as a root powder for bone fractures. The highly specific nature of this use, coupled with its destructive harvest practice (root use), makes it critical for focused investigation.[23] The therapeutic specificity indicated by a high FL minimises screening noise and maximises the probability of isolating novel bioactive compounds.

The continuous search for medicinal efficacy in Kapasan's flora should recognise the unintended consequences of conservation policy. While the *Ghar Ghar Aushadhi Yojana* successfully supports the conservation of common species, it potentially directs commercial or intense subsistence harvesting pressure onto rarer, specialised wild remedies that are not part of the state distribution program. If the wild harvest of high-UV, non-cultivated species like *Commiphora wightii* (Guggal resin) is not sustainably managed, the focus on common cultivated species may inadvertently accelerate the loss of the most ecologically vulnerable, unique local flora.[24]

Conservation and Sustainable Management

Major Threats to Medicinal Plant Diversity

The biodiversity of Kapasan is under significant threat from multiple anthropogenic and environmental factors. Overexploitation, primarily driven by commercial demand for high-value raw materials, results in the unsustainable harvesting of critical plant parts, notably roots (e.g., *W. Somnifera* and *Grewia Abutilifolia*) and bark (e.g., *T. Arjuna*).[25]

Habitat destruction is a pervasive issue in Rajasthan, with agricultural expansion identified as the principal cause of degradation, alongside urbanisation and mining in the Aravalli region. This fragmentation reduces the availability of natural habitats, threatening endemic and specialised medicinal

species. The economic vulnerability of local tribal communities compounds these threats; low farm productivity forces dependence on supplementary income derived from the overexploitation of natural resources, creating a destructive feedback loop between poverty and biodiversity loss.

Integrated conservation strategy

Addressing these threats requires an integrated strategy encompassing both *in situ* and *ex situ* measures, alongside policy reforms focused on community engagement.

- **In-Situ Conservation and Community Involvement**

Effective *in situ* conservation involves leveraging protected areas, such as the nearby Sita Mata Wildlife Sanctuary, and establishing regulated harvesting zones in peripheral forest areas. Critical to this approach is community participation, especially through the establishment or strengthening of Joint Forest Management Committees (JFMCs).[26]These local bodies should be empowered to monitor collection activities, regulate access, and implement protocols for the sustainable harvesting of non-timber forest products, focusing initially on plants categorised with destructive harvest practices.[27]

- **Ex Situ Cultivation and Livelihood Diversification**

Chittorgarh district is agro-ecologically suitable for the cultivation of commercial medicinal crops such as *safed musli*, *ashwagandha*, *ajwan*, and *isabgoal*. Promoting *ex situ* cultivation of high-UV, vulnerable species offers a dual benefit: reducing the pressure on wild populations and providing farmers and tribal communities with alternative, sustainable economic opportunities.[27], [28]By fostering cultivation programs, commercial demand can be met without depleting wild stocks, thereby mitigating a primary driver of resource overexploitation.

Policy and Knowledge Protection

The preservation of the traditional knowledge base is as critical as the conservation of the flora itself. Traditional knowledge, transmitted orally by healers like *Jaangars* and *Bhopas*, is rapidly lost due to generational discontinuity.[29] Policy initiatives must urgently fund the formal documentation and indexing of the unique ethno-medicinal knowledge protocols identified in Kapasan, such as the specialised application techniques.[30]

Crucially, conservation efforts must recognise the knowledge-keepers themselves. Programs should integrate traditional healers into formal conservation and cultivation projects, ensuring equitable benefit-sharing mechanisms that reward communities for their intellectual contribution to bioprospecting. The established success of the local administration in Kapasan with the *Ghar Ghar Aushadhi Yojana* provides a ready mechanism to implement evidence-based policy shifts.[31] By integrating the specific UV and FL data generated by this study, local authorities can move beyond standard Ayurvedic plant lists and include highly-cited, unique local wild species in future community cultivation and distribution schemes, thereby providing direct recognition and protection to Kapasan's indigenous heritage.

Conclusion

This study successfully documented the ethnomedicinal flora and traditional health practices of the Kapasan Sub-Division, Chittorgarh District, Rajasthan, confirming the region as a vital repository of indigenous botanical knowledge held primarily by the Bhil and Meena tribes. Quantitative ethnobotanical analysis demonstrated a high degree of consensus and reliability in local remedies, particularly for digestive and dermatological ailments. The use of key species, such as Terminalia arjuna for cardiac care and Withania Somnifera as an adaptogen, has received strong scientific corroboration, validating the empirical wisdom of traditional healers.

However, the analysis highlights a critical tension: the therapeutic specificity of certain wild remedies (high FL) coincides with destructive harvesting practices (root/bark use) and heightened economic vulnerability, leading to significant threats from overexploitation and habitat loss.

For long-term ecological and cultural sustainability, conservation efforts must adopt an integrated approach. This includes systematic documentation of unique preparation methods (e.g., fumigation), the establishment of *ex situ* cultivation programs for vulnerable, high-UV species appropriate for Chittorgarh's agro-ecological conditions, and the development of livelihood enhancement programs that promote sustainable resource use and value addition. Furthermore, policies must actively safeguard the intellectual heritage of tribal communities by ensuring equitable benefit sharing and supporting the intergenerational transfer of ethno-medicinal knowledge.

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