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Ethnomedicinal Plants of India: Advances in Traditional Knowledge, Ethnopharmacology, Therapeutic Validation and Conservation - A Comprehensive Review (2010-2026)

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Abstract

India's medicinal-plant traditions represent a large and dynamic interface between indigenous knowledge, biodiversity, pharmacology and healthcare. This review critically synthesizes selected peer-reviewed and institutional literature published from 2010 through 2026, with emphasis on Indian ethnomedicinal surveys, quantitative ethnobotany, pharmacological validation, conservation, botanical authentication and emerging research priorities. The period begins with influential quantitative field studies that used informant consensus, use-value and related indices to move beyond purely descriptive inventories, and extends to contemporary systematic reviews integrating phytochemistry, safety, quality control, conservation and evidence translation. Across the literature, leaves are repeatedly prominent in remedy preparation, while gastrointestinal, dermatological, respiratory, metabolic, wound-care and inflammatory indications recur across regions. At the same time, the evidence base remains uneven: traditional-use documentation is abundant, but botanical authentication, standardized extracts, toxicology, mechanistic work and clinical validation are much less consistent. Conservation concerns have intensified because habitat loss, climate stress, destructive harvesting and market demand affect medicinal-plant populations. The review argues for a next-generation framework that links community-led documentation with voucher-backed taxonomy, quantitative ethnobotany, reproducible pharmacology, safety assessment, sustainable cultivation, digital repositories and equitable benefit sharing. Rather than treating ethnomedicine as either folklore or proof of efficacy, the 2010-2026 literature supports its use as a structured source of hypotheses, conservation priorities and culturally grounded healthcare knowledge.

Keywords: Ethnomedicine; ethnobotany; medicinal plants; India; traditional knowledge; ethnopharmacology; phytochemistry; conservation; quantitative ethnobotany; 2010-2026.

Introduction

India combines exceptional biological diversity with long-standing systems of plant-based healthcare. Ayurveda, Siddha, Unani, Sowa-Rigpa, folk medicine and numerous community-specific traditions draw on medicinal plants, but the scientific literature differs greatly in the strength of evidence supporting individual uses. Ethnobotanical research provides the first bridge between community knowledge and formal scientific investigation by recording plant identity, parts used, preparation, administration, indications and cultural context.

The period 2010-2026 is particularly informative because it captures a methodological transition. In 2010, a large Eastern Rajasthan survey documented 213 medicinal species through interviews with 844 villagers and used informant-consensus approaches, illustrating the move toward quantitative analysis (Upadhyay et al., 2010). Studies in Tamil Nadu soon applied consensus metrics and structured interviews among traditional healers

(Ragupathy et al., 2011; Ayyanar and Ignacimuthu, 2011). Subsequent work expanded the use of use value, relative frequency of citation, fidelity level, informant consensus factor and cross-cultural comparison (Bhatia et al., 2014; Yabesh et al., 2014;

Prabhu et al., 2014).

By the middle of the review period, conservation and domestication became increasingly prominent. A National Medicinal Plants Board review described habitat loss, biotic and abiotic disturbance and unsustainable harvesting as major threats and summarized in-situ, ex-situ and cultivation initiatives for threatened Indian medicinal plants (Negi et al., 2015). Parallel ethnomedicinal studies continued to identify culturally important species and therapeutic domains, including cardiometabolic disorders and region-specific healthcare practices (Sivasankari et al., 2016).

From 2020 onward, the literature increasingly connected ethnobotanical documentation with phytochemistry, pharmacology, meta-analysis, clinical relevance and quality control. Reviews of Hemidesmus indicus, ethnodermatology and selected Indian medicinal plants illustrate this broader evidence-oriented approach (Das et al., 2020; Sarkar et al., 2022; Anmol et al., 2024). Recent 2025-2026 publications extend this trajectory toward botanical repositories, authentication, large-scale synthesis of ethno-dietary plants, wound-healing inventories and integrated conservation frameworks (Sharma et al., 2025; Venigalla et al., 2026; Das et al., 2026).

The objective of this article is therefore not to compile an indiscriminate list of medicinal species, but to review how Indian ethnomedicinal research evolved between 2010 and 2026, identify recurring methodological and biological patterns, distinguish traditional-use evidence from experimental validation, and propose priorities for future research and conservation.

Review Approach

This narrative review focuses on literature published from 2010 through 2026 concerning ethnomedicinal plants in India. Priority was given to peer-reviewed field studies, quantitative ethnobotanical analyses, systematic or integrative reviews, pharmacological syntheses and institutional conservation literature. Search concepts included combinations of India, ethnobotany, ethnomedicine, medicinal plants, traditional healers, quantitative ethnobotany, pharmacology, phytochemistry, conservation, authentication, quality control and systematic review. Foundational studies before 2010 were used only where necessary to explain concepts. The review is thematic rather than a PRISMA systematic review; therefore, it does not claim exhaustive capture of every publication from the period.

To avoid a common weakness in narrative reviews, this article distinguishes three evidence layers: (1) community-reported traditional use; (2) preclinical evidence such as phytochemical, in-vitro or animal studies; and (3) human clinical evidence. A traditional-use report is treated as culturally and scientifically valuable evidence of use, but not as proof of efficacy or safety.

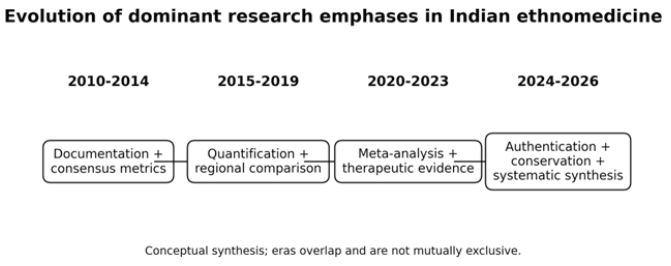

Figure 1. Conceptual evolution of dominant research emphases in Indian ethnomedicinal research during 2010-2026. The periods overlap; the figure summarizes broad trends rather than exclusive phases.

The 2010-2014 Phase: From Inventories to Quantitative Ethnobotany

The early years of the review period show a clear effort to strengthen ethnobotany with quantitative measures. Upadhyay et al. (2010) documented 213 medicinal species in Eastern Rajasthan and calculated informant consensus factor, demonstrating how large community datasets could be analyzed beyond simple species lists. Ragupathy et al. (2011) used prior informed consent and consensus-based analysis among 80 traditional healers in Tamil Nadu, while Ayyanar and Ignacimuthu (2011) quantitatively documented medicinal plants among Kani communities of the Western Ghats.

This methodological shift mattered because high agreement among independent informants can help prioritize culturally important remedies for further investigation. However, consensus is not equivalent to efficacy: repeated use may reflect accessibility, tradition, cultural preference or lack of alternatives. Quantitative indices are therefore most useful as prioritization tools rather than pharmacological endpoints.

Bhatia et al. (2014) reported 166 medicinal flowering-plant species used in Udhampur, Jammu and Kashmir, and analyzed the data using use value, informant consensus and fidelity level. Cross-cultural analysis of Jammu, Kashmir and Ladakh in the same period demonstrated the value of comparing knowledge across culturally and ecologically distinct regions (Bhatia et al., 2014; Kala et al., 2014). These approaches helped establish a stronger analytical foundation for later Indian ethnomedicinal research.

The 2015-2019 Phase: Conservation, Specialization and Regional Comparison

By 2015, conservation concerns had become inseparable from ethnomedicinal documentation. Negi et al. (2015) reviewed Indian programs for threatened medicinal plants and emphasized habitat loss, unsustainable harvesting and the need for cultivation, medicinal-plant conservation areas and herbal gardens. This period also saw increasingly specialized surveys. Quantitative work in the Nelliyampathy hills of Kerala documented 85 medicinal plants and applied frequency citation, relative frequency of citation, use value and correlation analysis (Prabhu et al., 2014).

Disease-focused ethnomedicine also became more visible. Sivasankari et al. (2016) documented medicinal plants prescribed for cardiometabolic diseases by non-institutionally trained Siddha practitioners in Tamil Nadu. Such focused studies can improve pharmacological prioritization because they connect plant selection with a narrower therapeutic domain, but they also require careful attention to diagnosis, preparation, dose and potential herb-drug interactions.

A broader 2018 review of traditional medicinal practices in the Indian subcontinent discussed Ayurveda, Unani, Siddha, Sowa-Rigpa and commonly used plants such as neem, tulsi, amla, turmeric and guggul, while stressing that many traditional practices still lacked rigorous systematic study (Gilca et al., 2018). This observation remains relevant in 2026.

The 2020-2023 Phase: Linking Traditional Use with Pharmacology

The 2020-2023 literature increasingly attempted to connect ethnomedicinal use with phytochemistry and pharmacological

evidence. Das et al. (2020) reviewed Hemidesmus indicus across ethnobotany, phytochemistry and pharmacology, illustrating the species-focused integrative model. A broader review of selected Indian medicinal plants summarized morphology, phytochemicals, traditional applications and experimental pharmacology across multiple species (Kumar et al., 2021).

Ethnodermatology provides a particularly instructive example. Sarkar et al. (2022) reviewed 178 articles and identified 119 plant-use records for 39 skin conditions in India, while comparing traditional applications with preclinical and clinical evidence. The authors emphasized that clinical relevance remained incompletely established for many uses. This is a general lesson for ethnomedicine: abundant traditional reports and promising laboratory activity do not automatically translate into safe, effective clinical interventions.

Meta-analytic and repository approaches also expanded. A meta-analysis of ethnomedicinal plants in West Bengal compiled 377 species used against 126 ailments and highlighted both leaf predominance and conservation concerns associated with unsustainable harvesting (Ghosh et al., 2021). Quantitative research in the Amarkantak hills documented 173 therapeutic plant species and used multiple indices to prioritize culturally important taxa for further investigation (Singh et al., 2022).

The 2024-2026 Phase: Systematic Synthesis, Authentication and Sustainability

Recent work has broadened the scope from documenting use to asking whether medicinal-plant research is reproducible, sustainable and translational. Anmol et al. (2024) systematically reviewed 13 Indian medicinal plants prioritized for cultivation support, integrating traditional uses, phytochemistry, pharmacology, quality control and conservation status. This model is valuable because medicinal-plant development depends not only on biological activity but also on correct identity, supply chains, cultivation and chemical consistency.

Authentication has become a major theme. Sharma et al. (2025) argued for harmonized botanical repositories for Indian medicinal plants, emphasizing the importance of authenticated reference material, quality control and conservation. These concerns address a fundamental problem: pharmacological conclusions are unreliable if the tested botanical material is incorrectly identified or chemically inconsistent.

The scale of recent synthesis is also notable. Venigalla et al. (2026) reviewed ethno-dietary information derived from CCRAS publications and documented 681 taxa across 445 genera and 137 families, demonstrating the enormous overlap between traditional food and medicinal knowledge. A 2026 systematic review of wound-healing plants in Northeast India compiled 257 species from 98 families and found leaves in 51.3% of treatments, again illustrating the recurring prominence of leaves in Indian ethnomedicine (Das et al., 2026).

Recent Rajasthan-focused work is also important for regional continuity. Contemporary surveys in Jaipur and Shekhawati indicate that medicinal-plant knowledge remains active in Rajasthan, complementing the influential 2010 Eastern Rajasthan study and showing that ethnobotanical documentation continues to be relevant in rapidly changing social and ecological settings.

Recurring Patterns Across the 2010-2026 Literature

Leaves as a recurrent medicinal resource

Across numerous Indian surveys and reviews, leaves repeatedly emerge as one of the most frequently used plant parts. This may reflect accessibility, ease of preparation, high concentrations of secondary metabolites in some taxa and the possibility of harvesting leaves without necessarily killing the plant. The 2026 Northeast India wound-care review reported leaves in 51.3% of treatments (Das et al., 2026), while multiple regional surveys during the review period similarly identified leaf use as dominant or highly prominent.

Herbs and locally accessible species

Herbaceous species are frequently prominent in regional inventories because they are abundant, seasonally available and often occur near settlements, agricultural margins and disturbed habitats. Nevertheless, woody species remain crucial in dry and semi-arid regions, where trees and shrubs provide bark, gum, fruits, seeds and leaves through extended periods. Ecological context therefore shapes pharmacopoeia composition.

Gastrointestinal, skin, respiratory and wound-related uses

Although disease classification varies among studies, gastrointestinal complaints, skin disorders, respiratory conditions, wounds, fever, pain and inflammatory conditions recur widely. Cardiometabolic applications have also received increasing attention. Repetition across regions can identify promising research themes, but the same vernacular disease category may encompass different biomedical diagnoses, which complicates direct comparison.

Knowledge erosion and generational change

Many studies warn that orally transmitted knowledge is declining as younger generations migrate, formal healthcare expands and traditional livelihoods change. This does not mean traditional knowledge is static or disappearing uniformly; rather, it is being transformed. Digital documentation can preserve records, but meaningful conservation also requires continued community participation and recognition of knowledge holders.

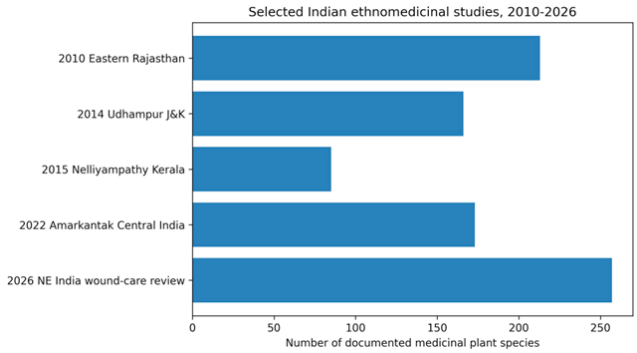

Figure 2. Species richness reported in selected Indian ethnomedicinal studies and reviews used in this article.
Values are not directly comparable because study design, geography and inclusion criteria differ.

Quantitative Ethnobotany: Strengths and Limitations

The 2010-2026 period saw widespread adoption of quantitative indices. Informant consensus factor estimates agreement within therapeutic categories; fidelity level describes the proportion of informants associating a plant with a particular use; use value reflects the relative number of reported uses; and relative frequency of citation describes how widely a species is mentioned. These measures can improve transparency and prioritization, especially when raw use-report data are retained.

However, numerical precision can create false confidence. High consensus may arise because a plant is common, culturally salient or one of few available options. Indices are also sensitive to sample design, participant selection, disease-category definitions and repeated reports. Future studies should publish sufficiently detailed anonymized use-report matrices to permit verification and meta-analysis.

From Ethnomedicinal Claim to Pharmacological Evidence

Ethnomedicinal knowledge can improve the efficiency of bioprospecting by prioritizing plants with repeated or culturally important uses. Yet the pathway from a field report to a medicine is long. Botanical identity must first be confirmed. Extract preparation should be standardized, active constituents characterized where possible, and assays chosen to match the traditional indication. Positive in-vitro findings should be followed by appropriate in-vivo studies, toxicology, pharmacokinetics and, where justified, human trials.

The literature repeatedly shows an evidence gap between traditional use and clinical validation. Ethnodermatology research, for example, has identified many plausible plant candidates but comparatively limited clinical evidence (Sarkar et al., 2022). Recent systematic reviews similarly emphasize phytochemical and pharmacological promise while calling for stronger safety and clinical data (Anmol et al., 2024).

This distinction is essential for scientific writing: traditional use should be described as ‘reported use’ or ‘traditional application’ unless efficacy has been demonstrated with an appropriate level of evidence. This protects both scientific credibility and community knowledge from overstatement.

Safety, Toxicity and Standardization

Natural origin does not guarantee safety. Toxic constituents, contamination, adulteration, dose variability, pregnancy-related risks, organ toxicity and herb-drug interactions can all affect medicinal-plant safety. Species authentication is particularly important where related taxa share vernacular names. Standardization should therefore include botanical identity, plant part, collection conditions, extraction procedure, chemical markers and contaminant testing.

The recent focus on botanical repositories and quality control is a major advance because reproducibility begins before pharmacological testing. A reference specimen, transparent supply chain and chemical characterization should increasingly be regarded as minimum requirements for translational medicinal-plant research (Sharma et al., 2025).

Conservation and Sustainable Harvesting

Medicinal plants face pressures from habitat conversion, climate change, grazing, fire, destructive harvesting and commercial demand. Roots, rhizomes, bark and whole-plant collection can be especially damaging because harvesting may kill or severely injure the plant. Leaves, fruits and seeds may be more renewable, although even these require limits when collection is intense.

India’s conservation response has included in-situ medicinal-plant conservation areas, ex-situ collections, herbal gardens, cultivation programs and research on threatened taxa (Negi et al., 2015). More recent reviews continue to emphasize cultivation and sustainable supply (Anmol et al., 2024). Conservation strategies should be species-specific and should involve the communities who use and manage the plants.

Traditional Knowledge, Ethics and Benefit Sharing

Ethnobotanical knowledge is not simply free scientific data. It is embedded in communities, histories, languages and cultural practices. Ethical research therefore requires prior informed consent, respectful attribution, appropriate handling of sensitive knowledge and attention to access and benefit-sharing obligations. Community members should not be reduced to anonymous sources of leads for commercial development.

Future projects can improve reciprocity by returning field guides and educational materials to participating communities, supporting local conservation or cultivation, involving knowledge holders in interpretation, and establishing clear benefit-sharing pathways when research generates commercial or intellectual-property value.

Digital Tools and Future Research

The next generation of Indian ethnomedicinal research can benefit from digital herbarium records, georeferenced occurrence data, standardized taxonomic backbones, searchable use-report databases, metabolomics and carefully governed machine-learning tools. Digital methods should improve traceability rather than replace field relationships. Artificial intelligence may help identify patterns across large literatures or chemical datasets, but the quality of any output depends on accurate taxonomy, transparent provenance and well-structured primary data.

A national-scale interoperable framework linking voucher specimens, traditional-use records, conservation status, phytochemistry, pharmacology and safety evidence could substantially improve research efficiency. Such a system should include safeguards for culturally sensitive or restricted knowledge.

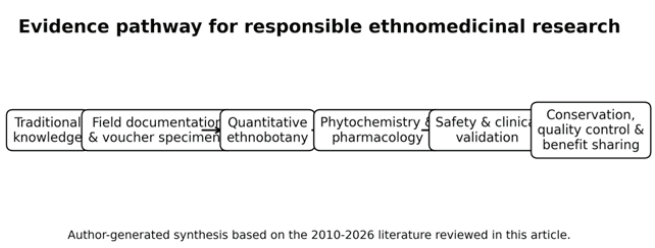

Figure 3. Evidence pathway proposed for responsible translation of ethnomedicinal knowledge. The diagram is an author-generated synthesis of themes identified across the reviewed literature.

Selected Comparative Studies

Year	Region/ scope	Scale	Notable contribution	Reference
2010	Eastern Rajasthan	213 species; 844 villagers	ICF and quantitative community survey	Upadhyay et al., 2010
2011	Theni, Tamil Nadu	80 traditional healers	Consensus analysis; prior informed consent	Ragupathy et al., 2011
2011	Western Ghats, Tamil Nadu	Kani communities	Quantitative ethnobotanical documentation	Ayyanar & Ignacimuthu, 2011
2014	Udhampur, J&K	166 species; 182 informants	UV, ICF, FL	Bhatia et al., 2014
2014/15	Nelliyampathy, Kerala	85 species; 66 informants	FC, RFC, UV, Pearson correlation	Prabhu et al., 2014
2015	India-wide conservation review	Threatened medicinal plants	In-situ/ex-situ conservation and domestication	Negi et al., 2015
2016	Tiruvallur, Tamil Nadu	Cardiometabolic remedies	Disease-focused quantitative survey	Sivasankari et al., 2016
2021	West Bengal	377 species in meta-analysis	Repository/ meta-analysis; conservation concern	Ghosh et al., 2021
2022	India	119 ethnodermatology records	Traditional use vs preclinical/ clinical evidence	Sarkar et al., 2022
2024	India	13 priority medicinal plants	Traditional use, chemistry, pharmacology, QC, conservation	Anmol et al., 2024
2025	India	Botanical repositories	Authentication, QC, conservation harmonization	Sharma et al., 2025
2026	India	681 ethno-dietary taxa	Large-scale CCRAS literature synthesis	Venigalla et al., 2026
2026	Northeast India	257 wound-care species	Systematic review; PRISMA; leaves 51.3%	Das et al., 2026

Table 1. Selected studies illustrating methodological and thematic development in Indian ethnomedicinal research, 2010-2026. This is a representative rather than exhaustive selection.

Major Research Gaps

First, many surveys remain difficult to compare because disease categories, sampling strategies and ethnobotanical indices are not standardized. Reporting guidelines tailored to ethnobotany would improve reproducibility.

Second, voucher deposition and taxonomic updating are inconsistent. Every pharmacological study based on ethnobotanical material should be traceable to authenticated botanical material. Third, preclinical evidence greatly exceeds high-quality clinical evidence. Future work should prioritize a smaller number of well-justified candidates rather than repeatedly screening large numbers of extracts without translational follow-through.

Fourth, safety receives less attention than efficacy. Toxicology, interaction studies, contaminant testing and vulnerable-population considerations should be integrated early.

Fifth, conservation status and harvest sustainability are often discussed after documentation rather than measured alongside it. Population ecology and harvesting studies should accompany research on heavily used wild taxa.

Finally, community rights and benefit sharing must become integral to research design, especially where traditional knowledge contributes to commercially valuable products.

Future Perspective

The strongest future model is interdisciplinary: ethnobotanists document knowledge with communities; taxonomists authenticate species; ecologists evaluate availability and harvest pressure; chemists characterize extracts; pharmacologists test indication-relevant mechanisms; toxicologists establish safety; clinicians evaluate promising interventions; and conservation scientists and local institutions support sustainable supply. This sequence can transform ethnomedicinal knowledge into both a conservation resource and a scientifically responsible source of therapeutic hypotheses.

Conclusion

Indian ethnomedicinal research from 2010 to 2026 has progressed from predominantly regional inventories toward quantitative ethnobotany, cross-cultural comparison, systematic synthesis, pharmacological integration, botanical authentication and conservation-oriented research. The literature consistently demonstrates the richness of community plant knowledge and identifies recurring patterns such as frequent leaf use and strong reliance on locally accessible species. At the same time, a persistent gap separates traditional-use evidence from clinical validation. The most productive future direction is neither uncritical acceptance nor dismissal of traditional medicine, but rigorous, ethical and community-sensitive translation: authenticated plants, transparent quantitative data, reproducible pharmacology, safety assessment, sustainable harvesting and equitable benefit sharing. Under this framework, ethnomedicinal knowledge can continue to inform healthcare research while strengthening biodiversity conservation and preserving India's biocultural heritage.

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