

Akhileshwar Kumar Srivastava ·
Ramesh Kumar Ahirwar ·
Deepanker Yadav ·
D. Guru Kumar *Editors*

Ethnomedicinal Plants for Drug Discovery

Current Developments

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Preface

Humankind has had a close relationship with its environment since the beginning of its development, using the components of the environment to get food and medication. The knowledge and use of plants for food and regimens have been acquired through trial and error, and over time, humans developed the capability to meet their needs from their environment. Knowledge of ethnomedicinal plants has long been inherited steadily from generation to generation, and human familiarity with plants has grown as civilizations have developed and offered greater conveniences. Therapeutic plants are used as a source of medicine in nearly all cultures. Ensuring the safety, properties, and efficacy of medicinal plants and herbal drugs has become a major issue in industrialization in developing nations. By standardizing and assessing the medicinal properties of active plant-derived components, herbal medicines can contribute to a new era in the healthcare system, providing remedies for human ailments in the future.

Ethnomedicinal plants have been employed since time immemorial, tracing back to the Vedic era. For millennia, they have been used to cure and thwart several kinds of ailments including epidemics. Certain medicinal plants are also used as flavorful condiments, as dyes, and to preserve food, among other purposes. Nearly all parts of the plant contain certain therapeutic properties. Several kinds of secondary metabolites found in medicinal plants possess vital medicinal properties that are used in the synthesis of medicines to combat a range of diseases.

Most of the world's population (~60–80%) still believe in traditional remedies for common ailments. In fact, the presence of antioxidative compounds in plants that scavenge reactive oxygen species (ROS) has drawn significant attention in drug development research. The increase in oxidative stress and the alteration of cellular redox homeostasis due to elevated ROS are linked to age-related illnesses, such as type 2 diabetes, cancer, and neurodegenerative disorders.

The book describes the history and traditional phytotherapy practices among tribal communities in different geographical regions worldwide, including India. It focuses on the development of phytodrugs in the modern era, highlighting the translational aspects of ethnomedicinal plants by explaining their medicinal properties against various diseases, genomic evolution in a changing environment, metabolic profiling for biomarker discovery, the role of non-coding RNA in synthesizing secondary metabolites, genome-wide transcriptome profiling, application of pluripotent stem cells for drug discovery, the importance of high-throughput omics, and

genome-editing techniques. In addition, some chapters discuss the role of artificial intelligence, plant databases, and network-based drug discovery in exploring the medicinal significance of various compounds as well as the challenges and opportunities in drug discovery from ethnomedicinal plants. The comprehensive insights provided in the book aim to meet the needs of students, researchers, and scientists from diverse fields, such as pharmacognosy, plant physiology, biotechnology, and pharmaceutical sciences, particularly those working in the areas of phytotherapy from ethnomedicinal plants.

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History and Culture of Traditional and Ethnomedicinal Plants of India

1

Aryama Mishra and Virendra Kumar Madhukar

Abstract

This chapter provides a comprehensive overview of the significant role played by various plants in the realms of ethnic medicines and cultural traditions. The inhabitants of earlier eras employed these plants in diverse ways, leading them to take special measures to ensure their conservation. This chapter explores the historical and cultural aspects of these plants, discovering their utilization since ancestral times.

Keywords

Traditional knowledge · Ethnobotany · India · History · Culture and rituals
Ayurveda · Siddha · Unani · Sowa Rigpa · Homeopathy

1.1 Introduction

The enduring connection between humans and plants traces back to the dawn of mankind. Ethnomedicine encompasses traditional beliefs and practices related to healing, often viewed as unscientific yet holding valued insights within specific cultures. These methods include empirically based natural remedies, often derived from plants, and rituals with a supernatural aspect. Despite being considered unscientific, these approaches are gaining recognition amid growing concerns

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about health, climate, and reliance on chemical-laden foods. In response, ethnobotany emerges as a pathway to explore new economic plants for food, medicine, and genetic diversity for agricultural and medicinal progress. The use of plants in medicine is not a recent phenomenon, as they have been integral to human civilization, addressing fundamental needs since prehistoric times. This relationship has deepened with the evolution of civilization, and the Indian subcontinent holds particular significance in the global context of economy and ethnobotany (Jain 1981). Castetter (1944) defined ethnobiology for the first time as the “utilization of plant and animal life by primitive people,” aiming to integrate two well-established ethnosciences fields: Ethnozoology and Ethnobotany. The term ethnobotany was coined by Harshberger (1896), a branch of botanical science applied to the economic aspects of plant origin in aboriginal or primitive societies. Schultes (1960) emphasized the significance of ethnobotany in uncovering new aspects of plant use. Ethnobotany is increasingly permeating various natural sciences fields, including archaeoscience, history, anthropology, and pharmacology (Paliwal and Badoni 1988). In ancient times, people introduced plants whose fruits, leaves, stems, flowers, or roots could serve as both food and medicinal resources, whether consumed internally or applied externally. India’s rich diversity is reflected in its cultures, each intricately weaving plants into traditional practices. Exploring these connections not only unveils new economic plant possibilities but also deepens our comprehension of the intricate ties between ancient societies and contemporary science (Goel 2007). Extensive global research has been conducted on diverse facets of ethnobotany by numerous scholars, including Harshberger (1896), Woodward (1956), Wren (1956), Schultes (1960), Vidal (1960, 1961a, b), Anderson (1986), and Martin (1995).

The primary tasks encompassed by ethnobotany involves preserving plant species, including crop varieties, and diverse biological forms, conducting botanical surveys and evaluating the conservation status of species; ensuring stability in the supply of wild plant resources including non-timber products, improving food security, nutrition, and healthcare, safeguarding, recovering, and disseminating local botanical knowledge and wisdom; reinforcing ethnic and national identity, securing land and resource ownership, advocating for the rights of local and indigenous communities, and formulating agreements on community rights in protected areas; identifying and developing new economic products from plants, such as crafts, foods, herbal medicines, and horticultural plants and last but not least contributing to the discovery and development of new drugs.

Ethnobotany centers on the historical and contemporary utilization, management, and cultural significance of plants in human society. It encompasses plants employed for purposes ranging from food, medicine, and prediction to cosmetics, dyeing, textile, building construction, tools, currency, clothing, rituals, social interactions, and music (Gerique 2006). Ethnobotany can be defined as the field dedicated to exploring the dynamic relationship between human communities and plants (Hamilton et al. 2003). In both current times and the foreseeable future, the domain of ethnosciences is propelled by considerations related to nutrition, life-supporting species, rural health, drug use, social customs, cottage industry, and the conservation of energy and systems (Chavda et al. 2022).

Traditional knowledge (TK) constitutes a vital facet of mankind's cultural heritage, paralleling the significance of biodiversity for our future. Notably, there has been a recurring emphasis on tribal communities utilizing plant and animal species for socio-economic development, exemplified by their insights into vaccines. Traditional knowledge is defined as "the wisdom and practices transmitted from one generation to the next, integral to the traditions and heritage of indigenous communities, safeguarded by them."

India's rich history of medicinal use, evident in ancient texts like Rigveda and Athrvaveda, highlights a profound understanding of medicinal properties dating back to 4000 years BC. During the Buddhist period, substantial advancements in medicinal knowledge and cultivation under herbalist guidance occurred, fostering collaborations with Greece, Rome, and later Arab and Persian nations. Traditional knowledge systems encompass diverse wisdom, spanning subsistence production, ecosystems, plant use in food, medicine, social practices, education, self-governance, and community decision-making. Plants have played a pivotal role throughout history, contributing to cultural identity and community health. Despite their significance, these knowledge systems are sometimes dismissed as superstitious, emphasizing the need to recognize their value in technical, social, organizational, and cultural aspects.

The original traditional knowledge, accrued over millennia, should be acknowledged as a comprehensive science in itself, reflecting a profound experiment in existence and evolution. Ethnic-based bioprospecting has led to the discovery of new food and medicinal plants, biomolecules crucial in nutraceuticals, cosmeceuticals, and pharmaceuticals, emphasizing the global importance of documenting and presenting ethnic plant knowledge (Montagne 1997; Krishnamurthy 2003).

Medicinal plants, integral to systems like Siddha, Ayurveda, Aamchi, Unani, Homeopathy, and Allopathy, serve as the foundation for pharmaceutical industries. Recognizing the value of plant-based ethnic and traditional knowledge, these systems have become indispensable in the ongoing discovery of drugs and pharmaceuticals (Shivraj et al. 2017).

Traditional knowledge proves crucial for the access to and equitable sharing of genetic resources; it finds diverse applications, both commercially and non-commercially. Industries utilize this knowledge for product development, while researchers leverage it to unravel the intricate web of life on Earth and biodiversity. This body of knowledge serves as a guide to familiar and beneficial flora and fauna within the environment. Its roots trace back through generations, and without it, many achievements would not have reached their current status.

Traditional knowledge plays a pivotal role in facilitating access to and ensuring equitable sharing of genetic resources. Its applications span various domains, encompassing both commercial and non-commercial spheres. Industries harness this knowledge for product innovation, while researchers utilize it to delve into the complexities of Earth's biodiversity. This reservoir of wisdom serves as a compass, directing us towards the familiar and advantageous flora and fauna within our surroundings. With roots extending through generations, traditional knowledge is indispensable; without it, numerous accomplishments would not have attained their

present stature. Ethnobotany and traditional knowledge maintain their relevance for indigenous and local communities, Community Natural Areas (CNAs), and individuals seeking access to genetic resources for academic research or commercial product development.

1.2 History of Ethnobotany and Traditional Medicines

Man has been dependent on nature for fulfillment of his various essentials, such as food, shelter, and clothing, for countless years. Over time, this dependency extended to the exploration of plants for medicinal purposes, leading to the emergence of the ethnomedicine branch within ethnobotany. In ancient times, early humans relied on observing animals to learn the differences between edible and non-edible plants, a method that undoubtedly led to unfortunate mishaps. Over time, the wisdom gained from the past experiences was transmitted from one generation to the next, with certain insights eventually being documented in the form of books.

The history of ethnobotany is extensive, with its significance evident in ancient Indian scriptures and literature, including the Rigveda, Atharvaveda, and other ancient texts. The Rigveda and Atharvaveda alone mention 148 medicinal plants. Charaka's Vedic literature includes 400-450 medicinal plants, and "Indian Medicinal Plants in Modern Times" by Kirtikar and Basu (1935) expands on this with information about 1775 plants. Chopra's *Glossary of Indian Medicinal Plants* and similar works encompass over 3500 medicinal plants. In the present day, our knowledge of Indian medicinal plants is rich, encompassing approximately 3500 species of both local and foreign origin. Notably, *A Glimpse of Indian Ethnography* by Jain (1981) stands as the earliest book after the independence exploring the medicinal properties of Indian plants.

The medicinal plants diversity of India has been well explored by several researchers over time, John Fleming (1812) "List of Medicinal Plants." Subsequently, "Materia Medica of Hindustan" (1813) by Against, followed by Roxburgh's "Flora Indica" (1820). Dr. Dimak's (1863) "Materia Medica of Western India," and Caring (1868) presented "Pharmacopoeia India." Dr. Mohiuddin Sharif (1869) with "Supplement to the Pharmacopoeia of Indica." Sir George Watt (1895) published the noteworthy "Dictionary of Economic Products of India." Dave contributed to the field with "Endemic Medicine of India," and "Chopra Indigenous Medicines of India" (Chavda et al. 2022).

The history of the oldest civilizations, encompassing diverse cultures in Africa, China, Egypt, and extending beyond the Indus depression, reveals compelling evidence supporting the utilization of flavor enhancers in the daily lives of inhabitants. Notably, the primary records documenting various medicinal plants in India can be traced back to the Rigveda and other scriptures, a monumental effort undertaken between 4500 BC and 1600 BC. This period stands as the earliest repository of human knowledge, documenting profiles of 67 plants. With reverence to the Rigveda, this body of work serves as a profound inspiration for the science of life, shaping the ethos of Hindu culture. The use of plants was already known to natives

by 1200 BC, but the documentation of these plants commenced around 2500 BC, which played a pivotal role in disseminating knowledge. The Greco-Arab society, dating back to ancient times, integrated numerous Ayurvedic principles and treatments, serving as a conduit for the transmission of knowledge to Greek foundations. The Charaka Vedic literature, originated around 900 BC, and Sushruta Vedic literature, predating the fifth century BC, provide comprehensive support for surgical practices, medical interventions, and medicinal knowledge found in the Atharvaveda. This lineage of knowledge can be traced back to Greek medicine, adopted by the Arabs, subsequently spreading to Asian nations and Europe (Schultes 1960). As the mid-nineteenth century unfolded, plants emerged as the predominant therapeutic agents in human use, a role that persists and remains relevant in modern medicine. During this era, a devastating infection swept through the residents of the plains—Eubacteria, identified as the causative organism for this disease, commonly known as Hansen's disease (Norton 1981). During the late nineteenth century, ethnobotany began to evolve into a scientific discipline, offering a novel tool for pharmaceutical analysis. Public institutions, including the World Health Organization, and individual pharmaceutical companies initiated engagements with ethnographic campaigns. The utilization of historical documents becomes crucial for extracting information that illuminates the historical relationships between individuals and their environments. The discovery or retrieval of information from manuscripts, books, and diverse sources, as exemplified by Ansari and Inamdar (2010), contributes to the unfolding narrative of the progressive use of plants as a means of addressing and understanding cultural responses to health challenges.

Information pertaining to the healing properties and *Materia Medica* effects of plants, minerals, and other substances traces its roots to prehistoric times, coinciding with the migration of people to the Indian territory. Historical evidence suggests that medical interventions, including dentistry and trepanation, were practiced in the Indian territory as early as 7000 BC. Ongoing Archaean botanical excavations have unearthed evidence in the middle Ganges region dating back to the second millennium BC, showcasing the continued use of medicinal plants found in Ayurvedic folk medicine. India, characterized by its unique group of individuals with distinct faith, beliefs, culture, language, and dialects, has been the cradle of various health systems. Over time, diverse health systems have flourished and evolved within the country. Traditional medical practices, integral to Indian society for centuries, faced challenges with the introduction of allopathic medicine during the British colonial period. The neglect of India's ancient medical heritage by the British rulers contributed to significant degradation. Despite the advancements in allopathic medicine and modern facilities, ancient medicine continues to play a significant role, with approximately 70% of the agricultural population in India relying on it for primary healthcare (Chavda et al. 2022).

While the comprehensive elucidation of ethnosciences concepts occurred by the 1870s, India displayed early indications of elements within this scientific realm. The Indian subcontinent, characterized by a diverse array of cultures, has made distinct contributions to ethnomedicines. With an enigmatic and rich history dating back to times immemorial, ethnomedicine, denoting traditional practices and

medicinal knowledge specific to communities or ethnic groups, has thrived in the Indian subcontinent. The roots of ethnomedicine in India can be traced back to the Indus Valley Civilization, approximately 2500 BCE, as evidenced by archaeological findings. The documentation of ethnobotanical plant use is abundant in the Indian subcontinent, with literature and religious texts of Hindus, such as the Rigveda, Atharvaveda, Upanishads, Mahabharata, and Puranas (4000 to 400 BCE), showcasing various plant uses encompassing worship, medicine, food, fuel, and agricultural tools (Rupani and Chawez 2018). Several enduring ethnomedicinal practices persist to this day, some of which are as follows:

Ayurveda, Naturopathy, Unani Herbal Medicines, Siddha, Sowa Rigpa, Homeopathy.

1.2.1 Ayurveda

Ayurveda, translating from Sanskrit as “science of life,” stands as a time-honored system of medicine with roots dating back millennia (Ravishankar and Shukla 2007). Ayurveda, a traditional medical system originated in India, is an alternative medicine form that pursues treatment by integrating the body, mind, and spirit through a comprehensive and holistic approach. Its core tenets include a particular focus on diet, herbal or plant-based remedies, exercise, meditation, breathing techniques, and physical therapy employing a diverse range of herbal compounds, minerals, and metal substances. Ayurvedic treatments have evolved into a comprehensive healing system. While some may view Ayurveda as a form of complementary and alternative medicine, in numerous rural villages, it remains the primary form of medical intervention. The cornerstone of Ayurveda lies in the concept of doshas—fundamental and constitutive substances named Vata (air), Pitta (bile/fire), and Kapha (water). These three doshas, according to Ayurvedic principles, play a crucial role in maintaining health and treating diseases. Originated around 600 BC, Ayurveda is one of the world’s oldest holistic healing systems. It encompasses a profound understanding of the human body, mind, and spirit, emphasizing the use of herbs, minerals, and other natural substances for healing.

Foundational texts such as the Charaka Samhita and the Sushruta Samhita offer comprehensive insights into diagnosis, treatment, and the use of medicinal plants. The origins of Ayurveda are often linked to the Atharvaveda (circa 1000 BCE), containing descriptions akin to early Egyptian medicine, classified as religious or priestly medicine. Ayurveda comprises eight branches, covering diverse aspects of medicine, including Kayachikitsa (internal medicine); Shalya Tantra (surgery); Alkya Tantra (ophthalmology and ENT); Kaumarbhritya (pediatrics, obstetrics, and gynecology); Agadtantra (toxicology); Chemistry (geriatrics and nutrition); Vajikarana (sexology); Bhoot Vidya (psychiatry and demonology). Notably, Acharya Charaka, a revered scholar and practitioner, was among the first to emphasize the importance and concept of ethnobotanical studies in his treatise *Charaka Samhita*. In the realm of Ayurveda, practitioners systematically evaluate plants for medicinal purposes by considering five distinct physical and energetic properties:

1. Rasa—denoting taste or “essence,” this property is broadly classified into sweet (*madhura*), sour (*amla*), salty (*lavana*), pungent (*kaṭu*), bitter (*tikta*), or astringent (*kaṣaya*).
2. Vīrya—reflecting the effect on metabolism or body temperature.
3. Vipāka—indicating effects on digestion.
4. Prabhāva—highlighting unique properties inherently present in the plant.
5. Karma—representing the therapeutic action, encompassing qualities such as digestive, stimulant, or purgative effects.

1.2.2 Naturopathy

Naturopathy is a therapeutic system focused on treating diseases without recourse to pharmaceuticals or surgical interventions. Instead, it places a strong emphasis on harnessing the healing properties of natural agents such as air, water, herbs, and employing various physical means. Naturopathy represents a holistic and systematic approach of treatment, encompassing the consideration of social, environmental, genetic, and mental components of health. It places a significant emphasis on preventive measures through diet and lifestyle interventions, with the overarching goal of enabling the body to heal itself. A vital component of this tradition is utilization of botanical medicines.

1.2.3 Unani Herbal Medicines

Unani medicine, rooted in Greek philosophy attributed to Hippocrates and further advanced by figures like Galen and Aristotle, found its way to India through Arab countries around 1350 AD. It gained prominence in Mughal India and among Muslim cultures in South Asia. The core philosophy revolves around the belief that the body is composed of four elements (Earth, Air, Water, Fire) with distinct natures (cold, hot, wet, dry), and optimal health is achieved through a balance of four qualities: phlegm, blood, yellow bile, and black bile (Rupani and Chawez 2018). The Unani pharmacopeia is extensive, boasting over 2000 drugs derived from diverse herbal, mineral, and animal sources. These medicines are often prepared by using classical methods rooted in Greco-Arabic medicine traditions (Britannica, 2024; <https://www.britannica.com/science/Unani-medicine/Modes-of-treatment>).

The Azizi Family of Lucknow, notably figures like Abdul Azeez and Abdul Latif Falsafi, made significant contributions to Unani medicine. Abdul Azeez (AD 1855–1911) established the Takmil-ut-Tibb College of Unani medicine in Lucknow in 1902, specializing in single-drug treatments. Abdul Latif Falsafi (AD 1900–1970) earned acclaim for his book *Kitabun-Nabz* and his Urdu translation of Avicenna’s monograph, *Advia Qalbia*. Hakim Abdul Majeed (AD 1883–1922) initiated Hamdard in Delhi, 1905, and currently it is the largest Unani pharmaceutical company in the Indian subcontinent. The formal teaching of Unani medicine commenced at the Oriental College of Lahore in 1872, and the field has since burgeoned

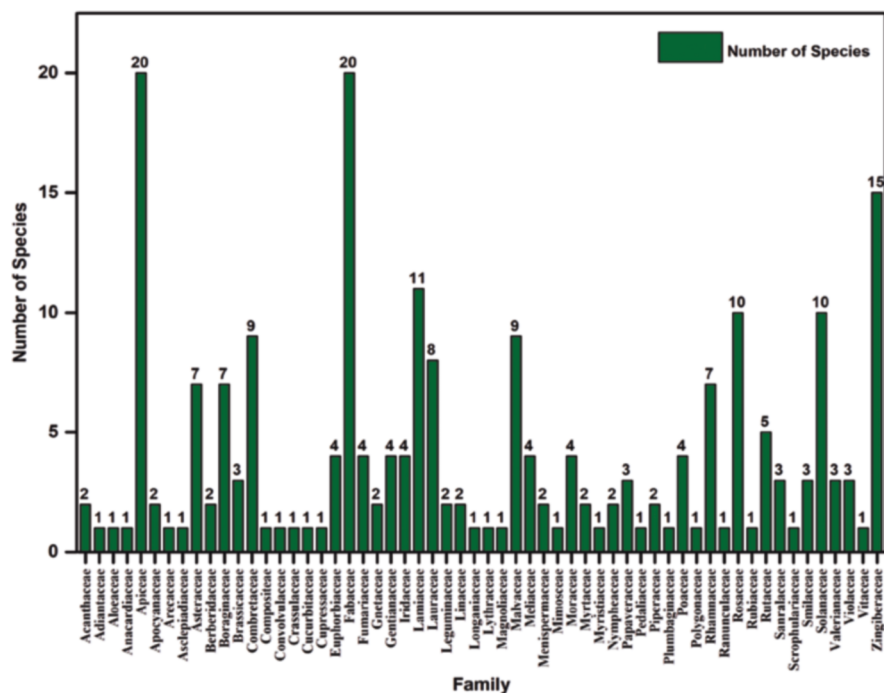


Fig. 1.1 Families with their number of species used in Unani herbal medicine system

with over 55 recognized colleges of Unani education in India. Unani made substantial progress during the Mughal rule (1526–1707), with renowned Hakims contributing treatises that enriched Indian medical literature.

There are a total of 58 plant families, holding 228 species mentioned, which are used in Unani herbal medicines (Khan et al. 2015). Of these, Apiaceae and Fabaceae are dominant, with each having 20 species followed by Zingiberaceae (15 spp.), Rosaceae and Solanaceae (10 spp.) (Fig. 1.1).

1.2.3.1 Al-Umoor Al-Tabiyah: Fundamental Physiological Principles of Unani Medication

According to the proponents of Unani medicine, the well-being of the human body is sustained through the harmonious interplay of seven fundamental physiological principles within the framework of Unani theory, known as Al-Umoor al-Tabiyah. These principles encompass (1) *Arkan*, representing elements, (2) *Mizaj*, denoting temperament, (3) *Akhlal*, signifying physical humors, (4) *Aza*, encompassing organs and systems, (5) *Arwah*, symbolizing vital spirit, (6) *Kwa*, representing faculties or powers, and (7) *Afal*, referring to functions. These seven inherent components, dynamically interacting with one another, uphold equilibrium in the inherent structure of the human body. Each individual's constitution possesses an inherent self-regulating capacity or power, referred to as *tabiyat* (or *mudabbirah-i-badan*; in Latin, *vis medicatrix naturae*), with these seven components acting to maintain a delicate balance.

1.2.4 Siddha

Originating from the Tamil culture in South India, Siddha medicine revolves around the fundamental concept that a healthy spirit is attainable only through a healthy body. In this healing system, diet and yoga/meditation serve as indispensable mind-body practices. Notably, Siddha medicine shares numerous parallels with Ayurveda, particularly in aiming to balance the three doshas or humors—Vata, Pitta, and Kapha. Similar to Ayurveda, Siddha medicine is rooted in the belief that the human body is composed of the five elements of the universe, collectively known as the “pancha mahabhootas.” These elements—Earth, Water, Fire, Air, and Ether (space)—form the foundational constitution of the body. The Siddha system acknowledges that an individual’s physical, moral, and physiological well-being is intricately influenced by a complex interplay of factors. These factors span various aspects of life, including perception, speech, and pulse diagnosis, among others. In addition to incorporating minerals and metals, Siddha medicine embraces plant-based preparations. Various plant parts, such as roots, leaves, and fruits, are utilized to craft herbal remedies. These plant-based medicines undergo specific techniques to extract and preserve their therapeutic properties.

The term Siddha is rooted in the Tamil word Siddhi, signifying “to achieve,” “perfection,” or “heavenly bliss.” Agasthya (alternatively Agastiyar) is venerated as the progenitor of Siddha medicine. Siddhars firmly held the belief that a flourishing soul can only be cultivated through a robust and healthy body. Those engaged in the practice of Siddha medicine are referred to as siddhars (or Siddhas).

Some of the important medicinal plant species which are used in Siddha system of medicine are listed in Table 1.1 (Nadkarni 1976).

1.2.5 Sowa Rigpa

Sowa Rigpa, also recognized as traditional Tibetan medicine, which stands as one of the most ancient medicinal traditions globally, is characterized by a comprehensive approach to diagnosis. Treatment modalities within Sowa Rigpa encompass dietary adjustments, physical interventions like acupuncture, and the application of natural/herbal remedies. Rooted in Ayurveda and Indian Buddhist literature, Sowa Rigpa subscribes to the traditional Buddhist belief that all ailments ultimately stem from three poisons: ignorance, attachment, and hatred.

The term “sowa rigpa” carries the profound significance of “Knowledge of Healing” or “Science of Healing,” deriving its meaning from the Ladakhi or Bhoti language. Yuthog Yonten Gonpo, hailing from Tibet, is revered as the progenitor of Sowa Rigpa. The foundational textbook of this medicinal tradition is the *Gyud-Zi*, also known as the four tantras. This text was initially translated from India and subsequently enriched in the region of Tibet, becoming a cornerstone of Sowa Rigpa (https://ayushedu.bisag-n.gov.in/AYUSH_EDU/sowa).

Perceived to share similarities with Ayurvedic Philosophy, over 75% of Sowa Rigpa’s diagnostic tests find their origins in the Ashtanga Hridaya, a renowned exposition of Ayurveda. Fundamentally, Sowa Rigpa adheres to the principles of

Table 1.1 Plants used in Siddha system of medicine

	Scientific name	Family	Common name
1.	<i>Acacia sinuata</i> (Lour.) Merr.	Fabaceae	Sehakai
2.	<i>Acalypha indica</i> L.	Euphorbiaceae	Kuppaimeni
3.	<i>Achyranthes aspera</i> L.	Amaranthaceae	Nayuruvi
4.	<i>Aerva lanata</i> (L.) A. L. Juss.	Amaranthaceae	Siru Poolai
5.	<i>Albizia lebbek</i> (L.) Willd.	Fabaceae	Vagai
6.	<i>Aloe vera</i> (L.) Burm.f.	Asphodelaceae	Katrazhai
7.	<i>Argemone mexicana</i> L.	Papaveraceae	Brammadani
8.	<i>Artemisia nilagirica</i> (Clarke) Pamp.	Asteraceae	Masipathri
9.	<i>Atalantia monophylla</i> (L.) Correa	Rutaceae	Kattu elumichai
10.	<i>Bauhinia purpurea</i> L.	Fabaceae	Mantharai
11.	<i>Calotropis gigantea</i> (L.) R.Br. ex Ait.	Asclepiadaceae	Errukku
12.	<i>Capparis zeylanica</i> L.	Capparidaceae/ capparaceae	Athondai
13.	<i>Carissa carandas</i> L.	Apocynaceae	Kilakai
14.	<i>Caryota urens</i> L.	Arecaceae	Koonthalpanai
15.	<i>Cassia auriculata</i> L.	Fabaceae	Avaram
16.	<i>Cassia fistula</i> L.	Fabaceae	Kontrai
17.	<i>Coccinia grandis</i> (L.) J. Voigt	Cucurbitaceae	Kovai
18.	<i>Coldenia procumbens</i> L.	Coldeniaceae	Serupadai
19.	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Arugampul
20.	<i>Erythrina variegata</i> L.	Fabaceae	Kayanamurungai
21.	<i>Gloriosa superba</i> L.	Colchicinaceae	Senkanthal
22.	<i>Hemidesmus indicus</i> (L.) R.Br.	Apocynaceae	Nannari
23.	<i>Hybanthus enneaspermus</i> (L.) F.V. Muell.	Violaceae	Orithalthamarai
24.	<i>Hydnocarpus laurifolia</i> (Dennst.) Sleum.	Achariaceae	Maravetti
25.	<i>Ricinus communis</i> L.	Euphorbiaceae	Amanakkau
26.	<i>Strychnos nuxvomica</i> L.	Loganiaceae	Ettiai
27.	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Ammam paccharisi
28.	<i>Hemidesmus indicus</i> (L.) R. Br.	Apocynaceae	Nannari
29.	<i>Murraya koenigii</i> (L.) Spreng.	Rutaceae	Karivepillai
30.	<i>Syzygium cumini</i> (L.) Skeels.	Myrtaceae	Nagai
31.	<i>Tinospora cordifolia</i> (Willd.) Miers	Menispermaceae	Chittamrutham

Jung-wa-nga (Sanskrit: Panchamahabhutas) and Ngepa-Sum (Sanskrit: Tridosa). According to this framework, the bodies of all living beings and non-living entities in the universe are composed of Jung-wa-nga, namely Sa, Chu, Me, Lung, and Nam-kha (which is: Prithvi, Jal, Agni, Vayu, and Akash). The Sowa Rigpa system incorporates various Indian-origin medicines such as Ashwagandha, Guggulu, Triphala, Ashok, Haridra, etc., for therapeutic purposes.

A total of 330 species belonging to 65 families and 205 genera were documented as ethnobotanical plants in the Sowa Rigpa medicine system. Of these, there were 302 herbs, 14 shrub species, 9 tree species, and 5 species of climbers. Figure 1.2

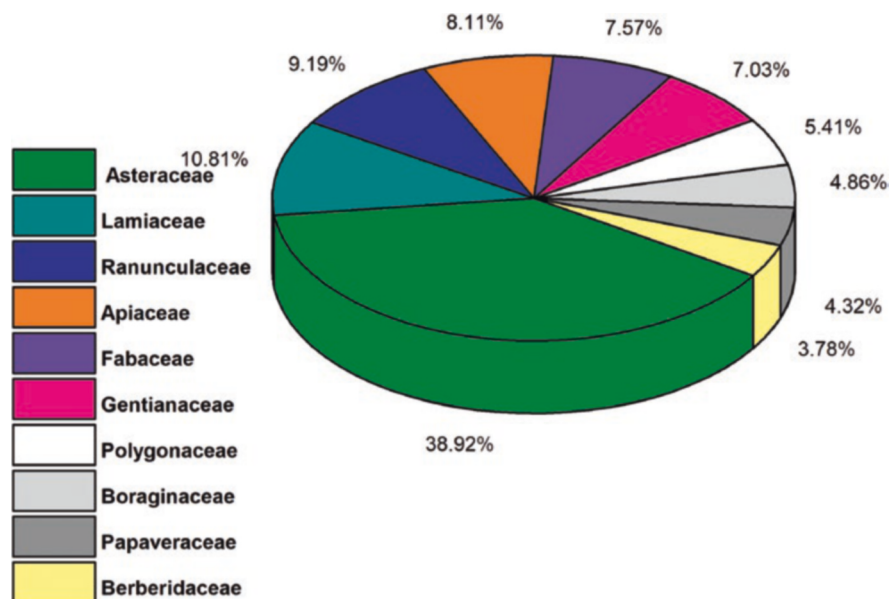


Fig. 1.2 Ten major angiosperm plant families of the study area

explains the ten major angiosperm families with their number of species such as Asteraceae (72), followed by Lamiaceae (20), Ranunculaceae (17), Apiaceae (15), Fabaceae (14), Gentianaceae (13), Polygonaceae (10), Boraginaceae (9), Papaveraceae (8), and Berberidaceae (7). Various plants were used in the traditional medicine system. Root (16%), stem (2%), leaves (16%), flower (10%), fruit (4%), tuber (1%), and rhizome (2%) of various plant species are used as medicines in many traditional methods of curing various diseases and ailments (Singh et al. 2021).

1.2.6 Homeopathy

Homeopathy operates on two foundational principles, centering around customized treatments aimed at fostering autoregulation and triggering self-healing processes. The first principle, known as “like cures like,” asserts that a disease can be treated with substances that induce similar clinical manifestations in healthy individuals. The second principle, the “law of minimum dose,” posits that the effectiveness of a remedy increases as the dose decreases. These principles were articulated by the German physician Samuel Hahnemann (1755–1843) in the late eighteenth century. Subsequently, homeopathy gained prominence in Bengal and expanded throughout India. In 1973, the Government of India officially recognized it as one of the national systems of medicine. Homeopathy is estimated to be the third most widely practiced system of medicine in India, following Allopathy and Ayurveda (Aminabhavi 2014).

The fundamental tenet of homeopathy, identified as the “law of similar,” posits that “let like be cured by like.” This principle was initially articulated by the German physician Samuel Hahnemann in 1796. Some important plants used in this system are as follows:

1. *Withania somnifera*, a member of the Solanaceae family, is characterized by its chemical constituents called Withanolides. It finds application in addressing conditions such as osteoarthritis and depression.
2. *Tinospora cordifolia*, part of the Menispermaceae family, contains chemical components like Tinosporin, Tinosporic acid, and Gilonin. This botanical remedy is employed for managing conditions like diabetes, malaria, and jaundice.
3. *Calotropis gigantea*, belonging to the Asclepiadaceae family, features chemical components including Calotropin, Calotoxin, and Lupeol in its latex. It is utilized in the treatment of asthma, bronchitis, fever, and jaundice.
4. *Andrographis paniculata*, a member of the Acanthaceae family, is rich in chemical components like Andrographolide and Andrographine. This plant is harnessed for addressing conditions such as typhoid, cancer, and high blood pressure.
5. *Pulsatilla nigricans*, part of the Ranunculaceae family, contains chemical components like Anemonin and Isoanemonin (C₁₀H₈O₄). It is utilized in managing conditions like fever, mumps, and sore throat.
6. *Bryonia alba*, a member of the Cucurbitaceae family, is characterized by chemical components like Cucurbitacin and Bryonin. It is employed in treating synovial inflammation, pneumonia, and measles.
7. *Aconitum napellus*, belonging to the Ranunculaceae family, features Aconitin, Isoaconitin, and Aconitic acid as its chemical constituents. It is utilized for addressing stress, anxiety, and fever associated with typhoid and measles.
8. *Berberis vulgaris* (Berberidaceae) contains the component Berberin and is employed for addressing liver and kidney problems (Joshi and Joshi 2013).

Abroma augusta, *Achyranthes aspera*, *Aegle folia*, *Aegle marmelos*, *Atista indica* (*Glycosmis pentaphylla*), *Azadirachta indica*, *Boerhaavia diffusa*, *Caesalpinia bonducella*, *Carica papaya*, *Cassia sophera*, *Cephalandra indica*, *Cynodon dactylon*, *Embelia ribes*, *Holarrhena asiatica*, *Hydrocotyle asitatica*, *Hygrophila spinosa*, *Justicia adathoda*, *Nyctanthes arbortristis*, *Saraca indica*, *Syzygium jambolanum*, *Terminalia arjuna*, *Terminalia chebula*, etc., are also few of the plants used in homeopathy (<https://hmbup.in/en/article/common-indian-plants-used-in-homoeopathy?brd=1>).

1.3 During British Invasion

When India was under British rule, it possessed a wealth of data on plants and their uses. However, a challenge arose as these plants were often referred to in vernacular terms, causing confusion due to variations in names across locations. Some British

individuals contributed significantly to this field, enhancing accuracy in plant nomenclature.

Notably, Roxburgh emphasized the health benefits of herbs during his floral research in South Asian countries, though biological identification and local names remained exceptions. Sir Patrick St. Watt, from 1873 onwards, conducted vital studies on economically essential plant species. His notable works include the “Lexicon of the Economic Goods of India” (1889–1896) and “Commercial Products of India.” Among miscellaneous works, Ainslie’s 1813 contribution and O’Shaughnessy and Wallich’s 1844 works are also noteworthy (Chavda et al. 2022).

1.4 After Independence

After independence from British rule in 1947, India witnessed a resurgence in the promotion of traditional medical systems. Official recognition was granted, integrating these systems into the national healthcare network to address the health-related needs of the populace. The Government of India implemented various measures to elevate Ayurveda as a prominent healthcare system, establishing numerous hospitals and colleges dedicated to its practice. Key initiatives included the foundation of the Central Institute for Research on Indigenous Systems of Medicine (CIRISM) in 1955, the establishment of the Postgraduate Training Center of Ayurveda in 1956, and the founding of Gujarat Ayurved University in Jamnagar in 1967 are the important steps towards the promotion of Ayurveda system of medicines in India. The National Institute of Ayurveda (NIA) was established in Jaipur, Rajasthan, and a new addition, Rajasthan Ayurved University in Jodhpur, further strengthened the foundation. A draft National Policy for the development of the Indian System of Medicine has been formulated, accessible on the Department of Ayurveda’s website (<http://www.indian-medicine.nac.in>).

The Central Council for Research in Indian Medicine, Homeopathy, and Yoga (CCRIMH) was instituted in 1971, later splitting into three separate councils—Central Council for Research in Ayurveda and Siddha (CCRAS), Center for Research in Unani Medicine (CCRUM), and Central Council for Research in Homeopathy (CCRH), along with the Central Council for Research in Naturopathy and Yoga (CCRNy). In 1972, the Central Council of Indian Medicine (CCIM) was formed to regulate education and registration in Ayurveda, Siddha, and Unani systems of medicine (Murugeswaran et al. 2016).

India’s rich ethnobotanical heritage is evident through ancient linkages and the diverse botanical angiosperms, numbering around 20,000. The all-India Asian Nations Community coordinated analysis on ethnobotany reveals that Indian tribes’ harness over 9500 wild plant species to fulfill various needs. Musical purposes involve 7500 species, food utilizes 3900 species, cordage and fiber employ 525 species, fodder encompasses 400 species, pesticides utilize around 300 species, gum utilizes 300 species, incense and perfume involve 100 species, and resins and dyes

use 300 species. An additional 700 species cater to cultural and various needs given by Fleming in 1810 (Chavda et al. 2022).

Jain conducted ethnographic studies among tribes in Central India, discovering that over 9500 wild plant species are employed by Indian tribals. Jain further explored tattooing therapy among Shariya tribals (1995), while Grosi and Shahzad (2002) identified 43 medicinal plant species in Dhirkot. Ravindran et al. (2005) conducted an ethnobotanical survey in Pichavaram, Tamil Nadu, identifying eleven plant species for various disorders. Chhetri and his team reported 281 plant species for medicinal purposes in Darjeeling Himalaya (Chhetri et al. 2005) and Sajem and Gosai (2006) documented 39 medicinal plant species used by the Jantia tribes.

Bhosle et al. (2009) surveyed medicinal plant use in Purandharin, Maharashtra, reporting 77 plant species with medicinal properties. Jain documented 110 plant species for various ailments in the Sariska and Silisedh region of Alwar district, Rajasthan, India. This diverse ethnobotanical knowledge underscores India's profound connection with its botanical resources.

1.5 Cultural Use of Plants in India

In India, a profound gratitude towards nature is ingrained in our culture, evident through practices like fasting and festivals dedicated to Mother Nature. Various gods and goddesses are revered, and plants, especially flowers and fruits, play a significant role in worship. Notable plant species like *Ocimum sanctum* L., *Ficus religiosa* L., *Ficus benghalensis* L., *Musa paradisiaca* L., *Aegle marmelos* (L.) Corroza, *Nelumbo nucifera* Gaertn., and *Tagetes erecta* L. are held in high esteem. Each state has unique rituals centered around plants, as shown in Table 1.2.