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Exploring Arunachal Pradesh and Sikkim

By

Mayaram Uniyal, Deepak Kumar Semwal, Ruchi Badoni Semwal and Ankit Kumar

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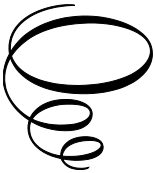

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PREFACE

Writing about the wealth of medicinal plants in Northeast India is primarily based on surveys conducted across various regions, including forested areas, with financial support from the Ministry of AYUSH, Government of India. This monograph focuses on the medicinal plants of the region, detailing their occurrences and medicinal uses, including traditional values. It describes the diversity of medicinal plants in the North-East Indian Himalayas, with particular emphasis on Arunachal Pradesh and Sikkim.

The Northeast region of India is known for its natural beauty, where life is closely connected to nature. This area is recognized for its peaceful, pollution-free environment, rich cultural heritage, and abundant production of organic crops and fruits. It serves as a vital biodiversity hotspot for both plant and animal life. Covering only about 7% of India's total land area, it harbors approximately 50% of the country's plant species. The region is also home to many rare and endangered species.

Northeast India includes eight states: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura, all of which have a rich heritage of traditional medicinal systems based on local medicinal plants. Traditional healers, known by various names such as Ojha, Dema, Vaidya, and Amchi, are well-known for treating different ailments using their traditional knowledge of medicinal plants and other substances, including metallic preparations.

The present monograph, entitled “Indian Medicinal Plants of North-East Himalayas - Exploring Arunachal Pradesh and Sikkim,” is divided into four chapters. The first chapter provides an overview of the Northeast region of India, covering its geography, biodiversity, cultural heritage, traditional wealth, and demographic information.

The second and third chapters provide detailed information about Arunachal Pradesh and Sikkim, respectively. These chapters highlight the main medicinal plants commonly used in their traditional medicinal systems and include a list of plants recorded from these regions. The fourth chapter presents details about the medicinal plants of these states, including their local names, taxonomy, occurrences, therapeutic potential, and traditional uses.

The authors have made every effort to ensure the accuracy of the content, primarily drawn from various internet sources, including government websites and subject specific books listed at the end of each chapter. Additionally, AI tools were utilized to enhance the language for greater clarity on a global scale. However, if any information in this monograph is found to be outdated or incorrect, the authors sincerely apologize. Readers are encouraged to reach out to the authors with any discrepancies so that corrections or updates can be made in future editions.

Our goal in writing this monograph is to explore the medicinal plant wealth of this region and compile this knowledge for students, scientists, and other readers interested in the study of medicinal plants and traditional medicines.

CHAPTER 1

MEDICINAL PLANTS BIODIVERSITY OF NORTH-EAST INDIA: AN OVERVIEW

Northeast India stands out as a major biodiversity hotspot, renowned not only for its vibrant ethnic and cultural diversity but also for its remarkable variety of plant and animal life. Covering just 7.7% of India's land area, this region is home to approximately 50% of the nation's plant species, totaling around 8,000, with 31.58% (2,526 species) being endemic. This makes Northeast India a crucial area for biodiversity conservation.

The region's diverse ecosystems range from tropical rainforests to alpine scrubs, supporting a rich array of flora, including orchids, ferns, oaks, bamboos, and magnolias, as well as numerous rare and endangered animal species. It hosts 51 distinct forest types, classified into six broad categories, and encompasses six of the nine major vegetation types found in India. This diversity is reflected in the presence of species from about 200 out of 315 recorded plant families in the region.

Significantly, 4.10% of India's flowering plants are endangered, with 800 of these species found in Northeast India, according to the Indian Red Data Book. While the region's faunal diversity is relatively well-documented, the rapid loss of forest cover—about 60% of each state's area—is a serious threat to its biodiversity. Deforestation leads to the extinction of many plant and animal species and disrupts the ecological balance.

Globally, deforestation remains a critical issue, with 51 million square kilometers of forest lost annually, particularly in tropical areas. In response, the national forest policy aims to achieve 33% forest cover across the country, with a more ambitious target of around 62% for hilly regions like Northeast India. This underscores the urgent need for effective conservation strategies to safeguard the region's invaluable biodiversity.

The traditional medical systems of Northeast India are diverse and rich, reflecting the region's cultural and ethnic diversity. These systems are closely intertwined with the local culture, beliefs, and natural resources,

and they have been practiced for centuries by various indigenous communities. The indigenous people of Northeast India have extensive knowledge of medicinal plants and herbs found in the region's rich biodiversity. This knowledge has been passed down through generations and is used to treat a wide range of ailments. Known by various names such as 'Ojha,' 'Dema,' or 'Baidya,' these traditional healers play a crucial role in the community. They diagnose illnesses and prescribe herbal remedies, rituals, and other traditional treatments.

Ayurveda is also practiced in the Northeast. Ayurvedic practitioners use herbal compounds, dietary practices, and lifestyle recommendations to promote health and treat diseases. In addition, Amchi medicine or Sowa-Rigpa, practiced mainly by the Tibetan and Himalayan communities, is a traditional system that involves the use of herbal remedies, minerals, and animal products, as well as lifestyle and dietary advice. It is based on the ancient Tibetan medical system and is prevalent in regions like Sikkim and Arunachal Pradesh.

Many indigenous communities in Northeast India practice animism and shamanism. They believe in the presence of spirits and supernatural forces in nature. Shamans, often regarded as spiritual healers, perform rituals and ceremonies to appease these spirits and cure ailments believed to be caused by spiritual disturbances. Each community in the region has its own set of folk medicinal practices. These may include the use of specific plants, animal parts, or minerals. Folk medicine often involves simple, practical remedies for common ailments, such as using turmeric for wounds or ginger for colds. In rural and tribal areas, traditional birth attendants play a crucial role in childbirth. They use traditional methods and herbal remedies to assist in deliveries and postpartum care. The region's diverse flora includes many plants with medicinal properties. Some of these plants have been documented in various ethnobotanical studies and continue to be used in traditional practices. Examples include *Tetrataenium wallichii, Thalictrum alpinum, Thalictrum foliolosum, Viscum album, Vitex negundo, Woodfordia fruticosa,* and *Zanthoxylum acanthopodium.*

The northeastern states of India each offer a unique tapestry of biodiversity, culture, and traditional knowledge, deeply intertwined with their geography and demographic diversity. This region is crucial for conservation efforts and sustainable development, reflecting a harmonious relationship between nature and culture. The brief summary about biodiversity, cultural heritage and traditional knowledge and demography the northeast states i.e. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura is given in the following heads.

Assam

Assam, with its capital at Dispur, attained statehood on August 15, 1947. According to the 2011 Census, the state has a population of 31,169,272 and covers an area of 78,438 sq. km, divided into 33 districts. The official languages are Assamese, Bengali (in the Barak Valley districts), Bodo (in the Bodo Territorial Council area), and English. Additionally, other languages and dialects spoken include Bengali, Dimasa, Mishing, Karbi, and Rambha, along with sub-groups such as Tai-Phake, Tai-Aiton, and Tai-Khamti. Assam is characterized by the majestic Brahmaputra River and its fertile plains, enjoying a subtropical climate marked by heavy monsoon rains. The state boasts a rich tapestry of biodiversity, home to Kaziranga National Park, renowned for its Indian rhinoceroses, and Manas National Park, which features a diverse range of flora and fauna. The population is a blend of indigenous tribes and settlers, with Assamese as the primary language. Assam is culturally vibrant, featuring diverse ethnic groups, including the Assamese, Bodos, and various tribes. The state is famous for its lively festivals, such as Bihu, and its exquisite silk weaving, particularly Muga silk. Traditional knowledge is prevalent among the people, especially in herbal medicine and rice cultivation practices. The major agricultural products include rice, globally acclaimed Assam tea, jute, and mustard.

Arunachal Pradesh

Arunachal Pradesh, with its capital at Itanagar, has a population of 1,382,611 according to the 2011 Census. Covering an area of 83,743 sq. km, the state is divided into 25 districts. English serves as the official language, reflecting the region's diverse cultural heritage. Arunachal Pradesh, often referred to as the "Land of the Rising Sun," is renowned for its stunning landscapes, characterized by the majestic Himalayas and lush valleys. The state experiences a diverse climate, ranging from subtropical in the foothills to alpine in the higher elevations. This region is a biodiversity hotspot, home to a rich variety of flora and fauna, including several endemic species. It features vibrant ecosystems, from dense forests to alpine meadows, and is known for its beautiful orchids and wildlife such as the red panda and snow leopard. Arunachal Pradesh is culturally rich, with numerous indigenous tribes, including the Apatani, Monpa, and Nyishi, each possessing unique traditions and languages. Arunachal Pradesh is home to a rich tapestry of languages, with estimates of 30 to 50 distinct languages and numerous dialects, primarily from the Tibeto-

Burman family. Notable languages include Nyishi, Dafla, Miji, Adi, and others. Hindi is increasingly common, while Nagamese serves as a link language in certain areas. The state celebrates a variety of festivals, such as Losar and Solung, showcasing its vibrant cultural heritage. Traditional knowledge is deeply embedded in the local way of life, with practices in sustainable agriculture and herbal medicine being common among communities. The primary agricultural products include rice, maize, millet, and various fruits and vegetables, often cultivated using traditional methods.

Manipur

Manipur, with its capital at Imphal, attained statehood on January 21, 1972. As per the 2011 Census, the state has a population of 2,721,756 and covers an area of 22,327 sq. km, divided into 16 districts. The official language is Meiteilon (Manipuri), while 29 different dialects are widely spoken. Among these, five languages—Tangkhul, Hmar, Paite, Lushai, and Thadou/Kuki—are recognized as mediums of instruction in schools up to the fifth grade, in addition to Meiteilon, which is taught up to the postgraduate level. Manipur, known as the "Jewel of India," is characterized by its picturesque landscapes, including the famous Loktak Lake, which is the largest freshwater lake in northeastern India. The climate is subtropical, with distinct seasons and significant rainfall during the monsoons. This state is rich in biodiversity, hosting a variety of unique flora and fauna, particularly around its wetlands and hills. Manipur is culturally vibrant, home to diverse ethnic groups, including the Meitei and various tribes, each with their own languages and customs. The state is renowned for its traditional dance forms, particularly Manipuri dance, and vibrant festivals such as Yaoshang. Traditional knowledge is prevalent, especially in weaving and herbal medicine. Major agricultural products include rice, maize, and a variety of fruits and vegetables, with an increasing emphasis on organic farming.

Mizoram

Mizoram, with its capital at Aizawl, attained statehood on February 20, 1987. According to the 2011 Census, the state has a population of 1,091,014 and spans an area of 21,081 sq. km, divided into 11 districts. The official languages are Mizo and English. The main dialects spoken in Mizoram include Aso, Chho, Halam, 'Hinar', Lai, Lusei, Mara, Miu-Khumi, Paite, and Thado-Kuki. Mizoram, often called the "Land of the

Highlanders," is known for its rolling hills and lush greenery. The state experiences a mild climate, with a mix of subtropical and temperate conditions, and receives substantial rainfall during the monsoon season. The region is rich in biodiversity, with diverse plant and animal species, particularly in its forested areas. Mizoram is home to various tribes, primarily the Mizo people, who celebrate vibrant festivals like Chapchar Kut and Pawl Kut, reflecting their rich cultural heritage. Traditional knowledge is integral to Mizo life, particularly in agriculture and crafts. The state practices shifting cultivation, with rice as the staple crop, alongside maize and various fruits. Mizoram is also known for its bamboo products and traditional textiles.

Nagaland

Nagaland, with its capital at Kohima, has a population of 1,980,602 according to the 2011 Census. The state covers an area of 16,579 sq. km and is divided into 11 districts. English is the official language. Each of Nagaland's tribes has its own dialect, totaling around 60 different spoken dialects that belong to the Tibeto-Burman family of languages. These dialects generally lack a written script. To facilitate communication, tribes often use "Nagamese," a lingua franca that blends Assamese, Bengali, and local dialects, serving as the language of the market. Nagaland, celebrated for its rich cultural diversity, is characterized by its hilly terrain and vibrant landscapes. The climate ranges from subtropical in the foothills to temperate in the higher elevations, with a heavy monsoon season. This state is home to a multitude of tribes, including the Ao, Sumi, and Naga tribes, each with unique customs, languages, and festivals, such as the Hornbill Festival, which showcases the region's rich heritage. Nagaland boasts significant biodiversity, with lush forests that harbor numerous species of flora and fauna. Traditional knowledge is prevalent, particularly in agriculture, with sustainable practices rooted in the local culture. Major crops include rice, maize, and various vegetables, with an increasing focus on organic farming.

Tripura

Tripura, with its capital at Agartala, has a population of 3,671,032 according to the 2011 Census. The state covers an area of 10,486 sq. km and is divided into 8 districts. The official languages are English and Bengali. Bengali is the predominant language spoken by the majority of Tripura's population, while "Kak-Barak" or "Tripuri," a language belonging

to the Tibeto-Burman group, is also significant. The Tripuri language uses the Bengali script. Additionally, the dialects spoken include Halam, with sub-dialects such as Rankhal and Chakma. Tripura, known for its rich history and culture, features a diverse landscape of hills and valleys. The state has a tropical climate, with heavy rainfall during the monsoon season, supporting its lush vegetation. The region is rich in biodiversity, with a variety of flora and fauna, particularly in its forests and wetlands. Tripura is home to various ethnic groups, including the indigenous Tripuri people and Bengali settlers, contributing to a vibrant cultural tapestry. Festivals like Garia Puja and Kharchi Mela reflect the state's diverse traditions. Traditional knowledge in agriculture is significant, with practices that include rice cultivation and the production of various fruits and spices. Major agricultural products include rice, tea, and rubber, with a focus on sustainable practices.

Sikkim

Sikkim, with its capital at Gangtok, attained statehood on May 16, 1975. According to the 2011 Census, the state has a population of 607,688 and spans an area of 7,096 sq. km, divided into 4 districts. The official language is English. Sikkim is home to a rich linguistic diversity, with 11 languages and dialects spoken, reflecting the state's varied population mix. These include Nepali, Bhutia, Lepcha, Limbu, Newari, Rai, Gurung, Mangai, Sherpa, Tamang, and Sunwar. Sikkim, nestled in the Himalayas, is renowned for its stunning landscapes, including majestic mountains and lush valleys. The state experiences a varied climate, from subtropical in the lower regions to alpine in the higher elevations. Sikkim is rich in biodiversity, home to a wide range of flora and fauna, including many endemic species. The state is known for its beautiful orchids and significant wildlife, such as the snow leopard. Culturally, Sikkim is diverse, with influences from Lepcha, Bhutia, and Nepali communities. Festivals like Losar and Bhadra Purnima highlight the rich cultural heritage of the state. Traditional knowledge is deeply rooted in agriculture, particularly in organic practices, as Sikkim is the first fully organic state in India. Major crops include rice, maize, and various fruits and vegetables.

Meghalaya

Meghalaya, with its capital at Shillong, attained statehood on January 21, 1972. As per the 2011 Census, the state has a population of 2,964,001 and covers an area of 22,429 sq. km, divided into 11 districts. The official

languages are Khasi, Pnar, and Garo, with English also used widely. Garo, which has a close affinity with the Koch and Boda languages, features many dialects, including Abeng or A Rengha, Along, Akarve (or Alve), Matchi, Dual, Uibok, Chisak Megam or Lingojam, Ruga, and Gao-Ganching. Pnar is spoken by tribal groups such as the Khynriam, Bhoi, Puai, and War, reflecting the rich linguistic diversity of the region. Meghalaya, often referred to as the "Abode of Clouds," is characterized by its stunning hills, deep valleys, and abundant rainfall, resulting in lush greenery. The climate is subtropical, with heavy monsoon rains shaping its ecosystem. The state boasts rich biodiversity, particularly in its forests and wetlands, and is home to unique species like the clouded leopard and diverse birdlife. Meghalaya is inhabited by various indigenous tribes, including the Khasi, Jaintia, and Garo, each with distinct languages and traditions. Festivals such as Wangala and Shad Suk Mynsiem celebrate the cultural richness of the state. Traditional knowledge in agriculture and herbal medicine is widely practiced. The primary agricultural products include rice, maize, and betel leaves, with sustainable farming methods deeply ingrained in the local culture.

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CHAPTER 2

MEDICINAL PLANT RESOURCES IN ARUNACHAL PRADESH

Arunachal Pradesh, a state in northeast India, was formed from the North-East Frontier Agency (NEFA) region and declared a state on 20 February 1987. Itanagar is the capital and largest town. The state borders Assam and Nagaland to the south, and has international borders with Bhutan to the west, Myanmar to the east, and Tibet to the north. Arunachal Pradesh is characterized by its rich cultural tapestry, with numerous tribes each possessing distinct languages, traditions, and customs. This cultural mosaic contributes to the unique identity of the state within the broader Indian subcontinent.

According to the 2011 Census of India, Arunachal Pradesh has a population of 1,383,727 and an area of 83,743 square kilometers, making it the least densely populated state in India with only 17 inhabitants per square kilometer. The state is ethnically diverse, hosting about 26 major tribes and 100 sub-tribes. Key tribes include the Monpa in the west, Tani in the center, Mishmi and Tai in the east, and Naga in the southeast. The eastern residents of Arunachal Pradesh were known as Lhobha, and the region as Lhoyü in ancient Tibetan texts. The western areas, including present-day Tawang and Kameng districts, were referred to as Monyul, meaning low land. The name "Arunachal Pradesh" translates to "Land of the Dawn-Lit Mountains" in Sanskrit, reflecting its geographical position in India.

Historical Account

The ancient history of the region now known as Arunachal Pradesh is limited, with recorded history primarily for the northwestern areas and those bordering Assam. The north fell under Monpa and Tibetan control, while the south was ruled by the Chutiya. The Monpa kingdom, known as Monyul, thrived between 500 BCE and 600 CE. Tibetan chronicles mention Monyul being ruled by Gongkar Gyal, a descendant of an exiled

Tibetan ruler. His descendants governed various regions, including parts of present-day Arunachal Pradesh and Bhutan. The Rgyal rigs text, dated 1668 or 1728, details tax payments from the Kameng and Tawang districts. The Monpas, referred to as Monbas by the Chinese, facilitated trade between Assam and Tibet, operating under the Tibetan government in Lhasa. Tibetan officials oversaw local Monpa chiefs.

Arunachal Pradesh, known as Lhoyu, came under the Tibetan Empire in the 7th century CE. The 5th Dalai Lama built the Tawang Monastery in the 17th century and imposed taxes, building fortresses like Dirang, Taklung, and Gyangkhar Dzongs for administration. The 6th Dalai Lama, born in Tawang, directed significant constructions in Lhasa before his death. Arunachal Pradesh falls within the Kham and U-Tsang cultural regions of Tibet. The Chutia kings of Assam controlled the foothills and plains. Excavations at Malinithan and Bhismaknagar reveal advanced Chutia culture and administration. The 400-year-old Tawang Monastery highlights the region's Buddhist influence. Key archaeological sites from the Chutia reign (8th-15th centuries) include Bhismaknagar Fort, Bolung Fort, and others. Additionally, Dirang Dzong and Tawang Monastery were built in the 17th century by the Monpa people and Merak Lama Lodre Gyatso, respectively.

In 1912–13, the British Indian government established the North-East Frontier Tracts, dividing them into three sections: the Ballipara Frontier Tract, the Lakhimpur Frontier Tract, and the Sadiya Frontier Tract. In 1913–1914, Tibet and Britain defined the borders of 'Outer Tibet' with China, resulting in the McMahon Line, which placed Tawang within British India. The Simla Accord, including the McMahon Line, was agreed upon by Tibet and Britain but not China, as China did not recognize Tibet's treaty-making authority. British records indicated Tibet's acceptance was contingent on China's approval, which was never secured. In 1935, the McMahon Line was officially recognized on maps, and by 1944, Britain had established administrations in the area. After India gained independence in 1947 and the PRC was founded in 1949, China maintained its stance against the McMahon Line. In 1950, China prepared to take over Tibet, and India supported Tibet. The North-East Frontier Agency (NEFA), now Arunachal Pradesh, was established in 1954. The border dispute led to the 1962 Sino-Indian War, during which China temporarily captured most of Arunachal Pradesh but withdrew in 1963, maintaining the McMahon Line as the border. In 1972, NEFA was renamed Arunachal Pradesh and became a union territory, achieving statehood in 1987 during Rajiv Gandhi's tenure as Prime Minister.

Geography and Climatic Conditions

Arunachal Pradesh, located between 26.28° N and 29.30° N latitude and 91.20° E and 97.30° E longitude, covers an area of 83,743 km². The highest peak in the state is Kangto at 7,060 meters, with other significant peaks including Nyegi Kangsang, the main Gorichen peak, and the Eastern Gorichen peak. The state's eastern mountain ranges, referred to as the Aruna Mountains, inspired its name and are described as "the place where the sun rises" in historical Indian texts. The villages of Dong and Vijaynagar are the first in India to receive sunlight. Major rivers include the Kameng, Subansiri, Siang (Brahmaputra), Dibang, Lohit, and Noa Dihing, with contributions from subsurface flows and summer snow melt. The mountains up to the Siang river are part of the Eastern Himalayas, those between the Siang and Noa Dihing are the Mishmi Hills (possibly part of the Hengduan Mountains), and the mountains south of the Noa Dihing in Tirap and Longding districts belong to the Patkai Range.

Arunachal Pradesh has diverse climate zones influenced by its varying elevations. Low-altitude areas experience a humid subtropical climate and relatively warm temperatures and high humidity throughout the year, with significant rainfall. However, at high-altitude areas (3,500–5,500 meters), the climate shifts to a subtropical highland climate and alpine climate. Here, temperatures are cooler, and the weather can be quite different from the lower regions. The subtropical highland climate has moderate temperatures and distinct wet and dry seasons, while the alpine climate features colder temperatures and can be snowy. Arunachal Pradesh receives a substantial amount of rainfall annually, ranging from 2,000 to 5,000 mm. Most of this rainfall occurs during the monsoon season from May to October, which accounts for 70% to 80% of the total annual precipitation. This heavy rainfall is due to the region's geography and its position along the monsoon wind path.

Agriculture

Arunachal Pradesh, with a 94% rural population, is the largest state in Northeast India and has an economy primarily based on agriculture. The main farming methods are Jhum cultivation and terrace farming, with most agricultural operations relying on manual and animal power. Common tools include spades, sickles, and dibblers. The state has 1.10 lakh hectares under Jhum cultivation and 90 lakh hectares under permanent cultivation. The topography and climate are suitable for crops like rice, millet, wheat, pulses, sugarcane, and potatoes. There is potential for

selective mechanization to reduce labor intensity, such as using improved hand tools and promoting power tiller equipment for seedbed preparation. Arunachal Pradesh also has ideal conditions for a variety of fruits and vegetables: tropical fruits like pineapple, oranges, and bananas in the valleys and foothills, and temperate fruits like apples, peaches, and plums in colder, higher areas. Additionally, the state has potential for coffee and tea cultivation.

Culture

Arunachal Pradesh is divided into several cultural regions based on tribal identity, language, religion, and material culture. These regions include the Tibetic-speaking Monpa area in the west, the Tani area in the center, the Mishmi area to the east, the Tai/Singpho/Tangsa area near Myanmar, and the Naga area in the south. Transition zones exist between these regions, with distinct tribes and isolated groups like the Sulung. Each cultural sphere has related tribes with similar traditions and languages. Key tribes include Monpa, Nyishi, Apatani, Tagin, Galo, Adi, Idu, Miju, Digaru, Tai Khamti, Nocte Naga, Wancho Naga, and Deori. The Deori tribe is historically significant as one of the earliest inhabitants.

Arunachal Pradesh has seen a rise in literacy, reaching 66.95% in 2011. The religious landscape is diverse: Christianity is the most followed religion (30.26%), followed by Hinduism (29.04%), indigenous religions (26.20%), and Buddhism (11.77%). Other religions include Islam, Sikhism, and Jainism. According to the 2011 census, the major languages spoken in Arunachal Pradesh include Nyishi (20.74%), Adi (17.35%), Nepali (6.89%), Tagin (4.54%), and several others. The majority of the population speaks Tani languages, which are part of the Tibeto-Burman family, and includes tribes like Nyishi, Apatani, Tagin, Galo, Adi, and more. Tani languages form a dialect chain with mutual intelligibility. To the east, the Mishmi group languages (Idu, Digaru) are highly endangered. Southwards, Singpho (Kachin) and Naga languages (Nocte, Wancho) are spoken, showing affiliations with Myanmar and Nagaland. West and north of the Tani area, Bodic languages (Dakpa, Tshangla) are spoken, mostly related to Bhutan and Tibet. There are many undescribed languages between the Bodic and Tani areas, such as Sherdukpen, Bugun, and Puroik/Sulung, which are unique and highly endangered. Additionally, languages spoken by migratory and central government employees are present. Tai Khamti, a Tai language, is also found here, originating from Myanmar. Hindi, taught by migrant teachers, acts as a lingua franca and is increasingly spoken, alongside other Indo-Aryan languages like Assamese,

Bengali, and Nepali. Despite the linguistic diversity, English is the only official language of the state.

Diversity

Arunachal Pradesh is renowned for its rich biodiversity, hosting around 750 bird species and over 200 mammal species. The state's forests, which make up one-third of the habitat in the Himalayan biodiversity hotspot, cover 63,093 km² (77% of its land area). In 2013, its forests were recognized as part of the vast "Intact Forest Landscapes" area extending into Myanmar, China, and Bhutan. Arunachal Pradesh features three tiger reserves: Namdapha National Park, Mouling National Park, and Pakke Tiger Reserve. The state's varied habitats include Brahmaputra Valley semi-evergreen forests, Eastern Himalayan broadleaf forests, and high-altitude alpine shrub and meadows. It supports over 5,000 plant species, with a significant number used medicinally, especially in Ziro Valley.

The state's fauna includes tigers, leopards, snow leopards, Asian elephants, and unique species like the Mishmi Hills hoolock gibbon and several giant flying squirrels. Its diverse forest types range from subtropical to alpine, with vegetation including dwarf rhododendrons, oaks, pines, and firs.

Plant diversity

The forests of Arunachal Pradesh possess a very wide range of biological diversity, not only in the variety of tree and animal species but also in species yielding Minor Forest Produce, now increasingly referred to as Non-Timber Forest Products (NTFP). Many of these species are widely used by the predominantly tribal inhabitants of the state for sustenance and livelihood. Medicinal plants form an important and valuable part of the NTFP found in Arunachal Pradesh.

Although better known for their valuable timber resources, which support several wood-based industries, the forests of Arunachal Pradesh also possess a wealth of NTFP which have the potential to sustain cottage and small-scale enterprises and thus offer a major source of employment and income to the local people. Medicinal plants are most promising in this regard.

With the growing pressure on natural forests for timber resources, both for use as fuel and for industrial purposes, it has become incumbent upon forest professionals, administrators, managers, and scientists to bring about appropriate policy and technological innovations to achieve a quantum growth in the productivity of NTFP from our forests. This will

help in weaning away the exploitative forces from the timber resources and thus aid in forest conservation in the long term.

It is very clear that the potential of medicinal plant resources in generating employment opportunities and providing a sustainable source of livelihood to the rural and forest-dwelling communities has not been fully realized. Medicinal plants, being mostly short-rotation species, can be termed the "cash crops" of the forestry sector in the sense that while tree crops take a long time to mature and yield returns, medicinal plants have very short gestation periods. This characteristic can help in the large-scale adoption of medicinal plants by local people as plantation crops on community and private lands.

Medicinal Plants Sector in Arunachal Pradesh

The ethnobotanical importance of medicinal plants is well known to the various tribal communities of Arunachal Pradesh, who have been using these resources since time immemorial. Until recently, a majority of the tribal population lived as hunter-gatherers, meeting all their requirements of food, clothing, and shelter from the forests. Many of these plants are also of socio-cultural significance to the people of the state.

Although medicinal plants are used as drugs, a host of other plants are used in various rituals to cure diseases and ailments. It may be noted that the present level of revenue generated by these resources is by no means an indication of their true potential, as so far, no systematic efforts have been made for their development, both for increasing their productivity and for their collection, processing, and marketing.

The present system of harvesting NTFP, including medicinal plants, is mainly through the traditional and customary usage by the tribals, through a system of permits issued by the Forest Department, through sales by auction, and by way of agreements entered into with local entrepreneurs. The collection of medicinal, spices, and aromatic plants is mainly done through the permit system.

West Kameng, Tawang, Lohit, Dibang Valley, Lower Subansiri, and East Siang are some of the districts where the medicinal plants trade is prevalent. Although the present level of extraction of medicinal plants in Arunachal Pradesh does not pose any serious threat of over-exploitation leading to depletion of the growing stock and the wild genetic diversity of these resources, this could well become a cause for concern with the increase in their demand.

The demand for various herbs and plant products used in the traditional system of medicines, such as Ayurveda, has grown manifold in recent

years. Consequently, the fear of losing some of the rare species which occur in the wild is very real and calls for timely intervention.

Besides, presently, the extraction and processing of various medicinal plants are being done in the unorganized sector, i.e., by individual entrepreneurs. There is tremendous scope for organizing the village/tribal communities into suitable cooperatives or other similar institutions to handle such activities. Such a measure will also have to be backed up by facilities for marketing and by suitable training and technology transfer input so that there would be greater value addition, rather than the marketing of primary commodities alone which are being collected from the forest areas. The number of people who would benefit from such employment and income-generating activities will also be much greater than at present.

In addition to some of the efforts already undertaken for cultivating medicinal plants, the forest department also has a strong research program through its Van Vigyan Kendra at Chessa. The program components include surveys to locate and document the occurrence and ethnobotanical importance of the medicinal plants. Several species are also being cultivated at the research center to create a germplasm bank. Propagation methods are being experimented with and perfected for adoption in the field. Genetic improvement through plant breeding and the use of tissue culture methods are other elements of the research program. A medicinal plant garden spread over an area of 1.5 ha and containing 140 species has been established at the Van Vigyan Kendra. This germplasm bank, apart from providing propagation materials, also provides opportunities to study the phenology, and productivity, etc. Many of the wild species, which are otherwise seasonal and scattered over a wide range, are now grown at this center, and samples of different species could be sent to agencies outside Arunachal Pradesh for testing and commercial applications.

The forests of Arunachal Pradesh are a rich storehouse of important drug-yielding plants, including many species of aromatic and spice plants. The occurrence of high-altitude (temperate) medicinal plants is a special characteristic of this category of flora in Arunachal Pradesh. As already pointed out, the over-exploitation of medicinal plants can lead to their depletion and even extinction from nature.

Therefore, systematic efforts are being launched for cultivating some species on an extensive scale, not only in the forest areas but also through the village communities. Medicinal plants easily lend themselves to plantation as intercrops within the existing forest plantations, and it is in such areas that their cultivation is being taken up by the forest department. These plants are also propagated easily through seedlings raised in the nursery. Plantations of a unique temperate medicinal plant, *Coptis teeta*

(Mishmi teeta), have been taken up in Dibang Valley and Lohit Districts. Some other species are also taken up for cultivation as given below:

1. *Coptis teeta*: This popular medicinal plant, also known as Mishmi Tita, is in great demand and occurs in Lohit, Dibang Valley, and Siang Districts of Arunachal Pradesh as undergrowth in temperate forests. Their ideal habitat is mostly shady, humus-laden forest floors with snowfall during winter. The forest department has been maintaining plantations of this species at Mayodia, Hundei, etc. 3-5 year old plants yield good rhizomes.
2. *Taxus baccata*: This conifer tree has gained popularity recently in Arunachal Pradesh and is being largely collected from the wild for its alkaloid-containing leaves used in anti-cancer research. Though this species is distributed throughout the temperate regions of the state, it is becoming rarer due to over-exploitation. The forest department has restricted the trade of this commodity pending silvicultural experiments to establish methods, patterns, and levels of harvesting leaves from the standing trees.
3. *Illicium griffithii*: This is another temperate tree of commercial importance for its spicy fruits. They are collected from the wild from Bodila-Dirang areas in Kameng Districts. There is a good scope for the tree to be taken up for plantation in Arunachal Pradesh. Naturally, they occur in Kameng, Subansiri, and Siang Districts, though presently exploitation is from Kameng District only. Nursery trials have yielded promising results, and plantations have already been started in the Bomdila area.
4. *Piper brachystachyum*: A tropical plant of importance which is widely seen in forest undergrowth and roadsides in Pasighat and Hayuliang areas. The forest department has successfully raised plantations at Banderdewa and Pasighat under Hollock plantations. Through such underplanting, the availability of this species can be increased substantially.
5. *Rauvolfia canescens* and *Rauvolfia serpentina*: These important medicinal plants are under cultivation under forest plantations at various locations. Mass production of seeds and seedlings has been done by the Silviculture Division for large-scale plantation throughout the state.
6. *Aconitum ferox* and *Aconitum heterophyllum*: Aconites are available in the sub-alpine and alpine zones of Arunachal Pradesh. Apart from medicinal applications, these are used by local people for poisoning their arrows for hunting. These could also be cultivated at suitable locations.

Several medicinal plants have significant potential for large-scale cultivation in Arunachal Pradesh in which some key plants are given in Table 1.

Table 1. Key Medicinal Plants Suitable for Large-Scale Cultivation in Arunachal Pradesh

S.No.	Botanical Name	Common Name
Lower elevations (Below 1500m MSL)		
1	*Acorus calamus*	Boach
2	*Andrographis paniculata*	Kalmegh
3	*Cymbopogon citratus*	Lemon grass
4	*Costus speciosus*	Crepe Ginger, Cane-reed
5	*Dioscorea floribunda*	Zimikand, Aerial yam
6	*Gloriosa superba*	Glary lily
7	*Piper brachystachyum*	Pipli
8	*Rauvolfia serpentina*	Indian snakeroot, Sarpagandha
9	*Solanum khasianum*	Dutch eggplant, Love-apple
10	*Vetiveria zizanioides*	Khus Khus
11	*Vinca rosea*	Soda bahar
Higher elevations (Above 1500m MSL)		
1	*Aconitum ferox*	Vatsanabha
2	*Aconitum heterophyllum*	Atis, Ativisha
3	*Berberis asiatica*	Indian barberry, Daruhaldi
4	*Colchicum luteum*	Suranjan
5	*Coptis teeta*	Mishmi teeta
6	*Fritillaria cirrhosa*	Yathu
7	*Gentiana spp.*	Gentiana
8	*Illicium griffithii*	Listsi
9	*Nardostachys jatamansi*	Jattamasi
10	*Orchis latifolia*	Salampanja
11	*Panax spp.*	Ginseng
12	*Picrorhiza kurroa*	Kutkin
13	*Podophyllum hexandrum*	Podophyllum
14	*Rheum emodi*	Rhubarb, Rewand chini
15	*Swertia chirayita*	Chiratta
16	*Valeriana jatamansi*	Tagar

A list of common medicinal plants found in different regions of Arunachal Pradesh is given in Table 2.

Table 2. Common medicinal plants found in Arunachal Pradesh

S.No.	Scientific Name (Family)
1.	*Abroma augustum* (L.) L.f. (*Malvaceae*)
2.	*Abrus precatorius* L. (*Fabaceae*)
3.	*Abutilon indicum* (L.) Sweet (*Malvaceae*)
4.	*Ageratum conyzoides* L. (*Asteraceae*)
5.	*Agrimonia eupatoria* L. (*Rosaceae*)
6.	*Aloe vera* (L.) Burm.f. (*Aloe barbadensis* Mill.) (*Asphodelaceae*)
7.	*Andrographis paniculata* (Burm.f.) Wall. ex Nees (*Acanthaceae*)
8.	*Argyreia nervosa* (Burm.f.) Bojer (*Convolvulaceae*)
9.	*Asparagus racemosus* Willd. (*Asparagaceae*)
10.	*Baliospermum solanifolium* (Burm.) Suresh (*Baliospermum montanum* (Willd.) Müll.Arg.) (*Euphorbiaceae*)
11.	*Berberis aristata* DC. (*Berberidaceae*)
12.	*Bergenia ciliata* (Haw.) Sternb. (*Saxifragaceae*)
13.	*Bergera koenigii* L. (*Murraya koenigii* (L.) Spreng.) (*Rutaceae*)
14.	*Boerhavia diffusa* L. (*Nyctaginaceae*)
15.	*Calotropis gigantea* (L.) W.T.Aiton (*Apocynaceae*)
16.	*Cannabis sativa* L. (*Cannabaceae*)
17.	*Cassia fistula L.* (*Fabaceae*)
18.	*Cassia occidentalis* L. (*Senna occidentalis* (L.) Link) (*Fabaceae*)
19.	*Centella asiatica* (L.) Urb. (*Apiaceae*)
20.	*Catharanthus roseus (L.) G.Don (Apocynaceae)*
21.	*Cleome gynandra* L. (*Cleomaceae*)
22.	*Clerodendrum indicum* (L.) Kuntze (*Clerodendrum siphonanthus* W.T.Aiton) (*Lamiaceae*)
23.	*Codonopsis foetens* Hook.f. & Thomson (*Campanulaceae*)
24.	*Cordia dichotoma* G.Forst (*Cordia wallichii* G.Don and *Cordia obliqua* Willd.) (*Boraginaceae*)
25.	*Coriaria napalensis* Wall. (*Coriariaceae*)
26.	*Cucumis melo* L. (*Luffa cylindrica* (L.) M.Roem.) (*Cucurbitaceae*)
27.	*Curculigo orchioides* Gaertn. (*Hypoxidaceae*)
28.	*Curcuma caesia* Roxb. (*Zingiberaceae*)
29.	*Curcuma longa* L. (*Zingiberaceae*)
30.	*Cuscuta reflexa* Roxb. (*Convolvulaceae*)

31.	*Cynoglossum zeylanicum* (Sw. ex Lehm.) Thunb. ex Brand (*Cynoglossum furcatum* Wall.) (*Boraginaceae*)
32.	*Cyperus rotundus* L. (*Cyperaceae*)
33.	*Dalbergia latifolia* Roxb. (*Fabaceae*)
34.	*Dalbergia sissoo* Roxb. ex DC. (*Fabaceae*)
35.	*Datura metel* L. (*Solanaceae*)
36.	*Dioscorea alata* L. (*Dioscoreaceae*)
37.	*Dioscorea bulbifera* L. (*Dioscoreaceae*)
38.	*Dioscorea deltoidea* Wall. ex Griseb. (*Dioscoreaceae*)
39.	*Dioscorea pentaphylla* L. (*Dioscoreaceae*)
40.	*Drymaria cordata* (L.) Willd. ex Schult. (*Caryophyllaceae*)
41.	*Eclipta prostrata* (L.) L. (*Asteraceae*)
42.	*Elaeocarpus sphaericus* (Gaertn.) Heer (*Elaeocarpaceae*)
43.	*Elsholtzia fruticosa* (D.Don) Rehder
44.	*Emilia sonchifolia* (L.) DC. (*Asteraceae*)
45.	*Erythrina arborescens* Roxb. (*Fabaceae*)
46.	*Erythrina stricta* Roxb. (*Fabaceae*)
47.	*Erythrina variegata* L. (*Fabaceae*)
48.	*Eupatorium cannabinum* L. (*Asteraceae*)
49.	*Fagopyrum cymosum* (Trevir.) Meisn. (*Fagopyrum dibotrys* (D.Don) H.Hara) (Polygonaceae)
50.	*Fagopyrum esculentum* Moench (*Polygonaceae*)
51.	*Garcinia cowa* Roxb. ex Choisy (*Clusiaceae*)
52.	*Gaultheria fragrantissima* Wall. (*Ericaceae*)
53.	*Geranium nepalense* Sweet (Geraniaceae)
54.	*Gloriosa* superba L. (*Colchicaceae*)
55.	*Gmelina arborea* Roxb. ex Sm. (*Lamiaceae*)
56.	*Gynocardia odorata* R.Br. (*Achariaceae*)
57.	*Hibiscus* × *rosa-sinensis* L. (*Malvaceae*)
58.	*Holarrhena pubescens* Wall. ex G.Don (*Holarrhena antidysenterica* Wall.) (*Apocynaceae*)
59.	*Hydrangea robusta* Hook.f. & Thomson (*Hydrangeaceae*)
60.	*Hydrocotyle javanica* Zoll. (*Hydrocotyle javanica* Thunb.) (*Araliaceae*)
61.	*Ichnocarpus frutescens* (L.) W.T.Aiton (*Apocynaceae*)
62.	*Impatiens balsamina* L. (*Balsaminaceae*)
63.	*Ipomoea batatas* (L.) Lam. (*Convolvulaceae*)
64.	*Ipomoea quamoclit* L. (*Convolvulaceae*)
65.	*Jatropha curcas* L. (*Euphorbiaceae*)
66.	*Justicia adhatoda* L. (*Adhatoda zeylanica* Medik.) (*Acanthaceae*)

67.	*Justicia gendarussa* Burm.f. (*Acanthaceae*)
68.	*Kaempferia rotunda* L. (*Zingiberaceae*)
69.	*Leucas lavandulifolia* Sm. (*Lamiaceae*)
70.	*Litsea cubeba* (Lour.) Pers. (*Lauraceae*)
71.	*Litsea monopetala* (Roxb.) Pers. (*Lauraceae*)
72.	*Luffa aegyptiaca* Mill. (*Cucurbitaceae*)
73.	*Lyonia ovalifolia* (Wall.) Drude (*Pieris ovalifolia* (Wall.) D.Don) (*Ericaceae*)
74.	*Malaxis muscifera* (Lindl.) Kuntze (*Microstylis muscifera* (Lindl.) Ridl.) (*Orchidaceae*)
75.	*Mallotus philippensis* (Lam.) Müll.Arg. (*Euphorbiaceae*)
76.	*Melia azedarach* L. (*Meliaceae*)
77.	*Melissa axillaris* (Benth.) Bakh.f. (*Melissa parviflora* Benth.) Lamiaceae
78.	*Mentha* × *piperita* L. (*Lamiaceae*)
79.	*Mentha spicata* L. (*Lamiaceae*)
80.	*Mesua ferrea* L. (*Calophyllaceae*)
81.	*Mimosa pudica* L. (*Fabaceae*)
82.	*Mirabilis jalapa* L (*Nyctaginaceae*)
83.	*Mucuna pruriens* (L.) DC. (*Mucuna prurita* (L.) Hook.)
84.	*Mussaenda glabrata* (Hook.f.) Hutch. Ex (*Mussaenda frondosa* var. *glabrata* Hook.f.) (Rubiaceae)
85.	*Mussaenda roxburghii* Hook.f. (Rubiaceae)
86.	*Nerium oleander* L. (*Nerium indicum* Mill.) (*Apocynaceae*)
87.	*Nicandra physalodes* (L.) Gaertn (*Solanaceae*)
88.	*Oroxylum indicum* (L.) Kurz (*Bignoniaceae*)
89.	*Ougeinia oojeinensis* (Roxb.) Hochr. (*Desmodium oojeinense* (Roxb.) H.Ohashi) (*Fabaceae*)
90.	*Oxalis corniculata* L. (*Oxalidaceae*)
91.	*Paris polyphylla* Sm. (*Melanthiaceae*)
92.	*Phlogacanthus thyrsiformis* (Roxb. ex Hardw.) Mabb. (*Phlogacanthus thyrsiflorus* (Roxb.) Nees) (*Acanthaceae*)
93.	*Phyllanthus emblica* L. (*Emblica officinalis* Gaertn.) (*Phyllanthaceae*)
94.	*Physalis angulata* L. (*Physalis minima* L.) (*Solanaceae*)
95.	*Physalis halicacabum* Crantz (*Physalis divaricata* D.Don) (*Solanaceae*)
96.	*Plantago major* L. (*Plantaginaceae*)
97.	*Pleurolobus gangeticus* (L.) J.St.-Hil. ex H.Ohashi & K.Ohashi (*Desmodium gangeticum* (L.) DC.) (Fabaceae)

98.	*Plumbago indica* L. (*Plumbaginaceae*)
99.	*Plumbago zeylanica* L. (*Plumbaginaceae*)
100.	*Plumeria rubra L. (Plumeria acutifolia* Poir. and *Plumeria acuminata* W.T.Aiton) *(Apocynaceae)*
101.	*Polygonatum verticillatum* (L.) All. (*Asparagaceae*)
102.	*Punica granatum* L. (*Lythraceae*)
103.	*Rauvolfia serpentina* (L.) Benth. ex Kurz (*Apocynaceae*)
104.	*Rheum australe* D.Don (*Rheum emodi* Wall. ex Meisn.) (*Polygonaceae*)
105.	*Rhododendron anthopogon* D.Don (*Ericaceae*)
106.	*Rhododendron arboreum* Sm. (*Ericaceae*)
107.	*Rhododendron barbatum* Wall. ex G.Don (*Ericaceae*)
108.	*Rhododendron campanulatum* D.Don (*Ericaceae*)
109.	*Rhododendron cinnabarinum* Hook.f. (*Ericaceae*)
110.	*Rhododendron lepidotum* Wall. ex G.Don (*Ericaceae*)
111.	*Rhododendron setosum* D.Don (*Ericaceae*)
112.	*Ricinus communis* L. (*Euphorbiaceae*)
113.	*Rosa sericea* Lindl. (*Rosaceae*)
114.	*Rumex nepalensis* Spreng. (*Polygonaceae*)
115.	*Salix tetrasperma* Roxb. (*Salicaceae*)
116.	*Sansevieria zeylanica* (L.) Willd. (*Asparagaceae*)
117.	*Scindapsus officinalis* (Roxb.) Schott (*Araceae*)
118.	*Scoparia dulcis* L. (*Plantaginaceae*)
119.	*Sedum multicaule* Wall. ex Lindl. (*Crassulaceae*)
120.	*Semecarpus anacardium* L.f. (*Anacardiaceae*)
121.	*Senna tora (L.) Roxb.* (*Fabaceae*)
122.	*Shorea robusta* C.F.Gaertn. (*Dipterocarpaceae*)
123.	*Sida acuta* Burm.f. (*Malvaceae*)
124.	*Sida cordata* (Burm.f.) Borss.Waalk. (*Malvaceae*)
125.	*Sida cordifolia* L. (*Malvaceae*)
126.	*Solanum anguivi* Lam. (*Solanaceae*)
127.	*Solanum dulcamara* L. (*Solanaceae*)
128.	*Solanum indicum* L. (*Solanaceae*)
129.	*Solanum melongena* L. (*Solanaceae*)
130.	*Solanum nigrum* L. (*Solanaceae*)
131.	*Solanum torvum* Sw. (*Solanaceae*)
132.	*Solanum viarum* Dunal (*Solanaceae*)
133.	*Stephania japonica* var. *discolor* (Blume) Forman (*Stephania hernandiifolia* (Willd.) Walp.) (*Menispermaceae*)

134.	*Stephania rotunda* Lour. (*Stephania glabra* (Roxb.) Miers) (*Menispermaceae*)
135.	*Withania somnifera* (L.) Dunal (*Solanaceae*)
136.	*Zingiber officinale* Roscoe (*Zingiberaceae*)
137.	*Zingiber zerumbet* (L.) Roscoe ex Sm. (*Zingiberaceae*)
138.	*Ziziphus mauritiana* Lam. (*Rhamnaceae*)

Medicinal Orchids found in Arunachal Pradesh

In addition to medicinal plants, Arunachal Pradesh is home to various medicinal orchids known for their therapeutic uses. These orchids underscore the rich biodiversity of Arunachal Pradesh and its potential for medicinal plant cultivation. Some notable orchids and their applications include:

1. *Acampe papillosa*: The roots of this orchid are used to treat rheumatism.
2. *Acampe praemorsa*: Similar to *Acampe papillosa*, its roots are also used for rheumatism.
3. *Bulbophyllum neilgherrense*: The pseudo bulbs of this orchid serve as a tonic.
4. *Cleisostoma williamsonii*: Both the leaves and stems are used in the treatment of bone fractures.
5. *Cymbidium aloifolium*: The whole plant is used as a tonic.
6. *Dendrobium nobile*: The seeds are applied to freshly cut wounds for healing.
7. *Dendrobium ovatum*: The juice extracted from the whole plant is used to alleviate all kinds of stomach aches, stimulate bile secretion, and act as a laxative.
8. *Eulophia nuda*: The tubers of this orchid are used as a tonic, aphrodisiac, blood purifier, and appetizer.
9. *Eulophia epidendrum*: The tubers of this orchid are used as a vermifuge to expel parasitic worms.
10. *Flickingeria macraei*: The pseudo bulbs are known for their aphrodisiac properties.
11. *Habenaria commelinifolia*: Root tubers are used to treat spermatorrhea (involuntary ejaculation) and urinary troubles.
12. *Luisia tenuifolia*: The whole plant is used as an emollient and poultice for boils and tumors.
13. *Malaxis acuminata*: The pseudo bulbs serve as a tonic, improve sperm count, and are used in the treatment of tuberculosis.

14. *Orchis latifolia*: The tuber acts as an expectorant and astringent.
15. *Pecteilis susannae*: Tubers are used to treat boils on the palm.
16. *Pholidota pallida*: The pseudo bulbs are used to relieve rheumatic pains.
17. *Rhynchostylis retusa*: The whole plant is used as an emollient.
18. *Satyrium nepalense*: Tubers are used to treat malaria, dysentery, and serve as a tonic.
19. *Vanda tessellata*: The roots and leaves are applied externally for rheumatism of the nervous system and scorpion bites.
20. *Vanda testacea*: Leaves and flowers are used externally for rheumatism of the nervous system and scorpion bites.
21. *Zeuxine strateumatica*: The stem is used as a tonic.

Formulations of Folk Medicine in Arunachal Pradesh

Arunachal Pradesh is rich in medicinal plants and orchids used in traditional folk medicine. These plants, whether cultivated or found in the wild, are integral to local healthcare practices. They reflect the rich traditional knowledge and biodiversity of Arunachal Pradesh, highlighting the importance of preserving and promoting these natural resources for future generations. Many plants are still used in their folk medicinal practices in various formulations.

For example, *Aconitum ferox* (Bikh, Seli), found in Tawang District (Tawang, Mego Pushingla), Lower Subansiri (Tale Valley), West Siang (Mechuka, Manigaon), Dibang (Anni), and Lohit (Hot Spring, Talukpoor), has tuberous roots used to treat diarrhea, dysentery, and neuralgia. *Andrographis paniculata* (Chirate), cultivated in lower elevations, uses fresh leaf juice or dry powder of the whole plant to treat worms, irregular stools, loss of appetite, and dysentery. *Adhatoda zeylanica* (Vasak), found throughout Arunachal in lower elevations, has leaf juice used for cough, bronchitis, and stomach complaints. *Acorus calamus* (Boch), also found throughout Arunachal in lower elevations, has a rhizome and leaf paste used to cure headaches and giddiness. *Alocasia cucullata*, found wild in lower elevations, has a corm eaten to cure body ache, rheumatism, and gout.

Aloe barbadensis (Chalkunwari), found in lower elevations, has juice mixed with rice water used to relieve headaches and giddiness. *Boerhavia diffusa* (Punarnava), found in lower elevations, uses juice of leaves or the whole plant to treat jaundice and asthma. *Coptis teeta* (Mishmi teeta), found in Lohit District (Melinja, Borphu, Hyuling, Chaglagam), Dibang Valley (Hunli, Malini), West Siang (Singa, Geling), Lower Subansiri (Tale