RESEARCH ARTICLE

Loss of Medicinal Plants due to Shifting Cultivation *(Jhum)* in Kiphire District, Nagaland, India

Pradeep Kumar*

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Abstract

Shifting cultivation, also referred to as slash-and-burn agriculture, is a traditional practice extensively carried out in the Kiphire district of Nagaland, India. While it serves as a livelihood for tribal communities, its ecological consequences, particularly on medicinal plant diversity, are profound. This study investigates the impact of shifting cultivation on the loss of medicinal plants by comparing vegetation in virgin forests and jhum fallows. A systematic vegetation survey was conducted using 10 m x 10 m quadrats to record medicinal plant diversity, abundance and ecological characteristics. Sixteen medicinal plant species belonging to 15 families were identified in the virgin forests. These species, including *Holarrhena pubescens*, *Kaempferia galangal* and *Laurus nobilis*, are known for their significant therapeutic, ecological and cultural roles. Alarmingly, these species were entirely absent in the jhum fallows, highlighting the adverse effects of shifting cultivation on biodiversity. Shortened fallow periods, driven by population pressures and demand for agricultural land, were found to exacerbate land degradation, as the forests fail to regenerate adequately. The ecological roles of medicinal plants in maintaining soil fertility, regulating ecosystem processes and supporting traditional healthcare systems are critical, yet they are increasingly under threat. The study further underscores the cultural and economic importance of these plants to local communities, necessitating immediate conservation measures. The findings advocate for integrating sustainable land-use practices, afforestation and community-based conservation strategies to mitigate biodiversity loss. Policymakers and local stakeholders must collaborate to promote agroforestry systems, enrich fallow lands with medicinal plants and preserve the region's ecological and cultural heritage. This research contributes valuable insights into the need for balancing agricultural practices with biodiversity conservation to ensure ecological resilience in Nagaland's fragile ecosystems.

Highlights

- Investigated the loss of medicinal plant species due to shifting cultivation (Jhum) in Kiphire District, Nagaland.
- Identified 16 medicinal plant species in virgin forests, all of which were absent in jhum fallows.
- Shortened fallow periods exacerbate land degradation, hindering forest regeneration.
- Emphasized the importance of medicinal plants in traditional healthcare, soil fertility and ecosystem processes.
- Recommended agroforestry and community-based conservation strategies to mitigate biodiversity loss.

Keywords: Shifting cultivation, Medicinal plants, Lost species, Nagaland

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Introduction

The term 'shifting cultivation' refers to 'slash and burn' agriculture and it is practiced in South American forests and savannahs, African tropics and parts of the Asian tropics, including tribal areas of Sumatra, the Malayan Peninsula and northeast (NE) India, where it is locally known as jhum cultivation or jhuming (Aweto, 2012, Borthakur *et al*., 2002). It is variably termed as rotational bush fallow agriculture, swidden cultivation, or slash and burn cultivation, and is an ancient form of agriculture still common in many parts of the humid tropics (Raman, 2001). Shifting cultivation is a practice which consists of a cyclic nature, under which the selection of fields usually on hills slopes is done and clearing the land is done by cutting down the jungle, drying and burning the dry debris on which seeds of different crops are sown by dibbing or broadcasting before the onset of rain is carried out. The ashes are left to enrich soil fertility and the burnt patch of the land is used for the cultivation of paddy and other subsidiary crops (Hauchhum and Singson, 2019).

Shifting cultivation is a highly dynamic and complex socio-ecological system that has evolved over centuries of experiential learning by traditional societies (Cairns, 2015). It is the most well-known and dominant agricultural practice in the North Eastern hilly states. Recent estimates of its extent show that roughly 280 million hectares of land, with the largest share in Africa, followed by the Americas and Asia, 62% of the one-degree cells investigated in the humid and sub-humid tropics currently show signs of shifting cultivation, the majority being in the Americas (41%) and Africa (37%) (Nath *et al*., 2022). Approximately one billion people (22% of the total population of developing countries situated in tropical and subtropical regions) are dependent upon various types of shifting cultivation, either directly or indirectly (Marak *et al*., 2023). The

Silviculture and Forest Management Division, Forest Research Institute, Dehradun-248006, Uttarakhand, India.

***Corresponding author:** Pradeep Kumar, Silviculture and Forest Management Division, Forest Research Institute, Dehradun-248006, Uttarakhand, India., Email: Pradeep.hau.11@gmail.com

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increasing population pressure on the limited land resources, followed by socio-economic and land tenure systems, has led to the decline in soil health and is responsible for the above fallow periods in the northeast region of India (Walling *et al*., 2018).

Species richness is typically lower in forests recovering from shifting cultivation than mature forests (review of 24 studies; Scales & Marsden, 2008), but not all taxa show consistent responses. Meta-analysis suggests that tropical secondary forests take at least 48 years to reach 80% of the species richness of mature forests, but with variation across taxa and locations (Norgrove & Beck, 2016). This average recovery time is much longer than the typical shifting cultivation cycle, which traditionally is around 20–30 years in most regions (Spencer, 1966) but has frequently been reduced to <5 years (6–27 years in Nagaland; Borah *et al*., 2018) due to increasing human population densities and associated demand for agricultural land (Ramakrishnan & Patnaik, 1992; Schmidt-Vogt *et al*., 2009; Thong *et al*., 2018). Shifting cultivation has been blamed for large-scale forest and land degradation and loss of wild biodiversity in north-eastern India and in other states of the country where such type of cultivation is prevalent. With increasing population pressure, and due to shortage of agricultural land, the fallow period in the tropical regions has been shortened excessively and the period of cultivation has been extended for too long (Whitmore, 1998) causing severe degradation of the land.

Disturbance in vegetation is a broad term that encompasses changes ranging from minor alterations in community structure to severe events, such as widespread mortality. While locally occurring high-magnitude disturbances are ecologically significant, gradual and pervasive disturbances often have a more substantial cumulative impact on ecosystems (Cohen *et al*., 2017). In undisturbed forests, a mosaic of patches with varying levels of species diversity is commonly observed. This pattern is attributed to the combined effects of stable, nonextreme environmental conditions and gap-phase dynamics within the forest ecosystem (Whittaker, 1972). The species in the studied forest ecosystems predominantly exhibited a clumped or contiguous distribution pattern, highlighting the heterogeneous and patchy nature of these forests. Such clumping of individuals within a species may result from factors like the chance of colonization or establishment and is often linked to species-specific dispersal mechanisms (Poore, 1968; Ashton, 2008; Hubbell, 1979). This spatial arrangement underscores the complex interplay of ecological processes shaping forest structure and composition.

Nagaland falls under the geographical coordinates of 25° 6′ and 27° 4′ North latitude and 93° 20′ and 95° 15′ East longitude covering an area of 16,579 sq km (Sarkar *et al*., 2023) with an altitude ranging between 194 to 3048 m above mean sea level (MSL) (Njuki *et al*., 2010). Of the total geographical area of Nagaland (16,579 sq km), 12,251 sq km - accounting for 73.90% - is designated as forest land (ISFR-2019 report). According to ISFR-2021 report, Nagaland recorded a 235 square km decline in forest cover during the 2019-21 period. It is a hilly tribal state in the North-Eastern region of India where agriculture is the primary occupation, and animal-based food forms an integral part of the local diet. Rearing pigs in the backyard is an essential aspect of Naga culture and is important to the economic and socio-cultural traditions of the tribal farmers in Nagaland (Singh *et al*., 2019a, b). It is bordered by Arunachal Pradesh and Assam in the north, and Manipur in the south. It shares the international border in the east with Myanmar. Physio-graphically, Nagaland consists of a narrow strip of hilly country running Northeast to Southwest and facing the Assam plains to its North and Northwest. The State is drained by several important rivers, the most significant being the Barak River. The annual rainfall ranges between 1,800 mm to 2,500 mm and the annual temperature varies from 21°C to 40°C. The State has 11 districts, all of which are tribal as well as hill districts (ISFR-2019 report: https://fsi.nic.in/isfr19/vol2/isfr-2019-vol-ii-nagaland.pdf. Accessed on 13th November, 2024).

As per the Champion & Seth Classification of Forest Types (1968), the forests in Nagaland belong to seven Type Groups, which are further divided into 10 Forest Types. The forest area in Nagaland is limited and therefore the department has purchased land from private owners for Biodiversity Conservation and taking up plantations. The total land purchased by the department is approximately 192.47 sq km. Forests in Nagaland are largely under the community and private forests. The Forest Department owns only certain areas classified as Reserved Forests, Protected Forests, Wildlife Sanctuaries, National parks, Nurseries & Botanical Gardens (ISFR-2019 report: https://fsi.nic.in/isfr19/vol2/isfr-2019-vol-ii-nagaland.pdf. Accessed on 13th November, 2024). In Nagaland, during the period 1st January 2015 to 5th February 2019, no forest land was diverted for non-forestry purposes under the Forest Conservation Act, 1980 (MoEF & CC, 2019).

To the best of our knowledge, this is the first systematic study comparing the dominance of medicinal plant species between virgin forests and Jhum fallows in the semi-evergreen forests of Nagaland using a quadrat-based approach within 1-hectare area. This research provides new insights into the ecological distribution of 16 medicinally important species and identifies dominant taxa that can guide conservation, sustainable harvesting and agroforestry integration. The findings serve as a valuable baseline for monitoring forest dynamics and traditional knowledge-driven biodiversity in Northeast India.

Materials and Methods

Study area

The present study was carried out in an identified virgin forest of Phelungre village, Kiphire district (25°53′10″N 94°47′08″E) of Nagaland state. Kiphire, the land of minerals, is located in the easternmost part of the state bordering Myanmar and has a total area of 1,255 sq. km. The district is 254 km away from the capital city, Kohima. It is wedged between Saramati, the highest mountain in the state, and the Jingkhu mountains. It is located at an elevation of 896.42 meters above the mean sea level. On the whole, the climate is humid and hot during summer and cold during winter with winter temperature touching a low of 2.7 ° C and a high of 37.0 ° C during summer. The monsoon period extends from June to September, occasionally lasting until October. The average rain falls 876 mm. There are officially three recognized tribes – Sangtam, Yimchungrü, and Sümi. With the majority of the people living in the rural villages, agriculture remains the main occupation of the people of the district. The

primary mode of agricultural practice is jhum, also known as swidden or slash-and-burn cultivation. The main crops grown in the jhum are largely traditional crops such as upland rice, maize, millet and varieties of beans. The farmers are gradually adopting the cultivation of cash crops such as potatoes with support from the agriculture department. Traditional crops such as soybeans and local varieties of beans called 'Kholar' (*Phaseolus* sp.) are also grown as cash crops using traditional methods. Additionally, farmers are adopting permanent paddy cultivation in terraced fields in favorable terrains. A number of traditional houses with stone slates which are rare sights in other parts of the state are seen in Phuvkiu, Mimi, Pongren, Phelungre and Pungro villages (Kiphire: Government of Nagaland, URL: https://kiphire.nic.in/about-district/. Accessed on 12th November, 2024).

Vegetation survey

To assess the impact of shifting cultivation on the loss of medicinal plants in the forest areas, the study site was stratified into two distinct categories: virgin (undisturbed) forest and jhum fallow areas. A systematic vegetation survey was conducted in both categories to compare plant diversity and ecological characteristics. In the virgin forest, 100 quadrats of 10 m x 10 m size, in 1 hectare area, were laid to record tree, shrub and herbaceous species, ensuring a comprehensive representation of vegetation structure and composition. Only medicinal herb/shrub/tree species were identified to understand the community dynamics and key ecological traits such as medicinal and ecological roles were documented for each species. The same survey protocol was applied in jhum fallow areas to evaluate the changes caused by cultivation practices. This comparative approach facilitated the identification of species loss patterns and provided insights into the ecological consequences of shifting cultivation on forest ecosystems. Standardized methodologies such as species identification through floristic guides, local communities and quantitative indices were employed to ensure robust data collection and analysis.

Results

Stand characteristic and abundance

The species composition differed significantly between jhum fallows and virgin forests, indicating broader ecological differences between the two land-use types. A total of 16 medicinal plant and tree species belonging to 15 families were recorded from the study area. According to the research conducted in this region, all medicinal species identified in the virgin forests were completely absent in the jhum fallow areas. This clearly reflects the negative impact of shifting cultivation on the conservation and persistence of medicinal plant diversity in these ecosystems. The description of the identified species is shown in Table 1.

Medicinal and Therapeutical uses

Bothriochloa ischaemum

Bothriochloa ischaemum is a key species in warm shrub grasslands, recognized for its ability to fix soil and retain water (Fig. 1). It is characterized by strong vitality, drought resistance, high yield and resistance to grazing (Li *et al*., 2018).

Table 1: Description of the identified medicinal plants

Scientific name	*Common/Local name*	*Family*	*Type*
Bothriochloa ischaemum (Linn.)	Yellow bluestem	Poaceae	Perennial grass
Breynia androgyna (L.)	Star gooseberry or sweet leaf	Phyllanthaceae	Shrub
Coleus barbatus	Patharchur, Pashanbhedi, Gandhmoolika	Lamiaceae	Succulent herb
Elatostema stewardii	ND*	Urticaceae	Succulent perennial herb
Holarrhena pubescens	Indrajab, Kurchi, Easter tree, Jasmine tree	Apocyanaceae	Deciduous tree
Juglans sigillata	Iron walnut	Juglandaceae	Tree
Kaempferia galangal L.	Kencur, Aromatic ginger, Sand ginger, Cutcherry	Zingiberaceae	Perennial aromatic rhizomatous plant
Laggera alata	Winged stem laggera	Asteraceae	Continuous winged aromatic herb
Laurelia sempervirens	Peruvian nutmeg, Chilean laurel	Atherospermataceae	Evergreen tree
Laurus nobilis	Bay laurel tree	Lauraceae	Aromatic evergreen tree
Lonicera periclymenum	Honey suckle, Wood bine	Caprifoliaceae	Vigorous deciduous twinning climber
Prunus undulata	Khasi cherry or Sohiong (Yanzhiguo)	Rosaceae	Tree
Robinia pseudoacacia L.	Black locust	Fabaceae	Medium sized melliferous tree
Sambacus javanica	Chinese elder	Viburnaceae	Perennial herb
Wisteria sinensis	Chinese wisteria	Fabaceae	Ornamental climbing plant
Zanthoxylum armatum	Prickly ash, Rattan pepper, Mukthrubi, Tejovati, Tejphal, Nepali dhaniya, Timru, Timur	Rutaceae	Aromatic, deciduous, spiny shrub

*ND: Not determind

Figure 1: *Bothriochloa ischaemum*

Figure 3: *Coleus barbatus*

Breynia androgyna (L.)

Breynia androgyna (L.) is a tropical shrub recognized for its significant nutritional and medicinal properties (Fig. 2). Its leaves, which are rich in proteins, vitamins (pro-vitamin A carotenoids, vitamin B and C) and minerals (Fletcher, Rob. 2012), are consumed in various forms including salads, soups and cooked vegetables. Additionally, the species is valued for its nutritional benefits and its adaptability in tropical horticulture (Chakrab. & N.P. Balakr; URL: https://www.rajagiricollege.edu.in/rajeevani-post/breynia-androgyna-l-chakrab-n-p-balakr/. Accessed on 8th November, 2024) but the excessive consumption of uncooked and juiced leaves can cause lung damage due to its high concentrations of the alkaloid papaverine (Kao *et al*., 1999).

Coleus/Plectranthus barbatus

Coleus barbatus Andr. (syn. *Coleus forskohlii* Briq.) is recognized for its medicinal and aromatic properties (Fig. 3). The tuberous roots are a rich source of forskohlin (coleonol), a compound with potential therapeutic applications in managing hypertension, congestive heart failure, eczema, colic, respiratory disorders, painful urination, insomnia and convulsions (Ammon *et al*., 1982). It also exhibits possible therapeutic benefits for asthma, angina, psoriasis and cancer metastasis prevention (Ammon *et al*., 1986). The entire plant is aromatic (Shah, 1989) and used as a condiment in India, with the tubers commonly prepared as pickles for consumption. In traditional Ayurvedic medicine, *C. forskohlii* is employed to treat heart diseases, abdominal colic, respiratory disorders, insomnia, convulsions, asthma, bronchitis, intestinal disorders, burning sensations, constipation, epilepsy and angina (Ammon *et al*., 1986). The roots are also used to treat intestinal worms, alleviate festering boils and when mixed with mustard oil, are applied to manage eczema and skin infections. The plant has veterinary applications as well (De-Souza *et al*., 1988). Beyond its medicinal value, the tubers contain an essential oil with an attractive and delicate spicy aroma (Misra *et al*., 1994), which holds potential for use in the food flavoring industry and as an antimicrobial agent (Chowdhary *et al*., 1998).

Elatostema stewardii

Elatostema stewardii is used in traditional Chinese medicine for promoting blood circulation, dispersing silt and providing detoxification effects (Fig. 4). Its roots are employed in fracture repair while its stems and leaves are used to treat coughs (Yang *et al*., 2012; Tseng *et al*., 2019). In addition to its medicinal uses, *E. stewardii* is a popular ornamental plant, valued for its ability to provide shade and humidity as a ground cover in both indoor and outdoor environments. Despite its widespread use, the chloroplast genomes of only three species within the genus *Elatostema* have been reported to date (Fu *et al*., 2019; Wang *et al*., 2020; Fu *et al*., 2021).

Figure 2: *Breynia androgyna*

Figure 4: *Elatostema stewardii*

Holarrhena pubescens

Holarrhena pubescens is commonly used in Indian medicine to treat various ailments including bleeding piles, diarrhea, amoebic dysentery, liver disorders and irritable bowel syndrome (Fig. 5). The plant is characterized by an astringent, bitter flavor. Due to its numerous therapeutic benefits and lack of harmful side effects, *H. pubescens* is considered one of the most beneficial medicinal plants (Jamadagni *et al*., 2017). The stem bark of this plant, known as Kurchi, possesses several pharmacological properties, including astringent, antidiarrheal, antidysenteric, anti-anthelmintic, stomachic, febrifugal, digestive and tonic activities.

The medicinal properties of *H. pubescens* include a wide range of therapeutic uses. It is a remedy for animal bites such as those from dogs, bugs, scorpions and snakes (Panda, 2014). The plant acts as an appetizer and stomachic, aiding in the treatment of indigestion (Prasad *et al*., 2013). It is also used for blood-related ailments such as anemia, blood infections, blood purification, hemorrhage, and nose bleeding (Manika N., 2014). It serves as a pain reliever for conditions like rheumatoid arthritis, knee pain, headaches and body aches (Ali *et al*., 2009). Additionally, it improves brain-related disorders including depression and enhances memory function (Ali *et al*., 2011). The plant has expectorant properties, helping to relieve cold, cough and throat infections (Panda, 2014, Ali *et al*., 2011). For dental and oral health, it acts as an analgesic for toothaches (Aqil *et al*., 2007). It is also effective against various dermatological problems such as warts, dermatitis, leukoderma, pimples, ringworm, scabies, skin allergies, abscesses, boils, bruises and other skin conditions (Husain *et al*., 2020). In managing diabetes, *it* regulates blood sugar levels (Panda, 2014, Diallo *et al*., 2012). The plant also has antipyretic and febrifuge effects, making it useful for treating intermittent fever and pyrexia (Rout *et al*., 2007). It is active against gastrointestinal disorders like colic, intestinal ulcers, stomach aches, dyspepsia, flatulence, cholera, diarrhea, dysentery, food poisoning, gastroenteritis and indigestion (Prasad *et al*., 2013).

For general health, it is known to enhance muscle strength, combat obesity and act as a tonic (Rout *et al*., 2007, Mallik *et al*., 2012). In gynecological care, it facilitates easy delivery, treats leukorrhea and tones vaginal tissues after delivery (Dey *et al*., 2012, Biswas *et al*., 2010). Joint and muscle ailments, such as arthritis and rheumatism, can also be alleviated with *H. pubescens* (Chopra *et al*., 1982, Rout *et al*., 2008). The plant is beneficial for liver complaints, particularly bilious disorders, bile infection and jaundice (Jena *et al*., 2011, Gaur *et al*., 2010). It also treats piles, fissures, fistula and hemorrhoids (Chopra *et al*., 1956, Ghani A., 1998). In respiratory disorders, *H. pubescens* is effective against asthma and bronchitis (Dua *et al*., 2013, Maroyi *et al*., 2008). The plant helps control urination, cystitis and other urinary problems including urinary tract infections and burning sensations during urination (Maroyi *et al*., 2008). Lastly, it has antihelmintic activity against intestinal parasites such as threadworms, tapeworms, and Guinea worms (Pradhan *et al*., 2008).

Figure 5: *Holarrhena pubescens*

Traditional uses of various parts of the plant

Bark

- The bark is used in Ayurveda medicine to treat piles, diarrhoea, leprosy, biliousness and illnesses of the spleen (Rudolf H., 1976, Yetein *et al*., 2012).
- It is used in Unani medicine to treat headaches, piles and heavy menstrual flow (Ghimire *et al*., 2009).
- It is also used to treat asthma, bronchopneumonia, stomach disorders, dyspepsia and dysentery in addition to acting as an antiprotozoal agent and treating malaria and chest infections (Wyk *et al*., 2000).

Leaf

- The leaves are used in Unani medicine to treat chronic bronchitis, urine discharges, wounds, ulcers as well as to relax the muscles and regulate menstruation.
- They are also used as aphrodisiacs, tonics, astringents and galactagogues (Dubey *et al*., 2012).

Roots

- The roots have aphrodisiac and abortifacient properties (Rajakumar *et al*., 2009).
- Root is used to treat severe abscesses, gonorrhoea, ascariasis, malaria and venereal infections (Basha *et al*., 2012).

Flowers

- In Ayurveda, flowers are used to cure leukoderma, blood and spleen illnesses as well as anthelmintic and antidiarrheal conditions (Jain *et al*., 1984).

Seeds

- Seeds are used as an anthelminitic and astringent in ayurveda to treat hallucinations, dysentery, biliousness, leprosy, tiredness, skin problems and bleeding piles (Holarrhena-Pubescens/images, Painuli *et al*., 1994, Harpreet *et al*., 2013).
- In Unani medicine, seeds are used as carminative, aphrodisiac, astringent and lithotriptic (Fotie *et al*., 2006).
- Utilized in Tibetan medicine as an alexipharmic, antidiarrheal, cholagogue and analgesic (Mahishi *et al*., 2005).
- Utilized as an astringent, anthelmintic, febrifuge, stomachic, anti-dysenteric and anti-diarrheal in the native medical system of Bangladesh (Gangwar *et al*., 2010).
- Generally used to treat diuresis, chronic chest infections, asthma, malaria, vaginitis, diabetes, arthritis, hematuria,

epilepsy, bronchitis, diarrhoea, dermatitis and jaundice (Kabir *et al*., 2018).

Juglans sigillata

Juglans sigillata highly valued for its versatile applications (Fig. 6). It produces high-quality wood that is prized for crafting furniture while the remaining wood is utilized as firewood. The dry leaves are traditionally collected and employed in Monpa toilets (Sikhang) to produce natural manure known as 'shi,' which enhances soil fertility. The nuts, particularly those with three ridges, are regarded as rare and precious. These unique three-ridged nuts are considered symbols of good fortune and people refrain from consuming them, instead preserving them as tokens to attract luck. Finding a three-ridged kae-nut is considered a rare and auspicious event in local cultural beliefs (Chozom *et al*., 2024).

Kaempferia galangal

Kaempferia galanga, is endemic to India and widely distributed across Indonesia (Pawera *et al*., 2020; Wijaya, 2019). Overexploitation has rendered this species rare and endangered in regions such as Bangladesh and India (Rahman *et al*., 2005; Labrooy *et al*., 2020). As a potent medicinal plant, *K. galanga* (Fig. 7) is used to treat a range of ailments including asthma, hypertension, stomachaches, headaches, rheumatism, toothaches, indigestion and bacterial infections (Mustafa *et al*., 1996; Kanjanapothi *et al*., 2004). The dried rhizome exhibits cardiotonic and sedative properties (Amuamuta *et al*., 2017) and is also utilized to restore internal heat and enhance blood circulation (Vittalrao *et al*., 2011). Its powdered form serves as an expectorant to relieve cough accompanied by phlegm and chest pain (DeFilipps *et al*., 2018), while the essential oil derived from rhizomes alleviates colds and nasal congestion when applied near the nose (Subositi *et al*., 2020). Additionally, processed rhizome paste is widely incorporated into balms for treating rheumatism and wounds (Mans *et al*., 2019).

K. galanga is a critical component of several Ayurvedic medicines, including Rasnairandadi kashayam, Valiya narayana tailam, Kaccoradi churnam, Sutura, Hinguvacadi churna, Nisakathakathi kashayam, Asanaeladi tailam, Palaashi rasa, Valiya rasnadi kashayam and Dasamularistam, which are prescribed for various health conditions (Ibrahim *et al*., 2007). Among indigenous communities of North-East and South India such as the Kuruma, Manipur, Malayali, Kurichiya, Mullu Kuruma and Meghalaya tribes, *K. galanga* is traditionally employed to treat an array of conditions, including ear inflammation in children, indigestion, stomach pain, vomiting of blood, gastroenteritis, whooping cough, tongue blisters in babies, menstrual pain, baldness, intestinal wounds, toothache, flatulence, rheumatism, headaches, mouth sores, dandruff, sore throat, body aches, diarrhea, runny nose and as an antidote for snake venom (Yao *et al*., 2018). This extensive traditional knowledge underscores the therapeutic versatility and cultural importance of *K. galanga*.

Laggera alata

The fragrant plant *L. alata* is extensively utilized in ethno-medical practices across Asian and African tropical regions (Fig. 8). It is a notable component of an ointment used against skin tumors in Chinese folk medicine (Onayade *et al*., 1990, Lee *et al*., 1974, Ekundayo *et al*., 1990). In Ethiopia, the plant is traditionally employed to treat cough (Geyid *et al*., 2005) while in India and Madagascar, the entire plant has been utilized as an antivenin and disinfectant, respectively (Onayade *et al*., 1990, Saïd *et al*., 2013). Similarly, in Kenya, *L. alata* is applied as a disinfectant and analgesic (Mwangi *et al*., 1994). Its leaves are widely used in West and East African traditional medicine as a remedy for various ailments (Ekundayo *et al*., 1990), and their essential oil, characterized by a black currant-like fragrance, finds application in perfumery (Onayade *et al*., 1990). The leaf sap and

Figure 7: *Kaempferia galanga*

Figure 6: *Juglans sigillata*

Figure 8: *Laggera alata*

root decoctions are consumed as treatments for pneumonia (Raharivelomanana *et al*., 1998, Onayade *et al*., 1990). Hunde and Asfaw, 2015 highlighted its traditional medicinal uses, including the antiseptic properties of its volatile components. Additionally, the plant has been reported to alleviate inflammatory conditions such as bronchitis, arthritis, hepatitis and nephritis (Wu *et al*., 2006, Wu *et al*., 2006, Wu *et al*., 2011). Furthermore, *L. alata* and other species within the *Laggera* genus are recognized for their analgesic properties (Onayade *et al*., 1990).

Laurelia sempervirens

The plant *L. sempervirens* (Fig. 9) has a long history of use in traditional medicine, where it serves as an anti-inflammatory agent, an expectorant and a treatment for venereal diseases (Muñoz *et al*., 1999). The leaves are particularly employed for treating headaches and as a diuretic (Montenegro *et al*., 2012). The plant also exhibits significant antifungal activity, particularly against filamentous fungi such as *Penicillium* spp. and *Fusarium oxysporum* (Lorca *et al*., 2012, Bittner *et al*., 2009). The antimicrobial efficacy of Chilean laurel essential oil is largely attributed to the presence of safrole, a compound known to inhibit the production of intracellular enzymes like amylases and proteases, resulting in cell wall degradation and extensive cell lysis (Bittner *et al*., 2009). Additionally, Chilean laurel essential oil demonstrates activity against *Candida albicans*, a pathogen responsible for approximately 90% of vulvovaginal fungal infections. This finding is particularly relevant given the challenges in managing fungal infections, which include a limited arsenal of antifungal drugs, issues of toxicity, rising resistance and high treatment costs (Khan *et al*., 2010).

Laurus nobilis

Laurel (*L. nobilis*), an evergreen tree, has been utilized for over 1,000 years, playing a significant role in both culinary and traditional medicinal applications (Hanif *et al*., 2019). The leaves used in fresh or dried forms, impart flavor to culinary preparations and are a source of aromatic essential oil used in perfumery (Fig. 10). Laurel has been traditionally recognized for its diverse pharmacological properties including antimicrobial, antioxidant, anticancer, insecticidal and antifungal activities (Bendjersi *et al*., 2016; Bekhti *et al*., 2020; Zibi *et al*., 2022). Additionally, the leaves are incorporated into various food products, toiletries and medicines (Ravindran, 2017).

In herbal medicine, bay leaves have been employed against ailments such as rheumatism, sprains, indigestion and earaches. They exhibit anti-diarrheal, anti-inflammatory and anti-diabetic properties and are known to enhance immune responses. Bioactive compounds in bay leaves contribute to their anti-inflammatory activity, inhibit alcohol absorption and enhance the activity of glutathione S-transferase in the liver (Fang *et al*., 2005). The essential oil derived from bay leaves also demonstrates analgesic properties (Barla *et al*., 2007). Studies have revealed their potential in managing diabetes and migraines (Aljamal, 2010; Fang *et al*., 2005; Mirbadal & Shirdel, 2011).

Fresh bay leaves are used to address blood dysentery, inflammation and kidney congestion. They are also effective in treating arthritis, headaches, fungal diseases, anorexia, colds, cataracts, diarrhea and colonic ulcers (Parthasarathy *et al*., 2008). Additionally, laurel leaves are reported to combat infections caused by fungi, viruses, bacteria and protozoa. They inhibit cancer cell growth and are used for conditions such as fevers, coughs, flu, colds, bronchitis and asthma. Laurel juice is particularly effective for soothing sore eyes and treating night blindness linked to vitamin A deficiency (Hanif *et al*., 2019).

The plant's various parts - including bark, flowers, leaves, roots, stems and seeds - are consumed as spices, which can be used fresh, dried or powdered (Raghavan & Orsat, 2007; Schweiggert-Weisz *et al*., 2007). The leaves primarily flavor dishes such as stews, soups, sauces, fish, meats and beverages. Dried and powdered leaves are also utilized industrially in food production. The essential oil obtained through steam distillation is applied in the production of candles, perfumes, creams and soaps (Elzebroek and Wind, 2008).

Due to its antioxidant molecules, laurel exhibits a wide range of biological and pharmacological activities, including antioxidant, antibacterial, antifungal, antiviral and insecticidal effects (Chahal *et al*., 2017). Bay laurel leaves are particularly beneficial for individuals with diabetes; their extract helps improve blood glucose levels and mitigate complications associated with diabetes. A clinical study by Khan *et al*., (2009) involving 40 type 2 diabetic patients administered 1, 2 or 3 g of ground bay leaves daily demonstrated a significant reduction in serum glucose levels by 21–26% after 30 days. Furthermore, an *in vitro* study showed that *L. nobilis* ethanolic extract enhances insulin sensitivity by increasing insulin receptor substrate expression and reduces oxidative stress caused by chronic

Figure 9: *Laurellia sempervirens*

Figure 10: *Laurus nobilis*

hyperglycemia. These effects are largely attributed to the phenolic compound gallic acid (Bourebaba *et al*., 2021).

Lonicera periclymenum

Lonicera periclymenum plant is a deciduous climber with notable expectorant and laxative properties. The syrup prepared from its flowers is traditionally used in the treatment of respiratory diseases while decoction of the leaves is beneficial for addressing liver and spleen disorders. It is commonly used as a mouthwash for ulcers and is considered an effective ingredient in gargles. The flowers exhibit antispasmodic, astringent, diuretic, expectorant, febrifuge and sudorific properties. The fruit acts as an emetic and cathartic and the herbage serves as a cutaneous and mucous tonic as well as a vulnerary and diaphoretic. The leaves are known for their laxative and mildly astringent effects while the seeds are diuretic. The bark possesses anticatarrhal, depurative, diuretic and sudorific properties. (URL: https://pfaf.org/user/Plant.aspx?LatinName=Lonicera+periclymenum#:~:text=It%20is%20used%20as%20a,as%20a%20vulnerary%5B4%5D. Accessed on 8th November, 2024).

Prunus undulata

Prunus undulata is a species valued for its edible fruits, ornamental appeal and medicinal applications (Fig. 11). The fruits are consumed fresh or processed into jams and jellies, highlighting their culinary utility. The plant is also cultivated as an ornamental species in gardens and parks, owing to its aesthetic appeal. Additionally, *P. undulata* exhibits medicinal properties and is traditionally used for treating digestive disorders, fever and various skin diseases, further emphasizing its multifunctional importance (URL: https://www.selinawamucii.com/plants/rosaceae/prunus-undulata/#uses-and-benefits. Accessed on 9th November, 2024).

Robinia pseudoacacia

Robinia pseudoacacia, commonly known as black locust (Fig. 12), is a rich source of bioactive compounds, particularly flavonoids such as acacetin, apigenin, diosmetin, luteolin and quercetin (Kim *et al*., 2019). Its flowers, often referred to as Black Locust Flowers (BLF), are widely utilized as a food additive and in traditional medicine, primarily as a raw material for honey production. BLF is recognized for its diuretic, sedative and anti-inflammatory properties. Additionally, the flowers are rich in ascorbic acid and phenolic compounds, which contribute to their notable antioxidant activity as well as free sugars and minerals, enhancing their nutritional value (Bhalla *et al*., 2017).

While the black locust is an invasive species in Europe with adverse effects on biodiversity, it remains a significant source of phenolic compounds used in traditional medicine. Its therapeutic applications include acting as an antispasmodic, febrifuge, diuretic, emollient, antitumor and antioxidant agent (Kaloo *et al*., 2018). The flower extracts exhibit free radical and nitrite scavenging abilities, reducing power and inhibition of α-glucosidase activity, alongside effects on the plasma coagulation pathway (Han *et al*., 2022). Black locust syrup is used for its antispasmodic, expectorant, diuretic, choleretic, sedative, hemostatic, antipyretic, laxative, hypotensive, anti-inflammatory and healing properties. The flowers are particularly effective as antipyretics and in the treatment and prevention of lung and bronchial diseases, while also acting as antispasmodics for smooth muscle or visceral spasms. Black locust jam is valued for its potential to enhance general well-being, reduce stress and have a calming effect on the nervous system. It is also rich in vitamin C and other nutrients that support immune health, promote healthy skin and improve digestion. However, caution is advised in its consumption due to its high sugar content, which can adversely affect individuals prone to allergic reactions, diabetics and those managing obesity. Black locust also contains flavonoids, which are powerful antioxidants with anti-inflammatory and bactericidal properties, further reinforcing its therapeutic potential (Lukash *et al*., 2024).

Sambacus javanica

Sambacus javanica, a perennial herb known for its diverse pharmacological properties, is widely utilized for its anti-inflammatory and hepatoprotective effects (Fig. 13). It is commonly used in the treatment of rheumatism, chronic airway inflammation and viral hepatitis (Liao *et al*., 2005; Zhang *et al*.,

Figure 12: *Robinia pseudoacacia*

Figure 11: *Prunus undulata*

Figure 13: *Sambacus javanica*

2010; Chen *et al*., 2019). Additionally, it plays a therapeutic role in managing fractures, traumatic injuries and chronic nephritis (Yuan *et al*., 2020; Li *et al*., 2021; Waswa, 2022). The herb also demonstrates significant anti-inflammatory and fracture-healing properties, making it a valuable treatment option for fractures and joint-related illnesses (Lv *et al*., 2015; Xiao *et al*., 2016).

Wisteria sinensis

The leaves and flowers of Wisteria are used as a substitute for tea, highlighting their versatility in traditional practices (Medicinal Herbs. Herbs: Chinese Wisteria). Additionally, the fiber extracted from its stems is utilized in paper production, demonstrating its utility in non-medicinal applications (Plants for a Future: *Wisteria sinensis*). Extracts from Wisteria galls have shown potential therapeutic effects in the treatment of gastric cancer (Needham, J., 1982), breast and stomach cancers and rheumatoid arthritis (Konoshima *et al*., 1997 and 2004). Furthermore, several species of Wisteria have been reported to exhibit significant antioxidant properties (Oh *et al*., 2008) as well as antibacterial activities (Yan-haul *et al*., 2009), underscoring their potential role in both health and industrial applications.

Zanthoxylum armatum

Zanthoxylum armatum, commonly known as Prickly ash, is widely recognized for its medicinal properties and is utilized in the treatment of various ailments (Fig. 14). It is particularly effective in managing respiratory disorders such as asthma and bronchitis, gastrointestinal conditions like indigestion and dyspepsia and other diseases including cholera, fever, rheumatism, varicose veins and skin diseases. The plant's bark, fruits and seeds hold significant therapeutic value in traditional medicine systems. The bark is pungent and commonly used for dental hygiene including cleaning teeth and as a carminative, stomachic, anthelmintic and antifungal agent. It also serves as a stimulant for rheumatism and fibrositis when applied externally. Moreover, the bark is employed in traditional practices, such as intoxicating fish. The fruits and seeds act as an aromatic tonic and are specifically used to alleviate fever and dyspepsia. Additionally, Prickly Ash exhibits a stimulating effect on the lymphatic system, circulation and mucous membranes, further enhancing its medicinal value. Its therapeutic applications extend to addressing chronic issues like leg cramps, ulcers, low blood pressure and inflammation (Kumar A. *Zanthoxylum armatum* DC has medicinal value. (Available from: URL: http://www.science20.com/humboldt_fellowand_science/blog/zanthoxylum_armatum_dc.

Figure 14: *Zanthoxylum armatum*

Accessed on 9th November, 2024).

In certain regions, bark powder is applied to the gums to alleviate pain, leading to its designation as the "toothache tree." The fruit juice of Prickly Ash is effective in expelling roundworms from the stomach. The fruit itself is highly regarded for addressing dental issues due to its deodorant, disinfectant and antiseptic properties. Additionally, fruit pickles are traditionally used to manage cold, cough, abdominal pain, tonsillitis and limb numbness. A preparation of fruit powder mixed with hot water is employed to treat dysentery and diarrhea. The berries exhibit carminative and antispasmodic characteristics, making them useful for the treatment of skin diseases. The entire plant has applications in the treatment of scabies and is also utilized for expelling worms from infected ears. These multifaceted uses underscore the therapeutic potential of Prickly ash in traditional medicine (Paul A. *et al*., 2023). Together, these attributes underscore the plant's importance in indigenous medicine for its multifaceted health benefits.

Discussion

The results underscore the profound impact of shifting cultivation on the medicinal plant diversity of Kiphire district. Virgin forests serve as vital repositories of biodiversity, maintaining ecological balance and supporting traditional healthcare practices through medicinal species. In contrast, jhum fallows exhibit a complete absence of these species, reflecting the unsustainable nature of shifting cultivation. This aligns with global studies indicating reduced species richness and prolonged recovery times for secondary forests. The disappearance of culturally and therapeutically valuable species like *Holarrhena pubescens* and *Kaempferia galanga* suggests ecological degradation and loss of indigenous knowledge systems. Shortened fallow periods, driven by population pressure, exacerbate land degradation, as observed in Nagaland and other tropical regions. However, the adaptive potential of the local community, seen through emerging cash crop cultivation, offers a pathway for integrating biodiversity conservation with livelihood enhancement. A participatory approach involving local communities and scientific intervention is essential to restore degraded landscapes and preserve medicinal plant diversity.

Conclusion

Shifting cultivation in Kiphire district significantly reduces medicinal plant diversity, threatening ecological integrity and cultural heritage. Virgin forests are indispensable for conserving biodiversity, but their loss due to unsustainable agricultural practices calls for immediate policy and conservation actions. Sustainable land-use practices, community engagement and afforestation efforts are critical for mitigating biodiversity loss and ensuring the resilience of forest ecosystems in Nagaland.

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