



Ethnomedicinal Plants of India with Special Reference to an Indo-Burma Hotspot Region: An overview

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Research

Abstract

Ethnomedicines are widely used across India. Scientific knowledge of these uses varies with some regions, such as the North Eastern India region, being less well known. Plants being used are increasingly threatened by a variety of pressures and are being categorized for conservation management purposes. Mizoram state in North East India has served as the location of our studies of ethnomedicines and their conservation status. 302 plants from 96 families were recorded as being used by the indigenous Mizo (and other tribal communities) over the last ten years. Analysis of distributions of species across plant families revealed both positive and negative correlations that are interpreted as evidence of consistent bases for selection.

Introduction

Biodiversity has been specifically investigated in the context of designing efficient programs of monitoring and setting out conservation priorities (Balmford & Long 1995, Gadgil 1996, Heywood 1995, Howard *et al.* 1998, Myers 1988, Myers *et al.* 2000, Negi & Gadgil 2002, Oliver & Beattie 1993, Pollard & Yates 1993, Swengel & Swengel 1999). The Global Biodiversity Assessment (Heywood 1995) requires a detailed knowledge of species distribution in particular landscapes. India's Biological Diversity Act 2002 aims to promote conservation, sustainable use and equitable sharing of benefits of India's biodiversity resources. In this context, traditional ecological knowledge (TEK) and its implication in the field of ethnobiology is of special focus in view of its deteriorating scenario due to the diverse environmental perturbations. Specific emphasis should be given to ethnomedicinal plants while setting priorities for biodiversity conservation in India (Sastri & Chatterjee 2000).

Global Relevance

Knowledge of useful plants must have been the first acquired by man to satisfy his hunger, heal his wounds and treat various ailments (Kshirsagar & Singh 2001, Schultes 1967). Traditional healers employ methods based on the ecological, socio-cultural and religious background of their people to provide health care (Anyinam 1995, Gesler 1992, Good 1980). Therefore, practice of ethnomedicine is an important vehicle for understanding indigenous societies and their relationships with nature (Anyinam 1995, Rai & Lalramnghinglova 2010a).

Globally, plant diversity has offered biomedicine a broad range of medicinal and pharmaceutical products. Traditional medical practices are an important part of the primary healthcare system in the developing world (Fairbairn 1980, Sheldon *et al.* 1997, Zaidi & Crow 2005.). In developed industrialized countries today, about 25% of drug prescriptions come from natural products while another 25% are from substances derived from modification of a

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natural product (Anyinam 1995). According to an estimate of the WHO, approx. 88% of people in developing countries rely chiefly on traditional medicines (mostly plant extracts) for their primary health care needs (Anyinam 1995, Azaizeh *et al.* 2003, Farnsworth *et al.* 1985, Rai & Lalramnghinglova 2010a, WHO 1995). In China, where there is one of the most sophisticated and extensive medical traditions, more than 5000 plants have been catalogued and 1700 of them are in common uses (Anyinam 1995). In India, at least 2500 plants, out of 18,000 recorded in the country are utilized for medicinal purposes (Anyinam 1995). There are about 46,000 licensed pharmacies manufacturing traditional remedies of Indian systems of medicine and homeopathy (Alok 1991, Anyinam 1995). Probably the region that makes the widest use of herbal preparations is Africa where people reputedly depend on plants, via ethnomedicine, for as much as 95% of their drug needs (Anyinam 1995, Iwu 1993).

Reyes-Garcia *et al.* (2008) used data collected among adult males in a society of farmers and foragers in the Bolivian Amazon, the 'Tsimane', for sixteen years. They empirically analyzed quantitative information on indigenous knowledge and uses of medicinal plants. Macías *et al.* (2007) in their review covered concerns regarding new theories addressing the role of secondary metabolites from an ecological point of view (i.e., co-evolution of plants and their potential enemies), chemical plant defence, adaptative strategies of phytophagous to plant toxins, and models and theories for carbon and nitrogen allocation.

All humans across the globe are somehow dependent on plants in order to meet various requirements for survival (Kala *et al.* 2004, Phillips & Meilleur 1998). The use of medicinal plants by people in developing countries like India is popular because these products are considered safe, widely available at low cost and easy to access.

Unfortunately, recent decades have seen significant changes occurring within several aspects of ethnomedicine as a result of environmental degradation and tremendous changes in modern, social, and economic systems (Anyinam 1995, Rai & Lalramnghinglova 2010a). Therefore, the present paper provides an overview on multifaceted aspects of ethnomedicinal plants in India with special reference to our research findings in Mizoram.

Phytochemistry of Ethnomedicinal Plants: Implications in diverse diseases

Curculigo orchoides Gaertn. contains flavonone glycoside-I (a powerful uterine-stimulant). It has been used along with other plants viz., *Asparagus adscendens* Roxb., *Asparagus racemosus* Willd., *Chlorophytum borivilianum* Santapau & R.R. Fern. and *Withania somnifera* (L.) Dunal in several pharmaceutical formulations in In-

dian systems of medicine as a metabolic enhancer and aphrodisiac (Ramawat *et al.* 1997, Suri *et al.* 1999).

Neurological disorders intimately linked with heart diseases are increasing. Mukherjee *et al.* (2001) has illustrated bioactive potential of some *Hypericum* species of India in relation to Central Nervous System (CNS) disorders. For example, *H. hookerianum* Wight & Arn. and *H. patulum* Thunb., are reported to have effects on the CNS in animal models (Mukherjee *et al.* 2001). Kumar (2006) provided a very specific review of medicinal plants for CNS disorders and focused on a set of plant species considered to be the most important: *Ginkgo biloba* L., *Hypericum perforatum* L., *Piper methysticum* G. Forst., *Valeriana officinalis* L., *Bacopa monnieri* (L.) Wettst., and *Convolvulus pluricaulis* Choisy.

In the current scenario of ever increasing human stress, ethnomedicinal plants having antioxidant properties are thought to be extremely fruitful. Many Indian plants have been investigated for their beneficial use as antioxidants or source of antioxidants using presently available experimental techniques (Ali *et al.* 2008). *Asparagus racemosus* is mainly known for its phytoestrogenic properties. With an increasing realization that hormone replacement therapy with synthetic estrogens is neither as safe nor as effective as previously envisaged, the interest in plant-derived estrogens has increased tremendously making *A. racemosus* particularly important (Bopana & Saxena 2007). In Ayurveda, *A. racemosus* has been described as a **rasayana** herb and has been used extensively as an adaptogen to increase the non-specific resistance of organisms against a variety of stresses. Besides use in the treatment of diarrhoea and dysentery, the plant also has potent antioxidant, immunostimulant, anti-dyspepsia and antitussive effects. Bopana and Saxena (2007) evaluated the biological activities, pharmacological applications and clinical studies of *A. racemosus* in their critical review.

Members of Amaranthaceae are good natural sources of carotenoids, vitamin C, nutritionally critical lysine, methionine and proteins (Ali *et al.* 2008, Bhatia & Jain 2003). Kumaran & Karunakaran (2007) used antioxidant assays such as total antioxidant activity, free radical scavenging, superoxide anion radical scavenging, hydrogen peroxide scavenging, nitric oxide scavenging, reducing power and metal ion chelating activities to illustrate the biological activity of *Phyllanthus* species. The antioxidant property of *Phyllanthus debilis* Klein ex Willd. can be attributed to the presence of phenolic compounds, flavonoids and flavonols (Ali *et al.* 2008, Kumaran & Karunakaran 2007).

Apart from the aforesaid applications, ethnomedicinal plants may be considered for treatment of the infections frequently associated with certain dreaded diseases such as HIV/AIDS. For example, Sawangjaroen *et al.* (2005, 2006) evaluated the *in-vitro* activity of selected medicinal plants used in a primary health care project by AIDS pa-

tients in southern Thailand against *Entamoeba histolytica* Schaudinn, 1903 and *Giardia intestinalis* (Lambl, 1859) Kofoid & Christiansen, 1915.

Asia is an important global center for ancient written traditions of knowledge regarding use of plant species for treatment of various diseases. Examples include Ayurveda, Unani and Chinese systems of medical care (Kala *et al.* 2004). Perry with Metzger (1980), Burkhill (1935) and others describe the medicinal plants of Asia (Houghton 2007).

Prospects of Ethno-medicinal Plants: An Indian Scenario

In India, the traditional folklore healthcare system has a long history and is very deeply rooted in rural and tribal populations. India has medicinal plants distributed in different geographical and environmental conditions (Chandler *et al.* 1979, Katewa 2009). India includes elements of three biodiversity hotspots (Himalay, Western Ghats, and Indo-Burma) that are highly endangered ecoregions (Myers *et al.* 2000, Sajem *et al.* 2008). The number of plant species in India is estimated to be over 45,000 representing about 7% of the world's flora (Ali *et al.* 2008, www.inheritanceindia.co.in) however, it covers only 2% of the earth's surface. India is one of the richest countries in the world in relation to genetic resources of medicinal and aromatic plants (Ali *et al.* 2008) with 11% of the total known plants having medicinal properties (Ali *et al.* 2008). Of the 20,000 angiosperm species in India, approximately 3,000 are used medicinally (Agarwal 1997, Rajendran *et al.* 2004).

An estimated 65% of the population in rural areas in India use the Ayurveda medicine system and medicinal plants to help meet their primary health care needs (Farnsworth *et al.* 1985, Pattanaik & Reddy 2008, WHO 1992).

India has the second largest tribal population in the world after Africa (Jagtap *et al.* 2006). Many tribal communities in India still practice use of their traditional knowledge to treat a variety of diseases and ailments. Because these are considered to be safe, effective and inexpensive, indigenous remedies are gaining popularity among the people of both the urban and rural areas, especially in India and China (Katewa *et al.* 2004). (Together these countries comprise 50% of the global population.) Plants and their parts are not only used as food and medicine but also used in various tribal rituals that are a part of their social and religious life. Hence, the age-old knowledge of plants is the basis for ethnobotanical research in India (Jagtap *et al.* 2006).

This plant-based traditional knowledge has become a recognized tool in the search for new sources of drugs and nutraceuticals (Sharma & Mujumdar 2003). There are a few surveys that reveal the practice of herbal medicine by

the Korkus (Bhogaonkar & Devarkar 2002a,b, Padhye *et al.* 1991, 1992) and other tribes of Melghat area (Chaudhari & Hutke 2002). Review of literature revealed that few reports on the ethnopharmacognostic studies and the use of some plants for antisterility and urogenital disorders are available (Bhogaonkar & Devarkar 2002a,b). Examination of aqueous residues of 16 ethnomedicinal plants (Samy *et al.* 1999) showed that *Azadirachta indica* A. Juss., *Pongamia pinnata* (L.) Merr., and *Aloe barbadensis* Mill. had maximum antibacterial activity. *Coleus amboinicus* Lour. and *Calotropis procera* (Aiton) W.T. Aiton were found to have high antioxidant activity of 91.64% and 88.72% respectively (Muthuvelan & Raja 2008). Hexane, chloroform, ethyl acetate, methanol and water extracts from the flower of *Cassia fistula* L. were tested against bacteria and fungi. All the extracts exhibited antibacterial activity against Gram-positive organisms with minimum inhibitory concentrations (MIC) between 0.078 and 2.5 mg/ml (Duraipandiyani & Ignacimuthu 2007).

When acetone, chloroform, ethyl acetate, hexane and methanol leaf extracts of *Acalypha indica* L., *Achyranthes aspera* L., *Leucas aspera* (Willd.) Link, *Morinda tinctoria* Noronha and *Ocimum sanctum* L. were studied against the early fourth-instar larvae of *Aedes aegypti* L., 1762 and *Culex quinquefasciatus* Say, 1823 all extracts showed moderate larvicidal effects. However, the highest larval mortality was found in the ethyl acetate extract of *A. aspera* (Bagavan *et al.* 2008). Highest larval (early fourth-instar larvae) of *C. quinquefasciatus* mortality was found in bark acetone extract of *Ficus racemosa* L. (Rahuman *et al.* 2008). They suggested that gluanol acetate that was present is a quite potent new mosquito larvicidal compound.

The global market for herbal drugs has registered a steady increase over the last two decades (Dhar *et al.* 2000, Martinez 1995, 1997, Olsen 1998), and annually exceeds over U.S.\$20,000 million (Dhar *et al.*, 2000, Valiathan 1998). The world trade records suggest that India ranks next to China in annual exports (32,600 tonnes: US\$46 million) of medicinal raw materials (Dhar *et al.* 2000, Lange 1997). All of these records indicate that medicinal plants offer a great motivation for conservation (Dhar *et al.* 2000, Marshall 1997) for all those concerned about human health care and the economy.

In India, traditional systems of medicine together with folklore systems continue to serve a large portion of the population, particularly in rural areas, in spite of the advent of the modern medicines. In forthcoming sections, we will review the ethnomedicinal plants from different sections of India, followed by ethnomedicinal plants of Mizoram, as an outcome of our research during the last ten years.

Ethnomedicinal plants of Western Ghats and Southern India

The Western Ghats is a global biodiversity hotspot extending to Sri Lanka (Conservation International 2005, Mittermeier *et al.* 2004). It harbors over 8000 medicinal plants of which 2242 have been recorded for the state of Maharashtra, India (Kareem Abdul 1997). The documented ethnomedicinal plants in Maharashtra were mostly used to treat skin disorders, diarrhea, jaundice, tuberculosis, stroke, migraine, menstrual problems, fertility problems, urinary problems, piles, wounds and poisonous bites (Jagtap *et al.* 2006). Seventy-six ethnomedicinal plants are being used traditionally in Mysore and Coorg district of Karnataka, India (Kshirsagar & Singh 2001).

An ethnobotanical survey was carried out among the ethnic groups (Kani/Kanikaran) in Southern Western Ghats (Ayyanar & Ignacimuthu 2005, Hebbar *et al.* 2004, Mahishi *et al.* 2005). Traditional uses of 54 plant species belonging to 26 families are described under this study (Ayyanar & Ignacimuthu 2005). The survey by Mahishi *et al.* (2005) revealed the utilization of 47 species of plants belonging to 46 genera in 28 families used to treat nine infectious and 16 non-infectious diseases in Shimoga district of Karnataka. In the Dharwad district of Karnataka in Southern India 35 plants belonging to 26 families are being used to treat different types of oral ailments (Hebbar *et al.* 2004). A total of 101 species of plants are used by Paliyar tribals in Theni district of Tamil Nadu, India, belonging to 90 genera and 48 families. These were reported with the help of standardized questionnaires among 15 tribal informants (Ignacimuthu *et al.* 2008). Savithramma *et al.* (2007) recorded the indigenous knowledge of Natuvaidyulu on plants to treat asthma and provided comparison of some plants with clinical uses of the species of Andhra Pradesh. The Virudunagar Hill region of Tamil Nadu, known for rare herbs, contains several medicinal plants used by traditional Ayurvedic and Siddha practitioners and by tribal practitioners (Rajendran *et al.* 2004).

Ethnomedicinal plants of Northern India

The Northern part of India constitutes four main broad regions: the Montane region; the sub-Montane region; the Northern plains; and the arid region. Nomadic tribes and pastoral communities dwelling in the North-West and Trans-Himalaya, e.g., Jammu and Kashmir, India, are reputed to have mastered their traditional practices and knowledge about plants used to combat different diseases (Sharma & Singh 2006). The herbal folk medicine in North India is commonly made available through the herbalists, elderly persons, **sadhush** (hermits), **ojhas** (village traditional healers practising their religion), and the traditional street vendors whether in the alpine region near the snows or in the arid region near the deserts. Some of the herbs used by local medical practitioners in Ladakh, India are popularly known as **amchis**. The **amchi** system

has a large following in Ladakh or Little Tibet (India) and has been practised for centuries (Ball 1986, Navchoo & Buth 1989). The system resembles, in some broad aspects, the Ayurvedic system but has its own characteristics. It makes use of minerals, hot water springs, puncturing of veins, branding, and herbs (Navchoo & Buth 1989). Wiley (2002) illustrated widespread and increasing usage of biomedical services for prenatal care and birth among women in Ladakh. Ballabh & Chaurasia (2007) assessed and documented the new information on medicinal plants used for the treatment of cold, cough and fever by the traditional Amchis of Ladakh. Further, Ballabh *et al.* (2008) document new ethno-medico-botanical information and traditional use of medicinal plants against kidney and urinary disorders, and thus aimed to conserve the rapidly disappearing traditional knowledge system of the **amchis** of Ladakh.

One hundred-twentyfive plants from 57 families were collected in order to explore ethnobotanical information with the help of local informants and other elders of the Gond and Kharwar communities in Singrauli region of Uttar Pradesh, India (Singh *et al.* 2002) which is undergoing serious environmental degradation (Singh *et al.* 1991). Similarly, in different remote villages and adjacent forest areas of Moradabad district, 45 plant species of 43 genera belonging to 27 families of angiosperms have been recorded as folk veterinary medicines (Ali 1999). Likewise, a field survey of the Sitamata wildlife sanctuary of Chitorgarh and Udaipur district located in the south-west region of Rajasthan was carried out in order to document the medicinal utility of herbs occurring in this area (Jain *et al.* 2005). Two hundred forty-three genera belonging to 76 families have been reported which are used by the tribal peoples of about 50 villages around the sanctuary for primary health care to treat various ailments (Jain *et al.* 2005). Commercial exploitation of species like *Arisaema tortuosum* (Wall.) Schott, *A. racemosus*, *Bombax ceiba* L., *Pueraria tuberosa* (Roxb. ex Willd.) DC., *Eulophia ochreatea* Lindl., *Chlorophytum borivillianum* Santapau & R.R. Fern., *Gloriosa superba* L., *Piper nigrum* L., *Costus speciosus* (J. König) Sm., *Ceropegia bulbosa* Roxb., *Ceropegia candelabrum* L., *Dioscorea hispida* Dennst., *Kydia calycina* Roxb., *Leea macrophylla* Roxb. ex Hornem. and *Sterculia urens* Roxb. has been reported from Rajasthan (Jain *et al.* 2005). Twentyfour ethnomedicinal and ten obnoxious grasses of Rajasthan were reported by another group (Katewa & Sharma 1998, Katewa *et al.* 2001). A field study of twelve districts of arid zones of Rajasthan was undertaken to evaluate the occurrence of three selected endangered medicinal plant species (*Lepadenia reticulata* (Retz.) Wight & Arn., *Mitragyna parvifolia* (Roxb.) Korth., *Withania coagulans* (Stocks) Dunal), and arbuscular mycorrhizal fungal (AMF) associations with them (Panwar & Tarafdar 2006). Panwar & Tarafdar (2006) revealed that the association with AMF of these plant species native to the harsh environmental conditions of the Indian Thar Desert may play a significant role in

the reestablishment and conservation of aforesaid multi-purpose endangered medicinal plants. Singh & Lal (2008) highlighted the new or lesser known medicinal uses of plants along with validation of traditional knowledge. Screening for toxin-neutralizing effects in case of snake bites was provided by Samy *et al.* (2008).

Ethnomedicinal plants of Eastern and North-East (NE) Indian Himalayas

The Himalayan medicinal plants are the major contributors to traditional systems of medicine in India. These plants have been a source of medicine for millions of people in the country and elsewhere in the world. Plant diversity of the Himalayas includes over 8000 angiosperms, 44 gymnosperms, 600 pteridophytes, 1737 bryophytes, and 1159 lichens etc. (Dhar *et al.* 2000, Singh & Hajra 1996). Of these, 1748 are used for various therapeutic purposes (Kala 1998a,b, 2000, 2002a,b, Kala *et al.* 2004, Paliwal & Badoni 1990, Samant *et al.* 1996, 1998, 2001). Uttaranchal, eastern India, has more than 3500 higher plant species. Among the various tribal ethnic groups of Uttaranchal, the Tharu, Buxas, Rajis, and Bhotiyas largely depend on wild resources (Farooquee 1994, Farooquee & Nautiyal 1999, Farooquee & Saxena 1996, Gaur 1999, Kala *et al.* 2004, Maikhuri *et al.* 1998, 2000, Nautiyal *et al.* 2000).

A total of 300 plant species used in treating 114 ailments in various cultural communities of Uttaranchal were documented and it was found that herbs contributed the highest number of medicinal plants (65%), followed by shrubs (19%) and trees (16%) (Kala *et al.* 2004). In Eastern Himalaya, *Vitex negundo* L. was the most important species, used for the treatment of more than 48 ailments while *A. indica*, *Woodfordia fruticosa* (L.) Kurz, *Centella asiatica* (L.) Urb., *Aegle marmelos* (L.) Corrêa, *Cuscuta reflexa* Roxb., *Butea monosperma* (Lam.) Taub., *Phyllanthus emblica* L., and *Euphorbia hirta* L. were among other important medicinal plants based on their high use values (Kala *et al.* 2004).

The Northeastern (NE) States of India comprising eight states that harbor more than 180 major tribal communities of the total 427 tribal communities found in India (Sajem *et al.* 2008). A large part of the NE India is botanically under-explored or even unexplored (Jain & Dam 1979). Jain & Dam (1979) conducted an ethnobotanical study of 48 plants from NE India. The tribes of the Himalayan region also have ethnomedicinal traditions for which little literature is available (Bennet 1983, Biswas 1956, Das & Lalramnghinglova 1999d, 2000, 2001, Lalramnghinglova & Jha 1997, Lalramnghinglova *et al.* 1997, Mandal 2003, Pandey 1991, Rai 2009, 2010b,c, 2011a,b, Rai & Bhujel 1999, 2002, Rai & Sharma 1994, Rai *et al.* 1998, Singh *et al.* 2002, Srivastava *et al.* 1987, Venu *et al.* 1990, Yonzon *et al.* 1984). Chhetri *et al.* (2005) found that 37 species of plants belonging to 28 families are used as an-

tidiabetic agents in the folk medicinal practices in the region and 81% of these plants are unreported as hypoglycemic agents. In Sikkim, a NE state, six important species of medicinal plants (*Aconitum heterophyllum* Wall. ex Royle, *Nardostachys jatamansi* (D. Don) DC., *Podophyllum hexandrum* Royle, *Picrorhiza kurrooa* Royle ex Benth., *Swertia chirayita* (Roxb.) H. Karst. and *Bergenia ciliata* Sternb.) were determined to be threatened. Shankar (2003) studied the distribution pattern and conservation status of *Aconitum fletcherianum* G. Taylor in NE Himalaya.

Further, an ethnobotanical survey carried out in the district of North Cachar hills, Assam, NE India which revealed 34 species of plants to be threatened in several parts of the country, and in the district itself (Sajem *et al.* 2008). Out of this, six species of plants are included in the Red Data Book of Indian Plants and five species have already been included in the Red Data List of the IUCN (Sajem *et al.* 2008). An ethnobotanical survey of medicinal plants used in the treatment of gynecological disorders was carried out among the rural people in Tinsukia district, Assam, India. *Aerva sanguinolenta* (L.) Blume, *Amaranthus spinosus* L., *Ananas comosus* (L.) Merr., *Baccaurea ramiflora* Lour., *Carica papaya* L., *Caryota urens* L., *Cicer arietinum* L., *Croton jofra* Roxb., *Curcuma longa* L., *Cynodon dactylon* (L.) Pers., *Eleusine indica* (L.) Gaertn., *E. hirta*, *Ipomoea aquatica* Forssk., *Justicia adhatoda* L., *Lasia spinosa* (L.) Thwaites, *Mollugo pentaphylla* L., *Meyna spinosa* Roxb. ex Link, *P. nigrum*, *Vandellia scabra* Benth. among others were found to be extremely useful for the aforesaid purpose (Buragohain 2008). Laboratory and clinical support for these folk herbal medicines might lead to potential drugs.

Ethnobotanical studies in Orissa were conducted by San- kar (2003). In Mayurbhanj district of Orissa, 58 plant species belonging to 34 families used in folk medicine have been documented (Rout *et al.* 2009). Due to poverty and the poor conditions of modern healthcare facilities, indigenous people of Orissa fully or partially depend on local medicinal plants. An ethnomedicinal survey among the local communities in the Kuldiha wildlife sanctuary of the Balasore district, Orissa, India indicated traditional uses of 49 plant species belonging to 32 plant families (Pattanaik & Reddy 2008).

Sacred groves of NE India are a reservoir of medicinal plants (Laloo *et al.* 2006, Mishra *et al.* 2004). The indigenous tribes have protected the groves since time immemorial due to their various religious beliefs attached to them. Besides acting as a gene pool and providing refuge to a large number of endemic, endangered and threatened species (Jamir & Pandey 2002, 2003), they render ecological services such as being sources of perennial water, maintaining local micro-environmental conditions and helping in biogeochemical cycles (Upadhaya *et al.* 2003). In Nagaland, the native population is comprised

of some fifteen tribes (e.g., Angami, Ao and Lotha) each with their own traditional medicines (Jamir *et al.* 1999). Jamir *et al.* (1999) reported 36 plant species used to address ailments of gastro-intestinal, dermal, respiratory, cardiac, dental systems. Plants and plant parts are used in different dosage forms, the most common being fresh juice, decoction, infusion and dry powders. External applications of drugs are indicated for ailments like cuts and wounds, dermatitis, sprains and swelling. Sometimes, the drug is taken by chewing a particular plant part (Jamir *et al.* 1999). There are records of about 400 plants of therapeutic value in the Sikkim Himalaya (Chhetri *et al.* 2008, Rai *et al.* 2000).

Kayang (2007) enumerated various aspects of the wild plants used by Khasi, Jaintia and Garo tribes of Meghalaya, NE India. These plants not only provide inexpensive food but several other useful products like medicine fiber, fodder, dyes, etc. In his specific study, Sharma *et al.* (2001) reported 135 plant species from 122 genera in 65 families utilized in certain spots of Mizoram.

Anthropocentric Approach: Threat to Ethnomedicinal Plants

Our planet is witnessing rapid changes in the composition of plant and animal species through over-exploitation of natural resources. Farming, lumbering and mining activities have particularly contributed to habitat loss. Deforestation, in particular, has had tremendous ramifications for the practice of ethnomedicine in many areas (Anyinam 1995). Existing estimates of species range from 1 to 50 per day, or a total of 365 to 18,250 each year. Of the estimated 250,000 known plant species, about 25% are expected to be extinct by the year 2050 (Anyinam 1995, Kaufman 1993).

At the broader level, some species are endemic to particular countries. For example, of approximately 10,000 plant species that grow on the island of Madagascar, half are endemic, i.e., they are not naturally found growing in other global ecosystems (Anyinam 1995). Reports indicate that many species are almost extinct in Madagascar due to extensive deforestation and marked soil erosion facing the island (Anyinam 1995, Jolly & Landting 1987). Elsewhere, such as in North America, some endangered species (e.g., bears) have fallen victim to illegal trade. South Korea appears to be the largest consumer of these North American bear parts (Anyinam 1995).

The practice of ethnomedicine has been also indirectly affected by loss of indigenous cultural communities and their traditional knowledge. The destruction of tropical forests has meant, in many parts of the tropical region, increasing disappearance of native people who have been living in these areas and who have accumulated a compendium of folk knowledge about the usefulness of plants for treating various diseases (Anyinam 1995, Daniels *et*

al. 1995). The declining number of indigenous people in many parts of Latin America illustrates the problems of disappearing societies (Anyinam 1995). When discovered by Europeans in the fifteenth century, the Amazon had an indigenous population estimated at six million or more (Anyinam 1995, Bunker 1985, Carneiro 1988, Denevan 1976). Approximately 250,000 remain today, distributed among more than 200 ethnic groups (Anyinam 1995, Schreider & Schreider 1970). One-third of the Amazonian tribes known to exist in 1900 are now said to be extinct (Anyinam 1995, Hecht & Cockburn 1989, Lewis *et al.* 1991). For example, Amazonian Ecuador supported 17 distinct ethnic groups before European contact but today, only seven remain. As part of their objective to Christianize the indigenous populations, the rich ethnobotanical knowledge of the Aztecs and other precolonial Meso American cultures was deliberately and systematically destroyed by the Spanish invaders (Anyinam 1995, Diaz 1977). However, the existence of these groups of people actually has contributed immensely to saving tropical forests from capitalist exploitation.

Likewise, in India, indiscriminate and non-systematic collection of medicinal plants has led to severe pressure on the availability of these plants, many of which are now rare, threatened or endangered. In the current scenario, medicinal plants are under extreme pressure due to their excessive collection or exploitation (Laloo *et al.* 2006, Mulliken & Schippmann 2007, Sajem *et al.* 2008). Rapid and continuous exploitation of several medicinal plant species and substantial loss of their habitats have resulted in the population decline of these species over the years (Kala & Sajwan 2007, Mulliken & Schippmann 2007, Planning commission 2000, Sajem *et al.* 2008). Further, the degree of threat to natural populations of medicinal plants has increased because more than 90% of medicinal plant raw material for herbal industries in India and also for export is drawn from natural habitats (Dhar *et al.* 2002, Sajem *et al.* 2008). There are many other potential causes of rarity in medicinal plant species, such as habitat specificity, narrow range of distribution, land use disturbance, introduction of non-natives, habitat alteration, climatic changes, heavy livestock grazing, explosion of human population, fragmentation and degradation of population, plant population bottlenecks and genetic drift (Kala 2000, 2005, Oostermeijer *et al.* 2003, Rao *et al.* 2004, Sajem *et al.* 2008, Weekley & Race 2000). Over-exploitation of these species, as well as trampling during collection has changed their habitat conditions causing a gradual loss of other associated species (Rai *et al.* 2000). Degradation and destruction of natural systems also poses a threat to sacred sites and spaces designated by local healers and people (Anyinam 1995). Lately much concern with commercially collected medicinal plants has been voiced, and the general perception is that the resource is being overexploited (Larsen *et al.* 2000, Sharma 1995, Shrestha & Joshi 1996).

Indigenous healers traditionally have been collecting medicines from local plants and animals probably without threatening the population dynamics of the species because of the low level of harvesting. In the last few decades, however, there has been a marked increase in the sale of herbal remedies. This has precipitating large-scale harvesting of medicinal plants and factory-like production of herbal drugs in many parts of developing countries (Anyinam 1995). In India, the collection of medicinal plants for sale in the markets forms an important part of the livelihood of the local inhabitants in forested areas. Traders also send their own workers into the forests to collect medicinal plants (Alok 1991, Anyinam 1995). The exploitation of wild-growing *Rauvolfia serpentina* (L.) Benth. ex Kurz in India for export exhausted the supply to a point where the Indian government several years ago placed an embargo on the export of this plant (Akerlele *et al.* 1991, Anyinam 1995). Another example of a plant that has been over-exploited in India for export to other Asian countries is *Coptis teeta* Wall., which is considered an endangered species in India (Alok 1991, Anyinam 1995).

In 2002, the World Summit on Sustainable Development re-affirmed the commitment of parties to the Convention on Biological Diversity to reduce the rate of biodiversity loss by 2010. Achieving this goal (itself only the first step towards halting, and eventually reversing, biodiversity loss) will require concerted and well focused action, not just by governments but also by a very wide range of organizations and individuals. TEK and its relation to biodiversity conservation particularly in the context of ethnomedicinal plants should be given due importance in millennium development goals.

The International Union for Conservation for Conservation of Nature (IUCN) Red List of Threatened Species (IUCN 2009) provides a key tool in helping to achieve this goal. The 2004 IUCN Red List (IUCN 2004) provides objective information on the threat status of an unprecedented number of species. This assessment presents analyses

at a range of geographical scales and from ecological and geopolitical perspectives. It examines the nature and impact of threats, and outlines current and potential conservation measures. The IUCN Red List of Threatened Species (also known as the "IUCN Red List" and "Red Data List"), created in 1963, is the world's most comprehensive inventory of the global conservation status of plant and animal species. The different categories frequently used in classification are: Extinct; Extinct in the Wild; Critically Endangered; Endangered; Vulnerable; Near Threatened; Least Concern; Data Deficient; and Not Evaluated. The 1994 version included an additional category that is used for some species, but once they are all reassessed it will no longer be used (IUCN 1994).

Since the amalgamation of the plant and animal Red Lists in the 2000 IUCN Red List of Threatened Species the number of plant assessments has steadily increased (Baillie *et al.* 2004, IUCN 2009). Of the 11,824 plants evaluated, 70% (8,321 species) are listed as threatened. Although 8,321 threatened species of plants appeared on the 2004 IUCN Red List, the number evaluated against the Red List Criteria represents only about 4% of the total number of species and almost 3% of these are threatened (Baillie *et al.* 2004). Moreover, the IUCN Red List shows that 110 species out of all plants are either extinct (86) or extinct in the wild (24) (Baillie *et al.* 2004, IUCN 2009). It is a matter of serious concern that 1,490 plants are critically endangered (Baillie *et al.* 2004, IUCN 2009).

The uneven distribution of threatened species means that a number of countries have a disproportionate number of species at risk of extinction (Baillie *et al.* 2004). The most threatened species occur in the tropics, especially on mountains and on islands (Baillie *et al.* 2004, IUCN 2009).

Table 1 presents the threatened taxa recorded from four states of NE India. Seven species in the Himalayan region are categorized as Critically Endangered (*Betula utilis* D. Don), Endangered (*P. hexandrum*, *Ephedra gerardi-*

Table 1. State wise number of threatened and total taxa evaluated from four states of NE India (Source: Ved *et al.* 2005).

Assigned Red List Category	Arunachal Pradesh	Assam	Meghalaya	Sikkim	Total taxa
Critically Endangered	6	1	4	1	9
Endangered	12	8	7	8	22
Vulnerable	17	7	13	12	26
Threatened taxa	35	16	24	21	46
Near Threatened	8	1	2	2	10
Least Concern	3	2	1	2	6
Data Deficient	1	3	5	9	11
Total taxa assessed	47	22	32	34	50

ana Wall. ex C.A. Mey., and *N. jatamansi*) and Vulnerable (*Bergenia ligulata* Engl., *B. stracheyi*, and *Hedychium spicatum* Buch.-Ham. ex Sm.) using new IUCN criteria (Samant & Pant 2006). *Nardostachys*, in India is reported from the Western Himalayas to the Kumaon Himalayas in the districts Uttarkashi, Tehri, Rudraprayag, Chamoli (in Garhwal), Kumaon; and from the Eastern Himalayas in the districts of Sikkim and Arunachal Pradesh (Shah 2007). Earlier, *N. jatamansi* was reported to be very common in the Kumaon and Nepal Himalayan region, but now it has become rare due to exploitation by local herb collectors and traders (Shah 2007). No clear cut information about the locations of *N. jatamansi* is available from NE India. Effective strategies should be implemented in order to avoid its extinction.

Medicinal plants may become critically endangered because of their small population size, narrow range of distribution, and/or habitat specificity. Humans may cause them to become critically endangered through destructive modes of harvesting, high use values, over-collection for commercial purposes, habitat alteration, and developmental activities (Dhar *et al.* 2000, Kala 2000, Samant *et al.* 1998). Within India rarity status of species has been demonstrated according to the Red Data Book of Indian Plants (Nayar & Sastry 1987) and the Conservation Assessment and Management Plan (CAMP) workshop (Kala *et al.* 2004, Ved *et al.* 1998, Ved & Tandon 1998). *Dactylorhiza hatagirea* (D. Don) Soó, *Picrorhiza kurrooa* Royle ex Benth., *A. heterophyllum*, *Rheum australe* D. Don, *P. hexandrum*, and *Taxus baccata* L. are among 35 rare and endangered medicinal plant species found in Uttarakhand and have become rare and endangered due to over-collection for therapeutic purposes (Kala *et al.* 2004). In 2004, *Taxus chinensis* (Pilg.) Rehder, *Taxus cuspidata* Siebold & Zucc., *Taxus fuana* Nan Li & R.R. Mill, and *Taxus sumatrana* (Miq.) de Laub. were included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). This decision was based on evidence that the species were at risk of being over-harvested in the wild for the purpose of extraction of chemical derivatives used in the production of anti-cancer drugs (i.e., paclitaxel) (IUCN 2007a, Mulliken & Schippmann 2007). CITES recommended that seven Asian medicinal plants, i.e., *Cistanche deserticola* Ma, *Dioscorea deltoidea* Wall. ex Griseb., *N. grandiflora*, *P. kurrooa*, *Pterocarpus santalinus* L.f., *R. serpentina*, and *Taxus wallichiana* Zucc. are the responsibility of the range states to ensure the implementation of regionally coordinated actions to improve the management and prevent illegal trade, including among other things, measures to combat illegal trade, regional capacity building workshops, and the harmonization of regulations and legislation (IUCN 2007a, Mulliken & Schippmann 2007). *Celastrus paniculatus* Willd., *C. orchoides*, *Gymnema sylvestre* (Retz.) R. Br. ex Schult., *Hemidesmus indicus* (L.) R. Br. ex Schult., *Mucuna monosperma* (Roxb.) DC., *R. serpentina*, *Saraca asoca* (Roxb.) De Wilde, *Tylophora*

indica (Burm.f.) Merr., and *Artocarpus hirsutus* Lam. are plants that were common in Western Ghats of India but have been added over the years to the IUCN Red List (IUCN 2009)

Bisht *et al.* (2006) attempted to integrate the analysis of several aspects of Himalayan trade in medicinal plants to reveal the threat to the plants. They suggested ways to overcome problems using *Angelica glauca* Edgew. as an example. An important example of a plant that has been threatened and is in need of solutions is *Taxus baccata*, known for the treatment of ovarian and breast cancer, that has been overexploited and smuggled heavily from Western Arunachal Pradesh (Chatterjee & Dey 1997).

In NE India, trade is a potential cause of threat for 43 taxa. Habitat loss is a common threat to all the taxa, while a few are reportedly also threatened by other causes such as fire. *Nepenthes khasiana* Hook.f. (listed under CITES Appendix I and Schedule VI of the Wildlife (Protection) Act, 1972) is threatened due to over collection as a botanical curiosity. *Dendrobium nobile* Lindl. is reportedly threatened on account of over collection for hybridization with domesticated populations (Chaudhari 2007).

Bio-resources of Mizoram comprise a great share of natural resources. The agroecosystems as well as natural ecosystems harbor genetic potential (Lalramnghinghlova 1999b, c, 2002a, b). Lalramnghinghlova & Jha (1998) described more than 200 medicinal plants used to treat diseases like: bleeding from nose, fever, malarial fever, asthma, tuberculosis, calculi, stones in kidney, gall-bladder, urinary troubles, hypertension, diabetes, stomachache, stomach ulcer, dysentery, diarrhoea, jaundice, hepatomegaly, fracture of bone, and snake bite. They added that over 60% of people living in the interior parts of the state depend upon herbal medicine. Further, Lalramnghinghlova & Jha (1997) identified and characterized the ethnomedicinal plants based on IUCN threat categories. Also, Lalramnghinghlova & Jha (1999) during their survey of ethnomedicinal plants identified new plant uses in forests of Mizoram. Lalramnghinghlova (1999d) marked that although more work has been undertaken on ethnobotany, less focus has been given to ethnozoology which is very necessary in order to address ethnobiology in its totality.

Excessive exploitation by Pharmaceutical Industries

Ethnopharmacology continues to identify possible new drugs and lead molecules for the pharmaceutical industry (Houghton 2007, Wiart 2006). The recent introduction of artemisinin from *Artemisia annua* L. as an effective antimalarial is a good example. This is based on its use to treat fevers and malaria-like symptoms in traditional Chinese medicine (Houghton 2007, Wiart 2006). A large amount of information still awaits disclosure to the scientific community particularly plants of Asia and the Pacific (Mulliken & Schippmann 2007, Wiart 2006).

Some pharmaceutical companies depend largely upon materials procured from naturally occurring sources that are being rapidly depleted. Although there are many mutual benefits of joint effort between ethnobotanists and pharmacologists, there are also challenges to overcome in order to foster successful partnerships (Kumar 1997). The difference in worldview underlying research objectives of both fields is complex. While bioprospecting (exploring biodiversity for new sources of natural products) is still the objective of some pharmacologists, the field of ethnobotany is generally more concerned about the cultural meaning of the relationship between humans and plants than in mining for plant pharmaceuticals and information about plants (McClatchey *et al.* 2009).

Most often excessive use of medicinal plants is motivated by immediate and short-term economic gains (Mulliken & Schippmann 2007, Ved *et al.* 1998). However, biologists (including conservation biologists, planners, etc.), whose concern is to set conservation priorities have their focused on rarity (Dhar *et al.* 2000, Rabinowitz *et al.* 1986), sensitivity, i.e., nativity (proportional representation of native taxa), endemism (Dhar *et al.* 2000, Rawal & Dhar 1997) and attempts to measure extent of decline or threat of extinction (Allendorf *et al.* 1997, IUCN 1994, Mace & Lande 1991).

Biotechnological Tools in Conservation

Conservation of valuable plant species in the Himalayan region has become imperative (Dhar 2002, Dhar *et al.* 2000) due to increasing interest in herbal medicines for health care across the globe (Franz 1993, Kala *et al.* 2004). The Himalayan region contributes 350 species (Purohit 1997) out of 700 plant species used in industries for making drugs.

Plant tissue culture is an alternative method of commercial propagation (George & Sherrington 1984) and is being used widely for the commercial propagation of a large number of plant species, including many medicinal plants (Rout *et al.* 2000). The factors that influence micropropagation of medicinal and aromatic plants have been reviewed by Bhagyalakshmi and Singh (1988), Hu and Wang (1983), Hussey (1980, 1983), Murashige (1977a), Rout *et al.* (2000), Short & Roberts (1991).

The concept of synthetic seed was given by Murashige (1977b) followed by first report on the development of synthetic seeds (Kitto & Janick 1982). Later, Redenbaugh *et al.* (1984) were successful in producing synthetic seeds for alfalfa by encapsulating somatic embryos with alginate hydrogel. Since then several scientists have been working on synthetic seeds incorporating encapsulation technology with different plant species of medicinal plants (Faisal & Anis 2007, Rai *et al.* 2009, Sharma *et al.* 1994, Singh *et al.* 2006a, b, 2009).

Naina *et al.* (1989) reported the successful regeneration of transgenic neem plants (*A. indica*) using *Agrobacterium tumefaciens* Smith & Townsend, 1907 containing a recombinant derivative of the plasmid pTi A6. Giri *et al.* (1997) induced the development of hairy roots in *A. heterophyllum* using *Agrobacterium rhizogenes* (Riker *et al.* 1930) Conn 1942. Pradel *et al.* (1997) developed a system for producing transformed plants from root explants of *Digitalis lanata* Ehrh. They evaluated different wild strains of *A. rhizogenes* for production of secondary products (cardenolides, anthraquinones, and flavonoids) obtained from hairy roots and transgenic plants. They reported higher amounts of anthraquinones and flavonoids in the transformed hairy roots than in untransformed roots.

Guha and Maheshwari (1964) first reported the development of embryos from microspores of *Datura innoxia* Mill. Corduan and Spix (1975) reported the induction of haploid callus and subsequently plant regeneration from anthers of *Digitalis purpurea* L. Subsequently, Perez-Bermudez *et al.* (1985) reported the induction of somatic embryogenesis and plant regeneration from cultured anthers of *Digitalis obscura* L.

Upadhyay *et al.* (1989) reported a propagation profile for *P. kurroa* and observed that the shoot multiplication rate gradually improved as the number of subcultures increased. Arora & Bhojwani (1989) compared the rate of shoot multiplication of *Saussurea lappa* (Decne.) Sch. Bip. using shoot tip explants. Koblitz *et al.* (1983) subcultured micropropagated shoots of *Cinchona ledgeriana* (Howard) Bern. Moens ex Trimen and *Cinchona succirubra* Pav. ex Klotzsch at weekly intervals and obtained 20,000 shoots from a single apical meristem within one year. Bajaj *et al.* (1988) observed 2200 plantlets of *Thymus vulgaris* L. from a single shoot grown *in-vitro* for 5 months. Rout *et al.* (1999) demonstrated a significant improvement in shoot multiplication rate by subculturing *Plumbago zeylanica* L. at 4-week intervals. Ghosh & Sen (1989) established plant regeneration via callus cultures from different explants of *Asparagus cooperi* Baker by modifying the composition of the growth medium and physical environment. The relative importance of genotype, explant and their interactions for *in-vitro* plant regeneration via organogenesis in *Solanum melongena* L. was studied (Sharma & Rajam, 1995). Rout & Das (1997) described *in-vitro* organogenesis of *Zingiber officinale* Roscoe via callus culture. *In-vitro* somatic embryogenesis of medicinal plants, e.g., *Acacia catechu* (L.f.) Willd., *Asparagus officinalis* L., *A. indica*, *Bunium persicum* B. Fedtsch., *Cayratia japonica* (Thunb.) Gagnep., *Chlorophytum borivilianum* Santapau & R.R. Fern., *Dioscorea floribunda* M. Martens & Galeotti, *D. obscura*, *Hyoscyamus niger* L., *Medicago sativa* L., *P. hexandrum*, *Piper betle* L., *Thevetia peruviana* (Pers.) K. Schum., *Typhonium trilobatum* (L.) Schott, and *Z. officinale* (Rout *et al.* 2000). A method has been developed for rapid multiplication of *C. orchoides* through

direct organogenesis and bulbil formation *in-vitro* (Suri *et al.* 1999).

Shoot tips of *D. deltoidea*, a medicinal yam, were cryopreserved using the vitrification and encapsulation-dehydration technique resulting in high-frequency direct plant regeneration (Dixit-Sharma *et al.* 2005). *Dioscorea deltoidea* is an important endangered medicinal plant, commercially exploited for the extraction of diosgenin, a precursor of steroidal drugs. Due to indiscriminate harvesting and shrinking of natural habitat, this native Indian species faces a serious threat of extinction. However, the species continues to remain an important natural source of diosgenin. It is still sold at U.S.\$1000 per kg (Das *et al.* 1999, Dixit-Sharma *et al.* 2005).

Plant part substitution, a strategy which would satisfy the requirements of sustainable harvesting, yet simultaneously provide for primary health care needs, would be the substitution of bark or underground parts with leaves of the same plant (Zschocke *et al.* 2000). Zschocke *et al.* (2000) suggested that every investigation into a medicinal plant must always include an investigation of leaves and other aerial plant parts, even though those might not be the parts traditionally used. Investigations like this, as well as a close interaction with traditional healers and the cultivation of medicinal plants, may protect more species from extinction, and allow the recovery of threatened medicinal plants (Zschocke *et al.* 2000).

Ethnoveterinary Plants

Ethnoveterinary research may also lead to important results (Diehl *et al.* 2004, Lans *et al.* 2007). For example, Lans *et al.* (2007) identified twelve plants used for backyard pigs and birds. Crushed leaves of *Erythrina pallida* Britton and *Erythrina micropteryx* Poepp. ex Urb. are used to remove dead piglets from the uterus. A leaf decoction of *Cecropia peltata* L. and *Bambusa vulgaris* Schrad. ex J.C. Wendl. is used for labor pains or leaves are fed as a postpartum cleanser. Boiled green *C. papaya* fruit is fed to pigs to induce milk let-down and the leaves and flowers of *C. papaya* plants are fed to deworm pigs. *Citrus aurantium* L. juice is given to pigs to produce lean meat. Coffee grounds (*Coffea* sp.) are used for scours. *Chenopodium ambrosioides* L. and *Gossypium* species are used as anthelmintics. *Aloe vera* gel is used for internal injuries and the yellow sap from cut *A. vera* leaf or the juice of *Citrus × limonia* (L.) Osbeck is used to purge the birds. *Euphrasia* sp. and *Plantago major* L. leaves are used for eye injuries of backyard chickens (Lans *et al.* 2007).

After finishing the review of ethnomedicinal plants of India, we confine ourselves towards the findings of our own study. The aims of the present study were to: 1) provide an updated account of medicinal plants utilized by the Mizos of Mizoram, India; 2) encourage preservation of Mizos culture and traditional knowledge; and 3) develop

recommendations for conservation and sustainable utilization of the plant wealth occurring in the study area.

Study area

North-East India forms a large portion of both the Himalaya and Indo-Burma biodiversity hotspots. The region, covering approximately 262,379 km², has been divided into two biogeographic zones – Eastern Himalaya and NE India, based on floristic composition, the naturalness of the flora and the local climate (Rodgers & Panwar 1988). The North-East region of India contains more than one-third of the country's total biodiversity.

Takhtajan (1980) treats this region as the 'Cradle of flowering plants'. Among insectivorous plants *N. khasiana*, endemic to Meghalaya and *Drosera peltata* Thunb. and *Drosera burmanii* Vahl. are important. Many families, represented in India by solitary genera with one or two species are in this region, e.g., Coriariaceae, Nepenthaceae, Illiciaceae, Ruppiaceae. The genus *Rhododendron* (Ericaceae) is a remarkable group of showy plants with nearly 98% of the total *Rhododendrons* reported from India confined to Himalayan region. According to Vavilov (1992, 1997), the NE region of India forming the 'Hindustan Center of Origin of Cultivated Plants' is very important for tropical and sub-tropical fruits, cereals, etc.

Study area, Mizoram state, covers an area of 21,087 km² and is sandwiched between Myanmar (Burma) and Bangladesh (Figure 1). Mizoram extends between 21° 58' to 24° 45' N latitude and 92° 15' to 93° 29' E longitude. Temperature varies from 18 to 29 °C in summer and from 11 to 24 °C in winter. There is no snowfall anywhere in Mizoram, though frost is experienced in the eastern region. Mizoram is under direct influence of monsoons, with heavy rains from May to September and an average rainfall of 245 cm per year (Sharma *et al.* 2001). Table 2 represents the population status of Mizoram and Aizawl according to a 1991 census which clearly indicates that most of the population of Mizoram is concentrated in Aizawl and there is an almost equal distribution of men and women.

The vegetation of Mizoram, according to the proposed classification, is tropical evergreen and semi-evergreen forest in the lower altitude hills; sub-tropical to montane sub-tropical in the high hills (Rai 2009). The total forest area is 15,825 km². Forests are growing from 500 to 2,157 m in altitude. However, these forests are exposed to various anthropogenic disturbances, e.g., shifting cultivation, timber logging, extraction of fuel wood by poor/rural tribals, industrialization and in fact urbanization in some parts of Mizoram like Aizawl. The relationship between the indigenous people of the region and the vegetation is considered to be both advantageous as well as detrimental to the plant wealth of Mizoram.

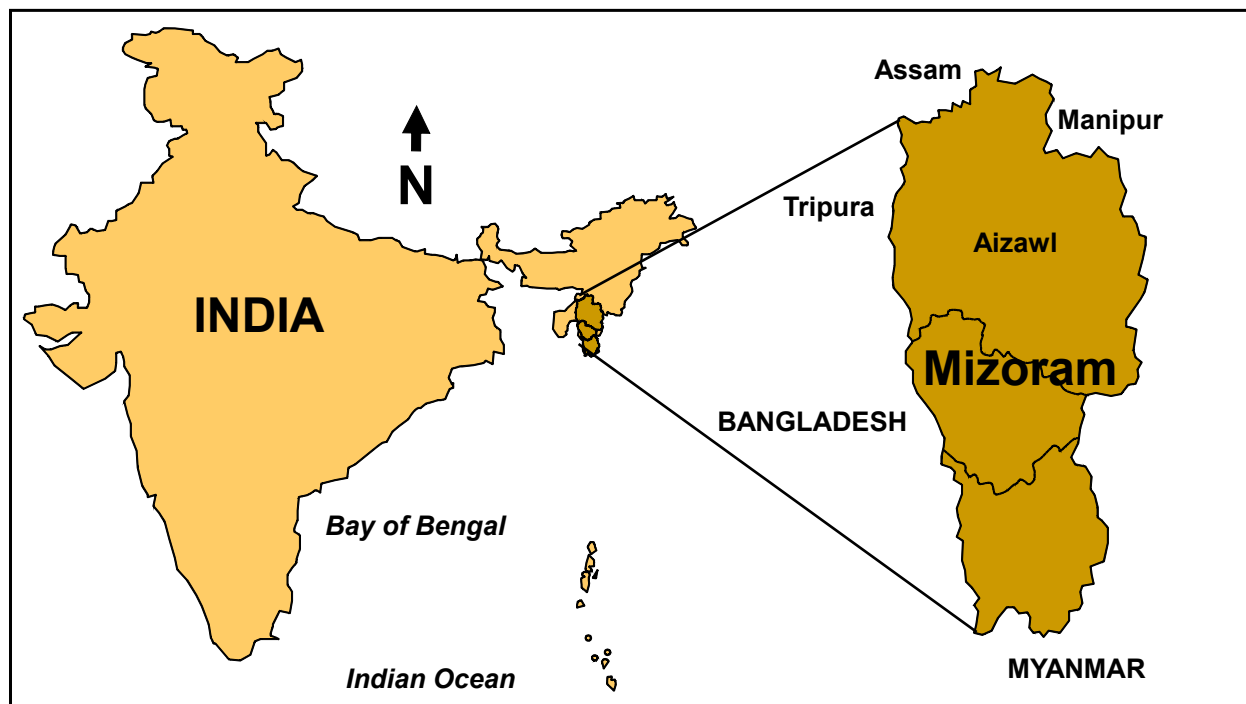


Figure 1. Location of study area in NE India (an Indo-Burma hotspot) in the state of Mizoram.

Mizo tribes of Mizoram are Sino-Tibetan in origin (Lewis 2009). Generally they are people with yellow complexion, oblique eyes, high cheekbones, sparse hair and medium height. Different tribes in Mizoram are Lushai, Mara, Lai, Chakma, Bru/Riang, Pang, Bawm and Mog/Magh (Lalramnghinglova 2003).

In Mizoram the number of doctors and other medical staff is very low in comparison to the total population (ratio doctors to total population was 1:3,415) (Rai & Lalramnghinglova 2010a, Sharma *et al.* 2001). Moreover, the topography of Mizoram is responsible for an under developed communication system. Thus, the people of the rural areas cannot take advantage of modern treatment methods and they instead rely on remedies from nature (Rai & Lalramnghinglova 2010a, Sharma *et al.* 2001).

Methodology

During the study period (1999-2008), indigenous people belonging to different tribes were interviewed about the mode of use and local names for plants by the second

author by Lalramnghinglova (Lalramnghinglova & Jha 1998, Lalramnghinglova 2003). Plants from different forest types and protected areas of Mizoram, home gardens, herbal gardens were collected in conjunction with the interviews. These were identified with assistance from Vansapati Van and the Botanical Survey of India, Howrah, West Bengal herbarium (CAL) where the specimens are deposited.

The indigenous people are hesitant to transfer their indigenous knowledge acquired from their ancestors. However, traditional medical practitioners were cooperative helping on two field trips per year. Ethnobotanical data were collected according to the methodology suggested by Jain (1964). Plant parts used were also characterized. Only corroborating information obtained from at least three traditional practitioners has been reported here. Field data assessment and comparison was conducted according to Heinrich *et al.* (2009). A guideline for Application of IUCN Criteria at Regional Levels was adopted for threat assessment (IUCN 2004). Red Listed Species documented in the study area were marked according to Nayar & Sastry (1990). SPSS 11.5 version was used for regression analysis.

Table 2. Population distribution in Mizoram and Aizawl, N.E. India. Source: Sharma *et al.* 2001.

	Mizoram			Aizawl		
	Male	Female	Total	Male	Female	Total
Rural	194 414	177 396	371 810	114 630	104 114	218 744
Urban	164 564	153 382	317 946	133 713	126 008	259 721
Total	358 978	330 778	689 756	248 343	230 122	478 465

sis between ethnomedicinal plant species recorded and families. Further, correlation coefficients were assessed between different life forms of dominant families.

Results

304 plants from 96 families were identified as medicinal (Table 3). Regression analysis revealed a significant and positive regression relationship (0.442) between total ethnomedicinal plant species recorded and plant families. Just a few families dominate and some families are represented by only single species. Ten dominant families shown in Figure 2 have a significant and positive regression with the lesser represented families. Medicinal plants from all families showed significant positive regression (0.95) with the number of ethnomedicinal plants from dominant families.

Fabaceae (25) followed by Asteraceae (16) contributed the highest number of medicinal plants. Distribution of major families into diverse life forms is represented in Figure 2. The total number of life forms within dominant families was positively correlated. Shrubs were uniformly represented throughout. Trees and herbs have shown a significant and negative correlation (-.659) while other life forms were unrelated with respect to each other.

Examination of the IUCN Red Listed Species identified through this study is informative about the complexity of issues (IUCN 2009). The following results are sorted primarily by the IUCN category with additional observations from this work.

Extinct (EX)

No extinct species were found through this project.

Extinct in the Wild (EW)

Aegle marmelos (L.) Corrêa is EW at the regional scale.

Critically Endangered (CR)

Ilex khasiana Purkay. is CR in NE India. *Syzygium travancoricum* Gamble is CR, while in our study, *Syzygium cerasoides* (Roxb.) Raizada, was identified under a threatened category.

Endangered (EN)

Mesua ferrea L. is common in Mizoram (having status of state plant), whereas, it is EN in Darjeeling Himalaya. *Dalbergia pinnata* (Lour.) Prain is EN at a regional scale, while, *Dalbergia horrida* is DD (data deficient) status. *Dendrobium denudans* D. Don is EN in NE India and Mizoram while at a global scale *Dendrobium ovatum* (L.) Kraenzl. is at Lower Risk (LR). *Garcinia lanceifolia* Roxb. (EN) and *Garcinia cowa* Roxb. (LR) at regional level, whereas, at a global level *Garcinia indica* Choisy is VU. *Garcinia pedunculata* Roxb. ex Buch.-Ham. is Near Threatened (NT). *Garcinia coronaria* is LR at regional scale as is *G. gum-mifera* at a global scale. *Hydnocarpus kurzii* is EN in NE India but by our observations should be CR. *Rauvolfia serpentina* is EN.

Vulnerable (VU)

Saraca asoca is VU/EN in Mizoram. *Cyclea fissicalyx* is EN while in our regional study *Cyclea peltata* is VU. *Elaeagnus pyriformis* at regional scale is VU, while, *Elaeagnus conferta* corresponds to LR. *Aquilaria malaccensis* Lam. is currently listed as VU but based on our observations should be moved to CR.

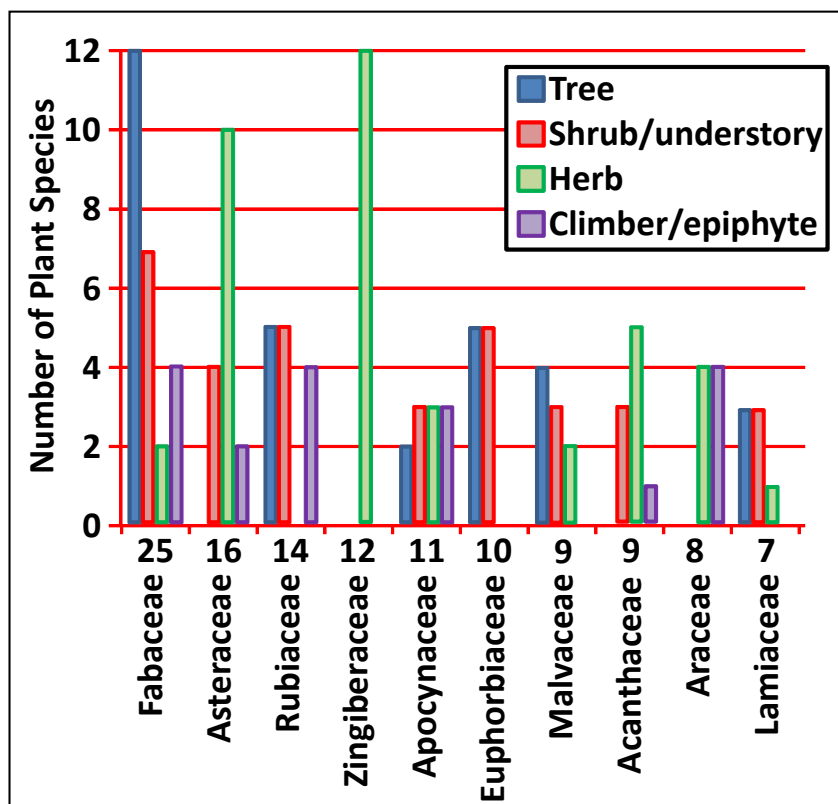


Figure 2. Species growth habits of ethnomedicinal plants in the ten dominant plant families. These were documented in Mizoram, India.

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Table 3. Ethnomedicinal plants recorded from Mizoram, N.E. India: An Indo-Burma hotspot. (Modified or updated from prior work (Lalramnghinglova 2003, Rai & Lalramnghinglova 2010a,b. Status: **A**- cultivated, **CR**-critically endangered, **DD**-data deficient, **E**-endemic to NE India, **EN**-endangered, **EW**-extinct in wild, **I**-invasive, **IN**-introduced & naturalized, **LR**-lower risk/conservation dependent, **NT**-near threatened (includes lower risk/near threatened), **VU**-vulnerable, **W**-weedy. Parts Used: **A**-aerial parts, **B**-bark, **Br**-branches, **Bu**-buds, **Ch**-charcoal, **F**-flowers, **Fr**-fruit, **G**-gum, **IS**-immature stems, **L**-leaves, **La**-latex, **P**-pulp of fruit, **Pe**-petioles, **Pi**-pith, **R**-roots, **Re**-resin, **Rh**-rhizomes, **Rs**-root stock, **S**-seeds, **Sa**-sap, **SC**-seed coat, **Sh**-shoots, **So**-seed oil, **Sp**-spadix & fruiting body, **St**-stem, **T**-tubers, **W**-wood, **WP**-whole plants. Species marked in red have uses from Mizoram that are published here for the first time.

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
<i>Abelmoschus moschatus</i> Medik.	Malvaceae	Uichhuhlo	Herb	LR	L,R,S
Boiled R & L are administered for the remedy of syphilis. Crushed R are applied externally on wounds/ulcers to suck the pus out. S are ground to powder & the powder is taken with water for throat-pain twice daily.					
<i>Acacia pennata</i> (L.) Willd.	Fabaceae	Khangsen	Tree	DD	B,L
B is an antidote for snake poison, & used in bronchitis & asthma. L are used for stomach ache & bleeding gums.					
<i>Acer laevigatum</i> Wall.	Sapindaceae	Thingkhim	Tree	LR	B
A decoction of B is applied externally for the remedy of muscle strain.					
<i>Achyranthes aspera</i> L.	Amaranthaceae	Buchhawl	Herb	LR	WP
Taken for the remedy of dysentery, colic diseases, in boils & cirrhosis.					
<i>Achyranthes bidentata</i> Blume	Amaranthaceae	Vangvat-tur	Herb	LR	L
The L are crushed & the juice is applied to treat a poisoned leach bite.					
<i>Adhatoda zeylanica</i> Medik.	Acanthaceae	Kawldai	Herb	LR	L
L are antispasmodic, used in chronic bronchitis, as antidiarrheal, expectorant, antirheumatism, & insecticidal. R are antiseptic, antiperiodic, antihelminthic, & antigonorrhoeal. F & Fr are also antispasmodic.					
<i>Adiantum caudatum</i> L.	Pteridaceae	Chakawkria	Herb	LR	Fr
The Fr are crushed & applied externally on skin diseases.					
<i>Adiantum philippense</i> L.	Pteridaceae	Chakawkte	Herb	LR	WP
An infusion of the WP is taken for the remedy of fever & dysentery.					
<i>Aeginetia indica</i> L.	Orobanchaceae	Sanghar-vaibel	Epheme- al	CR/VU	R/Rh
Juice of the Rh is applied to mumps & inflammatory glands. R in combination with other plants are prescribed as pills for fertility.					
<i>Aegle marmelos</i> L.	Rutaceae	Belthei	Tree	EW/VU	P
A decoction of Fr is applied for the remedy of dysentery, stomach ache & digestive problems.					
<i>Aeschynanthus sikkimensis</i> (C.B. Clarke) Stapf	Gesneriaceae	Bawltehlantai	An epiphytic undershrub	LR	L,F,Rs
The L & Rs are used for the remedy of fever & pain. Juice of crushed L are applied for inflammatory glands. An infusion of F is taken for the remedy of tonsillitis.					
<i>Ageratum conyzoides</i> L.	Asteraceae	Vailenhlo	Herb	LR	R
The R is crushed with <i>Callicarpa arborea</i> B & rhizome of <i>Curcuma longa</i> & the juice is drunk for the remedy of stomach cancer. St & L are used as antidiarrheal & also aid in blood clotting.					
<i>Albizia procera</i> (Roxb.) Benth.	Fabaceae	Kangtekpa	Small tree	LR	B,L,R
A poultice of L are applied to ulcers. The crushed B is used for fish-poisoning.					
<i>Albizia odoratissima</i> (L.f.) Benth.	Fabaceae	Kangteknu	Tree	LR	L
The L are boiled in ghee & is used in remedy for cough.					
<i>Allophylus cobbe</i> (L.) Raeusch.	Sapindaceae	Gendrama	Shrub	LR	L,R
A decoction of R is taken orally for chronic ulcer & L paste is applied externally for the remedy of ulcers.					

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
<i>Alocasia fornicata</i> (Roxb.) Schott	Araceae	Baibing	Herb	LR	Sp
The sap or juice of the plant is applied on a snake bite.					
<i>Alpinia bracteata</i> Roscoe	Zingiberaceae	Aichal	Herb	LR	Rh
Powdered Rh with that of <i>Zingiber officinale</i> Roscoe & a little salt is used for the remedy of stomatitis & cough.					
<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	Thumriat	Tree	LR	B,La,R
50 ml of R-B decoction is taken three times daily in for hypertension. The milky juice or La is applied on cuts & wounds. The La with an equal proportion of mustard oil is used as an eardrop for ear-aches.					
<i>Amaranthus spinosus</i> L.	Amaranthaceae	Thumriat	Herb	LR	R,L
R extract is drunk for the remedy of hemorrhages. L are boiled in water & drunk to treat difficult urination. Juice of crushed L are used as a hemostatic.					
<i>Amomum dealbatum</i> Roxb.	Zingiberaceae	Aidu	Herb	LR	B,R
The B is crushed & the juice is used as antiseptic. A decoction of R suckers is taken for hypertension.					
<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicolson	Araceae	Telhawng	Herb	LR	T
The T is sliced into pieces & boiled in water to remove the irritants.					
<i>Ampelocissus latifolia</i> (Roxb.) Planch.	Vitaceae	Heruipawl	Climber	LR	L,R
Juice of crushed R is taken orally to stop excess urination mixed with blood. The L are chewed against teeth set on edge.					
<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	Lakhuihthei	Herb	LR	Fr,L
The L or Fr are crushed & the juice is used for the remedy of convulsions.					
<i>Andrographis paniculata</i> (Burm.f.) Wall. ex. Nees	Acanthaceae	Hnahkhpui	Herb	NT	L,St,WP
L are antispasmodic, used to treat diarrhea, and loss of appetite in infants. R & L are used as a febrifuge, for treatment of stomach ache and used as an anthelmintic. WP in jaundice.					
<i>Angiopteris evecta</i> (G. Forst.) Hoffm.	Marattiaceae	Arthladawnpui	Terrestrial fern	LR	R
A R paste is used to treat bone fractures.					
<i>Anacardium occidentale</i> L.	Anacardiaceae	Sazupumpui-thei	Tree	EW/VU	B
Juice of crushed B is applied externally on ring worm, leprosy & warts.					
<i>Anacolosia crassipes</i> Kurz	Olacaceae	Lushai-nautur	Shrub	LR	L
Boiled L are used with water for bathing children to treat measles & skin eruptions.					
<i>Anogeissus acuminata</i> (Roxb. ex DC.) Guill., Perr. & A. Rich.	Combretaceae	Zairum	Tree	LR	B
The B is crushed & the juice is used as a remedy for diarrhoea & beriberi.					
<i>Anthocephalus chinensis</i> (Lam.) Rich. ex Walp.	Rubiaceae	Banphar	Tree	LR	B,L
B&L are used for the remedy of uterine complaints & blood diseases.					
<i>Aporosa octandra</i> (Buch.-Ham. ex D. Don) Vickery	Phyllanthaceae	Chhawntual	Small tree	LR	B
50 ml. of B decoction is taken for the remedy of stomach ache & stomach ulcer.					
<i>Aquilaria malaccensis</i> Lam.	Thymeleaceae	Thingrai	Small Tree	CR: E	Re,W

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
The W is used as a stimulant, antiasthmatic, antidiarrheal, antirheumatism, astringent, carminative diuretic, brain tonic, leucoderma, and for stomach problems and diseases of the eyes, ears & skin.					
<i>Ardisia colorata</i> Link	Primulaceae	Hnunthlum	Small tree	LR	R
The R paste is applied externally on chronic ulcer.					
<i>Ardisia paniculata</i> Roxb.	Primulaceae	Naunuar	Small tree	LR	R
Decoction of R is used for rheumatism. Crushed R in combination with <i>Smilax ovalifolia</i> Roxb. & <i>Bridelia tomentosa</i> Blume is boiled with water & taken for jaundice.					
<i>Ardisia polycephala</i> Wall. ex A. DC.	Primulaceae	Sialtuai	Small tree	VU	R
The R with that of <i>Amaranthus caudata</i> L. is crushed & taken with cold water to stop excess bleeding & with warm water for normal bleeding after child birth.					
<i>Arenga pinnata</i> (Wurmb) Merr.	Arecaceae	Thangtung	Shrub	LR	R
Decoction of R is applied for bronchitis & stomach ache.					
<i>Areca catechu</i> L.	Arecaceae	Kuhva	Palm tree	LR	Fr,L
The Fr/nut is antihelminthic, astringent, and used for urinary disorders. Young L are astringent and applied for the remedy of bleeding gums, as well as for checking pyrosis of pregnancy & watery vaginal discharges.					
<i>Arenga saccharifera</i> Labill.	Arecaceae	Thangtung	Palm tree	LR	R
R is used to treat stomach ache & bronchitis.					
<i>Artemisia indica</i> Wild.	Asteraceae	Sai	Herb	VU	L
Infusion of L taken orally for the remedy of fever, stomach ache, whooping cough, bleeding from the nose & gum.					
<i>Artocarpus chama</i> Buch.-Ham.	Moraceae	Tatkawng	Tree	LR	B
Decoction of B is taken for the remedy of diarrhoea. A paste of B is applied externally on sores & pimples.					
<i>Artocarpus lakoocha</i> Wall. ex Roxb.	Moraceae	Theitat	Tree	LR	B,S
The S is used as a purgative & B powder is applied to sores to draw out purulent matter. An infusion is applied to pimples & cracked skin.					
<i>Asparagus racemosus</i> Wild.	Asparagaceae	Arkebawk. Satavar	Herb	NT	R,L
R are used as a refrigerant, demulcent, diuretic, aphrodisiac, antiseptic, alternative, antidiarrheal, antidyenteric & used in fever, rheumatism & as a sexual tonic. A decoction of R is given for fever & as an extract to treat fungal infections. Boiled L are applied on boils & small pox.					
<i>Averrhoa</i> sp.	Oxalidaceae	Theiherawt	Small tree	NT	Fr,L
Three or four slices of Fr are take daily for jaundice, bleeding piles, & as an antiscorbutic. An infusion of L are taken to treat an enlargement of the liver.					
<i>Azadirachta indica</i> A. Juss.	Meliaceae	Nimthing	Tree	NT	WP
Stem B is used as an astringent for skin diseases. R B is used to prevent the periodic return of diseases. L are used as antiseptic, antibiotic, in boils, ulcer & eczema. F is used to treat stomach aches, with the berry used as a purgative, antihelminthic, and gum demulcent. S oil in used in rheumatism & skin diseases.					
<i>Baccaurea ramiflora</i> Lour.	Phyllanthaceae		Tree	LR	B,L
Purgative, used in stomach ache, juice of coat of inner B is taken against food allergy as well as antihelminthic. 2-3 young L are chewed 3 times a day for toothache.					
<i>Bauhinia variegata</i> L.	Fabaceae	Vaube	Tree	LR	B,FI
B is used as a carminative, tonic, astringent, antidiarrheal, blood purifier, and for treatment of goiters. F is used as a laxative.					
<i>Begonia inflata</i> C.B. Clarke	Begoniaceae	Sekhupthur-hmul	Herb	NT	WP
The WP is being used for the treatment of kidney & urinary problems.					

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
<i>Benincasa hispida</i> (Thunb.) Cogn.	Cucurbitaceae	Maipawl	Climbing herb	NT	Fr,S
Fr is used as a laxative, diuretic, antiperiodic and for treatment of internal organ hemorrhages. S are used as antihelminthics.					
<i>Bergenia ciliata</i> (Haw.) Sternb.	Saxifragaceae	Pan-damdawi	Herb	EN	Ls,R
L are used for ear ache. L & R as used as a tonic & antiscorbent, & to treat diarrhoea, fevers, piles & urinary problems.					
<i>Bidens pilosa</i> L.	Asteraceae	Vawkpuithal	Herb	LR: W	F,L,Sh
Young Sh are used to treat rheumatism. L are used for eye & ear complaints. F is used as an antidiarrheal.					
<i>Bischofia javanica</i> Blume	Phyllanthaceae	Khuangthli	Tree	LR	B,L,Sh
Young Ls & buds are used in tonsillitis & for throat pain. An infusion of young Sh & L are taken orally for diphtheria & pharyngitis. A decoction of the B is taken internally for cholera.					
<i>Blumea laciniata</i> (Roxb.) DC.	Asteraceae	Khuanglawr	Herb	LR	L,R
A paste from R is used against snake bite. L are crushed & the juice is applied externally on the bitten part.					
<i>Blumea lanceolaria</i> (Roxb.) Druce	Asteraceae	Buarze	Shrub	VU	L
Pressed juice of L are applied to treat wounds & chronic ulcers. An infusion of L are taken against dysentery.					
<i>Bombax ceiba</i> L.	Malvaceae	Phunchawng	Tree	VU	B,G, Fr,R
The R is used as a stimulant & tonic. B is used as an emetic. G is used as an aphrodisiac, demulcent, homeostatic astringent, & tonic (alternatively used for the remedy of diarrhoea & dysentery). Fr & F are used against snake bite.					
<i>Bombax insigne</i> Wall.	Malvaceae	Pang	Tree	LR	B
The B is boiled with that of <i>Mangifera indica</i> L. (equal part) & a half cup of water is taken twice daily for the remedy of tonsillitis & other throat infections.					
<i>Buddleja asiatica</i> Lour.	Scrophulariaceae	Serial	Shrub/ small tree	NT	F
F is used to treat skin diseases.					
<i>Callicarpa arborea</i> Roxb.	Lamiaceae	Hnahkiah	Tree	LR	B
The B is crushed & the juice is drunk for the remedy of stomach pain, dysentery & vomiting. Juice of the inner B coat is used as a hemostatic on cuts.					
<i>Callicarpa macrophylla</i> Vahl	Lamiaceae	Hnahkiahte JHR.	Small Tree	LR	Ls
L are turned into paste & applied on bone fractures.					
<i>Calotropis gigantea</i> (L.) W.T. Aiton	Apocynaceae	Madar	Shrub	EW/VU	L,Sa, St
Used for wound healing.					
<i>Camellia sinensis</i> (L.) Kuntze	Theaceae	Thingpui	Small tree	LR	L
Tea from boiled L are used as an astringent, stimulant & diuretic.					
<i>Canarium strictum</i> Roxb.	Burseraceae	Berawthing	Tree	NT	B
B is used to treat rashes.					
<i>Canavalia ensiformis</i> (L.) DC.	Fabaceae	Fangra	Climber	LR	S
Sliced S is applied to snake bite to draw out the poison.					
<i>Carica papaya</i> L.	Caricaceae	Thingfanghma	Small tree	LR	Fr,S
Juice of unripe Fr in large doses as taken as a toddy, is used to remove freckles & other blemishes from the skin, and is taken as an antihelminthic. Ripe Fr is used for digestive problems. S is used as a vermifuge.					

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
<i>Caryota urens</i> L.	Areaceae	Tum	Palm tree	LR	St
A flesh toddy from the St is used as food during famine.					
<i>Cassia alata</i> L.	Fabaceae	Tuihlo	Shrub	LR	L
The L are bruised & applied to ringworm (fungal) infections as well as to other skin infections.					
<i>Cassia fistula</i> L.	Fabaceae	Ngaingaw	Tree	LR	WP
R, B, S & L are used as purgatives, tonics & febrifuges.					
<i>Cassia hirsuta</i> L.	Fabaceae	Sab-daru	Shrub	CR/VU	L,R
In case of snake-bite juice of R taken internally while brushed L applied externally on affected part					
<i>Cassia tora</i> L.	Fabaceae	Kelbe-an	Shrub	LR	L,R,S
R paste is used externally against ringworm infections. A decoction of L/S is applied externally on cutaneous diseases.					
<i>Catharanthus roseus</i> (L.) G. Don	Apocynaceae	Kumtluang	Herb	LR/IN	L,R,St
The raw L are taken treat high blood pressure. L are used as an anti-cancer agent. A decoction of R, St & L are used for diabetes, diarrhoea, dysentery, & cholera.					
<i>Caulokaempferia linearis</i> (Wall.) K. Larsen	Zingiberaceae	Lung-ai-thing Lalram	Herb	LR	L
Chakmas apply crushed L on the head to treat vertigo.					
<i>Cautleya gracilis</i> (Sm.) D&y	Zingiberaceae	Pale	Herb	C/EW	Rh
An infusion of Rh is taken for flatulence, colic & hepatomegaly. The Rh is eaten raw to relieve colic, cough, & stomach heat.					
<i>Centella asiatica</i> (L.) Urb.	Apiaceae	Lambak/Hnahbi-al	Herb	LR	L
L are used as a memory stimulator and to treat hypertension. The L are boiled & the water is taken for the remedy of asthma & eye problems.					
<i>Cephalostachyum capitatum</i> Munro	Poaceae	Raw-ngal	Herb	LR	L
L are used as a tonic, antihelminthic, carminative & to treat stomach ache.					
<i>Chassalia ophioxyloides</i> (Wall.) Craib	Rubiaceae	Khummurmu	Shrub	LR	R
The R paste is applied externally to chronic ulcers, tumors & sores.					
<i>Chonemorpha fragrans</i> (Moon.) Alston	Apocynaceae	Phungthe ikelki	Climber	LR	R
100 ml of R infusion is applied internally (vaginally) twice daily to retain the placenta.					
<i>Chromolaena odorata</i> (L.) R.M. King & H. Rob.	Asteraceae	Tiangsam	Shrub	LR	L
Crushed L juice is applied externally as to stop bleeding.					
<i>Chukrasia tabularis</i> A. Juss.	Meliaceae	Zawngtei	Tree	LR	R,SC
Raw R are taken for the remedy of stomach pain. An infusion of S-coats is taken internally or a small portion is eaten raw to remedy diarrhoea & dysentery.					
<i>Cinnamomum obtusifolium</i> (Roxb.) Nees	Lauraceae	Thakthingsuak	Tree	LR	B
B is used to remedy dyspepsia & liver complaints.					
<i>Cinnamomum tamala</i> (Buch-Ham.) Nees & Eberm.	Lauraceae	Tejpatta	Tree	LR	B,L
L are used as a stimulant, carminative, antirheumatic, & antidiarrheal. B is used in treating gonorrhoea.					
<i>Cinnamomum verum</i> J. Presl	Lauraceae	Thakthing	Tree	LR	B,L
B is used as a carminative, antispasmodic, hemostatic, astringent, & antiseptic. L are used for diabetes.					

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
<i>Cissus repanda</i> Vahl.	Vitaceae	Vawmdawng	Climber	LR	L,R
A R paste in water mixed with <i>Murraya koenigii</i> (L.) Spreng. is drunk as a tea for heartburn. L are used for snake bite.					
<i>Cissus discolor</i> Blume	Vitaceae	Sangharhmai	Climber	NT	L,R,St
A decoction of the R, St & L is used for inflamed kidneys.					
<i>Citrus sinensis</i> (L.) Osbeck	Rutaceae	Serthlum	Tree	LR	L
The L are boiled & the water is taken for the remedy of malaria.					
<i>Claoxylon khasianum</i> Hook.f.	Euphorbiaceae	Nagabang	Shrub/ small tree	NT	R
A R paste is applied externally for tumors/cancer.					
<i>Clerodendrum bracteatum</i> Wall. ex Walp.	Verbenaceae	Phuihnam	Small tree	LR	L,R
The L & R are used to remedy diarrhoea.					
<i>Clerodendrum colebrookianum</i> Walp.	Verbenaceae	Phuihnam	Small tree	VU	L
50 ml of a decoction of L is taken twice daily to treat hypertension.					
<i>Colysis hemionitidea</i> (Wall. ex C. Presl) C. Presl	Polypodiaceae	Kawkte-bet*	Fern	LR	Rh
The Rh is used for the treatment of bone fractures.					
<i>Congea tomentosa</i> Roxb.	Verbenaceae	Sahuaihrui	Shrub	NT	St
St is used to treat animal wounds.					
<i>Cordia dichotoma</i> G. Forst.	Boraginaceae	Muk	WP parts	LR	B,Fr,L
The plant is used as an antidote for snake bite. Fr is used as an astringent, antihelminthic, demulcent, expectorant, & for treatment of urinary infections. B is used as a febrifuge. L are used to remedy ulcers, cough & colds.					
<i>Costus speciosus</i> (J. König) Sm.	Costaceae	Sumbul	Herb	LR	L,R,Rh
A cold infusion of the Rh is taken orally for kidney problem & leprosy. Crushed R juice is taken internally for the removal kidney/gall bladder stones. The L are boiled & the water is taken for the remedy of tonsillitis.					
<i>Crotalaria juncea</i> L.	Fabaceae	Tumthang	Shrub	LR	L
L are used as a demulcent, emetic, purgative & abortifacient.					
<i>Cucurbita maxima</i> Duchesne	Cucurbitaceae	Mai	Climber	LR	Fr,L
The Fr or L are boiled & the water is taken for the remedy of eye problem.					
<i>Curculigo crassifolia</i> (Baker) Hook. f.	Hypoxidaceae	Phaiphek	Herb	LR	IS,T
Tuber/immature stem juice is used in stomach ache & also applied on deep cuts & bandaged to relieve pain & to heal wounds.					
<i>Curcuma caesia</i> Roxb.	Zingiberaceae	Ailaidum	Herb	NT/C	Rh
Crushed Rh juice is used for the treatment of diarrhoea & stomach pain.					
<i>Curcuma longa</i> L.	Zingiberaceae	Aieng	Herb	A/C	Rh
Crushed Rh juice is used as an antiseptic.					
<i>Curcumorpha longiflora</i> (Wall.) A.S. Rao & D.M. Verma	Zingiberaceae	Ailaidum	Herb	EW/VU	Rh
A Rh infusion is taken to remedy dysentery & diarrhoea.					
<i>Cyathula prostrata</i> (L.) Blume	Amaranthaceae	Buchhawlsen Lalram	Herb	LR	L
The crushed L are applied on boils & then bandaged in order to draw pus out.					

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
<i>Cyclea peltata</i> Hook. f. & Thomson	Menispermaceae	Khauchhim	Climber	VU/NT	R
A R decoction is taken orally for colic, fever & diarrhoea.					
<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Phaitual	Perennial grass: on roadsides: to 1,800m	LR	WP
Bruised plant is inhaled for treatment of a toothache.					
<i>Daibergia pinnata</i> (Lour.) Prain	Fabaceae	Tengterehrui	Tree	CR/VU	B,R
B & R are used to treat stomach problems, hepatitis & toothache.					
<i>Datura suaveolens</i> Humb. & Bonpl. ex Willd.	Solanaceae	Tawtawrawt par	Shrub: Cultivated especially in home garden	LR	L
L are dried & smoked as tobacco for chest complaints, asthma. Roasted L are applied externally to treat breast lumps/ stony hard breasts.					
<i>Dendrocnide sinuata</i> (Blume) Chew	Urticaceae	Thakpui	Shrub	LR	R
The R are boiled along with crabs & the water is taken for the remedy of jaundice.					
<i>Dendrobium denudans</i> D. Don	Orchidaceae	Naubanhlosen	Orchid/ Shrub	EN/VU	St
The St are used as a narcotic.					
<i>Desmodium gyroides</i> (Roxb. ex Link) DC.	Fabaceae	Kerangkana	Shrub	LR	R
A R paste is used as a treatment for inflammatory glands.					
<i>Desmodium triflorum</i> (L.) DC.	Fabaceae	Bawngkek-hlo Lalram	Herb	LR	WP
The plants are boiled & the water is taken for kidney problem & urinal problems. Fresh L juice is applied on wounds.					
<i>Desmos chinensis</i> Lour.	Annonaceae	Zunin -damdawi	Scandent scrub	LR	L,R
<i>Desmos dumosus</i> (Roxb.) Saff. (Used alone & in combination)					
A R decoction is used for treatment of painful urination.					
<i>Desmos longiflorus</i> Saff.	Annonaceae	Chi-ri-pi	Small tree	NT	L,R
A R paste is used for the treatment of chronic ulcer. A L decoction is used to treat asthma.					
<i>Dillenia indica</i> L.	Dilleniaceae	Kawrthindeng	Tree	LR	B,Fr
The Fr is boiled & the water is taken for the remedy of jaundice. 50 ml of B infusion is taken twice daily for treatment of diarrhoea & dysentery.					
<i>Dillenia pentagyna</i> Roxb.	Dilleniaceae	Kaihzawl	Tree	LR	B,W
A B decoction is taken orally for diabetes,. A B paste is applied externally on rheumatic pains. W used for anticancer & antiulcer agents.					
<i>Dinochloa compactiflora</i> (Kurz.) McClure	Poaceae	Sairil	Bamboo	LR	St
The outer St epidermis is scraped off & applied externally on cuts to stop bleeding. Sap oozing out of the cut stem is given to children for influenza, cough & chest complaints.					
<i>Diplazium maximum</i> (D. Don) C. Chr.	Woodsiaceae	Chakawk-ei-chi	Fern	LR	R

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
The R is crushed, combined with other plants, & the mixture is applied externally on bone fractures.					
<i>Dioscorea alata</i> L.	Dioscoreaceae	Rambachim	Climber	LR	T
The T is used for treatment of leprosy, piles & gonorrhoea.					
<i>Dipterocarpus turbinatus</i> Gaertn.	Dipterocarpaceae	Lawngthing	Tree	LR	Re, St, W
Re is used as a stimulant & diuretic, & to treat gonorrhoea, chronic bronchitis & leprosy.					
<i>Dracaena spicata</i> Roxb.	Asparagaceae	Phunhring	Shrub	LR	L,R
The L & R are used to treat stomach ache.					
<i>Drymaria cordata</i> (L.) Willd. ex Roem. & Schult.	Caryophyllaceae	Changkalrit	Herb	LR	WP
The WP is boiled & the steam is inhaled to treat sinus problems & cough. Bruised L are used as lotion for joint pain & muscle strain.					
<i>Dysoxylum gobara</i> (Buch.-Ham.) Merr.	Meliaceae	Thingthupui	Tree	LR	Bu,L
A decoction of L & buds is used as a remedy for diarrhoea & dysentery.					
<i>Elaeagnus caudata</i> Schltld. ex Momi.	Elaeagnaceae	Sarzukpui	Scandent herb	LR	L,R
The R is boiled & the water is taken orally for against retained the placenta. Crushed R juice is taken for easy labor & as a treatment after child birth. A L infusion is taken orally to strengthen uterus function after child birth.					
<i>Elaeagnus pyriformis</i> Hook.f.	Elaeagnaceae	Ramsarzuk	Shrub	VU	R
R paste is dipped in water & drunk to treat appendicitis.					
<i>Elsholtzia blanda</i> (Benth.) Benth.	Lamiaceae	Nauhri	Shrub	NT	A
An A infusion is used for children's disease called nauhri , a combination of fever, cholera, skin diseases & inflammation. A L poultice is used to treat inflammatory glands.					
<i>Elsholtzia ciliata</i> (Thunb.) Hyl.	Lamiaceae	Ram-lengser* Lalam	Herb	LR	WP
L juice is used as a diuretic, and for treatment of cough & colds.					
<i>Embelia subcoriacea</i> (C.B. Clarke) Mez	Elaeagnaceae	Tling	Climber	LR	L
A L decoction is used for bathing in the treatment of small pox & for bathing woman's injuries after child birth.					
<i>Emblica officinalis</i> Gaertn.	Euphorbiaceae	Sunhlu	Tree	LR	Fr
The raw Fr is taken for the remedy of stomach problems.					
<i>Entada pursaetha</i> DC.	Fabaceae	Kawi	Climber	LR	S
The S are soaked in water & the water is dropped into the nostrils for treatment of leeches.					
<i>Ervatamia coronaria</i> (Jacq.) Stapf	Apocynaceae	Pararsi	Shrub	LR	B,L,R
The R are used to provide comfort for toothaches. R & B used as an antidote for scorpion stings. Milky juice is used to treat diseases of eyes.					
<i>Eryngium foetidum</i> L.	Apiaceae	Bahkhawr	Herb	LR	R
The R are used for treatment of stomach ache.					
<i>Erythrina stricta</i> Roxb.	Fabaceae	Fartuahpui	Tree	LR	B
The B is used as an astringent & antidote to snake bite. An inner B coating decoction is taken orally to treat stomach ulcer.					
<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Eucalyptus	Tree	LR	Ch,L

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
A L infusion is taken for treatment of pneumonia. Charcoal is ground to powder or made into paste & taken for treatment of stomach ulcer. A L decoction is used for treatment of diabetes.					
<i>Eupatorium adenophorum</i> Spreng.	Asteraceae	Hlothar	Herb	LR	L
Crushed L juice is applied to stop nose bleeding.					
<i>Eupatorium cannabinum</i> L.	Asteraceae	Hlothar	Herb	LR	L
Crushed L juice is applied to stop nose bleeding.					
<i>Euphorbia royleana</i> Boiss.	Euphorbiaceae	Chawng	Shrub	LR	Fr,L,Pi
Pi & unripe Fr of <i>Carica papaya</i> L. is cooked with chicken & the water is taken to treat diseases of the liver & chronic fever. Milky juice is used externally for ring worm, rheumatism, boils, warts. Juice of heated L are applied to earache.					
<i>Ficus benghalensis</i> L.	Moraceae	Hmawng	Tree	LR	B,L,La,R,S
The milky juice is applied externally for pains in rheumatism & lumbago. A B infusion is used as a tonic, astringent, & for treatment of dysentery, diarrhoea & diabetes. S is used as a cooling tonic. L are applied as a poultice to abscesses. R fiber is used in treatment of gonorrhoea.					
<i>Ficus prostrata</i> (Wall. ex Miq.) Miq.	Moraceae	Theitit	Epiphytic	LR	R
Crushed R juice is applied for remedy of poisoned snake bites.					
<i>Ficus religiosa</i> L.	Moraceae	Hmawngnahzum	Tree	LR	B,L
B is used as an astringent, & to treat gonorrhoea, dysentery, fever, scabies, & piles. L & young shoots are used as purgatives & to treat skin diseases.					
<i>Ficus semicordata</i> Buch.-Ham. ex Sm. var. <i>conglomerata</i> (Roxb.) Corner	Moraceae	Thenpui	Small tree	LR	B,L
B & L together are used to treat liver ailments.					
<i>Flemingia macrophylla</i> (Willd.) Prain	Fabaceae	Tuisithing Lalram*	Shrub	VU/NT	R
A R decoction is used as an external application for treatment of swellings & pain in the body.					
<i>Garcinia cowa</i> Roxb.	Clusiaceae	Chengkek	Tree	LR	B,L
B & L are for treatment of diarrhoea, leprosy & ulcers.					
<i>Garcinia lanceifolia</i> Roxb.	Clusiaceae	Pelhte	Tree	EN	Fr,L
Fr & L are used for remedy of stomach ache.					
<i>Garcinia paniculata</i> Roxb. ex Wight	Clusiaceae	Vawmva	Tree	LR	S
The S are used in treatment of roundworms.					
<i>Garcinia pedunculata</i> Roxb. ex Buch.-Ham.	Clusiaceae	Theipumlian	Tree	NT	Fr
An acidic Fr pericarp extract solution is mixed with sugar & is taken orally against dysentery & diarrhoea.					
<i>Gardenia coronaria</i> Buch.-Ham.	Rubiaceae	Rul-hluah* Lalran	Tree	LR	L,R
50 ml of an infusion of R & L is taken orally twice daily against snake bite.					
<i>Garcinia sopsopia</i> Mabb.	Clusiaceae	Thensaker	Tree	NT	Br
Br is used to treat snake bite.					
<i>Garuga pinnata</i> Roxb.	Burseraceae	Bangbutuairam	Tree	LR	B,L
Stem B juice is dropped into the eye to treat conjunctiva opacities. L juice mixed with sugar is taken for asthma.					
<i>Gelsemium elegans</i> (Gardner & Champ.) Benth.	Gelsemiaceae	Hnamtur	Tree	EN/VU	R
R used for veterinary purposes.					

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
<i>Girardinia palmata</i> (Forssk.) Gaudich.	Urticaceae	Kangthai	Tree	LR	R
Crushed R juice is taken against food allergies (e.g., pork).					
<i>Gmelina arborea</i> Roxb. ex Sm.	Verbenaceae	Thlanvawng	Tree	LR	F,Fr
A F decoction is used orally to treat hypertension. Roasted Fr is applied externally for itching.					
<i>Goniothalamus sesquipetalis</i> (Wall.) Hook. f. & Thomson	Annonaceae	Kham	Small tree	LR	Ls
L are burned & the smoke is inhaled to treat asthma & also to induce sleep.					
<i>Gynocardia odorata</i> Roxb.	Flacourtiaceae	Saithei	Tree	EN	SO
The Fr are crushed & the S are extracted & used as lotion for treatment of leprosy & other skin diseases.					
<i>Hedychium coronarium</i> J. König	Zingiberaceae	Ai-lalnu	Herb	NT/C	Rh,St
The base of St are used for swellings & the Rh are used for treatment of fevers & rheumatism.					
<i>Hedychium spicatum</i> Buch.-Ham. ex Sm.	Zingiberaceae	Kelhnamtur	Herb	LR	Rh
The Rh is used to remedy stomach ache, liver problems, vomiting, inflammation, pains, snake bite, & as a carminative, tonic, stimulant, & expectorant.					
<i>Hedyotis scandens</i> Roxb.	Rubiaceae	Laikingtuibur	Climber	LR	WP
The WP is boiled & the water is taken for treatment of swelling, malaria & kidney problems.					
<i>Helianthus annuus</i> L.	Asteraceae	Nihawipar	Herb	LR	S
The S are used as diuretics, expectorants, febrifuges, & in treatment of stomach ache, bronchitis, & laryngeal or pulmonary infections.					
<i>Helicia excelsa</i> Blume	Proteaceae	Sialhma	Tree	VU/NT	B
A B decoction is used for remedy of stomach problems.					
<i>Helicia robusta</i> R. Br. ex Blume	Proteaceae	Sialhma	Tree	LR	B
50 ml of a B decoction is taken twice daily for remedy of stomach problems.					
<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Midumpangpar/ Banglapar	Shrub	LR	F
The raw F is taken for the remedy of jaundice.					
<i>Hodgsonia macrocarpa</i> (Blume) Cogn.	Cucurbitaceae	Kha-um	Climber	LR	L
Crushed L juice is applied on fresh cuts to stop bleeding & treat wounds. Powdered L are applied externally to treat ulcers.					
<i>Homalomena aromatica</i> (Spreng.) Schott	Araceae	Anchiri	Herb	LR	Rh,WP
Rh is used as an aromatic stimulant. WP juice is used as a lotion for skin diseases.					
<i>Hoya griffithii</i> Hook.f.	Apocynaceae	Hnahchhah	Herb	LR	L,Sa
The L sap is applied on the burned skin.					
<i>Hydnocarpus kurzii</i> (King) Warb.	Flacourtiaceae	(King.) Warb.	Tree	CR/EN	B,Fr
The smoke of burning B is used for stupefying bees, especially honey-bees (<i>Apis mellifica</i>). Fr can be used for poisoning fish. The S are sold by Lushai tribes for making an oil, frequently used as a remedy for leprosy.					
<i>Hydrocotyle nepalensis</i> Hook.	Apiaceae	Hlovoidawr/ Darbengur	Herb	NT	L
L are used as diuretic, tonic, blood purifier, insecticidal, & stimulant, & for treatment of dysentery, stomach ache, scabies & cutaneous diseases.					

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Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
<i>Imperata cylindrica</i> (L.) Raeusch.	Poaceae	Di	Grass	LR	R
R juice is used for the removal or expelling of the intestinal worms.					
<i>Inula cappa</i> (Buch.-Ham. ex D. Don) DC.	Asteraceae	Buarthau	Shrub	LR	L,WP
The L are crushed with those of <i>Plantago erosa</i> Wall. ex Roxb. & <i>Lobelia angulata</i> G. Forst. & the juice is taken orally three times daily for diabetes & jaundice.					
<i>Ixora nigricans</i> R. Br. ex Wight & Arn.	Rubiaceae	Thainurual	Shrub/ small tree	VU	L
An infusion of the L is prescribed for dysentery & colic problems.					
<i>Jasminum nervosum</i> Lour.	Oleaceae	Hrurkha	Shrub	LR	L
The L are used for the remedy of stomach ache & fever.					
<i>Jatropha curcas</i> L.	Euphorbiaceae	Kangdamdawi	Shrub	LR	Br,Fr,L
Fr/nut is used as a purgative. L are used as a remedy for scabies, eczema, & ring worm. Br is used as tooth brush for treating swollen gums.					
<i>Juglans regia</i> L.	Juglandaceae	Khawkherh	Tree	LR	B,Fr,L
B & L are used as antihelmintics. L are used as astringents & tonics. Fr is used as an antirheumatic.					
<i>Justicia adhatoda</i> L.	Acanthaceae	Kawldai	Shrub	LR	L
Crushed L juice is applied externally on cuts & wounds to stop bleeding. The L are boiled & 20 ml of the water is taken internally twice daily for 3 days as a treatment for malarial fever. L paste is applied on the whole body for 24 hours & the patient bathes on the third day to treat acute or chronic malaria.					
<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	Zihor	Herb	NT/IN	L
Scorched L are applied on the forehead to treat vertigo.					
<i>Lagerstroemia speciosa</i> (L.) Pers.	Lythraceae	Chawnpui/Thlado	Tree	LR	B,R
A R decoction is taken for jaundice. A B infusion is taken for diarrhoea & dysentery.					
<i>Laggera crispata</i> (Vahl) Hepper & J.R.I. Wood	Asteraceae	Runhthung	Herb	LR	L
Crushed L are applied to treat sores.					
<i>Lannea corom&elica</i> (Houtt.) Merr.	Anacardiaceae	Tawitawsuak	Tree	LR	B,L
B is used as an astringent & for treatment of ulcers & sores. L are used for treatment of swellings, sprains & body pain.					
<i>Lantana camara</i> L.	Verbenaceae	Hlingpangpar	Shrub	LR	L
Leaves are used as a diaphoretic, antirheumatic, carminative & antispasmodic, & to treat malaria & tetanus.					
<i>Lasia spinosa</i> (L.) Thwaites	Araceae	Zawngzang	Herb	NT	Rh
Bawm medicine men prescribe a Rh infusion for throat-pain (diphtheria).					
<i>Lasianthus hirsutus</i> (Roxb.) Merr.	Rubiaceae	Changneithing	Large shrub/ small tree	LR	L
L juice is applied to stop bleeding.					
<i>Lasianthus wallichii</i> (Wight & Arn.) Wight	Rubiaceae	Ruih-thing	Shrub	LR	L
A decoction of L is used as an hallucinogenic.					
<i>Leea compactiflora</i> Kurz	Vitaceae	Kawlkar	Shrub	LR	R
The R is taken for the remedy of stomach problems.					

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
<i>Lepidagathis incurva</i> Buch.-Ham. ex D. Don	Acanthaceae	Vangvattur	Herb	LR	L
L are used to stop bleeding.					
<i>Lepidagathis rigida</i> Dalzell	Acanthaceae	Vangvattur	Herb	LR	L
L are used to treat tooth decay.					
<i>Lepionurus sylvestris</i> Blume	Opiliaceae	Anpangthuam	Shrub	NT	L
A L decoction is taken as a treatment for diabetes.					
<i>Lindernia ruelloides</i> (Colsm.) Pennell.	Scrophulariaceae	Thasuih	Herb	EN/VU	WP
WP is used externally for rheumatism, sciatica, skin worms, & wounds. WP is used internally for eye problems.					
<i>Litchi chinensis</i> Sonn.	Lauraceae	Theifeimung	Tree	NT	Fr,L
Fr aril is used as a tonic. L are used to treat animal bites.					
<i>Litsea cubeba</i> (Lour.) Pers.	Lauraceae	Sernam	Tree	LR	Fr
Fr is used as an antiparalytic, anticephalagic, antihysterical, & carminative. Fr is used to treat dizziness & loss of memory.					
<i>Litsea monopetala</i> (Roxb.) Pers.	Lauraceae	Nauthak	Tree	LR	B
B is used as an astringent, antidiarrheal, & stimulant. B is used to treat stomach ache & fractures.					
<i>Litsea cubeba</i> (Lour.) Pers.	Lauraceae	Sernam	Tree	LR	Fr
Fr is taken for hysteria, headache & paralysis.					
<i>Lobelia angulata</i> G. Forst.	Campanulaceae	Choakthi	Shrub		WP
The WP is crushed with those of <i>Plantago erosa</i> Wall. ex Roxb. & <i>Inula cappa</i> (Buch.-Ham. ex D. Don) DC. & the juice is taken orally three times daily for diabetes & jaundice.					
<i>Lobelia nicotianifolia</i> Roth ex Schult.	Campanulaceae	Berawchal	Herb	EN/VU	WP
WP juice is applied to boils & irritated skin.					
<i>Lonicera macrantha</i> (D. Don) Spreng.	Caprifoliaceae	Leihruisen	Climber	LR	L
L are used to treat diarrhoea.					
<i>Macaranga</i> sp.	Euphorbiaceae		Tree	LR	WP
WP is boiled & the water is taken to treat diabetes & retained placenta.					
<i>Mallotus leucocarpus</i> (Kurz) Airy Shaw	Euphorbiaceae	Sukiah	Small tree	LR	R
R are used to treat colic problems.					
<i>Mallotus philippensis</i> (Lam.) Müll. Arg.	Euphorbiaceae	Bari khei	Tree	LR	B,St
Fr gland & hair are used as antihelminthics & styptics, & used to treat scabies, ring worm & herpes.					
<i>Mallotus roxburghianus</i> Müll. Arg.	Euphorbiaceae	Zawngtenawhlung	Small tree	LR	Br
Br used to treat jaundice & hepatomegaly.					
<i>Melocalamus compactiflorus</i> (Kurz) Benth.	Poaceae	Sairil	Climber	LR	St
St juice is used to treat influenza.					
<i>Melastoma malabathricum</i> L.	Melastomataceae	Builukham	Evergreen shrub	LR	B,F,L
B is used as wound healer. L is used as an antidiarrheal & antiseptic. L & F used as an astringent & antileucorrhoeic.					
<i>Melia azedarach</i> L.	Meliaceae	Nim-suak	Tree	NT/IN	L

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
A L decoction is taken orally for treatment of fever & hypertension.					
<i>Melocanna baccifera</i> (Roxb.) Kurz	Poaceae	Mautak	Bamboo	LR	St
The outer St epidermis is scraped off & applied on cuts to stop bleeding.					
<i>Merremia umbellata</i> (L.) Hallier f.	Convolvulaceae	Vawktesentil	Tree	LR	L
A L poultice is applied on burns & sores.					
<i>Mesua ferrea</i> L.	Calophyllaceae	Herhse	Tree	LR	B,F,L
F is used as an astringent & to treat stomach ache. F & L are used to treat snakebite & scorpion stings.					
<i>Michelia champaca</i> L.	Magnoliaceae	Ngiau	Tree	LR	Fr,L,S
A L infusion with honey is used to treat colic. Crushed Fr & S are made into a paste & applied to cracked skin on feet.					
<i>Mikania micrantha</i> Kunth.	Asteraceae	Japan-hlo	Climber	LR	L
L juice is used to stop bleeding & treat dysentery. L boiled with B of <i>Vitex peduncularis</i> Wall. ex Schauer in A. DC. is drunk to treat typhoid or malarial fever.					
<i>Millettia pachycarpa</i> Benth.	Fabaceae	Rulei	Shrub/ climber	LR	R
A R infusion is used as a lotion to treat wounds, swellings, toothache, & sprains. A R decoction is used for washing scabies & itches.					
<i>Millettia piscidia</i> Wight & Arn.	Fabaceae	Ruteng	Tree	NT/E	Fr,R
R are used to treat infertility. A Fr(S) decoction is used as an abortifacient.					
<i>Mimosa invisa</i> Mart. ex Colla	Fabaceae	Dihlo	Climber	LR	R
A R infusion is used to treat kidney/gall bladder stones.					
<i>Mimosa pudica</i> L.	Fabaceae	Hlonuar	Herb	LR	L,R
L & R are used to remove piles & pistula. A R decoction is used to treat gall-bladder/kidney problems.					
<i>Mirabilis jalapa</i> L.	Nyctaginaceae	Ar-atukkhuan	Shrub	LR	L,R
R are used as a purgative & aphrodisiac, & in treatment of dropsy & piles. L are used as a tonic & for treatment of inflammatory, boils, & whitlow.					
<i>Morinda angustifolia</i> Roxb.	Rubiaceae	Kawrpel	Shrub	LR	L
A L poultice is applied to cracked skin on feet.					
<i>Morus australis</i> Poir.	Moraceae	Lungli	Tree	VU	B,L,R
B is as a purgative. A L decoction is used as a gargle for inflammation of the vocal cords. R are used as an astringent.					
<i>Mucuna pruriens</i> (L.) DC.	Fabaceae	Uiteme	Climber	LR	Fr,R
R are used as a diuretic & purgative, & to treat dropsy, fevers & kidney problems. S are used as aphrodisiacs & nerve tonics. Fr bristles are used as a vermifuge, & for treatment of liver & gall bladder diseases, parkinsonism & ulcers.					
<i>Murraya koenigii</i> (L.) Spreng.	Rutaceae	Arpatil	Herb	LR	WP
WP is used as a tonic & to treat stomach ache & diabetes. L are used as a febrifuge, & to treat dysentery, & kidney pain. L, B & R are used as stimulants, carminatives & to treat diabetes.					
<i>Myrica esculenta</i> Buch.-Ham. ex D. Don	Myricaceae	Keifang	Herb	LR	B,Fr
B is used as a rubifacient, antiseptic, carminative, antiasthmatic, & diuretic, & is used to treat bronchitis. Fr used as a sedative & to treat stomach ache.					
<i>Musa acuminata</i> X <i>balbisiana</i> Colla	Musaceae	Balhla	Herb	LR	Sa
The sap of stem is applied for antiseptic					
<i>Musa</i> sp.	Musaceae	Changel	Herb	LR	Sa

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
St Sa in combination with the chicken blood is given to treat epilepsy. Sa is used to treat snake bites.					
<i>Ensete glaucum</i> (Roxb.) Cheesman	Musaceae	Saisu	Herb	NT	S
S are made into beads & put on children to prevent convulsions.					
<i>Neolamarckia cadamba</i> (Roxb.) Bosser	Rubiaceae	Banphar	Tree	LR	L,Sa
Sa that oozes out of cut branchlets is used as lotion for bone ache & swellings.					
<i>Ocimum gratissimum</i> L.	Lamiaceae	Khum-bang-bang	Shrub	NT/C	F,L
A strong L & F decoction is given to children for aphthae. A L decoction is used as an aphrodisiac & to treat gonorrhoea.					
<i>Ocimum tenuiflorum</i> L.	Lamiaceae	Runhmu-dum	Shrub	NT/C	WP
The steam of boiling WP is inhaled to treat hepatitis. A WP infusion is used to treat cough, bronchitis, gastric disorders & as a mosquito repellent.					
<i>Oroxylum indicum</i> (L.) Kurz	Bignoniaceae	Archangkawn	Small tree	LR	B,R,S
R & B are used as a tonic & antidiarrheal. B is used to treat rheumatism. Tender Fr is used as a carminative & for stomach ache. S are used as a purgative. St is used as an treatment for scorpion stings.					
<i>Osbeckia sikkimensis</i> Craib	Melastomataceae	Builukhampa	Shrub	LR	R
Steamed R & extracted solution is taken internally for renal disorder & genital-urinary problems. A R decoction is taken to treat kidney problem & stomach ache.					
<i>Paederia foetida</i> L.	Rubiaceae	Vawihuihru	Climber	LR	L,R
R & L are used as a tonic. R are used to remove piles, & to treat pain in the chest & liver. L are used as a carminative, astringent, & diuretic.					
<i>Pajanelia longifolia</i> K. Schum.	Bignoniaceae	Ram-archangkawm	Tree	NT	L,St
L & St paste is used to treat fractures					
<i>Parabarium hookeri</i> Pierre ex Spire	Apocynaceae	Theikelkibawr	Climber	LR	R
A R decoction is taken as a tea to prevent placental disorders.					
<i>Parkia timoriana</i> (DC.) Merr.	Fabaceae	Zawngtah	Tree	LR	B,Br,Fr
A B & twig decoction is taken orally to treat diarrhoea & dysentery. Green Fr exocarps (pods) are ground into a paste & applied on cuts & wounds. Chakmas use a hot infusion of scraped pods to treat diarrhoea & dysentery.					
<i>Pavetta indica</i> L.	Rubiaceae	Pavet-var	Hairy shrub	LR	Fr,L,R
R are used to treat dropsy, jaundice & headaches, & are used as a diuretic & tonic. R & L are used to treat boils. L are used to treat hemorrhoids. Fr is used as an antihelminthic.					
<i>Passiflora nepalensis</i> Walp.	Passifloraceae	Nauawimu	Climber	LR	R
R are boiled & the water is taken to treat malaria.					
<i>Pentapetes phoenicea</i> L.	Malvaceae	Parsenbial	Herb	EN/VU	L
L are boiled & the water is taken to treat inflamed glands, cough & colds. L juice is applied on inflamed glands.					
<i>Phyllanthus airy-shawii</i> Brunel & J.P. Roux	Phyllanthaceae	Mawsai	Shrub	EN/VU	L
L juice is applied externally on measles, skin eruptions & inflamed glands. A L infusion is taken orally for diphtheria.					
<i>Phyllanthus emblica</i> L.	Phyllanthaceae	Sunhlu	Tree	LR	WP
B juice is used to treat diarrhoea & dysentery. A L decoction is used as a gargle for stomatitis & bleeding gums. A S decoction is used as an eye wash. Fr juice is taken to treat liver cirrhosis.					
<i>Phyllanthus fraternus</i> G.L. Webster	Phyllanthaceae	Mitthi sunhlu	Herb	EN/VU	Fr,WP

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Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
50 ml of WP infusion is taken twice daily to treat diabetes. WP juice is used to treat liver problems & jaundice. Fr is used to treat bronchitis, leprosy, anaemia, urinary discharges, anuria & asthma.					
<i>Phlogacanthus thysiformis</i> (Roxb. ex Hardw.) Mabb.	Acanthaceae	Khumtiangkohha	Shrub	LR	R
R are used to treat ulcers in combination with other plants.					
<i>Picrasma javanica</i> Blume	Simaroubaceae	Thing damdawi	Tree	LR	B
25 ml of a R decoction is taken internally twice daily for fever & malaria. 50 ml of a B decoction is taken 2-3 times daily to treat diabetes & hypertension.					
<i>Piper betle</i> L.	Piperaceae	Pandawng	Climber	LR	L,R
L are used as a carminative & stimulant, & for treatment of stomach ache, snake bite, eye pain, & night blindness. Oil is used to treat spasms & infections such as diphtheria. R are used as a female contraceptive.					
<i>Piper diffusum</i> Vahl.	Piperaceae	Pawhrual	Climber	LR	L
L are used to treat stomach ache.					
<i>Pithecellobium monadelphum</i> Kosterm.	Fabaceae	Ardahte	Tree	LR	L,S
L are used to treat leprosy & to promote hair growth. S are used to treat diabetes.					
<i>Plantago erosa</i> Wall. ex Roxb.	Plantaginaceae	Kelba-an	Herb	LR	L,WP
The L & WP are crushed with those of <i>Lobelia angulata</i> G. Forst. & <i>Inula cappa</i> (Buch.-Ham. ex D. Don) DC. & the juice is taken orally three times daily for diabetes & jaundice.					
<i>Plumeria acuminata</i> W.T. Aiton	Apocynaceae	Vaingai	Tree	LR	B,La,R
R & B are used to treat gonorrhoea & herpes. B is used as an emmenagogue & to treat dropsy & diarrhoea. La is used as a rubefacient & to treat rheumatism & gum problems.					
<i>Podocarpus neriifolius</i> D. Don	Podocarpaceae	Thlang-far	Tree	VU	L
L are boiled in water that is then used for bathing. A B decoction is applied with cotton on herpes.					
<i>Polygonum barbatum</i> L.	Polygonaceae	Anbawng	Herb	LR	S
S are taken to treat colic & infections.					
<i>Polygonum chinense</i> L.	Polygonaceae	Taham	Herb	DD	L,R
R are used as an astringent. L are used to treat fly-infected wounds on goats. S are used as a tonic, purgative, & emetic.					
<i>Pothos cathartii</i> Schott	Araceae	Lehpong	Epiphyte	LR	St
St are used in to treat bone fractures.					
<i>Pothos scandens</i> L.	Araceae	Leh-pong	Climber	LR	L,St
L & St are used to treat bone fractures.					
<i>Pottsia laxiflora</i> (Blume) Kuntze	Apocynaceae	Ludi-rani-tak	Climber	LR	L,R
R & L infusions are taken to treat snake bites.					
<i>Pratia begonifolia</i> (Wall.) Lindl.	Campanulaceae	Choak-thi	Herb	LR	L
Crushed L juice is taken to treat dysentery & vomiting.					
<i>Pseudodrynaria coronans</i> (Wall. ex Mett.) Ching	Polypodiaceae	Awmvel	Epiphyte	LR	Rh
Rh are used to treat stomach & tooth problems.					
<i>Pteridium aquilinum</i> (L.) Kuhn	Dennstaetiaceae	Katchat	Herb	LR	Rh
A Rh decoction is given for chronic disorders.					

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
<i>Pterospermum acerifolium</i> Willd.	Malvaceae	Siksil (Kanak champa)	Exotic tree	LR	B,F,L
B is used to treat headaches. F are used as a tonic & to treat inflammation, stomach ache, tumors, leprosy, & ulcers. L hairs are used to stop bleeding.					
<i>Quercus leucotrichophora</i> A. Camus	Fagaceae	Then/Phen	Tree	LR	R
R is used as a diuretic & astringent, & to treat gonorrhoea, diarrhoea, & asthma.					
<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz	Apocynaceae	Rullturzung	Herb	EN, VU. C	R
R are used to treat hypertension & stomach problems.					
<i>Rhus acuminata</i> DC.	Anacardiaceae	Chhimhruk	Herb	LR	Fr,L
L are used to treat nausea. Fr are used to treat colic. L are used to treat excrescences & diarrhoea.					
<i>Rhaphidophora decursiva</i> (Roxb.) Schott	Araceae	Makhal	Epiphyte	LR	L,St
Crushed L & St paste is used to treat bone fractures.					
<i>Rhaphidophora hookeri</i> Schott.	Araceae	Thiallawn	Climber	NT	L,St
L & St are used to ease the process of labor. L are used to treat malaria.					
<i>Ricinus communis</i> L.	Euphorbiaceae	Mutih	Shrub or small tree	NT	L,St
Heated young L are used to treat ulcers, sciatica & paralysis. Crushed L are applied as bandage to treat urinary problems.					
<i>Rubia cordifolia</i> L.	Rubiaceae	Rawngsen	Climber/ creeping herb	EN/VU	Root
Boiled R are taken orally for kidney problem & liver ailments. R are used to treat gonorrhoea, syphilis & renal infections.					
<i>Ruellia suffruticosus</i> Roxb.	Acanthaceae	Savangama	Herb	CR/VU	WP
WP are used to treat renal infection, gonorrhoea, syphilis & other venereal diseases.					
<i>Salix tetrasperma</i> Roxb.	Salicaceae	Tuipuisuthlah	Tree	LR	B
B is used as a febrifuge.					
<i>Sapindus mukorossi</i> Gaertn.	Sapindaceae	Hlingsi	Tree	LR	Fr,S
Fr is used as an emetic, expectorant & when there is excess salivation. Fr is used to treat epilepsy & chlorosis. S are used to treat fevers & dental caries.					
<i>Saraca asoca</i> (Roxb.) De Wilde	Fabaceae	Mualhawih	Tree	EN/VU	B
B is used for uterine inflation, as an astringent, & in treatment of gonorrhoea & scorpion stings.					
<i>Schima wallichii</i> (DC.) Korth.	Theaceae	Khiang	Tree	LR	B,Fr,L
A Fr decoction is used for snake & insect bites. B is used as a rubefacient, antihelminthic, & to treat gonorrhoea. L are used as a carminative.					
<i>Scoparia dulcis</i> L.	Plantaginaceae	Perhpawng-chaw/Hlothlum	Herb	LR	WP
Crushed WP juice is taken to treat kidney stones, jaundice & genital-urinary problems.					
<i>Securinega virosa</i> (Roxb. ex Willd.) Baill.	Euphorbiaceae	Saisiak	Shrub	LR	L
L boiled in water are used to bathe children suffering from scabies & measles.					
<i>Semecarpus anacardium</i> L.f.	Anacardiaceae	Vawmbal-pui	Tree	LR	Fr

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Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
Fr(nut) juice is applied externally to treat sprains & rheumatism.					
<i>Senecio sc&ens</i> Buch.-Ham. ex D. Don	Asteraceae	Sai-ek-hlo	Climber	CR	A,L
Boiled A & L are used to treat cancer & ulcers.					
<i>Sida acuta</i> Burm.f.	Malvaceae	Khingkhieh	Shrub	LR	R
Crushed R are applied on boils to draw out pus. R are used to treat nervous, urinary, stomach, & gastric diseases.					
<i>Smilax glabra</i> Roxb.	Smilacaceae	Tluang-ngil	Climber	LR	R
R are used to treat uterine & stomach infections.					
<i>Smilax parvifolia</i> Wall. ex Hook. f.	Smilacaceae	Kaiha	Climber	LR	R
Ground R with old molasses or coagulated cows milk is mixed with water & taken orally as a blood purifier.					
<i>Solanum khasianum</i> C.B. Clarke var. <i>chatterjeeanum</i> Sengupta	Solanaceae	Athlo	Shrub	VU	Fr,S
Fr & S are used to treat dental problems ("expel tooth worms from the mouth").					
<i>Solanum nigrum</i> L.	Solanaceae	Anhling	Herb	LR	WP
A WP infusion is used to treat liver problems & dropsy.					
<i>Solanum torvum</i> Sw.	Solanaceae	Tawkpui	Shrub	LR	S
Crushed S are applied to treat a toothache & tooth decay.					
<i>Sonchus wightianus</i> DC.	Asteraceae	Gangmula	Herb	LR	R
R are used as a cardiac tonic.					
<i>Spondias pinnata</i> (L.f.) Kurz	Anacardiaceae	Tawitaw	Tree	LR	B
B is used as a refrigerant & to treat dysentery. B mixed with water is used to treat auricular & muscular rheumatism.					
<i>Stemona tuberosa</i> Lour.	Stemonaceae	Kaimam	Climber	EN	R
10 ml of a R infusion is taken internally twice daily for tuberculosis & fever.					
<i>Stephania japonica</i> (Thunb.) Miers var. <i>discolor</i> (Blume) Forman	Menispermaceae	Hruifei	Climber	VU	R
A R infusion is taken orally to treat diarrhoea, fever & dyspepsia.					
<i>Sterculia urens</i> Roxb.	Malvaceae	Pangkhaus	Tree	LR	G,L,R
G is used to treat throat infections. L & tender branches are used to treat pleuropneumonia in cattle, & to treat dysentery & piles.					
<i>Stereospermum colais</i> (Buch.-Ham. ex Dillwyn) Mabb.	Bignoniaceae	Zihngal	Tree	LR	L
A L decoction is used as a febrifuge. L juice is applied to relieve itching.					
<i>Stereospermum neuranthum</i> Kurz	Bignoniaceae	Zihaw	Tree	LR	W
W is used to treat chronic ulcers.					
<i>Styrax serrulata</i> F.B. Forbes & Hemsl.	Styracaceae	Hmarhleng	Shrub	LR	Resin
Resin is used as an antiseptic, stimulant & expectorant.					
<i>Swertia angustifolia</i> Buch.-Ham. ex D. Don	Gentianaceae	Khawsik damdawl	Herb	LR	WP/ stem B
A WP infusion is used to treat malarial fever.					
<i>Syzygium cerasoides</i> (Roxb.) Raizada	Myrtaceae	Lenhmui	Tree	LR	Fr,L,R

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
Fr is used to treat rheumatism. L are used as compresses. R are used as a rubefacient.					
<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Lenhmui	Tree	LR	B,Fr,L
B is used as an astringent. Fr is used to treat stomach ache & is used as a carminative & diuretic. B & S are used to treat diabetes. B & L are used to treat diarrhoea.					
<i>Tabernaemontana divaricata</i> (L.) R. Br. ex Roem. & Schult.	Apocynaceae	Pararsi	Shrub	LR	R, Sa
R are chewed for the relief of tooth-ache & gum boils. R paste is applied 1-2 times daily on mouth ulcers. Sa mixed with oil is rubbed on the forehead to treat pain in the eyes & head.					
<i>Taraktogenos kurzii</i> King	Achariaceae	Khawitur	Tree	NT	S
S oil is applied for treatment of leprosy & skin diseases.					
<i>Tarenna odorata</i> (Roxb.) B.L. Rob.	Rubiaceae	Khalagor song	Shrub	LR	R
R paste is applied on snake bites.					
<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	Thingv&awt	Tree	LR	B,Fr
Fr is taken for treatment of stomach problems, piles, sore throat & diseases of the eye & nose. Fr is used to treat dropsy, leprosy, inflammation, diarrhea, asthma, headaches, & is taken as a tonic for bronchitis. Fr (kernel) is used as a narcotic & aphrodisiac. B is used as a diuretic & to treat anaemia & leucoderma.					
<i>Terminalia chebula</i> Retz.	Combretaceae	Reraw	Tree	VU	B,Fr
Fr is used to treat stomach problems, fevers, asthma, dysentery, piles, colds, sore throats, dental caries, bleeding & ulcerated gums, ophthalmia, & is used as a purgative & antiparalytic. Fr is also thought to enrich the blood. B is used as a diuretic & cardiogenic.					
<i>Tetracera sarmentosa</i> (L.) Vahl	Dilleniaceae	Hruithingdeng	Tree	LR	B
A B decoction is taken orally to treat stomach ache.					
<i>Tetrameles nudiflora</i> R.Br.	Tetramelaceae	Thingdawl	Tree	LR	B,L
B & L juice is dropped into ear to treat ear infection.					
<i>Thunbergia griffiflora</i> Roxb.	Acanthaceae	Zawngafian	Climber	NT	L
L juice is used to treat diabetes, eye diseases & as an antiseptic for treatment of cuts & wounds.					
<i>Tinospora cordifolia</i> (Willd.) Miers	Menispermaceae	Theisawntlung	Shrub/ climber	CR/VU	Fr,R,St
St are used to treat skin diseases, stomach ache, spasms, inflammation, diabetes, diuretic, piles, anemia, & as an emetic, aphrodisiac, & antiperiodic. R are used as an emetic and to treat leprosy. Fr is used as a tonic & to treat rheumatism. St & Fr are used to treat jaundice.					
<i>Toona ciliata</i> M. Roem.	Meliaceae	Teipui	Tree	LR	B & F
B is used as an astringent & tonic, & to treat dysentery & ulcers. F are used as an emmenagogue.					
<i>Trapa natans</i> L. var. <i>bispinosa</i> (Roxb.) Makino	Trapaceae	Singhara	Macro- phyte	CR/VU	Fr
Fr is used as a nutritious food. An infusion of aerial parts is used to treat diarrhoea.					
<i>Trema orientalis</i> (L.) Blume	Cannabaceae	Belphuar	Tree	I/LR	B,L,R
B, L & R are used to treat epilepsy. R are used to treat diarrhoea. B is used to treat muscular pain.					
<i>Trevesia palmata</i> (Roxb. ex Lindl.) Vis.	Araliaceae	Kawhtebel	Small tree	LR	L,R
Crushed L juice is taken to treat colic, stomach ache & high blood pressure.					
<i>Uncaria sessilifrutus</i> Roxb.	Rubiaceae	Ralsamkuai- ziksen	Climber	LR	L & R
Boiled young L are taken orally to treat diphtheria. Water from boiled R is taken to treat excess bleeding.					

Scientific name	Family	Local name	Habit	Status	Part Used
Mode of Utilization/Uses					
<i>Urena lobata</i> L.	Malvaceae	Sehnap	Shrub	LR	L,R
Crushed R mixed with water is taken as an aphrodisiac. L juice is used to treat rheumatism.					
<i>Vernonia albicans</i> DC.	Asteraceae	Dawn-do-u-pun	Herb	LR	L
A warmed L infusion is dropped into ear to treat earache or ear infection.					
<i>Vitex peduncularis</i> Wall. ex Schauer in A. DC.	Lamiaceae	Thingkhawilu	Tree	LR	B
Boiled B water is drunk to treat typhoid & malarial fevers.					
<i>Vitis bracteolata</i> Wall.	Vitaceae	Hruiveikual	Climber	LR	R
Crushed R are used to produce a mucous substance that is applied externally on swellings & sciatica.					
<i>Woodfordia fruticosa</i> (L.) Kurz	Lythraceae	Ainawn	Shrub	CR/VU	F
Powdered F are used externally to treat sores & ulcers.					
<i>Xylia xylocarpa</i> Taub.	Fabaceae	Thinguk	Tree	LR	B,S
A B decoction is used to treat ulcers, gonorrhoea & diarrhoea. S oil is used to treat rheumatism & piles. B & S oil are used to treat leprosy.					
<i>Zanonia indica</i> L.	Cucurbitaceae	Lalruanga-dawibur	Climber	CR/EN	Fr,L
L are used to treat inflammation & spasms. Fr is used as an expectorant, antiseptic & to treat cough & asthma. Water from boiled ripened Fr is taken to treat stomach problems.					
<i>Zanthoxylum armatum</i> DC.	Rutaceae	Arhrikreh	Small tree	NT	Fr,L
L are used to remove lice. Fr is used to promote appetite, treat headaches, asthma, leucoderma, piles, eye & ear diseases, & is used as an anthelmintic. F is used as an antidote for snake bite.					
<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Sawhthing	Herb	NT/C	Fr,Rh
Oil extract is used to treat cough & bronchitis. Rh is roasted & eaten to treat throat pain.					
<i>Zingiber purpureum</i> Roscoe	Zingiberaceae	Pale	Herb	NT/C	Rh
Chakmas tribe use Rh to treat stomach ache & diarrhoea.					
<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	Borai	Small tree	LR	R
R decoction is used to treat fever.					

Lower Risk (LR) / Near Threatened (NT)

Gardenia coronaria Buch.-Ham. is LR in Mizoram according to our study which was in accordance with *Gardenia gummifera* L.f., which is also of LR status. *Woodfordia fruticosa* (L.) Kurz is LR, however, based on our study it would be categories as EN/VU. *Adhatoda zeylanica* Medik. is LR, however, *Adhatoda beddomei* C.B. Clarke, is of CR status globally as well as in south Western Ghats of India. *Artocarpus lakoocha* Wall. ex Roxb. is LR at a regional scale in NE India and Mizoram, however, *A. hirsutus* is VU at the global scale. Similarly *S. asoca*, *Tinospora cordifolia* (Willd.) Miers and *Terminalia* sp. are all listed as LR.

Burning of **Holi**, a religious tradition in India, has led to over-exploitation of *B. ceiba*, one of the important medicinal plant species of India (Jain *et al.* 2007). In our study

area, *B. ceiba* is threatened due to land use change in the form of shifting cultivation.

Discussion

Plants used in diet and health

Many plants mentioned in Table 3 form an essential dietary component for tribal peoples in the form of vegetables or as an additive to impart flavor. Medicinal plants are of particular relevance when they are components of diet. According to Etkin & Ross (1991) the priority for further study should be given to plants that are also used in the diet, since the potential health impact is markedly greater for plants used in diet and medicine. Certain herbs like *Amaranthus paniculatus* L., *Aerva lanata* (L.) Juss. ex Schult., *Coccinia grandis* (L.) Voigt and *Coriandrum sativum* L. are used as vegetables indicating that these plants

could be sources of dietary antioxidant supplies, which is an emerging area of research (Ali *et al.* 2008). Antioxidants help organisms deal with oxidative stress, caused by free radical damage. Scartezzini & Speroni (2000) have reviewed the antioxidant activity of the traditional Indian medicinal plants: *C. longa*, *Mangifera indica* L., *Momordica charantia* L., *P. emblica*, *Santalum album* L., *S. chirayita*, and *W. somnifera*. Govindarajan *et al.* (2003) have reviewed *Acorus calamus* L., *A. vera*, *Andrographis paniculata* (Burm. f.) Nees, *A. racemosus*, *A. indica*, *B. monnieri*, *Desmodium gangeticum* (L.) DC., *Glycyrrhiza glabra* L., *P. kurroa*, *Psoralea corylifolia* L., *Semecarpus anacardium* L.f., *Terminalia chebula* Retz., *T. cordifolia*. Ali *et al.* (2008) in his review on antioxidant activity of Indian medicinal plants included *A. lanata*, *A. paniculatus*, *Aristolochia bracteolata* Lam., *Cissampelos pareira* L., *C. indica*, *C. sativum*, *Coscinium fenestratum* Colebr., *C. dactylon*, *Cyperus rotundus* L., *Enicostemma littorale* Blume, *Evolvulus alsinoides* (L.) L., *Fagonia cretica* L., *Gymnema montanum* (Roxb.) Hook. f., *Hygrophila auriculata* Heine, *Phyllanthus amarus* Schumach. & Thonn., *P. debilis*, *Phyllanthus maderaspatensis* L., *Phyllanthus niruri* L., *Rubia cordifolia* L., and *Trichopus zeylanicus* Gaertn. The majority of these same plants are being used in Mizoram and therefore the same potential value as antioxidants is likely to be functioning as well.

Herbal-based industry in Mizoram

The availability of more than 300 medicinal plant species in Mizoram (Lalramnghinghlova 1999d, 2000, 2001, Lalramnghinghlova & Jha 1997, Lalramnghinghlova *et al.* 1997, Rai 2010a,b, Rai 2011a,b, Singh *et al.* 2002) has potential for herbal-based industries. At present, besides local health care, these medicinal plants are the alternative income-generating source of the rural populations living in hilly areas. Biotechnological approaches should be implemented for clonally produced plants and their success in the natural environment. Moreover, in tribal areas of Mizoram, conventional methods of rural technology for cultivation of these rare medicinal plants should be promoted to reduce the pressure on the wild resources. There is also a need to involve local people and the indigenous practices developed by them for sustainable utilization of surrounding natural resources, so that the present pressures may be mitigated.

Concluding Remarks

Over the last century, ethnobotany has evolved into a specific discipline that looks at the people–plant relationship in a multidisciplinary manner, including perspectives from ecology, economic botany, pharmacology, public health and other disciplines as needed (Ayyanar & Ignacimuthu 2005, Balick & Cox 1996). However, the traditional knowledge system in India is fast eroding (Sinha 1996). If immediate steps are not taken for their conservation and

sustainable utilization the species discussed herein are threatened.

Further, adequate caution should be taken to categorize the threatened status at regional scale (Arvind *et al.* 2005). The ethnomedicinal plants should be cultivated in herbal gardens, agroforestry systems and home gardens to encourage their sustainable utilization and hence conservation. Assessment of the populations of threatened species, development of an appropriate strategy, action plan for the conservation and sustainable utilization of such components of plant diversity are recommended (Samant & Pant 2006). The ethnobotanical claims emanating from the present survey need to be subjected to pharmaco-chemical studies in order to discover their true potential.

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