Cross-cultural studies of important ethno-medicinal plants among four ethnic groups of Arunachal Pradesh, Northeast India

Jopi Siram, Nagaraj Hegde, Rambir Singh and Uttam Kumar Sahoo

Correspondence

Jopi Siram[1], Nagaraj Hegde[1], Rambir Singh[2] and Uttam Kumar Sahoo[1]*

[1]Department of Forestry, School of Earth Sciences & Natural Resource Management, Mizoram University, Aizawl-796004, India
[2]Department of Horticulture, Medicinal and Aromatic Plants, Mizoram University, Aizawl-796004, India

*Corresponding Author: uksahoo_2003@rediffmail.com, uttams64@gmail.com, mzut009@gmail.com

Ethnobotany Research and Applications 25:12 (2023) - http://dx.doi.org/10.32859/era.25.12.1-23
Manuscript received: 19/11/2022 – Revised manuscript received: 13/01/2023 - Published: 16/01/2023

Research

Abstract

Background: This study was carried out to measure cross-cultural variability of plant use knowledge and to understand the human-nature interface among Monpa, Miji, Aka and Bugun communities of district West Kameng, Arunachal Pradesh, India. We compared ethnomedical knowledge, diversity of medicinal plants, use values and informant consensus in the selected ethnic societies.

Methods: A total of 94 informants (53 men and 41 women) from 02 villages of each community agreed to participate in this cross-cultural ethnomedicinal study. They were interviewed using a semi structured questionnaire and asked about the medicinal plants used for the management of prevalent ailments, mode of preparation and administration of traditionally prepared medicine.

Results: Total 59 plant species from 52 genera and 43 families were recorded for their ethnomedicinal use by the selected communities. Zingiberaceae was the most common family with 3 genera and 5 species having high recommended use across the ethnic communities. *Curcuma amada* (1.85), *Curcuma longa* (1.60), *Zingiber officinalis* (1.48) of this family showed high cross-cultural use value as compared to other medicinal plants. The informant consensus factor for use of medicinal plants for management of cancer was high (0.99) indicating high prevalence of this ailment in this study area, availability and use of similar plants for its management.

Conclusions: The high consensus for plants used in management of most of the prevalent ailments indicate good cross-cultural interaction among Monpa, Miji, Aka and Bugun communities of district West Kameng, Arunachal Pradesh, India**.** The medicinal plants with high use value and consensus need to be conserved and propagated for their sustained availability to the future generations.

Keywords: Monpa, Miji, Aka, Bugun, Medicinal plants, Intercultural

Background

The use of medicinal plants for health benefits have been known since antiquity. The traditional medicinal systems such as Ayurveda, Traditional Chinese Medicine, Unani, Tibetan Medicine and African Medicine, although based on different theoretical and cultural models, integrate phytotherapy into their doctrine. As per World Health Organization (WHO) report, about 80% of the world's population still depends on traditional medicines for their health care need. Medicinal plants have been largely an integral part of the culture of rural and tribal communities (WHO 2006).India is a country of diverse culture and home for large number of ethnic communities. Its people practice various traditional systems of medicines (Gairola *et al.* 2014). Of the 17,000-18,000 species of flowering plants reported from India, 6000-7000 are estimated to have usage in folklore and documented system of traditional medicine such as Ayurveda (2000 sp.), Siddha (1121 sp.), Unani (751 sp.) and Tibetan (337 sp.) (NMPB 2014, Kala & Mathur 2002).

Most ethnobotanical studies focus on the role of medicinal plants within one culture, i.e., one ethnic group (Das *et al.* 2021, Jamir*et al.* 2022).Very often the use of medicinal plants in a specific geographical area or region has been documented, without comparing cultural ethnicity of the inhabitants (Buwa-Komoren *et al.* 2019; Mahwasane *et al.* 2013). Sometimes studies are also focused on selected ailments prevalent in a particular region (El Hachlafi *et al.* 2020, Khan *et al.* 2014). Little emphasis has been given to the comparison of medicinal plant species or other higher taxa (family, genera) in various cultures in the selected region. An analysis of intra and intercultural usage of medicinal plants must be performed in order to understand the cultural similarity or diversity of the ethnic societies in the study area. Usually the medicinal plants for management of ailments are not selected at random but exhibit a considerable degree of patterning within an ethnic culture. The principal reason for this is empiricism; i.e. plants are selected and used in a consistent manner because of their culturally perceived effectiveness in traditional uses, since millennia (Heinrich *et al.* 1998).

The Northeast India region of the Indo-Burma hot-spot is home to 145 native ethnic groups, constituting 12% of the total tribal population of the country (Ali & Das 2003). It politically consists of seven sister states namely Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura, and Sikkim as a brother state (Bhuyan 2015). The region has a strong heritage of using plants in ethno-therapeutic as well as cultural practices. The Indigenous forms of treatment are still important in this region. One of the main reasons of acceptance and practice of traditional system of medicine is the availability of medicinal plant resources in plenty and also the distrust of indigenous peoples towards allopathic medical practitioners. Arunachal Pradesh being one of the largest states of Northeast India is inhibited by 28 major tribes including Adi, Apatani, Bugun, Galo, Monpa, Sherdukhpan, Miji, Aka, Mishmi, Khampti, Nocte, Tangsa, Wangcho, Singpho, Tagin, Nyishi and Shertangetc (Government of India 2013). Each ethnic group has its distinctive dialects, custom, traditional beliefs and cultural identity. The state is known as the hub of medicinal plants and has been identified as 'paradise of ethno-botanist and anthropologist' (Myers *et al.* 2000).There are 500 species of important medicinal plants used by ethnic communities in Arunachal Pradesh (Rawat & Garg 2005).The ethnic societies in the remote area of the state largely depends on medicinal plants for their healthcare needs. There has been some documentation on ethnomedicinal use of plants by various communities in Arunachal Pradesh (Khongsai *et al.* 2011), however their cross-cultural evaluation has not been carried out so far. Hence this study was carried out to explore the cross-cultural knowledge of the use of medicinal plants in Monpa, Aka, Miji and Bugun ethnic communities of West Kameng District, Arunachal Pradesh.

Materials and Methods

Study area

The West Kameng district accounts for 8.86% of the total area of the state of Arunachal Pradesh. The name is derived from the Kameng River, a tributary of the Brahmaputra, which flows through the district. West Kameng lies approximately between 91°30′ to 92°40′ East longitudes and 26°54′ to 28°01′ North latitudes. The district shares border with Tibet, Bhutan and Tawang and East Kameng districts of Arunachal Pradesh. It comprises of an area of 7,422sq.km, having 5 blocks, 13 circles and 260 village (Figure 1). The population of the district is 83,947 and literacy rate is 69.4%, as per 2011 census (Government of India 2011).

Ethnographical background of informants

The inhabitants of the district comprise mainly of Monpa (Dirang, Boot, Lish, and Kalaktangmonpa), Miji (Sajalong), Sherdukpen, Aka, Sartangand Bugun (Khawa). The Monpas belong to the Tibeto-Mongoloid stock and are the largest tribe of the district, inhabiting mainly in Dirang and Kalaktang circles. The Mijis are settled in Nafra and Akas in Thrizino circles. The Khawas inhabit the Wanghoo, Kaspi, Singchung and Tenga areas. The Sherdukpens are mainly settled in 4 villages of Rupa, Jigaon, Shergaon, Thongre and also in Doimara area. These tribes largely

practice Buddhism though Akas, Khawas and Mijis believe in indigenous religion and follow partly Buddhist and Hindu practices.

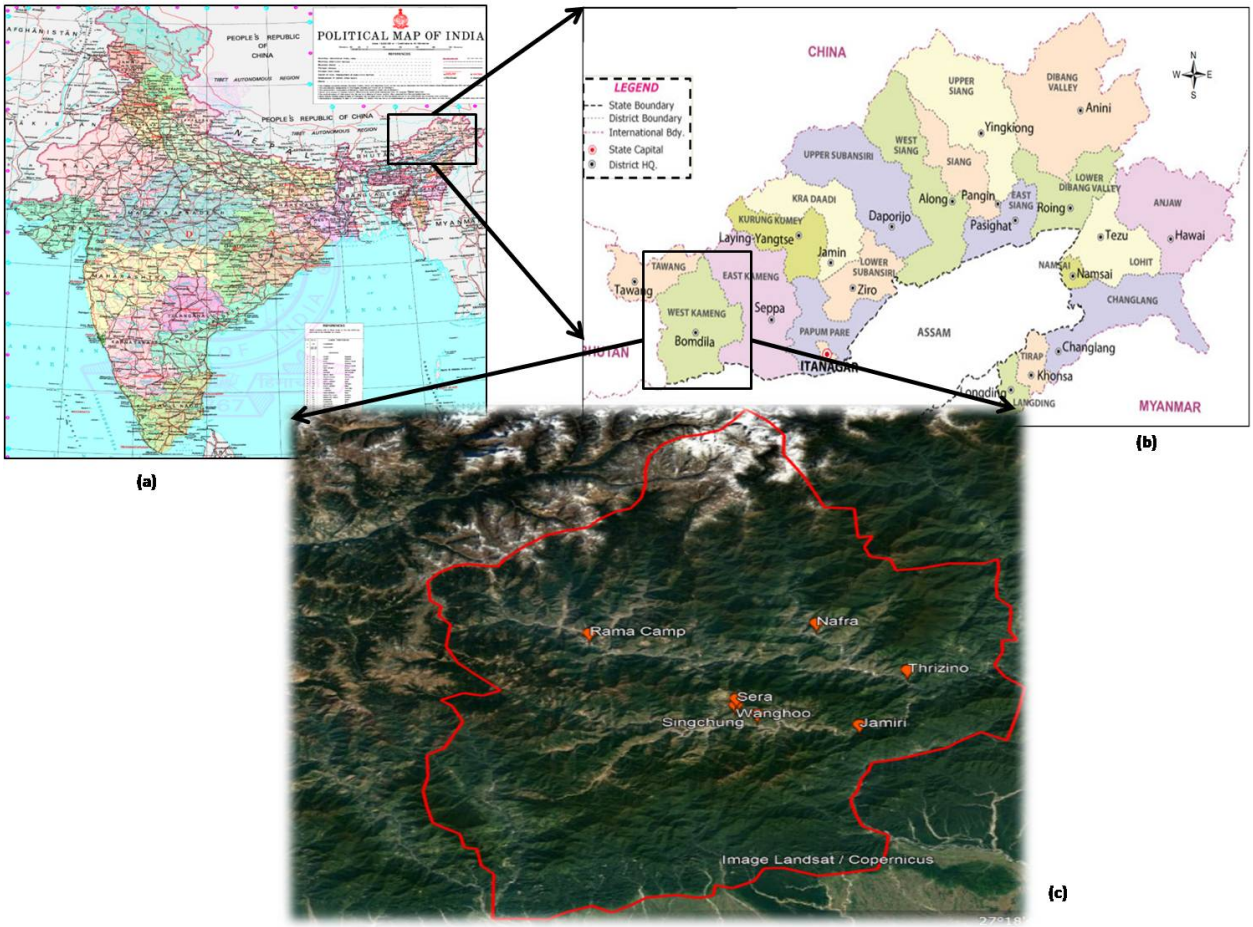

Figure 1. Map of the study site. a) Map of India showing Arunachal Pradesh, b) Map Arunachal Pradesh showing West Kameng district, c) Map of West Kameng district showing different circles

Monpa community

The Monpa, are among the major ethnic group of West Kameng in Arunachal Pradesh and have close ties with Tibet and Tibetan Buddhist faith, historically. The Monpas area traditionally known as Monyul and are currently inhabiting Tawang and West Kameng districts of the state (Mizuno & Tenpa 2015). Monpas are sub divided into 6 subgroup because of variation in their language and they are namely Tawang Monpa, Kalaktang Monpa, Lish monpa, Dirang Monpa, Bhut Monpa and Panchen Monpa. The main festival of Monpas includes the Choskar harvest festival, Losar and Torgya. The traditional dress of Monpas is based on Tibetan Chuba. Both men and women wear clothes which cover their body and keep them warm like woolen coats, jackets. Due to the cold climatic condition, the Monpa, like most of the other ethnic group in the region, construct their houses of stone and wood with plank floors, often accompanied with beautifully carved doors and window frames. The Monpa people practices shifting and permanent types of cultivation. Cattle, yaks, cows, pigs, sheep and fowl are kept as domestic animals

Aka community

Aka is one of the major tribes of West Kameng. Aka are territorially divided into two subtribe namely Hrusso and Korou. They have distinct features, traditional dresses, dialect, appearance etc. They speak their own dialect which of Tibeto-Burman origin and worship Nyezino which means sky and earth (Nimachow *et al.* 2011). The Aka area is located in between 27'N and 27.39' N latitude and 92 35'E and 92 55'E longitude. The territory is surrounded by the Mijison the North, Sonitpur district of Assam on the South, Nyishis on the East and Monpas on the West. There are 37 Aka villages, and their major festival is Nyetchdow. The name Aka has been given by the people of the plains of Assam and the British officials, which mean a painted, because of their custom of painting forehead, nose and chin (Mizuno & Tenpa 2015).

Miji community

The Miji tribe is inhabitant of the district of West Kameng, East Kameng and Minuscule region of Kurum Kumey in Arunachal Pradesh. The tribe Miji is also known by the name Sajolang and Damai. Miji derived from two distinct words Mai means 'fire' and Ji means 'giver', and the name came into being after Aka (Hrusso) community regarded the Sajolang people for their gracious help during pre-historic period. The Mijis practice a distinct religion which relies entirely on nature and God (nature being the replica of God). Mijis believe that God prevail in every aspects of nature, such as trees, rivers and even stones. Chindang, marked every 15thOctober is the main festival of the Mijis, inhabiting the Lada circle of the East Kameng, Sarli region of the Kurung Kumey and Nafra and Bomdila Sub-Division of the West Kameng district. Culturally and linguistically, the Miji and Hrusso Akas form a cognate group. The traditional costume of Miji women consists of an ankle-length white garment with a beautifully decorated red jacket along with silver ornaments, and glass/brass-based necklaces (Untracht 1997).

Bugun community

The Bugun community formerly known as Khowa, is one of the earliest recognized tribe of Arunachal Pradesh (Untracht 1997). Majority of them inhibiting the Singchung Subdivision of West Kamengdistrict, have their own folklores, songs, dances, music and rituals. A rare bird *Bugun liocichla*, was named after the tribe. According to native legend, Bugun believed that they are the descendant of single forefather Achinphumphulua. The Bugun language Bugunish/Kamenic under Kho-Bwalanguage is listed as an endangered language of India (Lieberherr & Bodt 2017). The Bugun are traditionally followers of Animistic religion, however, some are Buddhist (Mahayana). They celebrate Pham-Kho festival in the month of September every year. They practices shifting cultivation and rear animals like cow, goat, mithun, horses etc. for livelihood.

Field survey and data collection

This ethnomedicinal study was conducted in eight villages of West Kameng district during December 2019 to March 2020. Two villages for each community i.e. Miji (Lower Dzang and Upper Dzang), Aka (Gijiri and Jamiri), Monpa (Rama camp and Sera Basti) and Bugun (Wanghoo and Singchung) were selected for field survey. Most of the respondents comprise of elderly men and women and they have mostly inherited the ethnomedicinal knowledge from their direct ancestors (parents, grandparents) via verbal communication. A total of 30 field visits (4-5 days in each village) were conducted among the four ethnic groups during the study period in order to document the indigenous traditional knowledge on medicinal plants. A person who was familiar with the local language and some of the traditional plants used by local people had accompanied the investigator, during the survey.

The information was gathered using semi-structured questionnaire and personal interview with traditional healers, senior practitioners, village headmen and adult villagers on types of ailments cured by traditional uses of medicinal plants and plants part used in curing different ailments. A total of 94 households were interviewed for detail use of medicinal plants. During the interview, ethnomedicinal information regarding the medicinal use, plant part, mode of preparation, plant habit, and availability of the plants in the surrounding area was obtained from the informants. The best practices for collection, evaluation and reporting of data in ethnobotanical survey was followed during this study (Heinrich *et al.* 2018).

Plant collection and identification

During the interviews, fresh plants specimens were collected and voucher specimen for herbarium were prepared, and deposited in the Department of EnvironmentalScience, Mizoram University Herbarium, Aizawl, India. Whenever possible, informants were followed into the field to collect the plant. Photographs of the plants were also taken in the field. Species identification was done with the help of taxonomical tools and various available literatures with guidance of experts from State Forest Research Institute, State Medicinal Plant Board, Chimpu, Itanager, Arunachal Pradesh.

Ailment categories

Based on the information obtained during the semi-structured interviews, all the reported ailments were grouped into 09 broad categories, viz. cancer, antidote to poison, hypertension, dental problems, dermatological problems, cold and cough, gastrointestinal problem, urogenital problems and diabetes.

Data analysis

Use Value Index (UV)

The use value index (UV) is an estimate of cultural importance of species in the study area. It is calculated using the following formula:

$$UV = \frac{\sum Ui}{n}$$

Where, *Ui* is the number of uses mentioned for a species by each informant, *n* is the number of informants (Phillips et al. 1994).

Informant Consensus Factor (ICF)

The ICF evaluates the distribution of medicinal plant information among informants and determines the homogeneity of the information providers' knowledge of medicinal plants. The ICF was calculated as follows:

$$ICF = \frac{Nur - Nt}{Nur - 1}$$

Where Nur is the number of user reports of plants used for a certain type of disease. Nt is the number of species reported being used for the specific disease category by informants who mention all the species. The ICF values range between 0 and 1, and a higher ICF value (close to 1) indicates greater consensus that a species can be used to treat a particular disease; in contrast, an ICF close to 0 indicates disagreement among the informants (Trotter & Logan 1986).

Results and Discussion

Demographic characteristics of informants

All the 94 informants were randomly selected from the 08 villages of the 04 communities. Information was collected from informants who voluntarily agreed to participate in the study. There was not much difference between the male (56%) and female (44%) informants in the four ethnic groups. It showed that the female is contributing significantly in the ethnomedicinal and cultural practices in these ethnic groups. However, in Thangal–Naga ethnic group of Manipur, India, traditional medicinal system has been reported as male inherited (Pampuinath & Meitei 2021).Most of the practitioners (68%) interviewed were above 50 years of age, indicating that the traditional knowledge of ethnomedicinal plants is largely confined to elderly people as compared to young, aged group. The elderly people have more trust in the traditional medicine. Large number of informants (59%) was without any formal education as compared to literate (41%). Since most of the rural people rely on agriculture as source of livelihood, so the informants were largely farmers (44%), followed by professional healer (18%), govt. employee(15%) and small business holder (9%). The informants have largely gained the traditional knowledge from grandparents (43%) and parents (16%). Approximately 60% of the informants have leaned traditional medicine from their grandparents and parents (Table 1). It has been observed previously that the ethnomedicinal knowledge is largely vested in the elderly people in the community and they usually pass on this information to the interested members of their family and other near ones in the society. The information is not written systematically and passed on orally through discussions, practices and field tours (Sodipo & Wannang 2015).

Table 1. Demographic profile of informants

Characteristics	Categories	Monpa	Miji	Aka	Bugun	Total informants	Percentage
Sex	Female	12	17	6	6	41	44
	Male	18	9	11	15	53	56
Age level years	0-21	0	0	0	0	0	0
	21-50	10	11	8	7	36	38
	Above 50	20	15	9	14	58	62
Profession	Farmer	12	11	8	11	42	44
	Professional healer	6	4	3	4	17	18
	Priest/lama	6	3	2	3	14	15
	Govt. employee	3	5	3	2	13	14
	Business sector	3	3	1	1	8	9
Literacy	Literate	13	10	5	11	39	41
	Illiterate	17	16	12	10	55	59
Source of ethnomedicinal knowledge	Self-learning	6	13	5	4	28	29
	Media	4	2	2	3	11	12
	Parents	8	1	3	3	15	16
	Grandparents	12	10	7	11	40	43

Diversity of medicinal plants

In the present cross-cultural study on Monpa, Miji, Aka and Bugun communities, 59 sp. of medicinal plants belonging to 52 genera and 43 families have been recorded for their use in ethnomedicinal practices. Among the taxa, the maximum number of sp. belongs to family Zingiberaceae (5 sp.), Asteraceae and Lamiaceae (3 sp. each), Solanaceae, Rutaceae, Ranunculaceae, Apiaceae and Berberidaceae (2 sp. each). The remaining families were represented by one sp. each (Table 2). According to a previous report, medicinal plants of Zingiberaceae and Asteraceae have been widely used by Monpa ethnic tribe in Kalaktang region of West Kameng district of Arunachal Pradesh (Namsa *et al.* 2011).

Table 2. Diversity of medicinal plants

Family	No. of genera	No. of species
Acoraceae	1	1
Acanthaceae	1	1
Amerylliadaceae	1	1
Anacardiaceae	1	1
Apiceae	2	2
Araliaceae	1	1
Asteraceae	3	3
Asphodelaceae/Xanthorrhoeaceae	1	1
Berberidaceae	2	2
Bigoniaceae	1	1
Begonisceae	1	1
Caricaceae	1	1
Caryophyllaceae	1	1
Diplocystaceae	1	1
Ericaceae	1	1
Euphorbiaceae	1	1
Gentianaceae	1	1
Juglandaceae	1	1
Lamiaceae	3	3
Lauraceae	2	2
Leguminaceae	1	1
Melanthiaceae	1	1
Menspermaceae	1	1
Musaceae	1	1
Meliaceae	1	1
Ophiocordycipitaceae	1	1
Piperaceae	1	1
Poaceae	1	1
Polygonaceae	1	1
Phyllanthaceae	1	2
Plantiginaceae	1	1
Rutaceae	1	2
Ranunculaceae	1	2
Rubiaceae	1	1
Solanaceae	1	3
Saururaceae	1	1
Schisandraceae	1	1
Scrophulariaceae	1	1
Saxifragaceae	1	1
Taxaceae	1	1
Trapaeolaceae	1	1
Urticaceae	1	1
Zingiberaceae	3	5
43	52	59

Plant parts used, mode of preparation and administration

The medicinal plant species recorded during the study were largely herbs (50%) followed by shrubs (22%,) trees (18%), climbers and grasses (4% each) and mushroom (2%) (Figure 2a). The plant parts like leaves, stem, root, rhizome, fruits, barks, flowers etc. were used for treatment of different disease. The plants have been used in various forms such as crushed (23%), raw form (20%), decoctions (16%), juices (14%), cooked (12%), soft paste (8%), powdered (4%) and solid paste (3%) (Figure 2b). The frequency of usage of plant parts varies from leaves (38%),

rhizome (16%), whole plant (14%), seed (13%), root (9%), stem (5%), flower (4%), bark (3%) and culm (1%) (Figure 2c). The use of leaves of medicinal plants for therapeutic applications have been reported as the predominant partly the ethnic societies in northeast part of India (Temsutola *et al.* 2019).The ethnic communities follow the principle of co-existence with nature and believes in biodiversity conservation. Predominant use of leaves shall fulfil their healthcare requirement and also ensure the sustainable supply through plant survival. The plant medicines were either taken internally through ingestion (42%), chewing (22%) and inhalation (4%) or applied externally as an ointment (17%), bathing (8%) and lotion (5%) (Figure 2d).

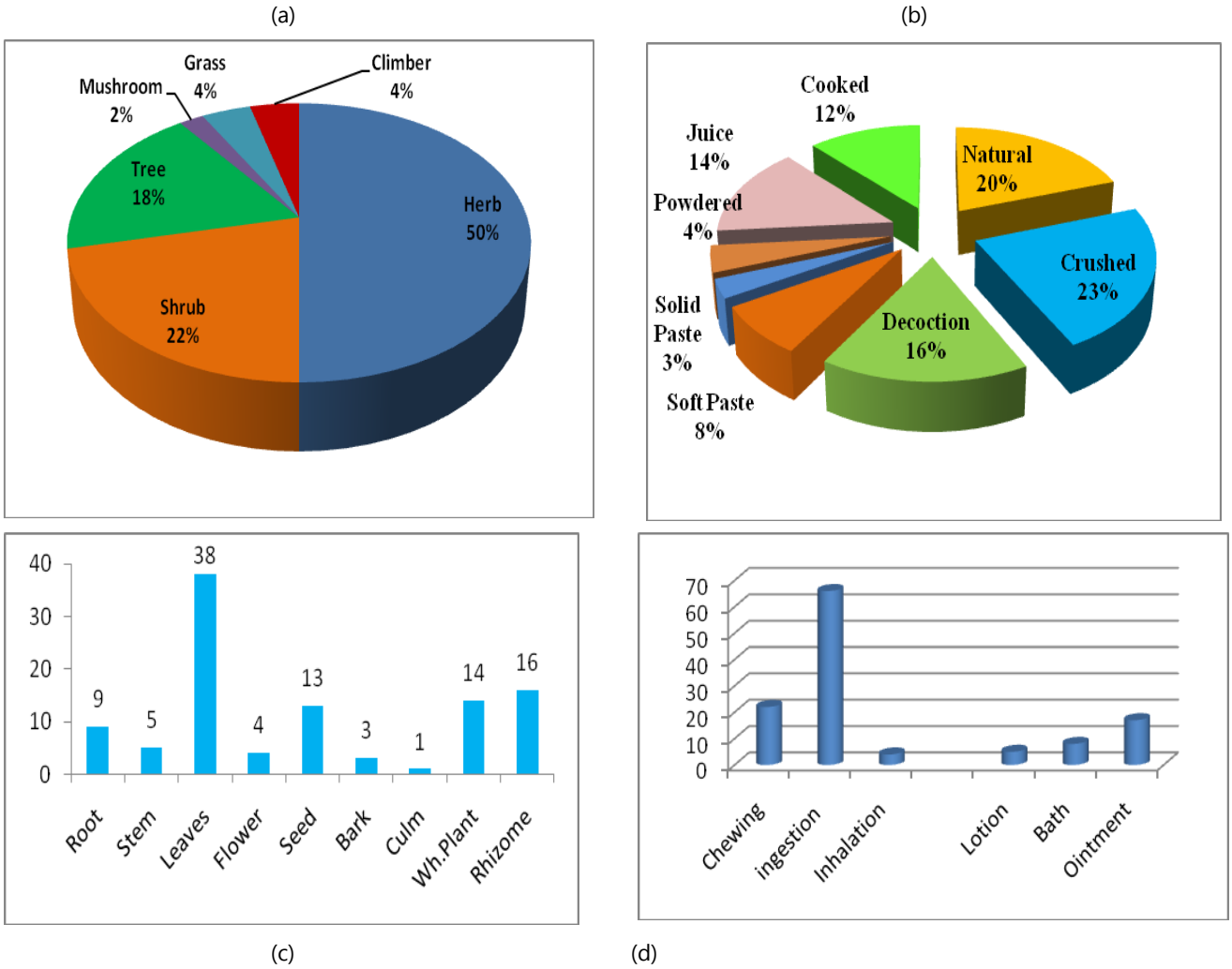

Figure 2. (a) plant habit, (b) mode of preparation, (c) plant part used, and (d) mode of application of the medicinal plants by the tribal communities.

Medicinal plants of cross-cultural importance

Effect of diverse social, economic and local institutional/political variables may influence the dynamics of folk plant knowledge. This study revealed that 59medicinal plants got a total number of 1748 recommended uses in nine broad ailment categories by the selected four ethnic communities. Highest number of usage of plants was by Monpa community with 1335 recommended use of 32 plants. It indicated that a plant was recommended for management of multiple ailments. There have been previous reports of use of medicinal plants for the management of multiple ailments by the ethnic communities in northeast part of India (Sajem & Gosai 2006). The most widely recommended medicinal plants in the present by Monpa community were *Aconitum ferox, Aconitum heterophyllum, Bergenia ciliata, Cordyceps sinensis, Curcuma amada, Curcuma longa, Juglans regia, Podophyllum hexandrum, Swertia chirayita, Tagetes erecta* and *Zingiber officinalis*. Similarly Miji community indicated use of 22 medicinal plants for various ailments. Likewise Bugun community reported used of 20 plants and Aka community indicated use of 15 plants. The most frequently used plants by all the communities were *Curcuma amada, Curcuma longa, Zingiber officinalis, Aloe vera, Swertia chirayita*, *Paris polyphylla* and *Bergenia ciliata* (Table 3). The variations in plant use by the 4 ethnic groups could be attributed to the interrelationship between cultural diversity and biological diversity the area.

Table 3. Comparative analysis of medicinal plants of cross-cultural importance

Species Name	Voucher Specimen Number (VSN)	Ethnic Group	Parts used	Therapeutic use	Mode of preparation	Mode of administration
Aconitum ferox Wall. ex Ser.	MZU00116	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	Rh	Tonsil, sore throat, gastric & relieving pain.	Decoction and crushed	Rhizomes are crushed and consumed to treat tonsil and sore throat.
Aconitum heterophyllum Wall. ex Royle	MZU00117	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	Rt, Fr&WhP	Tonic, throat infection, vomiting and dog bites	Decoction, juice and crushed	Decoction of root is used for dog bite. Juice is prepared from whole plant and consumed to treat throat pain.
Acorus calamus L.	MZU10146	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	Rt	Diabetes,	Juice	Juice consumed empty stomach
Ageratum conyzoides L.	MZU00563	Bugun	L	Cuts	Soft paste & crushed	Leaf is used as antiseptic when cut.
		Aka	L	Antiseptic and blood clotting.	Soft paste	Soft paste is prepared from leaves by hand squeezing methods and applied in cuts which stop bleeding.
		Miji	NR	NR	NR	NR
		Monpa	L	Wound, cuts, inflammations	Juice and paste	Young leaves are crushed and applied on freshly cut wound.
Aloe vera L.	MZU01360	Bugun	L	Skin problem	Paste	Paste is prepared and applied in sunburn areas. It can be used by any age group at any time.
		Aka	L	Urinary problem, skin problem and immune booster	Juice and naturally taken	Juice is prepared from Aloe vera and taken fresh to get rid of urinary tract infection. Fresh leaves are applied on sunburn and in burn areas.
		Miji	L	Antiseptic, antibiotic and immune booster	Soft paste	Soft paste is applied on skin problem and injury. Leaf extract can be taken internally to treat weak immune system. Helps in treating acne.

		Monpa	L	Sun burn, immune booster	Naturally taken and soft paste	Soft paste is applied on skin problem and injury. Leaf extract can be taken internally to treat weak immune system. Helps in treating acne.
Alpinia haenkei C. Presl	MZU00611	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	Rh, S and Fr	Gastric	Crushed	Rhizome are crushed and taken during gas pain. Fruits and seeds are edible.
		Monpa	NR	NR	NR	NR
Andrographis paniculata (Burm.f) Wall.ex Nees.	MZU00129	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	WhP	Stomach and kidney stone clearance	Crushed and juice	Used in stomach problem. Daily dose of 1 glass of freshly made juice for 1 month will help in clearing kidney stone.
		Monpa	NR	NR	NR	NR
Apium graveolens L.	MZU01256	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	L	Jaundice, cough, relief gas pain and blood purifier	Naturally taken and cooked	4-5 Leaves are eaten raw to treat jaundice, cough and to relief gas pain
Artemisia nilagirica L.	MZU00577	Bugun	NR	NR	NR	NR
		Aka	L	Skin problem	Decoction and crushed	Leaves are boiled along with water and bath with that water to get rid of skin allergic problem.
		Miji	NR	NR	NR	NR
			L	Antiseptic	Juice and paste	Leaves are boiled along with water and bath with that water to get rid of skin allergic problem.
Artemisia vulgaris L.	MZU00578	Bugun Monpa	Rt & L	Skin problem & cuts	Soft paste & decoction	The leaf is use for blood clotting and decoction is use for allergic problem.
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	NR	NR	NR	NR
Azadirachta indica A.Juss	MZU02120	Bugun	L	Skin problem	Decoction	Decoction of leaves is used for bathing during allergic.
		Aka	NR		NR	NR
		Miji	L	Allergy, chicken and small fox	Decoction and	Leaves are boiled in water and used for taking bath during skin allergic, chickenpox and smallpox.
		Monpa	NR	NR	NR	NR

Begonia pasighatensis D.Borah, Taram & Wahlsteen	MZU10129	Bugun	NR	NR	NR	NR
		Aka	L	Stomach problem	Naturally taken	Leaves are eaten naturally in constipation problem.
		Miji	NR	NR	NR	NR
		Monpa	NR	NR	NR	NR
Berberis aristata DC	MZU01115	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	S, Rt &Fr	Reduce pain and inflammation.	Paste	Paste is applied externally on the affected area to reduce pain and inflammation.
Bergenia ciliata Haw.	MZU02021	Bugun	L & Rh	Orthopaedic and kidney stone dysentery cough & fever	Steamed, crushed & paste	Leaves are steamed and applied on the affected part of bones and muscles.
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	L & Rt	Stone clearance, bone fracture and wound.	Solid paste and crushed	Solid paste of leaves is applied on fractured bone and wound.
Carica papaya L.	MZU00421	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	L, Fr and Fl	Dengu, abortion, diaarhea and galactagogue	Crushed, cooked, naturally taken and juice	Crushed and juice is obtained and taken to purify the blood during dengu. Unripe fruit is cooked and eaten during breast feeding. Flowers are crushed and eaten during diarrhea and dysentery problem.
		Monpa	NR	NR	NR	NR
Centella asiatica L.	MZU07122	Bugun	NR	NR	NR	NR
		Aka	WhP	Stomach problem, brain tonic, immune booster	Naturally taken, cooked and juice	Whole plant part is taken raw for increasing immune system, stomach problem and act as brain tonic or memory booster. All aged type can use this.
		Miji	WhP	Stomach problem	Crushed and naturally taken	Whole plant is crushed or eaten raw in stomach problem.
		Monpa	WhP	Stomach problem, skin disease and piles.	Juice	Dry leaves are good for T.B patient. Freshly made Juice is taken to treat piles.
	MZU21501	Bugun	NR	NR	NR	NR

Clerodendrum colebrookianum Lindl.		Aka	L	High pressure and diarrhea.	Decoction	Young leaves are boiled and taken to lower the BP and also for diarrhea.
		Miji	L	Hypertension	Cooked and juice	Young leaves are either cooked or juice is extracted from it and consumed to lower high pressure.
		Monpa	NR	NR	NR	NR
Cordyceps sinensis Berk.	MZU04201	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	WhP	Immune booster, diabetes, kidney disorder and male sexual problem.	Juice	1 glass of juice is consumed in empty stomach once in a week to treat male sexual problem.
Curcuma amada Roxb.	MZU04098	Bugun	Rh	Stomach, liver, skin problem,	Crushed	Rhizome are crushed and taken with milk in empty stomach for liver infection.
		Aka	NR	NR	NR	NR
		Miji		Delivery problem, female genital issues, thyphoid and diabetes	Crushed and juice	Freshly made juice is taken in empty stomach. Daily dose of 1 cup for 3-4 weeks will help.
		Monpa	Rh	Tonsil, delivery pain, throat pain, diabetes	Crushed, powdered and juice	Crushed and taken with milk and honey to get rid of tonsil and throat pain. Also, it can be applied on affected skin.
Curcuma caesia Roxb.	MZU04102	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	Rh	Diarrhoea and dysentery	Crushed, juice and n naturally taken	Juice taken in empty stomach to treat stomach problem.
Curcuma longa L.	MZU04103	Bugun	WhP	Diarrhea and immune booster.	Natural form & crushed	Naturally collected leaves are taken as chutney or eaten raw for immune boosting. 4-5 leaves are crush and given to children below 10 years for diarrhea.
		Aka	Rh	Liver disorder and tonsil	Crushed and juice	Rhizome is crushed and used for internal healing agent, tonsil and liver infection.
		Miji	Tu	Tonsil, throat pain skin disease	Powdered, juice, naturally taken	Crushed and taken with milk and honey to get rid of tonsil and throat pain. Also, it can be applied on affected skin.

		Monpa	Rh	Liver infection, tonsil and throat pain.	Powdered, Juice and soft paste	Rhizome is crushed and used for internal healing agent, tonsil and liver infection.
Dendrocalamus hamiltonii Gamble	MZU00368	Bugun	NR	NR	NR	NR
		Aka	C	Blood clotting	Peeled	Culm is peeled and used in freshly cut and injury for blood clotting.
		Miji	NR	NR	NR	NR
		Monpa	NR	NR	NR	NR
Dymaria cordata L.	MZU06110	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	WhP	Migraine, sinus, rheumatism and lumbago	Steamed and inhaled	Leaves are packed inside bigger leaves, steamed and the smoke from the leaves is inhaled for 2-3 times. Continuation of this process for 1 month will help in reducing sinus and migraine problem
		Monpa	NR	NR	NR	NR
Emblica officinalis L.	MZU01678	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	Fr	Piles, gum bleeding, cold and fever	Decoction	Decoction of the seeds is helpful in checking bleeding particularly of the gum. Fruits are taken to cure piles.
		Monpa	NR	NR	NR	NR
Houttunia cordata Thunb.	MZU05521	Bugun	L	Blood purifier and stomach problem.	Natural form	Freshly collected leaves are eaten raw for stomach problem and for blood purification. It is also used as appetizer.
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	WhP	Stomach problem, blood purifier	Naturally taken and cooked	Whole plants id eaten raw for purifying blood and cooked leaves are taken to get rid of stomach problem.
Illicium grafffithii L.	MZU04201	Bugun	S	Vomiting, fever abdominal pain.	Decoction	Seeds are used relieving fever and vomiting. Seeds are soaked for sometimes and water is taken immediately
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	Fr	Seed and fruit	Decoction	Seeds are used relieving fever and vomiting. Seeds are soaked for sometimes and water is taken immediately
Juglans regia L.	MZU45231	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR

		Monpa	B	Diarrhea, joint pain anthelmintic	Juice	Juice is given to children below 10 years to cure severe diarrhea.
Litsea cubeba Lour.	MZU21501	Bugun	Fr & S	Gastrointestinal problems and sleeplessness	Natural form	Fruits are eaten raw to help get good sleep and remove intestinal gas.
		Aka	NR	NR	NR	NR
		Miji	Fr	Sleeplessness	Naturally taken	Fruits are eaten raw to treat sleeplessness.
		Monpa	NR	NR	NR	NR
Mentha spicata L.	MZU04443	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	L	Cough, stomach cleanser and constipation	Juice and infusion.	Leaves are infused in tea to treat cough. Juice is prepared for stomach problem.
Musa paradisiaca L.	MZU00916	Bugun	NR	NR	NR	NR
		Aka	Fr	Diabetes	Powdered and crushed	Pressed powdered is used for diabetic patient.
		Miji	Fr and Fl	Diabetes and diarrhea.	Powdered and crushed	Crushed and powdered flower is helpful in curing diabetes. Half ripe fruits are eaten to cure diarrhea.
		Monpa	NR	NR	NR	NR
Ocimum sanctum L.	MZU01445	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	L	Cough, fever and throat pain	Juice, infusion and crushed	4-5 leaves are taken with tea to treat cough and fever.
		Monpa	Sd& Fr	Used in ritual	Soaked in water	Water is taken to purify the soul and to treat any kind of sickness.
Oenanthe javanica. (Blume) DC	MZU02116	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	L & Rt	Alcohol hangover, jaundice, immune enhancer	Naturally eaten	4-5 leaves are freshly taken to get rid of jaundice and improve immune system.
Oroxyllum indicum (L) Benth.ex Kurz.	MZU11326	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR

		Monpa	Sd& Fr	Used in ritual	Soaked in water	Water is taken to purify the soul and to treat any kind of sickness.
Paederia foetida L.	MZU10802	Bugun	NR	NR	NR	NR
		Aka	L	Gastric	Cooked	Leaves are good for stomach problem and gastritic
		Miji	NR	NR	NR	NR
		Monpa	NR	NR	NR	NR
Panax pseudoginseng Wall	MZU11124	Bugun	Wh P	Immune booster and diabetes.	Decoction	Dried roots are socked in water and consumed once a week to strengthen once health
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	NR	NR	NR	NR
Paris pollyphylla Smith	MZU10654	Bugun	Rt	Antiseptic, stomach pain, gastric, typhoid and antidote to snake bite	Decoction	Piece of roots is soaked in water and taken during stomach and gastric problem. If not administered properly it could cause vomiting.
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	Tu	Antiseptic, stomach pain, gastric, typhoid and antidote to snake bite	Soaked in water, crushed and juice	Piece of roots is soaked in water and taken during stomach and gastric problem. If not administered properly it could be poisonous
Passiflora edulis Sims	MZU01009	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	Leaves and Fr	Hypertension and memory booster	Cooked and naturally taken	Young leaves are eaten by high pressure people. Fruits are eaten for boosting memory.
		Monpa	NR	NR	NR	NR
Piper longum L.	MZU00987	Bugun	NR	NR	NR	NR
		Aka	Fr	Cough, and throat pain	Decoction	Seeds are grinded and taken along with lukewarm water during common cold cough and throat pain.
		Miji	NR	NR	NR	NR
		Monpa	NR	NR	NR	NR
Picrorhiza kurroa Royle ex Benth.	MZU02006	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR

		Monpa	S	Jaundice and diabetes	Juice	Ingest internally to treat jaundice. High BP patient should avoid. Side effect if vomiting after the consumption
Plantago major L.	MZU03100	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	Wh P	Would healing, inflammation	Paste and juice	Paste is applied on cut, wound and insect bites.
Podophyllum hexandrum (Royle) T.S.Ying	MZU02101	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	Rh & L	Typhoid, jaundice, genital warts, hypertension	Juice and paste	Paste is applied on genital part to get rid of warts. Juice is taken in empty stomach for typhoid and jaundice.
Psidium gujava L.	MZU00288	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	L	Diarrhea and dysentery	Soft paste and crushed	Young leaves are crushed, and juice is given to children below 5years for diarrhea and dysentery
		Monpa	NR	NR	NR	NR
Pueraria tuberosa (Willd) DC	MZU06002	Bugun	NR	NR	NR	NR
		Aka	Tu	Malaria, fever, male reproductive problem and galactagogue.	Juice and crushed	Freshly prepared Juice from tuber can cure malaria, fever, male reproductive problem and increase milk flow of a mother.
		Miji	NR	NR	NR	NR
		Monpa	NR	NR	NR	NR
Rhododendron dahuricum L. Ex. Dippel	MZU00054	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	Fl	Dysentery and diarrhea	Decoction	Decoction of flowers if taken twice a day to treat diarrhea and dysentery.
Rhus chinensis Mill	MZU10742	Bugun	NR	NR	NR	NR
		Aka	Sd and Fr	Indigestion	Juice	Fruits are soaked overnight and taken in the morning for digestion problem.
		Miji	NR	NR	NR	NR
		Monpa	NR	NR	NR	NR

Ricinus communis L	MZU09217	Bugun	NR	NR	NR	NR
		Aka	L	Bone fracture and abortion	Soft paste	Soft paste is prepared from leaves and used for bones fracture. Seeds are eaten for abortion.
		Miji	Sd and L	Abortion and rheumatics	Solid paste	Solid paste is prepared from leaves and applied on effected area to relieve pain and inflammation. Matured seeds are used for abortion.
		Monpa	NR	NR	NR	NR
Rumex obtusifolius L	MZU06142	Bugun	L & Rt	Boil and dysentery	Soft paste	A soft paste of leaves and root is prepared and applied on skin eruption.
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	NR	NR	NR	NR
Saccharum officinalis L	MZU05532	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	S	Jaundice and gum strengthening	Naturally taken	Brown sugarcane is taken 3-5 times a day and jaundice can be lowered down. It is good for gum strengthening.
		Monpa	NR	NR	NR	NR
Solanum khasianum L.	MZU00516	Bugun	Fr	Tooth decay &cavities	Crushed	Seeds are burned and put into the cavities for few minutes and the decaying substances are killed.
		Aka	Fr	Tooth decay and cavities	Steamed/ burned	Seeds are burned and put into the cavities for few minutes and the decaying substances are killed.
		Miji	Fr and Sd	Dental problem	Burned	Matured fruit is used to cure toothache. The fruits are burned and placed inside the affected teeth.
		Monpa	NR	NR	NR	NR
Solanum nigrum L.	MZU00510	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	L	Diabetes	Cooked	Leaves are eaten as vegetables. Also use for treating diabetes.
		Monpa	NR	NR	NR	NR
Swertia chirayita L.	MZU04242	Bugun	Wh P	Diarrhea, dysentery, skin problem, constipation, liver disorder, cough and fever	Crushed, juice & decoction	Decoction of leaves are consumed for stomach problem and taken in empty stomach.
		Aka	NR	NR	NR	NR

		Miji	NR	NR	NR	NR
		Monpa	WhP	Stomach problem, blood purifier and high Blood Pressure	Decoction and juice	Leaves are soaked in water and drink 2-3 times a day for stomach problem.
Tagetes erecta L.	MZU05663	Bugun	L	Mouth blister	Soft Paste & crushed	2-3 leaves are chewed freshly to get rid of mouth blister.
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	Fl & L	Anticancer, mouth blister, antianxiety and blood purifier.	Soft paste, crushed & juice	2 glass of pure juice is taken on daily basis to treat anxiety and cancer. Soft paste is applied on mouth blister for 2-3 times a day
Taxus bacata L.	MZU07789	Bugun	L, Rt & B	Anti-Cancer, headache liver disorder &diarrhea	Decoction	1 cup decoction of leaves is taken in empty stomach to get rid of stomach problem.
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	L and Rt	Anticancer	Decoction and crushed	Twigs are crushed and taken along with water.
Tinospora cordifolia (Thunb.) Miers.	MZU07114	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	S	Diabetes	Juice	1glas of prepared juice taken in empty stomach for 1 month which lower the sugar level.
		Monpa	NR	NR	NR	NR
Trapaeolum majus L.	MZU02945	Bugun	NR	NR	NR	NR
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	L	Skin problem and TB	Soft patches	Paste is applied on red patches covered by scales on skin.
Urtica dioica L.	MZU04237	Bugun	L	Gastritis	Cooked	Leaves are cooked and eaten to cool down the stomach during gastric problem. It is applicable to any age group.
		Aka	NR	NR	NR	NR
		Miji	L	Gastric and nose bleeding	Cooked and dried powdered	Dried powdered of leaves is used to stop nose bleeding. It is cooked and taken to reduce stomach gas/gastric.
		Monpa	NR	NR	NR	NR

Zanthoxyllum armatum DC	MZU00396	Bugun	S, B, Fr & S	Pyorrhea, Toothache, indigestion problem, intestinal worm problem and as a spice.	Cooked & natural form	Twigs are used for toothache; stem and leaves are eaten as a spice.
		Aka	NR	NR	NR	NR
		Miji	NR	NR	NR	NR
		Monpa	Fr & L	Antihelminthic, smallpox and chicken pox	Solid paste and juice	Ointment is prepared and used externally to treat lesions of chicken and smallpox.
Zanthoxyllum rhetsa (Roxb.) DC	MZU00398	Bugun	NR	NR	NR	NR
		Aka	L	Diarrhea& fish poisoning.	Naturally consumed, crushed	Fruits are used for fish poisoning. Young leaves are crushed and consumed for quick relief from diarrhea.
		Miji	NR	NR	NR	NR
		Monpa	NR	NR	NR	NR
Zingiber officinalis Roscoe	MZU06467	Bugun	Rh & L	Cough, common cold and blood circulation	Natural form & juice	Few pieces are eaten raw to increase body temperature during fever and for cough
		Aka	Rh	Cough, common cold	Crushed and juice	Zinger juice is taken for immune booster, cold and cough.
		Miji	NR	NR	NR	NR
		Monpa	Rh	Cough, throat pain, sinus, menstrual cramp and stomach problem	Natural, juice and crushed	Rhizomes are burned and eaten to get rid of common cold, cough, tonsillitis and sinus problem. Juice is taken to relieve from menstrual cramp.

NR- Not Reported
Plant Parts: Wh P- Whole plant, L- Leaf, Fr- Fruit, S- Stem, Rh- Rhizome, Rt- Root, Tu- Tuber, Sd- Seed, Fl- Flower, B- Bark

Cross cultural use value of medicinal plants

The ethnomedicinal cross-cultural comparison of 04 ethnic communities indicated 1748 recommended usage of 59 medicinal plants. Monpa community used highest number of medicinal plants (32) for management of various ailments, followed by Miji (22), Bugun (20) and Aka (15). The plants with high cross-cultural use value viz. *Curcuma amada* (1.85), *Curcuma longa* (1.60), *Zingiber officinalis* (1.48), *Paris polyphylla* (1.48) and *Aloe vera* (1.05) having multiple recommended usage are highly abundant in the study area and are largely available in the kitchen gardens in the communities. *Curcuma amada* have recommended use for gastro-intestinal and skin problem by Bugun community, for management of diabetes, typhoid fever and urogenital problem by Miji and diabetes, cold and cough by Monpa community. *Curcuma longa* has been used as immune booster and for management of diarrhea by Bugun, for gastro-intestinal problem by Aka, for gastro-intestinal and skin disease by Miji and for management of gastro-intestinal problems by Monpa community. *C. amada* and *C. longa* have been widely used as a spice in most of households in the northeast India. Their availability in every household and wider use may be the reason for their high cross cultural use value. Higher use value also indicates similar practice of management of an aliment among the communities and sharing of knowledge among the informants. The informant said that they generally have dialogue among themselves, whenever opportunity arises. In previous studies from the Terai forest of western Nepal *C. longa* was also reported as the highest used value similar to our findings (Singh *et al.* 2012). Recent literature has shown an increasing trend of cross-cultural comparisons of traditional knowledge on medicinal plants. In present study, some of the plants with low cross cultural use value have been *Paederia foetida* (0.14), *Begonia pasighatensis* (0.13) *and Acorus calamus* (0.18) (Table 4).

Table 4. Use value of medicinal plants

Species Name	Use Value (UV) Community Wise				Use Value (UV) Overall (n=94)
	Monpa (n=30)	Miji (n=26)	Aka (n=17)	Bugun (n=21)	
Aconitum ferox	1.33	0.00	0.00	0.00	0.43
Aconitum heterophyllum	1.53	0.00	0.00	0.00	0.49
Acorus calamus	0.57	0.00	0.00	0.00	0.18
Ageratum conyzoides	1.37	0.00	1.41	0.67	0.84
Aloe vera	0.93	1.27	1.35	0.71	1.05
Alpinia haenkei	0.00	0.73	0.00	0.00	0.20
Andographis paniculata	0.00	1.12	0.00	0.00	0.31
Apium graveolens	1.57	0.00	0.00	0.00	0.50
Artemisia nilagirica	0.63	0.00	0.00	0.81	0.38
Artemisia vulgaris	0.00	0.00	0.00	1.05	0.23
Azadirachta indica	0.00	1.50	0.00	0.71	0.57
Begonia pasighatensis	0.00	0.00	0.71	0.00	0.13
Berberis aristata	0.73	0.00	0.00	0.00	0.23
Bergenia ciliata	1.00	0.00	0.00	1.95	0.76
Carica papaya	0.00	1.50	0.00	0.00	0.41
Centella asiatica	1.37	0.88	1.59	0.00	0.97
Clerodendrum colebrookianum	0.00	0.96	1.35	0.00	0.51
Cordyceps sinensis	1.80	0.00	0.00	0.00	0.57
Curcuma amada	2.23	2.54	0.00	1.95	1.85
Curcuma caesia	0.80	0.00	0.00	0.00	0.26
Curcuma longa	1.67	1.65	1.59	1.43	1.60
Dendrocalamus hamiltonii	0.00	0.00	0.76	0.00	0.14
Dymaria cordata	0.00	1.92	0.00	0.00	0.53
Emblica officinalis	0.00	2.08	0.00	0.00	0.57

Houttunia cordata	1.33	0.00	0.00	1.48	0.76
Illicium graffithii	1.43	0.00	0.00	1.57	0.81
Juglans regia	1.70	0.00	0.00	0.00	0.54
Litsea cubeba	0.00	0.88	0.00	1.48	0.57
Menthe spicata	1.77	0.00	0.00	0.00	0.56
Musa paradisiaca	0.00	1.58	0.88	0.00	0.60
Ocimum sanctum	1.00	2.08	0.00	0.00	0.89
Oenanthe javanica	1.23	0.00	0.00	0.00	0.39
Oroxyllum indicum	0.93	0.00	0.00	0.00	0.30
Paederia foetida	0.00	0.00	0.76	0.00	0.14
Panax pseudoginseng	0.00	0.00	0.00	1.19	0.27
Paris pollyphylla	3.03	0.00	0.00	2.29	1.48
Passiflora edulis	0.00	1.58	0.00	0.00	0.44
Piper longum	0.00	0.00	1.53	0.00	0.28
Picrorhiza kurroa	1.47	0.00	0.00	0.00	0.47
Plantago major	1.40	0.00	0.00	0.00	0.45
Podophyllum hexandrum	1.93	0.00	0.00	0.00	0.62
Psidium gujava	0.00	0.92	0.00	0.00	0.26
Pueraria tuberosa	0.00	0.00	2.29	0.00	0.41
Rhododendron dahuricum	0.87	0.00	0.00	0.00	0.28
Rhus chinensis	0.00	0.00	0.88	0.00	0.16
Ricinus communis	0.00	1.65	1.59	0.00	0.74
Rumex obtusifolius	0.00	0.00	0.00	1.29	0.29
Saccharum officinalis	0.00	1.31	0.00	0.00	0.36
Solanum khasianum	0.00	0.96	0.88	1.00	0.65
Solanum nigrum	0.00	0.96	0.00	0.00	0.27
Swertia chirayita	1.53	0.00	0.00	2.57	1.06
Tagetes erecta	1.50	0.00	0.00	0.90	0.68
Taxus bacata	0.87	0.00	0.00	1.76	0.67
Tinospora cordifolia	0.00	0.73	0.00	0.00	0.20
Trapaeolum majus	1.17	0.00	0.00	0.00	0.37
Urtica dioica	0.00	1.38	0.00	0.90	0.59
Zanthoxyllum armatum	1.70	0.00	0.00	1.76	0.94
Zanthoxyllum rhetsa	0.00	0.00	1.53	0.00	0.28
Zingiber officinalis	2.10	0.00	1.88	2.10	1.48

Medicinal plant products have been used for management of health problems, across the cultures since prehistoric times (Halberstein 2005). Recent literature has shown an increasing trend of cross-cultural comparisons of traditional knowledge on medicinal plants for understanding the migration pattern of ethnic communities as well as vegetation biodiversity in the selected geographical area. A recent study on cross cultural use of medicinal plants of family Asteraceae confirmed that although Southern Spain and Northern Morocco are geographical and cultural distinct today, but they have a shared cultural past spanning more than seven centuries (Benitez *et al*. 2021). Similar results have been obtained in a cross-cultural comparison of medicinal plants around Georgia-Turkey border (Kazanci *et al*. 2020).

Most studies in the past from northeast part of India have documented the traditional knowledge of one ethnic group, however neglected the cross-cultural comparisons of such knowledge (Guha & Chakma 2015). The cross-cultural comparison has practical applications because we can address both the consensus and variations by this approach as well it may indicate the migration pattern and interaction among the ethnic communities (Gairola *et al.* 2014). The present study showed that the medicinal plants with high use value are largely used by most of the communities. It indicates that there must have been and there is a close interaction among the 04 studied ethnic communities.

Informant Consensus Factor (ICF)

The ICF values of the 09broad ailment categories ranged from 0.95to 0.99 (Table 5). The availability of the plant species in the study area and cultural closeness of the communities influence the ICF of the local traditional knowledge in the disease treatment (Usman *et al.* 2022). The higher values of ICF (>0.5) signified a level of consensus on the information shared by the local healers from the different communities. The communities under present study are located in close proximity in the West Kameng district of Arunachal Pradesh and are without any strong geographical barrier. Medicinal plants used for various ailments are spread over the whole West Kameng district due to similar agroclimate. Highest ICF of 0.99among the 09-ailment category was recorded for cancer. It indicates that there is high prevalence of cancer among the studied communities. Use of tobacco in smoking and chewing as well as consumption of local alcoholic beverages may be a reason for high prevalence of cancer. The frequent occurrence of the ailment means that the healers were more exposed to the ailment and their ways of treatment. The consensus on use of a particular plant could be explained by the fact that the communities have engaged in sociocultural agreements with others. Significant cross-cultural consensus on medicinal plant use has been reported in Bakerwal, Gujjar, and Pahadi communities in Jammu and Kashmir, India (Mir *et al.* 2022).

Table 5. Informant Consensus Factor (ICF)

Ailment Category	**Nur**	**Nt**	**ICF**
Cancer	77	2	0.99
Antidote to poison	61	2	0.98
Hypertension	98	4	0.97
Dental problems	94	4	0.97
Dermatological problem	307	12	0.96
Cold and Cough	329	14	0.96
Gastrointestinal	605	27	0.96
Urogenital problems	45	3	0.95
Diabetes	132	7	0.95

Nur - The number of user reports of plant spp. for an ailment category.
Nt- The number of plant spp. used for the specific ailment category by the informants who mention all the spp.

Conclusions

Present investigation reports the cross-cultural usage of medicinal plants by Monpa, Miji, Aka and Bugun communities in district West Kameng, Arunachal Pradesh, India. The hilly terrain and lack of all-weather roads are the major constraints for limited access to healthcare facilities in northeast, India. The ethnic communities have evolved the traditional system of medicine using locally available medicinal plant resources for their health care needs. The traditional knowledge among these communities is largely in the custody of elderly people. Approximately half of the informants of this study were women, indicating that women have equal share in all walks of life and are important discussion makers in families and communities in northeast, India.

A total of 59 sp. of medicinal plants have been recorded for their use in this cross-cultural and comparative study. Monpa community used highest number of medicinal plants (32) for management of various ailments, followed by Miji (22), Bugun (20) and Aka (15). Most of the plants have been used for treatment of multiple ailments. The Informant consensus factor (ICF) for 09 broad categories of ailments is quite high among the communities, indicating a strong intercultural relationship among them. The ICF for use of medicinal plants in management of cancer is 0.99. The high ICF may be due to- a) The selected ailment category being very prevalent in the area due to excessive consumption of tobacco and use of locally prepared alcoholic drinks, - b) the medicinal plants used for the management of cancer are present over a wider geographical area in West Kameng district and available to the local communities. The plants with high cross-cultural use value viz. *Curcuma amada* (1.85),*Curcuma longa* (1.60), *Zingiber officinalis* (1.48), *Paris polyphylla* (1.48) and *Aloe vera* (1.05) are having multiple recommended

usage. These plants are highly abundant in the study area and are largely available in the kitchen gardens in the communities. The high intercultural use of some of the medicinal plants and high informant consensus indicated that communities have strong interactions among themselves and may have a common cultural inheritance. The results of this study expand our understanding of patterns of knowledge of useful plants across cultures and geography in West Kameng district, Arunachal Pradesh, India.

Declarations

Ethics approval: All participants provided oral prior informed consent.
Consent to publish: The paper does not show any personal data or photographs.
Availability of data and materials: The authors will provide the raw data on request without the names of informants.
Competing interests and conflict of interest: None to declare
Funding: Not applicable.
Authors' contribution: Jopi Siram (JS) and Uttam Kumar Sahoo (UKS) developed the concept; JS conducted the field survey and data collection; Nagaraj Hegde (NH) and Rambir Singh (RS) analyzed the data; JS, NH and RS prepared the first draft; UKS and RS prepared the final draft; UKS supervised the work; all authors participated in the final revision and agreed to submit the manuscript.

Acknowledgements

We are thankful to the indigenous societies of the study area for contributing to the field survey and providing valuable information.

Literature cited

Ali AI, Das I. 2003. Tribal situation in northeast India. Studies of Tribes and Tribals 1(2):141-148.

Benítez G, El-Gharbaoui A, Redouan FZ, González-Tejero MR, Molero-Mesa J, Merzouki A. 2021. Cross-cultural and historical traceability of ethnomedicinal Asteraceae. Eastern Morocco and Eastern Andalusia: Two sides of a sea in 20 centuries of history. South African Journal of Botany 139:478-493.

Bhuyan M. 2015. Comparative study of ethnomedicine among the tribes of Northeast India. International Research Journal of Social Science 4(2):27-32.

Buwa-Komoren LV, Mayekiso B, Mhinana Z, Adeniran AL. 2019. An ethnobotanical and ethnomedicinal survey of traditionally used medicinal plants in Seymour, South Africa: An attempt toward digitization and preservation of ethnic knowledge. Pharmacognosy Magazine 15(60):115.

Das BD, Paudel N, Paudel M, Khadka MK, Dhakal S, Amrit KC. 2021. Ethnobotanical knowledge of Kewrat community of Morang district, eastern Nepal. Ethnobotany Research and Applications 21:1-11.

El Hachlafi N, Chebat A, Bencheikh RS, Fikri-Benbrahim K. 2020.Ethnopharmacological study of medicinal plants used for chronic diseases treatment in Rabat-Sale-Kenitra region (Morocco).Ethnobotany Research and Applications 20:1-23.

Elwin V. 1965.Democracy in NEFA. Shillong: North-East Frontier Agency, Shillong, India.

Gairola S, Sharma J, Bedi YS.2014. A cross-cultural analysis of Jammu, Kashmir and Ladakh (India) medicinal plant use. Journal of Ethnopharmacology 155(2):925-86.

Government of India 2011. Office of the Registrar General and Census Commissioner, India, West Kameng District Population Census 2011-2022, Arunachal Pradesh, India.

Government of India 2013.Statistical Profile of Scheduled Tribes in India. Ministry of Tribal Affairs. Statistics Division, Government of India. Ministry of Tribal Affairs

Guha A. 2015. Traditional usage of Ethno-medicinal plants among the Chakma community of Tripura, India. Global Journal of Pharmacology 9(4):377-384.

Halberstein RA. 2005. Medicinal plants: Historical and cross-cultural usage patterns. Annals of Epidemiology 15(9):686–99.

Heinrich M, Ankli A, Frei B, Weimann C, Sticher O. 1998. Medicinal plants in Mexico: Healers' consensus and cultural importance. Social Science & Medicine 47(11):1859-1871.

Heinrich M, Lardos A, Leonti M, Weckerle C, Willcox M, Applequist W, Ladio A, Long CL, Mukherjee P, Stafford G. 2018. Best practice in research: consensus statement on ethnopharmacological field studies–ConSEFS. Journal of Ethnopharmacology 211:329-339.

Jamir K, Seshagirirao K, Meitei MD. 2022. Indigenous oral knowledge of wild medicinal plants from the Peren district of Nagaland, India in the Indo Burma hot-spot. Acta Ecologica Sinica 42(3):206-223.

Kala CP, Mathur VB. 2002.Patterns of plant species distribution in the Trans-Himalayan region of Ladakh, India. Journal of Vegetation Science 13(6):751-754.

Kazancı C, Oruç S, Mosulishvili M. 2020. Medicinal ethnobotany of wild plants: a cross-cultural comparison around Georgia-Turkey border, the Western Lesser Caucasus. Journal of Ethnobiology and Ethnomedicine 16(1):1-20.

Khan TU, Agrahari RK, Chowdhury B, Borthakur SK. 2014. Plants used by Hmar, Manipuri and Barman community of Hailakandi District of Assam (India) for the treatment of Diabetes. Pleione 8(2):456-461.

Khongsai M, Saikia SP, Kayang H. 2011. Ethnomedicinal plants used by different tribes of Arunachal Pradesh. Indian Journal of Traditional Knowledge 10(3):541-546.

Lieberherr I, Bodt TA. 2017. Sub-grouping Kho-Bwa based on shared core vocabulary. Himalayan Linguistics 16(2):26-63.

Mahwasane ST, Middleton L, Boaduo N. 2013. An ethnobotanical survey of indigenous knowledge on medicinal plants used by the traditional healers of the Lwamondo area, Limpopo province, South Africa. South African Journal of Botany 88:69-75.

Mir TA, Jan M, Jan HA, Bussmann RW, Sisto F, Fadlalla IM.2022. A Cross-Cultural Analysis of Medicinal Plant Utilization among the Four Ethnic Communities in Northern Regions of Jammu and Kashmir, India. Biology 11(11):1578.

Mizuno K, Tenpa L. 2015. Himalayan Nature and Tibetan Buddhist Culture in Arunachal Pradesh, India: A Study of Monpa. International Perspectives in Geography 6 Springer: Japan.

Myers N, Mittermeler RA, Mittermeler CG, Da Fonseca GAB, Kent J. 2000. Biodiversity hotspots for conservation priorities. Nature 403(6772):853-858.

Namsa ND, Mandal M, Tangjang S, Mandal SC. 2011.Ethnobotany of the Monpa ethnic group at Arunachal Pradesh, India. Journal of Ethnobiology and Ethnomedicine 7(1):1-5.

Nimachow G, Joshi RC, Dai O. 2011. Role of Indigenous knowledge system in conservation of forest resources–A case study of the Aka tribes of Arunachal Pradesh. Indian Journal of Traditional Knowledge 10 (2): pp. 276-280

Pampuinath B, Meitei MD. 2021. Group of Manipur, India. Current Science 120(5):945.

Phillips O, Gentry AH, Reynel C, Wilkin P, Gálvez-Durand B C. 1994.Quantitative ethnobotany and Amazonian conservation. Conservation Biology 8(1):225-248.

Rawat RB, Garg GP. 2005. Medicinal plants: trade and commerce opportunities with India. Indian Forester. 131(3):275-287.

Sajem AL, Gosai K. 2006. Traditional use of medicinal plants by the Jaintia tribes in North Cachar Hills district of Assam, northeast India. Journal of Ethnobiology and Ethnomedicine 2(1):1-7.

Singh G, Joyce EM, Beddow J, Mason TJ. 2012. Evaluation of antibacterial activity of ZnO nanoparticles coated sonochemically onto textile fabrics. Journal of Microbiology, Biotechnology and Food Sciences 2(1):106-120.

Sinha R. 1962. The Akas. Directorate of Research, Government of Arunachal Pradesh, India.

Sodipo OA, Wannang NN. 2015. Ethnopharmacological survey of plants used by trado-medical practitioners (TMPs) in the treatment of typhoid fever in Gomari Airport Ward, Jere local government area, Borno State, Nigeria. American Journal of Ethnomedicine 2(4):185-218.

Temsutola ,Lothunglo ON , Vepu. 2019. Ethnomedicinal study of plants used by Chang Naga tribe of Tuensang, Nagaland, India. International Journal of Botany Studies 4(2): 107-109.

Trotter RT, Logan MH.2019. Informant consensus: a new approach for identifying potentially effective medicinal plants. In: Trotter RT, Logan MH. (eds).Plants in Indigenous Medicine & Diet: Biobehavioral Approaches. pp. 91-112, Routledge, Bedfore Hills, New York.

Untracht O. 1997. Traditional Jewelry of India. Harry N Abrams, New York, USA.

Usman KA, Egigu MC, Mahalingam JS. 2022. Ethnobotanical study on traditional medicinal plants used by Oromo ethnic people of Goro district, Bale zone of Oromia region, Ethiopia. Ethnobotany Research and Applications 24:1-21.

WHO. 2006. World Health Organization. The world health report 2006: working together for health. World Health Organization; 2006 Mar 23.