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A brief cross-cultural ethnobotanical note on the *Abotani* tribes of Arunachal Pradesh, India

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Abstract

This paper discusses the brief cross cultural ethnobotany of the *Abotani* tribes of Arunachal Pradesh which comprises five different indigenous tribal communities, namely *Adi*, *Apatani*, *Nyishi*, *Galo* and *Tagin* residing in Arunachal Pradesh, India. A brief ethnobotanical survey was conducted in *Abotani* Biocultural Landscape (ABL) in 11 districts of Arunachal Pradesh during the year 2018 – 2019 with fundamental aims to document significant ethnobotanical plants commonly used among all the 05 *Abotani* tribes in their local biocultural landscape and to document traditional knowledge and skills related to utilization of ethnobotanical plants resources using semi-structured questionnaire format. The survey have revealed impressive number of 45 species of ethnobotanically significant species frequently harvested and used as local food and medicine security as well as cultural materials among the local residents of 05 major tribes of *Abotani* cultural group residing in Siang, Subansiri, Kurung Kumey, Pakke Kessang and Papum Pare belt of Arunachal Pradesh.

Key words: *Abotani* Tribes, Arunachal Pradesh, Ethnobotanical notes, Conservation, Utilization

INTRODUCTION

The state of Arunachal Pradesh lies in the Northeastern region of India which is known to be a paradise for ethnobotanist and anthropologist (Mao & Hyniewta 2000). The state is a part of as Himalayan Hotspot recognized by IUCN endowed with rich biodiversity and amazing variety of local culture and dialects nurtured and spoken by 26 major tribes and 110 subtribes in their traditional biocultural landscape (Myers *et al.* 2000; Mittermeir *et al.* 2005; Tag 2007). The *Abotani* tribes of Arunachal Pradesh comprises of *Adi*, *Apatani*, *Nyishi*, *Tagin* and *Galo* is an interesting group of indigenous tribal communities belonging to the mongoloid racial stock and speaks Tibeto-Burman dialect group devoid of written script but maintain their folk literature and culture through oral traditions since time immemorial (Nabam 2013; Tag 2014, 2017). The *Abotani* tribes primarily resides in 14 districts of Arunachal Pradesh, namely, Kamle, Kra Daadi, Kurung Kumey, East Kameng, Pakke Kesang, Papum Pare,

East Siang, West Siang, Upper Siang, Lower Siang, Lower Dibang Valley, Lepa Rada, Lower Subansiri, and Upper Subansiri districts which falls within Eastern Himalaya region of India with an estimated population of over 450,000 souls (Census 2011). *Abotani* group of tribes considered mythical father *Abotani* as their primeval ancestor who pioneered *Abotani* languages, folk culture and oral literature tradition, traditional jhum agriculture, animal husbandry, fishing and hunting during ancient days (Showren 2009; Nabam 2013; Tag *et al.* 2008; Tag, 2018). Although *Abotani* groups of tribes and their traditional biocultural landscape are considered to be rich in biodiversity and ethnobotanical knowledge heritage, but only few publications are available to date which includes ethnobotanical appraisal on *Adi* of East Siang by Das (1986), Tag *et al.* (2008), Boko & Narsimhan (2014), Momang *et al.* (2018a,b); ethnobotany of the *Nyishi* of Lower Subansiri and Kamle by Pal (1993), Tag *et al.* (2005), Tag & Das (2007), Murtem (2000), Murtem & Chaudhry (2016); ethnobotany of the *Galo* of West Siang by Omem *et al.* 2016), Gode *et al.* 2018; ethnobotany of the *Tagin* by Rinyo *et al.* (2018); ethnomedicinal reports on the *Apatani* tribe of Lower Subansiri by Bipul *et al.* (2017) whereas the nutritional aspects of some selected edible plants used by the *Abotani* tribes were reported by Pallabi *et al.* (2014). However, no reliable literatures are available to date on comparative ethnobotanical discourses on *Abotani* tribes based on cross cultural approaches. Therefore, present paper discusses ethnobotanical heritage of the five tribes of *Abotani* group of tribes based on brief field survey report presented on each tribes focused on few significant food, medicinal and cultural plants in cross cultural approach which has the immense economic and cultural values to the tribes under investigation for future conservation priorities and sustainable utilization.

MATERIALS AND METHODS

Study area and ethnic culture

The target study - State of Arunachal Pradesh is located between 26°28' N - 29°30' N latitude and 91°30' E - 97°30' E longitude covering total geographical area of 83,743 sq km. In the present study, only 11 districts namely, Kamle, Kra Daadi, Pakke Kesang, Papum Pare, East Siang, West Siang, Upper Siang, Lower Siang, Lower Dibang Valley, Lower Subansiri, and Upper Subansiri Districts which are primarily inhabited by the *Abotani* groups of tribes were selected for a rapid ethnobotanical survey. Name of the villages targeted and visited for ethnobotanical data collection were *Dukum, Raga, Yada* (Kamle district), *Pakke-kessang HQ, Langpong* (Pakke Kesang district), *Doimukh, Sagalee, Hoj, Naharlagun, Itanagar, Rono* (Papum Pare district), *Pasighat, Ayeng, Niglok, Mirbuk* (East Siang district), *Aalo, Tadin, Kombo* (West Siang district), *Geku, Perem, Bum, kumku* (Upper Siang district), *Roing, Jia, Bolung, Parbuk* (Lower Dibang Valley district), *Yazali, Peni, Tepin Hapa, Posa, Joram, Ziro, Hapoli, Siiro, Hari, Bula, Tajang, Dutta, Hija., Mudang Tage, Bamin Michi, Hong* (Lower Subansiri district) *Daporijo, Dumporijo, Uli, Bullo, Nguki* (Upper Subansiri district). The forest of these 11 districts are rich in plant diversity which receive heavy rainfall during Northeast and Southwest Monsoon with annual relative humidity ranges between 80% - 85%. The tropical rain forest ranging up to 1000 m where under growth are quite thick and dense, and subtropical (1000 – 2000 m), temperate (2000 – 3000 m) and alpine forest (3000 – 4000 m) has their unique vegetation characteristics which support different life-forms or habit groups (Kaul & Haridasan 1987).

The major tribal communities found in the *Abotani* biocultural landscape are the followers of *Donyi-Poloism* sect of indigenous religion professed by Shaman called *Nyub/Nyubu* or *Miirii* predominant in Arunachal Pradesh. The *Nyishi* is the largest among the *Abotani* groups of tribes residing in 7 districts of central Arunachal Pradesh who celebrates

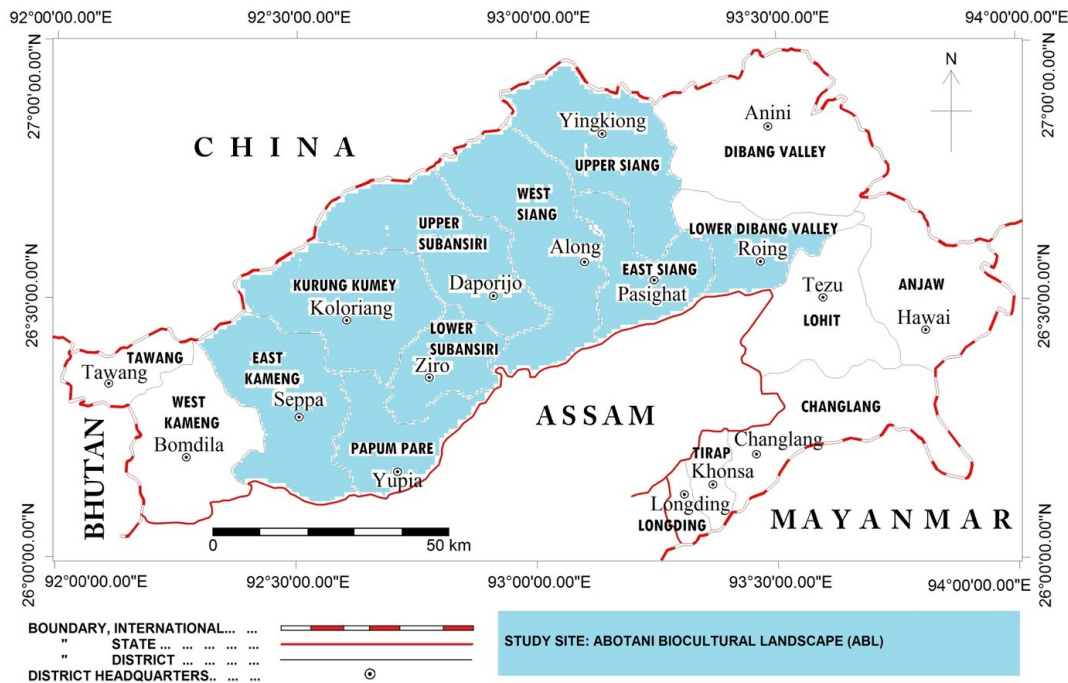


Figure 1. Map of Arunachal Pradesh showing study site – Abotani Biocultural Landscape (ABL) where cross cultural ethnobotanical survey was conducted

Boori Boot Yullo, *Nyokum Yullo* and *Longte Yullo*. The *Apatani* of Lower Subansiri celebrates *Myoko* and *Murung* in winter and *Dree* in summer month, whereas the *Adi* of Siang belt celebrates *Aran* and *Solung*, the *Galo* of West Siang, Lower Siang and Lepa Rada belt celebrates *Mopin* and *Podii Barbii*, and the *Tagin* of Upper Subansiri celebrates *Shii Donyi* festival. The celebration of the local festivals of all the *Abotani* groups of tribes begins in the month of January to February as they believe that during these winter months, the Gods and Goddesses have the warmest disposition towards the earth dwellers. The phase wise celebration of these local festivals culminates in the month of September is celebrated with fundamental aims to welcome new harvesting season and to dedicate their ritual prayers to the entire forces of the cosmos, almighty *Donyi-Polo* Gods, benevolent and malevolent demi-gods and goddesses for their bountiful blessings in the form of bumper harvest of agricultural crop, prosperity, protection of domesticated animals and humankind from epidemic diseases, protection of wildlife and biodiversity, and promotion of peace and social harmony in the society (Nabam 2013; Tag 2017).

Ethnobotanical field survey and sample Size

A brief ethnobotanical field survey was conducted in the *Abotani* biocultural landscape in 11 districts of Central Arunachal Pradesh for brief period of over 02 months during 2018 – 2019 following the quantitative ethnobotanical field method suggested by Martin (2008). Prior Inform Consent (PIC) was taken from the potential informants before start of the work. A total of 132 potential informants belonging to 66 household covering 22 villages were surveyed and interviewed from 11 districts. All the relevant ethnobotanical information including the vernacular name of plant species, part used, harvesting season and purpose of traditional uses shared by the potential informants were recorded in structured questionnaire format and field notebook.

The herbarium specimen of each ethnobotanically significant species were collected and prepared following the method suggested by Jain & Rao (1977). Each species were identified through consultation of standard regional flora such as *Flora of Assam* (Kanjilal *et al.* 1934 – 1940), *The Flora of British India* (Hooker 1875 – 1897), *Flora of Lower Subansiri* (Pal 1993), *Materials for the Flora of Arunachal* (Hajra *et al.* 1996; Giri *et al.* 2008; Chowdhery *et al.* 2009), *e-Flora of China*, and e-Herbarium of Kew. The accepted names were verified in the website www.theplantlist.org jointly hosted by Royal Botanic Garden, Kew UK and Missouri Botanical Garden, St. Louis USA, and Plants of World Online (POWO) hosted by RBG Kew. The taxonomically authenticated herbarium specimen bearing collection number and accession number were deposited in the Herbarium of Arunachal University (HAU), Department of Botany, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh for future reference.

RESULT & DISCUSSION

Species diversity and habit

Present cross cultural ethnobotanical investigations have revealed 45 ethnobotanically significant angiospermic plant species belonging to 34 genera clubbed within 27 families (Table 1; Figure 2) reported be used by the 05 tribes of *Abotani* Biocultural Landscape residing in 11 districts of Arunachal Pradesh. Among these, Asteraceae and Solanaceae were found to be most dominating group represented by highest number of 7 species each which is followed by Arecaceae, Cucurbitaceae and Poaceae represented by 2 species each (Figure 3). Among the 34 genera reported, the *Solanum* has been found to be most dominating genus represented by 5 species which is followed by *Acmella*, *Artemisia*, *Capsicum* and *Cucumis* represented by 2 species each (Figure 4). Herbs were represented by highest number of 23 species used by the *Abotani* tribes which is followed by shrubs (8 species), climbers (6), trees (5) and fern, grass, vine (1 each) (Figure 5).

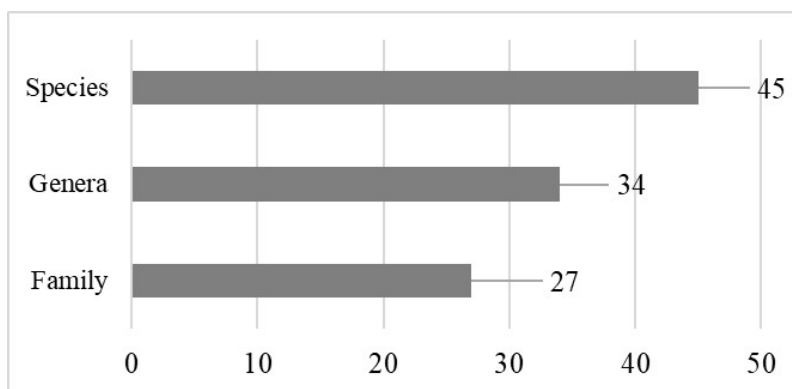


Figure 2. Taxonomic diversity of significant ethnobotanical species (45 spp.) used by the *Abotani* Tribes of Arunachal Pradesh

Diversity of ethnobotanical uses

It has been revealed that the *Abotani* tribes of Arunachal Pradesh have rich ethnobotanical knowledge bases related to diverse use of plant resources available in their biocultural landscape. Of the 45-species recorded, 10 species are exclusively consumed as food, 24 species are used both as food and medicine, 4 species are exclusively used for medicinal purpose, 4 species are used in rituals and socio-cultural occasions, and 3 species are used for handicraft and construction purposes (Figures 6 & 8).

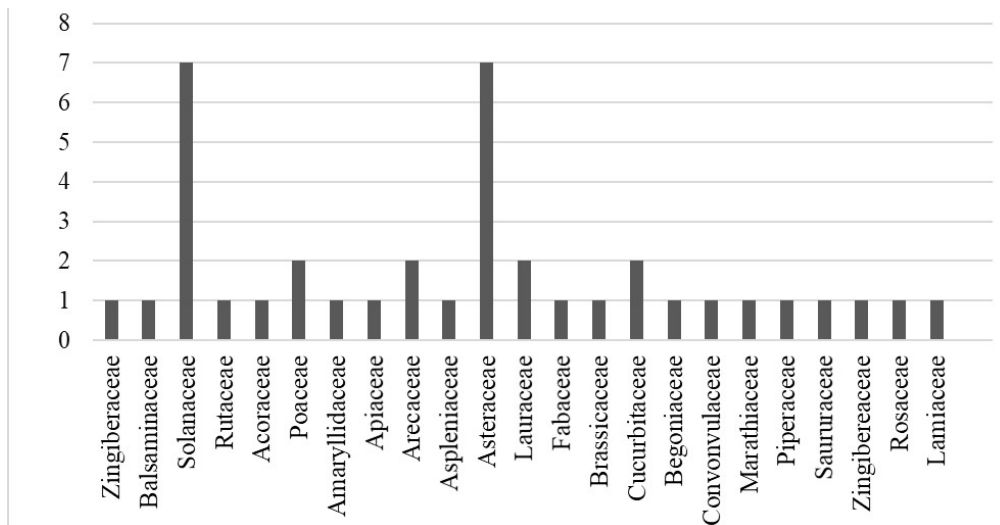


Figure 3. Frequency of the most frequently used plant Families reported from *Abotani* Biocultural Landscape (ABL) in Arunachal Pradesh

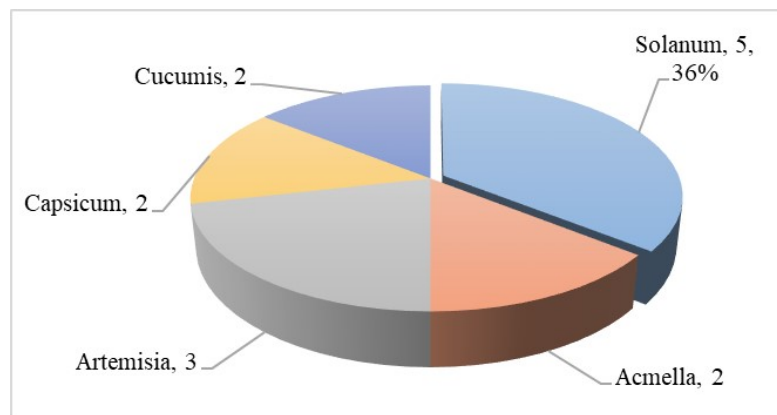


Figure 4. Statistics of frequently used genera

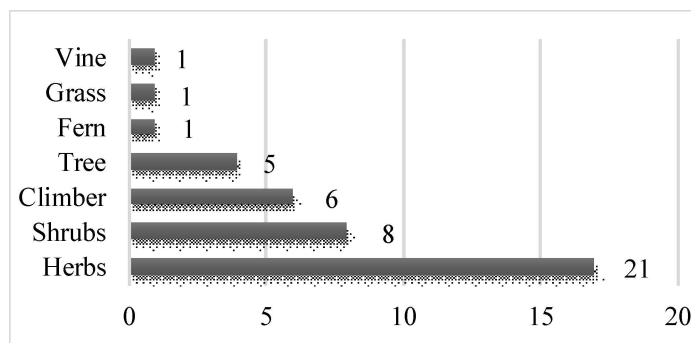


Figure 5. Diversity of habit and lifeform of significant ethnobotanical plants (45 spp.) reported from *Abotani* Biocultural Landscape (ABL) in Arunachal Pradesh

Table 1. Checklist of cross cultural applications of significant ethnobotanical plants species used by the *Abotani* Tribes residing in 11 districts of Arunachal Pradesh, India

[Abbreviations used: A = Adi; Ap = Apatani; G = Galo; T = Tagin; N = Nyishi; L = Leaf; F = Fruit; WP = Whole Plant; R = Rhizome; Tu = Tuber; S = Seed; B = Bark; YS = Young shoot; Fr = Frond]

Botanical Names	Vernacular Name	Habits	Part used	Type of use	Ethnic use
<i>Acmella oleracea</i> (L.) R.K. Jansen [Asteraceae]; HY/HT/HAU/1604/2018	<i>Marshang</i> (A), <i>Yorkhung</i> (Ap), <i>Marsha</i> (G), <i>Byadhi</i> (N), <i>Marsha</i> (T)	Herbs	L, F	Food, medicine	i. Flower and leaves are taken as vegetable ii. Remedy for cough iii. Flower paste is applied in toothache
<i>Acmella paniculata</i> (Wall. ex DC.) R.K. Jansen [Asteraceae]; HY/HT/HAU/1608/2018	<i>Marshang</i> (A), <i>Yorkhung</i> (Ap.), <i>Marsha</i> (G), <i>Byadhi</i> (N), <i>Marsha</i> (T)	Herbs	WP	Food, Pesticide	i. Leaves eaten raw and cooked with other vegetable ii. Whole plant paste is used as fish poison
<i>Acorus calamus</i> L. [Acoraceae]; HY/HT/HAU/1606/2018	<i>Kile tolyo</i> (Ap.), <i>Buch</i> (G), <i>Talyo</i> (T)	Herbs	R	Medicine	i. Rhizome paste is applied on cuts, wounds and bone fracture ii. Extracts of rhizome along with <i>Zingiber officinalis</i> rhizome is used for curing Gastric iii. Rhizome juice is used against Asthma & bronchitis. iv. Aromatic oil is used for treatment of joint pain, skin inflammation, boil, cut and wound.
<i>Ageratum houstonianum</i> Mill. [Asteraceae]; HY/HT/HAU/1601/2018	<i>Namsing Ing/Elee</i> (A.), <i>Borbia tami</i> (Ap.), <i>Eae-Namnya/ Hiigo remi</i> (G) <i>Pasho / pasu-payou</i> (N), <i>Garii / Myora</i> (T)	Herbs	L	Medicine	Paste is used for blood clotting and wound healing
<i>Allium hookeri</i> Thwaites [Amaryllidaceae]; HY/HT/HAU/1603/2018	<i>Diilap</i> (A), <i>Lepi</i> (Ap), <i>Diilap</i> (G), <i>Talap</i> (T), <i>Talap</i> (N)	Herbs	Tu, L	Food, medicine	i. Used as spice & vegetable ii. Used to cure Cold, cough & nausea
<i>Alstonia scholaris</i> R. Br. [Apocynaceae]; HT/HAU/1605/2019	<i>Popuk Siin</i> (N)	Tree	B	Medicine	Bark is used for treatment of sores and sores. Pinch of powdered bark is used for treatment of malarial fever.
<i>Angiopteris evecta</i> (G.Forst.) Hoffm. [Marattiaceae]; HY/HT/HAU/1606/2018	<i>Taba</i> (A), <i>Tari</i> (Ap), <i>Bakum</i> (G), <i>Nabay/Bom</i> (N), <i>Tabii/ Tach</i> (T)	Shrub	R	Famine food, medicine	i. Roots are made into paste and shed dried for 3-4 days and packed on leaves and cooked. ii. Anti-diarrhoeic and Anti-dysentery
<i>Artemisia indica</i> Willd. [Asteraceae]; HY/HT/HAU/1608/2018	<i>Kuklyu</i> (Ap.), <i>Tape-Nyobeng</i> (G), <i>Tapin</i> (N), <i>Tappen</i> (T),	Shrubs	L	Food, medicine	i. Vegetable ii. Leaves are kept in poultry baskets to repel pests and insects. iii. Inhaling strong smell of leaf relieves nose blockade and headache iv. Bathing with water diluted with its leaves relieves from itching & skin allergy v. Fresh juice from leaves is used for curing eye redness

Botanical Names	Vernacular Name	Habits	Part used	Type of use	Ethnic use
<i>Artemisia nilagirica</i> (C.B. Clarke) Pamp. [Asteraceae] HY/HT/HAU/1610/2018	<i>Kuklyu</i> (Ap), <i>Tappen</i> (T), <i>Tape-Nyobeng</i> (G), <i>Tapin</i> (N)	Shrubs	L	Food, medicine	i. Leaves used in stomach-ache and body pain. ii. Young aromatic leaves used as disinfectant
<i>Begonia roxburghii</i> (Miq.) A.DC. [Begoniaceae] HY/HT/HAU/1612/2018	<i>Sisi-Baying</i> (A), <i>Lukhu</i> (Ap), <i>Buku-Hurbu</i> (G), <i>Bakku yulu</i> (T), <i>Biku Yulu</i> (N)	Herb	S, R	Food, medicine	i. The stem is peeled and eaten ii. Root paste is used as a deworming agent
<i>Brassica juncea</i> (L.) Czern. [Brassicaceae]; HY/HT/HAU/1615/2018	<i>Pattu oin</i> (A), <i>Giyang Hamang</i> (Ap.), <i>Güiyi</i> (G), <i>Goying/Goi</i> (T), <i>Guyi O</i> (N),	Herb	L	Food	The leaves are used as vegetable
<i>Calamus acanthospathus</i> Griff. [Arecaceae]; HY/HT/HAU/1620/2018	<i>Taser</i> (Ap)	Climber	WP	Construction, rituals, crafts	i. House construction ii. Making accessories in Rituals and festivals iii. For crafting of traditional Baskets
<i>Calamus leptospathix</i> Griff. [Arecaceae]; HY/HT/HAU/1616/2018	<i>Tabh</i> (G)	Climber	WP	Construction, rituals, crafts	Used as roof for binding in house construction
<i>Capsicum annum</i> L. [Solanaceae]; HY/HT/HAU/1618/2018	<i>Sibol</i> (A), <i>Yobbu Terro</i> (Ap), <i>Yaluk</i> (G), <i>Yaluk</i> (G), <i>Hilup</i> (N)	Herb	F	Food, medicine	i. Important part of traditional food habit; it is taken raw, boil, as chutney and condiment ii. Taken to cure fever, cold and cough
<i>Capsicum chinense</i> Jacq. [Solanaceae]; HY/HT/HAU/1622/2018	<i>Maan mirsi/ Sibol mirsi/ Sibor mirsi</i> (A), <i>Tagin Terro</i> (Ap), <i>Nyipak mircha</i> (T), <i>Bongar Hilup</i> (N)	Herb	F	Food, medicine	i. It is taken raw and boil as chutney and condiments ii. Taken to cure fever, cold and cough
<i>Clerodendrum glandulosum</i> Lindl. [Lamiaceae]; HY/HT/HAU/1623/2018	<i>Ongin</i> (A), <i>Pato Hamang</i> (Ap), <i>Oin</i> (G), <i>Tiipin potho</i> (N)	Shrub	L	Food, medicine	i. Decoction of leaves is used for lowering high Blood pressure ii. Consumed as vegetable
<i>Crassocephalum crepidioides</i> (Benth.) S.Moore [Asteraceae]; HY/HT/HAU/1625/2018	<i>Gende/ibel</i> (A) <i>Genda Hamang</i> (Ap), <i>ling-Kayeng</i> (T), <i>Gendu</i> (G), <i>Yamin O</i> (N)	Herb	WP	Food, medicine	i. Leaf paste is used to cure cuts and wounds ii. Decoction of the plant is used to cure insomnia iii. Whole plant is used as a vegetable
<i>Cucumis melo</i> L. [Cucurbitaceae]; HY/HT/HAU/1621/2018	<i>Asi Tapa</i> (A), <i>Tape Hamang</i> (Ap), <i>Patum</i> (G), <i>Tapèh</i> (T) <i>Tapeh</i> (N)	Climber	L, F	Food	i. Leaves taken as vegetable ii. Fruits are cooked and consumed

Botanical Names	Vernacular Name	Habits	Part used	Type of use	Ethnic use
<i>Cucumis sativus</i> L. [Cucurbitaceae]; HY/HT/HAU/1622/2018	<i>Makung (A), Taku (Ap), Meku (G), Meku (T), Muku (N)</i>	Climber	F	Food	Fruit is eaten raw as a salad
<i>Dendrocalamus hamiltonii</i> Nees & Arn. ex Munro [Poaceae]; HY/HT/HAU/1624/2018	<i>Ea (A), Yai byapu (Ap), Eh Henu (T), Diba (G), Hej (N)</i>	Grass	S, YS	Food, rituals	i. Young shoots are used as vegetable ii. Shoots fermented are used to prepare ikhu/Hikhu/Hiyup iii. Stem is also used in marriage ceremony and customary Rituals
<i>Dioscorea bulbifera</i> L. [Dioscoreaceae]; HY/HT/HAU/1627/2019	<i>Egin (A), Huli- Hula (Ap), Egin Tabi/Ejo (G), Hiili (T), Hes (N)</i>	Climber	B, L	Food, fodder	i. Bulb are either roasted or boiled and taken as food and vegetable. ii. Leaves are used as fodder
<i>Diplazium esculentum</i> (Retz.) Sw. [Athyriaceae]; HY/HT/HAU/1630/2019	<i>Takang (A), Hiika Hamang (Ap), Taka (G), Pakya-Raya (T), Taka paya (N)</i>	Fern	Fr	Food	The tender fronds are boiled and used as a vegetable
<i>Eryngium foetidum</i> L. [Apiaceae]; HY/HT/HAU/1632/2019	<i>Ori, Ori-ritak, migom- ori (A), dhuniyapatta (Ap), Rithak (G), Nyipak Dhania (T), Jongli Dhaniya (N)</i>	Herbs	L	Food	Leaves used in chutney, salad and boiled food
<i>Glycine max</i> (L.) Merr. [Fabaceae]; HY/HT/HAU/1636/2019	<i>Rontung (A), Potung perung (Ap), Yagya (G), Peren (N)</i>	Shrubs	S	Food	Seeds are consumed after boiling and fermented seeds are eaten chutney.
<i>Houttuynia cordata</i> Thunb. [Saururaceae]; HY/HT/HAU/1634/2019	<i>Roram, Reram (A), Siiya Hamang (Ap), Moyumkneme (G), Hiingya (T) Hongyea/ Tadar O/Hiiya (N)</i>	Herbs	WP	Food, medicine	i. Eaten raw for indigestion, and Chutney making. ii. Use for treating chest, lung and skin inflammation, and stomach ulcer.
<i>Impatiens racemosa</i> DC. [Balsaminaceae]; HY/HT/HAU/1659/2019	<i>Nanor tangkor (A), Aki tai Hamang (Ap.), Nyamchi (G), Nyamche (T), Choyom (N)</i>	Herb	L	Food	Leaves are boiled and consumed as vegetable
<i>Ipomoea batatas</i> (L.) Lam. [Convolvulaceae]; HY/HT/HAU/1637/2019	<i>Egin tarii (A), Mita Alu (Ap.), Ramya/Karya- Riyamiya (T), Egin Pagre (N)</i>	Vine	Tu	Food	Tubers are either roasted or boiled and taken as food
<i>Litsea cubeba</i> (Lour.) Pers. [Lauraceae]; HY/HT/HAU/1639/2019	<i>Tayer Rajil /Taier /rayil (A), Santero (Ap),</i>	Tree	F	Food, medicine	i. Fruit is used as a condiments in curries and chutney ii. Fruits eaten as a remedy to cold and cough.

Botanical Names	Vernacular Name	Habits	Part used	Type of use	Ethnic use
<i>Litsea cubeba</i> (contd.)	<i>Tayer/ Ischi takke ame (G), Tayir (T), Sin-ter (N)</i>				iii. Oil is used for curing joint and muscle pain, relieve tissue inflammation, high blood pressure and insomnia.
<i>Mikania micrantha</i> Kunth [Asteraceae]; HY/HT/HAU/1644/2019	<i>Sina lota/ Mali Rimang (A), Manii Tami (Ap), Lindetare (G), Gandi Ter (N)</i>	Climber	L	Medicine	Paste of leaves and stem is used for healing wounds or clotting of blood.
<i>Panax arunachalensis</i> M.Taram, A.P. Das & H.Tag [Araliaceae]; MT/HT/1505/2018	<i>Mud Pigri (N) Zansang (Ap) Gainsing (A) Pagru (T) Miitum angina (G)</i>	Herb	R	Medicine	Powdered rhizome are used for treatment of chest inflammation, lung inflammation, fatigue, boil and sores, mouth ulcer and apply in cut wound.
<i>Panax bipinnatifidus</i> Seem. [Araliaceae]; HT/SK/HAU/1542/2017	<i>Mud Siw Pigri (N), Zansang (Ap), Gainsing (A), Pagru (T), Miitum angina (G)</i>	Herb	R	Food, medicine	Rhizome are used as herbal drink as health tonic. Dried rhizome powder are used for treatment of stomach ulcer, boil and sores, mouth ulcer chest inflammation.
<i>Panax bipinnatifidus</i> var. <i>angustifolius</i> (Burkill) J.Wen [Araliaceae]; HT/SK/HAU/1597/2018	<i>Mud Siw Pigri (N), Zansang (Ap), Gainsing (A), Pagru (T) Miitum angina (G)</i>	Herb	R	Food, medicine	Ripen fruits eaten raw. Powder of slice cut rhizome are used as herbal tea to boost stamina. Pinch of powder are used for treatment of chest inflammation, boil and sores, mouth ulcer.
<i>Paris polyphylla</i> Sm. [Melanthiaceae]; HT/HAU/1557/2017	<i>Mutum Enge, Tabu Billo (N), Nyomrang Takeng, Orpo & Kangkom Oying (A)</i>	Herb	R	Food, medicine	The leaves and fruits are edible. The smoked dried tuber is used for treatment of debility and boil and sores, skin inflammation, chest inflammation.
<i>Phoebe cooperiana</i> P.C.Kanjilal & Das [Lauraceae]; HY/HT/HAU/1642/2019	<i>Tapir (A), Hisir (G), Samper (Ap), Sechar (T), Jishir (N)</i>	Tree	F	Food, medicine	i. Fruit eaten raw as a Chutney ii. Fruit also boiled as food and to improve liver function, relieve insomnia and high blood pressure. iii. Pulp applied on inflamed burnt skin as anti-inflammatory agent
<i>Piper pedicellatum</i> C.DC. [Piperaceae]; HY/HT/HAU/1646/2019	<i>Lorii (A), Rare/ Raru (Ap.), Rer (G), Yarii (T), Raar/Ler O (N)</i>	Shrub	L	Food, medicine	i. Consumed as vegetable ii. It is also consumed to relieve high blood pressure.
<i>Rubus ellipticus</i> Sm. [Rosaceae]; HY/HT/HAU/1647/2019	<i>Pakkom Tayin (A), Jiling ayi / Jilyun (Ap), Tae (T)</i>	Shrub	F	Food	Fruit is eaten raw
<i>Saccharum spontaneum</i> L. [Poaceae]; HY/HT/HAU/1642/2019	<i>Tapi (A), Peji Paelo (Ap)</i>	Shrubs	WP	Ritual, construction	i. Whole plant is used in different rituals and used to cure insomnia ii. House construction iii. Mat making
<i>Saurauia punduana</i> Wall. [Actinidiaceae]; HY/HT/HAU/1649/2019	<i>Taan (A), Enchi (G), Hinch (T), Nyinch (N)</i>	Tree	WP	Ritual	Whole plant are considered to be sacred and is used in rituals. Berry are edible.

Botanical Names	Vernacular Name	Habits	Part used	Type of use	Ethnic use
<i>Solanum aethiopicum</i> L. [Solanaceae]; HY/HT/HAU/1653/2019	<i>Kopii (A), Byako (Ap), Kope (G), Kesia Bake (T), Byak (N)</i>	Herb	F	Food, medicine	Fruits are boiled and consumed as Chutney or vegetable
<i>Solanum americanum</i> Mill. [Solanaceae]; HY/HT/HAU/1656/2019	<i>Okomamang (A), Hiiro Hamang (Ap), Or-Re (G), Hor O (T & N)</i>	Herb	L, F	Food, medicine	i. Leaves are boiled and consumed as vegetable and also used for curing Diabetes, stomach pain and cough ii. Ripe fruit are eaten raw
<i>Solanum torvum</i> Sw. [Solanaceae]; HY/HT/HAU/1654/2016	<i>Kodu/Kopii Piuro (A), Mishang Byako (Ap), Baak (G), Sete Bake (T), Pata Byak (N)</i>	Herb	F	Food, medicine	i. Fruits are cooked and made into paste and consumed as Chutney ii. Boiled fruits are used against diabetes and stomach disorder
<i>Solanum tuberosum</i> L. [Solanaceae]; HY/HT/HAU/1652/2019	<i>Aalu (A, Ap., G, T, N)</i>	Herb	T	Food	Tubers are either roasted, boiled or fried and taken as food
<i>Solanum anguivi</i> Lam [Solanaceae]; HY/HT/HAU/1657/2019	<i>Kopii Pümiik (A), Adi Byako (Ap), Adi Baak (G), Adi Baake (T), Adi Byak (N)</i>	Herb	F	Food, medicine	i. Fruits are boiled and made into paste and consumed as Chutney ii. Boiled fruit used against diabetes and stomach disorder
<i>Zanthoxylum rhetsa</i> (Roxb.) DC. [Rutaceae]; HY/HT/HAU/1661/2019	<i>Ombe or ombeng, Ongar (A), Yakhung (Ap), Hiibe/ Onyor (G), Honyor (T), Honyir (N)</i>	Tree	L, F	Food, medicine	i. Leaf are boiled and consume as vegetable and seasoning ii. Fruits are used for fish poisoning
<i>Zingiber officinale</i> Roscoe [Zingiberaceae]; HY/HT/HAU/1533/2018	<i>Takeng (A), Taki (Ap), Takkeh (G), Tak-Kesi (T), Takq (N)</i>	Herb	R	Food, medicine	i. Used as a condiment ii. Taken raw to cure fever, headache, cold and cough

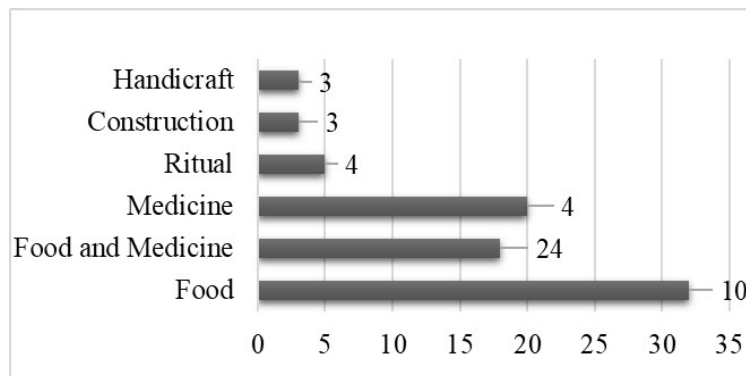


Figure 6. Diversity of ethnobotanical uses of plants (45 spp.) in *Abotani* Biocultural Landscape (ABL) in Arunachal Pradesh

Harvesting and utilization of plants parts

Of the total 45 species of angiosperm reported from the *Abotani* Biocultural Landscape (ABL), it has been observed that the leaves were most frequently harvested plant parts (15 spp.), while fruits are harvested from 13 species, whole plant used are harvested from 7



PLATE - I. Some significant ethnobotanical plants of *Abotani* tribes of Arunachal Pradesh: **A.** *Solanum anguivi*; **B.** *Solanum americanum*; **C.** *Solanum torvum*; **D.** *Clerodendrum glandulosum*; **E.** *Ipomoea batatas*; **F.** *Crassocephalum crepidioides*; **G.** *Begonia roxburghii*; **H.** *Piper pedicellatum*; **I.** *Capsicum chinense*; **J.** Interaction with local informants; **K.** Local tribal women selling organic vegetable; **L.** Collection of ethnobotanical plants in the field with potential local informants.

species, rhizome part used are harvested from 7 species, tuber and seed parts used are harvested from 3 species, and bark (2 spp.), frond and young shoot parts used are harvested from single species (Figure 7).

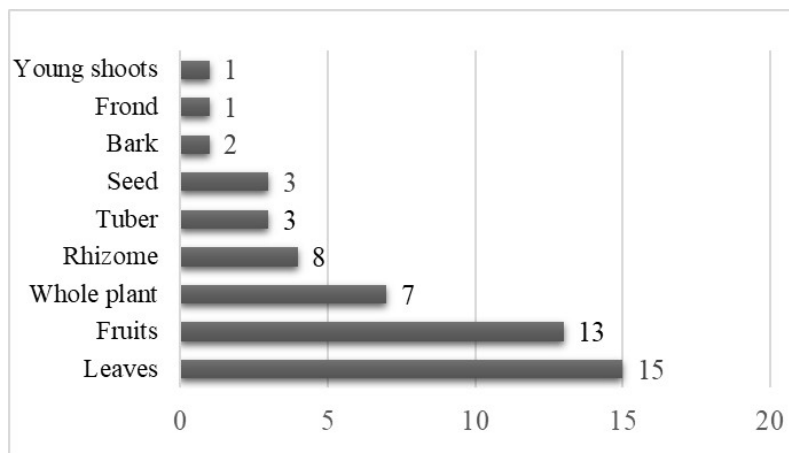


Figure 7. Diversity of plant parts harvested from significant ethnobotanical species of the *Abotani* Biocultural Landscape (ABL) in Arunachal Pradesh



Figure 8. Cross use of 38 species (out of total 45 spp.) of food and medicinal plants reported from the *Abotani* Biocultural Landscape in Arunachal Pradesh

Ethnopharmacological uses

Of the 45 ethnobotanically useful plant species reported, almost 24 species (50 %) are found to be used in traditional folk medicine for treatment of different ailments and diseases such as Diabetes, fever, stomach disorder, cold, cough, wounds, cuts etc. Majority of the species reported are used as both food and medicinal agents whereas only 04 species are exclusively used as medicine and 10 species are exclusively used as food (Fig.8). Some of the ethnopharmacologically significant species reported from the Abotani Biocultural Landscapes (ABL) are *Acorus calamus*, *Ageratum houstonianum*, *Allium hookeri*, *Alstonia scholaris*, *Angiopteris evecta*, *Artemisia indica*, *Artemisia nilagirica*, *Begonia roxburghii*, *Houttuynia cordata*, *Litsea cubeba*, *Mikania micrantha*, *Paris polyphylla*, *Panax bipinnatifidus*, *Panax bipinnatifidus* var. *angustifolius*, *Panax arunachalensis*, *Phoebe cooperiana* and *Zanthoxylum rhetsa*.

Species used for local food security

The five tribes, namely, *Nyishi*, *Adi*, *Galo*, *Apatani* and *Tagin* residing in the Abotani Biocultural Landscapes (ABL) of Arunachal Pradesh are solely dependent on natural resources from community forest land and agricultural land for the food and livelihood security.

Of the 45 angiosperm species reported from their respective biocultural landscape, the majority of 32 (80%) species reported are used for ensuring local food security. These species are either cultivated or harvested from the wild, and the most frequently used species are cultivated in traditional home garden and jhum plots whereas the wild edible vegetables and tubers are occasionally harvested from the community forest land as supplementary food items. The nutritionally and commercially viable local food plants reported to be available in the traditional biocultural landscape of *Abotani* tribes are *Piper pedicellatum*, *Solanum aethiopicum*, *Solanum americanum*, *Solanum torvum*, *Solanum violaceum*, *Solanum tuberosum*, *Zingiber officinale*, *Acmella oleracea*, *Acmella paniculata*, *Capsicum annum*, *Capsicum annum* hybrid, *Capsicum frutescens*, *Clerodendrum glandulosum*, *Crassocephalum crepidioides*, *Houttuynia cordata*, *Litsea cubeba*, *Zanthoxylum rhetsa*, *Brassica juncea*, *Cucumis melo*, *Cucumis sativus*, *Eryngium foetidum*, *Glycine max*, *Begonia roxburghii*, and *Dendrocalamus hamiltonii*.

Species used in local rituals and other purposes

The *Abotani* groups of tribes of Arunachal Pradesh have both theoretical and practical dimension knowledge and skills related to effective conservation and sustainable utilization of the plant bioresources of their traditional biocultural landscape. Some of the plant species recorded are also used for construction, handicrafts and even used to performing traditional rituals during indigenous socio-cultural occasion such as local rituals, festival and marriage ceremony. Some of the culturally significant plant species used by the 05 tribes are *Calamus leptospadix*, *Calamus acanthospathus*, *Saccharum spontaneum*, *Saurauia punduana* and *Dendrocalamus hamiltonii*.

CONCLUSION

It is concluded that the *Abotani* tribes of Arunachal Pradesh are rich in forest, agricultural and ethnobotanical resources. These tribes have both theoretical and practical dimension knowledge and skill related to effective conservation, harvesting and sustainable utilization of the significant ethnobotanical resources found in their traditional biocultural landscape which is worth learning and emulating. The diversity of ethnobotanical plant species used by the *Abotani* tribes of 11 districts ranges from food, medicinal and traditional ethnopharmacology to ritual, handicraft and house construction. All the 45 species reported from *Abotani* Biocultural Landscape (ABL) are commonly and frequently used by all the 05 *Abotani* tribes which are mostly found in tropical and subtropical climatic regime while few species are found to grow in temperate climatic regime. The food and medicinal plants frequently harvested are economically and commercially profitable species which can be further encouraged and be promoted in the rural localities for food, nutritional and medicinal security. Conservation of these significant ethnobotanical species in the community forest land and jhum land should be encouraged through village level stakeholders for ensuring sustainable and stable harvesting and supply chain of food, medicinal and cultural raw materials in the market.

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