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Ethnobotanical survey of spices and condiments used by some tribes of Arunachal Pradesh

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Abstract
Spices and condiments increase the palatability of food by adding flavour, aroma and colour to the food. The present study was carried out on Adi, Apatani, Galo and Nyishi tribes of Arunachal Pradesh. The data was collected from randomly selected 20 households from each village and a total of 120 informants were selected from each tribe. A total of 52 species belonging to 22 families and 35 genera were documented which were used as spices and condiments by selected tribes of Arunachal Pradesh. Maximum number of plants were used as spices and condiments by Adi (26 spp.) followed by Nyishi (24 spp.), Apatani (23 spp.), Galo (22 spp.). The plants belonging to families Amaryllidaceae, Lauraceae and Rutaceae were mostly used as spices and condiments. Herbs were mostly used as spices and condiments followed by trees and shrubs. The study revealed that leaves were most preferred part as spices and condiments than other plant parts. Flavouring was the most important category of spices and condiments among all tribes. Cultural importance index was maximum in *Litsea cubeba* and *Capsicum chinense*.

Keywords: Arunachal Pradesh, cultural importance index, ethnobotany, spices and condiments, tribes

1. Introduction
The terms spice and condiment are applied to a natural plant or vegetable products and mixture used in whole or ground form to enhance the flavour, aroma and piquancy of food [1]. There are different definitions of spices and condiments. “Spices are plant parts like seed, bark, berries, buds, floral parts, fruits, kernels, leaves, rhizome, latex etc”, which impart strong flavor or aroma to food or drinks [2]. These aromatic vegetable substances are used in the whole, broken or ground form to season food rather than nutrients [3].On the other hand, condiments are usually a combination of herbs and spices blended in a liquid form. They are prepared food compounds having the mixture of one or more spices or spice extracts and are added to the food [4]. Condiments are prepared food, mainly preserved or fermented used in variable quantities depending on diner’s taste [5]. According to International organization for standardization (ISO), spices and condiments do not show any clear cut division. Hence, they are clubbed together under one term ‘spices and condiments’ and are mainly used for flavouring, seasoning, meat preparation, bakeries, confectionaries and other food processing and packing industries.
North East India is rich in ethnic and cultural diversity. There are about 220 ethnic communities in this region [6]. It is also one of the mega biodiversity region in the world and has the richest reservoir of plant diversity supporting about 50% of India’s biodiversity [7]. Most of the ethnic communities residing in hills and slopes form small or isolated villages. The ethnic people mostly depend on natural resources from the nearby forest for their food, livelihood and ailments. They are repository of indigenous knowledge system belonging to agriculture, food, medicine etc. As they have very good knowledge of their natural resources, the local crops, wild plants, ethnic vegetables and indigenous fruits are mainly used in their local diet for food [8]. They use a variety of plants in ethnic food for flavoring, seasoning, coloring and sometime for preservation [9, 10].
An examination of literature reveals that there is limited information on ethnobotanical studies of spices and condiments used by tribes of Arunachal Pradesh. Species namely *Illicium griffithii, Cinnamomum tamala, Allium sativum, Houttuynia cordata, Mentha arvensis, Zingiber officinale* were documented as spices in Arunachal Pradesh [11]. On the other hand, the use of 9 *Allium* species as dried condiments and spices from different tribes of Arunachal Pradesh were reported [12].

The aim of the present study is to document ethnobotanical knowledge on plants used as spices and condiments and to identify the most important spice and condiment plants used by selected tribes of Arunachal Pradesh.

2. Materials and Methods

2.1 Study area

Arunachal Pradesh is located between 26° 28' to 29° 30' N latitude and 91° 30' to 97° 30' E longitude. It covers an area of 83,743 sq. km and shares international borders with Bhutan in the West, Myanmar in the East, and China in the North, Assam and Nagaland to the South. Arunachal Pradesh is a home of 26 major tribes [13]. Major tribes of Arunachal Pradesh are Adi, Apatani, Nyishi, Galo, Khampti, Khowa, Mishmi, Idu, Taroan, Momba, Sherdukpen, Singpho, Hrusso, Tagin, Khamba etc. The present study was carried out on four tribes namely Adi, Apatani, Galo and Nyishi from Papum Pare, East Siang, West Siang and Lower Subansiri districts of Arunachal Pradesh (Fig.1). These tribes were dominant in selected districts. For each ethnic community 4-5 villages were selected. Thus, a total of 19 villages namely Balek, Gunne, Mirku, Sibut, Hari, Hija, Hong, Pamluk, Raga, Abotani, Lekhi village, Papu II, Rono Basti, Tarajuli, Darka, Kabo village, Mugli pagyor, Pobdi, Zirdin were selected for the present investigation. A total of 20 households were selected randomly from each village.

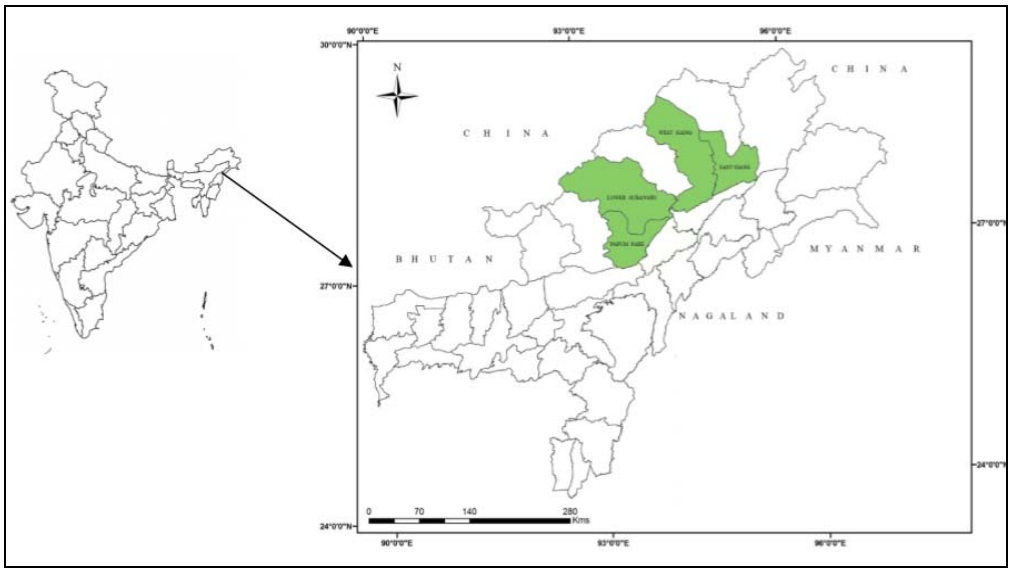

Fig 1: Map of study area.

2.2 Data collection

Continuous field surveys were conducted for three years from 2012 to 2015 for data collection on regular basis. Specimens were mostly collected from the forest areas on the basis of information given by the local guides, informants and common uses. Periodic visits covering all the seasons were made to collect specimens of some wild spices and condiment plants. Various discussions were made formally and informally with the knowledgeable persons like village elders, gaon burahs and women for gathering information on spices and condiments. Knowledgeable informants were selected with the help of administrative authority and village headmen. Interviews were taken from 120 villagers of each tribe. Indigenous knowledge, festivals and various rituals performed were observed and the information on use of plants in food preparation during ceremonies was collected for each tribe during the survey. Identification of these plants was done by visiting the herbaria of BSI (Itanagar), BSI (Kolkata) and also through consultation of taxonomic literature and Floras. The voucher specimens were deposited in the Department of Forestry, NERIST, Nirjuli, Arunachal Pradesh.

The collected spices and condiments plant species were divided into four categories i.e. flavouring, seasoning, colouring and preservation on the basis of ethnobotanical knowledge of selected tribes. Cultural importance index was determined to estimate the cultural significance of species [14].

3. Results and discussion

The present study revealed a total of 52 species belonging to 22 families and 35 genera which were used as spices and condiments by selected tribes of Arunachal Pradesh (Table 1). Among them, Adi utilized maximum number of plants as spices and condiments (26 spp.) followed by Nyishi (24 spp.), Apatani (23 spp.), Galo (22 spp.) in Arunachal Pradesh (Fig. 2). During field survey, it was observed that tribes of Arunachal Pradesh used maximum semidomesticated plants as spices and condiments. They have started cultivation of spice and condiment plants along with other crops in jhum lands, but they are still dependent on forest resources.

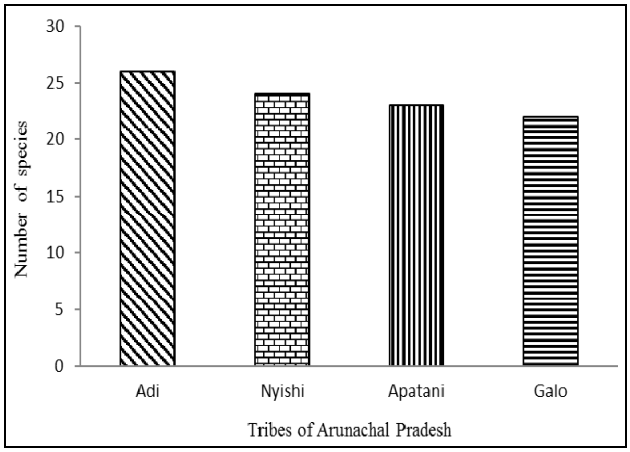

Fig 2: Spices and condiments used by tribes of Arunachal Pradesh.

Table 1: Plant species used as spices and condiments by tribes of Arunachal Pradesh.

Sl. No.	Scientific name	Family	Locale name	Part Used	Habit	Use categori	Utilization pattern
1.	*Acmella paniculata* (Wall. ex DC.) R. K. Jansen	Asteraceae	Adi shena (A), Marsa (G), Marsang (N)	L, Ys, In	H	Fl	Chutney and boiled food preparation
2.	*Allium cepa* L.	Amaryllidaceae	Piyaj (Ap)	L, Rh	H	Fl, Se	Boiled food, salad and chutney
3.	*Allium chinense* G. Don.	Amaryllidaceae	Dilab/mirrong (A), Talap (N)	L, Rh	H	F, Se	Boiled food and salad
4.	*Allium hookeri* Thwaites	Amaryllidaceae	Disang-talap (A), Lepi/Taley (Ap), Dilap (G), Talap (N)	L, Rh	H	Fl, Se	Fritters salad and chutney, curries, fried egg,
5.	*Allium rubellum* M. Bieb.	Amaryllidaceae	Talap (N)	L, Rh	H	P, Fl	Chutney and meat preservation
6.	*Allium sativum* L.	Amaryllidaceae	Jilap (A), Lasun (Ap)	L, Rh	H	F	Chutney and boiled food
7.	*Allium tuberosum* Rottler ex Sprengel	Amaryllidaceae	Tale (Ap), Talap (N)	L	H	Fl, Se	Chutney, salad, fritters and boiled foods
8.	*Amomum subulatum* Roxb	Zingiberaceae	Jepo(A)	F	H	S	Meat curry
9.	*Brassica juncea* (L.)Czern.	Brassicaceae	Tulang/tuka (A)	L, S	H	Fl	Fermented seeds make chutney and leaves make salad
10.	*Capsicum annuum* L.	Solanaceae	Nyamdak/pichak nyamday (N), Tero (Ap),	F	Sh	S, Fl	Boiled food, chutneys and also used in making pickle
11.	*Capsicum chinense* Jacq.	Solanaceae	Sibol (A), Mane yaluk (G), Yaluk (N)	F	Sh	C, Fl	Boiled food, chutney and pickles
12.	*Cardamine hirsuta* L.	Brassicaceae.	Pade-hama (Ap)	L	H	Fl, Se	Chutney and salads
13.	*Cinnamomum bejolghota* (Buch.-Ham.) Sweet	Lauraceae	Pode (G)	L, Br	T	Fl	Tea and meat curry
14.	*Cinnamomum camphora* (L.) J. Presl	Lauraceae	Bambe (N)	L, F	T	Fl	Tea and meat curry
15.	*Cinnamomum tamala* (Buch.-Ham.) T. Nees & Eberm.	Lauraceae	Rapi ising/ Jongkeng asing/Sepiriang (A)	L	T	Fl	Meat curry
16.	*Cinnamomum verum* J. Presl	Lauraceae	Hitipo-ri (A)	L, Br	T	Fl, Se	Curries
17.	*Coriandrum sativum* L.	Apiaceae	ori(A)	L,S	H	S	Chutney
18.	*Dendrocalamus hamiltonii* Nees & Arnott ex Munro	Poaceae	Yayibyapu/Eni (A), Bamboo (N)	Ys	T	Fl	Boiled food
19.	*Eryngium foetidum* L.	Apiaceae	Hariyo, Ori, Ori-ritak, migom ori (A),dhaniyapatta (Ap), Rithak (G), Jongli Dhaniya (N)	L	H	Se, Fl	Chutney, salad and boiled food
20.	*Etlingera linguiformis* (Roxb.) R. M. Sm.	Zingiberaceae	Zakir (G)	Rh	H	Fl	Chutney
21.	*Garcinia pedunculata* Roxb. ex Buch.-Ham.	Clusiaceae	Liba (A)	F	T	Fl	Chutney
22.	*Glycine max* (L.) Merr.	Fabaceae	Rontung (A), Yanni (Ap), Yagya (G).	S	H	F	Fermented seeds make chutney and boiled food preparation
23.	*Gynura procumbens* (Lour.) Merr.	Asteraceae	Ogin tamin (G), Tamin (N)	Ys	H	Fl	Chutney
24.	*Hibiscus sabdariffa* L.	Malvaceae	Amta (A)	L, F	Sh	Fl	Chutney and jam making
25.	*Houttuynia cordata* Thunb.	Saururaceae	Roram, Reram, Zizi baying (A), Siiya hamang (Ap), Moyum-kneme (G), Hongyea (N),	L, Rh	H	Se, Fl	Chutney making
26.	*Hydrocotyle sibthorpioides* Lamk.	Araliaceae	Manni Ao (G)	L	H	Fl	Curries
27.	*Illicium griffithii* Hook.f. & Thomson	Schisandraceae,	Taihelang (Ap)	F	T	Fl	Tea and local drink
28.	*Litsea cubeba* (Lour.) Pers.	Lauraceae	Tayer Rajil /Taier /rayil (A), Santero (Ap), Tayer/ Ischi tak – ke ame (G), Earking, Jayar/tanam (N).	F	T	Se, Fl, P	Curries, chutiny and pickle
29.	*Litsea lancifolia* (Roxb. ex Nees) Fern.-Vill.	Lauraceae	Take more (G)	S, L	T	Fl	Chutney and salad
30.	*Magnolia oblonga* (Wall. ex Hook.f.& Thomson) Figlar	Magnoliaceae	Serio-asing/Salyo (Ap),	F	T	Fl	Chutney and boiled food
31.	*Mentha arvensis* L.	Lamiaceae	Pudinang (A), Podina (G)	L, Ys	H	Fl	Chutney
32.	*Murraya koenigii* (L.) Spreng.	Rutaceae	Narasingha (Ap)	L	T	Fl, C	Salad, chutney and boiled foods
33.	*Neocinnamomum caudatum* (Nees) Merr.	Lauraceae	Tej pat(N),	Br	T	Fl	Meat curry
34.	*Ocimum americanum* L.	Lamiaceae	Take - mareng/Tasing oying/Tare mareng (A)	L	H	Fl	Chutney and boiled foods
35.	*Ocimum basilicum* L.	Lamiaceae	Tulsi (G)	L	H	Fl	Salad
36.	*Oenanthe javanica* (Blume) DC	Apiaceae	Kebunamul / Babon (N)	Ys, L	H	Fl, Se	Boiled food and chutney
37.	*Paederia foetida* L.	Rubiaceae	Phadobas lodi / Paritaru/ gandhali (Apatani), Aape–tare (G),	L	Cl	Fl, C	Salad and boiled foods
38.	*Perilla frutescens* (L.) Britton	Lamiaceae	Namdung (A), Tining (Ap), Tanam –namdu (N),	S	Sh	Se, Fl, P	curries, soup, meat preservation, sweet dish, rice cakes and boiled foods
39.	*Persicaria nepalensis* (Meisn.) Miyabe	Polygonaceae	Ruri (A), Yarung (N), Roli hamang (Ap)	Ys	H	Fl	Chutney

40.	*Phoebe cooperiana* P. C. Kanjilal& Das.	Lauraceae	Sampor (Ap), Jishir (N), Hisir (G)	F	T	Fl, P	Chutney and meat preservation
41.	*Phyllostachys bambusoides* Siebold & Zucc.	Poaceae	Bije (Ap), Bamboo (N)	Ys	T	Fl	Boiled food, pickles
42.	*Piper mullesua* Buch.- Ham.ex D. Don	Piperaceae	Odor (A), Pinee (G)	In	Sh	Fl	Chutney
43.	*Piper nigrum* L.	Piperaceae	Jaluk (G)	Fr	Cl	Fl, Se	Boiled food
44.	*Sesamum indicum L.*	Pedaliaceae	Tanam –namcha (N)	S	Sh	Fl, Se	Boiled food, curries and rice cake
45.	*Spilanthes acmella* (L.) L.	Asteraceae	Yakho hamang (Ap)	Ys, In	H	F	Boiled and making chutney
46.	*Tamarindus indica* L.	Caesalpiniaceae	Imli (G),	F	T	Fl	Chutney and pickles
47.	*Zanthoxylum acanthopodium* DC.	Rutaceae	Ombe or ombeng, Ongar (A), Yakhung (Ap), Onyor (G).	F	Sh	Fl, Se	Boiled foods
48.	*Zanthoxylum armatum* DC.	Rutaceae	Trimal onger (A), Yakhung /Yorkhung (Ap), Rikon (G), Singlu/sente (N)	L, F	T	Fl	Boiled foods and chutney
49.	*Zanthoxylum oxyphyllum* Edgeworth	Rutaceae	Honyor (N), Nemba yorkhung (Ap)	Ys, L, F	T	Fl	Boiled foods
50.	*Zanthoxylum rhetsa* DC.	Rutaceae	Onger (A), honyor (N)	L, F	T	Fl, C	Boiled foods
51.	*Zingiber montanum* (J. Koenig) Link ex A. Dietr	Zingiberaceae	Kekir (A)	Rh	H	Fl	Chutney
52.	*Zingiber officinale* Roscoe.	Zingiberaceae	Jakeng (A), Sing taki (Ap)	Rh, L	H	Fl	Boiled food and curries

Abbreviation : A-adi, Ap-apatani, Br-bark, C-colouring, Cl-climber F-fruit, Fl-flavour, G- galo, H-herb, In-inflorescence, L-leaves, N-nyishi, P-Preservation, Rh- rhizome, S-seed, Se- Seasoning, Sh-shrub, T-tree, Ys- young shoot.

Most dominant families were Amaryllidaceae, Lamiaceae, Lauraceae, Rutaceae and Zingiberaceae in Adi tribe. Amaryllidaceae and Rutaceae were the most dominant families in Apatani tribe. Lauraceae was the most dominant family in Galo tribe and both Amaryllidaceae and Lauraceae were the dominant families in Nyishi tribe (Fig.3). The present study is in agreement with the findings of other workers [15-17] who reported families Zingiberaceae, Lamiaceae, Lauraceae and Amaryllidaceae with maximum number of spices from other states of North East India.

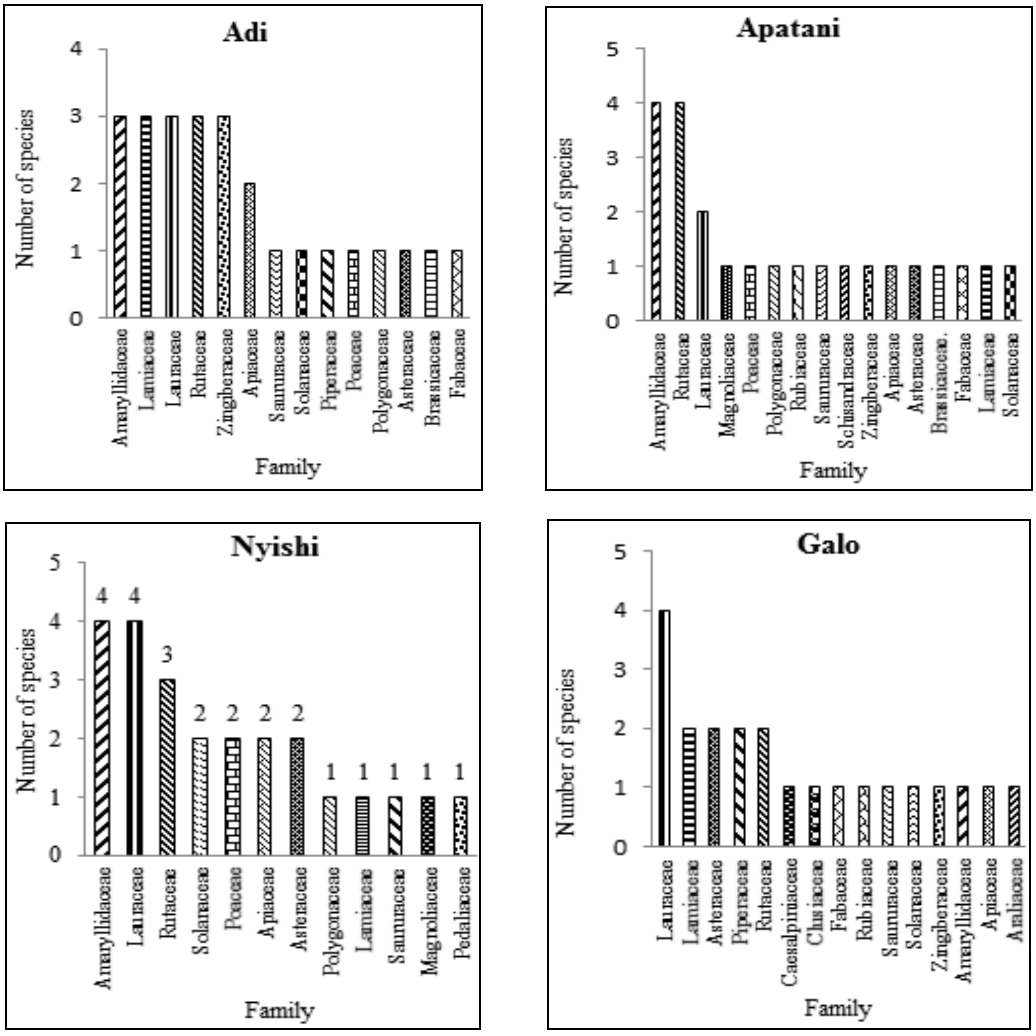

Fig 3: Number of species family-wise used as spices and condiments by tribes of Arunachal Pradesh.

The habitat wise grouping of the spices and condiments showed that herbs were most used than trees and shrubs by tribes of Arunachal Pradesh (Fig. 4). The maximum number of herbs were used by Adi (16 spp.) followed by Apatani and Nyishi (12 spp. each) and Galo (10 spp.). Herbs are mostly seasonal, easily available and rich in aroma may be the cause of using more number of herbs by these tribes.

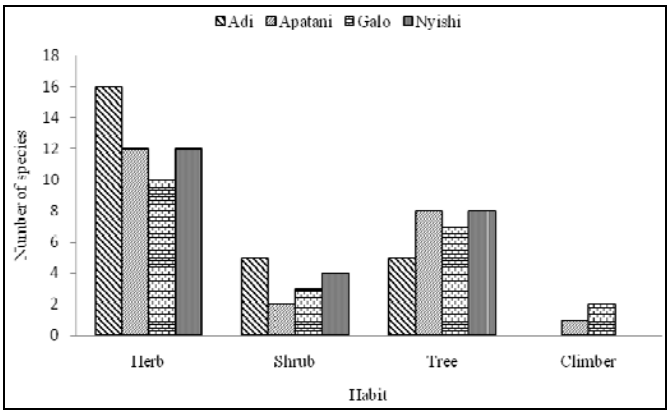

Fig 4: Habits of the spice and condiment plants used by tribes of Arunachal Pradesh.

Among Apatani, Galo and Nyishi tribes, leaves were used mostly followed by fruits, young shoots, rhizome, seed and bark. While in Adi tribe, use of leaves was followed by seeds, young shoots and rhizomes, fruits, inflorescence and bark (Fig 4). The present study showed that Apatani and Nyishi tribes did not use bark as spice and condiments. The maximum percentage of leaves used among all selected tribes may be due to presence of active secondary metabolites than other parts of the plants (Fig. 5). The present study is in agreement with the findings of other workers [15-17].

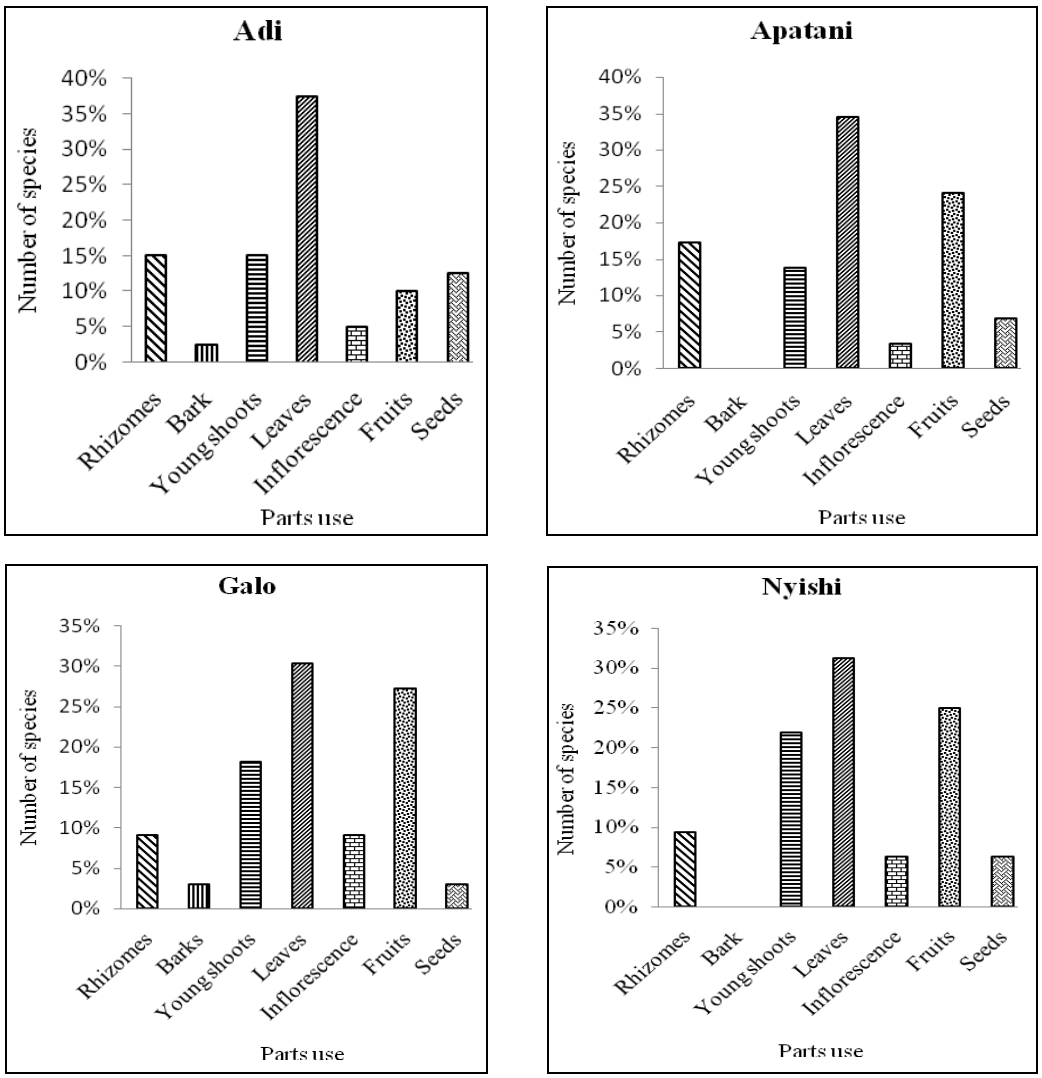

Fig 5: Plant parts of spices and condiments used by tribes of Arunachal Pradesh.

Spices and condiments were further divided into four categories on the basis of ethnobotanical knowledge of selected tribes. These categories were flavouring, seasoning, colouring and preservation. It was found that maximum number of plants species were used for flavouring followed by seasoning, preservation and colouring. Adi tribe used 20 species for flavouring, 7 species for seasoning and only one species for colouring. Apatani tribe used 23 species for flavouring, 9 species for seasoning, 2 species for colouring and one species for preservation. Galos used 22 species for flavouring, 3 species for seasoning and 1 species for colouring and 1 species for preservation respectively. Nyishis used 24 species as flavouring, 9 species for seasoning, 3 species for preservation and 2 species for colouring (Fig.6).

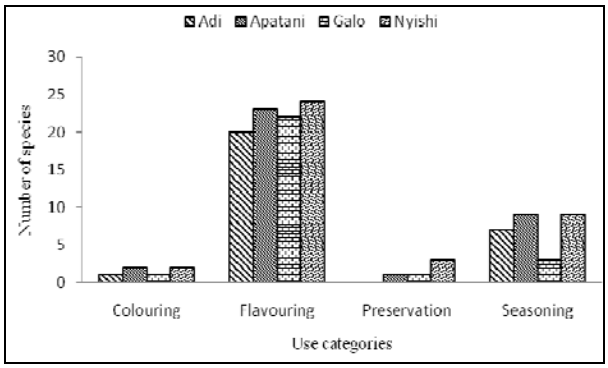

Fig 6: Ethnobotanical categories of spices and condiments used by tribes of Arunachal Pradesh.

The present investigation shows that some of the common plants like *Allium hookeri, Capsicum chinense, Eryngium foetidum, Litsea cubeba, Houttuynia cordata, Perilla frutescens, Phoebe cooperiana* and *Zanthoxylum armatum* are used for flavouring by tribes of Arunachal Pradesh (Plate 1). Mostly, *Curcuma longa* and *Capsicum chinense* are used to impart the colour to the food. During field survey, it is observed that leaves of *Zanthoxylum rhetsa are used* to impart both flavour and colour to meat and fish curries by Adi and Nyishi tribes. The leaves of *Zanthoxylum rhetsa* impart dark green colour to the non-vegetarian dishes. Apatanis add leaves of *Paederia foetida* to fish and meat curries which impart black colour to the cuisine. In addition, leaves of *Murraya koenigii* are used as a colour for non-vegetarian dishes by Apatani tribe. It shows that the tribal people have innovative ideas to improve the aroma and colour of boiled food. They use different plant parts for preserving meat and fish. The use of pericarp of *Phoebe cooperiana* by Galo and Nyishi tribes, fruits of *Litsea cubeba* by Apatani, seed of *Perilla frutescens* and bulbs of *Allium rubellum* by Nyishi show that they are also very skilled in utilizing their bioresources for preservation purpose.

Cultural importance index (CI) was evaluated to study the cultural importance of plants among different tribes. The results presented in Tables 2-5 showed category wise CI and total cultural importance index of 20 most relevent species used by selected tribes of Arunachal Pradesh

Plate 1: Spice and condiment plants used by tribes of Arunachal Pradesh (a-h): *Litsea cubeba* (a); Eryngium foetidum (b); *Allium hookeri* (c); *Capsicum chinensis* (d); *Perilla frutescens* (e); Houttuynia cordata (f); *Phoebe cooperiana* (g); Zanthoxylum armatum (h)

The results given in Table 2 showed that *Capsicum chinense* was the most culturally significant plant species with maximum CI value (1.38). *Litsea cubeba, Eryngium foetidum* and *Coriandrum sativum* score 2nd, 3rd and 4th ranks respectively depending on CI value. These species were used mainly for flavouring and seasoning. *Zanthoxylum rhetsa* was used only for flavouring and its rank is 5th in CI. Category wise *Capsicum chinense* shows highest value 0.92 in flavouring and *Litsea cubeba* 0.69 in seasoning and only one species (*Capsicum chinense*) was used by Adi tribe for colouring. There is no species under preservation category used by Adi tribe.

Table 2: Cultural importance index (CI) of 20 most relevant species used by Adi tribe.

Si. no.	Scientific name	Flavouring	Seasoning	Colouring	Preservation	CI
1.	*Capsicum chinense*	0.92	-	0.47	-	1.38
2.	*Litsea cubeba*	0.58	0.69	-	-	1.27
3.	*Eryngium foetidum*	-	0.94	-	-	0.94
4.	*Coriandrum sativum*	-	0.83	-	-	0.83
5.	*Zanthoxylum rhetsa*	0.82	-	-	-	0.82
6.	*Allium hookeri*	-	0.8	-	-	0.80
7.	*Houttuynia cordata*	-	0.79	-	-	0.79
8.	*Allium sativum*	0.78	-	-	-	0.78
9.	*Dendrocalamus hamiltonii*	0.78	-	-	-	0.78
10	*Perilla frutescens*	0.76	-	-	-	0.76
11.	*Zingiber officinale*	0.68	-	-	-	0.68
12.	*Ocimum americanum*	0.66	-	-	-	0.66
13.	*Acmella paniculata*	0.63	-	-	-	0.63
14.	*Amomum subulatum*	-	0.62	-	-	0.62
15.	*Piper mullesua*	0.59	-	-	-	0.59
16.	*Zanthoxylum armatum*	0.58	-	-	-	0.58
17.	*Cinnamomum zeylanicum*	0.54	-	-	-	0.54
18.	*Brassica juncea*	0.52	-	-	-	0.52
19	*Glycine max*	0.45	-	-	-	0.45
20.	*Mentha arvensis*	0.44	-	-	-	0.44

In Apatani tribe *Litsea cubeba* was culturally most important plant and score 1st rank with highest CI value 2.63 (Table 3). Since it is used by all Apatani people for flavouring and seasoning their food therefore, both categories showed highest value of CI i.e.1.In addition, it is also used for preservation. *Cardamine hirsuta, Allium hookeri, Eryngium foetidum, Allium cepa* score 2nd, 3rd, 4th and 5th rank respectively and mostly used for flavouring and seasoning. *Murraya koenigii* showed highest value in colouring category

Table 3: Cultural importance index (CI) of 20 most relevant species used by Apatani tribe.

Si. no.	Scientific name	Flavouring	Seasoning	Colouring	Preservation	CI
1.	*Litsea cubeba*	1.00	1.00	-	0.63	2.63
2.	*Cardamine hirsuta*	0.98	0.78	-	-	1.76
3.	*Allium hookeri*	0.78	0.78	-	-	1.57
4.	*Eryngium foetidum*	0.77	0.74	-	-	1.51
5.	*Allium cepa*	0.81	0.68	-	-	1.48
6.	*Perilla frutescens*	0.60	0.88	-	-	1.48
7.	*Houttuynia cordata*	0.69	0.58	-	-	1.27
8.	*Allium sativum*	0.92	-	-	-	0.92
9.	*Zanthoxylum armatum*	0.83	-	-	-	0.83
10	*Phyllostachys bambusoides*	0.77	-	-	-	0.77
11.	*Murraya koenigii*	0.26	-	0.47	-	0.73
12.	*Allium tuberosum*	0.34	0.34	-	-	0.68
13.	*Zingiber officinale*	0.59	-	-	-	0.59
14.	*Spilanthes acmella*	0.58	-	-	-	0.58
15.	*Glycine max*	0.48	-	-	-	0.48
16.	*Zanthoxylum acanthopodium*	0.23	0.23	-	-	0.45
17.	*Magnolia oblonga*	0.43	-	-	-	0.43
18.	*Phoebe cooperiana*	0.41	-	-	-	0.41
19	*Zanthoxylum oxyphyllum*	0.35	-	-	-	0.35
20.	*Paederia foetida*	0.08	-	0.21	-	0.29

Litsea cubeba also score 1st rank with CI 1.61 in Galo tribe (Table 4). *Eryngium foetidum, Capsicum chinense, Piper nigram, Phoebe cooperiana* score 2nd, 3rd, 4th and 5th positions. *Litsea cubeba* and *Eryngium foetidum* are used both for seasoning and flavouring. There is only one species namely *Capsicum chinense* under colouring category and one species namely *Phoebe cooperiana* under preservation category.

The results presented in Table 5 showed that *Litsea cubeba* also ranks 1st position in cultural importance index for Nyishi tribe. *Perilla frutescens, Allium chinense, Allium hookeri, Eryngium foetidum* score 2nd, 3rd, 4th and 5th ranks. Category wise, *Litsea cubeba* shows high value in flavouring category, *Allium chinense* for seasoning category, *Capsicum chinense* for colouring and *Phoebe cooperiana* for preservation.

The present study reveals that *Litsea cubeba* is the most cultural important plant as it is used by all the tribes except Adi. The highest score of *Litsea cubeba* show the diverse use of these species in maximum use categories (flavouring, seasoning and preservation) as spices and condiments.

Table 4: Cultural importance index (CI) of 20 most relevant species used by Galo tribe.

Sl. No.	Scientific name	Flavouring	Seasoning	Colouring	Preservation	CI
1.	*Litsea cubeba*	0.79	0.82	-	-	1.61
2.	*Eryngium foetidum*	0.72	0.82	-	-	1.53
3.	*Capsicum chinense*	0.83	-	0.63	-	1.46
4.	*Piper nigram*	0.58	0.58	-	-	1.16
5.	*Phoebe cooperiana*	0.58	-	-	0.54	1.12
6.	*Allium hookeri*	0.82	-	-	-	0.82
7.	*Acmella paniculata*	0.73	-	-	-	0.73
8.	*Mentha arvensis*	0.70	-	-	-	0.70
9.	*Houttuynia cordata*	0.69	-	-	-	0.69
10	*Litsea lancifolia*	0.63	-	-	-	0.63
11.	*Ocimum basilicum*	0.63	-	-	-	0.63
12.	*Glycine max*	0.59	-	-	-	0.59
13.	*Etlingera linguiformis*	0.45	-	-	-	0.45
14.	*Cinnamomum bejolghota*	0.38	-	-	-	0.38
15.	*Garcinia pedunculata*	0.30	-	-	-	0.30
16.	*Gynura procumbens*	0.23	-	-	-	0.23
17.	*Zanthoxylum armatum*	0.20	-	-	-	0.20
18.	*Piper mullesua*	0.19	-	-	-	0.19
19	*Hydrocotyle sibthorpioides*	0.13	-	-	-	0.13
20.	*Tamarindus indica*	0.11	-	-	-	0.11

Table 5: Cultural importance index (CI) of 20 most relevant species used by Nyishi tribe.

Sl. no.	Scientific name	Flavouring	Seasoning	Colouring	Preservative	CI
1.	*Litsea cubeba*	0.98	0.89	-	-	1.88
2.	*Perilla frutescens*	0.74	0.67	-	0.45	1.86
3.	*Allium chinense*	0.93	0.93	-	-	1.85
4.	*Allium hookeri*	0.83	0.83	-	-	1.66
5.	*Eryngium foetidum*	0.78	0.78	-	-	1.57
6.	*Phoebe cooperiana*	0.83	-	-	0.73	1.55
7.	*Capsicum chinense*	1.00	-	0.54	-	1.54
8.	*Zanthoxylum rhetsa*	0.83	-	0.40	-	1.23
9.	*Sesamum indicum*	0.61	0.49	-	-	1.10
10	*Houttuynia cordata*	0.94	-	-	-	0.94
11.	*Acmella paniculata*	0.82	-	-	-	0.82
12.	*Dendrocalamus hamiltonii*	0.81	-	-	-	0.81
13.	*Oenanthe javanica*	0.38	0.39	-	-	0.77
14.	*Zanthoxylum armatum*	0.70	-	-	-	0.70
15.	*Allium rubellum*	0.39	-	-	0.28	0.68
16.	*Zanthoxylum oxyphyllum*	0.60	-	-	-	0.60
17.	*Phyllostachys bambusoides*	0.42	-	-	-	0.42
18.	*Allium tuberosum*	0.19	0.1	-	-	0.29
19	*Magnolia oblonga*	0.29	-	-	-	0.29
20.	*Capsicum frutescens*	0.22	0.08	-	-	0.29

4. Conclusions

The aim of the present study to document the ethnobotanical knowledge on plants used as spices and condiments and to identify most important species. A total of 52 plant species belonging to 22 families and 35 genera were documented as spices and condiments by selected tribes of Arunachal Pradesh. Among them, Adi use maximum species followed by Nyishi, Apatani and Galo. Highest number of species used as spices and condiments are from families Amaryllidaceae, Lauraceae and Rutaceae. Herbs are mostly used as spices and condiments in Arunachal Pradesh. Among them Adi use maximum number of species followed by Apatani, Nyishi and Galo. Leaves are mostly used for flavouring, seasoning and colouring purposes than the other parts of the plant. Flavouring is the main category for which spices and condiments are mostly used. The cultural importance index of *Capsicum chinense* is highest (1.38) in Adi tribe. *Litsea cubeba* is the most cultural important plant in Apatani, Galo and Nyishi tribes respectively. The present study shows that a large number of spice and condiment plants are used by the tribes of Arunachal Pradesh to enhance the flavour and taste of their ethnic foods.

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