

## Original Research Article

# Ethnobotanical Uses of Legumes in the Papum Pare District of Arunachal Pradesh, India

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**Abstract:** The Leguminosae is one of the largest families of angiosperm with 18,000 species classified into around 650 genera and further classified under subfamilies Papilionoideae, Mimosoideae and Ceasalpinioideae. The largest genera reported are *Astragalus* with more than 2000 species, *Acacia* with more than 900 species and *Indigofera* with around 700 species. Other genera include *Crotalaria* with 600 species and *Mimosa* with 500 species. Due to its commercial, food, medicinal, aesthetic and socio-cultural values many leguminous species are being cultivated by the local tribes in Arunachal Pradesh beside their natural distribution. Here, an attempt was made for the survey and documentation of the native as well as exotic species of Leguminosae distributed along different forest types in the Papum Pare district of Arunachal Pradesh along with the ethnobotanical uses of each species by the local residents residing in the district. This study reported 43 species of Leguminosae which is classified under three subfamilies, namely: Papilionoideae, Mimosoideae and Ceasalpinioideae. Among 43 species reported, 10 species were tree, 12 shrubs, 10 species were climber & Liana and 11 species were herbaceous which is put into diverse ethnobotanical uses by the local residents (*Nyishi*) of the study sites.

**Key words:** Arunachal Pradesh, Ethnobotanical uses, Legumes, Nyishi community, Papum Pare

## Introduction

The forest of Arunachal Pradesh is known for housing a rich variety of flora. It is one of the richest states in Himalayan zone of India, in terms of biodiversity containing 40% of the floral and faunal species of India, many of which are endemic to the region. Out of 8000 flowering plants reported from the Himalayas, 5,000 species are found in the Northeast region (Chowdhery *et al.*, 1996). The Leguminosae is one of the dominant families found in the region. It is a large and economically important family of flowering plants commonly known as Legume family, pea family, bean family or pulse

family. The family is characterized by having trees, shrubs, or herbs, sometimes climbing or decumbent, very often bearing root-nodules that harbor nitrogen-fixing bacteria. The species of this family are found throughout the world, growing in various climatic conditions. Due to its commercial, aesthetic, socio-cultural value many Leguminosae trees are being cultivated besides their natural distribution. Perusal of literature revealed that very few works has been done on legumes of Eastern Himalaya (Kalita *et al.*, 2015). Due to its food, medicinal, aesthetic and socio-cultural values many leguminous

species are being cultivated by the local tribes in Arunachal Pradesh beside their natural distribution (Dash, 2009). Apart from the part publication made by the few workers on some selected genera such as *Desmodium* and allied genera by Dash & Singh (1998) and Dash (2009) from Sikkim and Arunachal Pradesh, no comprehensive taxonomic treatment are available till date on the other genera of Legumes of Arunachal Himalayan region of India

The family is divided into three subfamilies: Papilionoideae, Caesalpinioideae, and Mimosoideae, identified by their flowers. The Papilionoideae is the largest of the three subfamilies and the most widespread, extending farther into temperate regions. This subfamily can be easily recognized by its butterfly-like flowers. Most of the important legume crop species consumed by humans, including soybean, field pea, chickpea, field bean, and peanut are in this group.

The subfamily Caesalpinioideae is comprised of tropical or subtropical trees and shrubs. The useful products derived from this subfamily include edible fruits (*Tamarindus indica*), senna medicine (*Senna* spp.), hematoxylon red dye from the logwood tree (*Haematoxylon campechianum*), and resins used in paints, varnishes, inks, plastics, adhesives, and fireworks derived from the copal (*Copaifera* spp.) tree.

The subfamily Mimosoideae includes species of industrial, forage, browsing, and fodder importance, such as *Acacia* spp. (Bisby *et al.*, 2000). The Australian black-wood (*Acacia melanoxylon*) tree provides useful timber, and gum arabic from the tree of that name (*Acacia senegal*) is used in an array of industrial processes.

Leguminosae is a large and economically important family of flowering plants. The important agriculture plants, including *Glycine max*, which are among the best known members of Leguminosae. The study of legumes classification and biology over last 30 years has benefited in understanding the morphology, evolution, systematic and ecology of the family (Polhill, 1994; Lewis 2005). Most of this knowledge is recorded in the Vulnerable Advances in Legume Systematic series (Polhill and Raven, 1981). Legumes vary in habit from annual and perennial herbs to shrubs, trees, vines or lianas

and a few aquatic. Ranging in size from some of the smallest plants of deserts and Arctic, Alpine region to the tallest of the in forest trees, legumes are a conspicuous and often dominant, component of most of the vegetation types distributed throughout temperate and tropical regions of the world (Rundel, 1989). Their inhabitation for semi- arid to arid habitats is related to a nitrogen demanding metabolism. The fixation of atmospheric nitrogen via root nodulating rhizoidal bacteria is just one of several ways, in which legumes obtain high level of nitrogen to meet the demands of their metabolism (Sprent, 2005).

The present study deals with the survey and documentation of the native as well as exotic species of Leguminosae distributed along different forest types in the Papum Pare district of Arunachal Pradesh which is dominated by the *Nyishi* tribe. It also deals with ethnobotanical uses of the species by the local residents residing in the district.

## Materials and methods

### Study site

Present study site-Papum Pare district of Arunachal Pradesh of north-east India is located within geographical coordinates



Fig. 1. Map of the study area.

between 26°55' and 28°40'N latitude and longitude 92°40' and 94°2'E. It occupies an area of 2875 sq. km with total population of 17,6573 persons as per 2011 census. The entire region of Papum Pare district is mountainous forming a part of the Eastern Himalayas. The area comprises of a cross-section of the foothill region adjoining the border of Assam, the lower hills and the lofty mountain extending northwards (Anonymous, 2011).

### Field collection and Herbarium preparation

The collected specimen was pressed, dried and poisoned to avoid fungal and insects attack. It was mounted and labeled for identification. The standard methodology of Jain & Rao (1977) had been followed during field survey and the herbarium preparation.

### Characterization

The collected herbarium specimens were brought in the laboratory and the specimen was characterized by observing their morphological characters such as habitat, stem, phyllotaxy, venation, inflorescence flower, fruits etc.

### Identification

Identification of species was carried out with the help of taxonomic literature (eFlora of China, www.theplantlist.org; Flora of British India) and authenticated with herbarium specimens of Botanical Survey of India (ARUN), and SFRI (APFH), Itanagar. The voucher specimens were deposited in the Herbarium of Department of Botany, Rajiv Gandhi University (HAU), Rono Hills, Doimukh for future reference. The ethnobotanical survey was also carried out simultaneously in the above mentioned localities through interaction with knowledgeable local residents (*Nyishi*) to record medicinal, food and cultural uses of the selected species of Legumes encountered during field survey.

### Results

A total of 43 species of Legumes were recorded from the study sites, of which 10 species were trees, 12 species shrubs,

**Table 1.** Tree species (Leguminosae) recorded from the Papum Pare district of Arunachal Pradesh

Botanical Name	Sub family	Use
<i>Albizia arunachalensis</i> K.C. Sahni	Mimosoideae	Wood as local timber source; wood is also crafted for rice husking
<i>Albizia lebbek</i> (L.) Bentham;	Mimosoideae	Gum is used by local during skin allergy
<i>Albizia lucidior</i> (Steudel) I.C. Nielson;	Mimosoideae	Fire wood, fencing, ornamental
<i>Bauhinia purpurea</i> L.	Caesalpinoideae	Leaves are used as fodder. Bark used for dyeing and tanning.
<i>Bauhinia roxburghiana</i> Voigt;	Caesalpinoideae	Timber is used as house post
<i>Bauhinia variegata</i> L.	Caesalpinoideae	Leaves and flowers are used as vegetables; Wood is used as house post
<i>Cassia fistula</i> L.	Caesalpinoideae	Leprosy, heart disease and abdominal pain and as common laxative.
<i>Parkia roxburghii</i> G. Don	Mimosoideae	Vegetables
<i>Pongamia pinnata</i> L.	Papilionoideae	Bio-fuel crops.
<i>Tamarindus indica</i> L.	Caesalpinoideae	Fruits are edible.

10 species were climber & liana and 11 species were herbs. The highest number of species (15) were recorded from subfamily Papilionoideae and Caesalpinoideae followed by Mimosoideae (13 species). Of the total 24 genera reported, *Bauhinia* genus has highest number of 7 species followed by *Mucuna* with 4 species, and *Cassia* and *Crotalaria* with 3 species each.

**Table 2.** Shrub species (Leguminosae) recorded from the Papum Pare district of Arunachal Pradesh

Botanical Name	Sub family	Use
<i>Bauhinia vahlii</i> Wight & Arn	Caesalpinoideae	Seeds are edible.
<i>Bauhinia variegata</i> L.	Caesalpinoideae	Leaves and flowers are used as vegetables.
<i>Caesalpinia bonducella</i> (L.) Roxb	Caesalpinoideae	Leaves and seeds are medicinal.
<i>Caesalpinia crista</i> L.	Caesalpinoideae	Treat colic, leprosy etc.
<i>Cajanas cajan</i> L. Huth	Papilionoideae	Vegetables.
<i>Cassia alata</i> L.	Caesalpinoideae	Leaves used for ringworms infection.
<i>Codariocalyx motorius</i> (Houtt.) Ohashi.	Papilionoideae	As replacement tea leaf.
<i>Crotalaria pallida</i> Ait.	Papilionoideae	Roots relieve pain and stop bleeding
<i>Entada phaseoloides</i> (L.) Merr.	Mimosoideae	Roasted seeds are eaten and substitute for shampoo.
<i>Flemingia macrophylla</i> (Willd) Merr.	Papilionoideae	Contour hedgerows for erosion control.
<i>Senna alata</i> (L.) Roxbur	Caesalpinoideae	Leaf paste is used against ringworms
<i>Phyllodium pulchellum</i> (L.) Desv.	Papilionoideae	Grown as ornamental plant in home garden

**Table 3.** Herb species (Leguminosae) recorded from the Papum Pare district of Arunachal Pradesh

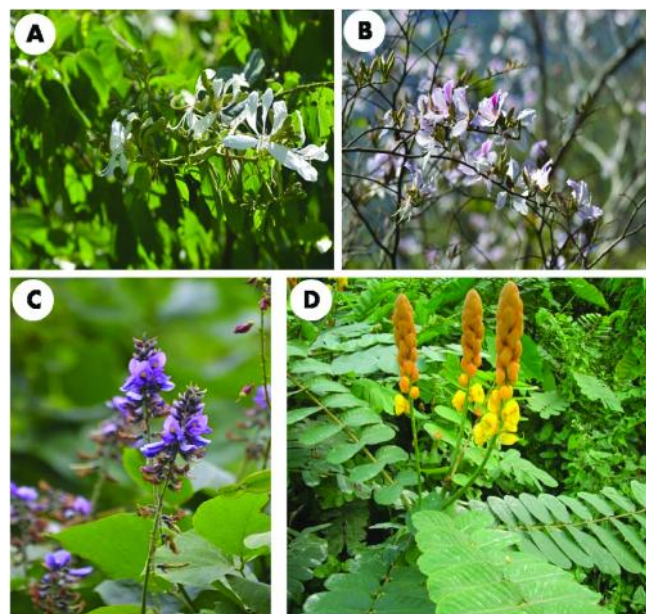
Botanical Name	Sub family	Use
<i>Cassia tora</i> L.	Caesalpiinoideae	Infusion of leaves and seeds low blood pressure particular during pregnancy.
<i>Crotalaria pallida</i> Aiton;	Papilionoideae	Root paste is used against bleeding and skin inflammation
<i>Crotalaria capitata</i> Bentham ex Lamark;	Papilionoideae	
<i>Glycine max</i> (L) Merr	Papilionoideae	Vegetable
<i>Lens culinaris</i> Medik;	Papilionoideae	
<i>Mimosa pudica</i> L.	Mimosoideae	Medicinal use like diabetics.
<i>Mucuna macrocarpa</i> Wallich.	Papilionoideae	Vegetable
<i>Mucuna pruriens</i> var. <i>utilis</i> (Wallich ex Wight)	Papilionoideae	Snakebite and antidepressant
<i>Senna tora</i> (Linnaeus) Roxburgh	Caesalpiinoideae	Infusion of leaves and seeds is used against low blood pressure during pregnancy
<i>Smithiagrandis</i> Baker;	Papilionoideae	
<i>Vigna mungo</i> (Linnaeus) Hepper;	Papilionoideae	Green immature pods are used as vegetable

The common genera encountered during field survey were *Albizia*, *Bauhinia*, *Crotalaria* and *Caesalpinia*. The most widespread species observed are *Bauhinia variegata*, *Bauhinia purpurea*, *Bauhinia scandens*, *Crotalaria pallida* and *Mimosa pudica*. These species are mostly found in open and degraded forests, road side, plantation sites and agricultural fields. A

**Table 4.** Liana & Climber species (Leguminosae) recorded from the Papum Pare district of Arunachal Pradesh

Botanical Name	Sub family	Use
<i>Bauhinia scandens</i> Linnaeus;	Caesalpiinoideae	Stem fiber is used for making ropes
<i>Bauhinia vahlii</i> Wight & Arnott;	Caesalpiinoideae	Seeds are edible; Stem fiber is used for making bow string
<i>Clitoria ternatea</i> L.	Papilionoideae	Pod is consumed as vegetable; Cultivated as ornamental climber
<i>Derris elliptica</i> (Wallich) Bentham;	Papilionoideae	Paste of root bark is used as Piscicidal
<i>Entadaphaseoloides</i> (L) Merrill;	Mimosoideae	Roasted seeds are used as substitute for shampoo
<i>Mastersia assamica</i> Bentham;	Papilionoideae	Fiber is used in local rituals
<i>Mucuna macrocarpa</i> Wallich;	Papilionoideae	Pod is used as vegetable
<i>Mucuna pruriens</i> (L.) DC;	Papilionoideae	Seed is used as antidote against venom
<i>Pueraria Montana</i> var. <i>lobata</i> (Willd.) Sanjappa & Pradeep	Papilionoideae	Stem fiber is used for making local ropes
<i>Pueraria phaseoloides</i> Bentham;	Papilionoideae	Stem fiber is used in local ritual

few species such as *Caesalpinia bouduc* and *Albizia sp.* were also located in the dense forest areas. The recorded plant species along with their ethnobotanical uses are presented in the Table 1. In the present study maximum diversity of Leguminosae were found in tropical moist forest. Among the total recorded plants, 39 species are put into diverse ethnobotanical uses as medicine, ritual, ornamentals and vegetables by the local residents of the study sites. The wood of some plants are used for their house making and furniture making purposes.

**Fig. 2.** Common legumes of Papum Pare district of Arunachal Pradesh : (A) *Bauhinia purpurea* L (B) *Bauhinia variegata* L; (C) *Pueraria Montana* var. *lobata* (Willd.) (D) *Senna alata* (L.) Roxbur

Present study has made an important contribution in understanding the diversity and ethnobotanical aspects of leguminous plants of Papum Pare district of Arunachal Pradesh. Due to the food, medicinal and economic importance, the leguminosae group of plants warrant necessity conservation measure to sustain the diversity of species in natural and cultivated conditions.

## Discussion

Arunachal Pradesh is one of the richest states in Himalayan zone of India, in terms of biodiversity. Arunachal Pradesh contains 40% of the floral and faunal species of India, many

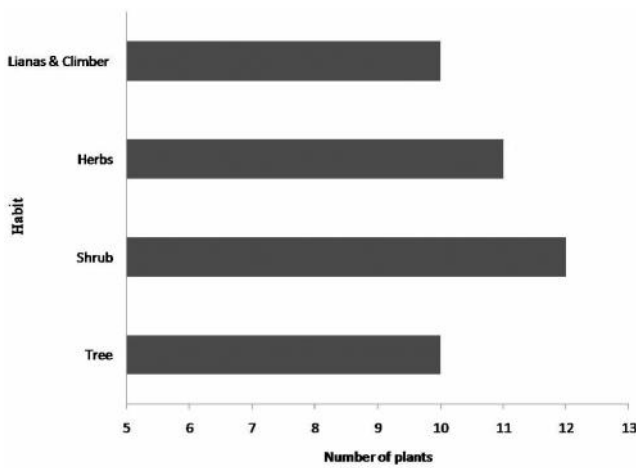


Fig. 3. Habit of ethnobotanical uses of Legumes by the Nyishi tribe of Arunachal Pradesh.

of which are endemic to the region. Out of 8000 flowering plants reported from the Himalayas, 5,000 species are found in the Northeast region. The Leguminosae is one of the dominant families found in the region. Due to its commercial, aesthetic, socio-cultural value many Leguminosae trees are being cultivated besides their natural distribution.

Leguminosae or Fabaceae is a large and economically important family of flowering plants, which is commonly known as Legume family, pea family, bean family or pulse family. The name Fabaceae comes from the defunct genus *Faba*, now include into *Vicia*. Leguminosae is older name still considered valid, and refers to the typical fruit of these plants, which are called legumes. Ranging habit from large trees to annual herbs, the family is cosmopolitan in distribution and well represented throughout temperate and tropical regions

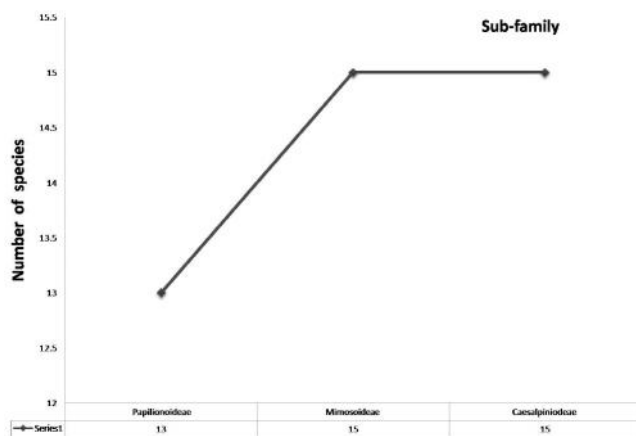


Fig.4. Family contribution of the recorded ethnobotanical uses of Legumes by the Nyishi tribe of Arunachal Pradesh.

of the world (Rundel, 1989). They are particularly diverse in tropical forests with a seasonally dry aspect and temperate shrubs land tailored by xeric climate. The preferences of legumes for semi-arid to arid habitats are related to nitrogen demanding metabolism, which is thought to be an adaptation to climatically variable or unpredictable habitats. Legumes also play an important role in the terrestrial nitrogen cycle regardless of whether they form root nodule (Spent, 2005).

The diversity of legumes is highest in Peninsular India which hosts about 550 species, followed by Himalaya 500 species and North-Eastern India 400 species. Due to the richness of plant wealth in Eastern Himalaya it has become a centre for attraction to the botanist, plant explorers and travelers. Accordingly a large number of botanists from the time of Buchanan-Hamilton, (1820) explored the region and made some valuable contribution in understanding the plant curiosity of the region.

In spite of the existence of rich tree species diversity of Leguminosae family in the Eastern Himalaya, a systematic account of tree flora of the region is yet to be initiated. No attempt has been made for systematic investigation of the same in this region. In this regard the present study is an attempt to throw light on the survey and collection of the indigenous as well as exotic species of this family and their traditional uses from the local communities residing within Papum Pare district of Arunachal Pradesh.

As the family is cosmopolitan in distribution, the occurrence of the species is common throughout the study area. Present study reveals that Papum Pare district harbours good numbers of Leguminous plants. Some economically and ethnobotanically useful species under this group are *Glycine max*, *Bauhinia purpurea*, *Bauhinia variegata*, *Dalhousie bracheata* and *Vigna mungo*.

In the present study maximum diversity were found in Banderdewa forest range while Kimin forest range showed comparatively less diversity of leguminous species. Importantly the capital city Itanagar also showed very good diversity but the populations of the species were found to be very less compared to the other study sites. This could be due to the

anthropogenic activities, expanding human population and urban development.

Scientific input on present indigenous knowledge system related to Legumes is likely to benefit the traditional society as well as will help in conservation of useful plant species. Therefore, it is the right time to come up with immediate conservation and documentation measures for ethnomedicinal knowledge of the local community for the larger benefit of our future generation.

In conclusion it can be stated that the present study has made an important contribution in understanding the ethnobotany and diversity of leguminous plants of Papum Pare district of Arunachal Pradesh with their identification and distribution. A total of 43 species has been collected within a limited time which can give an insight to the possibilities of selecting some species for commercial cultivation and indicates the necessity of taking urgent conservation measures for the ethnobotanically important species.

Thus the present study has made an important contribution to understanding the leguminous plants of Papum Pare district of Arunachal Pradesh. Due to the importance and the cultivation of the plants it indicates the necessity of taking urgent measures for conservation of the species.

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### References

**Anonymous, 2011.** Forest Survey of India, State of Forest Report, Ministry of Environment & Forests, Dehradun. Available online at: [www.fsi.nic.in](http://www.fsi.nic.in)

**Buchanan-Hamilton, F. 1820.** An account of Assam with some notices concerning the neighbouring territories. London.

**Bisby, F. A., James, L. Z., Schrire, B. D., Roskov, Y. R. and Richard J. W. 2000.** In: International Legume Database and Information Service. 5th ed. Reading, U.K. ILDIS.

**Choudhery, H. J., Giri, G. S., Pal, G. P., Pramanik, A. and Das, S. K. 1996.** Materials for the Flora of Arunachal Pradesh. BSI, Calcutta.

**Das, S. S. 2009.** The genus *Desmodium* Devs. (Leguminosae) and its allied genera in Arunachal Pradesh. Bulletin of Arunachal Forest Research. 25(1&2): 18-33.

**Dash, S. S. and Singh, P. 1998.** The Genus *Desmodium* Devs. (Leguminosae) in Sikkim. Journal of Hill Research. 11(2): 212-223.

**Jain, S. K. and Rao, R. R. 1977.** Field and Herbarium methods. Today and Tomorrow publishers, New Delhi, India.

**Kalita, C. B., Bharali, P., Jamoh, L. and Tag, H. 2015.** Diversity of Legumes in the Papum Pare District of Arunachal Pradesh of India. 9(2): 440-448.

**Lewis, G., Schrire, B., Mackinder, B. and Lock, M. 2005.** Legumes of the world. Richmond, U.K. Royal Botanic Gardens, Kew.

**Polhill, R. M. and Raven, P. H. 1981.** Advances in legume Systematics part 1. Royal Botanic Gardens, Kew. Pp: 425.

**Polhill, R. M. 1994.** Classification of the Leguminosae and complete synopsis of legume genera. In: Phytochemical dictionary of the Leguminosae. (Bisby, F. A., Buck-ingham, J. & Harborne, J. B. eds.). Chapman & Hall, Cambridge. Pp: xxxv-lvii.

**Rundel, R. W. 1989.** Ecological success in relation to plant form and function in the woody legumes. In: Advances in legume biology, Monographs in Systematic Botany from the Missouri Botanical Garden. (C. H. Stirton and J. L. Zarucchi eds.). 29: 377-398.

**Sprent, J. I. 2005.** Nodulation in legumes. Royal Botanic Gardens, Kew, UK.