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# Medicinal Plants in Traditional Use at Arunachal Pradesh, India

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## Abstract
In rural world, the use of medicinal plants in healthcare system is an integral source of easily available remedy. This study was conducted on herbal preparations of different plant parts used by the tribal people of Arunachal Pradesh for controlling the diseases. The villages like Yekar, Dulom, Sippi, Soki, lamdik in Upper Subansiri District, Ngopok, Passighat, in East Siang Distrivt, East Kameng District, West Kameng District, Lower Subansiri District of Arunachal Pradesh, India were surveyed through personal interviews with the villagers and medicine men and assistance of local information. We recorded the traditional use of 101 medicinal plants species belonging to 50 taxonomic plant families used for treating a total of 156 different diseases/ailments. The informant consensus factor (ICF) values demonstrated that local people tend to agree more with each other in terms of the plants used to treat malaria (0.71), jaundice (0.62), urological problems (0.56), dermatological disorders (0.45), pain (0.30), and respiratory disorder (0.33), and while the general health (0.15) and gastro-intestinal disorders category (0.28) were found low ICF values. The highest number of medicinal plants (101 species) was reported from the Adi of Lower Dibang Valley followed by the Nocte of the Tirap (25 species) and the Nyishi ethnic groups of Papum Pare districts (13 species).
**Keywords:** Medicinal, Traditional, Plants, Arunachal Pradesh.

## 1. Introduction
Plants are the most important sources of curative drugs and play a major role in the endurance of the ethnic and tribal communities. According to WHO, for millions of people in the rural areas of developing countries, which is about 80% of the world's population, herbal medicines serve the health requirements [1].

India is one of the twelfth mega biodiversity countries of the world, with only 2.4% of the land area. India is harbouring about 5,00,000, out of some 10 to 30 million species of living organisms. India has contributed at least 167 plants to global agriculture and is the home to two of the world's 25 hotspots – Western Ghats and the Eastern Himalayans [2].

There are 28 major different ethnic groups residing different areas of the state and they have diverse native, original knowledge on medicinal plants and have developed different methods for using the available nature's resources [3][4]. Their understanding in using these assets is distinguishingly different from tribe to tribe. With the use of these plants for the medicinal purpose their belief in their native folklore medicine for remedies have grown. The knowledge and belief was transmitted from one generation to another only verbally. Now, due to modernization

the traditional knowledge is vanishing with time. Though, some workers have reported several utilization of medicinal plants by the indigenous tribes, still there is the need of doing much work in the field of ethno-medico-botany of Arunachal Pradesh. The purpose of this study was to explore the relative information and conventional uses of medicinal plants by tribal communities of Arunachal Pradesh.

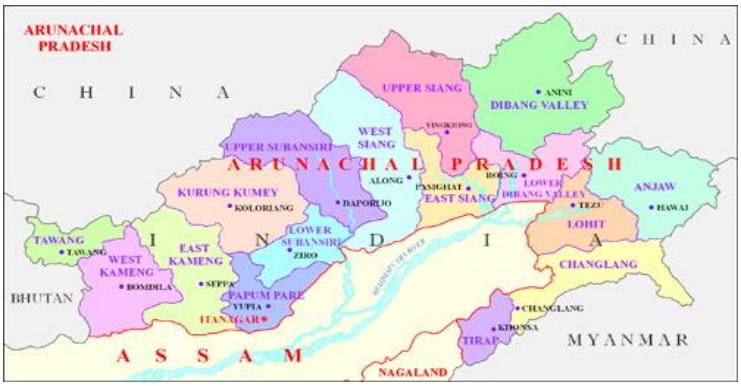


**Figure 1: Map of Arunachal Pradesh showing location of selected study districts namely (1) Tirap, (2) Papum Pare, and (3) Lower Dibang valley.**

## 2. Methodology

### *2.1 Description of the study area*

Arunachal Pradesh, also known as 'Land of Dawn lit Mountain' is also known as the orchid state of India or the paradise of the botanist. Geographically it is the largest among the North-east Indian States commonly known as "the seven Sister state". Arunachal Pradesh is located between 26.28°N and 29.30°Latitude and 91.20°E and 97.30°E longitude and has 83,743 sq km area. Most of the Arunachal Pradesh is covered by the mighty Himalaya. Arunachal Pradesh borders the state of Assam, Nagaland to the south and shares international border with Bhutan in the west, Myanmar in the east and China in the north.

Most of Arunachal Pradesh is covered by the Himalayas. The land is mainly mountainous with the Himalayas ranges running north south. These divide the state into five river valleys: The Kameng, the subansiri, the siang, the Lohit and the Tirap. All these are fed by snow from the Himalayas and countless rivers and rivulets. It receives heavy rainfall of 2,000 – 4,100 millimetres annually, most of it between May and September. The climate of Arunachal Pradesh varies with elevation of area. The average recorded in Arunachal Pradesh is 3000 millimetres.

### *2.2 Sampling informants*

A total of 198 informants were selected at random during house-to-house surveys represented largely by villagers and 45 respondents (31 males and 14 females) constitute traditional plant practitioner (THP), who had traditional knowledge on the medicinal use of the plants and have a tradition of healing in their families (Fig. 2). However, age, class and educational background were taken into consideration; 55 were from 20 to 40 years of age, 81 were ≥40–60 years of age, 62 were from 60 to 80 years of age, 57 were females and 141 were males. In this study, 52 respondents constituted having educational background upto class VIII standard and the majority of the informants were illiterate.

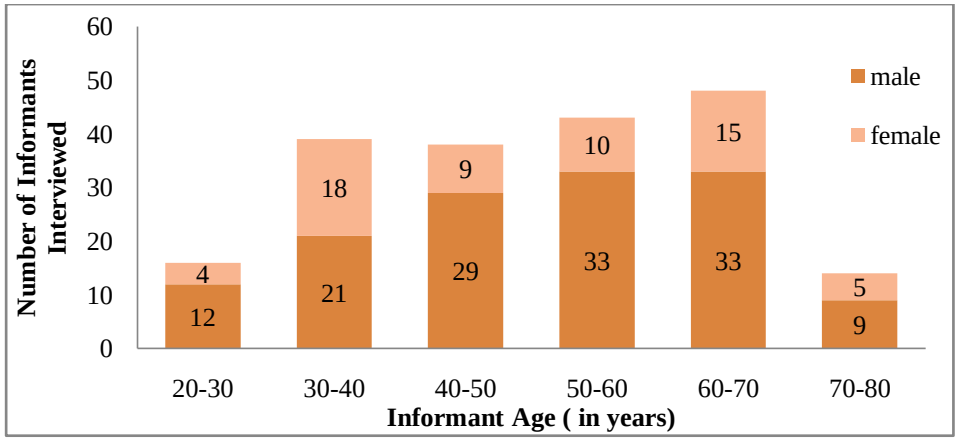


**Figure 2: Field Study participants interviewed (villagers and traditional health practitioner, THP).**

***2.3 Ethno-botanical data collection and ethical considerations***

From each participant of this study, before getting the answer to the queries, they were clearly explained regarding the objective of the study and their verbal consent was taken. This study was conducted between June 2013 and May 2015.

The first author, who could speak the local language and also knows some of the traditional plants used by the local tribal people of the region, collected the data. A semi-structured questionnaire [4] was used to interview the participants. During the period of the study from June 2013 and May 2015, each survey took 3-4 days and a total of 26 field visits were conducted before compiling the report.

The questionnaire used had three sections.

Section 1 deals with demographic information such as age, sex, religion, nationality, practice specification, period of practice and educational background of the participant.

Section 2 consist of professional experience on the treatment of diseases and includes question such as type of diseases treated, frequency of treatment, use of herbal therapy alone or otherwise, duration of treatment, accompanied side effects, accompanied verbal instructions, plant part(s) frequently used, availability of plants/plant part(s) and knowledge of treatment.

In Section 3, plants and recipes used in the treatment of common diseases, herbal preparation, arrangement of plant part(s) ingredient, traditional solvent of choice, traditional extraction methods/method of preparation and method of administration were considered.

However, the author mainly stressed on the collection of information such as local names of the plants, plant parts used, method of preparation and associations with other plants along with age and educational background of the participants.

***2.4 Statistical analysis***

To summaries, the data were tabulated on excel sheet and hence various properties like plant families, habit, ethno medicinal uses, plant parts used as medicine and phytochemicals reported to be present.

**Table 1: Plants used in the traditional healthcare as medicine in the state Arunachal Pradesh, India**

| Sl No | Scientific name of the plant | Family | Local name of plant | Habit | Ethno-medicinal uses | Plant parts used | Phytochemicals reported | Ref. |
|---|---|---|---|---|---|---|---|---|
| 1 | *Ageratum conyzoides* | Asteraceae | Pashpaya | Weed | Wound healing, antihelmintic | Leaf, stem | Chromene, chromone, monoterpenes(β-pinene, linalools, sabinene), sesquiterpene, flavonoides, alkaloids | [5] [6] |
| 2 | *Alstonia scholaris* | Apocynaceae | Tayesangn e | tree | Treatment of ulcer, swelling, latex is given during abdominal pain after delivery | Leaves, root, bark, latex | Flavonoids, alkaloids, proanthocyanidines, echitenine and echitamine | [5] |
| 3 | *Artemesia nilagirica* | Asteraceae | Tipintarin | Shrub | In headache and stomach pain, used as vegetable, to get relief from asthma | Leaves | Glycosides, tannins, phenols, terpenoides, saponins, amino acids, alkaloids, essential oil | [5] |
| 4 | *Cassia alata* | Fabaceae | Kra-pat | Shrub | Leaf juice is applied in eczema and itching | Leaves and roots | Alkaloids, tannins, anthraquinone, cardiacglycoside,phenols,diter pene, flavonoides | [5] |
| 5 | *Centella asiatica* | Apiaceae | Barang | herb | Fresh plant juice with honey is given in stomach ulcer, leprosy | Whole plant | Pentacyclictriterpenoids, asiaticoside, brahmoside, Asiatic acid, brahmic acid etc | [5], [7] |
| 6 | *Clerodendron glandulosum* | Lamiaceae | Pattoi | Shrub | For treatment of high blood pressure and bowel troubles, obesity | Fruits and leaves | Ascorbic acid, polyphenols, steroids, saponin, flavonoids etc | [5] |
| 7 | *Colocasia esculenta* | Araceae | Yaksar | aquatic tropical Plant | Fever and cough,petiole juice is used as styptic and stimulant | Leaves, stem and rhizome | Apigenin, luteolin, anthocyanin, minerals, steroids, sitosterol, starch | [5] |
| 8 | *Curcurma longa* | Zingiberaceae | Longobom | Herb | Used in bone fracture, anti tumour, in cardiovascular disease, anti bacterial | Leave, rhizome | Curcuminoides which includes curcumin, demethoxy-curcumin, resin, atlantone, turmerone, bisdemethoxycurcumin, sugars | [5], [8] |
| 9 | *Dillenia indica* | Dilliniaceae | Ahutenga | large shrub/ medium tree | Fruit decoction is applied to scalp for curing dandruff, wound healing, bone fracture, anti | Fruit pulp and leaves | Diterpene namely dipoloicacid, kaempferol, quercetin, betulin, betulinic acid, mallicacid, free amino | [5] |

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|---|---|---|---|---|---|---|---|---|
| | | | | | diarrhoea | | acid | |
| 10 | *Moringaoleifera* | Moringaceae | Sajana | Tree | In liver disorder, water purification etc | Pods, leaves | Catechol tannins, gallic tannin, anthraquinones, reducing sugar, saponin, steroids | [5] |
| 11 | *Musa sapientum* | Musaceae | Nyoro-kopa | flowering plant with herbaciou s growth | Boiled unripe fruits are given during dysentery, diabetes, in anaemia | Fruits and leaves | Saponins, potassium, protein, calcium, sodium, iron etc | [5] |
| 12 | *Piper betel* | Piperaceae | Ritik-rhinik | vine (Creeper) | Leaf after rubbing with mustard oil and warming over burning charcoal is applied to belly during stomach ache of children | Leaf | Nicotinic acid, thiamine, starch, eugenol, eugenylacetate, camphene,cineole, caryophyllene, D-limonene, terpinen-4-ol | [5], [9] |
| 13 | *Solanum khasianum* | Solanaceae | Thitbya-ke | shrub | Root decoction is used to treat malaria,antifertilityproperty,anti-inflammatory | Seeds, berries and roots | Glyco-alkaloid, solasodine,a nitrogen analogue of diosgenin | [5] |
| 14 | *Spilanthus acmella* | Asteraceae | Mershang | herb | Antimalarial, antipyretic, analgesic, flowers are chewed during toothache | Flower bud, stem, roots, leaves | Spilanthol, stigmasteryl-3-O-6-D-glycopyranoside, N-isobutylamidemoeity | [5] |
| 15 | *Swertia chirayita* | Gentianacee | Chirata | herb | Plant decoction is taken in fever, anti- hepatitis B | Whole plant | Sawertiamarine, mangeferin, amarogenitine, oleinicacid, maslinic acid, sumaresinolic acid, swerilactones | [5] |
| 16 | *Terminalia myriocarpa* | Combrtaceae | Hilika | Tree | Bark extract is given in chest pain and as cardiac stumulant | Fruit, leaves, bark | Methyl-flavogallonate, gallic acid, methyl gallate, ethyl gallate, vitexin, isovitexin, orientine,rutin, ellagic acid, flavogallonic acid | [5] |
| 17 | *Zanthoxylum armatum* | Rutaceae | Honyur | tree | Seed and bark are used as tonic during fever and cholera, stomach disorder | Fruit, seed, bark | Aliphatic and aromatic amides, alkaloids like benzophenanthridines, furoquinolines( dictamine), carbazoles, berberine, acridones, lignansesamin | [5] |
| 18 | *Zingiber officinale* | Zingiberaceae | Kekir | herb | Stomach pain, carminative, stimulant, rhizome juice mixed with honey is used for cough | Rhizome | Zingiberene,cineol,citral, β-phellandrene,gingerols, shogaols,zingerone. | [5], [10] |
| 19 | *Tacca integrifolia* | Dioscoraceae | Tagoon | herb | skin disease, leprosy, wound healing, stomach pain,dysentry | Rhizome s, tubers | Diosgenin, costanogenin, taccalin, betulinic acid, n-triacontanol, amino acids like valine, leucine | [11] |
| 20 | *Solanum nigrum* | Solanaceae | Byako | weed | Vomiting, diarrhoea,also used to cure tuberculosis,reduce mild abdominal pain | Berries, leaves, shoots | Pinoresinol,syringaresinol, medioresinol, scopoletin, tetracosanoic acid and β-sitosterol | [11] |
| 21 | *Erigeron bonariensis* | Asteraceae | Daglentao | herb | Vapour of leaves is inhaled in sinus problem | Leaves | Stigmasterol, freideline, quercitrin, caffeicacid, the aromatic glycoside called erigoside G, acrylic acid | [11] |
| 22 | *Chromolaena odoratum* | Asteraceae | Telimbabo | shrub | Wound healing, skin diseases, diuretic, analgesic, anti-microbial, relieve pain | Roots and leave | α-pinene,β-pinene, geijerone,cubebol, epicubebol, camphor, limonene, himachalol, β-caryophyllene, 5 phenyl derivatives | [11], [12] |
| 23 | *Artemisia indica* | Asteraceae | Laglin | herb | For skin allergy,believe to be effective in breast cancer | Leaves, young seedlings | Sesquiterpenes,β-pinene(15%),β-elemene, linalool,limonene,1,8-cineole,sabinene, arcurcumene(1.3%), δ-cadinene(1.3%) | [11] |
| 24 | *Cyclosorus parasiticus* | Thelypteridaceae | Rukdik | fern | Gout and rheumatism , anthihelmintic, antifungal and antibacterial | Leaves, rhizome | Chalcone derivatives called parasiticins, flavonoids, saponin, tannins, alkaloid, terpenoids | [11] |
| 25 | *Piper longum* | Piperaceae | Saturikki | climber | Treat joints pain, gout, paralysis, improve immune and digestive | Leaves, stem | Piperene 3%,rutin4%, sabinene, β-caryophyllene, chavicin, phellandrene, | [13] |

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| | | | | | system, arthritis | | piperamine, piperoleines, β-bisabolene | |
| 26 | *Gerbera piloselloides* | Compositae | Pangnesir | Small flowering plant | Treat cold,fever, acute conjunctivitis, rheumatic pain | Leaves and rhizomes | Dicoumarin like dibothrioclinins I, dibothrioclinins II, | [11] |
| 27 | *Oxyspora paniculata* | Melastomataceae | Porkijale | shrub | Treatment of various liver disorder, stomachic, antidote against snake poisioning | Leave, whole plant | Andrographolide, 14-deoxyandrographo- lide, neoandrographolide, andrographiside, 14-deoxyandrographiside | [11] |
| 28 | *Perilla ocymoides* | Lamiaceae | Namdung | herb | Locally used as spices or as a curry, in treatment of asthma, also used for nausea, sunstroke, reduce muscle spasms | Seeds, leaves | Perillaldehyde(50-60%), farnesene, perilla oil is a rich source of omega-3-fatty acid | [11] |
| 29 | *Plantago erosa* | Plantaginaceae | Donihana-kang | herb/ subshrubs | Constipation, improvesdigestion, astringent, demulcent, diuretic, expectorant, anti-inflammatory | Seeds, leaves | Flavonoids, alkaloids, steroids which causes anti-inflammatory ,tannins etc | [11] |
| 30 | *Rubia manjith Roxb.* | Rubiaceae | Tamin | climber | Used to cure headache, cough, cold, locally used as a textile dye | Roots, fruits and leaves | Roots contains an organic compound called alizarin that gives its red colour | [11] |
| 31 | *Ricinus communis* | Euphorbiaceae | Miggim | shrub | Orthopaedic, intestinal worms, in piles, glandular tumours | Whole plant | Alkaloid, ricinoleic acid, stearic, linoleic, palmitic acid, squalenetocopherols, ricinine,ricin, lignanetc | [13] |
| 32 | *Scoparia dulcis* | Plantaginaceae | Mithipatti | herb | Jaundice, diabetes, anti - oxidant, diuretic, analgesic, anti-inflammatory | Roots, leaves, all parts | Scoparicacid,scopadubic acid, scopadulciol, scopadulin, triterpene, mannital, dulcitol | [11], [14] |
| 33 | *Embelia ribes* | Myrsinaceae | Onior | herb | Anti-diarrhoea, also used against intestinal worm infection | Leaves and fruits | Embelia, quercitol, christembine, honsoembelin, vilangineetc | [4] |
| 34 | *Clerodendrum serratum* | Lamiaceae | Bortapipik | herb | Diabetes, obesity, hypertension, locally it is also used as a vegetable | Whole plants | D-mannitol, hispidulin, apigenin, serratagenic acid, acteoside, oleanolicacid,cholestanol, clerosterol, campesterol, 24-ethyl cholesterol | [3] |
| 35 | *Gynocardia odorata* | Achariaceae | Teeksin | tree | In treatment of leprosy, toothache, lupus, scrofula and many skin diseases | Seeds and fruits | Flavonoides, protein, fixed oil, tannins, alkaloids, glycosides, carbohydrate, triterpenoides, saponins | [3] |
| 36 | *Hedychium coccineum* | Zingiberaceae | Uii-telli | herb | Cure asthma and indigestion, anti microbial, also used for local ornamental purposes | Whole plant | 1,8-cineole,β-pinene,α-terpineol,caryophylleneoxide,caryophyllenol I, caryophyllenol II etc | [3] |
| 37 | *Laggera pterodonta* | Asteraceae | Dindo eh | herb | Antihelmintic, treatment in inflammation and swelling | Whole plant | n-tricontane(43%), dimethoxydurene(9%), caryophyllene oxide(7%), linoleoyl chloride (7%), oleic acid(4%), γ-eudesmol (4%) | [3], [15] |
| 38 | *Phrynium capitatum* | Marantaceae | Ekkam | herb | Anti-diabetic, analgesic, antih-yperglycemic, locally used as wrapping and packaging materials | Leaves | Saponin, alkaloid, flavonoides, tannin etc | [3], [16] |
| 39 | *Alnus nepalensis* | Betulaceae | Taram sin | tree | Disinfectant, diuretic, reduce swelling, prevent excessive sweating, also used for carpentry | Branches , bark, leaves | Bark is reported to contain 7% tannin | [3] |
| 40 | *Aconitum ferox* | Ranunculaceae | Omli | herb | Underground roots and tubers are used in arrow poisioning by local hunters | Roots and tubers | Aconitine, mesaconitine, hypaconitine, benzoylaconcine, benzoylm-esaconine, diterpenoid alkaloid such as liaconitine A, transconitine A, geniconitine, foresaconitine | [3] |
| 41 | *Arisaema consanguineum* | Araceae | Biram sing | Perenial Plant | Locally used for arrow poisioning for hunting | Rhizome | Saponins, aspartic acid, amino acids like leucine, phenylalanine, histidine, valine, isoleucine etc | [3] |

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| 42 | *Alpinia nigra* | Zingiberaceae | Bugbii-talli | herb | Analgesic, appetizer, antifungal, jaundice, gastric ulcer, diuretic, expectorant, anti-inflamma- tory, flavouring agent, leaves are used in beer preparation | Rhizome, fruits and leaves | Caryophyllene oxide(23%), geraniol(19.9%), eudesmol (19.4%), citronellyl(16.5%), 1,8-cineol,α-pinene, β-pinne etc. | [3] |
| 43 | *Baliospermum calycinum* | Euphorbiaceae | Gilagal | Shrub | Purgative, stimulant, antidote in snake bite, asthma,jaundice, gastric problem, gout and rheumatism, toothache | Whole plant | Axillarenic acid, steroids, baliospermin, glycosides, terpenoides,saponinetc | [11] |
| 44 | *Asplenium phyllitidis* | Aspleniaceae | Patalak | herb | Anti-oxidant, anti – microbial, locally used for decoration in local festival | Leaves, aerial parts of plant | Hesperidin, xanthone, mangiferen, spiropyranosyl derivatives, triperpenoids, kaempferol derivatives | [11] |
| 45 | *Bambusa tulde* | Poaceae | Eng | herb | Bamboo shoot are consumed as integral part of diet, | Stem, shoots | Cellulose, hemicellulose, lignin, resin, tannin, waxes, starch ,silica contents, ligno-cellulose, inorganic salts | [11], [17] |
| 46 | *Bauhinia variegata* | Fabaceae | Pacham | tree | Asthma, ulcer, digestive problem, anti oxidant, locally also used as spies | Flowers, leaves, root and buds | Quercetin derivatives, saponin, phenanthraquinone, triterpene, kaempferol, flavonoides | [11] |
| 47 | *Callicarpa arborea* | Verbenaceae | Tato, yahorin | tree | Insect repellant, skin diseases, scorpion sting, also used in toothache | Branch, bark and leaves | B-sitosterol, maslinic, oleanolic acid, ursolic acid, methlbetulinate, banrenoletc | [11] |
| 48 | *Carica papaya* | Caricaceae | Omiir | tree | Anti-malarial, treatment of cuts, rashes, burns, stings, digestive problem, improve hearing capacity and improve lactation. | Whole plant | Carotene, free fatty acid, sucrose, papain, carposide, dehydrocarpines, carpaine, pectin, chymopapain, cryptoglavine. | [11], [18] |
| 49 | Chenopodium album | Chenopodiace-ae | Taye | herb | Locally used in preparing local wine and also eat as a vegetable | Leaves, seed, young shoots | Aldexydes, coumarin, flavones, flavonol, catechins, zoosterol, isoflavone, phytosterol, vitamins | [11] |
| 50 | *Chromolaena odoratum* | Asteraceae | Telimbabo | shrub | Wound healing, relieve pain, anti-gonorrhoeal, diuretic,skin disease | Leaf and root | Limachalool, 5-phenyl derivatives, camphor, limonene, vestitenone, bulnesol, kushimone, cyperene, α-muurolol, geijereneetc | [11] |
| 51 | *Citrus medica* | Rutaceae | Jipin | tree | Treatment of scurvy, intestinal ailments, antidote, anti cancer, weak eyesight, vomiting , skin diseases, haemorrhoids | Leaves and fruit | Limonene, geraniol, neral, P-coumaric acid, nomiline, sabinene,myrcene, 1,8-cineole | [11], [19] |
| 52 | *Crassocephalu m crepidioides* | Asteraceae | Hogegain | herb | Anti malarial, analgesic, epileptic, wound bleeding, headache | Whole plant | Caryophyllene, cubebene, famesene, thymol, tannin, dihydroisocoumarins, monoterpenes, jacoline. | [11] |
| 53 | *Drymaria diandra* | Caryophyllace ae | Kadokairo | herb | Anti-HIV ,anti-tumours, malnutrition in infants, anti-malarial, edema, rheumatism | Whole plant | Drymaritin, diandraflavone, torosaflavone, isovitexin, spinasterol β-d-glycoside, p-hydroxybenzoic acid, p-hydroxybenzalde -hyde. | [11] |
| 54 | *Debregeasia longifolia* | Urticaceae | Jirepole | shrub | Anti-tumours, rheumatism , juice is applied to the areas of the skin affected by scabies | Fruits, leaves | Flavonoids, palmitic acid, hemicosanoic acid, betulinic acid, hederagenin, ponolic acid, catechin, monogynol A, β-danso-sterol, β-sitosterol. | [11] |
| 55 | *Elensine coracana* | Poaceae | Tami | annual plant | Cough,cold,congestion, antimicrobial,anti-inflammatory, food preservative | Whole plant | Diadzene acid, gallic acid, coumaricacid, syringic and vanillic acid, β-carotene-linoleic acid are responsible for anti-oxidant activity. | [11] |
| 56 | *Eryngium foetidum* | Apiaceae | Hariyo | herb | Anti-epileptic, headache, scorpion sting, anti-diabetic, anti- bacterial, analgesic, fever, arthritis | Leaves, seed | 2,4,5-trimethylbenzaldehyde, 2-dodecenal, carotol, 3-dodecenal, riboflavin, terpinene. | [11] |

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| 57 | *Fagopyrum esculantum* | Polygonaceae | Amintatek | herb | To control high blood pressure, anti-diabetic, pain relief, anti-oxidant | Whole plant | Amino acids like lysin, tryptopan, threonine, fats, protein, salicylaldehyde, 2-nonenal, starch,2,4-decadienal,phenyl acetaldehyde | [11] |
| 58 | *Gerbera piloselloides* | Asteraceae | Pangnesir | herb | Treat cold, fever and acute conjunctivitis, in rheumatic pain | Whole plant | Dibothrioclinis I and II, n-hexadecanoic acid, neryl-2-methylbutanoate etc. | [11] |
| 59 | *Gnaphalium affine* | Asteraceae | Buli | herb | Treatment of common cold, gout,antioxidant, antimicrobial, locally used as vegetable also | Flower, dried plant | Eugenol, linallol, trans-caryophyllene, α-terpineol, hexadecanoic acid, α-humulene, β-elemene, γ-cadinene | [11] |
| 60 | *Hadychium gracile* | Zingiberaceae | Bibu | herb | Mosquito repellant, antifungal, also used as spies | Leaves, rhizome | Myrcene, terpinolene, camphor, pinocarvone, α-campholene, nerolidol, 1,8-cineole. | [11], [20] |
| 61 | *Litsea cubeba* | Lauraceae | Tayer | tree or shrub | Astringent, antiseptic, worm infection, blood dysentary, stimulant, anti-inflammatory, hypotensive, insecticide, in bone fracture, headache | Whole plant | Citral B, β-phellandrene, β-terpenene,D-limonene, monoterpene, geranial, cubebanone, sabinene, myrcene, citronellal. | [11] |
| 62 | *Macaranga denticulata* | Euphorbiaceae | Yaduk | tree | Skin damage, anti-bacterial, antityrosinase, fungal infection, wound healing, stomach pain | Whole plant | High phenolic contents, triterpene like 3-epitaraxerol, teraxerone, β-sitosterol, flavonoids | [11] |
| 63 | *Mucuna pruriens* | Fabaceae | Dimpa | tree | Parkinson disease, anti epileptic, antidote in snake bite, in the treatment of itching | Seeds, dried leaves | Serotonin,nicotine,L-Dopa,bufotenine,5-Meo-dimethyl trypthopan, β-carboline | [11] |
| 64 | *Murray paniculata* | Rutaceae | Nyibumt-arum | shrub | Analgesic, anti-diarrhoel, anti- inflammatory | Whole plant | Coumarin, β-cyclocitral(22.9%), methyl salicylate (22.4%), cubenol (6.8%),germacrene(8.3%), transnerolidol (11.7%),α-capaene(5.5%). | [11] |
| 65 | *Musa acuminate* | Musaceae | Kulu | herb | In anaemia, diarrhoea, constipation, ulcer, for menstrual cramps | Whole plant | Campesterol, stigmasterol, β-sitosterol, linoleic acid, α-linolenic acid, carbendazim, serotonin, thiabendazole | [11] |
| 66 | *Mussaenda roxburghii* | Rubiaceae | Tangmeng | Shrub | Detoxify mushroom poison, anti-pyretic, diuretic, treat blemishes on tongue, acute gastro-enteritis | Whole plant | Iridoids, mussaenoside, shanzhiside methyl ester, mussaein, quercetin, rutin, hyperin, ferulic acid, sinapic acid. | [11] |
| 67 | *Mycetia longifolia* | Rubiaceae | Tangnge | herb | Pain relief, ulcer, wound healing, inflammation, antinociceptive | Leaves | Alkaloids, tannins, glycoside, polyphenols, flavonoids | [11] |
| 68 | *Physalis minime* | Solanaceae | Bodopati | herb | Gastric trouble, laxative, diuretic, anti-cancer, in hypertension, anti-inflamma- tory | Whole plant | Tannins(0.6%),pectin(0.5%), sugars(6%), physalin F, physalin B, isophysalin B, physalin H. | [11] |
| 69 | *Sapium baccatum* | Euphorbiaceae | Shigum | tree | Analgesic, antimicrobial, skin irritant, locally used as fish poison | Leaves, stem | Lupeol, betulin, β-taraxerol, taraxerone, stigmasterol, docosanoic acid, docosyltransisoferulate, β-sitosterol. | [11] |
| 70 | Solanum indicum | Solanaceae | Bayom | herb | Ringworm, gout, asthma, diuretic, stimulant, expectorant, toothache | Whole plant | Limonene(2.03%), para-cymene (10%), β-damascenone (9%), α-bisabolol acetate(4.53%), phytol(2.49%),linalylbutanoate (2.13%) | [11] |
| 71 | *Solanum kurzii* | Solanaceae | Teeta-baigun | herb | Appetizer, toothache, roughage, berry is given to patient of stone problem | Berry | Phenolic content, flavonoid content etc | [11], [14] |
| 72 | *Coptis teeta* | Ranunculaceae | Rinko, idu-aro | herb | Fever, headache, gastric trouble, dysentry, ulcer, insomnia, vomitting, | Roots | Berberin, coptisine, epiberberine, berberrubin, palmeatin, columbamine, | [11], [21] |

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| | | | | | stimulant to heart, anti-bacterial | | ferrulic acid, worenine, magnoflorine, obakumone, obakulactone. | |
| 73 | *Acorus calamus* | Acoraceae | Wok-kak-hing | Semi aquatic creeper | Sedative, laxative, carminative, stroke, insecticidal activities, also in making perfume | Leaves, stems and roots | α-asarone,β-asarone,eugenol, triploid and tetraploid A. | [22], [23] |
| 74 | *Chrysanthemum indicum* | Compositae | Halakalrangkak | flowering plant with herbacious growth | Chest pain,prostate cancer,anti-diabetic, stomach ache, fever, dysentry,cold, swelling | Whole plant | Luteolin, acaciin,3-o-caffeoylquinic acid, boscialin, blumenol A, chrysanthenone, α-pinene,1,8-cineol,acacetin 7-o-β-sophoroside. | [22] |
| 75 | *Erythrina stricta roxb.* | Fabaceae | Sit-pan | tree | Scorpion sting,gout, anti-inflammatory, anxiolytic property | Flower, root, bark | Scoulerine, erysodin, erysovin, sitosterol,hypaphorine,7-methoxy-8-coumarin, | [22] |
| 76 | *Euphorbia ligularis roxb.* | Euphorbiaceae | Thamran-hingme | tree | Bone fracture, arrow poisoning,anti-arthritis, purgative, anti asthma,expectorant | Stem, root, latex, leaves | Alkaloids,cyanogenic,glucoside, glucosinolates, triterpenoids, alcohol, antraquinones | [22] |
| 77 | *Litsea polyantha* | Lauraceae | Ngop | tree or shrub | Antidepressant, bruises,anti-infertility, cytoxic,antifungal, insecticide,antiseptic, | Stem | Alkaloides, butanolides, amides, butenolactones, steroids fatty acid, lignans, monoterpenes, sesquiterpene. | [22] |
| 78 | *Oroxylum indicum* | Bignonaceae | Panokni | tree | Cancer,anti-malarial, jaundice,anti-arthritic, diarrhoea,fever,ulcer, anti-inflammatory | Roots | baicalein, oroxylin, chrysin, apagenin, oroxindin, ellagic acid, aloe-emodin,anthraquinone, prunetin,biochanin A. | [22] |
| 79 | *Phlogacanthus thyrsiflorus* | Acanthaceae | Ran-hing | shrub | Expectorant, asthma,stomach problems, fever | Leaves and fruit | Lupeol, betulin, vasicine, β-sitosterol, pyrroloquinazoline alkaloid. | [22] |
| 80 | *Phlogacanthus curviflorn* | Acanthaceae | Thamran-hingse | shrub | Boiled leaf juice are used to cure cough and fever | Leaves, roots | Phlogacanthollides B and C, lupeol, β-dancosterol, betulin, β-sitosterol | [22] |
| 81 | *Syzgium cumini* | Myrtaceae | Jamun | tree | Astringent, carminative, anti-diabetic, stomach disorder, diarrhoea and dysentery | Fruit and bark | Resin, albumin, jambosine-3, gallic acid, ellagic acid, corilagin, tannin, steroid, zinc, sodium, potassium. | [24] |
| 82 | *Aesculus assamica* | Hippocastana-ceae | Ozonsak | tree | Skin infection, reduces backache, in the treatment of haemorrhoids. | Seed, roots and flowers | Triterpenesaponin called escin, assamicin and isoescin | [24] |
| 83 | *Amaranthus spinosus* | Amaranthacea e | Maon, yankhisoulpa | weed | Leprosy, skin infection, piles, expectorant, appetizer, desentry, hallucinogenic | Whole plant | n-alkanes, hentriacontane, aspinasterol, campesterol, cholesterol,oleic, linoleic acid, rutin, stigmasterol, stearic acid. | [24] |
| 84 | *Bidens pilosa* | Asteraceae | Hou-bak | herb | Wound healing, ulcer, ear and eye problem, influenza, hepatitis, urinary tract infection, anti-malaria, anti-pathogenic | Whole plant | Friedelin, n-tridecane, friedelinol, β-sitosterol, lupeol, eleosanole acid,friedelin-3-β-ol-27-oic acid, 21-a-hydroxyfriedelan-3-one, polyacetylenes. | [24] |
| 85 | *Cannabis sativum* | Cannabaceae | Bang | herb | Stomach disorder, hypnotic, sedative, anti-inflammatory, analgesic, nausea,vomiting, hallucinogenic | Stem, seed, leaves, flower | Cannabidiol, myrcene,linalool,α-pinene, α-terpinolene, α-humulene, caryophyllene oxide, tetrahydrocannabinol. | [24], [25] |
| 86 | *Costus speciosus* | Costaceae | Jam-lakhmti | herb | Respiratory problem, astringent, stimulant, anti helminthic, liver cirrhosis, aphrodisiac, urinary problem | Roots and stem | Diosgenin,cycloartanol,25-en-cycloartenol,prosapogenin B, diosgenone, octacosanoic acid, gracillin, ligogenin, methyl proto dioscin | [24] |
| 87 | *Emplica officinalis* | Euphorbiaceae | Amloki | herb | Liver tonic, anti-diabetic, asthma, peptic ulcer,analgesic, heart problems, jaundice | Fruits, seed | Phyllembin, tannin(5%),fixed oil, vitamin C, pectin, iron, calcium, | [24], [26] |
| 88 | *Houttuynia cordata* | Saururaceae | Nekir name | Herb | Measles, gonorrhoea, skin troubles ,anti-tumour, anti-cancer, pneumonia, bronchitis, stomach ulcer | Shoots, leaves, stem | HouttuynosideA(1) and A(2), quercitrin, kaempferal, esters, quercetin, nonanol,bornyl acetate, lauraldehyde. | [24] |
| 89 | *Mentha arvensis* | Lamiaceae | Pudina | herb | Stomach disorder, influenza, appetizer, gall bladder problems, | Leaves | Menthol, menthone,piperiton, isomenthone, neomenthol, methyl acetate, α-pinene, β- | [24] |

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| | | | | | flavouring agent | | caryophyllene, β-pinene | |
| 90 | *Mikania scandens* | Asteraceae | Chakpan | climber | Blood clotting, insect bites and sting,anti-fungal, gastric ulcer, locally used as ornamental plant | Leaves, flower | Cardinene (12.2%), α-cubebine, 1,2-benzenedicarboxylic acid (10.17%), β-himachalene (4.68%),T-cadinol (3.98%), β-farnesene(3.08%). | [24] |
| 91 | *Mimosa pudica* | Mimosaceae | Haniang | herb | Anti-depressant, anti-convulsant, anti-fertility, sinus, dysentery, tumour, insomnia, antidote in snake poison | Whole plant | Mimosine, quinines, phenols, tannins, coumarins ,phytosterol, amino acid,saponin, glycosides, flavonoides | [24] |
| 92 | *Ocimum sanctum* | Lamiaceae | Eulochi | herb | Bronchitis, cough, in several heart disease, believe to promote longevity | Whole plant | Ocimunosides A and B, ocimarin, apigenin, eugenol, cerebroside, carvacrol, methylcarvicol | [24] |
| 93 | *Paedaria foetida* | Rubiaceae | Phodoaslodi | herb | Rheumatism and gout, emetic, astringent, gastritis, body pain, for active digestion | Leaf, root, bark, fruit | Iridoid glycoside, asperuloside, scandoside, paederoside, linalool, ceryl alcohol, benzo-furan, campesterol, epifriedelinol. | [24] |
| 94 | *Terminalia chebula* | Combretaceae | Ontyal | tree | Dehydration, cure blindness, cardiotonic, constipation, tumours, antihelmintic | Fruit | Arjungenin, chebulosides I and II, coumarin, gallicacid,chebulin, chebulinicacid,ethylgallate, punicalagin,terflavin A, tannic acid, luteolin. | [24] |
| 95 | *Aloe barbadensis* | Liliaceae | Ghrit-kumari | herb | Burns and cut, applied in face for smoother skin, anti-inflammatory, dermatitis | Leaf | Aloe-emodin, aloeninaglycone, chrysophenol, aloin A, aloesin, aloenin B, elgonicadimerA,resin, barbaloin, isobarbaloin, amino acid, polysaccharides. | [24] |
| 96 | *Andrographis paniculata* | Acanthaceae | Chiraitateeta | herb | Malaria, jaundice, liver tonic, respiratory problems, stomach disorder, rheumatism, ulcerativecolitis | Whole plant | Andrographolide, andrographine, neoandrographolide, panicoline, paniculide A and B and C, 14-deoxy-11-dehydroandrographo-lide. | [24] |
| 97 | *Berberis aristata* | Berberidaceae | Kanchan | Shrub | Eye lotion,anti-pyretic, anti-bacterial,fever, as a bitter tonic | Whole plant | Alkaloids, amino acid, flavonoids, phenol, protein, sterols,resins, saponin, berberine,non-reducing sugar,terpenes | [24], [27] |
| 98 | *Dioscorea floribunda* | Dioscoreaceae | Khamalu | climber | Intestine diverticupsis, gall bladder pain, for increasing energy, rheumatoid arthritis | Roots | Diosgenin, steroidal saponins like floribundasaponins A and B. | [24] |
| 99 | *Gmelina arborea* | Lamiaceae | Gamari | tree | Purify blood, stomach trouble, leprosy, diuretic, anaemia, snake bite and scorpion sting, ulcers | Whole plant | Arborea, paulownin, gmelinol, endermin, β-sitosterol, 6-bromo-isoarboreal, 4-hydroxysesamin, umbelliferone, gmelanone. | [24] |
| 100 | *Rauvolfia serpentine* | Apocynaceae | Sarpaga-ndha | herb | Antihypertensive, sedative, hypnotic, liver ailments, constipation, epilepsy, schizophrenia | Roots and leaves | Ajmaline, aricine, corynanthine, deserpidine, rescinnamine, reserpine, reserpiline,iso-reserpine, serpentine, yohimbine. | [24] |
| 101 | *Oxalis corniculata* | Oxalidaceae | Amrul | herb | Dyspepsin, bowel disorder, aneamia, scurvy, daturapoisioning, cure opacity of cornea | Whole plant | Flavonoids, vitexin, isovitexin, oxalic acid, ascorbic acid, malic acid, tartaric acid, oxalates of calcium and pottassium | [24] |

## 3. Results

### *3.1 Report from the informants on Medicinal Plants and their uses*

A total of 198 informants, 57 were females and 141 were males were consulted. In this study age, class and educational background were taken into consideration; 55 were from 20 to 40 years of age, 81 were 40-60 years of

age, 62 were from 60 to 80 years of age. In the survey, out of 198 informants, 45 respondents (31 males and 14 females) were traditional plant practitioner (THP), who had traditional knowledge on the medicinal use of the plants and have a tradition of healing in their families. The survey also included the study of educational background of the informants. 52 respondents constituted having educational background upto class VIII standard and the majority of the informants were illiterate. A total of 101 medicinal plant species were reported that are distributed across 50 families and 101 genera were used by the local people in traditional health care system to cure at least 25 different diseases/ailments (Table 1). Of the total species 101, 52% were herbs, 20% were tree,18% were shrubs, 4% climber/vine, 3% weed, 2% creeper and 1% fern (Fig. 3).

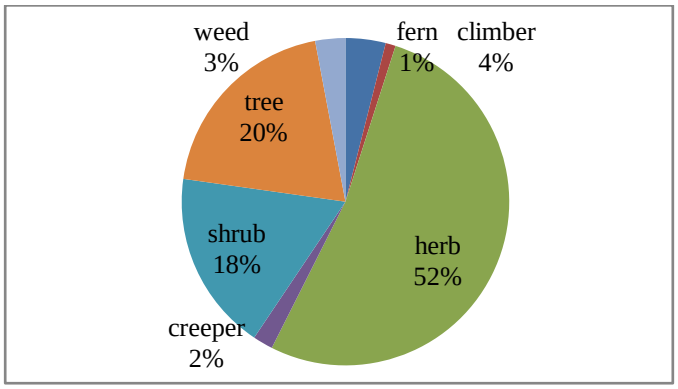


**Figure 3: Growth habits of the reported medicinal plant species.**

The different parts of these plants are used as a medicine. The use of above ground plant parts (81%) is higher than the below ground plant parts (19%). Of the above ground plant parts (Fig. 4), leaf is used in the majority of the cases (28%) followed by roots (11%), fruit (9%) Stem 7%, seed (6%), rhizome5%, bark 4%, flower 3%, berries 2% shoots (2%) and branches, buds, dried leaves, dried plants, flower buds, flower pulp, pods, tubers, young seedlings, young shoots less than 1% respectively and about 16% from whole plant.

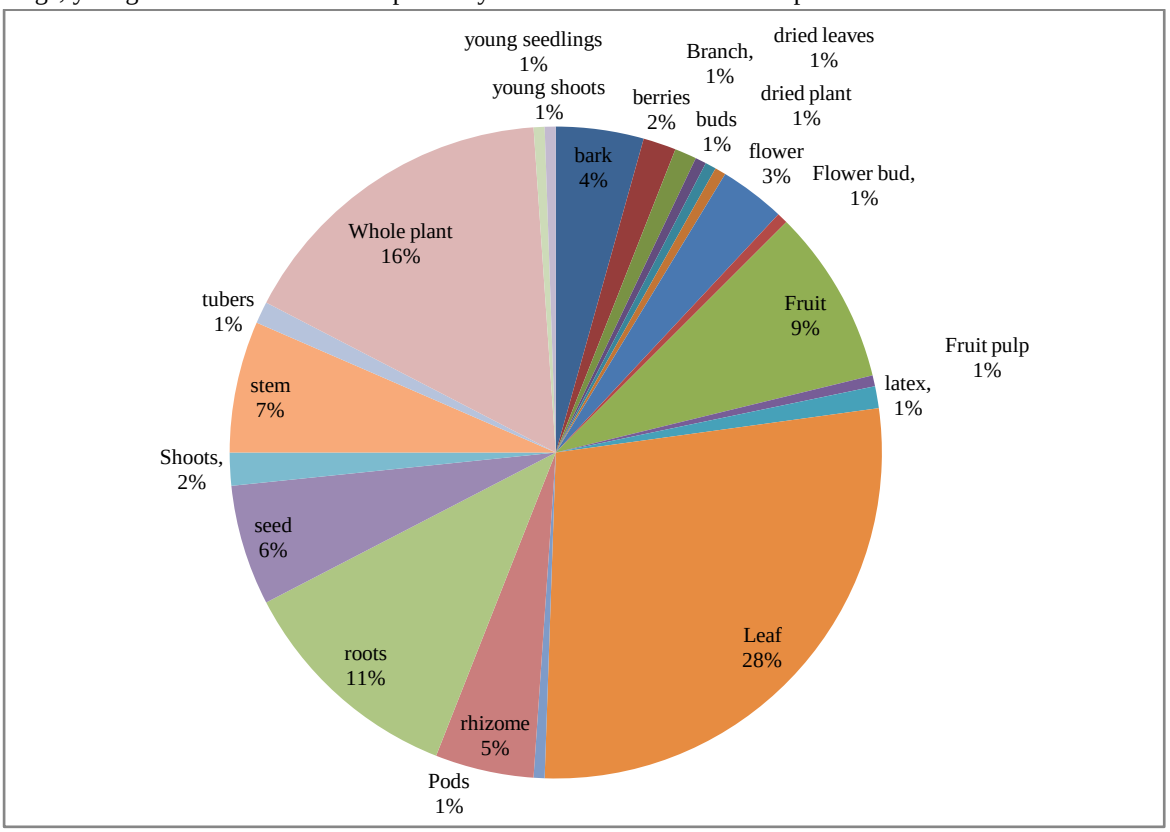


**Figure 4: Morphological plant parts used in the preparation of traditional medicines.**

***3.2 Modes of remedy preparation, routes administration and dosage***

The method of preparation was mostly a paste (31 Species) or juice form (25 species), decoction (19 species)) and raw (19 species) and vegetable (7 species), eaten raw (7 species) (Fig. 5). Doses were mainly taken twice a day and the dosage depends on the age and physical appearance of the individual and children's are given less than adults which approximate to 100–150 ml twice daily depending on the type of illness and treatment.

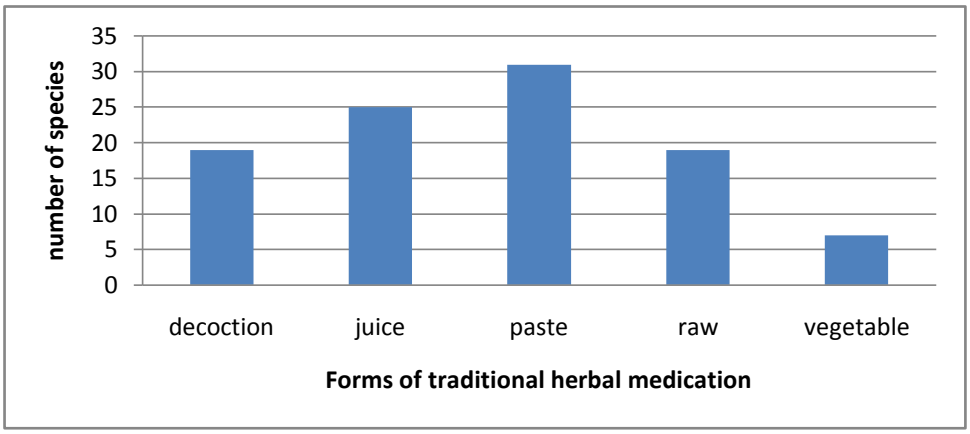


**Figure 5: Forms of medication used in herbal healthcare system.**

## 4. Discussion

The present study showed high diversity of plant used by the ethnic communities of Arunachal Pradesh in treating different types of ailments. This can be an indication of the significant role of phytotherapy based traditional medicine in meeting the basic healthcare needs of the people. The frequent use of herbaceous species among the tribal communities could be a result of their relative abundance as compared to trees and shrubs as also witnessed by investigators of this study. The study area experiences tropical, sub-tropical and temperate humidity for most months of the year creating favorable condition for the growth of herbs. The fact that medicinal plants are used for the same purpose by more than one community might indicate their pharmacological effectiveness. Literature survey on pharmacological properties of medicinal plants revealed the presence of bioactive compounds in many species having high fidelity level reported in this study, which could be attributed to harmacological effectiveness of plants used by the tribal community for treating various ailments or disease disorders

The majority of the informants reported that they keep their medicinal plant knowledge secret and that transfer of the knowledge has mainly been taking place vertically from father/mother to child mainly a son. The present ethno-pharmacological survey work reported 101species of plant for the first time for the treatment of various diseases and the herbal medicines has become integral component of traditional healthcare system among the tribal communities of Arunachal Pradesh. The highest informant's consensus for malarial fever, jaundice and urological problems indicated moderate consistency of informant knowledge and could be related to the high prevalence of these disorders in the study area. The efficacy and safety of all the claimed medicinal plants need to be evaluated through pharmaco-chemical studies.

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