

## Indigenous biodiversity of *Apatani* plateau: Learning on biocultural knowledge of *Apatani* tribe of Arunachal Pradesh for sustainable livelihoods

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The paper throws light on various uses of 106 species of plants by the *Apatani* tribe of Arunachal Pradesh. The data have been collected using personal interview schedule through established contact with key communicators of *Apatani* villages. There are a range of indigenous plant species (106) used in food, ethnomedicine, handicrafts, hunting and cultural uses. In majority of the cases, knowledge on plant resources use is observed to be *community knowledge* (public domain). Resource base of bio-culturally rich plant biodiversity is the backbone for livelihoods of *Apatani* tribe. The knowledge on plant resources use was observed to be location specific. Activities relating plant collection and their processing for various uses are primarily performed by women folk. Integration of outstanding traditional knowledge of this tribe with farming systems may further sustain their livelihoods. Characterization of plant based knowledge and refinement and value addition to bio-products may further advance livelihoods regime of *Apatani* tribes. This approach would also ensure their IPR protection on plant based knowledge and products, and equitable benefit sharing over plant based knowledge systems.

**Keywords:** Traditional knowledge, Biocultural value, Plant biodiversity, Ethnobotany, *Apatani* tribe, Arunachal Pradesh

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Arunachal Pradesh spread over an area of 83,743 sq km has a very rich biodiversity with undulating topography, extreme variations in altitude from 150 m to 6,500 m and climatic conditions<sup>1-4</sup>. Arunachal Pradesh is home to 26 major tribes and 110 ethnic groups. Among them, some are like *Adi* (*Minyong, Padam, Pasi Iand Pangi*), *Galo, Monpa, Memba Dafla/Nyishi, Apatani, Mizi, Nokte, Wanchhoo*, etc. Although the tribal population in this zone is less than 12% of the total tribal population of the country, it constitutes bulk of the population in this region<sup>5</sup>. The wide geographical, climatic and cultural diversity of Arunachal Pradesh provides a repository of wealthy traditional knowledge in the region<sup>6-9</sup>. The majority of the mountainous population of Arunachal Pradesh (falling under Eastern Himalayan region) depends upon agricultural and forest based natural resources for their livelihood and these resources are sustained with traditional ecological knowledge<sup>10-13</sup>. The forest biodiversity is intricately linked with crop farming and livestock domestication, which provides substantial base to

meet the needs of food, ethnomedicine, fodder for livestock and firewood, and thereby sustain biocultural diversity of tribal communities<sup>8,9</sup>. The *Apatani* or more accurately *Tanii*, which corresponds to the autonym, are an ethnic community of approximately 26,000 people living in the Arunachal Pradesh. The great majority of them inhabit a small plateau surrounded by mountains in the Lower Subansiri district, popularly known as the Ziro Valley. Till 1950, all *Apatanis* inhabiting this plateau were living in seven villages, Hong, Hari, Bulla, Hija, Dutta, Bamin-Michi and Mudang-Tage, whose foundation, according to the oral tradition, dates back to the time their ancestors first entered the valley and eventually settled there<sup>14-17</sup>. A significant number of *Apatani* have also settled in the township of Hapoli in the Southeast of the valley, many of them parallelly owning a family house in their village (Fig.1)<sup>17</sup>.

The *Apatani* society has two divisions mainly, *Mura* (slave) and *Mite* (patrician). The *mites* are distinguished by high stature, light skin, prominent nose and deep-set eyes, whereas the *mura* have more mongoloid characteristics<sup>17</sup>. An *Apatani* man/woman can easily be recognized by the dark green tattoo lines

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on their thin<sup>17</sup>. Defacing off *Apatani* girl through tattoo is done to avoid attraction of people of *Nyshi* tribe, who used to commit criminal assault on beautiful *Apatani* girls/women. The *Apatani* society is patriarchal, but women play a central role in agricultural operations (Fig.2) and conserving indigenous biodiversity of plateau. *Apatani* people in remote pockets of Arunachal Pradesh still exclusively depend on forest plant resources beside their survival with subsistence farming systems (rice + fish)<sup>13</sup>. The forest range from subtropical (Fig.3) to temperate nature. These forest vary from scattered niches around hilly agricultural fields to dense in community owned forest<sup>18,19</sup>. These forests provide an ample opportunity to *Apatani* tribe for interaction, learning and enriching traditional knowledge, and thereby selecting plant species for specific use. The *Apatanis* are good cultivators and practice both wet and terrace cultivation. Paddy-cum-fish culture is very popular among them with a high level of sustainability<sup>18,19</sup>. This special attributes of sustainable farming systems and people's traditional ecological knowledge in sustaining ecosystems, the plateau is in the process of declaring as world heritage centre<sup>18-20</sup>. People of the tribe use several local plants in their day to day life, and many of which are still not known to the civilized society<sup>21,22</sup>.

Though, exhaustive work has been done on the analysis of farming systems, agricultural practices, sustainability of traditional agricultural practices, ecological values of forest biodiversity and energy flow of ecosystem of *Apatani* plateau, however sufficient information on traditional uses of plant biodiversity and related biocultural values are scanty<sup>10,11,13,18,19,23-26</sup>. The scientific account on the biocultural values of eight species viz. *Cirsium lepskyle*, *Dicranopteris linearis*, *Eleusine coracana*, *Gynura nepalensis*, *Oenanthe javanica*, *Peristrophe roxburghiana*, *Sonchus asper*, *S. wightianus* and *Strobilanthes helictus* used by *Apatani* tribes for making salt has been provided<sup>21</sup>. Some researchers have reported about some plants used by *Apatani* people while others have reported ethnomedicinal uses of some species and recommended the scope of commercial exploitation of 8 species viz. *Abroma augusta*, *Centella asiatica*, *Eclipta prostrata*, *Paedaria foetida*, *Rubia manjith*, *Solanum nigrum*, *Terminalia belerica* and *Terminalia chebula* in socio-economic development of the aborigines<sup>27-30</sup>. The inherited knowledge (local names of plants and the methodology of their use by tribal people) of *Tani*,

*Adi*, *Apatani* and *Nyishi* tribes of Subansiri district of Arunachal Pradesh have also been recorded<sup>31</sup>. About 3 main substitutes for their staple food viz. *Tashe* (*Wallichia densiflora*), *Tache* (*Cyathea gigantea*) and *Tabe* (*Angiopteris evecta*); hunting aids viz. gum (used in bird traps) obtained from 8 species (botanical names not ascertained by Kohli); mild arrow poisons from *Raring* (*Polygonum hydropiper*), bark of *Ombeng* and *onger's* leaves (*Zanthoxylum rhetsa*); natural dyes obtained from seven species viz. stem of *Taming* (*Rubia manjith*), leaves of *Sankhi* (*Symplocos paniculata*), leaves of *Moru* – a tree, bark of *Sipon* – a tree, bark of *Sinking Moling*, leaves of *Sipon* – a tree, bark of *Sinking Moling*, leaves of *Engot* and fruits of *Nimar* tree. Locally made instrument *Tippo* for weaving cloth and source of the yarn viz. *Ampykokarmo* or *Sachcha* seeds are recorded. However, the scientific names of these plants could not be ascertained. A list of 158 ethnomedicinal plants used by *Apatani* tribe is also reported<sup>22</sup>. However, this review of study reveals that researches were very centric to a particular object, and no study could depict the conservation perspective in context of livelihood and ensuring IPR protection and benefit share over traditional knowledge of *Apatani* tribe. Hence, the study is of exclusive and beside the list of ethnomedicinal plants, it also provides the conservation livelihood and IPR led model of plant biodiversity conservation for *Apatani* tribe.

### Methodology

During the course of studies on the Flora of Arunachal Pradesh, interacting with the *Apatani* tribe, list of 106 local plants species were documented. Few plants used by *Nyshi*, who are neighbors of *Apatani*, are also reported in few cases. The observations about traditional knowledge of people of the *Apatani* tribe about various uses of plants are presented in the paper along with livelihood and IPR led conservation model for knowledge and plants species. The data pertaining to use of plants were recorded using a structured interview schedule. The representative specimens are housed in ARUN Herbarium. Accepted botanical names are given followed by the name of family and vernacular (*Apatani*) name. While collecting data on biocultural values (food, ethnomedicinal, hunting, fishing, cultural and handicrafts) of plants, contacts were often established with the key communicators of respective villages. Almost every traditional knowledge relating to plant species was found to be a

community knowledge (known and practice by majority members of society of a particular village). Therefore, prior informed consent (PIC) was sought from the community leaders (*Gaon Burha/Panchayat* body) and concerned information providers. Since, the information on plant species was primarily qualitative of nature; therefore, data pertaining to listed 108 plants were quantified with number and percentage and are presented.

### Results

During the study, 108 numbers of plants have been recorded being used by *Apatani* tribe of Arunachal Pradesh.

#### *Acorus calamus* (Acoraceae), *Kilatolyo*

Uses: Rhizome paste is applied on dislocated and swollen bones; also applied on wounds for quick healing.

#### *Ageratum conyzoides* (Asteraceae), *Pasho*, *Pasu-ayou* (Fig.4)

Uses: Leaves are used on swollen parts to relieve pain. Plant juice is applied twice daily in red eye (conjunctivitis). Tribes apply leaf-paste, leaf-juice on cuts and wound to check-bleeding and early healing. Plants are pounded and made into pills of the size of pea; one pill thrice a day is administered to cure blood dysentery.

#### *Alpinia malaccensis*, *Tili*

Uses: Fruits are edible, aromatic.

#### *Anisomeles ovata*, *Narutami*

Uses: Whole plant paste is applied in muscular pain.

#### *Artemisia indic*, *Kukulu*

Uses: *Apatani* people eat boiled leaves to get relief from asthma; aromatic smell of plant clears the nose blockade, when inhaled. Bath with diluted leaf juice gives relief in itching and skin allergy. Fresh leaf juice is dropped in eyes to cure redness of eye but is painful. Leaf paste is applied on back; leaf spread over bed, give relief in back pain. Fomentation by leaves gives relief in headache.

#### *Arundinaria callosa*, *Tabyo*

Uses: Rope made from bark is very hard and durable.

#### *Aspidopterys indica*, *Taru*

Uses: Extract of the plant crushed and boiled with water is boiled further till the extract becomes thicker into a gum; the gum is used for catching birds.

#### *Bambusa tulda*, *Bije*

Uses: Stem is used for making flute, locally called *eloo*. It is used by priest during *Dree* festival. The sound is believed to keep evil spirits away.

#### *Bauhinea variegata*, *Pacham*

Uses: Tender leaves and flowers (cooked) are eaten as vegetable.

#### *Begonia roxburghii*, *Bekhoo*, *Lukhu*

Uses: Roots, petioles and leaves are used in cold/fever/malaria; pounded leaves are applied in itching. Leaves and whole plants are eaten by *Nyishi* as well as *Apatani* people.

#### *Begonia observa*, *Lukhu*

Uses: *Nyishi* people use roots, petioles and leaves in cold/fever/malaria; pounded leaves are applied in itching. Leaves are eaten by *Nyishi* as well as *Apatani* people.

#### *Berberis wallichiana*, *Lobetree/Tipetire*

Uses: Root bark paste is applied on swollen parts of body to get relief from body pain. Spines are used for tattooing on chin and forehead; a mixture of rice starch and *soot* is applied on the wound; rich starch pierces the skin and soot gives the colour; tattoo, locally called *te* is traditional custom.

#### *Calamus floribunda*, *Easoo*

Uses: Fruits are eaten. Stem is used for making basket, locally called *nara* and hat, called as *beopa*.

#### *Canarium strictum*, *Apatani-Dhuna*

Uses: Bark juice is used against insect bite. Bark and resin of plants are burnt in and outside house for prevention of diseases like chickenpox.

#### *Centella asiatica*, *Glangkhako*

Uses: Plants are eaten with salt and chilly as vegetable as blood purifier and remedy for gastric; leaves are taken to cure abdominal pain and relief in constipation; fresh leaves and stem are taken to increase digestive power and promote appetite by *Apatani* tribes.

#### *Chlorophytum arundinaceum*, *Tale*

Uses: Entire plant is taken as vegetable either raw or after boiling. It is used as a substitute for onion.

#### *Coptis teeta*

Uses: Rhizomes with water are eaten as tonic; also taken in fever, headache and gastric trouble.

*Crassocephalum crepidioides, Gendattamang*

Uses: Whole plant is eaten either fresh or boiled; leaf juice is applied on cuts to prevent bleeding; pain is relieved and the wound heals up quickly.

*Curcuma caesia, Kali Haldi*

Uses: Roasted rhizome is eaten by *Apatani* people at bedtime to get relief from cough and asthma.

*Cyathula prostrata*

Uses: It is an ingredient of *Tapyo*- the *Apatani* black salt.

*Cyclosorus glandulosus, Riji*

Uses: whole plant is used in festivals.

*Dendrocnide sinuata, Hathi pata*

Uses: Warm root paste is applied on swollen muscles, injury and itching by *Nyishi* community. Its leaves with those of *Stephania glabra* (2:1) are boiled and a decoction is taken during fever and malaria in *Nyishi* community. *Apatani* people use leaf decoction in dysentery, urinal disorders, red urine etc.

*Dendrocalamus strictus, Eabing*

Uses: This is planted in house and in places of worship. It is believed to keep devil spirits away; plant is used in *Meoko* festival for decoration. Stem is used for making arrow. Bark is used as rope which is very hard.

*Dichrocephala bicolor, Pechikai*

Uses: Tender plants are edible.

*Dillenia indica, Jampa, Tenga* (Fig.5)

Uses: Fruit ash is given in stomachache by *Nyishi* community. Fresh fruits are eaten with salt by *Apatani* people in stomachache. Fruits are eaten and made into pickles also.

*Dioscorea hamiltonii, Engi*

Uses: Bulbils and tubers are cooked and taken as food; also eaten by wild boar.

*Discorea bulbifera*

Uses: Tubers with those of *Stephania glabra* are used in dysentery. Pounded tubers are rubbed on spots with burning sensation.

*Diplazium esculentum, Hokahmang*

Uses: Young fronds are eaten as vegetable (cooked).

*Eclipta prostrata*

Uses: *Apatani* people use plants on cuts and wounds. Plants taken with sugar and salt twice a day gives relief in dysentery and stomach pain.

*Elaiagnus latifolia, Hari*

Uses: fruits are edible, sour-tasted.

*Eleusine coracana, Sase*

Uses: Country liquor *Apong* (Fig.6) is made from the grains. Ash of grain (*Tachoo*) is taken twice in cough, cold, congestion and for neutralizing wine.

*Emblica officinalis, Amlaki ghoss*

Uses: Fruits are edible and used as appetizer and freshness of mouth by both the tribes.

*Entada purseatha*

Uses: Seed paste with mustard oil is used in bone fracture.

*Erigeron bonariensis, Daglentado*

Uses: Vapour of leaves is inhaled in sinus problems.

*Eryngium foetidum, Dhaniya Pat*

Uses: Paste of stem and leaves is applied on forehead in headache. Seed powder is used in madness in *Adi* & *Apatani*. Leaves are used to make *chutney* with leaves of *Centella asiatica*.

*Eurya acuminata DC. var euprista, Turku* (*Nyish*)

Uses: Decoction of leaves mixed with *Rubia manjith* plant is used as permanent dye.

*Ficus fistulosa, Mobopu*

Uses: Plants are used as firewood.

*Galeola falconeri*

Uses: Seeds are collected by the bees to prepare beehive.

*Gnaphalium affine, Miang*

Uses: Dried plants are used as fuel.

*Gynostemma pedata ern., Rikoh*

Uses: *Apatani* take mixture of *Tapyo* (*Apatani* black salt) and *Rikoh* along with less quantity of chilly and common salt to get relief from throat problems<sup>32</sup>. Dry seed powder is found to be anthelmintic<sup>31</sup>. Plant with name *Tapyo* is reported for its folk values among *Apatani* of Zero Valley<sup>33</sup>. Powder of stem or root with water is taken orally as a remedy for cough and stomach troubles.

*Gynura cusimbu, Kochibamang*

Uses: Leaf juice, bitter in taste is taken orally as a preventive measure against worms.

*Hedychium dekianum*

Uses: Rhizome paste or powder is applied on injury and wounds for immediate healing and relief from pain by *Apatani*.

*Hibiscus rosa-sinensis, Ghasphu*

Uses: Paste of flowers and leaves of *Michelia champaca* (1:2) is applied with water for washing of hairs to remove hair dust and dandruff; also used as hair tonic. Flower paste is taken in fever.

*Houttuynia cordata, VeSiahmang*

Uses: People use whole plant as condiment or improving appetite; fresh plants are eaten twice daily in case of jaundice. Plants are kept inside the banana leaf and roasted; roasted plants are taken twice daily to stop dysentery. *Apatani* people use the stem and leaves as vegetable; considered effective for providing good sleep and freshness of mind. Plants are also used as condiment and sold in bundles. Leaves are eaten raw as chutney.

*Hyptis suaveolens, Narutami*

Uses: Leaf juice or pounded tender twigs, is rubbed against skin disorders and itching; leaf juice drops are mixed with water for taking bath against itching and to children for the treatment of cough and cold by *Apatani* people.

*Lasianthus longicauda, Santupaya*

Uses: Fruit extract is used as gum for praying birds.

*Litsea citrate, Santetero*

Uses: Both ripe and unripe fruits are edible. It is used as substitute of spices during preparation of vegetables, curry and meat. Pickle is prepared from the fruit, fragrant.

*Litsea cubeba, Santero*

Uses: People use pounded fruits and leaves mixed with water in blood dysentery, stomach trouble and fever. Leaf paste is also applied on forehead in case of headache. *Apatani* people eat fresh ripe or unripe fruits as a remedy for cold and cough and also for good sleep. Fresh fruits are edible and also used as spice. Fruits and seeds are used as condiments. Seeds are also chewed in case of thread worm infection.

*Loropetalum chinense, Marri*

Uses: Plants are used in religious ceremony.

*Mahonia acanthifolia, Tamen, Taming*

Uses: Ripe fruits are edible, sweet, tongue becomes black; generally, select their sacred places near the plant.

*Mahonia napaulensis, Tamen, Taming*

Uses: Stem juice is applied for the treatment of itching and skin rashes. Stem juice is also used as a local yellow dye and colouring agent. Fumes from boiling of stem are useful in conjunctivitis and eye troubles. Ripe berries are eaten by both the tribes.

*Mallotus albus, Fishkuri*

Uses: Leaf powder is used in fever and cold. Root juice is useful in earache.

*Melastoma malabathricum, Akysanyi*

Uses: Fruits are edible. Stem is used as tooth brush. Fruits cause shining of teeth. Fruits offered to God for better yield of paddy.

*Melia azedarach, Tapa Tale*

Uses: Fresh bark paste is applied against burning sensation till complete relief by both the tribes. Leaves are boiled in one bucket of water and taken bath in case of itching.

*Melothria heterophylla, Kabomako*

Uses: Pounded tubers is taken with one glass of hot water (very bitter in taste) against fever, malarial fever and headache; juice from fleshy roots is rubbed on itching skin till complete relief. Fruit are edible; children are fond of the fruits.

*Michelia champaca, Salyo*

Uses: Fresh or dry seeds (raw or boiled) are eaten to improve the loss of appetite and liver disorder; paste of leaves of the plant and flowers of *Hibiscus rosa sinensis* (2:1) is applied with water for washing of hair to remove hair dust.

*Michelia oblonga, Salyo*

Uses: Similar to *M. champaca*.

*Mikania micrantha, Mantami*

Uses: *Apatani* people apply juice of stem and leaves in skin diseases, itching and skin allergy. Juice mixed with water is used as germicides during bath; leaf juice is also used for healing of wounds; also used in cuts to stop bleeding. Leaves are warmed above fire and kept on the eyes to cure any type of eye trouble. Plants are used as a

remedy for snakebite and scorpion sting. Leaves are used in itches and poulticing wound.

*Millettia cinerea*, *Rolang*

Uses: Stem is used as rope.

*Molineria prainiana*, *Loli*

Uses: Fresh leaves are used to tie over the lower abdomen of pregnant lady for relieving of labour pain, easy and quick delivery.

*Molineria recurvata*, *Loli*

Uses: Crushed fresh leaves are applied against body pain and labour pain. Root juice is applied on cuts and wounds for early healing. Fruits are also eaten by *Nyishi* tribe.

*Murraya paniculata*, *Nyibumtarum* (*Adi*)

Uses: Ripe fruits are edible.

*Musa sapientum*, *Kol*

Uses: Fruits and stem are taken as food. Fruits are eaten by pig; entire plants are used in all festivals. Juice of stem and leaves is applied over swollen feet and skin disorders.

*Musa velutina*

Uses: Stem juice is used in dysentery.

*Myrica esculenta*, *Baching*

Uses: Bark juice is applied on itching and skin eruptions. Some time juice mixed with water is taken as bath. Fruits are edible.

*Ocimum basilicum*, *Nangpara*

Uses: Leaves and inflorescence crushed with salt and water is taken in case of cholera.

*Oenanthe javanica*, *Aguhama*

Uses: Whole plant is eaten raw or cooked as vegetable.

*Oxalis corniculata* (*Oxalidaceae*), *Okhui hamang*, *Ohokhuhii*

Uses: *Apatani* people use (raw/boiled) whole plant as vegetable to promote appetite; but it is not taken with local drink, *Apung*. *Nyishi* people apply juice of plant on cuts and injuries to stop bleeding. Leaf juice is used as eye drops for removal of dust from eyes or against redness of eyes. Fruits are edible, sour and iris.

*Oxalis debilis* (*Oxalidaceae*), *Khui-hamang*

Uses: Whole plant is used as vegetable either raw or cooked to promote appetite but local drink *Apung* should not be taken with the plant.

*Paederia foetida*, *Gandhali*

Uses: *Apatani* people use juice from the pounded leaves mixed with boiled water twice daily for drinking against gastric trouble. Boiled leaves and twigs are used as vegetable and is said to be effective for cleaning of stomach and against stomach swelling and diarrhoea.

*Pericampylus glaucua*, *Rukitaru*

Uses: Stem is used as rope which is very hard and durable.

*Perilla frutescens* (*Lamiaceae*), *Timing*

Uses: Seeds are edible but harmful if taken more and develops cough. Seed oil is applied on forehead against headache and fever by *Apatani* people.

*Pinus wallichiana* (*Pinaceae*), *Tel ghos*

Uses: Resin collected from live plants by piercing the stem is applied in cracks of heels usually during winter at bed time for one week.

*Piper trioicum* (*Piperaceae*), *Ridi*

Uses: Leaves warmed above fire, either covered locally or tied over with a piece of cloth against bodyache, which mainly occurs due to tiredness by *Nyishi*. Roots are chewed by *Apatani* as a remedy for cough.

*Plantago erosa*, *Mepi-hamang*

Uses: *Apatani* people use leaves either raw or boiled as vegetable and considered as remedy for constipation; also improves digestion.

*Plectranthus japonica*, *Yode*

Uses: Fresh leaf juice is applied externally on swollen parts and wounds resulting from insect bites.

*Polygonum barbatum* (*Polygonaceae*), *Rerupi*

Uses: Plant paste is mixed with water to catch fish; it acts as fish poison.

*Portulaca oleracea* (*Portulacaceae*), *Pathavi*

Uses: Stem and leaves are used as vegetable to promote appetite by the tribes. Pounded stem, leaves and flowers are applied against skin allergy, rashes, etc. by *Nyishi* tribe.

*Prunus cerasoides*, *Putu*

Uses: Ripe sweet fruits are edible.

*Prunus refa*, *Gonde*

Uses: Fruits are edible.

*Pterospermum acerifolium*, *Sippopasing*

Uses: Paste of floral calyx is applied as plaster in swelling in the body.

*Quercus dealbata* (*Fagaceae*), *Kra*

Uses: Leaves and flowers are used in *Apatani* festivals. Woods are used for preparing poles and wooden materials for house construction.

*Rhus chinensis*, *Tamo*

Uses: Fruits are edible; fruits eaten twice daily in case of blood dysentery. Fruits are used like that of tea leaves against body pain.

*Roydsia suaveolens*, *Rokputtutum*

Uses: Fruits are edible, sweet.

*Rubia manjith* (*Rubiaceae*), *Tamin*

Uses: Plant is used as a dye; stem is cut into pieces and boiled in water; extract thus obtained is used to dye the yarn (red). Roots are also used as red dye for colouring of local clothes and articles, etc. Powdered roots mixed with water is given against cold & cough. Often roots are chewed for the same purpose. Powder is also applied on forehead in case of headache.

*Rubus ellipticus* (*Rosaceae*), *Jilyung*

Uses: Ripe fruits are eaten, sweet.

*Rubus niveus* (*Rosaceae*), *Nikhee*

Uses: Fruits are edible but sour.

*Rubus rosaefolius* (*Rosaceae*), *Hitimbulum*

Uses: Fruits are edible, sour.

*Sapium baccatum*, *Samperai*

Uses: Fruits are edible, sweet.

*Saurauia roxburghii* (*Saurauiaceae*), *Tarsingahi*

Uses: Leaves are used for preparing country liquor. Bamboo basket is wrapped with leaves and boiled with water and kept within the pot for few days. Leaves promote quick fermentation. Ripe fruits are eaten.

*Schizostachyum capitatum*

Uses: *Apatani* people use tender shoots or liquid inside bamboo in small quantity orally to get relief from diarrhoea, dysentery and stomach troubles. Young tender shoots are also considered as wormicide if added in water before bath.

*Silene heterophylla*, *Jajru*

Uses: Fruits are edible, sweet.

*Skimmia anquetifolia*, *Dising*

Uses: Plants are used by the *Apatani* people for the treatment of gastric pain.

*Solanum kurzii* (*Solanaceae*), *Byakh*, *Byako*

Uses: *Apatani* people use fruits with small quantity of salt for the treatment. Dried fruits are powdered and mixed with water (1:4) and boiled; decoction is taken for complete relief from worm infestation.

*Solanum myriacanthum* (*Solanaceae*), *Byako*, *Thitbyako*

Uses: Dried seeds pounded and mixed with water and mustard oil is kept on heated stone; smoke is inhaled through mouth for removal of teeth worms.

*Solanum nigrum* (*Solanaceae*), *Harohamang* (Fig.7)

Uses: Stem and leaves are used as vegetable and considered digestive and liver tonic; also useful for clear motion. Berries are eaten raw. Leaves are eaten raw or cooked.

*Solanum torvum* (*Solanaceae*), *Bykh*

Uses: Paste of fruits mixed with little salt is given for the treatment of cough.

*Sonchus brachyotus* (*Asteraceae*), *Paku Hadu Hammang*, *Kochi hama*

Uses: Decoction made from stems and leaves is administered for the treatment of gastric trouble, stomach pain and waist pain. Boiled leaves are used as vegetable and said to be effective in stomach troubles.

*Sonchus oleraceus* (*Asteraceae*), *Paku Hadu Hamang*

Uses: Stem and leaves are used by the *Apatani* people as substitute for *S. brachyotus*.

*Spilanthes paniculata* (*Asteraceae*), *Yakho hama*

Uses: Plants are used for curing intestinal worms. Leaves are used as a condiment or eaten raw/boiled to remove constipation. Flower paste is applied or chewed in case of toothache.

*Terminalia chebula* (Fig.8)

Uses: *Apatani* people chew fruits for the treatment of cough; fruits are considered stomachic.

*Toddalia aculeate*, *Tanoai*

Uses: Fruits are edible, fragrant.

*Trichosanthes bracteata* (*Cucurbitaceae*), *Bullungkoha*

Uses: Fruits are considered poisonous.



Fig.1 An Apatani hamlet



Fig.2 Apatani women in rice field



Fig.3 A dense vegetation of Apatani plateau

Fig.4 Leaves of *A. Conyzoides*Fig.5 Fruits of *D. indica*

Fig.6 Apong made of sase

Fig.7 Leaves & fruits of *S. nigrum*Fig.8 Fruits of *T. chebula****Trichosanthes tricuspidata* (Cucurbitaceae), Bhullung koha**

Uses: Pounded roots and stems is taken with hot water for the treatment of dysentery by *Nyishi* tribe. Stem is kept for a long period after drying; small pieces mixed with other vegetables are eaten as a remedy of stomach trouble. It is also used as appetizer if almost dried stem is taken with hot water at bed time. *Thunbergia coccinea* root is also in use as substitute.

***Vernonia cinerea***

Uses: Plants are used in preparation of *Tapyo*, known as *Apatani black salt*.

***Villebrunea integrifolia*, Pattatan**

Uses: Bark is used as rope; sometimes used as a substitute of cotton thread for preparing fishing net.

***Vitis repens* (Vitaceae), Tarupakhu**

Uses: Fruits are edible but sour.

*Zanthoxylum acanthopodium* DC. (Rutaceae), *Yokhung*

Uses: Tender shoots are cooked and taken as vegetable. Fruits are eaten. Pounded fruits are prescribed for dysentery and stomachache.

*Zanthoxylum armatum* DC. (Rutaceae), *Yarkhung*

Uses: *Apatani* people use seed powder with equal amount of salt against cold, cough and fever; also given to increase appetite. Seeds are used as spice. Fruits are chewed and twigs are used as tooth brush in toothache. *Nyishi* people use decoction of dry fruits in stomach disorders.

*Zingiber officinale* (Zingiberaceae), *Sing Taki*

Uses: Dried stem mixed with salt is used in the treatment of hysteria. Fresh rhizome is eaten; juice is taken in cough.

### Discussion and conclusion

Out of total 108 listed local species, majorities (45) of them were used in ethnomedicinal purposes followed by food plants (37) and for handicrafts and others (13) (Fig.9). Seven plant species were found to be used in food as well as ethnomedicine also, while equal numbers of species were recorded for use in hunting and fishing and for cultural uses (4 each). Scrutiny of plant parts used by *Apatani* indicated that in maximum of them, the fruits are used (27) followed by leaves (21) and whole plant (17) (Fig.10). Eight species were recorded in which bark is used (9) and similar cases were recorded for grains/seeds also (8). In a few species, rhizomes (5), roots (3) and flowers were found important for their use. Analysis indicated that out of 108 plant species, most of them are used as fresh or raw (40), followed by in boiled form (mostly foods and vegetables) and extract/juice (mostly ethnomedicinal plants) (Fig.11). Twelve species (ethnomedicinal) recorded were used in form of solution and liquid, whereas 10 were found in use as paste. Four species each were recorded which were consumed in form of decoction and roasted (these are also ethnomedicinal). In some cases (10-12%) it was found that professional healers are major expert of plant collection. But, in majority of cases plant resources used for various purposes are primarily collected by women folk. These plant resources find habitats to grow in domestic gardens, community forest and other wild niches. However, expanding agricultural fields with population pressure are threats to these species. This problem is more among young *Apatani* members, who need proper education and

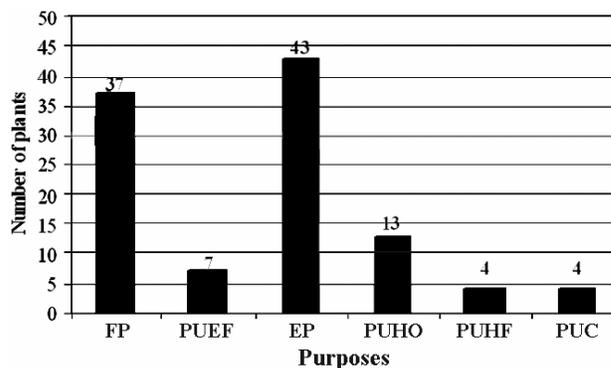


Fig.9 — Local plants used by *Apatani* tribes

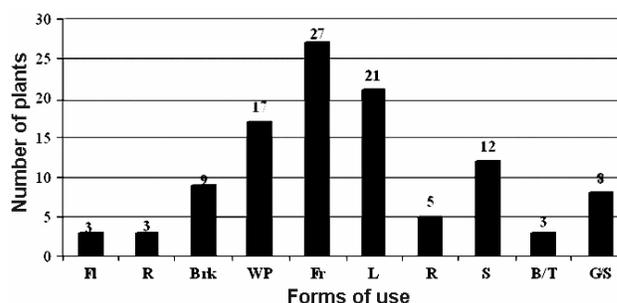


Fig.10 — Different parts of local plants species used

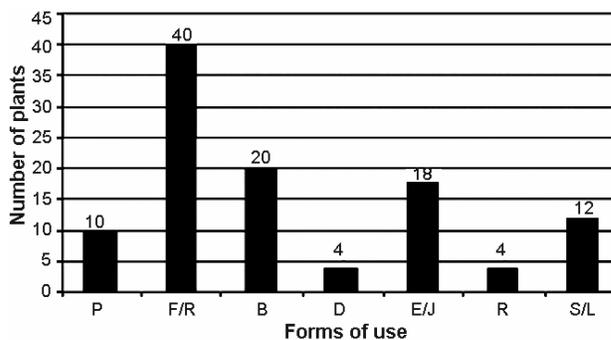


Fig.11 — Forms of use of different local plants

training on plant resource conservation. Hence, the challenging task to sustain plant biodiversity and related knowledge is the conservation of species and checking knowledge erosion among younger generation. Species could be conserved through the integrated approach of *in-situ* and *ex-situ* conservation. Establishing Village Traditional Knowledge Bank (VTKB) and Community Knowledge Garden (CKG) in participatory manner could be a most significant approach to not only conserve the plant biodiversity and related knowledge, but could also contribute in sustaining livelihoods of *Apatani* tribe<sup>7-9</sup>. Looking to the nature of community knowledge of *Apatani* tribe, a

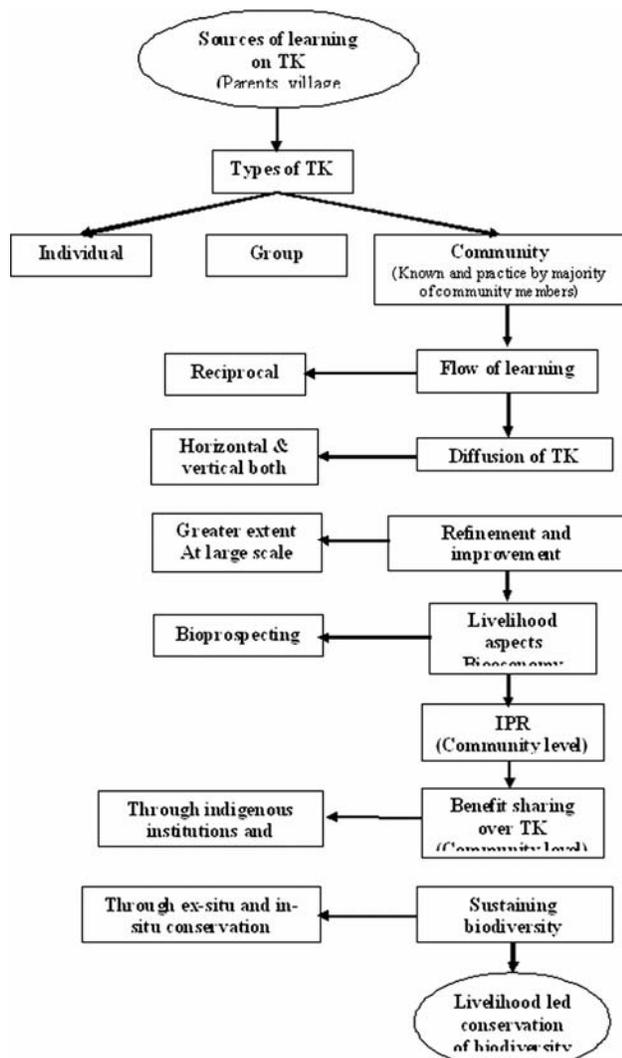


Fig.12 —Conservation of TK & related biodiversity of *Apatani*

livelihood and IPR protection led model of conservation and promotion of biocultural knowledge among *Apatani* tribe is required (Fig.12). This model ensures the related components and assured participation of traditional knowledge holders (TKH) and knowledge nurturing institutions (KNI) to enhance the livelihoods led biodiversity conservation and diffusing of traditional knowledge<sup>7</sup>.

In this context, it is worth to mention that a well planned and time bound strategy has to be adopted for proper documentation of the inherited ethnic knowledge of *Apatani* tribe<sup>6-9</sup>. It is not surprising that after a decade or two, there may not be a single person to tell us about their knowledge and culture (who have been drivers in conservation of biocultural knowledge)<sup>7</sup>. In view of the above facts, it is felt that there is a prime need to establish a full-fledged

multidisciplinary *Institute of Ethnobiology* in the state. This institute can monitor all the ethnobiological researches in state as well as entire NE region of India. Recently, the establishment of Northeastern Institute of Folklore Medicine at Pasighat in East Siang district (Arunachal Pradesh) is one of the significant steps in protecting and promoting ethnomedicinal knowledge of tribal communities of state and NE region as a whole<sup>5</sup>. Further work on isolation of active principles, clinical tests, etc. from local plants species would be an additional scientific requirement to establish theories on biocultural knowledge. This approach could facilitate for alternative professional and alternative livelihoods of this tribe. This effort can also facilitate in protecting the IPR of tribe on plant related knowledge and products as well as to ensure the equitable benefit sharing over knowledge.

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