

Ethnobotanical Investigation of Edible and Medicinal Plants in Pakke Wildlife Sanctuary of East Kameng District in Arunachal Pradesh, India

L. Jeri, Hui Tag¹, J. Tsering, P. Kalita, T. Mingki and A.K Das

Plant Systematic & Ethnobotanical Research Laboratory, Department of Botany, Rajiv Gandhi University,
Rono Hills, Itanagar-791112, Arunachal Pradesh, India

¹Corresponding author: huitag2008rgu@gmail.com

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Abstract

Pakke Wildlife Sanctuary & Tiger Reserve (PWLS & TR) in the East Kameng District of Arunachal Pradesh that falls within the Himalaya Biodiversity Hotspot is known for its rich plant resources. The present paper unveils ethnobotanical resources used by the *Nyishi* community of fringe villages of sanctuary focused on edible and medicinal plants. Quantitative ethnobotanical survey was conducted in 22 fringe villages covering 90 household and 180 respondents interviewed through structured questionnaire. Study reveals 62 plant species belonging to 48 genera and 32 families, and shows high use value index (UVI) for economically significant plants.

Key words: *Nyishi* tribe, Pakke WLS, Edible & Medicinal plants, Ethnobotany

INTRODUCTION

Arunachal Pradesh has a total geographic area of 83,743 km² which has a variety of agro-climatic condition due to which the region is exceptionally rich in biodiversity. The region has 26 major tribe and 110 sub tribes which has its own traditional way of using forest bioresources for sustaining livelihood (Tag & Das 2004). The Pakke Wildlife Sanctuary in East Kameng district including its fringe villages has exceptionally rich forest heritage with diverse ethnobotanical plants. Being forest dwellers, the *Nyishi* community of the Arunachal Pradesh in general and Pakke region in particular have been adopting traditional way of harvesting these rich ethnobotanical resources to fulfil healthcare and other basic day to day needs (Tag & Das 2007; Tag *et al* 2010). Though the region is rich in medicinal plant diversity but no status assessments have been made to date on ethnobotanical account with particular on food and medicinal plants. The present paper discusses some of the plants used by the fringe villagers as food and medicine.

Study Site

The present study sites lies around the Pakke Wildlife Sanctuary & Tiger Reserve (92° 36" E and 93° 24" E longitudes and 26° 56" and 27° 59" N Latitudes). The sanctuary is bounded by two rivers, *Pakke* in the eastern border, *Kameng* in the Northern West and western border and Nameri Wildlife Sanctuary in the southwestern border of East Kameng District of Arunachal Pradesh. It is covering a total geographical area of 861.95 km², which account for 9.04 % of total protected area in Arunachal and 20 % of the total area of East Kameng District (Tag *et al* 2010). There are almost 25 villages located in an around Pakke WLS, 16 villages in the Pakke Kessang Region, 10 villages in Seijosa region and 3 villages in western side bordering Balukpong with a total population of 6544 persons (Anonymous 2001). We surveyed 90 household and 180 respondents residing in 22 fringe villages of West, East & Northeastern border of the sanctuary for assessment of ethnobotanical knowledge status.

MATERIALS AND METHODS

Conventional ethnobotanical and floristic method of Jain & Rao (1977) was used in present investigation for random plant collection. For quantitative ethnobotanical studies in fringe villages the methods of Phillips (1996) was followed: $UVI = \frac{RMXC}{N}$ [Where: UVI = Use Value Index of plants; “ = Summation; RM = Total number of body parts extracted from plants; C= Number of times which a particular plants has been reported to be utilized; N= Total number of informants questioned]

Rarity status of plants was worked out using IUCN Red List Category & Criteria for regional guidelines, Version 7 (2008) and also consulted Indian Red Data Books (Nayar & Sastry 1990). Interactions with the local villagers were done to know the various plant parts used as medicine and food. Local names and the parts used against various ailments were recorded and statistical data were compiled using Microsoft Excel to know the status of plant parts used in both food and medicines. Community level interactive workshops were conducted so as to have a wider sharing in conservation and spreading of ethnomedicinal knowledge. Plant samples were collected and mounted herbarium were made, the plants were then matched at the Herbarium of the Botanical Survey of India, Itanagar for further identification and authentication. The identified herbarium sheets are deposited at the Herbarium of the Department of Botany, Rajib Gandhi University for future reference.

RESULT AND DISCUSSION

Present ethnobotanical investigation reveals the uses of 62 plant species belonging to 48 genera and 32 families are used by the people of *Nyishi* community of fringe villages in Pakke WLS as food and medicine (Table 1). Further analysis reveals that there are 32 species of herbs, 14 species of shrubs and 8 species each of trees and climbers, with % value presented in Figure-1. Statistical analysis on utility, rarity and climatic adaptation has revealed that almost 23 species are widely cultivated and 39 species are harvested from wild. Out of total, 51 species are common while 11 species are extremely rare in their habitat (Figure-2). Cross species analysis on climatic adaptation and ecological zone adaptation shows that almost 61 species are capable of grow in tropical, subtropical and temperate climatic zones, while 60 species are purely subtropical in origin and 58 species are mostly tropical plants. Analysis on the basis of plant parts used reveals that 32 species are used through leaves, 1 rhizome, 8 seeds, 2 corm, 16 fruits, 3 flowers, 4 tubers and 1 pod (Figure-3). Statistics on plant-part used reflects leaves as most preferred and widely used parts out of 62 plants identified, while fruits and tubers comes to the next slot of our statistical analysis. Our random observation implies that people are rich in ethnobotanical knowledge but somewhat poor in ethnomedicinal knowledge. Based both empirical observation and quantitative ethnobotanical result, we conducted community level interactive workshop at Pakke Kessang and Seijosa as part of awareness campaign to educate the fringe villagers so as to enrich their medicinal knowledge to treat some of the tropical diseases. Working with community by sharing the bioresources management and modern conservation knowledge workshops has yielded desirable result and fringe villagers are now managing their ethnobotanical resources with stringent community conservation laws so that existing human pressure on buffer and core zone of Pakke WLS & Tiger Reserve could be reduced to some extent.

CONCLUSION

It was found that the fringe villages harbor diverse species of both food and medicinal plants. During the field survey it was found that the villagers had their own indigenous medicinal knowledge of using plant based traditional medicine for treating common ailments but such knowledge seems to be declining as majority of the villagers could not identify medicinal plants available within their community forest land. Such decline in medicinal plant knowledge could be due to the increasing inclination towards modern medicine as well as lack of the script to record their knowledge earlier centuries. Such similar decline of TK related to nomenclature and use of plants has been reported by earlier workers from *Nyishi* and *Adi* Communities of Subansiri and Siang District of Arunachal

Pradesh (Tag & Das 2004, 2007; Nimachow *et al* 2008). However, the *Nyishi* community of fringe village in Pakke WLS has rich treasure of cultivated and wild crop species, and most of them are wild edible as well as cultivated species which includes cereal crops, wild edible vegetable and tuber crops which could be nurtured through scientific methods for commercial harvesting. Further investigation on entire *Nyishi* dominated region of 5 districts in Arunachal Pradesh for cross use analysis could enlighten diversity of plant resources of the above mentioned tribe. However, it is important that traditional knowledge of villagers related to bioresources includes the conservation of rare and valuable species should be encouraged with further input from modern conservation knowledge so that pressure of fringe villagers on wildlife sanctuary could be minimized in immediate future.

Table 1: List of wild & cultivated plants used as food and ethnomedicinal agents by the *Nyishi* community living in fringe villages of Pakke Wildlife Sanctuary of Arunachal Pradesh.

[Abbreviations used: ES=Ecological Status; T=tropical; ST= Subtropical; Tm=Temperate; Alp=alpine; C=Common; R=Rare; E=Endangered; H= Herb; Sr=Shrub; Tr=tree; Cl=Climber; Cult.=Cultivated; W=Wild.; E=Endangered; Aq.=Aquatic; Agri=agricultural field; For.=forest; Ter,=terrestrial; Fam: Family]

Botanical Name [Family] Exsiccatae; Ecological Status	Nyishi Name	Part Used	Mode of consumption	Medicinal Uses	UVI
<i>Allium hookeri</i> Thwaites [Alliaceae] TM-HAU 17; ES: H/Cult/T/ST/Tm/R	Talap	Leaves	Raw paste with Zinger and Apong taken as salad	Stimulant, vermicide, anti-inflammatory, cuts & wounds	0.68
<i>Allium rubellum</i> M. Bieberstein [Alliaceae] TM-HAU 14; ES: H/Cult/ST/T/Tm/C	Mud talap	Leaves	Consumed raw as salad	Skin allergy, wound & infection, brain numbness	1.35
<i>Amaranthus spinosus</i> Linnaeus [Amaranthaceae] TM-HAU 21; ES: H/W/ST/T/Tm/C	Puchu kinnyu	Leaves	Boiled and consumed with rice	Chest inflammation, trout pain, constipation	5.42
<i>Amaranthus viridis</i> Linnaeus [Amaranthaceae] TM-HAU 56; ES: H/W/ST/T/Tm/C	Yorko puchu kinyu	Leaves	Boiled and consumed as vegetable	Rheumatism, chest pain, asthma, cough, boils/ sores	4.33
<i>Bambusa stricta</i> Roxburgh [Poaceae] TM-HAU 98; ES: Sr/W/ST/T/Tm/C	Eh here	Young shoot	Cooked and consumed as vegetable; fermented and dried one used as salad	Chest pain, indigestion, constipation, low blood pressure	6.51
<i>Bauhinia variegata</i> Linnaeus [Caesalpiniaceae] TM-HAU 70; ES: H/W/ST/T/Tm/C	Pachaum	Leaves	Tender leaves/ shoots are boiled and taken as vegetable	Liver disorder, chest pain, rheumatism	2.32
<i>Begonia roxburghii</i> A. DC. [Begoniaceae] TM-HAU 52; ES: H/W/ST/T/Tm/C	Boku yulu	Leaf petiole	Consumed raw as salad	Wound, boils and sores, stomachache, indigestion	1.76
<i>Cardamine hirsuta</i> Linnaeus [Brassicaceae] TM-HAU 44; ES: H/W/ST/T/Tm/R	Soram guyi	Leaves	Consumed raw as salad	Liver disorder, chest pain, cough, toothache, cuts & wounds	0.99
<i>Centella asiatica</i> (Linnaeus) Urban [Apiaceae] TM-HAU 25; ES: H/W/ST/T/Tm/R	Bodo	Leaves/ stem	Consumed raw as salad	Brain numbness, body- ache	1.86
<i>Chenopodium album</i> . Linnaeus [Chenopodiaceae] TM-HAU 07; ES: H/Cult/ST/T/Tm/R	Tai	Seeds/ Leaves	Seeds cooked and consumed; boiled leaves as vegetable	Indigestion, lack of appetite, debility	5.22
<i>Clerodendrum colebrookianum</i> Walpers [Verbenaceae] TM- HAU 16; ES: Sr/W/ST/T/Tm/R	Potto	Tender leaves	Boiled/ roasted and consumed with rice	High BP, liver pain, insomnia, dysentery, diarrhea, cough	2.30
<i>Coix lacryma-jobi</i> Linnaeus [Poaceae] TM-HAU 22; ES: Sr/Cult/T/ST/Tm/R	Tangek	Grain	Powdered/ cooked/ boiled (Dogom/ Opo)	Low vitamins, fats and carbohydrate, calcium supplements	3.66
<i>Colocasia esculenta</i> (Linnaeus) Schott [Araceae] TM-HAU 29; ES: H/Cult/ST/T/Tm/C	Eng ngepop	Leaves/ Rhizome	Roasted/ boiled rhizome consumed; leaves used as vegetable	Indigestion, lack of appetite, constipation	4.48

Botanical Name [Family] Exsiccatae; Ecological Status	Nyishi Name	Part Used	Mode of consumption	Medicinal Uses	UVI
<i>Crassocephalum crepidioides</i> (Bentham) S.Moore [Asteraceae] TM-HAU 48; ES: H/W/ST/T/Tm/C	Yamen	Leaves	Raw/ boiled consumed as vegetable and salad	Constipation, chest pain, liver disorder, difficult delivery	4.39
<i>Cucumis melo</i> Linnaeus [Cucurbitaceae] TM-HAU 58; ES: Cl/Cult/T/ST/Tm/C	Meble	Fruits/ Leaves	Raw fruits consumed; also as vegetable	Laxative, digestive, thirst quencher	6.86
<i>Cucumis sativa</i> Linnaeus [Cucurbitaceae] TM-HAU 63 ; ES: Cl/Cult/T/ST/Tm/C	Muku	Fruits/ Leaves	Raw fruits consumed; also as vegetable	Thirst quencher, laxative	5.44
<i>Cucurbita maxima</i> Duchesne [Cucurbitaceae] TM-HAU 55; ES: Cl/Cult/T/ST/Tm/C	Tapp	Fruits/ Leaves	Boiled and consumed as vegetable; famine food	Seeds anti-inflammatory, digestive, laxative	7.86
<i>Dendrocalamus gigantea</i> Wallich ex Munro [Poaceae] TM-HAU 46; ES: Sr/W/ST/T/Tm/C	Eeh Hiku	Young shoot	Taken cooked as famine food; fermented and dried for salad	Chest pain, indigestion, constipation, low BP	3.76
<i>Dillenia indica</i> Linnaeus [Dilleniaceae] TM-HAU 73; ES: Tr/W/ST/T/Tm/C	Champak	Acresc-ent calyx	Boiled and taken as salad	Indigestion, liver disorder, stomachache	5.50
<i>Dioscorea alata</i> Linnaeus [Dioscoreaceae] TM-HAU 37; ES: Cl/W/T/ST/Tm/R	Egin nginek	Tuber	Roasted/ cooked/ fermented food and beverage (<i>Opo/ Dogom</i>)	Laxative, stimulant; asthma	2.18
<i>Dioscorea deltoidea</i> Wallich [Dioscoreaceae] TM-HAU 45; ES: Cl/Cult/T/ST/Tm/R	Egin nginte	Tuber	Roasted/ boil/ fermented food and beverage (<i>Dogom/ Opo</i>)	Laxative; indigestion, fatigue	1.69
<i>Diplazium esculentum</i> Swartz [Athyraceae] TM-HAU 82; ES: H/W/ST/T/Tm/C	Taka peya	Tender leaves	Boiled and consumed as vegetable	Liver disorder, alcohol addiction, indigestion	5.11
<i>Elusine coracana</i> (Linnaeus) Gaertner [Poaceae] TM-HAU 88; ES: H/Cult/T/ST/Tm/C	Teem	Grain	Powdered/ cooked/ roasted/ fermented local beer (<i>Mirik dogom/ Opo</i>)	Low vitamins, low stamina, iron deficiency	4.36
<i>Fagopyrum esculentum</i> Moench [Polygonaceae] TM-HAU 72; ES: H/W/ST/T/Tm/C	Huku	Leaves	Boiled and consumed as vegetable	Appetizer & laxative; stomachache	3.57
<i>Ficus semi-cordata</i> Buchanon - Hamilton ex Smith [Moraceae] TM-HAU 65; ES: Tr/W/ST/T/Tm/C	Tokuk	Fruits	Consumed as carbohydrate sources	Indigestion, constipation, asthma; brain stimulant	4.12
<i>Gnaphalium affine</i> D. Don [Asteraceae] TM-HAU 86; ES: H/W/ST/T/Tm/C	Tikpey ngm	Leaves	Consumed raw with maize and rice as salad	Body-ache, urinary trouble, running stomach	6.15
<i>Houttuynia cordata</i> Thunberg [Saururaceae] TM-HAU 94; ES:H/W/ST/T/Tm/C	Hiya	Stem/ leaves	Boiled/ raw taken as salad	Insomnia, high BP, diarrhea	2.86
<i>Ipomoea batatas</i> (Linnaeus) Lamarck [Convolvulaceae] TM-HAU 110; ES: Cl/Cult/T/S/T/Tm/C	Egin pegri	Tuber	Boil/ roasted/ cooked/ fermented food and beverage (<i>Dogom/ Opo</i>)	Indigestion, lack of appetite, asthma	4.59
<i>Lactuca sativa</i> Linnaeus [Asteraceae] TM-HAU 93; ES: ES: H/W/ST/T/Tm/C	Rabjap	Leaves	Consumed raw with maize	Cough, mild fever, stomach pain, gas trouble, liver disorder	2.66
<i>Lagenaria vulgaris</i> Seringe [Cucurbitaceae] TM-HAU 83; ES: Cl/Cult/T/ST/Tm/C	Opum ojuk	Leaves/ Fruits	Boiled and taken as vegetable (<i>Oh</i>)	Asthma, joint pain	5.78
<i>Manihot esculenta</i> Crantz [Euphorbiaceae] TM-HAU 105 ; ES: Sr/Cult/T/ST/Tm/C	Sin Eegin	Root tuber	Boil/ roasted/ cooked/ fermented food and beverage sources (<i>Dogom/ Opo</i>)	Constipation, indigestion, raw juice emetic	0.15

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<i>Musa ensete</i> J.F. Gmelin [Musaceae] TM-HAU 61; ES: Tr/W/ST/T/Tm/C	<i>Kodum</i>	Flower	Boiled and consumed as vegetable	Liver & chest pain, cuts & wounds, indigestion	7.98
<i>Oenanthe javanica</i> DC. [Apiaceae] TM-HAU 221; ES: H/W/ST/T/Tm/C	<i>Bubu</i>	Tender leaves/ stem	Consumed raw as salad	Insomnia, high BP, chest pain, indigestion	4.28
<i>Oryza sativa</i> Linnaeus [Poaceae] TM-HAU 96; ES: H/Cult/T/ST/Tm/C	<i>Aam</i>	Grain	Cooked/ roasted/ powder fermented for traditional beer (<i>Dogom/ Etti/ Opo</i>)	Asthma, diabetes, low stamina	0.66
<i>Phaseolus vulgaris</i> Linnaeus [Fabaceae] TM-HAU 95; ES: Cl/Cult/T/ST/Tm/C	<i>Peren</i>	Pod/ Seeds	Cooked mature seeds/ young pods consumed as protein-rich vegetable	Laxative, digestive; constipation	5.86
<i>Phyllostachys pubescens</i> Mazel ex Houz. de Lehaie [Poaceae] TM-HAU 111; ES: ES: Sr/C/ST/T/Tm/C	<i>Taab</i>	Young shoot	Cooked shoot taken as vegetable item	Low vitality, indigestion, lack of appetite, rheumatism	3.39
<i>Piper pedicellatum</i> C. DC. [Piperaceae] TM-HAU 122; ES: Sr/W/ST/T/Tm/R	<i>Riir</i>	Leaves	Taken raw or boiled as vegetable	Insomnia, body-ache, chest pain, cough, lack of appetite	1.29
<i>Plantago major</i> Linnaeus [Plantaginaceae] TM-HAU 99; ES: H/W/ST/T/Tm/C	<i>Sot nyuru</i>	Leaves	Consumed raw as salad	Lack of appetite, cough, chest inflammation, joint pain	3.01
<i>Polygonum molle</i> Wight [Polygonaceae] TM-HAU 134; ES: H/W/ST/T/Tm/C	<i>Yuru</i>	Tender leaves	Boiled/ raw consumed as salad	Constipation, sensational urination, boils & sores	1.08
<i>Pouzolzia bennettiana</i> Wight [Urticaceae] TM-HAU 128; ES: H/W/T/ST/Tm/C	<i>Huik</i>	Tender leaves	Cooked and consumed as vegetable	Difficult delivery, laxative	3.27
<i>Prunus persica</i> (Linnaeus) Batsch [Rosaceae] TM-HAU 116; ES: Tr/Cult/ST/T/Tm/C	<i>Siikom</i>	Fruits	Fruits consumed raw	Constipation, cough	6.11
<i>Rubus ellipticus</i> Smith [Rosaceae] TM-HAU 118; ES: Sr/W/ST/Tm/C	<i>Ngingek berek</i>	Ripe berry	Consumed raw as carbohydrate source	Indigestion, constipation, asthma; brain stimulant	2.19
<i>Rubus lineatus</i> Reinwardt [Rosaceae] TM-HAU 146; ES: Sr/W/Tm/C	<i>Ngintum bulum</i>	Ripe berry	Consumed raw as carbohydrate source	Indigestion, voice problem, constipation	1.64
<i>Rubus niveus</i> Thunberg [Rosaceae] TM-HAU 217; ES: Sr/W/ST/Tm/C	<i>Kib-lukpum hench</i>	Ripe berry	Consumed raw as carbohydrate source	Indigestion, constipation, asthma	2.66
<i>Saurauja nepaulensis</i> DC. [Saurauiceae] TM-HAU 228; ES: Tr/W/Tm/C	<i>Sicho hench</i>	Berry	Consumed raw as carbohydrate source	Indigestion, constipation, asthma	0.68
<i>Setaria italica</i> (Linnaeus) P. Beauvois [Poaceae] TM-HAU 241; ES: H/Cult/T/ST/Tm/C	<i>Tayak</i>	Grain	Boiled/ cooked/ food fermented beverage (<i>Opo/ Dogom</i>)	Diabetes, excess blood sugar, chest suffocation	1.35
<i>Solanum aculeatissimum</i> Jacquin [Solanaceae] TM-HAU 162 ; ES: H/Cult/ST/T/Tm/C	<i>Kasi biik</i>	Fruits	Cooked and consumed as vegetable/ salad	Liver disorder, chest pain, fever, cough, stomach pain, indigestion	5.42
<i>Solanum nigrum</i> Linnaeus [Solanaceae] TM-HAU 133; ES: H/W/ST/T/Tm/C	<i>Hoor</i>	Leaves	Consumed raw and cooked as vegetable	Diabetes, stomach pain, cough	4.33
<i>Solanum torvum</i> Swartz [Solanaceae] TM-HAU 139; ES: H/W/ST/T/Tm/C	<i>Sot biik</i>	Fruits	Roasted and consumed as salad	Liver disorder, chest pain, fever, cough, stomachache, toothache	6.51
<i>Solanum viarum</i> Dunal [Solanaceae] TM-HAU 119; ES: H/W/ST/T/Tm/C	<i>Sibin biik</i>	Fruits	Roasted and consumed as salad	Liver disorder, chest pain, fever, cough, stomachache, toothache	2.32

Botanical Name [Family] Exsiccatae; Ecological Status	Nyishi Name	Part Used	Mode of consumption	Medicinal Uses	UVI
<i>Solanum violaceum</i> Ortega [Solanaceae] TM-HAU 142; ES: H/Cult/ST/T/Tm/C	<i>Biik</i>	Fruits	Raw/ dried fruits consumed as salad	Liver disorder, chest pain, fever, cough, stomachache, indigestion	1.76
<i>Sonchus arvensis</i> Linnaeus [Asteraceae] TM-HAU 188; ES: ES: H/W/ST/T/Tm/C	<i>Tuku rubu</i>	Leaves	Consumed raw with maize	Diarhea, cough, liver disorder, inflamed skin	0.99
<i>Spilanthes paniculata</i> Wallich ex DC. [Asteraceae] TM-HAU 178; ES: H/W/ST/T/Tm/C	<i>Buud</i>	Leaves	Consumed raw/ cooked as salad	Toothache, constipation	1.86
<i>Spondias axillaris</i> Roxburgh [Anacardiaceae] TM-HAU 115; ES: Tr/W/ST/T/Tm/C	<i>Paka kat</i>	Fruits	Consumed raw as salad	Constipation, chest pain, circulation problem	5.22
<i>Spondias pinnata</i> (Linnaeus f.) Kurz [Anacardiaceae] TM-HAU 90; ES: Tr/W/ST/T/Tm/C	<i>Pakka</i>	Fruits	Consumed raw as salad	Liver disorder, fever, cough, stomach pain, skin inflammation	2.30
<i>Toddalia asiatica</i> (Linnaeus) Lamarck [Rutaceae] TM-HAU 41; ES: Cl/W/T/ST/Tm/C	<i>Koche taa</i>	fruits	Fresh ripe sweet fruits consumed as thirst quencher	Constipation, indigestion	3.79
<i>Trevesia palmata</i> Visiani [Araliaceae] TM-HAU 174; ES: Tr/W/ST/T/Tm/C	<i>Tago- meyo</i>	Flower	Cooked and consumed as vegetable	Asthma, indigestion, liver disorder	3.66
<i>Urtica parviflora</i> Roxburgh [Urticaceae] TM-HAU 228; ES: Sr/W/ST/T/Tm/C	<i>Push pun</i>	Tender leaves	Boiled and consumed with rice	Stimulant; numbness, constipation	4.48
<i>Zanthoxylum acanthopodium</i> DC. [Rutaceae] TM-HAU 254; ES: Sr/W/T/ST/Tm/R	<i>Honior</i>	Leaves	Consumed raw as salad	Laxative, stimulant; mental retardation, chest pain	3.79
<i>Zanthoxylum rhetsa</i> DC. [Rutaceae] TM-HAU 212; ES: Sr/W/T/ST/Tm/R	<i>Honior</i>	Seeds/ Leaves	Powdered seeds used as salad; cooked leaves taken as vegetable	Stimulant, digestive, laxative; numbness	4.39
<i>Zea mays</i> Linnaeus [Poaceae] TM-HAU 171; ES: Sr/Cult/T/ST/Tm/C	<i>Toop</i>	Grain	Boil/ roasted/ cooked and consumed as food/ fermented beverage (<i>Pumik/ Opo</i>)	Nutrient supplement for the chronic patients, debility	6.86
<i>Zingiber officinale</i> Roscoe [Zingiberaceae] TM-HAU 158; ES: H/Cult/T/ST/Tm/C	<i>Taikke</i>	Rhizome	Raw paste used in salad, consumed with <i>apong</i>	Vermicide, stimulant; debility, brain dampness	5.44

Figure 1: Habit groups of edible and medicinal plants used by Fringe Villagers in Pakke WLS & Tiger Reserve.

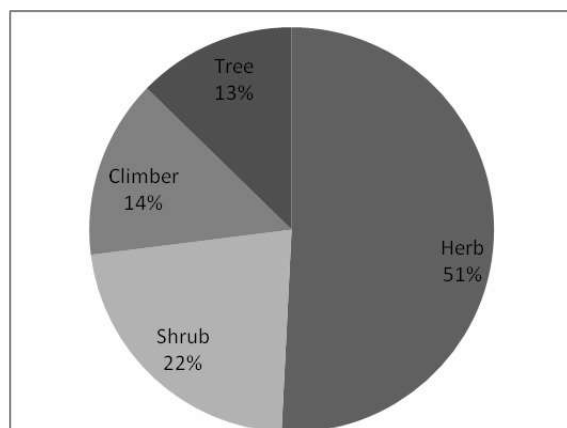


Figure 2: Percentage of the availability sources of edible & medicinal plants used by the fringe villagers in Pakke WLS & Tiger Reserve.

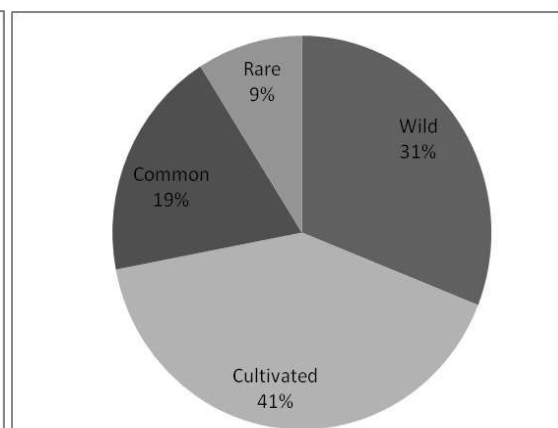
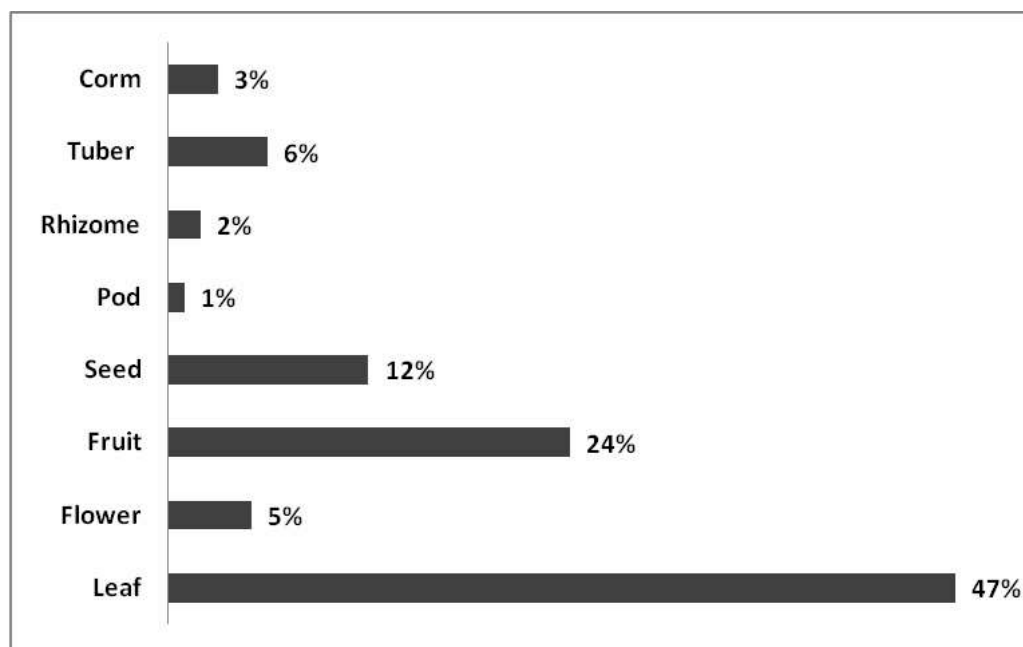


Figure 3: Percent distribution of useful parts of ethnobotanical plants used by the Nyishi community of fringe villages in Pakke WLS & Tiger Reserve.



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