

## Higher Plant Diversity in Pakke Wildlife Sanctuary and Tiger Reserve in East Kameng District of Arunachal Pradesh: Checklist - I

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### Abstract

Present paper discussed the higher plant diversity in Pakke Wildlife Sanctuary and its fringe locality of East Kameng District, Arunachal Pradesh. The area is located within Himalaya Conservation Hotspot. Random phytogeographical and floristic study exposed the diversity of higher plant species distributed in tropical, subtropical and temperate zones of the sanctuary along its altitudinal gradient. Some of the species those include globally significant medicinal plants were found threatened in fringe localities but coherent efforts are needed to include these species under IUCN Redlist category. An appropriate conservation measure through active participation of local community is needed to save those valuable higher plants resources from extinction in near future.

**Key words:** Floristic Survey, Pakke Wildlife Sanctuary, Higher Plant Diversity, Arunachal Pradesh

### INTRODUCTION

Current estimation puts Indian higher plant diversity is over 17000 species of which 33.5% are endemics. These are mostly concentrated in Central and Eastern Himalayan region with 2532 species, whereas 1782 species are restricted in peninsular India (Nayar & Sastry 1997-1999; Kumar & Chauhan 2005). Arunachal part of the Himalayas represents 33% of total Indian flora with  $\pm$  5000 species of higher plants (Chowdhery 1997), while Pakke Wildlife Sanctuary in East Kameng district is reported as exceptionally rich in higher plant diversity but no status assessments has been made to date (Tag *et al* 2010). There are 4 fringe villages in western zone and 18 in Eastern-North-eastern zone of Pakke Wildlife Sanctuary. Literature study has confirmed that no status assessment was made to date on plant diversity in the sanctuary area which has prompted the author and his team to carry out preliminary status survey, taxonomic database, habitat mapping in the core, buffer and fringe zone of the Sanctuary for status assessment for further future research and conservation priorities of higher plant diversity and medicinal uses if any.

### Study Area

The present study sites in Pakke Wildlife Sanctuary and Tiger Reserve lies approximately between 92°36" E and 93°24" E longitudes and 26°56" N and 27°59" N latitudes. The sanctuary is bounded by two rivers, *Pakke* in the eastern border, *Kameng* in the North 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 km<sup>2</sup>, which account for 9.04 % of total protected area of Arunachal Pradesh and 20% of the total area of East Kameng District (4134 km<sup>2</sup>) with varied topographical features ranging from steep terrain to rugged Siwalik type hills (Muthu *et al* 2004). There are three officially designated forest Ranges which includes – Seijosa, Tipi and Sunder view. The major ethnic group found is *Nyishi* tribe with population of over 10,000 (Census 2011). Their livelihood includes shifting and wet-rice agriculture, fishing and hunting,

collection of wild food plants, etc. Forest types of Pakke Wildlife Sanctuary and Tiger Reserve is classified into 5 major types which ranging from tropical to sub-alpine climate type. Species diversity and crop composition varies significant from tropical to sub-alpine zone along the altitudinal gradient. Climatically the entire ranges of wildlife sanctuary are humid and hot in tropical and subtropical whereas there is severe chill in temperate and sub-alpine type climate (Anonymous 2005). The dominant species in tropical and subtropical belt (100 – 1200 m) is characterised by lofty and medium height tree such as *Tetramelis nudiflora*, *Dillenia indica*, *Canarium strictum*, *Altingia excelsa* among others in top storey while temperate belt (1200 – 2500 m altitude) is dominated by tree species of *Schima wallichii*, *Alnus nepalensis*, *Betula alnoids*, *Quercus latifolia* and *Magnolia campbelli* associated with *Cinamomum*, *Saurauia* and *Ficus* species. The sub-alpine vegetation is characterized by few species of *Rubus*, *Prunus*, *Abies*, *Cupressus* and *Rhododendron* (Table 1). The riparian vegetation is dominated by *Duabanga grandiflora*, *Sterculia villosa*, *Bauhinia purpurea*, *Bauhinia variegata* and *Streospermum chelonoides* in the tropical and subtropical belt whereas secondary bamboo track forms as isolated patches along the hill slop in tropical and subtropical belt with total of 8 bamboo species reported to date from the sanctuary. Certain species of angiosperms species such as *Duabanga*, *Litsea*, *Terminalia*, *Eleocarpus* and *Musa* species are found to grow along secondary bamboo track (Tag *et al* 2010).

## MATERIALS AND METHODS

Random phytogeographical and floristic survey was done in core, buffer and manipulation zones of Pakke Wildlife Sanctuary during 2008 – 2010 to document the higher plants following the methods of Jain & Rao (1977). Taxonomy of collected threatened flora and associated flora was done through herbarium and literature studies at BSI-AFS-Itanagar. Random survey was done in four locality of the Sanctuary and the positions of threatened plants were located using GPS (Garmin Rhino 530HCx). IUCN status assessment was done following Red Data Book of Indian Plants (Nayar & Sastry 1997 - 1999) & IUCN Red listing Criteria Version 7 (2008). Research findings were shared with local community and fringe villagers through Community level interactive workshops wherein live threatened plants of the sanctuary fringe area was demonstrated by systematic botanists for local conservation initiatives.

## RESULTS AND DISCUSSION

Phytogeographical and floristic survey conducted in 861.95 km<sup>2</sup> area of the Pakke WLS & TR has revealed the occurrence of almost 215 species of higher plants belonging to 165 genera and 70 families (Table 1). Of the total 70 plant families, atleast top 7 families have been found to be dominant in the sanctuary which is represented by maximum number of species (Fig. 1). Further, our habit-wise analysis has revealed that around 91(42.32 %) species were herbs, 50 (19.5 %) species were shrubs, 30 (14.84 %) species were climbers and liana, and the rest 64 (30.86 %) species were trees (Fig. 2). The IUCN status reflects that majority of the species of around 178 (83.69 %) are not evaluated (NE) and not enlisted under IUCN Redlist Category. Almost 20 (9.3 %) species are under the IUCN Least Concern Category while 17 (8.8 %) species reported are under Vulnerable (VU) category of IUCN (Fig. 3). However, some species were observed to be extremely rare in their natural habitat but coherent efforts are needed to include these species under IUCN Redlisting category which includes globally significant medicinal plants such as *Aesculus assamica*, *Derris scandens*, *Phoenix rupicola*, *Paris polyphylla* *Illicium grifithii* and *Laggera crispata* found within the sanctuary area. By applying IUCN Regional Redlist Criteria, the above mentioned species either qualify under rare and threatened category as indicated in Table-1. The analysis of medicinal values of each species through ethnobotanical field inputs and critical screening of available medicinal plant literature has revealed that almost 150 (70.66 %) of higher species reported are having medicinal and economic values while 65 (30.23 %) of the species could not be

**Table.1:** Higher Plant Diversity of Pakke Wildlife Sanctuary & Tiger Reserve, East Kameng District, Arunachal Pradesh along with their medicinal value and IUCN status: Checklist-I. [Abbreviations used: NK = Not Known; S = Shrub; H = Herb; T = Tree; C = Climber; L = Liana; NE = Not Evaluated; LC = Least Concern; VU = Vulnerable]

Botanical Name [Family]; Voucher specimen	Medicinal Values	Habit	IUCN Status
<i>Ambroma augusta</i> (Linnaeus) Linnaeus f. [Sterculiaceae]; TM/HT/01/2009	Leaf used to cure menstrual problem, piles.	S	NE
<i>Acanthus ilicifolius</i> Linnaeus [Acanthaceae]; TM/HT/02/2009	NK	S	LC
<i>Acanthus leucostachys</i> Wallich [Acanthaceae]; TM/HT/03/2009	Leaf used to cure cut & wound; anti-inflammatory.	H	NE
<i>Actephila excelsa</i> (Dalzell) Mueller Argoviensis [Euphorbiaceae]; TM/HT/04/2009	NK	T	NE
<i>Adenostemma lavenia</i> (Linnaeus) Kuntze [Asteraceae]; TM/HT/05/2009	Leaf use to cure cut & wound.	H	NE
<i>Aesculus assamica</i> Griffith [Hippocastanaceae]; TM/HT/06/2009	Leaf juice use to cure earache; bark used as fish poison; antipyretic effect.	T	VU
<i>Ageratum conyzoides</i> Linnaeus [Asteraceae]; TM/HT/07/2009	Leaf juice for cut & wound, use to cure jaundice.	H	NE
<i>Alnus nepalensis</i> D. Don [Betulaceae]; TM/HT/08/2009	Diuretic, cure swelling of the leg; bark as anti-inflammatory agent	T	NE
<i>Alocasia macrorrhizos</i> (Linnaeus) G. Don [Araceae]; TM/HT/09/2009	Mixed in arrow poison along with <i>Aconitum</i> paste	H	NE
<i>Alpinia allughas</i> Roscoe [Zingiberaceae]; TM/HT/10/2009	Rhizome used as antiinflammatory agent	H	NE
<i>Alpinia galanga</i> Swartz [Zingiberaceae]; TM/HT/11/2009	Rhizome used as antiinflammatory agent	H	NE
<i>Alpinia malaccensis</i> (Burman f.) Roscoe [Zingiberaceae]; TM/HT/12/2009	Rhizome used to high BP, cut wound & wound	H	NE
<i>Alstonia scholaris</i> (Linnaeus) R. Brown [Apocynaceae]; TM/HT/13/2009	Bark used to cure malarial fever, urticaria, chronic dysentery, diarrhoea, in snake bite	T	LC
<i>Altingia excelsa</i> Noronha [Hamamelidaceae]; TM/HT/14/2009	NK	T	NE
<i>Amentotaxus assamica</i> Ferguson [Taxaceae]; TM/HT/14/2009	NK	T	VU
<i>Anthocephalus chinensis</i> (Lamarck) A. Richard ex Walpers [Rubiaceae]; TM/HT/16/2009	Antipyretic.	T	NE
<i>Antidesma velutinsum</i> Blume [Euphorbiaceae]; TM/HT/17/2009	NK	T	NE
<i>Arenga obtusifolia</i> Martius [Arecaceae]; TM/HT/18/2009	NK	T	NE
<i>Argemon maxicana</i> Linnaeus [Papaveraceae]; TM/HT/19/2009	Antiinflammatory, constipation, flatulence, colic, malarial fever and vesicular calculus	H	NE
<i>Arisaema tortuosum</i> (Wallich) Schott [Araceae]; TM/HT/20/2009	Antiinflammatory & wound healing, anti-snake venom.	H	NE
<i>Artemisia jacuimonti</i> Blume [Asteraceae]; TM/HT/21/2009	Antipyretic, mild fever.	S	NE
<i>Artocarpus heterophyllus</i> Linnaeus [Moraceae]; TM/HT/22/2009	Diarrhoea, fever, wound, skin diseases, urinary retention and general weakness.	T	NE
<i>Arundo donax</i> Linnaeus [Poaceae]; TM/HT/23/2009	Root is diaphoretic, diuretic, emollient and galactofuge; a paste of the root is applied to the forehead to treat headaches.	S	NE

Botanical Name [Family]; Voucher specimen	Medicinal Values	Habit	IUCN Status
<i>Baliospermum micranthum</i> Mueller Argoviensis [Euphorbiaceae]; TM/HT/24/2009	NK	S	NE
<i>Bambusa hispida</i> (Linnaeus) Schrader [Poaceae]; TM/HT/25/2009	Powered culm is used to cure bleeding, cut & wound; young shoot digestive, constipation.	S	NE
<i>Bambusa pallida</i> Munro [Poaceae]; TM/HT/26/2009	Powered culm is used to cure bleeding, cut & wound; young shoot digestive, constipation.	S	NE
<i>Bambusa tulda</i> Roxburgh [Poaceae]; TM/HT/27/2009	Powered culm is used to cure bleeding, cut & wound.	S	NE
<i>Bambusa vulgaris</i> Schrader ex J.C. Wendland [Poaceae]; TM/HT/28/2009	Powered culm is used to cure bleeding, cut & wound. Young shoot digestive, constipation.	S	NE
<i>Bauhinia purpurea</i> Linnaeus [Caesalpiniaceae]; TM/HT/29/2009	Flower used to cure stomache, Constipation.	T	NE
<i>Bauhinia variegata</i> Linnaeus [Caesalpiniaceae]; TM/HT/30/2009	Diarrhoea, skin diseases, rectal prolapse, diabetes, inflammations, worms, tumours, haemorrhoids.	T	NE
<i>Begonia arborensis</i> Dunn [Begoniaceae]; TM/HT/31/2009	Young petiole is used as anti-snake venom, treat scorpion bite.	H	NE
<i>Begonia inflata</i> Clarke [Begoniaceae]; TM/HT/32/2009	Young petiole is used as anti-snake venom, treat scorpion bite.	H	LC
<i>Begonia palmata</i> D.Don [Begoniaceae]; TM/HT/33/2009	The roots are antiphlogistic and astringent; a decoction is used in the treatment of haematemesis, amenorrhoea and traumatic stagnant blood collection.	H	NE
<i>Begonia roxburghii</i> (Miquel) DC. [Begoniaceae]; TM/HT/34/2009	Juice use to cure toothache; anti-inflammatory.	H	NE
<i>Betula cylindrostachya</i> Lindley [Betulaceae]; TM/HT/35/2009	NK	T	NE
<i>Bidens biternata</i> (Loureiro) Merrill & Sherff [Asteraceae]; TM/HT/36/2009	Leaf juice is used to treat eye and ear affections; raw leaf cure diarrhoea.	H	NE
<i>Bignonia picta</i> Humboldt, Bonpland & Kunth [Bignoniaceae]; TM/HT/37/2009	Bark used to cure high BP, reduce heart palpitation.	H	LC
<i>Bombax ceiba</i> Linnaeus [Bombacaceae]; TM/HT/38/2009	Dysentery, hemoptysis in pulmonary tuberculosis, influenza and menorrhagia.	T	NE
<i>Bridelia verrucosa</i> Haines [Euphorbiaceae]; TM/HT/39/2009	NK	T	NE
<i>Buddleja asiatica</i> Loureiro [Buddlejaceae]; TM/HT/40/2009	Juice of leaf use to treat skin diseases, joint pain & swelling.	S	LC
<i>Buddleja crispa</i> Benthham [Buddlejaceae]; TM/HT/41/2009	NK	S	LC
<i>Calamus erectus</i> Roxburgh [Arecaceae]; TM/HT/42/2009	Fresh seeds are taken in dyspepsia.	L	NE
<i>Calamus flagellum</i> Griffith [Arecaceae]; TM/HT/43/2009	Juice use to cure high BP, insomnia.	L	NE
<i>Calamus floribundus</i> Griffith [Arecaceae]; TM/HT/44/2009	Juice use to cure high BP, insomnia.	L	NE
<i>Calamus gracilis</i> Roxburgh [Arecaceae]; TM/HT/45/2009	NK	L	NE
<i>Callicarpa arborea</i> Roxburgh [Verbenaceae]; TM/HT/46/2009	Bark use to cure toothache, high BP.	T	NE
<i>Callicarpa nudiflora</i> Vahl [Verbenaceae]; TM/HT/47/2009	Plant is used to reduce haemorrhage after drug abortion.	S	NE
<i>Canarium strictum</i> Roxburgh [Bursereaceae]; TM/HT/48/2009	Resins skin diseases, rheumatoid arthritis, fever cough, epilepsy venereal diseases, burn, and asthma	T	VU
<i>Carex cruciata</i> Wahlenberg [Cyperaceae]; TM/HT/49/2009	NK	H	LC

Botanical Name [Family]; Voucher specimen	Medicinal Values	Habit	IUCN Status
<i>Caryota urens</i> Linnaeus [Arecaceae]; TM/HT/50/2009	Seeds hyperdipsia, arthritis, burning sensation, migraine and general weakness.	T	VU
<i>Cassia floribunda</i> Cavan [Caesalpiniaceae]; TM/HT/51/2009	Bark cures skin diseases.	S	NE
<i>Cassia tora</i> Linnaeus [Caesalpiniaceae]; TM/HT/52/2009	Skin diseases, dandruff, constipation, cough, hepatitis, fever, and haemorrhoids.	H	NE
<i>Castanopsis armata</i> Spach [Fagaceae]; TM/HT/53/2009	Seeds improve low stamina, debility.	T	NE
<i>Castanopsis indica</i> (Roxburgh) Miquel [Fagaceae]; TM/HT/54/2009	Seeds improve low stamina, debility.	T	NE
<i>Chloranthus erectus</i> (Buchanon-Hamilton) Verdcour [Chloranthaceae]; TM/HT/55/2009	Leaf antiinflammatory & antipyretic activity.	S	LC
<i>Chromolaena odorata</i> (Linnaeus) King & Robinson [Asteraceae]; TM/HT/102//2009	NK	S	NE
<i>Chrysopogon aciculatus</i> (Retzius) Trinius [Poaceae]; TM/HT/57/2009	Roots against diarrhoea, gastric, boil, etc.	H	NE
<i>Cinnamomum bejolghota</i> (Buchanon-Hamilton) Sweet [Lauraceae]; TM/HT/58/2009	Bark in dyspepsia and liver complaints in Nepal.	T	NE
<i>Cinnamomum tamala</i> (Buchanon-Hamilton) Nees [Lauraceae]; & Eberm. TM/HT/59/2009	Leaf possesses antispasmodic, antifungal, antibacterial and carminative agents, Rheumatism.	T	VU
<i>Citrus maxima</i> (Burman f.) Merrill [Rutaceae]; TM/HT/60/2009	Fruit cure epilepsy, chorea and convulsive coughing.	T	NE
<i>Citrus medica</i> L. [Rutaceae]; TM/HT/61/2009	Fruit juice use to cure anorexia, vomiting, tumours, asthma, cough, constipation, worm infestations, cardiac debility, jaundice, skin diseases, muscle inflammation.	S	LC
<i>Clerodendrum bracteatum</i> Wallich [Verbenaceae]; TM/HT/62/2009	NK	S	NE
<i>Clerodendrum colebrookianum</i> Wallich [Verbenaceae]; TM/HT/63/2009	Leaf used in hypertension, heart diseases, insomnia.	S	NE
<i>Clerodendrum viscosum</i> Ventenat [Verbenaceae]; TM/HT/64/2009	Leaf use to cure dog bite, stomach stone, asthma, cough, diarrhoea, rheumatism, fever and skin diseases.	S	NE
<i>Clerodendrum vestita</i> Wallich [Verbenaceae]; TM/HT/65/2009	NK	S	NE
<i>Coelogyne corymbosa</i> Lindlley TM/HT/66/2009	NK	H	NE
<i>Coffea benghalensis</i> Heyne ex Roemer & Schultes [Rubiaceae]; TM/HT/67/2009	NK	S	NE
<i>Colocasia esculanta</i> Schott [Araceae]; TM/HT/68/2009	Corm cures constipation.	H	NE
<i>Commelina benghalensis</i> Linnaeus [Commelinaceae]; TM/HT/69/2009	Leaf cures leprosy and nervous system disorders; antibacterial.	H	LC
<i>Commelina paludosa</i> Blume [Commelinaceae]; TM/HT/70/2009	Leaf cure burn, muscle inflammation.	H	NE
<i>Convolvulus arvensis</i> Linnaeus [Convolvulaceae]; TM/HT/71/2009	NK	C	NE
<i>Coriandrum sativum</i> Linnaeus [Apiaceae]; TM/HT/72/2009	Leaf cure asthma, stomach inflammatory, mild fever.	H	NE
<i>Croton caudatus</i> Geiseler [Euphorbiaceae]; TM/HT/73/2009	NK	S	NE
<i>Croton roxburghii</i> Balakrishnan [Euphorbiaceae]; TM/HT/74/2009	Leaf cure skin infection, antibacterial activity.	S	NE
<i>Curcuma amada</i> Roxburgh [Zingiberaceae]; TM/HT/75/2009	Rhizome juice cures skin diseases, cut and wound, muscle and joint inflammation.	H	LC
<i>Cyanotis cristata</i> (Linnaeus) D. Don [Commelinaceae]; TM/HT/77/2009	NK	H	NE

Botanical Name [Family]; Voucher specimen	Medicinal Values	Habit	IUCN Status
<i>Cynodon dactylon</i> (Linnaeus) Persoon [Poaceae]; TM/HT/76/2009	Roots cure urinary tract infections, prostatitis, syphilis, and dysentery.	H	NE
<i>Cyperus diffusus</i> Vahl [Cyperaceae]; TM/HT/78/2009	Roots cure cracked lips.	H	LC
<i>Cyperus rotundus</i> Linnaeus [Cyperaceae]; TM/HT/79/2009	Root used as astringent, appetizer, stomachic, anthelmintic and useful in treatment of leprosy.	H	LC
<i>Dalbergia sissoo</i> Roxburgh ex DC. TM/HT/80/2009	Bark cure eye ailments, wood and bark abortifacient, anthelmintic, antipyretic, aperitif, aphrodisiac, expectorant and refrigerant.	T	NE
<i>Delonix regia</i> (Bojer) Rafinesque [Caesalpinaceae]; TM/HT/81/2009	Seeds cure skin rash, inflammation in joint & muscle.	T	VU
<i>Derris scandens</i> (Roxburgh) Benth [Fabaceae]; TM/HT/82/2009	Bark cure mild fever, local residents used root bark as fish poisoning agent.	C	LC
<i>Dillenia indica</i> Linnaeus [Dilleniaceae]; TM/HT/83/2009	Fruit has antiinflammatory activity, cure skin infection, indigestion.	T	NE
<i>Dioscorea alata</i> Linnaeus [Dioscoreaceae]; TM/HT/84/2009	Haemorrhoids, leprosy, intestinal worms, seminal weakness, post menopausal syndrome, and general weakness.	C	NE
<i>Dioscorea bulbifera</i> Linnaeus [Dioscoreaceae]; TM/HT/85/2009	Tubers cure diabetic, constipation and hypertension.	C	NE
<i>Dioscorea deltoidea</i> Grisebach [Dioscoreaceae]; TM/HT/86/2009	Tuber cures constipation.	C	NE
<i>Dioscorea pentaphylla</i> Linnaeus [Dioscoreaceae]; TM/HT/87/2009	Tuber cures constipation.	C	NE
<i>Dracaena reflexa</i> Lamarck. [Agavaceae]; TM/HT/88/2009	Leaf & bark used in malarial symptoms, food poisoning, dysentery, diarrhoea	H	LC
<i>Duabanga grandiflora</i> (Roxburgh ex DC.) Walpers [Sonneratiaceae]; TM/HT/89/2009	Seeds have antiaging and antiinflammation properties.	T	NE
<i>Duranta erecta</i> Linnaeus [Verbenaceae]; TM/HT/90/2009	NK	S	NE
<i>Eclipta alba</i> (Linnaeus) Hasskarl [Asteraceae]; TM/HT/91/2009	Whole plant has antioxidant, cytotoxic and antimicrobial properties.	H	NE
<i>Elatostema platyphylla</i> Weddell [Urticaceae]; TM/HT/92/2009	Root juice is used in vomiting.	H	NE
<i>Eleusine indica</i> (Linnaeus) Gaertner [Poaceae]; TM/HT/93/2009	Root cure urinary problem.	H	LC
<i>Elsholtzia blanda</i> (Benth) Benth [Lamiaceae]; TM/HT/94/2009	Leaves cure mild fever & muscle, joint inflammation, cut & wound.	H	NE
<i>Entada phaseoloides</i> (Linnaeus) Merrill [Fabaceae]; TM/HT/95/2009	The seeds are considered tonic, emetic, antiperiodic and anthelmintic.	C	NE
<i>Eria acervata</i> Lindley [Orchidaceae]; TM/HT/96/2009	NK	H	NE
<i>Erianthus arundinaceus</i> (Retzius) Jeswiet [Poaceae]; TM/HT/97/2009	NK	H	NE
<i>Eryngium foetidum</i> Linnaeus [Apiaceae]; TM/HT/98/2009	Powdered leaves are used as a tea for curing diarrhoea, flu, fevers, vomiting, diabetes and constipation.	H	NE
<i>Erythrina stricta</i> Roxburgh [Fabaceae]; TM/HT/99/2009	Bark and pods has antiinflammatory effect.	T	NE
<i>Eugenia balsamea</i> Wight [Myrtaceae]; TM/HT/100/2009	NK	T	NE
<i>Eulophia zollingeri</i> (Reichenbach f.) J.J. Smith [Orchidaceae]; TM/HT/101/2009	NK	H	NE
<i>Fagopyrum esculentum</i> Moench [Polygonaceae]; TM/HT/103/2009	Leaf cures circulatory problems, high BP, constipation and diabetes.	H	NE
<i>Ficus benghalensis</i> Linnaeus [Moraceae]; TM/HT/104/2009	Bark cure biliousness, ulcers, erysipelas, vomiting, vaginal	T	NE

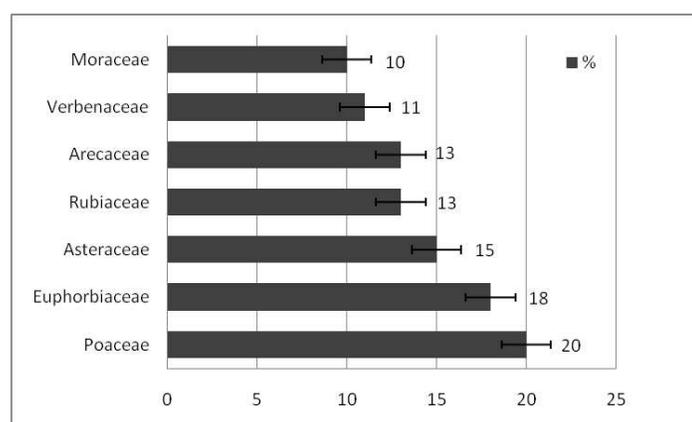
Botanical Name [Family]; Voucher specimen	Medicinal Values	Habit	IUCN Status
<i>Ficus elastica</i> Roxburgh [Moraceae]; TM/HT/105/2009	Leaf cure diabetic and resin cure skin diseases.	T	NE
<i>Ficus hispida</i> Linnaeus f. [Moraceae]; TM/HT/106/2009	Leaf cures diabetic and ulcerogenic condition.	T	NE
<i>Ficus racemosa</i> Linnaeus [Moraceae]; TM/HT/107/2009	Fruits are used for treating blood impurity, horse voice, bronchitis, cystitis, debility, diabetic and leprosy.	T	NE
<i>Ficus religiosa</i> Linnaeus [Moraceae]; TM/HT/108/2009	Leaves cure asthma, diabetes, diarrhea, epilepsy, inflammatory disorders, infectious disorders and sexual disorders.	T	NE
<i>Glochidion harveyanum</i> Domin [Euphorbiaceae]; TM/HT/109/2009	Leave are reported to have abortifacient effect.	T	NE
<i>Glochidion lanceolarium</i> (Roxburgh) Dalziel [Euphorbiaceae]; TM/HT/110/2009	Leave are reported to have antipruritic activity.	S	NE
<i>Gloriosa superba</i> Linnaeus [Liliaceae]; TM/HT/109A/2009	Tuber is useful in ulcers, leprosy, piles, inflammations, abdominal pains, itching and thirst.	H	VU
<i>Gynostemma pedata</i> Blume [Cucurbitaceae]; TM/HT/111/2009	NK	C	NE
<i>Hedychium stenopetalum</i> Loddiges [Zingiberaceae]; TM/HT/112/2009	Rhizomes cure High BP, skin inflammation.	S	NE
<i>Hedyotis scandens</i> Roxburgh [Rubiaceae]; TM/HT/113/2009	Leaf reported to have antipyretic, antiinflammatory properties.	S	NE
<i>Hemamelis virginiana</i> Linnaeus [Hamamelidaceae]; TM/HT/114/2009	Leaf reported to used as remedy for haemorrhoids in varicose veins and ulcers, phlebitis, nosebleeds, heavy periods.	S	NE
<i>Hisbiscus rosa-sinensis</i> Linnaeus [Malvaceae]; TM/HT/115/2009	Flower used for abortion, and as a cure for headache and indigestion.	S	NE
<i>Houttuynia cordata</i> Thunberg [Saururaceae]; TM/HT/116/2009	Whole plant is reported to have anti-diarrheal, antiviral, antibacterial and antileukemic activities.	H	NE
<i>Illicium griffithii</i> Hooker f. & Thomson [Illiciaceae]; TM/HT/118A/2009	Dry flowers are reported to have antimicrobial activity; cure asthma and bronchitis.	T	VU
<i>Impatiens auriculata</i> Wight [Balsaminaceae]; TM/HT/117/2009	NK	H	NE
<i>Impatiens balsamina</i> Linnaeus [Balsaminaceae]; TM/HT/118/2009	Whole plant paste cure inflammation, burns and scalds, ulcers, constipation, arthritis, urinary retention.	H	NE
<i>Ipomoea batatas</i> (Linnaeus) Lamarck [Convolvulaceae]; TM/HT/119/2009	Tuber reported to used as remedy for nausea, diarrhea, fever and diabetics.	H	NE
<i>Jasminum grandiflorum</i> Linnaeus [Oleaceae]; TM/HT/120/2009	Flower cures paralysis, wounds, ulcers, constipation, flatulence, skin diseases, odontalgia, stomatitis and dysmenorrhoea.	T	NE
<i>Jatropha curcas</i> Linnaeus [Euphorbiaceae]; TM/HT/122/2009	Sap form the bark is used to dress wounds and ulcers and can also be used to stop bleeding vomiting and diarrhoea; also used in skin diseases.	S	NE
<i>Justicia adhatoda</i> Linnaeus [Acanthaceae]; TM/HT/123/2009	Leaf is used as remedy for cough, bronchitis, asthma, inflammation, haemorrhage, haemorrhoids, diseases of eyes, and bleeding diarrhoea.	S	NE
<i>Lagerstroemia indica</i> (Linnaeus) Persoon. [Lythraceae]; TM/HT/125/2009	Bark used as febrifuge and stimulant	S	NE
<i>Lagerstroemia speciosa</i> (Linnaeus) Persoon [Lythraceae]; TM/HT/124/2009	Whole plant is reported to have anti-diabetic and anti-obesity activities.	T	NE

Botanical Name [Family]; Voucher specimen	Medicinal Values	Habit	IUCN Status
<i>Laggera crispata</i> (Vahl) Hepper & J.R.I. Wood [Asteraceae]; TM/HT/126/2009	Leaves are used to cure muscle and joint swelling; internal inflammation and mild fever.	H	VU
<i>Leea indica</i> (Burman f.) Merrill [Leeaceae]; TM/HT/127/2009	Root and leaves are used in diarrhoea, dysentery, colic, ulcers, skin diseases, and vertigo	S	NE
<i>Leea macrophylla</i> Roxburgh ex Hornemann [Leeaceae]; TM/HT/128/2009	NK	S	NE
<i>Lindenbergia hookeri</i> C.B. Clarke ex Hooker f. [Scrophulariaceae]; TM/HT/129/2009	NK	H	NE
<i>Lindernia nummularifolia</i> D. Don [Scrophulariaceae]; TM/HT/130/2009	NK	H	NE
<i>Litsea cubeba</i> (Loureiro) Persoon [Lauraceae]; TM/HT/131/2009	Seeds has anti- inflammatory activity, barks has astringent, antiseptic, insecticide, hypotensive, stimulant and tonic.	T	NE
<i>Litsea monopetala</i> (Roxburgh) Persoon [Lauraceae]; TM/HT/132/2009	Seeds contain oil which is used in rheumatism; bark is used as astringent and in diarrhoea.	T	NE
<i>Livistona jenkinsiana</i> Griffith [Arecaceae]; TM/HT/133/2009	Seeds have anti-diabetic properties, cure high BP and astringent.	T	VU
<i>Luffa cylindrica</i> (Linnaeus) Roemer [Cucurbitaceae]; TM/HT/134/2009	Leaf has reported to possess antimicrobial activity.	C	NE
<i>Macaranga denticulata</i> (Blume) Mueller [Euphorbiaceae]; TM/HT/135/2009	Seeds used to cure debility and low stamina.	T	NE
<i>Magnolia hodgsonii</i> (Hooker f. & Thomson) H. Keng [Magnoliaceae]; TM/HT/193/2010	Latex is used as dyeing of lip	T	NE
<i>Magnolia pterocarpa</i> Roxburgh [Magnoliaceae]; TM/HT/137/2009	NK	T	NE
<i>Mangifera sylvatica</i> Roxburgh [Anacardiaceae]; TM/HT/138/2009	NK	T	LC
<i>Mazus reptans</i> N.E. Brown [Scrophulariaceae]; TM/HT/139/2009	NK	H	NE
<i>Melastoma normale</i> D. Don [Melastomataceae]; TM/HT/140/2009	Fruits used to cure High BP, insomnia	S	NE
<i>Melia azedarach</i> Linnaeus [Meliaceae]; TM/HT/141/2009	Leaves used as remedy for headache, skin diseases, wounds, ulcers, worm infestations, cough, diabetes, amenorrhoea, fever.	T	NE
<i>Mesua ferrea</i> Linnaeus [Clusiaceae]; TM/HT/142/2009	Seeds reported to possess anti-inflammatory activity, diuretic and hypotensive activity; volatile oil from seeds possesses antibacterial, antifungal and anthelmintic activities.	T	NE
<i>Mikania micrantha</i> Kunth [Asteraceae]; TM/HT/143/2009	Leaf cure cut & wound, diarrhoea and mild dysentery.	C	NE
<i>Momordica dioica</i> Roxburgh ex Willdenow [Cucurbitaceae]; TM/HT/144/2009	Fruit reported to possess anti-hyperlipidemic activity.	C	NE
<i>Morus macroura</i> Miquel [Moraceae]; TM/HT/145/2009	NK	T	NE
<i>Murdannia nudiflora</i> Brenan [Commelinaceae]; TM/HT/146/2009	NK	H	NE
<i>Mussaenda glabra</i> Vahl [Rubiaceae]; TM/HT/147/2009	Aerial parts and fruits are useful in treatment of diabetes.	S	NE
<i>Mussaenda roxburghii</i> Hooker f. [Rubiaceae]; TM/HT/148/2009	Leaf paste applied to boils and rush skin.	S	NE
<i>Ophiorrhiza repens</i> (Wallich ex G. Don) Bennet [Rubiaceae]; TM/HT/149/2009	NK	H	NE
<i>Oroxylum indicum</i> (Linnaeus) Ventenat [Bignoniaceae]; TM/HT/150/2009	Bark reported to possess anticancer, antioxidant, hepatoprotective and immunomodulatory properties.	T	VU

Botanical Name [Family]; Voucher specimen	Medicinal Values	Habit	IUCN Status
<i>Osbeckia nutans</i> Wallich ex C.B. Clarke [Melastomataceae]; TM/HT/151/2009	NK	S	NE
<i>Oxyspora paniculata</i> (D. Don) DC. [Melastomataceae]; TM/HT/152/2010	NK	S	NE
<i>Pandanus furcatus</i> Roxburgh [Pandanaceae]; TM/HT/153/2010	NK	T	VU
<i>Pandanus pyriformis</i> (Martelli) H.St. John [Pandanaceae]; TM/HT/154/2010	NK	T	VU
<i>Paris polyphylla</i> Smith. [Liliaceae]; TM/HT/153A/2010	The Rhizome possesses analgesic and anthelmintic properties.	H	VU
<i>Phoenix rupicola</i> T. Anderson [Arecaceae]; TM/HT/155/2010	Young shoot possess anti-inflammatory; cure high BP, rheumatism.	T	NT
<i>Phragmites australis</i> (Cavan) Trinius ex Steudel [Poaceae]; TM/HT/156/2010	Whole plant is used as alexeteric, diaphoretic, diuretic, emetic, refrigerant, sialogogue, stomachic and sudorific.	H	NE
<i>Phrynium pubinerve</i> Blume [Marantaceae]; TM/HT/157/2010	Leaf used in ritual among the tribes of Subansiri and Kameng.	H	NE
<i>Phyllanthus emblica</i> Linnaeus [Euphorbiaceae]; TM/HT/158/2010	Fruits reported to have antioxidant property, used in cancer prevention.	T	NE
<i>Phyllanthus niruri</i> Linnaeus [Euphorbiaceae]; TM/HT/159/2010	Fruit is useful in thirst, bronchitis, leprosy, anaemia, urinary discharge, biliousness, asthma, for hiccups, and as a diuretic.	H	NE
<i>Pinanga gracilis</i> (Roxburgh) Blume [Arecaceae]; TM/HT/160/2010	NK	H	NE
<i>Piper brachystachyum</i> Wallich [Piperaceae]; TM/HT/161/2010	Leaf paste used to cure skin diseases, local infection.	C	NE
<i>Piper griffithii</i> C.DC. [Piperaceae]; TM/HT/162/2010	NK	C	NE
<i>Piper rhytidocarpus</i> Hooker f. [Piperaceae]; TM/HT/163/2010	NK	C	NE
<i>Piper sylvaticum</i> Roxburgh [Piperaceae]; TM/HT/164/2010	NK	C	NE
<i>Polygonum molle</i> D. Don [Polygonaceae]; TM/HT/165/2010	Young shoot used to cure toothache, remove mouth odour.	S	NE
<i>Pouzolzia bennettiana</i> Wight [Urticaceae]; TM/HT/166/2010	Leave reported to have purgative and antidiabetic properties.	H	NE
<i>Psychotria denticulata</i> Wallich [Rubiaceae]; TM/HT/167/2010	NK	S	NE
<i>Pterospermum acerifolium</i> (Linnaeus) Willdenow [Sterculiaceae]; TM/HT/168/2010	Bark is used in inflammation, bleeding piles, ulcers, smallpox, tumours and leprosy.	T	NE
<i>Rhamnus nepalensis</i> (Wallich) Lawson [Rhamnaceae]; TM/HT/169/2010	Bark is used in treatment of herpes.	S	NE
<i>Rhaphidophora glauca</i> (Wallich) Schott [Araceae]; TM/HT/170/2010	Stem juice is used in arrow poison as lubricant.	C	NE
<i>Rhaphidophora grandis</i> Schott [Araceae]; TM/HT/171/2010	NK	H	NE
<i>Rhynchosglossum obliquum</i> Blume [Gesneriaceae]; TM/HT/172/2010	NK	H	NE
<i>Ricinus communis</i> Linnaeus [Euphorbiaceae]; TM/HT/173/2010	Oil from seeds and leaf paste is used as remedy for joint pain and muscle swelling.	S	NE
<i>Rubus insignis</i> Hooker f. [Rosaceae]; TM/HT/174/2010	NK	S	NE
<i>Saccharum officinale</i> Salisbury [Poaceae]; TM/HT/175/2010	Youth shoot is used as remedy for high BP and reported to have diuretic properties.	S	NE

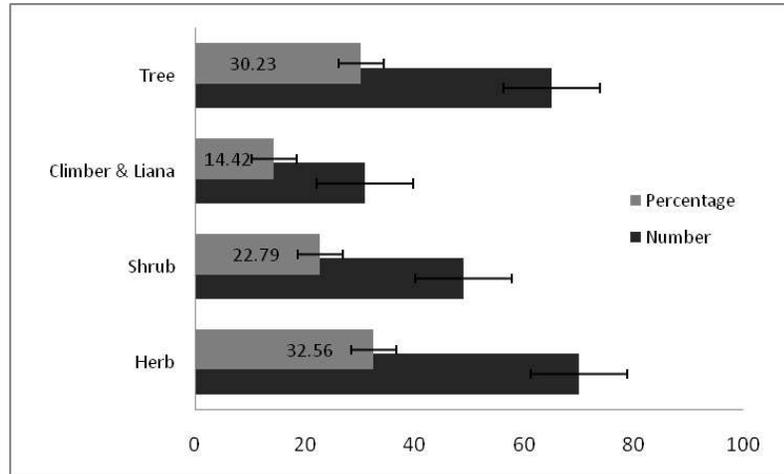
Botanical Name [Family]; Voucher specimen	Medicinal Values	Habit	IUCN Status
<i>Saccharum spontaneum</i> Linnaeus [Poaceae]; TM/HT/176/2010	Burning sensation, piles, sexual weakness, gynaecological troubles, respiratory troubles.	H	LC
<i>Sarcopyramis napalensis</i> Wallich [Melastomataceae]; TM/HT/177/2010	NK	H	NE
<i>Schefflera venulosa</i> (Wight & Arnott) Harms [Araliaceae]; TM/HT/178/2010	NK	S	NE
<i>Scleria terrestris</i> (Linnaeus) Fassett [Cyperaceae]; TM/HT/179/2010	NK	H	LC
<i>Scutellaria scandens</i> Buchanon-Hamilton ex D. Don [Lamiaceae]; TM/HT/180/2010	NK	H	NE
<i>Seigesbeckia orientalis</i> Linnaeus [Asteraceae]; TM/HT/183/2010	NK	H	NE
<i>Setaria pumila</i> (Poiret) Roemer & Schultes [Poaceae]; TM/HT/181/2010	NK	H	NE
<i>Sida acuta</i> Burman f. [Malvaceae]; TM/HT/182/2010	Leaf reported to have antibacterial and antimalarial properties.	S	NE
<i>Smilax lanceaeifolia</i> Roxburgh [Smilacaceae]; TM/HT/184/2010	Root powder is used as remedy for inflammation in urinary tract.	C	NE
<i>Smilax perfoliata</i> Loureiro [Smilacaceae]; TM/HT/185/2010	NK	C	NE
<i>Solanum torvum</i> Swartz [Solanaceae]; TM/HT/186/2010	Fruits are used as remedy for skin diseases, inflammations, colic, flatulence, rheumatoid arthritis, cough, fever, asthma, bronchitis, urinary retention and kidney stones.	S	NE
<i>Sorbus lanata</i> (D. Don) Schauer [Rosaceae]; TM/HT/187/2010	Plant stimulate respiration and improve digestion, it is also claimed to be of benefit in the treatment of cancer.	T	NE
<i>Spermacoce latifolia</i> Aublet [Rubiaceae]; TM/HT/188/2010	NK	H	NE
<i>Spilanthes paniculata</i> Wallich ex DC. [Asteraceae]; TM/HT/189/2010	Leaf is used as remedy for gum infection.	H	NE
<i>Stephania glabra</i> (Roxburgh) Miers [Menispermaceae]; TM/HT/190/2010	Tubers are used as remedy for pulmonary diseases, asthma, intestinal disorders and hyperglycaemia.	C	NE
<i>Stephania glandulifera</i> Miers [Menispermaceae]; TM/HT/191/2010	Tuber is used as remedy for flatulence in stomache, muscle inflammation.	C	NE
<i>Stephania japonica</i> (Thunberg) Miers [Menispermaceae]; TM/HT/192/2010	Tuber is used as remedy for fever, diarrhoea, urinary diseases and dyspepsia.	C	NE
<i>Talauma ovata</i> A.St.Hilaire [Magnoliaceae]; TM/HT/194/2010	Bark is used as remedy for fever and diabetes.	T	NE
<i>Tectona grandis</i> Linnaeus f. [Verbenaceae]; TM/HT/195/2010	Wood is used as remedy for inflammation, skin diseases, diabetes, stomatitis, ulcers, haemorrhages, kidney diseases, urinary calculi and arthritis.	T	NE
<i>Terminalia arjuna</i> Beddome [Combretaceae]; TM/HT/196/2010	Fruit is used as remedy for Cardiomyopathy.	T	NE
<i>Terminalia chebula</i> Retzius [Combretaceae]; TM/HT/197/2010	Fruit is used as remedy for cut & wound, ulcer, inflammation, haemorrhoids, jaundice, hiccough, cough, epilepsy, leprosy, intermittent fever and cardiac disorders	T	NE
<i>Terminalia myriocarpa</i> Heurck & Mueller Argoviensis [Combretaceae]; TM/HT/198/2010	NK	T	NE
<i>Tetrameles nudiflora</i> R. Brown [Tetrameleaceae]; TM/HT/199/2010	NK	T	LC

Botanical Name [Family]; Voucher specimen	Medicinal Values	Habit	IUCN Status
<i>Trastigma lanceolarium</i> (Roxburgh) Planchon [Vitaceae]; TM/HT/200/2010	Leaf paste is used as remedy for fractured bone.	C	NE
<i>Trastigma serrulatum</i> (Roxburgh) Planchon [Vitaceae]; TM/HT/201/2010	NK	L	NE
<i>Themeda villosa</i> (Poiret) A. Camus [Poaceae]; TM/HT/202/2010	NK	H	NE
<i>Thunbergia grandiflora</i> Roxburgh [Acanthaceae]; TM/HT/203/2010	Leaf is used to treat stone in urinary bladder and elephantiasis in feet.	C	NE
<i>Toona ciliata</i> M. Roemer [Meliaceae]; TM/HT/204/2010	Bark is used as astringent and tonic, to treat dysentery and to heal wounds.	T	LC
<i>Torenia asiatica</i> Linnaeus [Scrophulariaceae]; TM/HT/205/2010	Used to treat diabetics combined with other species; skin inflammation.	H	NE
<i>Trichosanthes bracteata</i> Voigt [Cucurbitaceae]; TM/HT/206/2010	Used in skin disease, liver disorder and alexipharmic.	C	NE
<i>Uncaria sessilifructus</i> Roxburgh [Rubiaceae]; TM/HT/207/2010	NK	C	NE
<i>Urena lobata</i> Linnaeus [Malvaceae]; TM/HT/208/2010	Flower & seed used as remedy for colic, cough, bronchitis, dry cough, asthma, low back pain, arthritis and general weakness.	H	NE
<i>Vanda cristata</i> Lindley [Orchidaceae]; TM/HT/209/2010	NK	H	NE
<i>Vitis heyneana</i> Roemer & Schultes [Vitaceae]; TM/HT/210/2010	NK	C	NE
<i>Xanthium indicum</i> J. Koenig ex Roxburgh [Asteraceae]; TM/HT/211/2010	Leaf has antifungal, antiinflammatory, antinociceptive and vasorelaxant activities.	H	NE
<i>Zanthoxylum armatum</i> DC. [Rutaceae]; TM/HT/212/2010	Fruits used as remedy for fever, cough, liver disorder, high BP and cardiac pulpiation, skin diseases.	S	VU
<i>Zanthoxylum rhetsa</i> (Roxburgh) DC. [Rutaceae]; TM/HT/213/2010	Leaf is used as remedy for diabetes, indigestion, flatulence and high BP.	T	VU
<i>Ziziphus mauritiana</i> Lamarck [Rhamnaceae]; TM/HT/214/2010	Fruit is used as remedy for indigestion, gastroenteritis.	T	NE
<i>Ziziphus rugosava</i> var. <i>glabrescens</i> Prain [Rhamnaceae]; TM/HT/215/2010	NK	T	NE

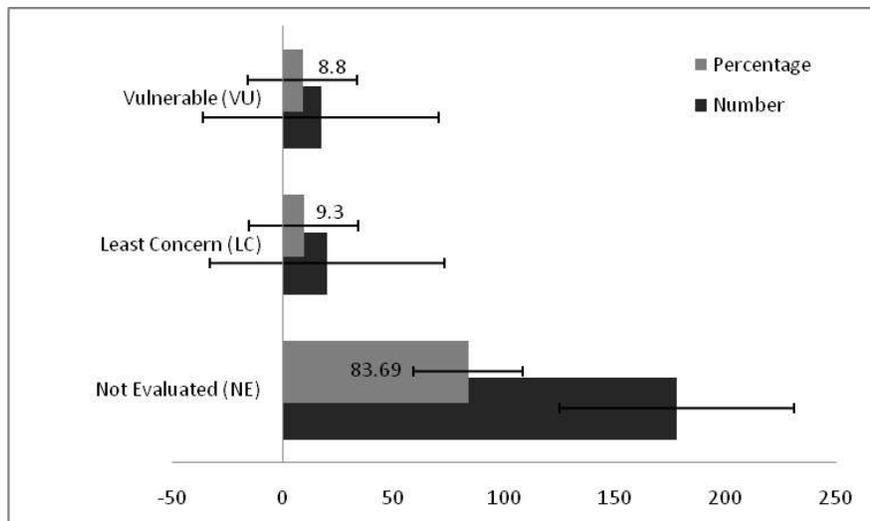


**Figure 1.** Statistics of top 7 families of higher plants of Pakke WLS & TR which is represented by maximum number of species

confirmed for their medicinal and economic values if any. Input of viable conservation knowledge in fringe villages would surely minimise current pressure on Pakke WLS & Tiger Reserve. Current checklist provides only part of higher plant species available in the sanctuary area but subject to further phyto geographical, ecological and floristic study for ascertaining density, frequency and abundance of different lower and higher plant groups. Our community interactive workshop with



**Figure 2:** Habitwise statistics of Higher Plants Diversity (n=215) of Pakke WLS & TR, East Kameng District of Arunachal Pradesh



**Figure 3:** The number and percentage of higher plant species of Pakke WLS & TR (N=215) which are listed and yet to be listed (Not Evaluated-NE) under various IUCN Redlist Category.

fringe villages has yielded positive result as the fringe villagers have started to initiate conservation programme for medicinally useful higher plants which includes rare and threatened category at community level through traditional method of resource conservation while working in close coordination with forest official and experts. Almost 18 self help group of Pakke and Seijosa administrative region has taken the initiative for cultivation and conservation of the commercially significant but rare and threatened plants of fringe area in their community forest land which includes *Aesculus assamica*, *Cinnamomum tamala*, *Canarium strictum*, *Derris scandens*, *Illicium griffithii*, *Lagera crispata*, *Paris polyphylla*, and *Phoenix rupicola*.

### CONCLUSION

The Pakke Wildlife Sanctuary & Tiger Reserve is rich in higher plant diversity including medicinal ones but further taxonomic study, phytogeographical survey and habitat mapping is needed in core, buffer and fringe zones for correct status assessment and future conservation practices.

The few globally significant medicinal species which includes *Aesculus assamica*, *Cinnamomum tamala*, *Phoenix rupicola*, *Gloriosa superba*, *Illicium griffithii*, *Laggera crispata* and *Paris polyphylla* were observed to be extremely rare in terms of distribution in four climatic zones – viz tropical, subtropical, temperate and sub-alpine zone along its altitudinal gradient within the Sanctuary area. However, most of these species comes under NE category as per IUCN Redlisting Category which need further extensive survey within Eastern Himalayan Region to enlist under IUCN threatened list and such redlisting exercise based on IUCN regional red-listing criteria would help in future conservation initiative. Present investigation has revealed that almost 37 species of both rare and threatened higher plants that further qualifying under LC and VU category of IUCN Redlist and these were recorded from core, buffer and fringe zone of the sanctuary which warrant urgent conservative initiative at local and regional level. Literature studies on Indian medicinal flora which includes recent English version of Ayurvedic literature (Balrishna 2008) and current medicinal plant and ethnobotanical literature of India (Jain 1991; Sumy *et al* 2000; Ved & Goraya 2008; Nima *et al* 2009; Jeri *et al* 2011) has further confirmed that, of the total 215 species of higher plants recorded, almost 70.6 % are reported to have medicinal value and economic values but few species were observed to be extremely rare in their natural habitat which need conservation initiatives for sustainable utilization. Few globally significant medicinal plants can be cultivated in commercial scale through input of modern science that could sustain the economic needs of the fringe villagers. Fringe villagers were very cooperative with our conservation awareness workshop, and they have started taking conservation measures on their own with traditional approach by cultivating few rare medicinal plants in their community forest land but need further patronization from responsible scientific and Government agencies.

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