Bio Bulletin 3(1): 14-24(2017)
(Published by Research Trend, Website: www.biobulletin.com)
ISSN NO. (Print): 2454-7913
ISSN NO. (Online): 2454-7921

Diversity of Medicinal Plants used by Adi Community in and Around Area of D' Ering wildlife Sanctuary, Arunachal Pradesh, India

K. Jeyaprakash*, Y. J. Lego** and S. Rathinavel***

**North Eastern Institute of Folk Medicine,*
Pasighat-791102, East Siang District, Arunachal Pradesh, India
***Indigenous Healing Heritage,*
Pasighat-791102, East Siang District, Arunachal Pradesh, India
****Department of Botany,*
Saraswathi Narayanan College (Autonomous), Perungudi, Madurai - 625 022, Tamil Nadu, India

(Corresponding author: K. Jeyaprakash, jprakash@live.in)
(Published by Research Trend, Website: www.biobulletin.com)
(Received 01 November 2016; Accepted 25 December 2016)

ABSTRACT: The present survey was carried out from March 2014 to June 2016 to document the diversity of medicinal plants among the Adi community in four settlements which are located nearby area of Daying Ering Memorial Wild Life Sanctuary, Arunachal Pradesh, North East India. The information was obtained through open and face-to-face interviews with the local knowledgeable people. A total of 73 plant species belonging to 66 genera and 44 families were documented in the study. The dominant family in the survey was Asteraceae (eight species) followed by Euphorbiaceae (seven species). Of the collected ethno medicinal plants, 46% herbs followed by 36% shrubs, 11% trees and 7% climbers. Among the different plant parts used for the preparation of medicine, leaves were mostly used and predominantly used herbal preparations were taking raw materials directly followed by decoction. The herbal medicines to treat variety of ailments such as to heal cuts and wounds (eight species), jaundice (six species), bone fracture and gastritis (six species each), blood pressure, and ring worm (four species each), diarrhoea, headache, snake bite and toothache (three species each), anaemia, antidote, asthma, diabetes, expel worms, gynaecological problems, loose motion, malaria, sinusitis, skin disease and stomach problems (two species each) and other diseases containing one species each were recorded. The plants like *Alstonia scholaris, Diplazium esculentum, and Hydrocotyle sibthorpioides* should be given priority in conservation point of view, since these plants eroding rapidly in study area due to over-exploitation. The usage of plants by the Adi community reflects their interest in herbal medicine and further investigation on these species may lead to the discovery of novel bioactive molecules.

Key words: Diversity, medicinal plants, Adi community, DEWLS, Arunchal Pradesh.

INTRODUCTION

Plants have been used since long to heal and cure diseases. About 70–95% population of developing countries are using traditional medicines for their healthcare. Plants playing a vital role not only in day to day livelihood of human being but also in economic development and health management system in form of traditional and modem medicament. The importance of traditional systems of medicine that provides health service to 80% of world's population and having great economic value in the 21st century in both developed and developing countries. The plants are rich in active ingredients, thus knowledge on

plant diversity of an area and knowledge on medicinal uses of those plants by local people is of prime importance for development of those species considered effective in the treatment of various ailments (Tuttolomondo *et al*., 2014). The plants also used as source of nutrition, appetizers, energy boosters and for aroma in tea's (Maundu *et al*., 2001). Nowadays the traditional knowledge and practices are disappearing and losing their intrinsic values at an alarming rate due to one or other reasons in various ethno medico botanical rich countries of the world. Some of the reasons for vanish such invaluable knowledge/wealth are said to be shrinkage of forest areas and disappearance of indigenous culture and practices and due to the adoption of modem life style. A major bulk of folk or ethno medicines remained endemic to certain regions or communities in the concerned countries of the world. However, due to lack of communication of intermingling and breeding of ideas and varying way of life, many of these earlier remedies survived only by word of mouth from generation to generation (Anonymous, 1996). India possesses a total of 427 ethnic communities, of these more than 130 ethnic communities live in North East India, which is comprised of the 8 states, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. The major ethnic communities of the North East India have been categorized in to sub-tribes and if these are taken into account the total number of ethnic groups reach up to 300 (Ramakrishnan, 1992, Anonymous, 2005 and Dutta and Dutta, 2005). In North East India, each state contains a number of ethnic communities with varied cultures. Arunachal Pradesh is one of the states in N.E. India inhabited by 28 major tribes and 110 sub tribes (Tag *et al*., 2005). Arunachal Pradesh has provided an initial advantage to its inhabitants for observing and scrutinizing the rich flora and fauna for developing their own traditional knowledge.

The state has 20 districts, out of which seven districts are inhabited by the Adi community, namely Siang, East Siang, Upper Siang, West Siang, Lower Dibang valley, Lohit and Upper Subansiri. Adi is one of the major tribes and consists of 14 sub-tribes, namely Ashing, Bori, Bokar, Karko, Komkar, Minyong, Millang, Pasi, Padam, Panggi, Pailibo, Ramo, Shimong and Tangam (Mandal *et al.,* 2002; Dutta & Ahmad 1995). The Adi language spoken by the people belongs to Tibeto-Burman language family (Mandal *et al.,* 2002; Singh 1998; Dutta & Ahmad 1995). Adi people celebrate different festivals which are essential parts of their socio-cultural life. Festivals reflect the traditions, costumes and life style of the people. The festivals are mainly celebrated for feasts, good harvest of crop, merriment and for narrating the myths, legends, folklores and mythologies (Boko & Narsimhan 2014).

More than fifty papers have been published and several unpublished reports are also available with ethno medicinal claims among different ethnic communities of Arunachal Pradesh. Earlier ethno botanical studies published different districts on Adi tribe are very limited. These include, Singh *et al*., (2008), Sharma & Borthakur (2008), Srivastava & Adi Community (2009), Singh *et al.,* (2010), Singh *et al*., (2012), Nimasow *et al.,* (2012), Baruah *et al*., (2013) and Yumnum & Tripathi (2013). A perusal of the literature reveals that a few ethnobotanical studies among Adi ethnics have been reported by Tag *et al*., (2008), Yumnam *et al.,* (2011), Boko and Narasimhan (2014), Payum *et al.*, (2014 & 2015) Dai *et al.*, (2015) from the East Siang district of Arunachal Pradesh. But D' Ering Wildlife Sanctuary and its adjacent areas has not yet been explored in ethno botanical point of view. There is no report available in the literature about the same. The present research work is part of first author's doctoral degree to ascertain the detailed information on plants used by Adi community and document their usage based on ethno botanical knowledge.

MATERIAL AND METHODS

A. Study area

D' Ering memorial Wildlife Sanctuary lies between 27°51' to 28°05' North latitudes and 95°22' to 95° 29' East longitude nearby Sigar, Borguli, Seram (located with Borguli range) and Namsing (located with Namsing range) settlements in the East Siang district of the state of Arunachal Pradesh. The sanctuary covers a total area of 190 km^2 and sandwiched between Siang and Sibya rivers. The sanctuary lies in low-altitude flood plains on the border of Arunachal Pradesh and Assam states. The total length of the river course is approximately 100 km. D'Ering is approximately divided into three ranges – Anchalghat, Borghuli and Namsing. It is administered by divisional Forest officer based at Pasighat Anonymous (2000). The entire area is actually a riverine plain and hence not much elevation variation is witnessed in this protected area. Most part of the sanctuary lies in the range of 101–115 m, while least area falls in highest elevation category of 136 – 187 m, which is only 3% of the total area. The entire sanctuary area is riverine plain crossed

by rivers Siang and Sibia forming several riverine islands. The altitude ranges from 135 m to 140 m above MSL gradually decreasing from north to south (MOEF). The surrounding area of the sanctuary mainly comprised of agriculture fields and dense forests. The main agriculture crop of the region is paddy, while forest composed of mixed vegetation such as *Albizzia procera, Bombax ceiba, Daubanga grandiflora, Dipteria wallichii, Ficus dumosa, Solanum torvum* and *Talauma hodgsonii* etc. (Hajra *et al.,* 1996 and Giri *et al.,* 2008).

B. Data collection

Ethnobotanical study were carried out from March 2014 to June 2016 through field surveys in the ethnic settlements are located in this region. Four ethnic hamlets (Sigar, Borguli, Seram and Namsing) were identified nearby D' Ering Wildlife Sanctuary, for the present study.

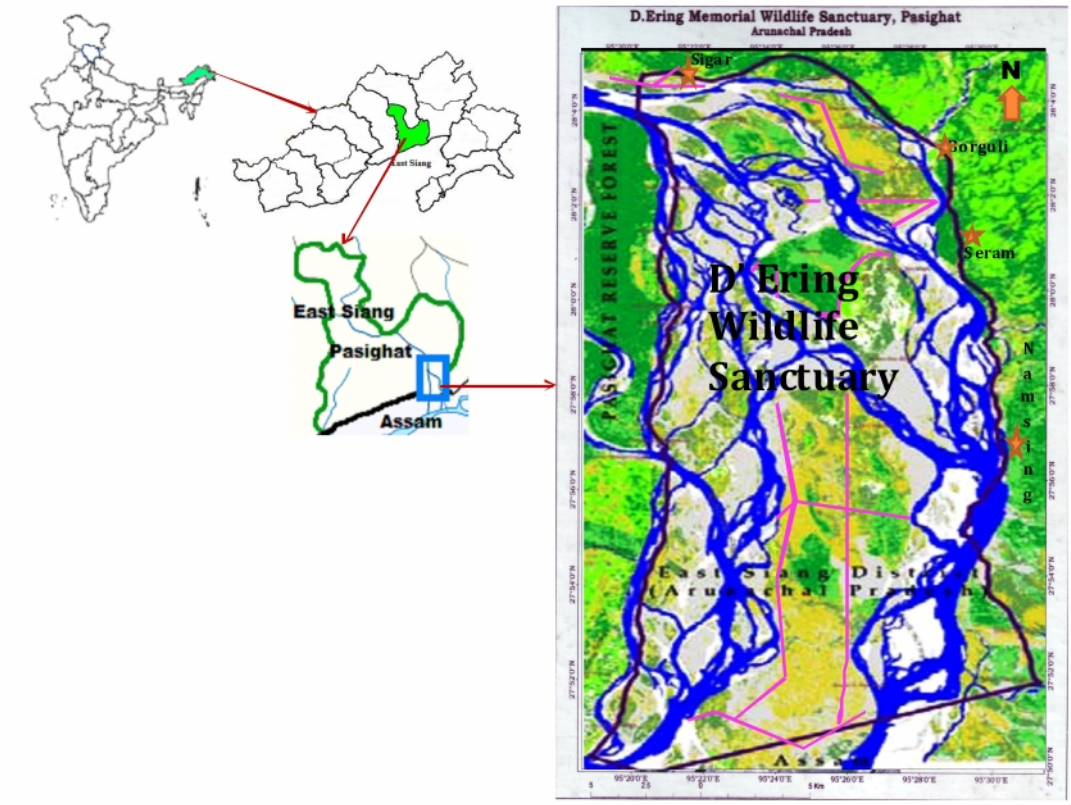

Fig.1. Location map: Study area in and nearby D' Ering Wildlife Sanctuary, Arunachal Pradesh, N. E. India (Map source: DFO, DEWS, Pasighat).

Knowledgeable traditional healers were identified based on their experience on herbal medicine with frequent field visits in the study area and interviews were carried out with the identified local people and traditional healers. During the course of time, twelve informants were identified, of which three were professional traditional healers (herbalists) and other nine were local knowledgeable persons who had much knowledge on medicinal plants and frequently practicing herbal medicines. Age of the interviewed informants is ranging between 35 and 85.

The ethno botanical data were collected according to the methodology suggested by Jain (1964). The information was collected through questionnaires and discussions among the informants in their local dialogue (Adi) and later translated. The questionnaire allowed responses on the plant prescribed, part of the plant used, medicinal uses for each part, mode of preparation (i.e., decoction, paste, powder and juice), form of usage (either fresh or dried) and additional plants used as ingredients.

C. Plant collection and identification

Most of the plants reported in this study were collected from D' Ering Wildlife sanctuary natural vegetation (95%) and few of them from home gardens (5%). The collected plants were identified using Material for the flora of Arunachal Pradesh (Hajra *et al.,* 1996, Giri *et al.,* 2008 and Chowdhery *et al*., 2009); Floristic diversity of Arunachal Pradesh: Upper Subansiri District (Ambrish, 2013) and e-flora of China and authenticated by Scientists, Botanical survey of India. We also checked the identified plants for their updated botanical names according to standard database (http://www.theplantlist.org). Voucher specimens were deposited in the Herbarium & Raw Drug Museum of North Eastern Institute of Folk Medicine, Pasighat, Arunachal Pradesh, India for future reference.

D. Ailments recorded from study area

The diseases recorded in the present study were Allergy, anaemia, antidote, asthma, blood pressure, bone fracture, chest pain, chicken pox, contraceptive, cough, cuts & wounds, diabetes, diarrhoea, digestive, dysentery, expel worms, gastritis, gynaecological problem, headache, infertility, itching, jaundice, joint pain, loose motion, malaria, menstrual problem, piles, pimples, post delivery problems, rheumatic pain, ring worm, sinusitis, skin diseases, snake bite, stomach problems, swelling, toothache and urinary problem.

RESULTS AND DISCUSSION

A. Demographic profile of the informants

Demographic characteristics of the informants in the present study were determined and recorded through face-to-face interviews with 12 informant's around the D' Ering wildlife sanctuary. Of which, women informants (9) were dominating and male informants (3) in the practice of traditional medicine since most of the men's are not interested to practice herbal medicines. But in majority of the previous ethnobotanical studies, mostly male informants were dominating then female informants (Ayyanar and Ignacimuthu, 2005, 2011; Giday *et al*., 2010; Ghorbani *et al*., 2011; Jeyaprakash *et al*., 2011; Sivasankari *et al*., 2014; Shah *et al*., 2015). The informants were learned this knowledge from their ancestors, other family members and neighbors etc. The medicinal plants knowledge shared by the professional traditional healers and local people who are practicing herbal medicines is totally different with each other due to the way of learning medicinal practices from their ancestors. Most of the interviewed informants were illiterate, only some people had secondary level education. The professional healers were treating patients on free of cost, but in case patients give some money, healers will accept it. Three of the interviewed professional healers are specialized in particular like Atlic (Massage) and bone fracture.

B. Medicinal plant diversity and their uses

A total of 73 plant species belonging to 66 genera and 44 families were documented in the study. The dominant family in the survey was Asteraceae (eight species). These investigations are similar with earlier reports Boko and Narasimhan (2014), Yumnam *et al.,* (2011), Payum *et al.,* (2015); followed by Euphorbiaceae (seven species). Solanaceae and Verbinaceae (four species each), Malvaceae, Lamiaceae, Rubiaceae and Urticaceae (three species each); Ceasalpiniaceae and Polygonaceae (two species each) and remaining families consists one species each (Table 1). Of the collected ethno medicinal plants, 34 (46%) were herbs followed by 26 (36%) shrubs, 8 (11%) trees and 5 (7%) climbers (Fig. 2). Use of herbaceous plants among the indigenous communities is a result of wealth of herbs in their environments (Giday *et al*., 2010; Namsa *et al*., 2011; Yumnam *et al*., 2011; Sivasankari *et al*., 2014).

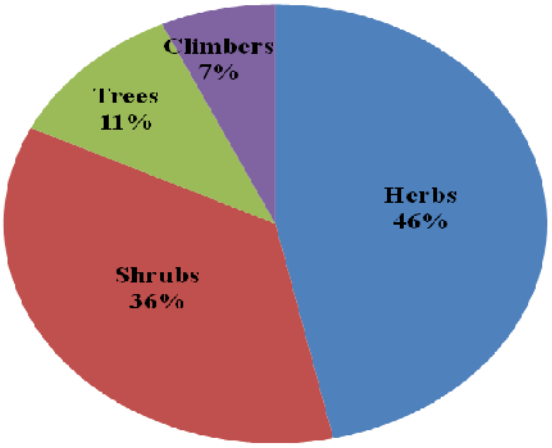

Fig. 2. Life forms of collected ethno medicinal plants in the study area.

Table 1: List of plants used for various ailments by Adi community in the study area (* cultivated).

Family	Botanical Name and Voucher No. (Vn.)	Habit	Local Name (s) (*Adi*)	Part(s) used	Mode of preparation	Route of Adminis-tration	Used against
Acanthaceae	*Andrographis paniculata** (Burm.f.) Nees Vn.: KJ 384	Herb	Sirota	Whole plant	Decoction	Oral	Malarial fever
Apiaceae	*Hydrocotyle himalaica* Muk. Vn.: KJ182	Herb	Peruk	Whole plant	Raw	Oral	Gastritis
Apocynaceae	*Alstonia scholaris* (L.) R. Br. Vn.: KJ 348	Tree	Singar	Latex	Raw	External	Cuts and wounds
Araceae	*Pothos scandens* L. Vn.: KJ 442	Shrub	Loma-losut	Whole plant	Raw	External	Bone fracture
Araliaceae	*Eleutherococcus trifoliatus* (L.) S.Y.Hu Vn.: KJ 307	Shrub	Kekut	Leaves	Raw	Oral	Jaundice
Asteraceae	*Ageratum conyzoides* L. Vn.: KJ 066	Herb	Namnying eing	Leaves	Raw	External	Cuts and wounds
	Eclipta prostrata (L.) L. Vn.: KJ 087	Herb	Keharaj / Bringaraj	Leaves	Decoction	Oral	Dysentery & hair conditioner
	Xanthium indicum (L.)Koen. Vn.: KJ 282	Shrub	Thangom	Root	Decoction	Oral	Jaundice
	Gnaphalium affine D.Don Vn.: KJ 097	Herb	Paput	Leaves	Raw	Oral	Loose motion
	Bidens pilosa L. Vn.: KJ 127	Herb	Taso lapyo	Leaves	Raw	External	Cuts and wounds
	Crassocephalum crepidioides (Benth.) S.Moore Vn.: KJ 076	Herb	Jogen / Telimbabo	Leaves	Raw	External	Cuts and wounds
	Picris hieracioides L. Vn.: KJ 108	Herb	Okoag pellong	Leaves	Raw	Oral	Diabetes
	Spilanthes acmella L. Vn.: KJ 231	Herb	Marsang	Fruits	Raw	Oral	Toothache
Bombacaceae	*Bombax ceiba* L. Vn.: KJ 109	Tree	Singe	Thorn	Paste	External	Pimples
Bignoniaceae	*Oroxylum indicum* (L.) Kurz Vn.: KJ 534	Tree	Domir Etkung	Stem bark	Decoction	Oral	Sinusitis
Buddlejaceae	*Buddleja asiatica* Lour. Vn.: KJ 303	Shrub	Omum delum	Leaves	Paste	External	Snake bite
Caesalpiniaceae	*Senna tora* (L.) Roxb.Vn.: KJ 380	Herb	Donyi-sori	Leaves	Paste	External	Ring worm
	Senna alata (L.) Roxb.Vn.: KJ 388	Shrub	Donyi-gori	Leaves	Paste	External	Ring worm
Capparaceae	*Crateva religiosa* G.Forst. Vn.: 543	Tree	Pekisiye	Leaves	Paste	Topical	Headache
Caricaceae	*Carica papaya* L.* Vn.: KJ 377	Shrub	Omri tang	Root	Paste	External	Headache
Caryophyllaceae	*Drymaria cordata* Willd. Vn.: KJ 491	Herb	Perok taiter	Whole plant	Paste	External	Ring worm
Chenopodiaceae	*Dysphania ambrosioides* (L.) Mosy. & Clem. Vn.: KJ 194	Herb	Adi-gandha	Plant	Decoction	External	Chicken pox
Clusiaceae	*Garcinia xanthochymus* Hook.f. ex T.Anderson Vn.: KJ 487	Tree	Tabi-tarak	Fruits	Raw	Oral	Stomach problems
Combretaceae	*Terminalia chebula* Retz., Vn.: KJ 349	Tree	Eilika	Fruits	Raw	Oral	Digestive
Costaceae	*Chamaecostus cuspidatus* (Nees & Mart.) C. Specht & D.W.Stev., Vn.: KJ 383	Shrub	Urom bangen	Leaves	Raw	Oral	Diabetes
Cuscutaceae	*Cuscuta europaea* L.Vn.: KJ 154	Climber	Taleng -Rimang	Whole plant	Paste	External	Bone fracture
Crassulaceae	*Bryophyllum pinnatum* (Lam.) Kurz Vn.: KJ 544	Herb	Nevi nelaum	Leaves	Juice	Oral	Gastritis

Dioscoriaceae	*Dioscorea bulbifera* L. Vn.: 457	Climber	Uli	Tubers	Raw	Oral	Loose motion
Ericaceae	*Agapetes bhutanica* Balakr. & Chow.Vn.: KJ 528	Shrub	Miti mitang	Leaves	Paste	External	Snake bite
Euphorbiaceae	*Bischofia javanica* Blume. Vn.: KJ 495	Tree	Urium	Tender leaves	Raw	Oral	Gastritis
	Euphorbia hirta L.Vn.: KJ 123	Herb	Korek oying	Tender shoots	Raw	Oral	Piles and increase mother's milk.
	Homononia riparia Lour. Vn.: KJ 100	Shrub	Asipumi	Leaves	Paste	External	Joint pain
	Ricinus communis L. Vn.: KJ 147	Shrub	Aki-rokmi	Stem bark and leaves	Paste	External	Bone fracture
	Croton caudatus Geisel. Vn.: KJ 144	Shrub	Lata mahudi	Leaves	Paste	External	Cuts & wounds
	Phyllanthus amarus Schumach. & Thonn. Vn.: KJ 336	Herb	Kobelang	Whole plant	Paste	Oral	Jaundice
	Phyllanthus urinaria L.Vn.: KJ 178	Herb	Kobelang	Whole plant	Paste	Oral	Jaundice
Equisetaceae	*Equisetum diffusum* D. Don Vn.: KJ 220	Herb	Sisidungki	Stem	Paste	External	Bone fracture
Flacourtiaceae	Casearia vareca Roxb. Vn.: KJ 447	Shrub	Barbi	Stem bark	Paste	External	Bone fracture
Lamiaceae	Elsholtzia blanda Benth. Vn.: KJ 357	Shrub	Papitduli	Leaves	Paste	Oral	Gastritis
	Leucas aspera (Willd.) Hook.F. Vn.: KJ 065	Herb	Ekisipyak	Leaves	Paste	External	Sinus and headache.
	Gomphostemma lucidum Wall. Ex Benth. Vn.: KJ 309	Shrub	Payum toti	Leaves	Paste	External	Itching
Lauraceae	Litsea cubeba L. Vn.: KJ 156	Shrub	Ragel	Fruits	Raw	Oral	Cough
Malvaceae	Hibiscus rosa-sinensus L.* Vn.: KJ 385	Shrub	Joba pul	Leaf bud	Raw	Oral	Diarrhoea
	Sida rhombifolia L. Vn.: KJ 506	Herb	Jarues sing	Root	Decoction	Oral	Post delivery problems.
	Urena lobata L. Vn.: KJ 229	Herb	Arik tangom	Root	Juice	Oral	Jaundice
Meliaceae	Dysoxylum alliaceum (Blume) Blume Vn.: KJ 488	Tree	Siti	Stem bark	Decoction	Oral	Contraceptive
Moraceae	Morus alba* L. Vn.: KJ 221	Shrub	Nuni	Roots	Raw	External	Jaundice
Myrtaceae	Psidium guajava* L. Vn.: KJ 294	Shrub	Muduri	Leaves	Juice	Oral	Diarrhoea
Oxalidaceae	Oxalis corniculata L. Vn.: KJ 122	Herb	Piyakiyup	Leaves	Raw	Oral	Dysentery & conjunctivitis
Papaveraceae	Argemone mexicana L. Vn.: KJ 547	Herb	Tanggakir	Leaves	Juice	Oral	Jaundice
Piperaceae	Piper attenuatum Buch.-Ham. ex Miq. Vn.: KJ 362	Climber	Dolopan	Leaves	Raw	Oral	Urinary problem
Poaceae	Imperata cylindrica (L.) P.Beauv. Vn.: KJ 113	Herb	Dibin Tache	Root	Decoction	Oral	Expel worm
Polygonaceae	Persicaria orientalis (L.) Spach Vn.: KJ 472	Herb	Diku-tamu	Whole plant	Decoction	Oral	Menstrual problem
	Polygonum chinense L. Vn.: KJ 311	Herb	Tasum momi	Leaves	Paste	External	Cuts & wounds
Rubiaceae	Chassalia curviflora (Wall.) Thwaites Vn.: KJ 189	Shrub	Osit-oyit / Migyot	Leaves	Paste	External	Ring worm
	Hedyotis auriculata L. Vn.: KJ 125	Herb	Korek	Whole plant	Juice	Oral	Gynaecological problems.

	Paederia foetida L. Vn.: KJ 525	Climber	Yepe tare	Tender shoot	Raw	Oral	Gastritis, anaemia, asthma and allergy
Scrophulariaceae	Scoparia dulcis L. Vn.: KJ 304	Herb	Mita- miti.	Leaves	Decoction	Oral	Antidote against rabies & snake bite
Solanaceae	Solanum nigrum L. Vn.: KJ 195	Herb	Oko mamang	Leaves	Paste	Oral	Diarrhoea, malaria, low blood pressure and anaemic
	Solanum spirale Roxb. Vn.: KJ 061	Shrub	Bangko	Tender leaves; seed; root	Juice / raw / decoction	Oral	Gastritis; infertility; blood pressure
	Solanum torvum Sw. Vn.: KJ 532	Shrub	Migom kopi	Fruit	Fume	Inhale	Toothache
	Solanum viarum L. Vn.: KJ 071	Shrub	Kopir	Leaves; fruit; root	Juice / powder / decoction	Oral	Rheumatic pain; toothache; asthma and chest pain.
Smilacaceae	Smilax perfoliata Lour. Vn.: KJ 211	Climber	Dangal engine	Stem	Raw	External	Swelling
Sterculiaceae	Abroma augusta (L.) L.f. Vn.: KJ 509	Shrub	Nyomra sipyak	Stem bark	Juice	Oral	Gynaecological problem.
Saururaceae	Houttuynia cordata Thunb. Vn.: KJ 106	Herb	Roram	Whole plant	Paste	Oral	Expel worms
Urticaceae	Gonostegia hirta (Blume ex Hassk.) Miq. Vn.: KJ 358	Herb	Oyik	Leaves	Paste	External	Bone fracture, cuts and wounds
	Boehmeria macrophylla Hornem. Vn.: KJ 366	Herb	Ombe	Leaves	Raw	Oral	Antidote
	Pouzolzia zeylanica (L.) Benn. & R. Br. Vn.: KJ 135	Herb	Oyik	Leaves	Paste	External	Cuts and wounds
Verbenaceae	Clerodendrum colebrookianum Walp. Vn.: KJ 475	Shrub	Ongin	Tender shoots	Raw	Oral	Blood pressure.
	Clerodendrum serratum Sprengel. Vn.: KJ 209	Herb	Pakkomleyo	Leaves	Raw	Oral	Blood pressure
	Vitex negundo L. Vn.: KJ 152	Shrub	Posotia	Leaves	Paste	External	Skin diseases
	Callicarpa arborea Roxb. Vn.: KJ 082	Shrub	Yahorin	Stem bark	Paste	External	Skin diseases
Zingiberaceae	Zingiber zerumbet (L.) Rosc. ex Sm.Vn.: KJ 233	Herb	Kekir	Rhizome	Juice	Oral	Cough & cold

C. Plant parts used

Among the plant parts used for preparation of medicine (Fig. 3.), leaves were 37 reports (50%) most frequently used individually. It was followed by whole plant 14 reports (14%), root 8 reports (11%), fruit and stem bark were 6 reports (8%), tender shoot were 3 reports (4%), stem 2 reports (3%), rhizome, tuber and thorn 1 report each (1%). Likewise, most of the tribal communities around the World using leaves for the preparation of herbal medicines for the treatment of various diseases (Rajendran *et al*., 2003; Jagtap *et al*., 2006; Gonzalez *et al*., 2010; Ayyanar and Ignacimuthu, 2011; Giday *et al.,* 2010) because of the availability of leaves throughout the year and can be easily collected from the forests. In Arunachal Pradesh also, Apatani tribals in the lower Subansiri district (Kala, 2005), Adi tribals in East Siang district (Yumnam, 2011; Payum *et al.,* 2014); Chakma community in north western periphery of Namdapha National Park (Sarmah *et al.,* 2008) and Monpa ethnic group (Namsa *et al*., 2011) predominantly using the leaf parts in various forms for preparation of folk medicines to the treatment of diseases. The methods of preparation of remedies fall into six categories, *viz*.: plant parts used as raw 27 (35%), applied as a paste 27 (35%), plant plants used to prepare decoction 12 (16%) in combination with water, juice 9 (12%) extracted from the fresh parts of the plant, rough powder 1 (1%) made from dried material and for fume 1 (1%) prepared from dried plant part (Fig.4.) The mode of usage are categorized into three viz, oral (58%), external (40%) and 2% inhale (Fig. 5).

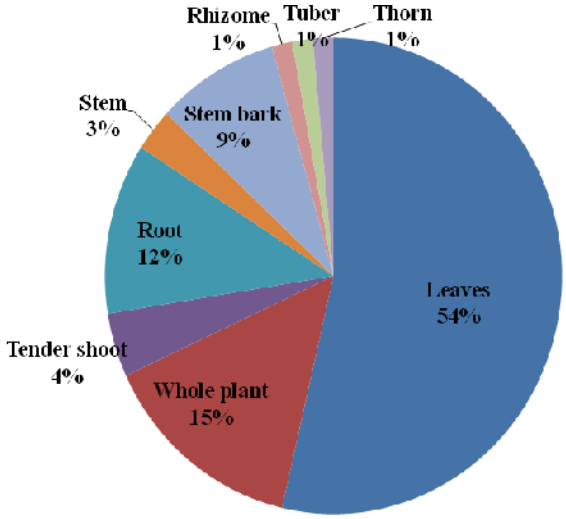

Fig. 3. Plant parts used for the preparation of herbal medicines by Adi community in study area.

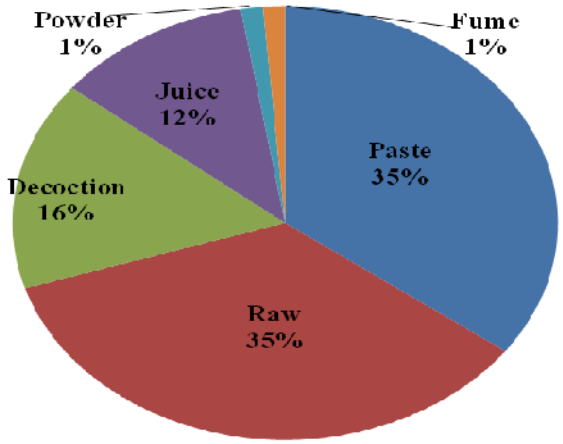

Fig. 4. Mode of preparation of herbal medicines by Adi community in study area.

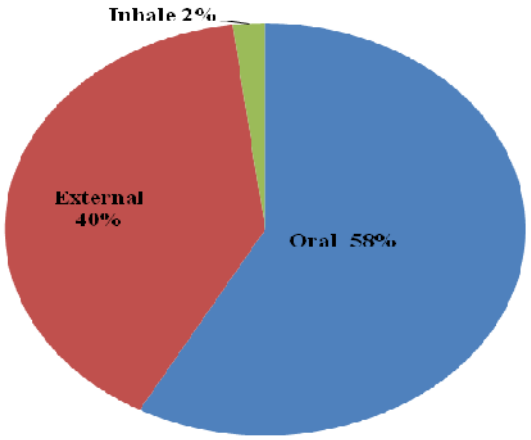

Fig. 5. Mode of administration of herbal preparations by the informants.

D. Plant species used for various ailments

The traditional healers in the study areas use the herbal medicines to treat variety of ailments such as to heal cuts and wounds (eight species), jaundice (six species), bone fracture and gastritis (six species each), blood pressure, and ring worm (four species each), diarrhoea, headache, snake bite and toothache (three species each), anaemia, antidote, asthma, diabetes, expel worms, gynaecological problems, loose motion, malaria, sinusitis, skin disease and stomach problems (two species each) and other diseases containing one species each (Table 1).

E. Uses documented first time from study area

Efforts were made to compare and discuss the use of medicinal plant species recorded in and nearby area of D' Ering wildlife sanctuary with those reported for other ethnic communities with the publications the across India. Of the reported

ethnomedicinal plants, *Boehmeria macrophylla* (antidote), *Chassalia curviflora* (ring worm), *Persicaria orientalis* (menstrual problem), *Picris hieracioides* (diabetes) and *Piper attenuatum* (urinary problem) are recorded for first time with the different uses. Whereas, *Crateva religiosa* (headache), *Croton caudatus* (cuts, wounds), *Cuscuta europaea* (bone fracture), *Eleutherococcus trifoliatus* (jaundice), *Equisetum diffusum* (bone fracture), *Hydrocotyle himalaica* (gastritis), *Phyllanthus urinaria* (jaundice), *Pouzolzia zeylanica* (cuts, wounds) Sida rhombifolia (post delivery problems) and *Xanthium indicum* (jaundice) are reported for first time from North East India, since none of the researchers previously provided any ethnomedicinal information about these plants.

CONCLUSION

The utilization of medicinal plants by the Adi community living around the D' Ering Wildlife Sanctuary seems to be highly controversial (most of the claims of present study are different from the previously published literature) when compared with other ethnic communities across India. Scientific validation of ethnomedicinal plants used by the local people and ethnic communities for associated diseases/disorders could be very useful for the development of potential drugs. So there is an urgent need to scientifically screen the plants of present survey to identify bioactive compounds, to formulate new drugs for public usage, and providing royalty to these group might be an another mile stone for these tribes (access benefit sharing). From the study, So we strongly recommend the plants such as *Bischofia javanica, Clerodendrum cloebrookianum, Clerodendrum serratum, Crassocephalum crepidioides, Drymaria cordata, Houttuynia cordata, Oroxylum indicum Paederia foetida* and *Urena lobata* which should be addressed scientifically with associated pharmacological activities through bioassay guided fractionation. Since these plants has much potential uses among the studied ethnic people through the traditional knowledge collected during the course of present investigation and these plants have few reports for their potential pharmacological activities.

ACKNOWLEDGEMENTS

The first author is thankful to The Director, North Eastern Institute of Folk Medicine, Pasighat and The PCCF (WL & BD), Department of Forest, Itanagar for providing permission, facilities and encouragements for carryout present research work. The author grateful to Shri T. Mize, Divisional Forest Officer, D' Ering Memorial Wildlife Sanctuary division, Shri K. Panggeing, Range Forest officer, Pasighat for providing permission to survey; forest officials and staffs D' Ering Memorial Wildlife Sanctuary accompanied during the field visits. Dr. Manas Bhaumik, Scientist-D and Dr. Manish Kr. Kandwal- Scientist C (for Grasses-Monocots) Botanical survey of India, Arunachal Pradesh Regional centre, Itanagar, Arunachal Pradesh and Dr. A. Benniamin, Scientist D, (for ferns) Botanical survey of India, Western Regional Centre, Pune for his kind help in plant identifications. We also acknowledged Shri Ongki Dai for his kind help and accompanied during field visits.

REFERENCES

Ambrish, K. 2013. Floristic Diversity of Arunachal Pradesh: Upper Subansiri District, Bishen Singh Mahendra Pal Singh, Dehra Dun.

Amri, E. and Kisangau, D.P. 2012. Ethno medicinal study of plants used in villages around Kimboza forest reserve in Morogoro, Tanzania. *J. Ethnobiology and Ethnomedicine* **8** (1).

Anonymous, 1996. Global Plan of Action for the Conservation and Sustainable Utilization of Plant Gentetic Resourcs for Food and Agriculture .FAO, Rome, Italy. pp.35.

Anonymous, 2000. Management Plan-2013-2016 (D' Ering Memorial Wild Life Sanctuary). Forest Department, Arunachal Pradesh.

Anonymous: Editorial. 2005. *Indian J. Traditional Knowledge,* **4**(1): 3-4.

Ayyanar, M. and Ignacimuthu, S., 2005. Traditional knowledge of Kani tribals in Kouthalai of Tirunelveli hills, Tamil Nadu, India. *J. Ethnopharmacology*. **102**: 246-255.

Ayyanar, M. and Ignacimuthu, S., 2011. Ethnobotanical survey of medicinal plants commonly used by Kani tribals in Tirunelveli hills of Western Ghats, India. *J. Ethnopharmacology*. **134**: 851–864.

Baruah, S., Borthakur, S.K., Gogoi P. and Ahmed, A. 2013. Ethnomedicinal plants used by Adi–Minyong tribe of Arunachal Pradesh, Eastern Himalaya. *Indian J. Traditional Knowledge.* **4**(3): 278– 282.

Boko, N. and Narsimhan, D. 2014. Rapid survey of plants used by Adi tribe of Bosing- Banggo, East Siang District, Arunachal Pradesh, India, *Pleione*. **8**(2): 271- 282.

Chowdhery, H.J., Giri, G.S., Pal, G.D., Pramanik, A. and Das S.K (eds.); 2009. Material for the flora of Arunachal Pradesh Vol. **3**, Botanical survey of India, Kolkata.

Dai, O., Jeyaprakash, K., Pertin, M., and Hazarika, H. 2015. Folk Remedies of Arunachal Pradesh (East Siang District), North Eastern Institute of Folk Medicine, Pasighat, Arunachal Pradesh.

Dutta, B.K., and Dutta, P.K., 2005. Potantial of ethnobotanical studies in North East India: an overview. *Indian J. Traditional Knowledge.* **4**(1): 7-14.

Dutta, P. and Ahmad, S.I. (eds.); 1995. People of India, Arunachal Pradesh, Vol. **XVI**. Anthropological Survey of India, Calcutta.

Evensen, N.A., Braun, C.P. 2009. The effects of tea polyphenols and Candida albicans inhibition of biofilm formation and proteosome inactivation. *Canadian J. Microbiology* **55**(9): 1033-1039.

Ghorbani, A., Langenberger, G., Feng, L. and Saurborn, J. 2011. Ethno botanical study of medicinal plants utilised by Hani ethnicity in Naban River Watershed National Nature Reserve, Yunnan, China. *J. Ethnopharmacology,* **133**: 651-667.

Giday, M., Asfaw, Z. and Woldu, Z. 2009. Medicinal plants of the Meinit ethnic group of Ethiopia: an ethno botanical study. *J. Ethnopharmacology,* **124**: 513–521.

Giday, M., Asfaw, Z. and Woldu, Z. 2010. Ethno medicinal study of plants used by Sheko ethnic group of Ethiopia. *J. Ethnopharmacology.* **132**: 75–85

Chowdhery, H.J., Giri, G.S., Pal., G.D., Paramanik, A. and Das, A. 2008. Material for the flora of Arunachal Pradesh Vol. **2**, (Eds. Giri GS, Pramanik A and Chowdhery H J) Botanical survey of India, Kolkata.

Gonzalez, J.A., Garcia-Barrriuso, M. and Amich F. 2010. Ethno botanical study of medicinal plants traditionally used in the Arribesdel Duero, Western Spain. *J. Ethnopharmacology,* **131**: 343–355.

Chowdhery, H.J., Giri, G.S., Pal., G.D., Paramanik, A. and Das, A. 1996. Material for the flora of Arunachal Pradesh Vol. 1, (Eds. Hajra P K, Verma D M and Giri G S) Botanical survey of India, Kolkata.

Ignacimuthu, S, Ayyanar, M and Sankarasivaraman, K. 2008. Ethnobotanical study of medicinal plants used by Paliyar tribals in Theni district of Tamil Nadu, India. *Fitoterapia*. **79**: 562-568.

Jagtap, S.D., Deokule, S.S. and Bhosle, S.V. 2006. Some unique ethnomedicinal uses of plants used by the Korku tribe of Amravati district of Maharashtra, India. *J. Ethnopharmacology* **107**: 463-469.

Jain, S.K. 1964. The role of botanist in folklore research. *Folklore.* **5**: 145-150.

Jeyaprakash, K., Ayyanar, M., Geetha, K.N., and Sekar, T. 2011. Traditional uses of medicinal plants among the tribal people in Theni District (Western Ghats), Southern India, *Asian Pacific J. Tropical Biomedicine*. S20-S25.

Kala, C.P. 2005. Ethnomedicinal botany of the Apatani in the Eastern Himalayan region of India; *J. Ethnobiology and Ethnomedicine,* **1** (11).

Mandal, H., Mulherjee, S. and Datta, A. 2002. India an illustrated Atlas of Tribal World. Anthropological Survey of India, Kolkata.

Maundu, P., Berger, D.J., Ole Saitabau, C, et al., 2001. Ethnobotany of the Loita Maasai: Towards Community Management of the Forest of the Lost Child—Experiences from the Loita Ethnobotany Project. People and Plants working paper 8. UNESCO, Paris.

Namsa, N.D., Mandal, M., Tangjang, S. and Mandal, S.C. 2011. Ethnobotany of the Monpa ethnic group at Arunachal Pradesh, India, *J. Ethnobiology and Ethnomedicine,* **7**(31).

Nimasow, G., Ringu, N. and Nimasow, O.D. 2012. Ethnomedicinal Knowledge Among the Adi Tribes of Lower Dibang Valley, Arunachal Pradesh, India. *International Research J. Pharmacy*. **3**(6): 223–229.

Payum, T, Das, A.K. and Shankar, R. 2014. Nutraceutical folk food plants used among indigenous people of East Siang District of Arunachal Pradesh, India. *America J. PharmTech Research.* **4**(4): 696-704.

Payum, T, Das, A.K., Shankar, R. and Lego, Y.J. 2015. 99 Selected Folk Medicinal Plants of East Siang District of Arunachal Pradesh, India. *American J. Pharm Tech Research.* **5**(1): 398-409.

Rajendran, S.M., Agarwal, S.C. and Sundaresan, V. 2003. Lesser known ethnomedicinal plants of Ayyakarkoil Forest Province of South Western Ghats, Tamil Nadu, India-Part I. *J. Herbs Spices Medicinal Plants*. **10**: 103-112.

Ramakrishnan, P.S., 1992. Tropical forests, exploitation, conservation and management. *Impact of science on society,* **42**(166): 149-162.

Sarmah, R., Adhikari, D., Majumder, M., and Arunachalam, A. 2008. Traditional medicobotany of Chakma community residing in the Northwestern periphery of Namdapha National Park in Arunachal Pradesh; *Indian J. Traditional Knowledge* **7**(4): 587-593.

Shah, A., Bharathi, K.A., Ahmed, J. and Sharma M.P. 2015. New ethnomedicinal claims from Gujjar and Bakerwals tribes of Rajouri and Poonch districts of Jammu and Kashmir, India. *J. Ethnopharmacology*. **166**: 119-28.

Sharma, T.K. and Borthakur, S.K. 2008. Ethnobotanical observations on Bamboos among Adi tribes in Arunachal Pradesh. *Indian J. Traditional Knowledge*. **7**(4): 594– 597.

Singh, R.K., Singh, A. and Bhardwaj, R. 2012. Namdung (Perilla ocymoides): A Bioculturally rich plant in food and livelihood security of Adi Women in Arunachal Pradesh, Eastern Himalaya. *Indian J. Traditional Knowledge*. **11**(1): 143–149.

Singh, R.K., Singh, A., Tag, H. and Adi community. 2008. Traditional Skill among the Adi tribes of Arunachal Pradesh. *Indian J. Traditional Knowledge*. **7**(1): 27–36.

Singh, R.K., Srivastava, R.C., Adi community and Mukherjee, T.K. 2010. Toko-Patta (Livistona jenkinsiana Griff): Adi community and conservation of culturally important endangered

tree species in eastern Himalaya. *Indian J. Traditional Knowledge.* **9**(2): 231–241.

Singh, S.K. 1998. India's Communities A-G. Vol. IV. Anthropological Survey of India, Calcutta.

Sivasankari, B., Anandharaj, N. and Gunasekaran, P. 2014. An ethno botanical study of indigenous knowledge on medicinal plants used the village peoples of Thoppampatti, Dindukal district, Tamilnadu, *India. J. Ethnopharmacology* **153**: 408–423.

Srivastava, R.C. and Adi community. 2009. Traditional Knowledge of Adi tribe of Arunachal Pradesh on plants. *Indian J. Traditional Knowledge.* **8**(2): 146–153.

Tag, H., Das, A.K. and Kalita, P., 2005. Plants used by the Hill Miri of Arunachal Pradesh in ethno fisheries. Indian J. Traditional Knowledge. **4**(1): 57-64.

Tag, H., Murtem, G., Das, A.K. and Singh, R.K. 2008. Diversity and distribution of ethno medicine plants used by the Adi Tribe in East Siang District of Arunachal Pradesh, India. *Pleione.* **2**(1): 123– 136.

Teklehaymanot, T., Giday, M., Medhin, G. and Mekonnen, Y. 2007. Knowledge and use of medicinal plants by people around Debre Libanosmonastery in Ethiopia. *J. Ethnopharmacology* **111**: 271–283.

Tuttolomondo, T., Licata, M., Leto, C., et al., 2014. Popular uses of wild plant species for medicinal purposes in the Nebrodi Regional Park (North-Eastern Sicily, Italy). *J. Ethnopharmacol.* **157**: 21–37.

Ullah, M., Khan, M.U., Mahmood, A., Malik, R.N., Hussain, M., Wazir, S.M., Daud M. and Shinwari Z.K. 2013. An ethno botanical survey of indigenous medicinal plants in Wana district South Waziristan agency, Pakistan. *J. Ethnopharmacology,* **150**: 918–924.

Uniyal, S.K., Singh, K.N., Jamwal, P. and Lal, B. 2006. Traditional use of medicinal plants among the tribal communities Chhota, Western Himalaya. *J. Ethnobiology and Ethnomedicine*, **2**(14).

www.moef.nic.in

Yumnum, J.Y. and Tripathi, O.P. 2013. Ethnobotany: Plants use in fishing and hunting by Adi Tribe of Arunachal Pradesh. *Indian J. Traditional Knowledge*. **12**(1): 157–161.

Yumnum, J.Y., Bhuyan, S.I., Khan, M.L. and Tripathi, O.P. 2011. Agro-diversity of East Siang-Arunachal Pradesh, Eastern Himalaya. *Asian J. Agricultural Sciences.* **3**(4): 317–326.