



Diversity of Medicinal Plants Used By Adi Community In and Around Area of D' Ering Wildlife Sanctuary, Arunachal Pradesh, India

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ABSTRACT

The present survey was carried out to document the traditional uses 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.

Keywords: Diversity, traditional uses, medicinal plants, Adi community, DEWLS, Arunchal Pradesh

1. 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 modern 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 modern 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.

2. MATERIAL AND METHODS

2. 1. 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 Sagar, 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 km² 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 Sibya forming several riverine islands. The altitude ranges from 135 m to 140 m above MSL gradually decreasing from north to south (MOEF).

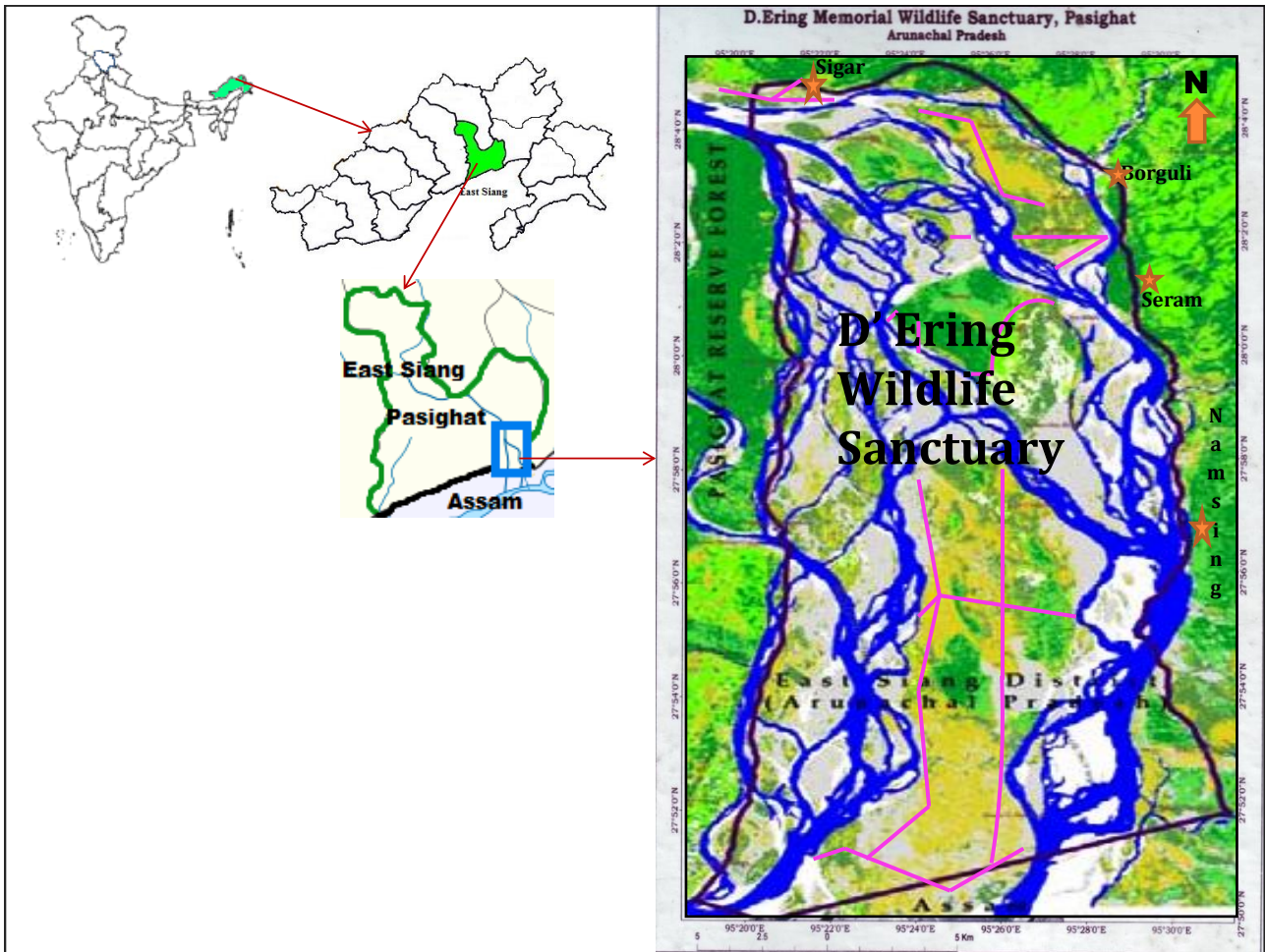


Figure 1. Location map: Study area in and nearby D' Ering Wildlife Sanctuary, Arunachal Pradesh, N. E. India (Map source: DFO, DEWS, Pasighat).

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 *Albizia procera*, *Bombax ceiba*, *Daubanga grandiflora*, *Dipteria wallichii*, *Ficus dumosa*, *Solanum torvum* and *Talauma hodgsonii* etc. (Hajra et al., 1996 and Giri et al., 2008).

2. 2. Data collection

Ethnobotanical study were carried out 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. 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.

2. 3. 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.

2. 4. 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.

3. RESULTS AND DISCUSSION

3. 1. 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.

3. 2. 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).

3. 3. 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%).

Table 1. List of plants used for various ailments by Adi community in the study area

Family	Botanical Name and Voucher No. (Vn.)	Habit	Local Name (s) (Adi)	Part(s) used	Mode of preparation	Route of Administration	Used against
Acanthaceae	Andrographis paniculata* (Burm.f.) Nees Vn.: 384	Herb	Sirota	Whole plant	Decoction	Oral	Malarial fever
Apiaceae	Hydrocotyle himalaica Muk. Vn.: 182	Herb	Peruk	Whole plant	Raw	Oral	Gastritis

Buddleiaceae	Buddleia asiatica Lour. Vn.: 303	Shrub								
Bignoniaceae	Oroxylum indicum (L.) Kurz Vn.: 534	Tree	Domir Etkung	Stem bark	Decoction	Oral	Sinusitis			
Bombacaceae	Bombax ceiba L. Vn.: 109	Tree	Singe	Thorn	Paste	External	Pimples			
	Spilanthes acmella L. Vn.: 231	Herb	Marsang	Fruits	Raw	Oral	Toothache			
	Picris hieracioides L. Vn.: 108	Herb	Okoag pellowg	Leaves	Raw	Oral	Diabetes			
	Crassocephalum crepidioides (Benth.) S. Moore Vn.: 076	Herb	Jogen / Telimbabo	Leaves	Raw	External	Cuts and wounds			
	Bidens pilosa L. Vn.: 127	Herb	Taso lapyo	Leaves	Raw	External	Cuts and wounds			

Clusiaceae	Garcinia xanthochymus Hook.f. ex T. Anderson Vn.: 487	Tree	Herb	Chenopodiaceae	Dysphania ambrosioides (L.) Mosy. & Clem. Vn.: 194	Herb	Caryophyllaceae	Drymaria cordata Willd. Vn.: 491	Shrub	Capparaceae	Cratava religiosa G. Forst. – Tree, - 543	Caesalpinaceae	
												Senna alata (L.) Roxb. Vn.: 388	Senna tora (L.) Roxb. Vn.: 380
Tabi-tarak			Herb	Adi-gandha	Perok taitter	Omri tang	Pekisiye	Donyi-gori	Donyi-sori				
Fruits		Plant	Whole plant	Root	Leaves	Leaves	Leaves	Leaves	Leaves	Paste	Paste	External	Ring worm
Raw		Decoction	Paste	Paste	Paste	Paste	Topical	External	External	External	External	External	Ring worm
Oral		External	External	External	External	External	External	External	External	External	External	External	Ring worm
Stomach problems		Chicken pox	Ring worm	Headache	Headache	Headache	Headache	Headache	Headache	Headache	Headache	Headache	Headache

Euphorbiaceae							
Phyllanthus amarus Schumach. & Thonn. Vn.: 336	Herb	Kobelang	Whole plant	Paste	Oral	Jaundice	
Croton caudatus Geisel. Vn.: 144	Shrub	Lata mahudi	Leaves	Paste	External	Cuts & wounds	
Ricinus communis L. Vn.: 147	Shrub	Aki-rokmi	Stem bark and leaves	Paste	External	Bone fracture	
Homomonium riparia Lour. Vn.: 100	Shrub	Asipumi	Leaves	Paste	External	Joint pain	
Euphorbia hirta L. Vn.: 123	Herb	Korek oying	Tender shoots	Raw	Oral	Piles and increase mother's milk.	
Bischofia javanica Blume. Vn.: 495	Tree	Urium	Tender leaves	Raw	Oral	Gastritis	

Lamiaceae		Flacourtiaceae	Equisetaceae	
Gomphostemma lucidum Wall. Ex Benth. Vn.: 309	Leucas aspera (Willd.) Hook. F. Vn.: 065	Casearia vareca Roxb. Vn.: 447	Equisetum diffusum D. Don Vn.: 220	Phyllanthus urinaria L. Vn.: 178
Shrub	Herb	Shrub	Herb	Herb
Payum toti	Ekisipyak	Barbi	Sisidungki	Kobelang
Leaves	Leaves	Stem bark	Stem	Whole plant
Paste	Paste	Paste	Paste	Paste
External	External	External	External	Oral
Itching	Sinus and headache.	Bone fracture	Bone fracture	Jaundice
	Gastritis			

Moraceae	Meliaceae	Malvaceae		Lauraceae	
Morus alba* L. Vn.: 221	Dysoxylum alliaceum (Blume) Blume Vn.: 488	Urena lobata L. Vn.: 229	Sida rhombifolia L. Vn.: 506	Hibiscus rosa- sinensis L.* Vn.: 385	Litsea cubeba L. Vn.: 156
Shrub	Tree	Herb	Herb	Shrub	Shrub
Nuni	Siti	Arik tangom	Jarues sing	Joba pul	Ragel
Roots	Stem bark	Root	Root	Leaf bud	Fruits
Raw	Decoction	Juice	Decoction	Raw	Raw
External	Oral	Oral	Oral	Oral	Oral
Jaundice	Contraceptive	Jaundice	Post delivery problems.	Diarrhoea	Cough

Poaceae	Imperata cylindrica (L.) P.Beauv. Vn.: 113	Herb	Piperaceae	Piper attenuatum Buch.- Ham. ex Miq. Vn.: 362	Climber	Papaveraceae	Argemone mexicana L. Vn.: 547	Herb	Oxalidaceae	Oxalis corniculata L. Vn.: 122	Herb	Myrtaceae	Psidium guajava* L. Vn.: 294	Shrub
	Dibin Tache			Dolopan			Tanggakir			Piyakiyup			Muduri	
	Root			Leaves			Leaves			Leaves			Leaves	
	Decoction			Raw			Juice			Raw			Juice	
	Oral			Oral			Oral			Oral			Oral	
	Expel worm			Urinary problem			Jaundice			Dysentery & conjunctivitis			Diarrhoea	

Rubiaceae		Polygonaceae	
Paederia foetida L. Vn.: 525	Hedyotis auriculata L. Vn.: 125	Chassalia curviflora (Wall.) Thwaites Vn.: 189	Polygonum chinense L. Vn.: 311
Climber	Herb	Shrub	Herb
Yepe tare	Korek	Osit-oyit / Migyot	Diku-tamu
Tender shoot	Whole plant	Leaves	Whole plant
Raw	Juice	Paste	Decoction
Oral	Oral	External	Oral
Gastritis, anaemia, asthma and allergy	Gynaecological problems.	Ring worm	Cuts & wounds Menstrual problem

Urticaceae	Boehmeria macrophylla Hornem. Vn.: 366	Herb	Herb	Herb	Herb	Herb
	Gonostegia hirta (Blume ex Hassk.) Miq. Vn.: 358	Herb	Herb	Herb	Herb	Herb
Saururaceae						
Sterculiaceae						
Smilacaceae						

Verbenaceae							
Callicarpa arborea Roxb. Vn.: 082	Shrub	Yahorin	Stem bark	Paste	External	Skin diseases	
Vitex negundo L. Vn.: 152	Shrub	Posotia	Leaves	Paste	External	Skin diseases	
Clerodendrum serratum Sprengel. Vn.: 209	Herb	Pakkomleyo	Leaves	Raw	Oral	Blood pressure	
Clerodendrum colebrookianum Walp. Vn.: 475	Shrub	Ongin	Tender shoots	Raw	Oral	Blood pressure.	
Pouzolzia zeylanica (L.) Benn. & R. Br. Vn.: 135	Herb	Oyik	Leaves	Paste	External	Cuts and wounds	

Zingiberaceae	Zingiber zerumbet (L.) Rosc. ex Sm. Vn.: 233	Herb	Kekir	Rhizome	Juice	Oral	Cough & cold
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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).

3. 4. 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).

3. 5. 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 trifolius* (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.

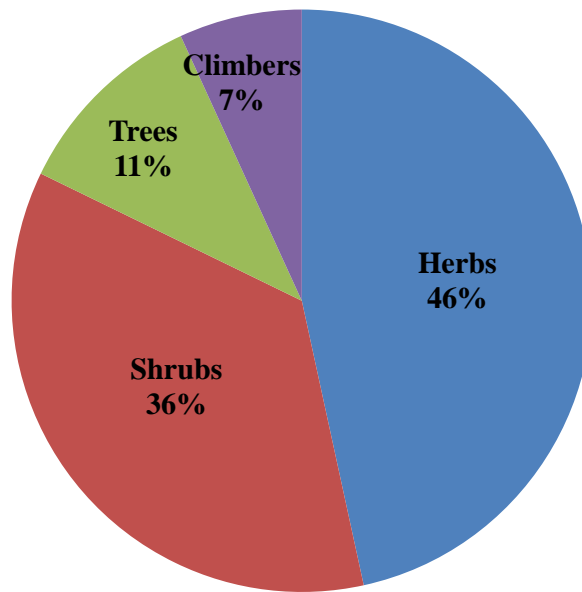


Fig. 2. Life forms of collected ethno medicinal plants in the study area

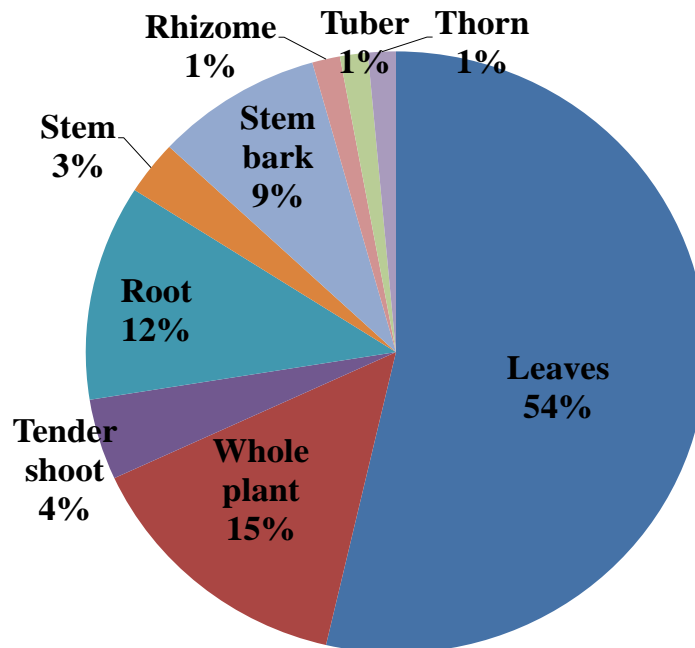


Fig. 3. Plant parts used for the preparation of herbal medicines by Adi community in study area

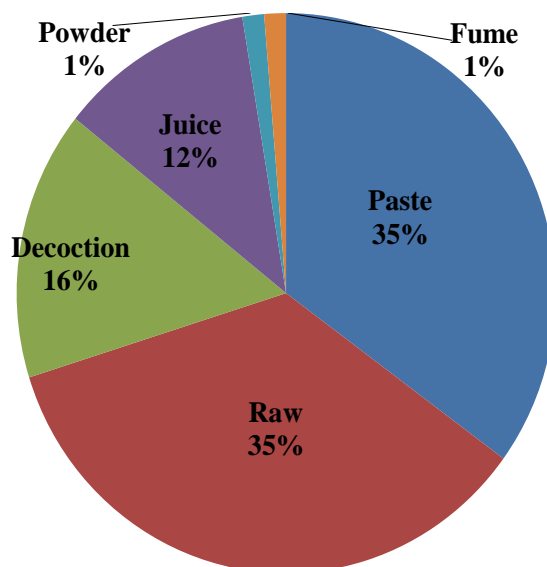


Fig. 4. Mode of preparation of herbal medicines by Adi community in study area.

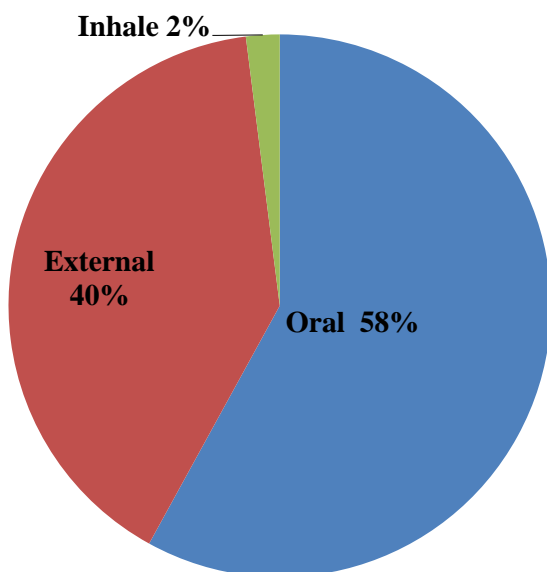


Fig. 5. Mode of administration of herbal preparations by the informants

4. 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.

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