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Estimation of Ethnobotanical Plants of the Naga of North East India

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In the present investigation, literature survey on ethnobotanical plants published by different workers was conducted to records data on ethnobotanical uses of plants by the indigenous Naga tribal community. A total of 37 published papers covering about 13 different tribes of the Naga were investigated. Analysis of the taxonomic diversity recorded a total of 628 species belonging to 398 genera and 146 families. Of this, about 73.88% (464) of the species are used as ethnomedicine, 27.23% (171) as edible plants, 13.69% (86) as edible fruits, 5.73% (36) as dyes, 4.30% (27) as fish poison, 1.60% (10) as fermented food and beverage, 1.75% (11) as fodder and pasture grass and about 7.96% (50) for other uses. Further analysis of the species from different taxonomic groups showed that about 95.06% belongs to angiosperms (78.18% dicots and 16.88% monocots) and the remaining 4.94% are from gymnosperm, pteridophytes and edible mushrooms. Moreover, 176 species have been listed to have more than one category of used. This study is an attempt to present the most comprehensive and detailed list of ethnobotanical plants of the Nagas of Northeast India.

Keyword: Ethnobotanical plants, Naga community, biodiversity, edible plants.

1. Introduction

The term Naga is a broad general category and include several tribes each having its own dialect, cultural features and settle in different areas of Northeast India. They formed one of the largest tribal communities from Northeast India comprising about 36 tribes and are mainly inhabited in contiguous areas in the state of Nagaland, Manipur, parts of Arunachal Pradesh and Assam (Fig. 1). The Nagas are of Mongolian race, speak Tibeto-Burmese language, have racial and socio-cultural affinities with the inhabitants of Southeast Asian countries [44]. They have very rich cultures and are considered as one of the most colorful traditions among the tribal communities in India. Until the advent of the British in the late nineteenth century, they were virtually isolated from outside civilization. Prior to the advent of Christianity, the Nagas were animist with belief in a supreme creator [5]. Although modern cultures have greatly influenced the life of Naga society today, they still have a culture rich with ethnobotanical and traditional folk practices and are still widely depend on nature for food, shelter, and medicines. They have a great heritage of oral traditions that are treasured in various research fields. Many of these oral traditions involve beliefs and practices associated with plants and animals.

In Northeast India, the areas occupied by the Naga tribal community are considered as one of the most bio-diverse in this biodiversity hotspot region. The rich floral diversity of the area is largely due to wide altitudinal variation, topographical features, soil characteristics and climatic factors which favored the luxurious growth of plants. The richness of the plant diversity is also evident from the use of varieties of wild edible plant species, fruits and medicinal plants by this hill tribal community. Although

some early works on ethnobotanical studies listing wild edible plants, ethnomedicine, bio-folklore, beliefs and practices have been reported [10, 11, 24, 33, 34, 35]. However, there is still a good scope of ethnobotanical field exploration due to existence of diverse cultures and the presence of rich resources of plants having ethnobotanical values. For the conservation of indigenous knowledge, proper documentation has been suggested [36]. Hence there is an urgent need for exploration on traditional knowledge of plant uses, development of database, strategy for conservation through sustainable use and management of the resources and also in the search for new potential plant sources as drugs and food. In view of this, an attempt has been made in the present investigation to collect, compiled and create a database on ethnobotanical plants of the various Naga tribes published by different workers in reputed scientific Journals (Table 2 and 3).

2. Materials and Methods

2.1 Study site

The study site is located in the North eastern region of India in between 92°37' E - 95°44' E longitudes and 24°19' N - 27°07' N latitudes. The area covered 21 districts in four states namely Assam, Arunachal Pradesh Nagaland and Manipur with total geographical areas of 50,969 Km^2 approximately. The altitudinal elevation ranges from 200 to 3,826 m a.s.l. The average annual rainfall and temperature are 1881mm and 19 °C.

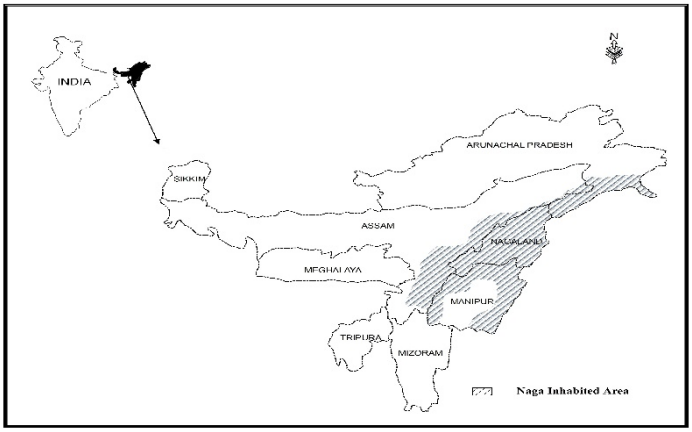

Fig 1: Map showing the location of Naga inhabited areas of N-E India

2.2 Methods

A literature survey and compilation of data on ethnobotanical works of the Nagas reported in different reputed scientific Journals were conducted during the period from April to November, 2013. The published literatures were collected from NEHU Central Library; Library of Botanical Survey of India (BSI), Regional Centre, Eastern Circle, Shillong; North East Council (NEC) Library, Shillong; papers available online from www.niscair.res.in; www.ehsst.org; www.sciencedirect.com; www.springer.com, etc. We also checked the reference section of all the collected publications as a cross reference. A table data format (Table 1) was also created to in cooperate all the relevant ethnobotanical information's viz. name of the plant family and species arrange in sequence according to alphabetical orders, use categories like plant used as ethnomedicine, edible plant, edible fruit, fish poison, etc. Only accepted name and not synonym of the plant species were considered while counting the number of species or genera in each family. This is done to avoid repetition of the species name of the same plant.

Table 1: Data format for recording ethnobotanical plants use by the Naga

S.No	Family	Botanical name	Categories of ethnobotanical uses							
			EM	EP	EF	FP	FFB	DY	FPG	Misc
1.	Acanthaceae	*Acanthus leucostachys* Wall.	Y							
		Achyranthes aspera Linn.	Y					Y		
		Achyranthes bidentata Bl.	Y							
		Adhatoda zeylanica Medic.	Y							
		Adhatoda vasica Nees	Y	Y						
		Andrographis paniculata Wall. ex Nees	Y							
		Justicia gendarussa Linn.	Y							
		Phlogacanthus curviflorus Ness	Y	Y						
		Phlogacanthus thyrsiflorus Nees	Y	Y						
		Rungia parviflora Nees	Y							
		Scutellaria discolor Wall. ex. Benth.	Y	Y						
		Scutellaria glandulosa Colebr.	Y							
		Strobilanthes acrocephalus T. And.	Y							
		Strobilanthes cusia (Nees) Imlay						Y		
		Strobilanthes decurrens T. Anders.						Y		
2.	Adiantaceae	*Adiantum philippense* Linn.	Y							
		Cheilanthes farinosa (Forst.) Fee	Y							Y
3.	Agaricaceae	*Agaricus campestris* Linn. ex. Fr.		Y						
		Agaricus silvaticus Schaeff		Y						
4	Alangiaceae	*Alangium chinense* (Lour.) Harms.	Y							

3. Results

During the literature survey, about 37 published ethnobotanical works of the Nagas of N-E India were collected and recorded (Table 2). The paper of each published work was evaluated to record the types of ethnobotanical work according to used category, name of the tribe of the Naga where the work was investigated, total number of species, genera and families reported, etc. were listed and recorded. A total of 628 species of plant (Table 3) belonging to different taxonomic groups such as angiopserms, gymnosperms, ferns and fern allies, edible fungi, etc. were recorded. These species belongs to 398 genera and 146 families. Out of the total 628 number of species recorded in this study, 73.88% (464) of the species are use as ethnomedicine, 27.23% (171) as edible plants, 13.69% (86) as edible fruits, 5.73% (36) as dyes, 4.30% (27) as fish poison, 1.60% (10) as fermented food and beverage, 1.75% (11) as fodder and pasture grass and about 7.96% (50) for other uses (Fig. 6) such as fibers,

furniture, jams and pickles, oil and gum, masticatory, plants use as seasonal indicator, etc. Similarly, about 318 genera of ethnomedicinal plants, 124 genera of edible plants and 53 genera of edible fruits (Fig. 5) etc. are also recorded in this study. The number of families belonging to each used category was also presented in figure 3. Analysis of the families with the largest number of species having ethnobotanical use observed that Leguminosae with 43 species showed the highest number follow by the families Asteraceae and Zingiberaceae each with 39 and 23 species respectively (Fig. 4). Further analysis of the species from different taxonomic groups showed that about 95.06% belongs to angiosperm (78.18% Dicot and 16.88% Monocot) and the remaining 4.94% are from gymnosperm, pteridophytes and edible mushrooms (Fig. 2). Moreover, about 176 species are recorded to have more than one used category.

Table 2: Name of the Naga sub-tribes, type of ethnobotanical works, taxonomic diversity and names of the worker who reported

Name of Naga sub-tribe	Types of ethnobotanical work reported	No. of species	No. of genera	No. of families	Ethnobotanical works investigated
non specific	ethnomedicine	54	51	42	Rao & Jamir, 1982b [34]
Tangkhul	ethnomedicine, food, fibers, etc.	36	35	23	Elangbam *et al*. 1989 [8]
Ao & Angami	ethnomedicine & edible plants	110	103	57	Rao & Jamir 1990 [35]
Zeliang	ethnomedicine	50	41	31	Jamir & Rao 1990 [11]
Mao	ethnomedicine	71	62	49	Mao 1993 [19]
Ao	folk practices & beliefs	…….			Changkija & Kumar 1996 [5]
Mao	traditional beverage	1	1	1	Mao 1998 [20]
non specific	ethnomedicine	36	35	28	Jamir *et al*. 1999 [12]
non specific	ethnomedicine	109	85	60	Changkija 1999 [4]
Mao	symbolic & botanical folklore	11	11	11	Mao 2000 [21]
Rengma	ethnomedicine	9	9	7	Kemp 2003 [16]
Zemei	ethnomedicine	32	28	22	Tamuli & Saikia 2004 [48]
non specific	traditional dyes	18	18	16	Akimpou *et al*. 2005 [1]
non specific	traditional fermented foods	7	7	7	Mao & Odyuo 2007 [22]
Konyak	ethnomedicine	53	51	36	Jamir *et al*. 2008 [13]
Angami	ethnomedicine, edible food, dyes, fodder, fish poison, etc.	75	59	41	Barua *et al*. 2008 [2]
Lotha	edible fruits	56	41	26	Takatemjen *et al*. 2009 [47]
Lotha	ethnomedicine	55	54	35	Jamir *et al*. 2010 [14]
Sumi	ethnomedicine	55	53	35	Lanusunep & Jamir

					2010 [17]
Tangkhul	edible plants	61	56	34	Salam *et al*. 2010 [39]
non specific	ethnomedicine	1	1	1	Pfoze *et al*. 2010 [28]
Zemei	ethnomedicine	8	8	7	Rout *et al*. 2010 [38]
Mao	agricultural seasons indicator	4	3	3	Mao & Hynneiwta 2011 [23]
Mao, Poumei Naga &Kuki	edible plants & fruits	89	75	56	Pfoze *et al*. 2011 [30]
non specific	antibacterial	1	1	1	Pfoze *et al*. 2011[29]
non specific	edible fungus	13	9	6	Bhaben *et al*. 2011 [4]
Kabui	ethnomedicine	74	65	43	Devi *et al*. 2011 [6]
non specific	edible fruits	98	58	38	Mozhui *et al*. 2011 [25]
Phom	ethnomedicine	66	59	37	Imchen & Jamir 2011 [9]
non specific	ethnomedicine	38	34	22	Ringmichon *et al*. 2011 [37]
Chirus	ethnomedicine	15	15	12	Singh *et al*. 2011 [42]
Mao, Poumei Naga &Kuki	edible plants & fruits	30	29	25	Pfoze *et al*. 2012 [31]
Mao, Poumei Naga &Kuki	ethnomedicine	120	109	56	Pfoze *et al*. 2012 [30]
Mao	ethnomedicine	61	56	39	Lokho 2012 [17]
non specific	ethnomedicine	122	101	65	Shankar & Devalla 2012 [41]
Nagas of Nagaland	piscicidal	17	15	14	Dominic & Ramanujam 2012 [6]
Tangkhul	edible plants & fruits	46	42	31	Salam *et al*. 2012 [39]

Table 3: List of plant families with number of species under different used categories

Family	Taxonomy group	Number of species recorded	No. of species in different categories of ethnobotanical uses							
			EM	EP	EF	FP	FFB	DY	FPG	Misc
Acanthaceae	Di	15	13	4				3		
Adiantaceae	Pt	2	2							1
Agaricaceae	Em	2		2						
Alangiaceae	Di	1	1							
Amaranthaceae	Di	5	4	2						
Amaryllidiaceae	Mo	1	1							
Anacardiaceae	Di	5	4	1	3					1
Annonaceae	Di	1	1							
Apocynaceae	Di	7	6	1		1		1		1
Araceae	Mo	10	8	4						
Araliaceae	Di	4	3	1						
Arecaceae	Mo	10	5	3	7					

Asclepiadaceae	Di	2	2							
Asteraceae	Di	39	36	5		2		1		
Athyriaceae	Pt	2	1	2						
Auriculariaceae	Em	1		1						
Averrhoeaceae	Di	1	1		1			1		
Balanophoraceae	Di	1	1							
Balsaminaceae	Di	2	1	1						
Begoniaceae	Di	3	2	2						
Berberidaceae	Di	1	2							
Betuliaceae	Di	2	2							
Bignoniaceae	Di	2	2	1						1
Bixaceae	Di	1	1					1		
Bombacaceae	Di	2	2							
Boraginaceae	Di	1		1						
Brassicaceae	Di	4	2	2						
Bromeliaceae	Mo	1	1		1					
Buddlejaceae	Di	2	1					1		
Burseraceae	Di	2	1		1					
Cannabinaceae	Di	1	1							
Cannaceae	Mo	2	2							
Capparidaceae	Di	1	1							
Caprifoliaceae	Di	1	1		1					
Caricaceae	Di	1	1	1	1					
Caryophyllaceae	Di	2	1	1						
Caesalpiniaceae	Di	10	10	4	1			1	1	1
Chenopodiaceae	Di	2	1	1						
Clusiaceae	Di	3	2		2			1		1
Combretaceae	Di	3	2					1		
Commelinaceae	Mo	1		1						
Convolvulaceae	Di	3	1	3						
Crassulaceae	Di	2	2							
Cucurbitaceae	Di	19	10	9	2		1			1
Cuscutaceae	Di	1	1					1		
Cycadaceae	Gy	1	1	1						
Cyperaceae	Mo	1	1							
Dilleniaceae	Di	1	2							
Dioscoriaceae	Mo	3	1	3						
Ebenaceae	Di	3	1		3	1		1		
Ehretiaceae	Di	1							1	
Elaeagnaceae	Di	2			2					
Elaeocarpaceae	Di	1			1					
Equisetaceae	Pt	2	2							
Ericaceae	Di	2	2	2		1				
Euphorbiaceae	Di	20	17	4	2	1	2	2		1
Fagaceae	Di	7	1		3			2		2
Flacourtiaceae	Di	2	1		1	1				1

Fumariaceae	Di	1	1							
Gentianaceae	Di	3	2	1						
Gesneriaceae	Di	2	1	1						
Gnetaceae	Gy	1		1						
Haemodoraceae	Mo	2	1		1					
Hemionitidaceae	Di	1	1							
Hypericaceae	Di	1	1							
Hypoxidaceae	Mo	2	2	1						
Iridaceae	Mo	1	1							
Juglandaceae	Di	2	2		1	1		1		
Lamiaceae	Di	19	15	5						1
Lardizabalaceae	Di	1	1		1					
Lauraceae	Di	7	5	3						3
Leeaceae	Di	3	3							
Liliaceae	Mo	10	9	2						
Lobeliaceae	Di	1	1							
Loganiaceae	Di	1	1					1		
Loranthaceae	Di	3	1							2
Lycoperdaceae	Em	2		2						
Lygodiaceae	Pt	2	2							
Lythraceae	Di	1	1							
Magnoliaceae	Di	3	1					1		3
Malvaceae	Di	8	8	1						
Marantaceae	Mo	1					1			
Melastomataceae	Di	3	3		1					
Meliaceae	Di	9	8	1	2	1		1		
Menispermaceae	Di	5	5							
Mimosaceae	Di	11	10	1		5		1	2	3
Moraceae	Di	19	11	5	12			1		6
Musaceae	Mo	2	2	1	1					
Myricaceae	Di	2	2		1	1				
Myrsinaceae	Di	5	3	2	1			1		
Myrtaceae	Di	3	2		2			1		
Nyctaginaceae	Di	2	2							
Oleaceae	Di	1	1							
Oleandraceae	Pt	1	1	1						
Orchidaceae	Mo	6	4							2
Oxalidaceae	Di	1	1	1						
Pandanaceae	Mo	2	1							1
Papaveraceae	Di	1	1							
Papilionaceae	Di	22	18	3		2	1	2		1
Passifloraceae	Di	2	2	1	1					
Pedaliaceae	Di	2	1				1			
Periplocaceae	Di	1	1							
Pinaceae	Gy	1	1							
Piperaceae	Di	3	3							

Plantaginaceae	Di	1	1	1						
Plumbaginaceae	Di	1						1		
Poaceae	Mo	20	11	5	1		1		6	4
Polygonaceae	Di	15	8	10		2		1		
Polypodiaceae	Pt	1	1							
Polyporaceae	Em	5		5						
Polytrichaceae	Pt	1	1							
Primulaceae	Di	1		1						
Pteridaceae	Pt	2	2							
Pterocarpaceae	Di	1	1							
Punicaceae	Di	1	1	1	1			1		
Ranunculaceae	Di	5	4	1						1
Rhamnaceae	Di	3	3							1
Rosaceae	Di	15	8		14					1
Rubiaceae	Di	13	11	3		1	1	1		
Rutaceae	Di	11	11	3	5	2				
Salicaceae	Di	1	1							
Sapindaceae	Di	2	2			1				1
Saururaceae	Di	3	3	1						
Saxifragaceae	Di	2	2							
Schizophyllaceae	Em	1		1						
Scrophulariaceae	Di	1	1							
Selaginellaceae	Pt	1	1							
Smilacaceae	Mo	3	3	2						
Solanaceae	Di	22	17	9	4		1	1		1
Sterculiaceae	Di	2	1							1
Taxaceae	Gy	1	1			1				
Theaceae	Di	3	2	2		1		1		1
Thelypteridaceae	Pt	1	1			1				
Thymelaeaceae	Di	2	1							1
Tiliaceae	Di	2		1	1					
Tricholomataceae	Em	3		3						
Trilliaceae	Mo	1	1							
Ulmaceae	Di	1	1							
Umbelliferae	Di	8	5	7						
Urticaceae	Di	16	9	5	3	1			1	2
Valerianaceae	Di	1	1							
Verbenaceae	Di	15	10	4			1	2		2
Violaceae	Di	1		1						
Viscaceae	Di	1	1							
Vitaceae	Di	5	2	2	1					1
Zingiberaceae	Mo	23	20	7				1		

N.B: Di = Dicot; Em = Edible mushroom; Gy = Gymnosperm; Mo = Monocot; Pt = Pteridophyte; DY = Dye yielding plant; EF = Edible fruit; EP = Edible plant; FP = Fish poison; FFB = Fermented food and beverage; FPG = Fodder and pasture grass; Misc = Miscellanous (Plants used for making pickle, jam, catching birds, gum, etc.)

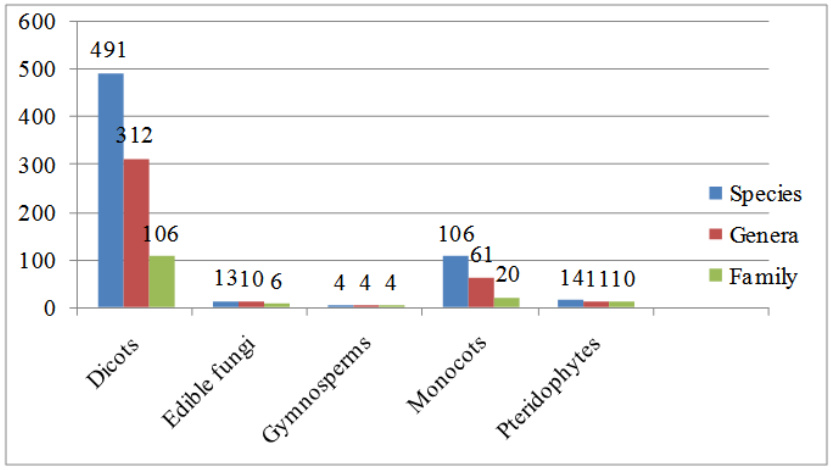

Fig 2: Ethnobotanical species, genera and families from different plant groups

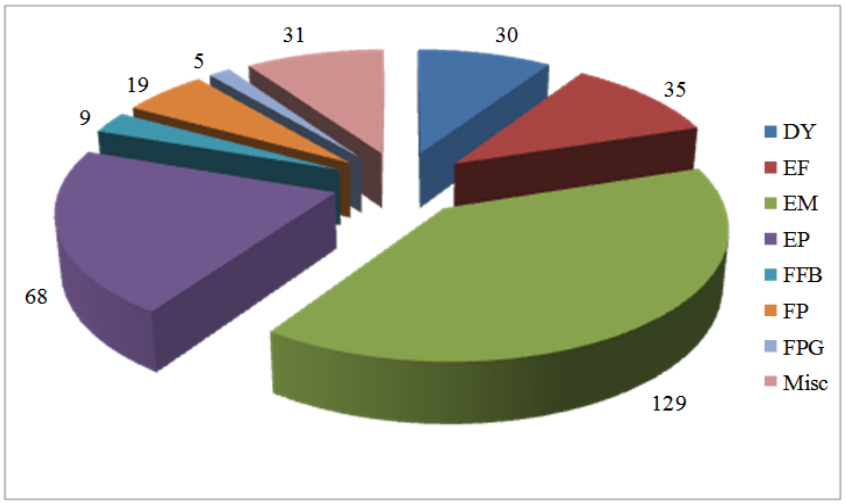

Fig 3: Number of families belonging to each different used category

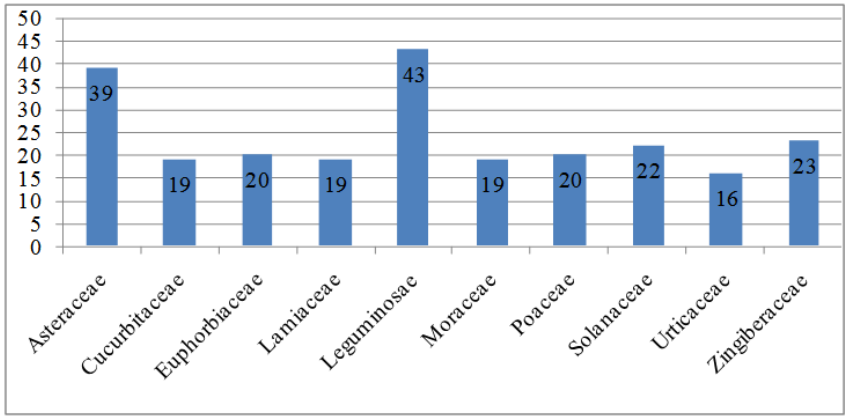

Fig 4: Families having highest number of ethnobotanical species

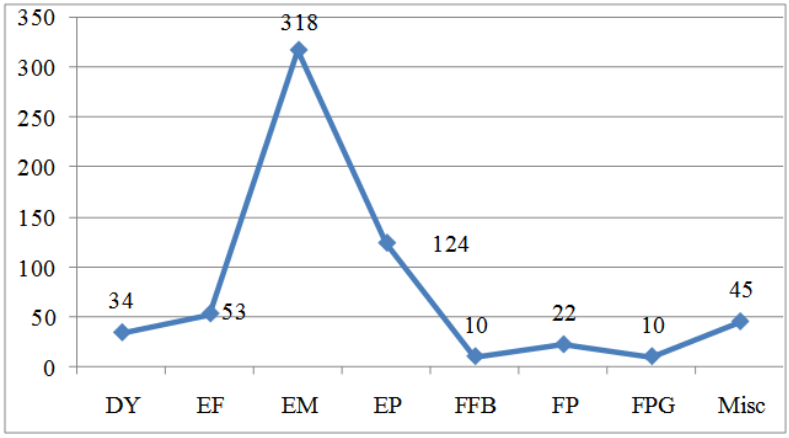

Fig 5: Number of genera belonging to each different used category

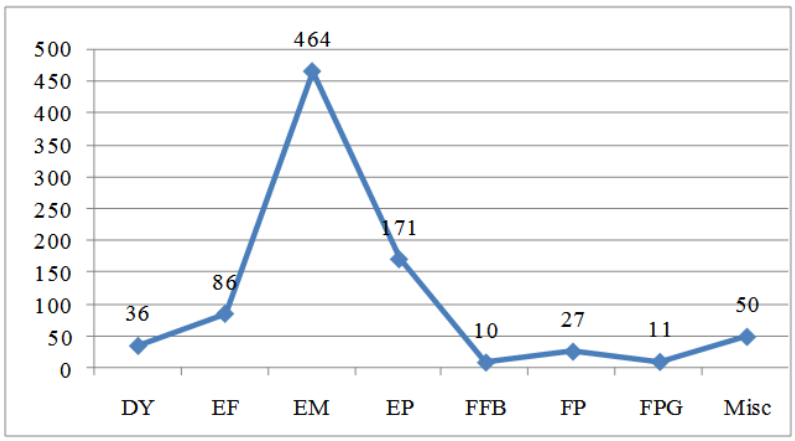

Fig 6: Number of species belonging to different used categories

4. Discussion and conclusion

World over, the tribal population still stores a vast knowledge on utilization of local plants as food and other specific uses [45]. The North Eastern region including the state of Sikkim is inhabited by over 130 major tribes and 300 sub-tribes [15] and harbors a rich heritage on traditional herbal remedies, wild edible food plants and bio-folklores. However, the ethnobotanical works of most of these tribal communities have not been reported. For instant, out of the 36 tribes of the Nagas from the region only the following viz. Angami, Ao, Chirus, Kabui, Konyak, Lotha, Mao, Phom, Poumei, Rengma, Sema, Sangtam, Tangkhul, Zemei, etc. have been reported and that too mostly on listing of the plants used. These tribal people, particularly those residing near the forest fringes are still largely depend on these wild resources for food, medicine and various others for their sustenance. A wide range of wild plant species are consumed by these peoples as vegetables, roots, shoots, flowers, fruits as well as edible mushrooms. They used wild plants not only for household consumption, but also a good amount of the collections are also available for selling in the local markets thereby supplementing to their household income [30]. The present investigation listed about 171 edible plants and 86 edible fruits, however studies on nutritional content have not been reported from the area, although such studies have been reported [26, 27, 41, 46] from the region and elsewhere. Hence such studies can be taken up for some of the most commonly

preferred and consumed wild plants from the area. The information generated from such studies will be useful to identify and prioritized species for conservation and management of the resources in a more sustainable way.

Also, there have been no report of cultivation of ethnobotanical plants, particularly the medicinal plants by the local people and the preparations are made by collecting the plants from the wild. This is a serious concern from the point of conservation and sustainability of the resources because such collection from the wild may lead to depletion of the population or even extinction of the resources particularly the rare and endangered species if it goes unabated. Good examples of such case recorded from the region are *Panax pseudoginseng* Wall. and *Paris polyphylla* Sm. Excessive collection of this high value medicinal plants for trade outside the area or region in recent years leads to wiping out of the whole population from their natural habitats [31]. In addition, a large majority of the plants used in local traditional medicine in the study areas or elsewhere in the region lacks phyto-therapeutic evidences. Therefore, it is required that steps must be taken up to perform phytochemical and pharmacological studies to support and validate the potential of local plants used in medicine.

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