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Indigenous uses of antidiabetic plants by ethnic inhabitant of Mizoram, Northeast India

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Abstract
The age long association of medicinal plants is highlighted in different utilization pattern by an indigenous community. Tribal people have their own system of herbal medicine. An ethnobotanical investigation was done to gather information about medicinal plants used in diabetes by the ethnic communities of Mizoram, Northeast India. The indigenous knowledge of local healers and plants used for the treatment of diabetes were collected through questionnaire and personal interviews. The study revealed that the traditional healers and the inhabitants use 53 species of plant distributed in 49 genera and belonging to 32 families to treat diabetes in the studied region.

Keywords: Mizo, Mizoram, Northeastern region, indigenous use, antidiabetic plants

1. Introduction
An indigenous community seems to hold the habitual knowledge of herbal remedies for different diseases. The indigenous identity of the particular community is derived due to the immemorial association with their floral and faunal environment (Ayyanar and Ignacimuthu, 2009) [9]. This association has lead to the use of many plants as medicine (Abbasi *et al.* 2009) [1]. The local folks are therefore dependent on the herbal medicinal plants for curing various ailments (Annalakshmi *et al.* 2012) [12]. Various parts were utilized for such purposes. This traditional knowledge has being passing on verbally from one generation to another (Majumdar *et al.* 2006, Manikandan *et al.* 2009) [7, 8] which is equivalent to the irreversible loss of flora and fauna (Mishra *et al.* 2012) [5, 15]

India is one of the twelve mega-diversity countries of the world having a rich vegetation with a diverse variety of plants. As per the 2001 census the tribal population of India is 8.43 crore constituting 8.2% of total population of the country with enormously diversified ethnic groups and rich biological resources, represents one of the great emporia of ethnobotanical wealth (Pal, 2000) [4]. Even today tribals and local communities in India still collecting and preserving locally available wild and cultivated plant species for their day to day life (Pareek, 1996) [13].

The Northeastern states of India comprises of eight sister states viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura harbour 130 major tribal communities. Mizoram is a state situated on the extreme south of northeastern India, it is a land of unending natural beauty with a variety of flora and fauna. It is located between 21-58° to 24°29' north latitude and 92° 29' to 93°22' east longitude. It is bounded on the north by the state of Assam and the state of Manipur, on the east and south by Chin Hills and Arakan (Myanmar), and on the west by the Chittagong hill tracts of Bangladesh and the state of Tripura. Mizoram is a land of hills, the hills run in ridges from north to south and have an average height of 900 meters. Mizo tribal group basically mongoloid belong to tibeto-burma subfamily of tibeto-chinese group. The tribal economy have been historically engaged in agriculture, gathering and over the years have developed a great deal of knowledge on the use of plants in curing diabetes. The diverse flora in the region provide a rich source of plants used by them in their folk medicine.

Diabetes is the commonest endocrine disorder that effect more than 171 million people worldwide (Wild *et al*. 2004) [14] and has become a very common problem in our society, it is a challenge to developing countries like India (Srinivastava, 1998) [10]. Diabetes is a metabolic syndrome of multiple etiologies charecterised by chronic hyperglycemia with abnormalities in carbohydrate, fat and protein metabolism due to defect in insulin secretion (Balkau *et al*. 2000) [3]

and is associated with long term damage such as malfunction of eyes (blindness), kidneys (renal failure), nerves, heart (stroke), blood vessels, foot ulcers and sexual dysfunction (Nagappa *et al*. 2003) [2]. Plant derivatives with hypoglycaemic properties have been used in folk medicine and traditional healing system around the world from very ancient time. Ethnobotanical plants are now more focussed than before because they have the capability, importance and produce many benefits to mankind.

Many ethnic area and ethnic communities in the region are either under explored or unexplored with regard to plant wealth used in the treatment of diabetes and there is always a search for ethnobotanical knowledge therefore the current study provide to assess, explore, document the indigenous knowledge on floristic diversity of plants used by ethnic people in healing complications associated and general awareness for diabetes. It is important from the view point of plant resources, sustainable utilisation in management of diabetes and its related complication of the species growing in around their habitation.

2. Materials and Methods

In order to collect information on antidiabetic plant intensive field visit was undertaken over a period of two years from 2013 to 2015 covering different seasons so as to gather information on each and every species found useful in herbal medicine by conducting field survey among the ethnic people. The ethnobotanical data were collected by conducting a questionnaire survey and formal group discussions. In the survey details of the species were asked which are mainly used for curing diabetes. Vernacular names, parts used and field data were recorded to validate the curing process. The details were carefully recorded and the species were also identified by visiting the natural growing sites. During the survey necessary photographs and specimens were collected to ensure the species identification. Instant pressing of the specimen as far as possible was done. Rainy season collections were pressed by spraying 10% formaldehyde. Dried specimens were poisoned with saturated solution of mercuric chloride dissolved in absolute alcohol and mounted on standard herbarium sheet. The collected plant were identified with the help of flora (Hooker 1975 and Kanjilal *et al*. 1984) [6] and standard literatures.

The study was carried out from 2014 to 2015 using a well structured questionnaire. The set of questions contained the local name, part used mode of administration of the plant material. The traditional healers consisted of men and women between 40 to 60 years.

3. Result and Discussion

The traditional healers consulted claimed to recognise diadetes by observing symptoms such as loss of weight, fatigue, excessive urination and presence of sugar in urine. Extracts of plant parts taken according to traditional healers reduces the body weakness, disappearance of sugar in urine and decrease in frequency of urination. The study revealed the diversity of antidiabetic plants in the region found a total of 53 plant species, distributed among 32 families were identified and documented. The documented family with the largest number of seven species belong to Leguminoseae, followed by Moraceae with four species, Euphorbiaceae and Rutaceae with three species each, Apocyanaceae, Cucurbitaceae, Dioscoreaceae, Malvaceae, Myrtaceae, Nyctaginaceae, Lamiaceae, Liliaceae and Verbenaceae with two species each, Anacardiaceae, Apiaceae, Bombacaceae, Bromeliaceae, Caricaceae, Convolvulaceae, Cruciferae, Labiatae, Lauraceae, Meliaceae, Menispermaceae, Moringaceae, Musaceae, Oxalidaceae, Punicaceae, Rubiaceae, Solanaceae, Umbelliferae and Zingiberaceae with one species each (Table 1, Figure 1). The status on the habit of the antidiabetic plants show the dominant species tree, followed by herbs, shrubs and climbers as such tree 23 species (43 %), herbs 13 species (25 %), shrubs 10 species (19 %) and climbers 7 species (13 %) (Table 1, Figure 2). The study on the plant part(s) used for the procurement of the ingredient show that the most preferred form of use is leaf 29 species (40 %), followed by fruit 10 species (14 %), bark 8 species (11 %), flower 7 species (10 %), seed 6 species (8 %), root 4 species (5 %), whole plant 3 species (4 %), bulb two species (3 %), tuber two species (3 %) stem 1 species (1 %) and rhizome 1 species (1 %), (Table 1, Figure 3). The ethnobotanical usage that is method of preparation, formulation of crude drug show that the most preferred form of use is decoction 45 species (76 %), infusion 6 species (10 %), paste 3 species (5 %), raw 3 species (5 %) and powder 2 species (4 %) (Table 1, Figure. 4).

Table 1: Antidiabetic plants with Family, Local name, Habit, Part(s) and Ethnobotanical usage

Sl. No.	Botanical Name	Family	Local Name	Habit	Part(s) used	Ethnobotanical usage
1.	*Aegle marmelos* (L). Corr	Rutaceae	Belthei	Tree	Leaves	Powder
2.	*Albizia procera* Roxb.	Leguminosae	Kangṭek	Tree	Leaves, flower, bark	Decoction and infusion
3.	*Allium cepa* Linn.	Liliaceae	Purunsen	Herb	Bulb	Paste
4.	*Allium sativum* Linn.	Liliaceae	Purunvar	Herb	Bulb	Paste
5.	*Alstonia scholaris* (Linn.) R.Br	Apocyanaceae	Ṭhuamriat	Tree	Leaves, bark	Decoction
6.	*Ananas comosus* L.	Bromeliaceae	Lakhuihthei	Herb	Whole plant	Decoction
7.	*Artocarpus heterophyllus* Lamk.	Moraceae	Lamkhuang	Tree	Leaves	Decoction
8.	*Aartocarpus lakoocha* Wall ex Roxb.	Moraceae	Theitat	Tree	Bark, leaves, seed	Decoction
9.	*Azadirachta indica* A.Juss.	Meliaceae	Hnahkha	Tree	Leaves	Decoction
10.	*Bauhinia purpurea* Linn.	Leguminosae	Vaube	Tree	Seed	Decoction
11.	*Bombax ceiba* L.	Bombacaceae	Pang	Tree	Leaves, flower, bark	Decoction
12.	*Bouganvillea spectabilis* Wild.	Nyctaginaceae	Sarawn par	Shrub	Leaves	Decoction
13.	*Brassica juncea* L.	Crucifereae	Anṭam	Herb	Leaves, seed	Decoction and powder
14.	*Butea monosperma* (Lam.) Taubert	Leguminosae	Farṭuahnu	Tree	Leaves, fruits	Decoction and paste
15.	*Carica papaya* L.	Caricaceae	Thingfanghma	Tree	Seed	Decoction
16.	*Cassia alata* Linn.	Leguminosae	Uihlo	Shrub	Leaves	Decoction
17.	Cassia tora Linn.	Leguminosae	Kelbaan	Shrub	Leaves	Decoction
18.	*Catharanthus roseus* (Linn.) G.Don	Apocyanaceae	Kumtluang	Herb	Leaves, flower	Decoction and infusion
19.	*Centella asiatica* L.	Umbelliferae	Lambak	Herb	Whole plant	Decoction
20.	*Citrus medica* Linn.	Rutaceae	Sertawk	Shrub	Leaves	Decoction
21.	*Cinnamomum tamala* (Bach-Ham) Nees & Eberm	Lauraceae	Tespata	Tree	Stem, bark, root	Decoction
22.	*Cucumis melo* Roxb.	Cucurbitaceae	Hmazil	Climber	Seed	Decoction

23.	*Curcuma longa* Linn.	Zingiberaceae	Aieng	Herb	Rhizome	Decoction
24.	*Daucus carota* L.	Apiaceae	Kerawt	Herb	Flower	Infusion
25.	*Dioscorea alata* L.	Dioscoreaceae	Rambachim	Climber	Tuber	Raw
26.	*Dioscorea bulbifera* Linn.	Dioscoreaceae	Rambahra	Climber	Tuber	Raw
27.	*Erythrina variegata* Lam.	Leguminosae	Farṭuahpa	Tree	Leaves	Decoction
28.	*Ficus benghalensis* Linn.	Moraceae	Hmawng	Tree	Root	Raw
29.	*Ficus hispida* Linn.	Moraceae	Paihte maian	Tree	Fruit	Decoction
30.	*Gmelina arborea* Roxb.	Verbenaceae	Thlanvawng	Tree	Leaves, fruits	Decoction
31.	*Gossypium arboretum* Linn.	Malvaceae	La	Shrub	Leaves	Decoction
32.	*Hibiscus rosasinensis* Linn.	Malvaceae	Midum pangpar	Shrub	Leaves	Decoction
33.	*Ipomea botatus* Linn.	Convolvulaceae	Kawlbahra	Climber	Leaves	Decoction
34.	*Jatropha curcas* Linn.	Euphorbiaceae	Kang damdawi	Shrub	Leaves	Decoction
35.	*Lantana camera* Linn.	Verbenaceae	Hling pangpar	Shrub	Leaves, flowers	Decoction, infusion
36.	*Mangifera indica* L.	Anacardiaceae	Theihai	Tree	Young leaves	Decoction
37.	*Mentha arvensis* Linn.	Labiatae	Pudina	Herb	Leaves	Decoction
38.	*Mimosa pudica* Linn.	Leguminosae	Hlonuar	Shrub	Whole plant	Decoction
39.	*Mirabilis jalapa* L.	Nyctaginaceae	Artukkhuan	Herb	Root	Decoction
40.	*Momordica charantia* L.	Cucurbitaceae	Changkhate	Climber	Leaves, fruits	Decoction
41.	*Moringa oleifera* Lam.	Moringaceae	Archangkawm	Tree	Leaves	Decoction, infusion
42.	*Musa paradisiacal* L.	Musaceae	Balhla	Tree	Flower, fruit	Decoction
43.	*Ocimum sanctum* L.	Lamiaceae	Runhmui	Herb	Leaves	Decoction
44.	*Oxalis corniculata* L.	Oxalidaceae	Sialthur	Herb	Leaves	Decoction
45.	*Psidium guajava* L.	Myrtaceae	Kawlthei	Tree	Leaves	Decoction
46.	*Punica granatum* L.	Punicaceae	Theibuhfai	Tree	Fruit	Decoction
47.	*Phyllanthus emblica* Linn.	Euphorbiaceae	Sunhlu	Tree	Fruit	Infusion
48.	*Ricinus cummunis* Linn.	Euphorbiaceae	Mutih	Shrub	Flower	Decoction
49.	*Rubia cordifolia* L.	Rubiaceae	Rawngsen	Climber	Root	Decoction
50.	*Solanum lycopersicum* Linn	Solanaceae	Sapbawkbawn	Herb	Fruit	Decoction
51.	*Syzygium cumini* (Linn.) Skeel	Myrtaceae	Lenhmui	Tree	Bark, fruit, seed	Decoction
52.	*Tinospora cordifolia* (Wild.) Hook. f & Th.	Menispermaceae	Theisawntlung	Climber	Leaves, bark	Decoction
53.	*Zanthoxylum armatum* DC.	Rutaceae	Arhrikreh	Tree	Bark, fruit	Decoction

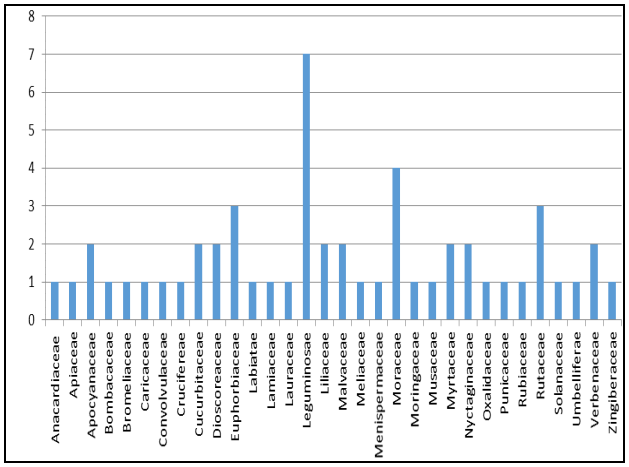

Fig 1: Family wise distribution of plants

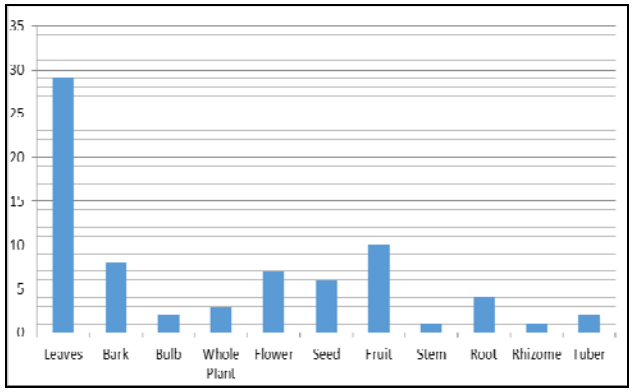

Fig 3: Number of different plant parts used

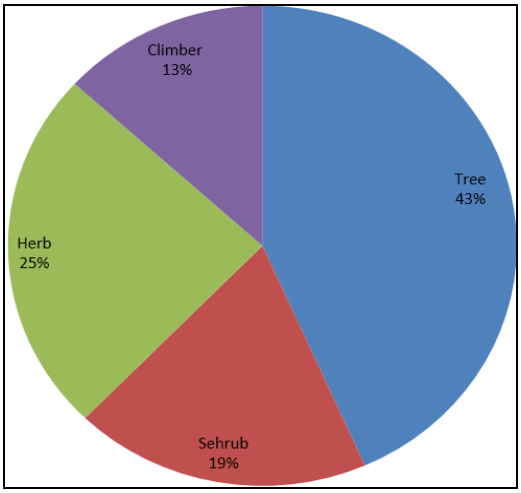

Fig 2: Habit of the plants with percentage

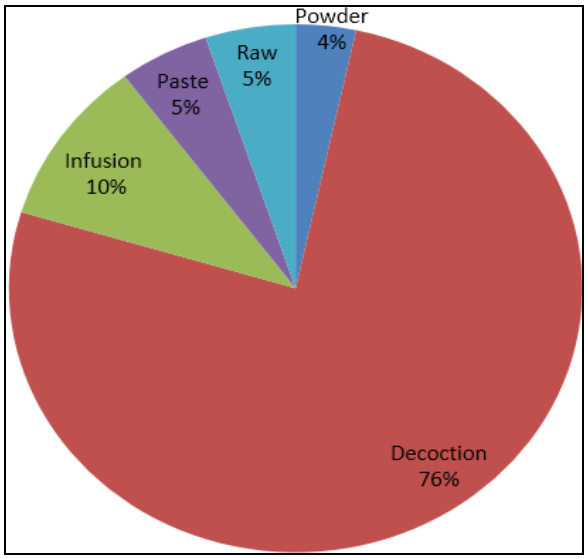

Fig 4: Ethnobotanical usage with percentage

4. Conclusion

The present investigation indicated that the region is blessed with diversity of ethnobotanical species, therefore documentation of traditional knowledge is the only mean to preserve the knowledge. The knowledge is most useful for scientists, research scholars, pharmaceutical company for further work on isolation, identification of active compounds that can be formulated into antidiabetic drugs. In conclusion, tribal are the parent of the natural resources and their utilization is based on the trial and error method (Ayyanar and Ignacimuthu 2009) [9]. Plants are the repository of potential medicinal values, thus can be widely used for alleviating several health problems. New formulations of drugs are based on the local trials by the indigenous people. But due to the absence of the modern medicine and existence of the belief (Karmakar *et al.* 2012; Das *et al.* 2012) [11, 15] in the effect of the herbal drugs, people in the rural area still prefer traditional ways of curing. Therefore, proper and intensive inventorying of medicinal plants specific to certain health problems becomes necessary. The diminishing pattern of the knowledge system is in danger (Das *et al.* 2012) [15] leading to more in-depth study across the genders and age to know the transfer system. It is necessary to carry the ethno-botanical study of these plants which would help in the preservation of their knowledge and can be utilized in the conservation of these potential plants. The study has provided brief information about the medicinal uses of plants amongst various tribes in the state. It however requires detail work initiated with inter-cultural study and representing about the status and usage of the same species in curing different ailments coupled with chemical analysis.

The study revealed that the ethnic peoples of the study region used traditional plants for treatment of diabetes further the treatment is cost effective and biological safe. The herbal heritage must be protected for future which may ultimately lead to the development of new molecules for human health as well as national economy. There is an urgent need to formulate strategies for conservation of these ethnobotanical plants by domestication and cultivation endemic to the region.

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