



Ethnobotanical uses of some Hill road side Pteridophytes in Mizoram, India

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ABSTRACT

Mizoram is one of the biodiversity hotspots in the Eastern Himalayan region and is a bio-diversity rich area. Its unique location, topography with hills and valleys, and geology provide immense ranges of microclimatic conditions, which are replete with rich diversity of Pteridophytes. Roadside flora of Mizoram also rich in pteridophytes. These pteridophytes are one of the source of carbon sink along the road. Some work related to Pteridophytes have been reported by some researchers in some protected areas like sanctuaries and some forests in Mizoram. Till date no work has been reported on the Diversity, Ecology and Utilization of Pteridophytes along the Hill Roads in Mizoram. The paper elucidates the current diversity, taxonomy, ecology and utilization status of the Pteridophytes along some selected roads of Mizoram so that proper attention should be made during further capacity augmentation /widening of these roads for conservation of the Pteridophytes. The study would be helpful in monitoring and management of remaining population of the Pteridophytes along other roads also.

Key words: Hill roads, Pteridophytes, Diversity, Ecology, Hotspots, and Carbon sink.

INTRODUCTION

Himalaya, which amongst the global mountains, represents the youngest, still evolving, and a complex mountain system on the surface of earth has been recognized as one of the 34 global biodiversity hotspots. On account of it being in an evolving state, the ecosystem components in the region exhibit great dynamism. (Zobel & Singh, 1997). The region holds great significance from ecological and evolutionary point of view. This region is rich in biodiversity and harbours largest number of endemics and Schedule I species as compared to any other part of India (MacKinnon, 1986).

Mizoram has geologically distinctive terrain with low but steep hills ranging from 900 - 1,100 meters high, and slightly higher in the east. Its unique location, topography with hills and valleys, and geology provide immense ranges of microclimatic conditions, which are replete with rich diversity of flora and fauna. Mizoram is one of the biodiversity hotspots in the Eastern Himalayan region with about 94% tribal people living in the state. Mizoram has total 1,585 ha of Forest which is 75.71% of the total geographical area. In term of forest canopy classes, Mizoram has 138 sq. km very dense forest, 5858 sq. km moderately dense forest and 24,534 sq. km open forest (India State of Forest Report 2015).

Mizoram has important areas of biological significance and gene pools of a variety of flora and fauna. Within India, the entire North-East region – the transition zone between India, Indo-Malayan and Indo-Chinese geographic regions—is recognized under the National Biodiversity Strategy and Action Plan to be an eco-region. From all accounts, Mizoram is a “bio-diversity rich” area (Swamliana, 2013).

Pteridophytes, the seedless vascular plants, had a very flourishing past in dominating the vegetation on the earth about 280-230 million years ago. India with a highly variable climate has a rich diversity of its flora and Pteridophytic flora greatly contributes to its diversity. Pteridophytic flora of India comprises of 67 families, 191 genera and more than 1,000 species (Dixit 1984) including 47 endemic Indian ferns, less than 10% of those reported previously and 414 species of Pteridophytes (219 At risk, of which 160 critically endangered, 82 Near-threatened and 113 Rare), constituting 41-43 % of the total number of 950-1000 Pteridophytes of India. Chandra (2000) recorded 34 families, 144 genera and more than 1100 species of ferns with about 235 endemic species from Indian region (Rawat & Satyanarayana 2015).

Occurrence of 36 taxa (28 terrestrial, 7 lithophytic, 1 epiphytic) belonging to 19 genera and 15 families of pteridophytes has been reported from Thorangtlng wild life sanctuary of Mizoram. The species like *Adiantum philippense* L., *Blechnum orientale* L., *Thelypteris nudata* (Roxb.) C.V.Morton, *Leptochilus pteropus* (Blume) Fraser-Jenk and *Polystichum pseudotsus-simense* Ching grow luxuriantly in the study area (Barbhuia & Singh, 2014). Verma et al. (2013) has reported total of 33 species of pteridophytes belonging to 21 genera and 18 families from Ngengpui Wildlife

Sanctuary, Mizoram. This includes three new distributional records viz., *Nephrolepis exaltata* (L.) Schott, *Pleocnemia submembranacea* (Hyata) Tagawa & K.Iwats and *Tectaria decurrens* (C. Presl) Copel from Mizoram, remaining all were new report to the sanctuary. Vanlalpeka & Laha (2015) reported 32 species of Pteridophytes from the eight selected forest sites in Champhai district, Out of the 32 species found 27 species are terrestrial Pteridophytes while the other 5 species i. *Pseudodrynaria coronans* (Wall.exMett.) Ching, *Drynaria quercifolia* (Bory)J.Sm., *Platyserium wallichi* Hook., *Drynaria propinqua* J.Sm.ex Bedd, *Drynaria quercifolia*(Bory) J.Sm are epiphytic and 6 species are of ethno botanical use(s). Singh et al. (2016) reported 37 taxa of pteridophytic flora from Tawi Wildlife Sanctuary, Mizoram. This includes 11 taxa viz., *Microlepia firma* Mett. ex Kuhn, *Lindsaea odorata* Roxb., *Aleuritopteris subdimorpha* (Clarke & Baker) Fraser-Jenk., *Coniogramme serrulata* Fee, *Pteris arisanensis* Tagawa, *P. subindivisa* C.B. Clarke, *Asplenium yoshinagae* Makino subsp. *yoshinagae*, *A. yoshinagae* subsp. *Indicum* (Sledge Fras.-Jenk., *Thelypteris esquirolii* (Christ) Ching, *T. hispidula* (Decne.) C.F. Reed, *Athyrium setiferum* C.Chr., and *A. woodsioides* Christ, new record for the state of Mizoram. Sharma et al. (2013) collected a total of 35 species of pteridophyte under 23 genera and 21 families from Pualreng Wildlife Sanctuary, Kolasib, and Mizoram. Sharma et al. (2017) reported taxonomic inventorization of pteridophytes occurring in a human inhabited buffer zone of Murlen National Park, Mizoram, India. This survey revealed 35 species belonging to 27 genera and 15 families. Polypodiaceae was recorded as dominant family. Of the recorded species, 23 species were terrestrial, 11 (epiphytic) and two (lithophytic) in their habit forms. Verma et al. (2014) reported a total of 33 species of pteridophytes belonging to 24 genera and 17 families from Khawnglung Wildlife Sanctuary, Mizoram. Polypodiaceae, Thelypteridaceae and Dennstaedtiaceae, are dominant families. With regard to habitats, 25 species are terrestrial, 4 species are lithophytes, 2 species are epiphytic and remaining two are either terrestrial, lithophyte or epiphytic. Vanlalpeka & Laha (2015) reported 32 species of ferns belong to 17 families from eight different sites Champhai district, Mizoram and their taxonomic identification. Amongst them 32 species are terrestrial species 5 species are epiphytic and 6 species are of ethno botanical use.

Lot of studies focusing on the medicinal properties and uses of plants, especially angiosperms, have been taken place, unfortunately limited amount of studies have

been done to explore the medicinal potentialities and uses of the pteridophytes. The medicinal qualities of ferns, real or imaginary, are mentioned as early as 300 B.C. by the Greek philosopher Theophrastus and by his Indian contemporaries Sushrut and Charak. The medicinal uses of some ferns and pteridophytes of India have also been described (Caius, 1935; Nair, 1959). The medicinal uses of 61 different ferns and fern-allies have been well described by (Benjamin & Manickam, 2007). *Adiantum capillus-veneris* and *Marsilea minuta* have been mentioned as of medicinal importance in 'Charak Samhita' and the rhizome of *Polystichum squamosum*, which is known as 'Nirviri' in India is effectively used against scorpion bite and insect bites (Dixit, 2000). Another important pteridophyte which plays very important roles in the ecosystem is *Azolla* commonly found in still or slow moving water bodies' act as bio fertilizer for rice cultivation with nitrogen-fixing, blue-green algae namely - *Anabaena azollae* has been recognized in many countries including India. *Azolla* has also been used as food supplement in fresh or dried or silage form for a variety of animals including pigs, cattle, rabbits, ducks, chicken (Ahluwalia *et al.*, 2002). Besides having all these wonderful properties, the pteridophytes are also greatly valued as ornamentals. Prior to the discovery of these benefits obtained from this group of plants, ferns were used to enhance the beauty of the landscape and are continued to be used so till now.

As far as studies on the pteridophytes of Mizoram is concerned, it appears that this state has received less attention and is known only through sporadic reports, identification and proper records of pteridophytes has not been made till today. Some work related to Pteridophytes have been reported by some researchers in some protected areas like sanctuaries and some forests in Mizoram. Many areas of the state are still unexplored which require systematic exploration. Ethnobotanical uses of pteridophytes are also not well reported in Mizoram. Vanlalpeka & Laha (2015) reported 32 species of ferns belong to 17 families from eight different sites Champhai district, Mizoram amongst them 6 species are of ethno botanical use. The different plant parts as leaves, rhizome and young stem are used for the treatments of dysentery, ulcer, burning sensation, rheumatism, wound, skin infection etc. and also as vegetable by the different forest ethnic people.

Mizoram has total road of length of about 6840 Km having road density of 32.43 kms /100 sq.kms which is

below India's national average of 48.80 kms/ 100 sq.kms, hence Mizoram is planning for 300 km of new road within 5 years and to widen existing 6220 km of road within 10 years, which will create impact on biodiversity (Mizoram Economic Survey 2014 - 15). Roadside flora of Mizoram rich in Pteridophytes. They are the important part of the ground vegetation of many roads and also an important component of many epiphytic plant communities. Some species are very beneficial to humans and many species attracts many plant lovers for their graceful, fascinating and beautiful foliage. These Pteridophytes are one of the source of carbon sink along the road (India State of Forest report 2015). Till date no work has been reported on the diversity, ecology and utilization of Pteridophytes along the hill roads in Mizoram. In this paper an attempt has been made to explore and understand the diversity, ecology of pteridophytic flora and their utilization along some selected roads of Mizoram so that proper attention should be made during further capacity augmentation /widening of these roads for conservation of the Pteridophytes. The study would be helpful in monitoring and management of population of the Pteridophytes vegetation along other roads also.

MATERIALS AND METHODS

For listing of the Pteridophytes along the roads three major roads of Mizoram in three different locations were selected for the present study. Three roads selected were - Aizawl- Lunglei road, Sheling - Champhai road and Lunglei -Tlabung road (Figure -1). All the roads were surveyed with team of experts for two consecutive years during the months of October to January (2016 & 2017). Data were collected within 200m (considering corridor of impact) of the roads by traversing on foot along all the pteridophytic habitats in on both side of the roads (valley side and hill side). Vegetation water channels, ridges and various habitats within the corridor of impact (200m of the road) were also considered for the listing of the pteridophytes. The taxonomy of recorded species followed Fraser-Jenkins (2009). The families are enumerated in text according to Fraser-Jenkins (2009). However, the genera and species within the families are listed alphabetically. The authorities of plant names follow Brummitt & Powell (1992) while the taxonomic citation is based on published literature and IPNI, Tropicos and The Plant List. All the specimens were collected in fertile stage and were processed through conventional herbarium (Jain 1977). Field records and voucher specimens were

identified by matching with herbarium specimens of Local universities and research institutions herbarium and by using different floras of nearby areas (Beddome R.H. (1892), Ghosh S.R *et al.* 2004, Ghose *et al.* 2008, Singh 2005) Identifications of specimens were based on field characters with the aid of existing literature (Baishya & Rao 1982; Jamir & Rao 1988; Kholia 2010a, 2014; Benniamin 2012).

The data on the uses of the pteridophytes were collected through questionnaire, interviews and discussions among local people in presence of the Village Council (VCP), local Vadhya and old men and women of local village community along the roads.

RESULTS AND DISCUSSION

Pteridophytes along the roads

For listing of the Pteridophytes along the roads three major roads of Mizoram in three different locations were selected for the present study. Three roads selected were - Aizawl- Lunglei road, Sheling – Champhai road and Lunglei –Tlabung road (Figure -1).

Along the Aizawl – Thenzal – Lunglei road 40 species of Pteridophytes were identified and listed which represent 20 families of pteridophytes. Members of family Silaginaceae and Tectariaceae are the dominant along the road both with 4 species followed by members of family Polypodiaceae and Lycopodiaceae with 3 species each. Other families show their presence with 2 or 1 species along the road (Figure 2). Habitat wise distribution of the pteridophytes indicate the fact that out of total pteridophytes listed along the road 33% are terrestrial, 27% are sciophytes , 18% are Hydrophytes , 10% are Lithophytes and 12% are Epiphytes (Figure 3).

Along the Seling - Champhai Road road 35 species of Pteridophytes were identified and listed which represent 19 families of pteridophytes. Members of family Pteridiaceae and Polypodiaceae are the dominant along the road both with 4 species followed by members of family Cyathaceae and Lycopodiaceae, Theloppteridaceae and Marsilliaceae with 2 species each. Other families show their presence with 2 or 1 species along the road (Figure 4). Habitat wise distribution of the pteridophytes indicate the fact that out of total pteridophytes listed along the road 33% are terrestrial, 19.4 % are sciophytes , 11.1% are Hydrophytes and Lithophytes and Epiphytes are 16.6% (Figure 5).

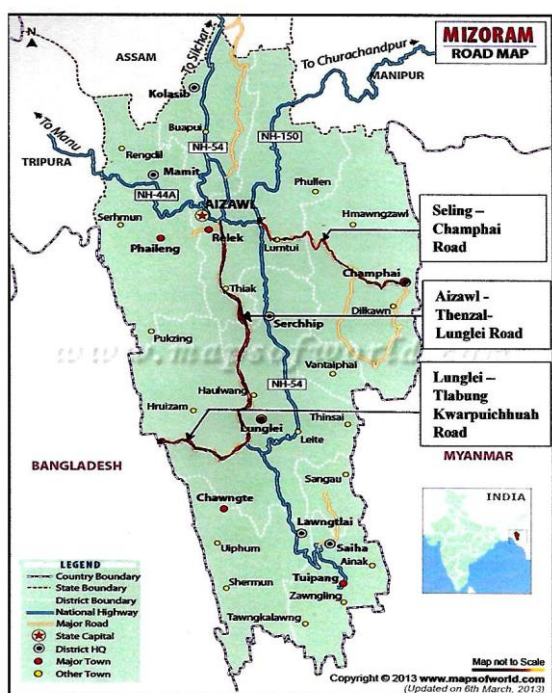


Figure 1: Roads considered for the study

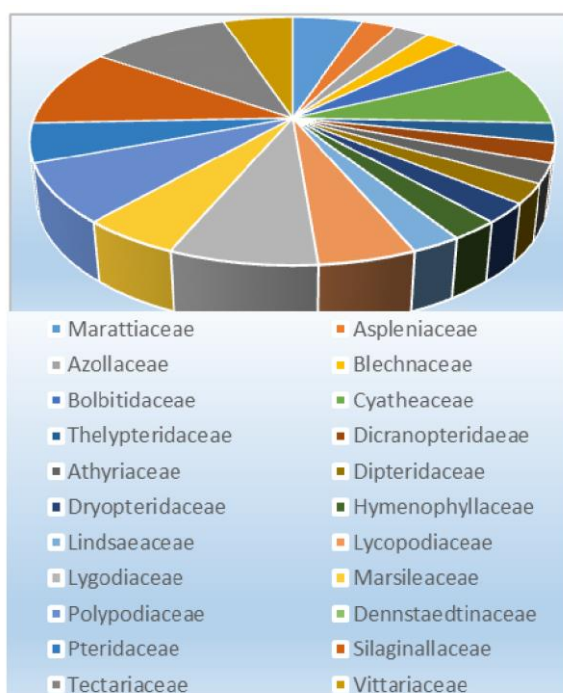


Figure 2: Family wise distribution of Pteridophytes along Aizawl - Thenzal - Lunglei Road

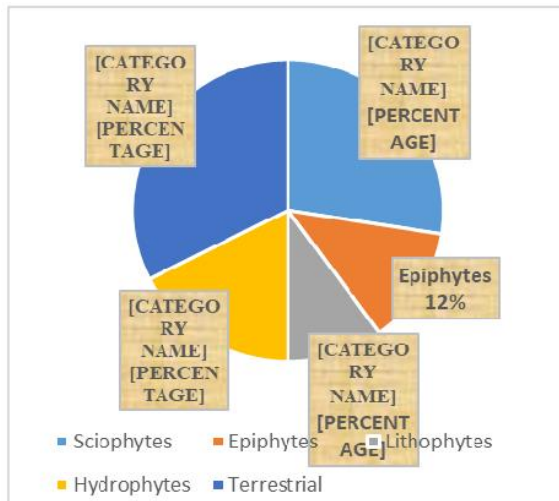


Figure 3: Habitat wise distribution of Pteridophytes along Seling - Champhi Road

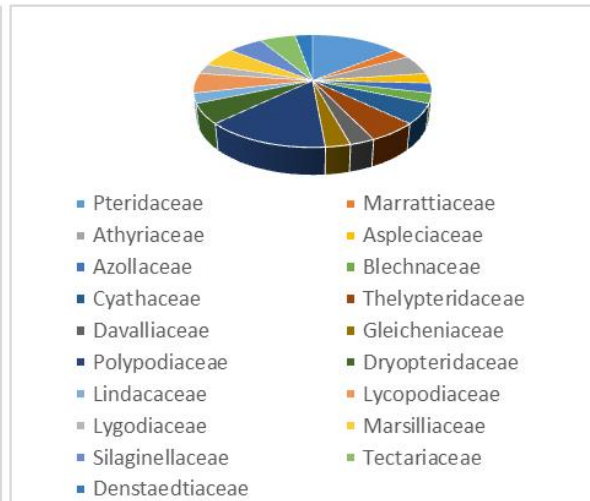


Figure 4: Family wise distribution of Pteridophytes along Aizawl - Thenzal - Lunglei Road

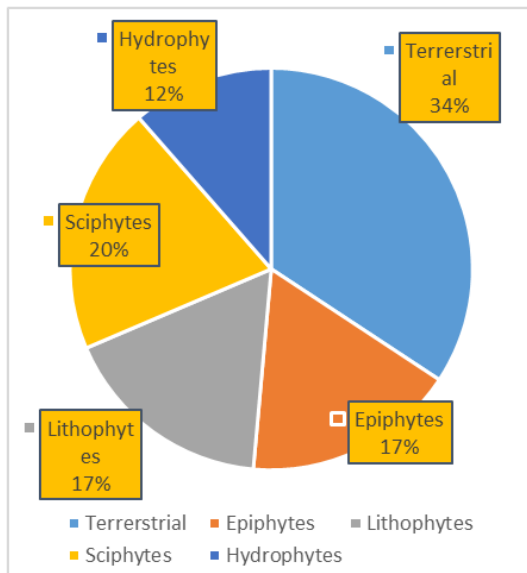


Figure 5: Habitat wise distribution of Pteridophytes along Lunglei - Tlabung - Kwrapiuchhuah Road

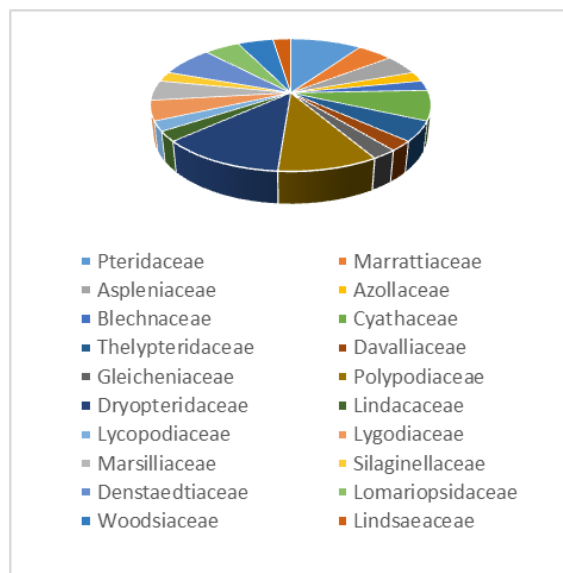


Figure 6: Family wise distribution of Pteridophytes along Seling - Champhi Road

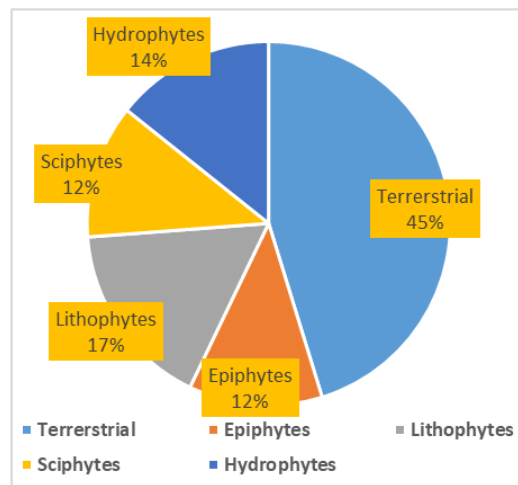


Figure 7: Habitat wise distribution of Pteridophytes along Lunglei - Tlabung - Kwrapiuchhuah Road

Table 1: Use of pteridophytes by local people along the road

S. N.	Name of the Pteridophyte	Family	Use by Local people
1.	<i>Adiantum lunulatum</i> Burnhand.	Pteridaceae	Leaf and root decoction is generally used for treatment of chest complain. The decoction of also used as diuretic, and useful in dysentery.
2.	<i>Adiantum phillipensis</i> L.	Pteridaceae	The leaf and root decoction is used for treatment of chest complaints
3.	<i>Angiopteris evacta</i> (G.Forst.)Hoffm.	Marrattiaceae	Paste of rhizome is applied externally in case of bone fracture and apical parts of caudex is cut into pieces and boiled with water extract to apply locally over carbuncle to get relief from pain
4.	<i>Asplenium nidus</i> L.	Aspleniaceae	The leaves are said to be contraceptive, depurative and sedative, treatment of chest pains .Also used externally for the treatment of stings and bite.
5.	<i>Azolla pinnata</i> Lamarck	Azollaceae	Azolla has also been used as food supplement in fresh or dried or silage form for variety of animals including pigs, cattle, rabbits, ducks, chicken and fish
6.	<i>Blechnum orientale</i> L.	Blechnaceae	Hot decoction of pinnae is applied externally over abscess to release pus and also for antiseptic action
7.	<i>Cyathea spinulosa</i> Wall. ex Hook	Cyatheaceae	Dried powder of fronds and stem used orally in Rheumatic Arthritis
8.	<i>Cyathea gigantea</i> (Wall. ex Hook.)	Cyatheaceae	Extract of grinded rhizome and young petiole is given in snake bite Fresh soft pith is edible. Paste of fresh rhizome is used locally on the cuts and boils. It has antitumor, antiviral and hepatoprotective activity
9.	<i>Dicranopteris lineris</i> (Burm. f.) Underwood.	Gleicheniaceae	Fronds juice is slightly heated and the decoction is taken to get relief from throat pain.
10.	<i>Diplazium esculentum</i> (Retx.) Sw.	Athyriaceae	Young and fresh frond is boiled with salt and taken internally for maintaining all round health. Traditionally, the plant is used in treating headache, pain and fever,
11.	<i>Drymoglossum heterophyllum</i> (Linn.) Trimen	Polypodiaceae	Pinnae paste is applied externally on fractured bones after setting up the bones.
12.	<i>Drynaria quercifolia</i> (Linn) J. Smith.	Polypodiaceae	Pinnae paste is applied externally on fractured bones after setting up the bones. Sometime used rhizome paste applied externally for blood clotting
13.	<i>Dryopteris</i> sp.	Dryopteridaceae	Ornamental use in house and churches during celebration.
14.	<i>Lycopodium cernuum</i> Linn.	Lycopodiaceae	The plant paste applied externally over the cut portion to reduce swelling and itching.
15.	<i>Lygodium flexuosum</i> (Linn.) Sw.	Schizaeaceae	To reduce headache rachis of the plant tied over forehead. Boiled with mustard oil used against rheumatism
16.	<i>Marsilea minuta</i> L.	Marsileaceae	Used as vegetable and mixed with pulses as food supplement which act as Medicinal – antioxidant
17.	<i>Marsilea quadrifolia</i> L.	Marsileaceae	Used as vegetable and mixed with pulses as food supplement which act as Medicinal – antioxidant
18.	<i>Pteris vitata</i> L.	Pteridaceae	A paste prepared from the whole plant is applied to the affected area for the treatment of fractures and also taken for coughs in children
19.	<i>Pteris semipinnata</i> Linn.	Pteridaceae	Used as treatment of carbuncle for getting it burst and also to reduce pain
20.	<i>Pyrrosia lanceolata</i> L.	Polypodiaceae]	Used for curing cold and sore throats

Forty two (42) species of Pteridophytes were listed along the Lunglei – Tlabung – Kwarpuicchuah road which represent 20 families of pteridophytes. Dominant species of the pteridophytes along the road is represented by the members of the family Dryopteridaceae with 6 members followed by members of the family Pteridaceae and Polypodiaceae with 4 members each. Others family members has presence with two members and sometimes with single member (Figure 6). Habitat wise distribution of the pteridophytes indicate the fact that out of total pteridophytes listed along the road 45.2 % are terrestrial, 12 % are sciophytes , 14.2 % are Hydrophytes, Lithophytes 16.6% and Epiphytes are 12% (Figure 7).

Ethnobotanical use of Pteridophytes by local people in the villages along the roads

Many tribal communities and rural populations who are living along the road are dependent upon such natural resources like pteridophytes distributed along the roads for treatment of various ailments and diseases and also as food and fodder supplement. Local people are using various pteridophytes as medicinal, food, fodder and other multipurpose uses. The fronds of ferns are also used in for decorating the churches and houses in various occasions. During focus group discussions and consultations in villages along the roads under study reveal the fact that villagers could identify and could disclose the information on use of only 20 pteridophyte species which are of ethnobotanical use. The different plant parts as leaves, rhizome and young stem are used for the treatments of dysentery, rheumatism, healing of wound, skin infection , chest complain, treatment of carbuncles, treatment of fractures, cold and sore throats , snakebites etc. and also as vegetable by ethnic people (table 1)

CONCLUSION

The pteridophytes are moisture and shade loving plants and dependent upon the microclimatic conditions of the region for their successful survival in that region. Any kind of disturbance in these microclimatic conditions can hinder the growth and evolutionary processes occurring naturally in these plants thereby, leading to decline in their populations. Thus, factors like climate change, encroachment of lands for road development pose a major threat to the survival of these groups of plants along the roads. Unplanned felling of road side

trees in is also a major threat for epiphytic pteridophytes.

Roadside flora of Mizoram rich in Pteridophytes. They are the important part of the ground vegetation of many roads and also an important component of many epiphytic plant communities. Some species are very beneficial to humans and many species attracts many plant lovers for their graceful, fascinating and beautiful foliage. These Pteridophytes are one of the source of carbon sink along the road (India State of Forest report 2015). Till date no work has been reported on the diversity, ecology and utilization of Pteridophytes along the hill roads in Mizoram. In this paper an attempt has been made to explore and understand the diversity ,ecology of pteridophytic flora and their utilization along some selected roads of Mizoram so that proper attention should be made during further capacity augmentation /widening of these roads for conservation of the Pteridophytes. The study would be helpful in monitoring and management of population of the Pteridophytes vegetation along other roads also.

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