

Assessment of Plant Species Richness of Phawngpui National Park in Lawngtlai District of Mizoram, India

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Abstract

The Phawngpui National Park (PNP) is situated on the highest mountain peak in Mizoram, which is about 2200 m asl. Plant species richness was studied in PNP during 2007 – 2009 and recorded the occurrence of 208 species of plants. The species of *Eria lacei* Summerhayes, *Dendrobium capillipes* Reichenbachf. and *Mahonia borealis* Takeda were recorded as endemic, rare and endangered. *Camellia kissi* Wallich, *Rhododendron veitchianum* Hooker, *Dendrobium pycnostachyum* Lindley and *Gastrochilus calceolaris* (Buchanan-Hamilton ex J.E. Smith) D. Don have also been recorded as endemic and critically endangered species. Detailed information on assessment of plant species richness is presented in the paper.

Key words: Phawngpui National Park, Plant resources, Species richness, Threatened species

INTRODUCTION

Mizoram is rich in flora and fauna and has the highest forest cover in the country. It is one of the biodiversity hotspots in the North east India (Nayar 1996) and is covered by Indo-Burma Hotspot of IUCN. About 94 % of the people living in the State are tribal. The forest cover, based on interpretation of satellite data of November 2006 – January 2007, is 19,240 km², which is 91.27 % of State's total geographic area. In terms of forest canopy density classes, Mizoram has 134 km² very dense forests, 6,251 km² moderately dense forests and 12,855 km² open forests. The State has two National Parks and eight Wildlife Sanctuaries covering an area of about 1241 km² which is 5.89 % of its geographical area (SFR 2009).

The plant diversity of Mizoram is not adequately studied as compared to other states of North East India. Exploration on plant diversity was first made by Gage in 1899; he recorded 317 species including 26 species of Cryptogams. Then, it was followed by earlier workers such as Parry (1932), Kanjilal *et al* (1934 – 1940); Fischer (1938); and recent workers include Sawmliana (2003); Lalramnghinglova (1997, 2003) and Singh *et al* (2002). Lalramnghinglova (1997) published the *Handbook of Common Trees of Mizoram*. He then recognized Ethno-botanically important plants in different forest areas and published *Ethno-Medicinal plants of Mizoram* in 2003. Botanical Survey of India has published the *Flora of Mizoram* (First Volume) in the year 2002 (Singh *et al* 2002). So far, Lalnunmawia (2003) identified 20 species of bamboos and Environment & Forest Department, Govt. of Mizoram, Aizawl published 35 species of bamboos (Anonymous 2010). Lalnuntluanga (2007) identified 12 species of canes from Mizoram. Saithantluangi Zote (2010) recorded 233 species of orchids from Mizoram.

The reported floral resources of Mizoram are: Flowering plants 2141 species; genera 905; Family 176; Gymnosperms 6 species; and Pteridophytes 211 species. Important genera includes *Quercus* (18 species), *Desmodium* (17 species), *Ficus* (34 species), *Polygonum* (20 species),

Begonia (18 species) and *Piper* 126 (species). Also, 30 species of endemic flowering plants were recognized from Mizoram (Chaudhuri & Sarkar 2003).

MATERIALS AND METHODS

Study Area

Phawngpui (Blue Mountain) National Park (PNP) is situated in Lawngtlai District, the south-eastern corner of Mizoram between 22°36'37" to 22°41'33" N latitude and 92°00'41" to 93°04'57" E longitude with an area of 50 sq km. It is accessible from Sangau village in the north and Vawmbuk village in the south. PNP lies under the Sub-tropical Hill forests (Lalramnghinglova 1997) and consists of a series of parallel hills running from North to South direction including the highest peak (2200 m amsl) in the State called Blue Mountain. It has a pleasant and equable warm climate throughout the year. In summer, the temperature ranges from 18° C to 24° C and in winter 6° C to 15° C. Winter starts in November and ends in February. The area receives maximum rainfall between May and September, with an average annual rainfall of about 2300 mm. A small extent of grassland plateau known as "Far Pak" is situated on the hillock.

PNP is surrounded by the villages of Sangau, Sentetfiang, Thaltlang, Vawmbuk, Bualpui (NG), Pangkhua, Cheural, Tialdawngi lung, Rawlbuk, Pangrang, Archhuang and Lungpher. The Park is managed by the Range Officer with headquarters at Sangau village and Beet Officers under the control of Divisional Forest Officer, Lawngtlai.

Location map and Sketch Map of PNP are given in Figs. 1 & 2, respectively.

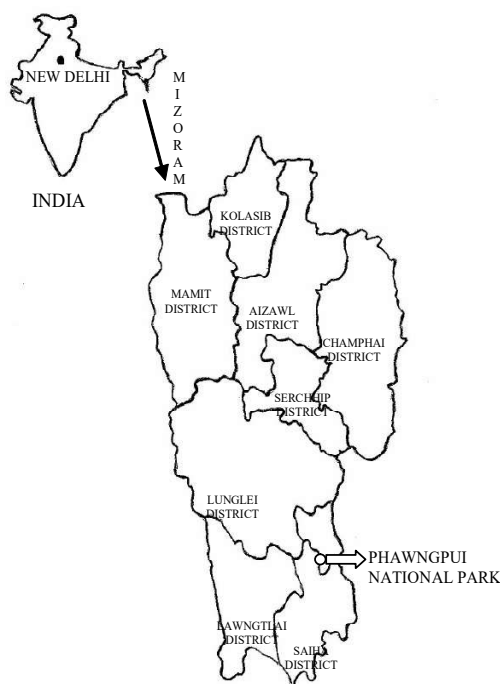


Fig.1. Location Map of Phawngpui National Park.

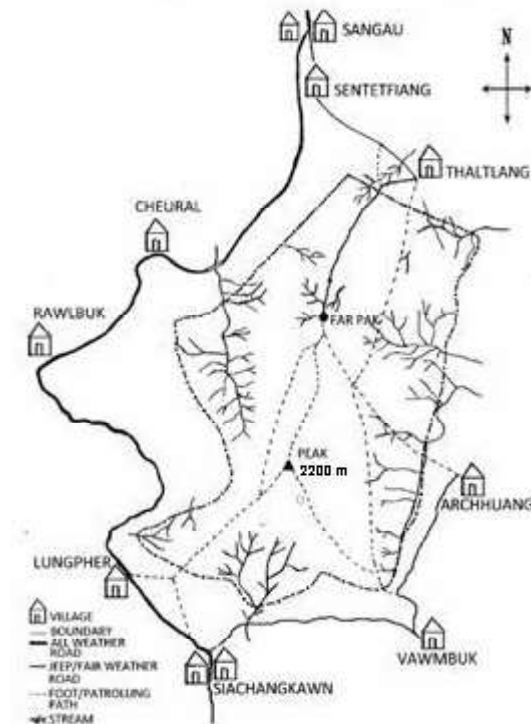


Fig.2. Sketch Map of Phawngpui National Park.

Vegetation analysis

Vegetation analysis was carried out during 2007 – 2009 using quadrat method. A total of 75 quadrates of size 10 m x 10 m were laid randomly for woody plants. Adopting nested quadrature

method, 150 quadrates each of size 1 m x 1 m and 5 m x 5 m were laid for herbs and shrubs respectively. Plant species (trees, shrubs, herbs, epiphytes, climbers, bamboos and canes) present inside each quadrates were counted and recorded. The field data were taken into consideration for determining frequency, density and abundance of plant species and their relatives as per Curtis & McIntosh (1950).

Plant collection, processing and identification

The flowering twigs or with fruits or both of different plant species inside the quadrates were collected and recorded in the field book. In case of grasses, sedges and other herbs, the whole plant including the underground parts were collected and processed in the laboratory for identification by adopting herbarium methods following Jain & Rao (1977) and Womersey (1981). The voucher specimens were identified with the help of various regional floras, including *Flora of British India* (Hooker 1892 – 1897), *Flora of Assam* (Kanjilal *et al* 1934 – 1940), *Flora of Mizoram* (Singh *et al* 2002), *A Handbook of Common Trees of Mizoram* (Lalramnghinglova 1997), *Ethno-Medicinal Plants of Mizoram* (Lalramnghinglova 1997) and *The book of Mizoram Plants* (Sawmliana 2003). Unidentified specimens were identified by matching at ASSAM. Identified specimens were deposited ASSAM and in the Herbarium of the Department of Environmental Science, Mizoram University, Aizawl.

Plant specimens collected were screened with the help of IUCN criteria 2009, Red Data Sheet and published materials of Botanical Survey of India.

RESULTS AND DISCUSSION

Vegetation analysis

A total of 208 species of plants belonging to 71 families and 150 genera have been recorded from the sampling units. Out of which, 84 species were trees, 31 were shrubs, 45 species of herbs, 33 species of climbers and epiphytes, 5 species of canes and palms and 10 species of grasses and bamboos. The plant species recorded in the study area were presented in Table 1(A-F). Orchidaceae is the most dominant family in the area in respect to number of species (28 species), followed by Asteraceae (20 sp.), Poaceae (10 sp.), Rosaceae (9 sp.), Fagaceae (9 sp.), Euphorbiaceae (7 sp.), Lauraceae (7 sp), etc. Of all the plant species recorded, *Cymbopogon khasianus* is the most abundant species followed by *Microstegium petiolare* and *Arundinella khasiana* which are all grasses. The abundance of these species is due to the presence of a small extent of grassland in the study area. The highest density was shown by *Helicia erratica* (323 individuals per hectare) followed by *Engelhardtia spicata* (269 individuals per hectare). The most frequently distributed species recorded is *Helicia erratica* (F = 76 %) followed by *Quercus leucotrichophora* (F = 69.33 %).

The study recorded few species of plants which are described as endemic, rare and endangered based on the sample survey and IUCN criteria (IUCN 2009). Two species of orchids, *Eria lacei* and *Dendrobium capillipes* and, *Mahonia borealis* were recorded as endemic, rare and endangered. *Dendrobium pychnostachyum* and *Dendrobium formosum* were rare and endangered while *Gastrochilus calceolaris* were critically endangered (IUCN 2009). It also recorded *Camellia kissi*, *Mantisia spathulata* and *Rhododendron veitchianum* as endemic and critically endangered. Other species *viz.*, *Cephalotaxus griffithii* and *Helicia robusta* are also recorded as rare and endangered.

Table 1(A – F). Ecological Data of Plant species of Phawngpui National Park**A. TREES**

1 Name of Species	2 Frequency (%)	3 Abundance (A)	4 Density (Indv. Ha ⁻¹)
<i>Ailanthus integrifolia</i> Linnaeus [Simaroubaceae]; ALF 11121	12.00	1.56	19
<i>Albizia chinensis</i> (Osbeck) Merrill [Mimosaceae]; ALF 11145	9.33	1.00	9
<i>Alseodaphne petiolaris</i> Hooker f. [Lauraceae]; ALF 11176	25.33	1.05	27
<i>Antidesma bumis</i> (Linnaeus) Sprengel [Euphorbiaceae]; ALF 11134	12.00	1.78	21
<i>Aphananthe cuspidata</i> (Blume) Planch [Ulmaceae]; ALF 11122	8.00	1.33	11
<i>Betula alnoides</i> Buchanon-Hamilton ex D. Don [Betulaceae]; ALF 11178	24.00	1.11	27
<i>Boehmeria rugulosa</i> Weddel [Urticaceae]; ALF 11198	16.00	1.33	21
<i>Bruinsmia polysperma</i> Clarke [Styracaceae]; ALF 11111	4.00	1.67	7
<i>Buddleia macrostachya</i> Bentham [Buddlejaceae]; ALF 11130	13.33	1.20	16
<i>Camellia kissi</i> Wallich [Theaceae]; ALF 11167	2.67	1.00	3
<i>Carallia brachiata</i> (Loureiro) Merrill [Rhizophoraceae]; ALF 11193	6.67	1.40	9
<i>Castanopsis indica</i> (Roxburgh ex Lindley) DC. [Fagaceae]; ALF 11234	21.33	1.63	35
<i>Castanopsis tribuloides</i> DC. [Fagaceae]; ALF 11235	69.33	3.08	213
<i>Cephalotaxus griffithi</i> Hooker f. [Cephalotaxaceae]; ALF 11156	6.67	1.20	8
<i>Chukrasia velutina</i> A. Jussieu [Meliaceae]; ALF 11113	4.00	1.33	5
<i>Cinnamomum bejolghota</i> (Buchanon-Hamilton) Sweet [Lauraceae]; ALF 11190	29.33	1.32	39
<i>Cinnamomum cecicodaphne</i> Nees [Lauraceae]; ALF 11192	12.00	1.33	16
<i>Cinnamomum verum</i> Presler [Lauraceae]; ALF 11195	32.00	1.29	41
<i>Clerodendrum bracteatum</i> Wallich ex Walper [Verbanaceae]; ALF 11108	8.00	1.33	11
<i>Debregeasia velutina</i> Gaudichaud [Urticaceae]; ALF 11187	20.00	1.07	21
<i>Derris robusta</i> (Roxburgh ex DC.) Bentham [Fabaceae]; ALF 11110	16.00	1.17	19

1	2	3	4
<i>Drimycarpus racemosus</i> (Roxburgh) Hooker f. [Anacardiaceae]; ALF 11233	12.00	1.11	13
<i>Duabanga grandiflora</i> (Roxburgh ex DC.) Walper [Sonneratiaceae]; ALF 11183	4.00	1.33	5
<i>Dysoxylum alliarum</i> (Buchanon-Hamilton) Balakrishnan [Meliaceae]; ALF 11201	9.33	1.14	11
<i>Dysoxylum binecteriferum</i> (Roxburgh) Hooker f. ex Beddome [Meliaceae]; ALF 11205	18.67	1.29	24
<i>Dysoxylum gobarum</i> (Buchanon-Hamilton) Merrill [Meliaceae]; ALF 11206	6.67	1.00	7
<i>Elaeocarpus aristatus</i> Roxburgh [Elaeocarpaceae]; ALF 11203	6.67	1.20	8
<i>Elaeocarpus lanceaefolius</i> Roxburgh [Elaeocarpaceae]; ALF 11207	13.33	1.40	19
<i>Elaeocarpus tectorius</i> (Loureiro) Poiret [Elaeocarpaceae]; ALF 11202	12.00	1.22	15
<i>Engelhardtia spicata</i> Lechen ex Blume [Juglandaceae]; ALF 11200	69.33	3.88	269
<i>Eurya japonica</i> Thunberg [Theaceae]; ALF 11197	37.33	2.11	79
<i>Ficus religiosa</i> Linnaeus [Moraceae]; ALF 11179	14.67	1.00	15
<i>Ficus rigida</i> Jacquin [Moraceae]; ALF 11185	20.00	1.13	23
<i>Glochidion velutinum</i> Wight [Euphorbiaceae]; ALF 11162	18.67	1.14	21
<i>Helicia erratica</i> (Roxburgh) Blume [Proteaceae]; ALF 11199	76.00	4.25	323
<i>Helicia robusta</i> (Roxburgh) Blume [Proteaceae]; ALF 11116	2.67	1.00	3
<i>Heteropanax fragrans</i> (Roxburgh) Seemann [Araliaceae]; ALF	28.00	1.10	31
<i>Homalium bhamoense</i> var. <i>debbarmani</i> Kanjilal et al [Flacourtiaceae]; ALF 11149	4.00	1.00	4
<i>Kydia calycina</i> Roxburgh [Malvaceae]; ALF 11143	9.33	1.14	11
<i>Lasianthus biermanni</i> King ex Hooker f. [Rubiaceae]; ALF 11148	18.67	1.36	25
<i>Lithocarpus elegans</i> (Blume) Hatusima ex Soepadmo [Fagaceae]; ALF 11135	20.00	2.13	43
<i>Litsea cubeba</i> (Loureiro) Persoon [Lauraceae]; ALF 11131	20.00	1.27	25
<i>Litsea monopetala</i> (Roxburgh) Persoon [Lauraceae]; ALF 11126	9.33	1.29	12
<i>Macaranga indica</i> Wight [Euphorbiaceae]; ALF 11123	22.67	1.29	29
<i>Macropanax undulatum</i> (Wallich ex G. Don) Seemann [Araliaceae]; ALF 11142	16.00	1.83	29
<i>Mahonia nepalensis</i> Kanjilal et al. [Berberidaceae]; ALF 11188	4.00	1.33	5

1	2	3	4
<i>Mallotus macrostachyus</i> (Miquel) Mueller-Argoviensis [Euphorbiaceae]; ALF 11124	21.33	1.13	24
<i>Michelia champaca</i> Linnaeus [Magnoliaceae]; ALF 11117	9.33	1.14	11
<i>Michelia doltsopa</i> Buchanon-Hamilton ex DC. [Magnoliaceae]; ALF 11180	8.00	1.00	8
<i>Myrica esculenta</i> Buchanon-Hamilton [Myricaceae]; ALF 11165	44.00	2.12	93
<i>Nyssa javanica</i> (Blume) Wanger [Nyssaceae]; ALF 11171	2.67	1.50	4
<i>Olea dioica</i> Roxburgh [Oleaceae]; ALF 11175	4.00	1.67	7
<i>Olea salicifolia</i> Wallich ex G. Don [Oleaceae]; ALF 11177	22.67	1.35	31
<i>Ostodes paniculata</i> Blume [Euphorbiaceae]; ALF 11151	13.33	1.50	20
<i>Phoebe lanceolata</i> Nees [Lauraceae]; ALF 11170	21.33	1.13	24
<i>Pinus kesiya</i> Royle ex Gordon [Pinaceae]; ALF 11171	34.67	2.46	85
<i>Pithecellobium bigeminum</i> (Linnaeus) Martius [Mimosaceae]; ALF 11144	8.00	1.33	11
<i>Pithecellobium heterophyllum</i> (Roxburgh) J.F. Macbride [Mimosaceae]; ALF 11141	12.00	1.33	16
<i>Prunus cerasoides</i> D. Don [Rosaceae]; ALF 11152	8.00	1.00	8
<i>Prunus jenkinsii</i> Hooker f. & Thomson [Rosaceae]; ALF 11157	5.33	1.00	5
<i>Prunus undulata</i> Buchanon-Hamilton ex D. Don [Rosaceae]; ALF 11153	4.00	1.33	5
<i>Quercus dealbata</i> Hooker f. & Thompson ex Miquel [Fagaceae]; ALF 11173	21.33	1.56	33
<i>Quercus dilatata</i> Lindley [Fagaceae]; ALF 11263	30.67	1.96	60
<i>Quercus helferiana</i> A.DC. [Fagaceae]; ALF 11266	10.67	1.25	13
<i>Quercus lanceafolia</i> Roxburgh [Fagaceae]; ALF 11268	22.67	1.18	27
<i>Quercus leucotrichophora</i> A. Camus [Fagaceae]; ALF 11269	69.33	3.12	216
<i>Quercus polystachya</i> Wallich ex A. DC. [Fagaceae]; ALF 11267	6.67	1.00	7
<i>Rhododendron arboreum</i> Smith [Ericaceae]; ALF 11189	29.33	1.73	51
<i>Rhododendron wallichii</i> Hooker f. [Ericaceae]; ALF 11191	10.67	1.38	15
<i>Rhus semialata</i> Miller [Anacardiaceae]; ALF 11127	12.00	1.33	16
<i>Rhus succedanea</i> Linnaeus [Anacardiaceae]; ALF 11136	13.33	1.10	15
<i>Sapium baccatum</i> Roxburgh [Euphorbiaceae]; ALF 11128	12.00	1.11	13
<i>Saurauja punduana</i> Wallich [Actinidiaceae]; ALF 11132	24.00	1.17	28
<i>Schima khasiana</i> Dyer [Theaceae]; ALF 11181	18.67	1.43	27
<i>Schima wallichii</i> (DC.) Korthals [Theaceae]; ALF 11104	29.33	1.45	43
<i>Styrax serrulatum</i> Roxburgh [Styracaceae]; ALF 11107	6.67	2.00	13
<i>Syzygium cumini</i> (Linnaeus) Skeels [Myrtaceae]; ALF 11119	14.67	1.00	15

1	2	3	4
<i>Toona ciliata</i> M. Roemer [Meliaceae]; ALF 11109	4.00	1.00	4
<i>Trema orientalis</i> (Linnaeus) Blume [Ulmaceae]; ALF 11236	16.00	1.33	21
<i>Vitex heterophylla</i> Roxburgh [Verbanaceae]; ALF 11221	4.00	1.00	4
<i>Vitex peduncularis</i> Wallich ex Schauer [Verbanaceae]; ALF 11164	4.00	1.67	7
<i>Wandlandia grandis</i> (Hooker f.) Cowan [Rubiaceae]; ALF 11161	29.33	2.05	60
<i>Xantolis hookeri</i> (C.B. Clarke) P. Royen [Sapotaceae]; ALF 11273	4.00	1.00	4
<i>Zizyphus incurva</i> Roxburgh [Rhamnaceae]; ALF 11160	4.00	1.67	7

B. SHRUBS

<i>Amomum dealbatum</i> Roxburgh [Zingiberaceae]; ALF 11209	42.00	1.78	75
<i>Ardisia macrocarpa</i> Wallich [Myrsinaceae]; ALF 11215	32.67	1.69	55
<i>Artemisia nilagirica</i> (C.B. Clarke) Pampan [Asteraceae]; ALF 11243	38.00	2.21	84
<i>Blumea lanceolaria</i> (Roxburgh) Druce [Asteraceae]; ALF 11270	61.33	1.59	97
<i>Cirsium interpositum</i> Patrak. [Asteraceae]; ALF 11298	24.67	1.38	34
<i>Clerodendrum viscosum</i> Ventanat [Verbanaceae]; ALF 11194	35.33	1.55	55
<i>Crotalaria cytisoides</i> Roxburgh [Fabaceae]; ALF 11272	10.67	1.31	14
<i>Desmodium heterocarpon</i> (Linnaeus) DC. [Fabaceae]; ALF 11296	23.33	1.43	33
<i>Hedera nepalensis</i> K. Koch [Araliaceae]; ALF 11291	12.00	1.39	17
<i>Hedychium villosum</i> J.E. Smith [Zingiberaceae]; ALF 11288	12.00	1.06	13
<i>Hypericum elodeoides</i> Choisy [Hypericaceae]; ALF 11285	12.00	1.06	13
<i>Indigofera heterantha</i> Wallich ex Brandis [Fabaceae]; ALF 11283	12.67	1.11	14
<i>Indigofera stachyodes</i> Lindley [Fabaceae]; ALF 11280	12.00	1.06	13
<i>Inula eupatorioides</i> DC. [Asteraceae]; ALF 11292	20.00	2.10	42
<i>Mahonia borealis</i> Takeda [Berberidaceae]; ALF 11300	2.00	1.33	3
<i>Mantisia spathulata</i> Schultes [Zingiberaceae]; ALF 11265	0.67	3.00	2
<i>Osbeckia chinensis</i> Linnaeus [Melastomataceae]; ALF 11289	46.00	1.83	84
<i>Osbeckia sikkimensis</i> Craib [Melastomataceae]; ALF 11290	49.33	2.14	105
<i>Pilea symeria</i> Weddel [Urticaceae]; ALF 11282	10.00	1.27	13

1	2	3	4
<i>Rubus burmanicus</i> Hooker f. [Rosaceae]; ALF 11226	40.00	1.65	66
<i>Rubus ellipticus</i> Smith [Rosaceae]; ALF 11227	46.00	1.65	76
<i>Rubus niveus</i> Thunberg [Rosaceae]; ALF 11237	45.33	1.53	69
<i>Rubus rosaefolius</i> Smith [Rosaceae]; ALF 11229	45.33	1.54	70
<i>Rubus rugosus</i> Smith [Rosaceae]; ALF 11230	42.67	1.70	73
<i>Strobilanthes capitatus</i> T. Anderson [Acanthaceae]; ALF 11238	44.00	1.71	75
<i>Strobilanthes macrostegius</i> [Acanthaceae]; ALF 11242	11.33	1.71	19
<i>Strobilanthes parryorum</i> T. Anderson [Acanthaceae]; ALF 11245	11.33	1.59	18
<i>Trichodesma khasianum</i> T. Anderson [Boraginaceae]; ALF 11244	11.33	1.47	17
<i>Turpinia cochinchinensis</i> (Loureiro) Merrill [Staphyleaceae]; ALF 11222	12.00	1.50	18
<i>Vernonia volkameriaefolia</i> Wallich ex DC. [Asteraceae]; ALF 11216	34.00	1.41	48
<i>Viscum articulatum</i> Burmann f. [Loranthaceae]; ALF 11295	2.00	1.00	2

C. HERBS

<i>Ageratum conyzoides</i> Linnaeus [Asteraceae]; ALF 11112	12.67	1.37	17
<i>Ainsliaea latifolia</i> (D. Don) Schultz Bipontinus [Asteraceae]; ALF 11257	36.00	1.87	67
<i>Ainsliaea pteropoda</i> DC. [Asteraceae]; ALF 11256	26.67	1.75	47
<i>Arisaema speciosum</i> (Wallich) Schott [Araceae]; ALF 11255	41.33	1.50	62
<i>Begonia roxburghii</i> Miquel [Begoniaceae]; ALF 11231	18.00	1.33	24
<i>Bergenia ciliata</i> (Hawarth) Sternberg f. [Saxifragaceae]; ALF 11259	18.00	1.48	27
<i>Bidens pilosa</i> Linnaeus [Asteraceae]; ALF 11118	11.33	1.06	12
<i>Blumea alata</i> (D. Don) DC. [Asteraceae]; ALF 11278	26.67	1.35	36
<i>Boehmeria platyphylla</i> D. Don [Urticaceae]; ALF 11241	56.67	1.96	111
<i>Boenninghausenia albiflora</i> (Hooker) Meissner [Rutaceae]; ALF 11232	12.00	1.61	19
<i>Centella asiatica</i> (Linnaeus) Urban [Apiaceae]; ALF 11159	44.67	1.49	67
<i>Cicerbita macrorhiza</i> (Royle) Beauverd [Asteraceae]; ALF 11158	8.00	1.50	12
<i>Cissampelos pareire</i> var. <i>hirsuta</i> (Buchanon-Hamilton ex DC.) [Menispermaceae]; ALF 11210	18.67	1.32	25
<i>Conyza bonariensis</i> (Linnaeus) Cronquist [Asteraceae]; ALF 11218	11.33	1.29	15
<i>Crassocephalum crepidiodes</i> (Bentham) S. Moore [Asteraceae]; ALF 11223	8.00	1.50	12

1	2	3	4
<i>Crotalaria albida</i> Heyne ex Roth [Fabaceae]; ALF 11163	8.00	1.75	14
<i>Curculigo crassifolia</i> Hooker f. [Hypoxidaceae]; ALF 11166	65.33	2.12	139
<i>Disporum pullum</i> Salisbury [Liliaceae]; ALF 11264	24.00	1.22	29
<i>Drosera peltata</i> Smith ex Willdenow [Droseraceae]; ALF 11286	8.67	1.15	10
<i>Drymaria diandra</i> Blume [Caryophyllaceae]; ALF 11294	8.67	1.00	9
<i>Eupatorium odoratisum</i> (Linnaeus) King & Robinson [Asteraceae]; ALF 11152	13.33	1.55	21
<i>Galium elegans</i> Wallich ex Roxburgh [Rubiaceae]; ALF 11168	17.33	1.19	21
<i>Gynura bicolor</i> (Roxburgh ex Willdenow) DC. [Asteraceae]; ALF 11261	48.67	1.79	87
<i>Hemistepta lyrata</i> Bunge ex C.E.C. Fischer [Asteraceae]; ALF 11287	10.00	1.67	17
<i>Heracleum burmanicum</i> Kurz [Apiaceae]; ALF 11246	7.33	1.18	9
<i>Hypericum monanthemum</i> Hooker f. & Thomson ex Dyer [Hypericaceae]; ALF 11251	8.00	1.00	8
<i>Inula nervosa</i> Wallich ex DC. [Asteraceae]; ALF 11271	9.33	2.07	19
<i>Isodon repens</i> (Wallich) Murata [Lamiaceae]; ALF 11277	23.33	1.60	37
<i>Melothria heterophylla</i> (Loureiro) Cogniaux [Cucurbitaceae]; ALF 11201	18.00	1.19	21
<i>Microlepia strigosa</i> (Thunberg) Presl [Dennstaedtiaceae]; ALF 11169	48.67	1.56	76
<i>Myriactis wallichii</i> Lessing [Asteraceae]; ALF 11239	10.00	1.60	16
<i>Ophiorrhiza treutleri</i> Hooker f. [Rubiaceae]; ALF 11304	6.00	1.22	7
<i>Polygonatum oppositifolium</i> (Wallich) Royle [Liliaceae]; ALF 11306	6.00	1.44	9
<i>Potentilla lineata</i> Treviranus ex Reichter [Rosaceae]; ALF 11299	8.67	1.62	14
<i>Prenanthes khasiana</i> C.B. Clarke [Asteraceae]; ALF 11219	17.33	2.00	35
<i>Sanicula elata</i> Buchanon-Hamilton ex D. Don [Apiaceae]; ALF 11133	6.67	1.20	8
<i>Saussurea deltoidea</i> (DC.) Schultz Bipontinus [Asteraceae]; ALF 11217	19.33	2.00	39
<i>Scleria levis</i> Retzius [Cyperaceae]; ALF 11172	48.67	1.77	86
<i>Scleria terrestris</i> (Linnaeus) Fassett [Cyperaceae]; ALF 11182	42.67	1.80	77
<i>Scutellaria discolor</i> Colebrook [Lamiaceae]; ALF 11184	6.67	1.00	7
<i>Swertia cordata</i> Clarke [Gentianaceae]; ALF 11196	23.33	1.57	37
<i>Uncaria laevigata</i> Wallich [Rubiaceae]; ALF 11211	6.67	1.10	7
<i>Viola betonicifolia</i> J. Smith [Violaceae]; ALF 11186	8.00	1.25	10
<i>Viola hamiltoniana</i> D. Don [Violaceae]; ALF 11212	7.33	1.18	9
<i>Viola pilosa</i> Blume [Violaceae]; ALF 11213	30.67	1.74	53

D. CLIMBERS AND EPIPHYTES

1	2	3	4
<i>Agrostophyllum callosum</i> Reichenbach <i>f.</i> [Orchidaceae]; ALF 11252	2.00	1.33	3
<i>Anoetochilus brevilabris</i> Lindley [Orchidaceae]; ALF 11253	2.00	1.33	3
<i>Bulbophyllum cylindraceum</i> Wallich <i>ex</i> Lindley [Orchidaceae]; ALF 11254	3.33	1.00	3
<i>Bulbophyllum khasianum</i> Griffith [Orchidaceae]; ALF 11258	3.33	1.00	3
<i>Cleisostoma racemiferum</i> Lindley [Orchidaceae]; ALF 11260	2.67	1.25	3
<i>Coelogyne ovalis</i> Lindley [Orchidaceae]; ALF 11262	2.67	1.00	3
<i>Cymbidium devonianum</i> Paxton [Orchidaceae]; ALF 11271	2.67	1.00	3
<i>Cyratia mollis</i> (Wallich) Gagnepain [Vitaceae]; ALF 11247	16.00	1.92	31
<i>Dendrobium cappillipes</i> Reichenbach <i>f.</i> [Orchidaceae]; ALF 11240	2.00	1.00	2
<i>Dendrobium devonianum</i> Paxton [Orchidaceae]; ALF 11250	2.00	1.33	3
<i>Dendrobium formosum</i> Roxburgh <i>ex</i> Lindley [Orchidaceae]; ALF 11275	3.33	1.20	4
<i>Dendrobium infundibulum</i> Lindley [Orchidaceae]; ALF 11249	4.67	1.43	7
<i>Dendrobium logicornu</i> Lindley [Orchidaceae]; ALF 11228	2.67	1.00	3
<i>Dendrobium peguanum</i> Lindley [Orchidaceae]; ALF 11279	2.00	1.00	2
<i>Dendrobium pycnostachyum</i> Lindley [Orchidaceae]; ALF 11293	1.33	1.50	2
<i>Entada rheedei</i> Sprengel [Mimosaceae]; ALF 11281	7.33	1.09	8
<i>Eria discolor</i> Lindley [Orchidaceae]; ALF 11284	2.00	1.00	2
<i>Eria lacei</i> Summerh [Orchidaceae]; ALF 11301	0.67	1.00	1
<i>Eria pannea</i> Lindley [Orchidaceae]; ALF 11207	2.00	1.00	2
<i>Gastrochillus calceolaris</i> (Buchanon-Hamilton <i>ex</i> J.E. Smith) D. Don [Orchidaceae]; ALF 11310	1.33	1.00	1
<i>Oberonia acaulis</i> Griffith [Orchidaceae]; ALF 11302	2.67	1.00	3
<i>Oberonia spp.</i> [Orchidaceae]; ALF 11303	3.33	1.20	4
<i>Ornithochillus difformis</i> Schltr. [Orchidaceae]; ALF 11308	2.67	1.00	3
<i>Otochilus albus</i> Lindley [Orchidaceae]; ALF 11311	2.00	1.00	2
<i>Otochilus porrectus</i> Lindley [Orchidaceae]; ALF 11305	2.67	1.00	3
<i>Pholidota imbricata</i> Lindley [Orchidaceae]; ALF	2.00	1.33	3
<i>Pholidota rubra</i> Lindley [Orchidaceae]; ALF 11214	3.33	1.40	5

1	2	3	4
<i>Platyserium wallichii</i> Hooker [Polypodiaceae]; ALF 11220	9.33	1.29	12
<i>Pleione humilis</i> D. Don [Orchidaceae]; ALF 11225	2.00	1.00	2
<i>Porpax fibuliformis</i> King & Pantling [Orchidaceae]; ALF 11208	2.00	1.00	2
<i>Rhododendron veitchianum</i> Hooker f. [Ericaceae]; ALF 11309	2.00	1.33	3
<i>Smilax ovalifolia</i> Roxburgh [Smilacaceae]; ALF 11224	10.00	1.27	13
<i>Zeuxine gooderiodes</i> Lindley [Orchidaceae]; ALF 11312	2.67	1.50	4

E. CANES AND PALMS

<i>Arenga pinnata</i> (O. Kuntze) Merrill [Aricaceae]; ALF 11152	10.67	1.13	12
<i>Calamas khasianus</i> Beccari [Aricaceae]; ALF 11155	10.67	1.56	17
<i>Calamus flagellum</i> Griffith ex Martius [Aricaceae]; ALF 11140	12.00	1.56	19
<i>Caryota mitis</i> Linnaeus [Arecaceae]; ALF 11120	11.33	1.00	11
<i>Caryota urens</i> Linnaeus [Arecaceae]; ALF 11125	11.33	1.29	15

F. GRASSES AND BAMBOOS

<i>Arundinella khasiana</i> Nees ex Steudel. [Poaceae]; ALF 11315	18.67	12.00	224
<i>Bambusa tulda</i> Roxburgh. [Poaceae]; ALF 11321	12.00	6.00	72
<i>Cymbopogon khasianus</i> (Hackel) Stapf ex Bor [Poaceae]; ALF 11318	18.67	13.00	243
<i>Dendrocalamus hookeri</i> Munro [Poaceae]; ALF 11324	10.67	4.00	43
<i>Dinochloa compactiflora</i> (Kurz) McClure [Poaceae]; ALF 11319	12.00	4.83	58
<i>Leersia hexandra</i> Swartz [Poaceae]; ALF 11317	18.67	11.00	205
<i>Microstegium petiolare</i> (Hackel) Bor [Poaceae]; ALF 11316	18.67	12.00	224
<i>Schizostachyum capitatum</i> (Munro) R. Majumdar [Poaceae]; ALF 11323	14.67	6.00	88
<i>Sinarundinaria falcata</i> (Nees) Chao & Renvoize [Poaceae]; ALF 11322	19.33	10.00	193
<i>Sinarundinaria griffithiana</i> (Munro) Chao & Renvoize [Poaceae]; ALF 11320	18.00	8.00	144

Acknowledgements

Our heartiest gratitude goes to the authority of the Department of Environment & Forest, Govt. of Mizoram for permitting us to take up the research work in Phawngpui National Park. Financial support in the form of Rajiv Gandhi National Fellowship from the University Grants Commission is greatly appreciated. Kind help in identification of plants by the scientists of Botanical Survey of India, Eastern Circle, Shillong is greatly acknowledged.

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