

1. INTRODUCTION

1.1 Background

Pteridophyte flora of the Himalayan region is considered to be the basic requirements for advancement of knowledge in the field of Pteridology (Gurung, 1994). The Pteridophytes are non flowering and spore-bearing plants including ferns and fern-allies. The pteridophytic flora in Nepal is very rich due to remarkable altitudinal variations, from humid tropical to mountain ranges and also due to the presence of great variety of climatic conditions and soil type (Gurung, 1992). They grow luxuriantly in moist tropical and temperate forests. Ferns are found in a wide range of altitude between 100-4800 m in Nepal (DPR, 2002).

The world flora consists of approximately 12,000 species of Pteridophytes (World Conservation Monitoring Centre, 1992), while 534 species distributed in 35 families and 102 genera are reported in Nepal (DPR, 2002). Thus, Nepal shares 4.16% of Pteridophytes of the world (World Conservation Monitoring Centre, 1992). According to Fraser-Jenkins (2010), pteridophytes are represented by 556 taxa at specific and sub-specific ranks in Nepal.

1.2 History and Contribution on Pteridophytes of Nepal

History on study of Pteridophytes began after the publication of “Species Plantarum” by Linnaeus in 1753. It includes 149 genera and 182 species of Pteridophytes. The pioneer plant exploration and taxonomic work on Nepalese Pteridophytes, along with other groups of plants, started since the work of British botanists. Pteridophytes of Nepal were studied in the last century mostly by British botanists, and the results were published in many excellent papers

In context of Nepal, according to Fraser-Jenkins (2010), the first collection of Nepalese pteridophytes was made by Francis Buchanan during 1802- 1803. His collections were from two hills in Kathmandu valley, the Swamyambhunath and Shivpuri hill. He collected some 31 specimens of pteridophytes, including on the way up to the Valley at Hetaura. The second botanist to collect Nepalese ferns was Nathaniel Wallich. In 1819 Francis Buchanan published a book, “*An Account of Kingdom of Nepal*”, containing 34 species of Pteridophytes collected by him and given to Lambert, which were described by David Don (1825).

David Don (1825) described 86 species of Nepalese Ferns in "*Prodromus Florae Nepalensis*". Burkill's “Notes from a journey to Nepal in Records of the Botanical survey of India” (1910) includes 15 species of pteridophytes from Nepal.

According to Department of Plant Resources (2002), the historical account on the collection and study of Nepalese Pteridophytic flora can be divided into two periods viz. pre 1945 and post 1945 such as:

Before 1945, Alexander Frederick Richmond Wollaston, Charles Baron Clarke, Charles Maries, Charles William Webley Hope, David Don, Francis Buchanan, Henry Logan, Isaac Henry Burkill, James Edward Winterbottom, John Firminger Duthie, Sir Joseph Dalton Hooker, J.R. Reid, C.E. J.Scully, Lal Dhwoj, Nathaniel Wallich F.R.S., Percival Landon, Col. Richard Henry Beddome, Thomas Moore, Sir William Jackson Hooker, William Roxburgh, C.V. Morton were the main contributors in the collection and study of the Pteridophytic flora of Nepal.

Hope (1899-1904) elucidated many Pteridophytes of Nepal in his book "*The Ferns of North-Western India*". Lal Dhwoj (1931) along with Indian botanist listed 7 species of ferns in Forest Bulletin (DPR 2002). Beddome (1883) published "*Handbook of the Ferns of British India, Ceylon and Malay Peninsula*" including many species collected in Nepal, is very authentic and is even useful today. He published his observations in the form of illustrations and then compiled his contributions in a handbook in 1883 with a supplement in 1892.

"*Species Filicum*" by Hooker and later "*Synopsis Filicum*" by Hooker and Baker marked a great advance in the knowledge of ferns, and the ferns of the Himalayas were comprehensively treated in these monumental works (Iwatsuki, 1988).

After 1945, few notable European and American contributors in exploration of Nepalese Pteridophytes are Alan Henry Norkett, Anne Sleep, Anthony D. (Tony) Schilling, Arthur Hugh Garfit Alston, Brian F.C. Sennitt, Christopher Roy Fraser-Jenkins, C. Roy Lancaster, Dan Henry Nicolson, Col. Donald G. Lowndes, Georg and Sabine Miehe, G. Wormald and Dawson, H. Emery, Edward W. Cronin Jr, and A. Foster, H. Van T. Cotter, Irene S. Cotter and George Staples together with Prem Kumar Rai and Harka Tamang, Jacobus Hendrikus de Haas, J.F. Dobremez, John David Adam Stainton with W.R. Sykes and L.H.J. Williams, John Makin and Naomi Bishop, Kare Ansten Lye, Kenneth de B. Codrington, Oleg Vladimir Polunin, P.C. Gardner, Rebecca Gay Troth, R.N. Parker, Robert L. Fleming Sr., M.B. Raizada and K.M. Vaid, Ruth Schaffner, S. Einarsson, L. Sakrby and B. Wetterhall, Tone Wraber.

Mainly in the 1950s, when Nepal was opened to botanists from abroad, a new era of research on Nepalese Ferns began. Many Japanese botanists visited and did a variety of botanical researches. Nakao, Namikawa, Kawakita and others made trips to Nepal and collected many specimens, including Ferns. Nakaike took part in the National Science Museum Cryptogamic Botany

Expedition and collected in Nepal: he published checklists of *Polystichum* and *Crypsinus* in Nepal (Iwatsuki 1988).

Among all, Christopher Roy Fraser- Jenkins is one of the famous Pteridologist still actively working in pteridophytes of Nepal. He has collected approximately 4000 Nepalese pteridophytic specimens, of which about 50 important specimens were not previously represented in the National Herbarium (DPR, 2002). He has published many botanical publications on pteridophytes, some of his notable publications are “*New species syndrome in Indian pteridology and the ferns of Nepal*” (1997), “*Taxonomic Revision of Three Hundred Indian Subcontinental Pteridophytes with a Revised Census-List*” (2008).

British and Indian botanists also made various expeditions to Nepal. Banerji explored Nepal many times, and published a paper on the Pteridophytes of Nepal in 1972. Nayar and his collaborators made contributions to the study of Ferns of India, and included Nepalese Ferns. Similarly, B.M.B. Sinha, K. Biswas, R.B. Srivasatava, Rolla S.Rao, R.P. Roy, S.R.Ghosh, Surjeet Kaur, F. Razza and V. Puri are few Indians who have worked on Nepalese ferns. A check list of the collections made by Zimmermann was prepared by Alston and Bonner (1956). Other Indian Scientists also have done significant work on Pteridophytes of Nepal, few notables are as follows.

Chowdhury (1973) reported occurrence of 15 species of Ferns in Nepal.

Dixit (1984) reported occurrence of 129 species of Ferns in Nepal in Census of Indian Pteridophytes.

Sharma, Tripathi and Srivastava (1970) have listed 55 species of Ferns from Butwal Tansen area.

Vartak (1975), reported 48 species of Ferns from Annapurna and Dhaulagiri Ranges, Central Nepal.

Pandey (1962) collected Pteridophytes from Kathmandu and published a list of 65 species

Banerji (1972) collected 84 species of Ferns from East Nepal out of which 24 species were new to Nepal.

Das (1973) collected 23 species of Ferns and mentioned the presence of Ferns allies in the Daman, Makwanpur district, Central Nepal.

The Department of Plant Resources of Nepal started work on the flora of Nepal as a whole since its establishment in 1960 (DPR, 1976). Considering the collection preserved in the National Herbarium (KATH) the Department of Medicinal Plants published a series of books as Bulletin which also comprised lower Vascular plants. Some are as follows:

'Key to Pteridophytes, Gymnosperm and Monocotyledon genera of Nepal' (DPR, 1981) has given the keys for 84 genera and 21 families of ferns and fern allies. 'Supplement to the Flora of Phulchowki and Godawari' (DPR, 1974) has enumerated 80 species of ferns and 42 species fern allies between altitudes of 2110-2700 m. In 'Royal Botanical Garden, Godawari' (DPR, 1975), 60 species of living ornamental ferns of 37 genera and 14 families are described. Likewise, in "Flora of Langtang and cross-section vegetation survey", Central zone (DPR, 1976), 75 species of ferns and fern allies of 40 genera and 13 families are described. In Catalogue of Nepalese Vascular Plants (DPR, 1976) 308 species of ferns and fern allies belonging to 82 genera and 19 families has been enumerated.

Gurung (1984) has reported 375 species of ferns and their allies belonging to 84 genera and 21 families which was the list of fern and fern allies for Nepal. In 'Flora of Kathmandu Valley' (DPR, 1986), 172 species of ferns and fern allies belonging to 57 genera and 17 families is described. Similarly, 'Enumeration of the vascular plants of west Nepal' (DPR, 1994) contains a list of 139 species of Pteridophytes. While recently, 'Pteridophytes in Nepal' (DPR, 2002) enumerated 534 species belonging to 35 families and 102 genera.

Phuyal, Bhatta, Maharjan, and Pokhrel (2011) enumerated 100 species of ferns and fern allies found in Makwanpur district. Likewise, Pathak, Phuyal, and Tharu (2012) enumerated 40 species of Pteridophytic flora of Sankhuwasabha district. Recently, Kandel and Pathak (2013) documented 25 species of ferns from subtropical forests of Pyuthan District, Western Nepal. Besides the efforts made by Department of Plant Resources, contributors from Nepal who have contributed in the study of Pteridophyte flora in the past can be summarized as follows.

Nakkaike and Gurung (1988) enumerated 80 species of Pteridophytes from Kathmandu with place of collection, notes on habitat and distribution maps. Gurung (1991) published a book "Ferns: Beauty of Nepalese Flora" consisting of 93 species of ferns under 51 genera and 13 families. The book also provides photographs and drawings of Ferns for easy identification. Tagawa (1995) enlisted 34 ferns and fern allies of Nepal Himalaya belonging to 11 families

Siwakoti and Sharma (1998) recorded 95 species of ferns that belonged to 50 genera and 32 families of Eastern Nepal (Koshi zone). Among these, family Polypodiaceae (18 species) and genus *Thelypteris* (6 species) occupy the top position.

Thapa (2000) collected 79 species of Ferns and Fern allies belonging to 38 genera and 19 families from Milke – Jaljale Area Nepal, in the eastern Himalayas.

Jha (2000) described 61 species of Pteridophytes belonging to 23 families and 44 genera and from Morang district.

Baral (2000) enumerated 128 species of Pteridophytes belonging to 27 families and 62 genera from Makalu-Barun National Park and Buffer zone, Eastern Nepal.

Baral (2001) reported 11 species of Pteridophytes belonging to 7 families and 9 genera from Kimathanka, Sankhuwasabha district of Koshi zone, Eastern Nepal

Shivakoti and Dangol (2001) reported 6 species of ferns and fern allies belonging to 5 genera and 5 families.

Siwakoti (2006) reported 23 species of pteridophytes from Wetlands of Terai Region of Nepal.

Hideaki *et al.* (2008) in Flora of Mustang has described 11 species of ferns and fern allies belonging to 8 genera and 5 families.

Joshi and Joshi (2008) reported 14 species of ferns and fern allies to have ethnobotanical uses in central Nepal in the 2005- 2007.

Bhagat and Shrestha (2010) reported 35 species of ferns and fern allies belonging to 28 genera and 23 families from Eastern Terai, Nepal.

Koirala and Jha (2011) reported 7 pteridophytes from lowland wetlands in Morang district, Nepal.

Singh and Siwakoti (2012) reported 4 species of ferns belonging to genus *Adiantum* and family Adiantaceae from Shivapuri National Park, Central Nepal.

1.3 Justification of the study

Pteridophytes are neglected plants; their exploration is not taken seriously. Reporting on ferns and their allies is far behind that on the flowering plants and there is no modern enumeration listing all the species known from Nepal (Iwatsuki, 1988). Study of Pteridophytes has not been conducted in Daman till date. So this would be the first floristic survey of Pteridophytes to be undertaken in Daman and its adjoining areas although a paper has been previously published by Das (1973). Very few works has been done on Pteridophytes after 2002, so this research is put forward for fulfilling a gap experienced. The systematic documentation of plants in the study area with their distribution will be helpful for study of plant diversity in future.

1.4 Hypothesis

Diversity of Pteridophytes differs according to habitat, altitude and forest types.

1.5 Research Questions

-) Do diversity of Pteridophytes differs according to the habitat, altitude and forest types?
-) What is the elevational range of the recorded Pteridophytes?

1.6 Objectives

General objective is to fill the gap in the knowledge of Pteridophyte flora by documenting overall distribution and diversity of Pteridophytes of Daman and adjoining areas. The specific objectives are as follows:

1. Taxonomic treatment of collected species.
2. To deduce the distribution patterns of pteridophytes with respect to altitude, forest types, habitats.
3. Economic importance of the collected fern and fern allies.

1.7 Limitations of the study

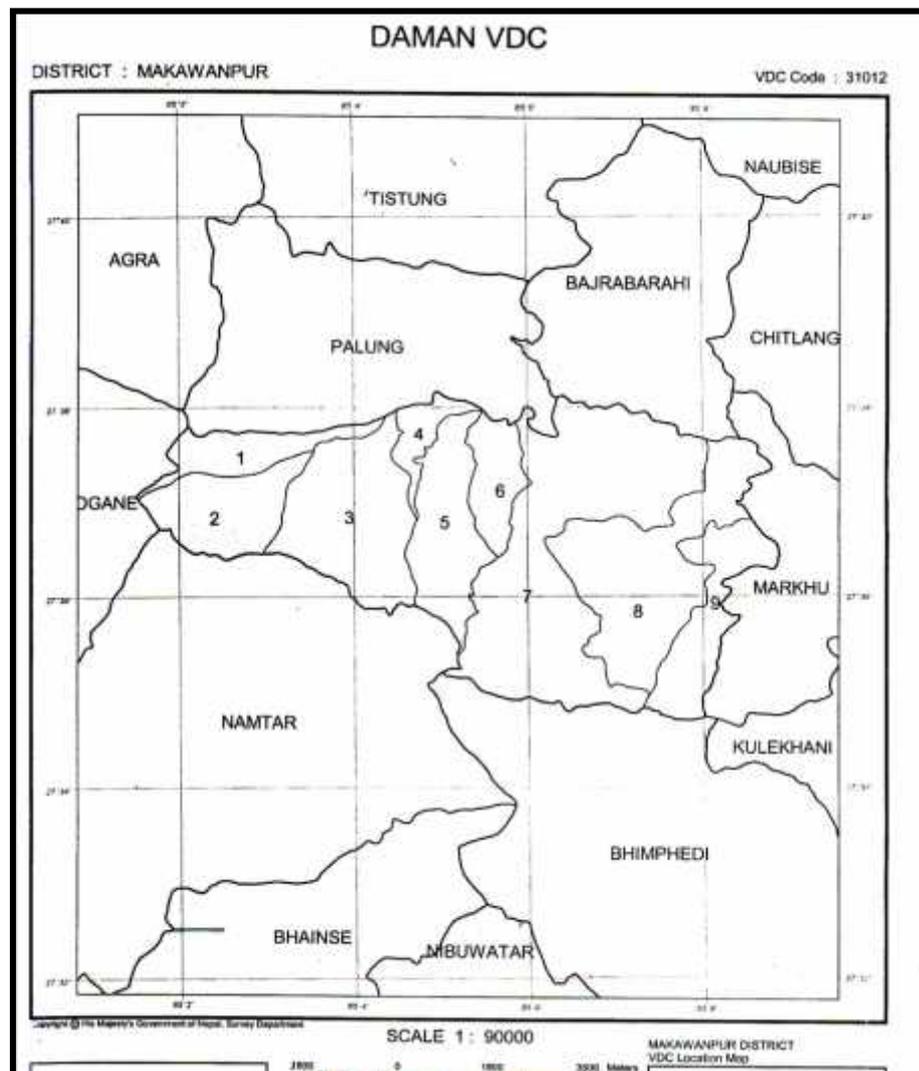
Time period was the major limitation of the study. Formation of the spores usually depends on the season which is very limited time, from almost end of July to September. If the specimen is sterile it is very difficult to identify so after September most of the species were either dry or sterile. No collection could be done after that and for the ecological study also which was done in November most of the species were dry in higher altitude, so very few species could be collected. Due to the lack of relevant fern literatures and poor collections of specimens in both the herbaria of KATH and TUCH, identification became both difficult and time consuming.

2. MATERIALS AND METHODS

2.1 Description of the Study Area

2.1.1 Location

The study is carried out in Daman VDC and the other adjoining areas located at the northern and southern side of Makwanpur district, in Narayani zone of the Central Development Region of Nepal. Makwanpur district lies between 166m and 2584m above mean sea level (Anonymous 2004). The study is mainly focused in Daman area. Daman is situated at an altitude of 2320m and 100km southwest of Kathmandu. It is halfway between Kathmandu and Hetauda. It is situated at 27°58' to 27°63' N latitude and 85°02' to 85°148' E longitude covering an area of 43 square kilometers. The adjoining area includes Tistung, Palung, Namtar, Bhaise, Kulekhani, and Fakhel. Daman and its surrounding areas come under Mahabharat hills.



Map 1: Map of Daman and other adjoining areas.

2.1.2 Vegetation

Most of the area of Daman VDC is covered by forest which consists of tropical to temperate in nature. There are mainly three specific forest areas viz: community forest, national forest and private forest. Major forest types found in Makwanpur district are Sal forest, Terai hardwoods forest, Chirpine forest, Upper mountain hardwood, *Quercus* forest and Riverine forests.

Daman, Simbhanjyang is characterized by pure *Quercus* as well as mixed *Quercus-Rhododendron* forest. The mixed forest in the Daman is represented by Risheswor Mahadev forest which comprises the tree species such as *Quercus lanata*, *Lyonia ovalifolia*, *Gaultheria* sp etc. *Pinus wallichiana* becomes common at an altitude of 2200-2300m. Further down there is a pure *Alnus* forest at the height of 2100–2200m. As one descends at the height of 2000-2100, there is *Alnus-Pinus* forest. Below 2000m there is a complete pure stand of *Pinus wallichiana*. At lower altitude most of the areas near the settlements are farmland or agricultural land where most of the locals cultivate vegetables (Plate 1).

Makwanpur district is diverse in caste and ethnic composition as four castes and several ethnic groups reside over here. Tamang is the most dominant ethnic group with the population of about 47%. Brahmin and Chhetry ranked second and third respectively. Magar and Chepang have also a representative population followed by Dalits (DFO, 2003).

2.1.3 Climate and Seasons

Climatic variation in the district ranges from tropical to temperate. The northern side of the Mahabharat range is predominated by the temperate climate. Makwanpur district can be broadly divided into three seasons: cold, hot, and rainy season. Cold season exists between December and February. The temperature in cold season falls down to 0.6⁰ C (avg) but in the up hills, particularly Daman and Simbhanjyang area, snowfall occurs. Hot season exist between March to June with the average temperature of 32.9⁰ C (DFO, 2003).

Monsoon remains active, generally from July to September and is rainy during these months. With the approach of November the temperature starts to fall and the rain is also stopped. Average rainfall is 1908.6 mm in Mahabharat range. Average humidity of the district is 73.5% (DFO, 2003).

The recent data from the Department of Hydrology and Meterology gives following figures as shown in the graph below.

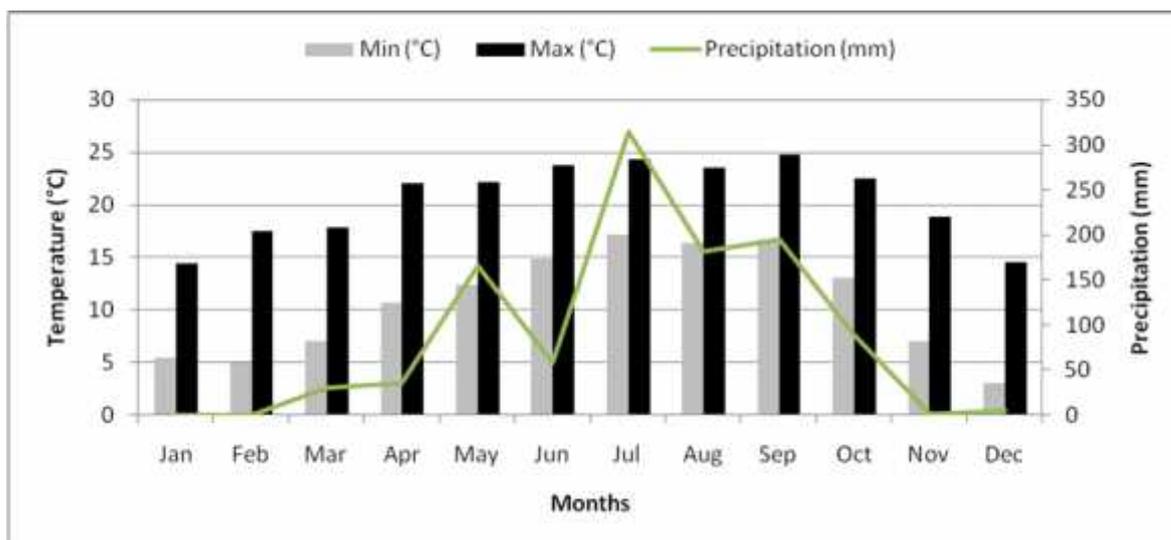


Fig: 1. Graph showing fluctuation of average temperature and precipitaton of Daman (2009). (Source: DHM).

The graph (Fig: 1) shows there is high precipitation in the month of July. The maximum average temperature is recorded in September and minimum in December.

2.2 Field visit and collection of Pteridophytes

Daman and Simbhanjyang area was selected mainly for the collection. The adjoining areas Tistung, Palung, Markhu, Kulekhani, Fakhel, Namtar and Bhaise were also visited for the collection of Pteridophytes. The adjoining areas were paid very few visits. For the collection of Pteridophytes, frequent field trips were arranged in different seasons viz August, September, November and June so as to record the overall diversity of fern and fern allies from Daman and the surrounding areas.

2.3 Collection and preparation of herbarium

The Pteridophytes on the field were collected by using digging tools and secator. During collection care was taken on collecting the pteridophytes with mature spores and rhizome. In case of dimorphic ferns both fertile and sterile parts was collected. Each specimen was photographed on its natural habitat before collection. The collected specimen was kept into a large polythene bag to keep specimen fresh. The collected species was tagged and the details were recorded accordingly. A special attention was paid for the analytical studies on observation of their habitats as well as association with other flora. Ecological information was collected during the field study. Ethnobotanical knowledge, medicinal, culinary and other utility values of the pteridophytes were collected from the locals whenever and wherever possible.

Blotters, newspapers, plant press was used to dry the plant specimens. The plant specimens were dried on the same day of collection. Pteridophyte specimens can be dried by simple drying process just by properly pressing, regularly checking the specimens during drying and changing paper to obtain neat and clean herbarium. Once the specimens were dried, as described by Lawrence (1951), herbarium was prepared accordingly by attaching dried plant specimen to the herbarium sheet of standard size by stitching. The herbarium was also labeled with complete details such as date of collection, tag number, scientific name, local name, family, locality, altitude, name of the collector and additional information. The voucher specimens are deposited at National Herbarium and Plant Laboratories (KATH), Godawari and Tribhuvan University Central Herbarium (TUCH), Central Department of Botany, Tribuvan University, Kirtipur, Nepal.

2.4 Morphological Study and Identification

For the identification of the specimens, detail morphological study of the herbarium specimen was done with the help of hand lens, 15*2X stereomicroscope and compound microscope. The major characters of morphology that were studied and used for the taxonomic treatment as well as for the identification of pteridophytes are as follows:

1. Rhizome type (creeping or suberect or erect), presence or absence of scales, colour and shape of scale
2. Whole frond, shape or outline, its measurement, texture, Stipe (length, colour, texture, presence or absence of scales), Leaf blade (simple or pinnate or compound, shape, size, apex, texture) and arrangement of pinnae and pinnules.
3. Veins (simple, forked, anastomosing, distinct or not)
4. Sori (indusiate or exindusiate, number, shape, position, arrangement, colour) (Plate III)
5. Colour of spores.

Aforementioned morphological character, geographical distribution of respective specimen, along with altitudinal range and ecological information collected during field study were mainly focused for identifying the herbarium specimen. Relevant literatures that were used during the identification include Smith (1879); Beddome (1865-70, 1883, 1892); Blatter & d'Almeida (1922); DPR (1986); Iwatsuki (1988); Gurung (1991); Khullar (1994); Khullar (2000); DPR (2002); and Fraser-Jenkins (2008); Fraser-Jenkins et al. (2010) etc. During identification, the collected specimens were also compared and studied thoroughly with specimens deposited at KATH and National Herbarium and Plant Laboratories (KATH), Godawari. Most of the species were verified as well as identified by Fraser-Jenkins.

2.4.1 Taxonomic study

General description of family, genera and species are given. Detailed information on vegetative characters, ecology, distribution and other additional information are given for species. General distribution of the recorded species was prepared by taking references of DPR (2002).

2.4.2 Construction of Identification keys

Artificial keys to genera and species were prepared for the easy identification of species for the taxa containing more than one lower taxa based on observed characters of different morphological features. Distinct character states of the major characters are used in preparation keys. Keys are arranged in 'Bracketed format'.

2.5 Economic Importance of Pteridophytes

Field notes were specially used for assessing economic importance of pteridophytes. Commonly used pteridophytes were grouped into distinct use values. Pteridophyte species used for food, medicine, and ornamental for other various purposes were recorded taking references from the local people.

2.6 Data analysis

The data collected in the field were analyzed with major focus on habitat type, forest type, and their altitudinal range, and their utility. The total species collected from the field were first categorized into their major families and then to the genera. Further they were categorized on the basis of their major habitat type as epiphytic, terrestrial or as lithophyte, their diversity in habitats were also analyzed. The species richness and altitudinal gradient of the entire collected specimen were analyzed to study their relationship. Further to assess distribution patterns of Pteridophytes on the basis of forest type, a technique of random sampling design was applied for which a quadrat of size $10 \times 10 \text{ m}^2$ was laid along the altitudinal gradient. The elevational gradient was divided between 1800m and 2500m into 7, each of 100m elevation intervals. A quadrat was subdivided into 5 subplots of $2 \times 2 \text{ m}^2$ as shown in figure below.

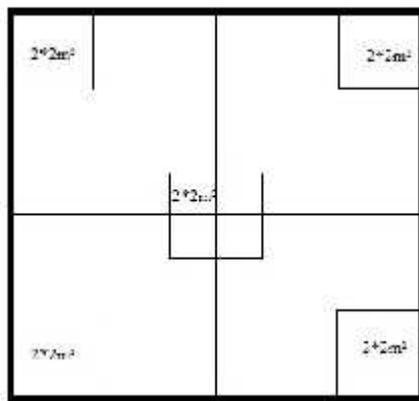


Fig: 2. A sample quadrat of 10*10m² showing 5 sub- plots.

For assessment of the phytosociological attributes of pteridophytes, the no. of mature (vegetative and reproductive) individuals in each 2 X 2m² plots were counted. Altitude, Latitude, and Longitude, along with forest types were recorded.

The phytosociological attributes: abundance, density and frequency and their relative values and Importance Value Index (IVI) were calculated as follows.

$$\text{Frequency (\%)} = \frac{\text{Total number of quadrates in which the species occur} \times 100}{\text{Total number of quadrates studied}}$$

$$\text{Density} = \frac{\text{Total number of individuals of a species in all quadrates}}{\text{Total number of quadrates studied}}$$

$$\text{Abundance} = \frac{\text{Total number of individuals of a species in all quadrates}}{\text{Total number of quadrates in which the species occurred}}$$

$$\text{Relative frequency} = \frac{\text{Frequency of individuals of a species} \times 100}{\text{Total frequency of all species}}$$

$$\text{Relative density} = \frac{\text{Density of individuals of a species} \times 100}{\text{Total density of all species}}$$

$$\text{Relative abundance} = \frac{\text{Abundance of individuals of a species} \times 100}{\text{Total abundance of all species}}$$

$$\text{Importance Value Index} = \text{Relative density} + \text{Relative frequency} + \text{Relative abundance}$$

Based on Raunkiers (1934) the frequency classes of pteridophytes were determined. There are 5 frequency classes, i.e. 'A' class with the species of frequency ranging from 0-20%; 'B' class 21-40%; 'C' class 41-60%; 'D' class 61-80% and 'E' class 81- 100%. (Singh, 2008). Further the pteridophytes frequency patterns were compared with the normal frequency pattern of Raunkiaer's (A>B>C>=D<E). Based on the frequency pattern of the community, the homogeneity and heterogeneity of the vegetation was concluded. If the values are high with respect to B, C and D, then the community is said to be heterogeneous where as higher values of E indicates the homogeneous nature.

3. RESULTS

3.1 Total no. of families, genera and species

From the present study, a total of 128 specimens of Pteridophytes belonging to 24 families, 47 genera and 85 species (Fig. 3) were recorded (Appendix I). Polypodiaceae is the largest family representing 9 genera and 18 species (Fig. 4), followed by Pteridaceae representing 5 genera and 14 species, and Dryopteridaceae with 4 genera and 7 species. Similarly, Davalliaceae, and Lycopodiaceae are represented with 3 genera each, Dennstaedtiaceae, Gleicheniaceae, Lindsaeaceae and Thelypteridaceae are represented by 2 genera each, while all the other families were monogeneric. Among the monogeneric families, Selaginellaceae is the largest family with 5 species followed by Aspleniaceae and Woodsiaceae with 3 species, Adiantaceae, Hymenophyllaceae and Schizaeaceae representing 2 species each (Fig. 4).

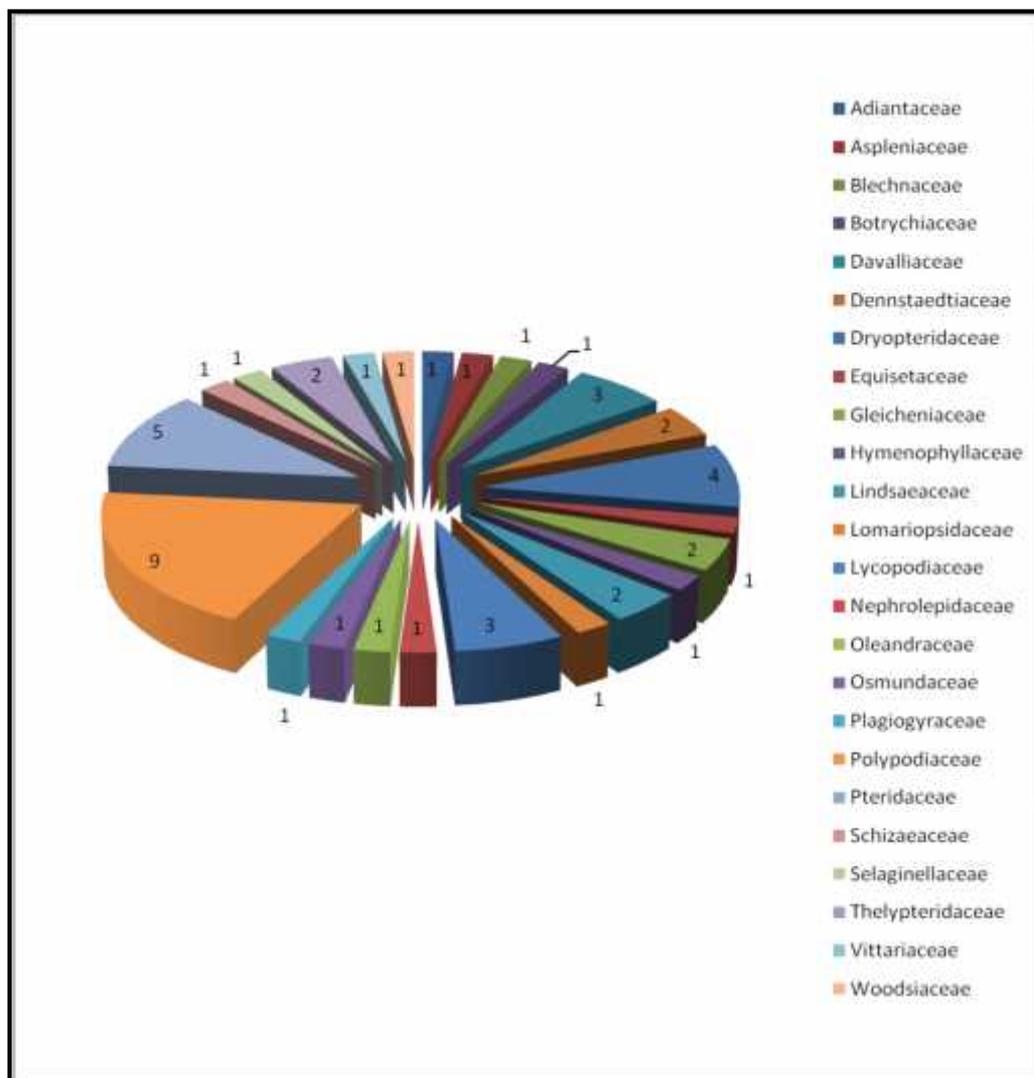


Fig. 3. Pie-chart showing number of genera represented by a family.

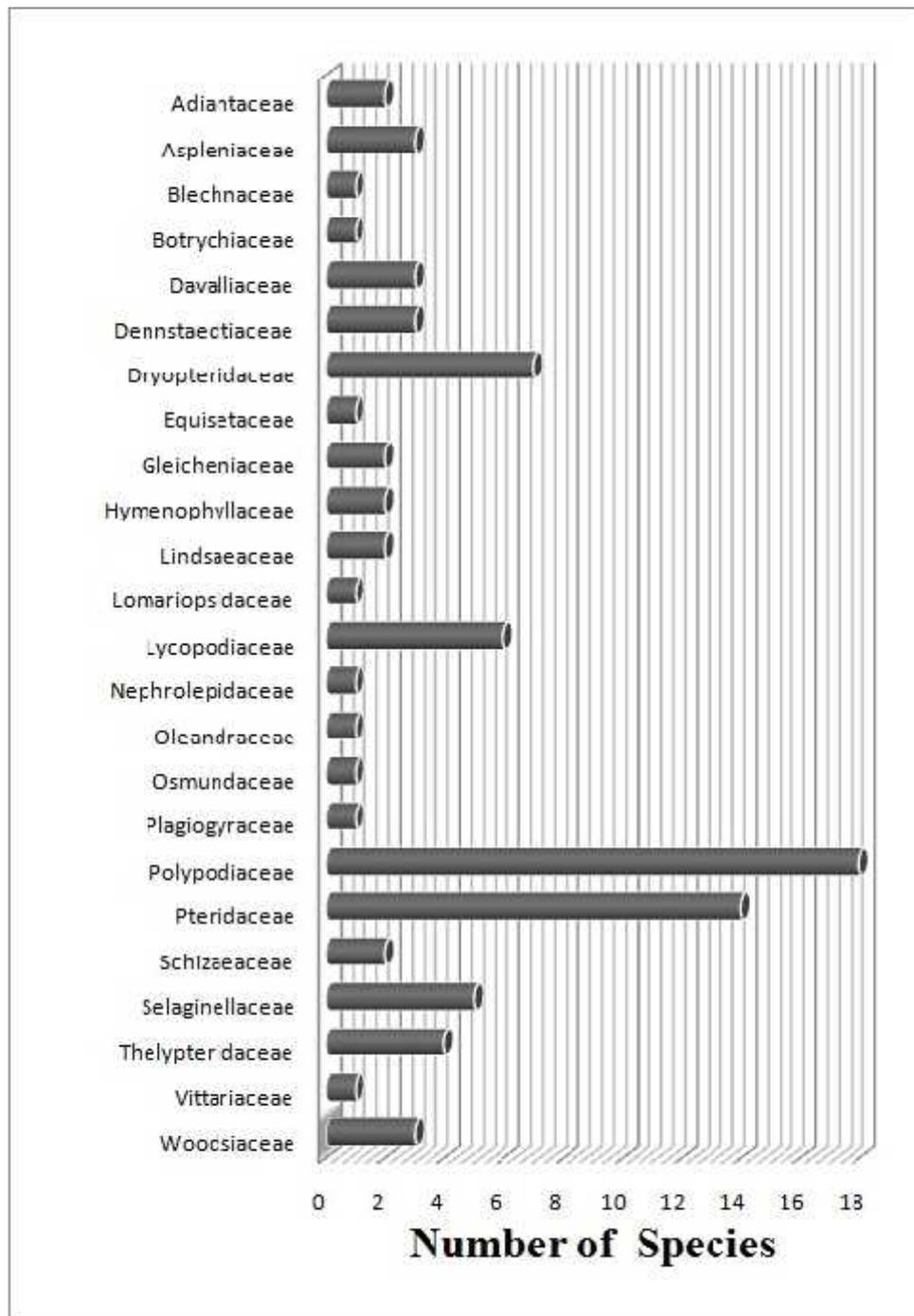


Fig. 4. Species composition by families.

Among the total 47 genera with 85 species, *Pteris* is the largest genera with six species (Fig. 5), followed by, *Selaginella* with five species. Other large genera are *Cheilanthes*, *Dryopteris*, *Huperzia*, *Lepisorus*, *Pichisermollia* with four species each. While, *Asplenium*, *Athyrium* *Polypodiodes* are represented with 3 species each followed by genera like *Adiantum*, *Dennstaedtia*, *Hymenophyllum*, *Lygodium*, *Onychium*, *Pseudophegopteris*, *Pyrrrosia* and *Thelypteris* all comprised with two species each (Fig. 5). Rest of all genera is monogeneric containing only 1 species each.

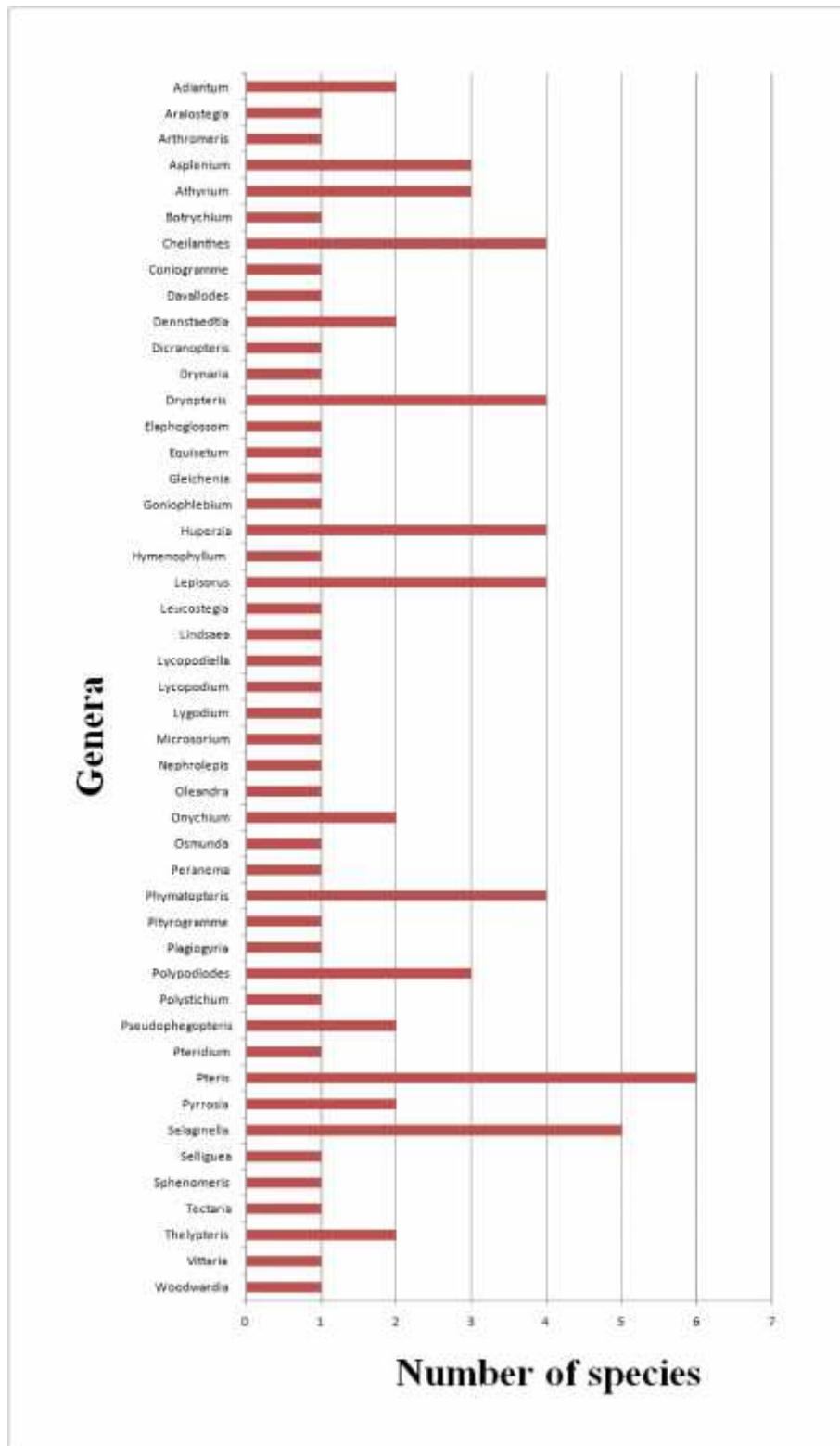


Fig. 5. Species composition by genera.

3.2 Habitat diversity of Pteridophytes

Pteridophytes grow in many different habitats around the world. The best habitat for pteridophytes is on rock outcrops with mosses. They can even be found embedded in mosses on trees, on rocks and rock crevices, marshes, bogs, mudflats, woodland forests, areas with rocky soils, near waterfalls, and even floating on the water surface. In course of this study, three distinct types of habitats of pteridophytes were identified namely epiphytes, lithophytes and terrestrial.

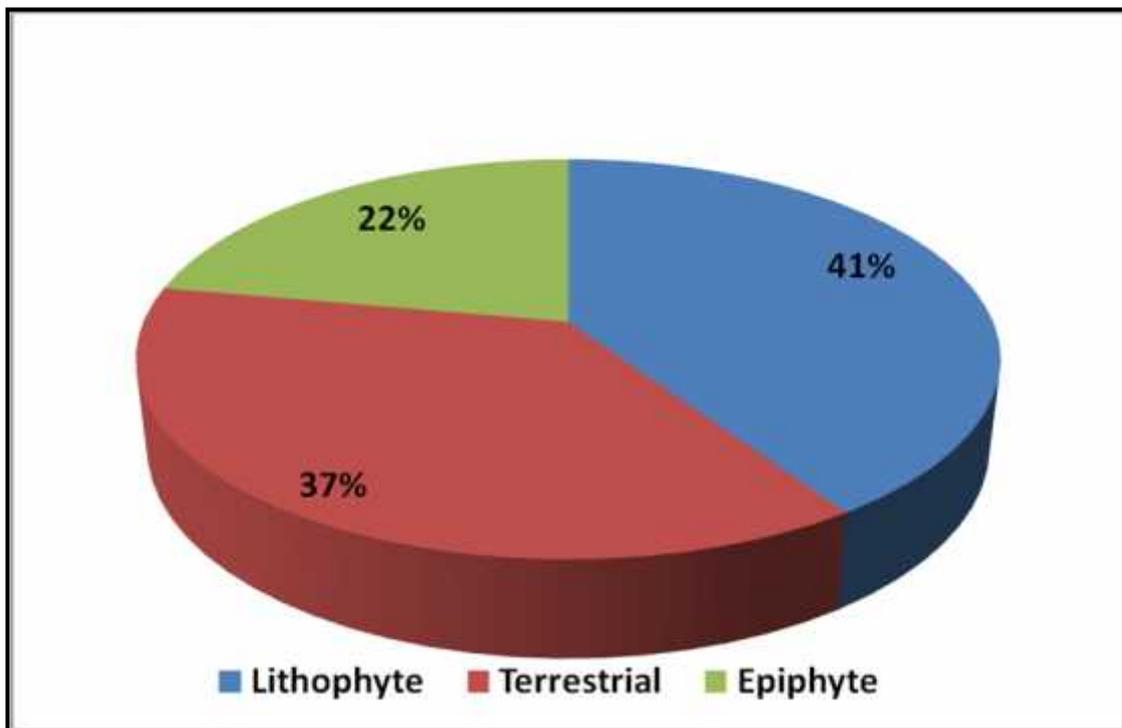


Fig. 6. Diversity of pteridophytes in regards to different habitat.

On the basis of habitat, out of 85 species of pteridophytes 42 species were found in terrestrial habitat (37%), 46 species as lithophytes (41%) and 25 species (22%) as epiphytes (Appendix II; Plate II). Apart from these three habitats there are species found in more than one habitat. Only one species *Nephrolepis cordifolia* occurred in terrestrial habitat as well as epiphyte and lithophytes, while, seventeen species (*Adiantum phillipense*, *Arthromeris wallichiana*, *Athyrium fimbriatum*, *Dryopteris juxtaposita*, *Dryopteris cochealata*, *Dicranopteris linearis*, *Huperzia serrata*, *Leucostegia immersa*, *Lycopodium japonicum*, *Onychium cryptogrammoides*, *Onychium siliculosum*, *Osmunda japonica*, *Polystichum squarrosus*, *Pteris aspercaulis*, *Pteris vittata*, *Sphenomeris chinensis* and *Tectaria coadunata* were found as terrestrial and lithophytes and ten species (*Araiostegia pulchra*, *Huperzia hamiltonii*, *Huperzia subulifolia*, *Lepisorus nudus*,

Microsorium membranaceum, *Oleandra wallichii*, *Polypodiodes amoena*, *Polypodiodes lachnopus*, *Pyrrrosia porosa* and *Selliguea oxyloba*) was found growing as epiphytic and lithophytes.

3.3 Distribution of species along altitudinal gradient

Altitude is one the most influencing ecological factor that directly affects the vegetation of an area when along with temperature and precipitation. Generally with the increasing altitudinal gradient, the temperature and rainfall differs markedly. According to Bhattarai *et al* (2004), the relationship between species richness and elevation is unimodal, and maximum fern richness is observed at about 2000m.

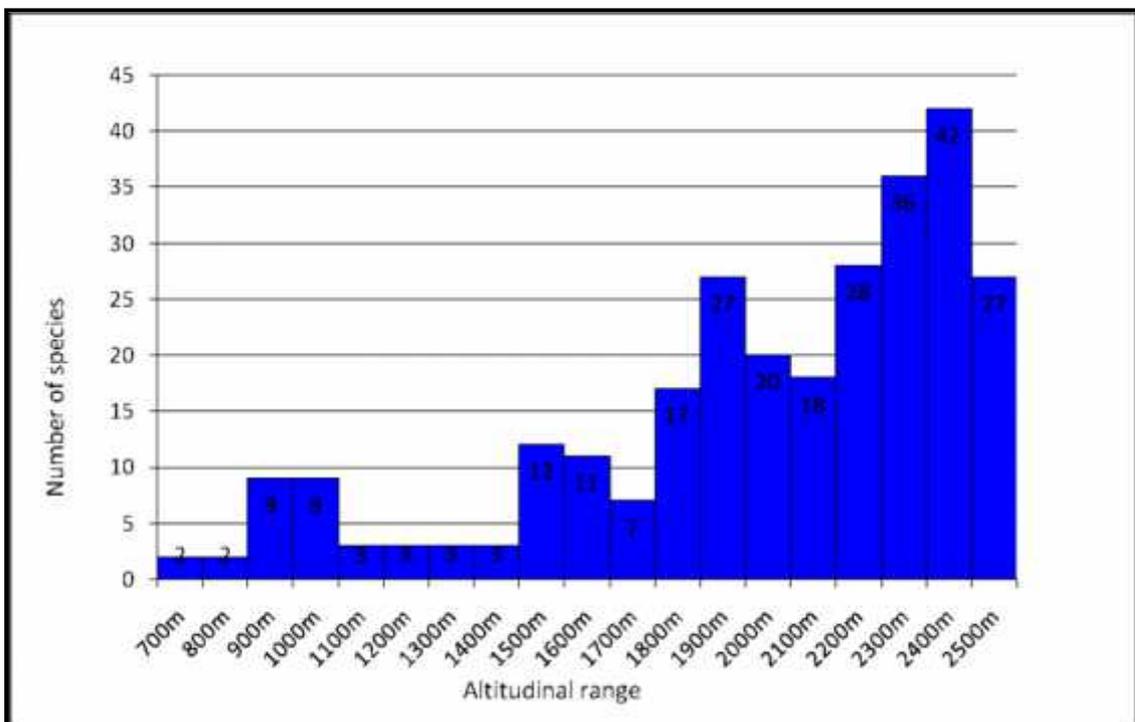


Fig. 7. Diversity of pteridophytes in regards to different altitudes.

In the present study, it does not show uniform species richness all along the altitudinal gradient. There is a peak at 1900m with a downfall at 2000m and 2100m (Fig. 7). The species richness then continuously increases from 2200- 2400m. Highest number of species i.e 42 is found at 2400 m followed by at 2300m with 36 species and 2200m with 28 species. This result clearly shows that the number of species is quite high in between 1900m to 2500m. The altitudinal range of the collected specimen is given in the Appendix III.

3.4 Distribution of species in different forest types based on quadrat studies

During this study, 8 quadrats were laid along the 7 elevational gradients each of 100m interval. Five different forest types and one open area were distinguished viz *Rhododendron- Quercus* forest, Mixed forest, *Alnus* forest, *Alnus - Pinus* forest, *Pine* forest and a open area near roadside verge. Three quadrats were laid in mixed forest while for the rest of the forest type only 1 quadrat was laid, as there was change in different forest types even in the short interval of elevation gradient below and above the mixed forest.

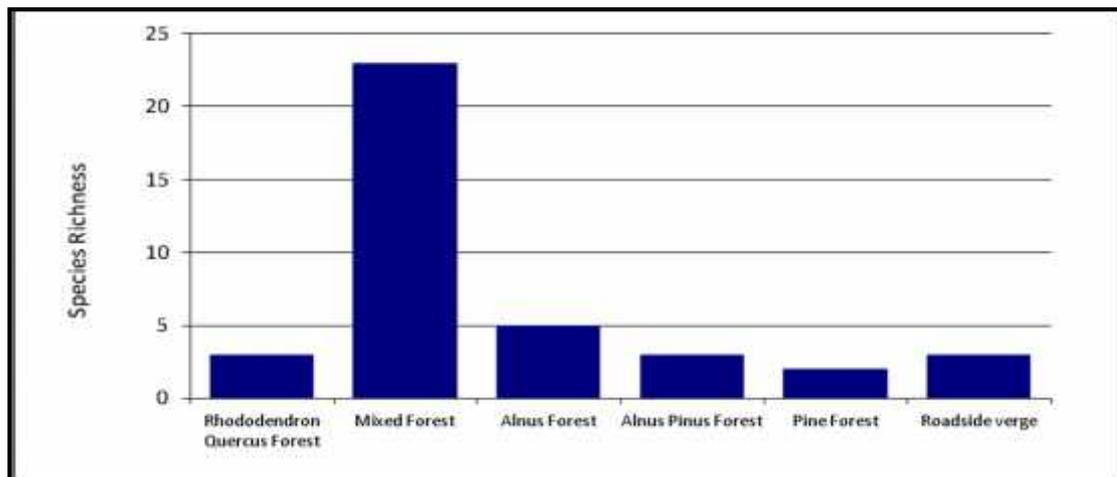


Fig. 8. Diversity of pteridophytes in regards to forest types.

It was also observed that the distribution of ferns is dependent on the floristic composition and structure of the woody vegetation along the slope. Mixed forest favours the diversity and distribution of more pteridophytes than any other forest types. Forest between 2200-2400m is mixed forest because of which the diversity is high in this altitude (Fig. 8). The mixed forest seems to be very suitable for many fern species, along with suitable temperature and high level of moisture content large number of fern species are found above 2200m. As the forest above 2300m is covered by mossy forest where many epiphytic fern species are present.

3.5 Phytosociological attributes of Pteridophytes in the study area

A total 29 species have been recorded from the quadrat in the present study and they belong to 22 genera and 11 families. Species composition of different plant population is shown in Appendix IV. Maximum relative density and frequency was reported for *Selaginella chrysocaulos* (39.52 and 17 respectively) it was followed by *Pteris puberula* (16.55 and 9). Minimum relative density was reported for *Huperzia hamiltonii* (0.03) while Minimum relative frequency were reported in the species such as *Lepisorus nudus*, *Asplenium ensiforme*, *Pteris cretica*, *Coniogramme pubescens*,

Polypodiodes amoena, *Huperzia hamiltonii*, *Thelypteris cana*, *Athyrium drepanopterum*, *Onychium siliculosum*, *Pseudophegopteris pyrrorachis subsp. distans*.

Relative abundance is maximum for *Lepisorus mehrae* (19.94) which is followed by *Selaginella chrysocaulos* (10.57) and *Pteris puberula* (8.37) respectively.

The maximum IVI was reported in *Selaginella chrysocaulos* (67.09) followed by *Pteris puberula* (33.92), *Lepisorus mehrae* (25.33) and minimum in *Huperzia hamiltonii* (1.16) and *Polypodiodes amoena* (1.16). Quadrat studies records the species like *Pteris puberula*, *Selaginella chrysocaulos*, *Dryopteris juxtaposita*, and *Athyrium foliolosum* to have occurred in most of the plots and dominates some regions of the hill slopes.

Among the 29 recorded species *Pteris puberula* is widely distributed from higher to lower (2500-1800m) elevations, while some species was restricted to lower elevations and their abundance is minimum in the present study.

According to Raunkiaer (1934), if the frequency class D is greater than A, B and C then the community is said to be heterogeneous (Singh, 2008), but the present study doesn't contain any species in frequency class D, so it is considered that the frequency class is lesser than A, B, C and hence the community is homogeneous.

3.6 Economic importance of Pteridophytes

Being lower group of plant, Pteridophytes are largely ignored but its useful aspects can't be ignored so easily. Pteridophytes are of immense value, as it plays a vital role in the life and economy of the local people. They are used by local people traditionally for treating different diseases. Pteridophytes mainly ferns are well known and widely used as source of food, fuel, medicine, fodder, building material, crafts, decorative material, and other various puposes. Based on personal communication and information gathered from the locals, the economic importance of pteridophytes based on their use values can be summarized as follows (Plate IV).

The immature shoots of species like *Tectaria coadunata*, *Dryopteris cochleata* are widely used as vegetables. The young and tender shoots *Dryopteris chrysocoma* locally known as 'kuthurke' is used for vegetable. Similarly fiddleheads of *Pteris aspercaulis* is used as vegetable commonly called 'neuro'. The water balls of *Nephrolepis cordifolia* are usually eaten. Young plants of *Polypodiodes argutum* and *Polystichum squarrosum* are used as fodder for cattles.

Rhizome of *Pteridium revolutum* is used for curing eye problems, juice of its rhizome is also used in healing bites of wasp. *Bortyrium lanuginosum* is locally called 'bi', its rhizoids is used in headache. Different species of *Lepisorus* locally called 'harjaro', its rhizome is used as medicine

for delivered woman. Leaf juice of *Pityrogramme calomelanos* is used in earache. Paste of whole plant of *Equisetum diffusum* is used in treatment of fractured bones. The paste of rhizome of *Arthromeris wallichiana* is also used in healing fractured bones. *Cheilanthes dalhousiae* is antihelminthic and is used for treating gastric. Another species used frequently for medicine is *Pteris bicolor*, *Sphenomeris chinensis* and *Asplenium laciniatum*, which are used in cuts and wound. Decoction of roots and rhizomes of *Adiantum phillipense* is another fern is used in fever and also in dysentery. *Drynaria mollis* and *Oleandra wallichi* are also of medicinal value.

The attractive ferns have been used in decoration of gardens, public parks, buildings and houses as well. *Selaginella involvens* is used for indoor decoration. *Nephrolepis cordifolia* and *Drynaria mollis* are frequently used for decoration.

Beside aforementioned values, pteridophytes are also used for different purposes. *Polystichum squarrosum* is used in making incense stick. Most of the species of *Lepisorus* is used for making dye from its rhizoid. *Microsorium membranaceum* is the most preferred among the local for making dye. *Huperzia pulcherrima* locally known as 'narayan jhyau' is used for performing religious rituals. *Cheilanthes dalhousiae* is used for piercing ears. *Onychium tenuifrons* and *Leucostegia immersa* is used for animal bedding. *Lycopodium japonicum* is used for the bedding infants in the bamboo basket by local to carry their babies. *Lycopodium japonicum* is used in making fire crackers. *Gleichenia gigantea* is used for building animals sheds. *Pteridium revolutum*, *Pteris wallichiana*, *Nephrolepis cordifolia* and *Gleichenia gigantea* are preferred to plant for preventing landslides. *Pteris biaurita*, *Pteris cretica* and *Pteris wallichiana* are used for making manure.

3.7 Taxonomic Treatment

Representative pteridophytes specimen collected from the study area are arranged accordingly as followed in DPR (2002). Key to the genera and species found in the field are prepared with the help of available standard literatures and self observation for easy identification. Each taxon with its recent name, author citation, synonyms and distribution based on DPR (2002) and Fraser-Jenkins (2008) is given. Taxonomic description, habitat, fruitification and voucher specimen with collection details are provided.

Lycopodiaceae P.Beauv. ex Mirb. (Club moss Family)

Perennial, evergreen herbs, terrestrial or epiphytic or lithophytic. Stems erect or prostrate, rather branched; branches leafy, more or less elongated, dichotomous or pinnate. Leaves small pinnate, 1-nerved, simple, without ligule, mostly spirally arranged. Leaves on subterranean parts flat, appressed, nonphotosynthetic, and scalelike; leaves on aerial parts appressed, ascending, or spreading, with 1 central unbranched vein, needlelike to lanceolate to ovate. Strobili sessile or stalked, upright, nodding, or pendent. Sporangia solitary in the axils of the sporophylls or in terminal spikes in the axils of the modified leaves or bracts, sporangia reniform to globose, thick-walled. Homosporous spores, trilete, thick-walled, surfaces pitted to small-grooved, rugulate, or reticulate.

Key to the genera

- 1.(a) Horizontal stems present, Cones distinct; sporangia borne in axils of highly modified, reduced sporophylls aggregated into upright or nodding or pendent strobili; spores reticulate or rugulate. (2)
 - 1.(b) Horizontal stems absent; Cones not distinct; sporangia borne in axils of unmodified leaves; spores pitted to small-grooved..... *Huperzia*
- 2.(a) Strobili borne on distinct peduncles or sessile; peduncles, if present, bearing remote, reduced leaves; spores reticulate..... *Lycopodium*
- 2.(b) Strobili erect on leafy peduncles or nodding or pendent on lateral shoots; peduncles, if present, bearing closely spaced, unreduced leaf; spores rugulate..... *Lycopodiella*

Huperzia Bernh.

Epiphytic or lithophytic herb. Pendent or erect. Rhizome short creeping, with or without hairs. Stems dichotomously branched. Leaves arranged spirally, sessile or subsessile, small, acicular-elliptic-lanceolate, entire or serrate. Sporangia solitary in the axils of the modified leaves, compressed.

Key to the species

- 1.(a) Leaf margin serrate..... *Huperzia serrata*

- 1.(b) Leaf margin entire.....(2)
- 2.(a) Leaf elliptic to lanceolate..... *Huperzia hamiltonii*
- 2.(b) Leaf acicular..... (3)
- 3.(a) Pendent or erect, rhizophore pale and glabrous, leaf slightly broader..... *Huperzia pulcherrima*
- 3.(b) Pendent, rhizophore dark and hairy, leaf narrower..... *Huperzia subulifolia*

Huperzia hamiltonii (Spreng.) Trevis., Atti Soc. Ital. Sci. Nat. **17**: 248 (1875); Dixit: 50 (1981); Ollgaard: 165 (1975); Nakaïke *et al.*: 192 (1990); Fraser-Jenkins: 313 (1997b); DPR: 22 (2002).

Lycopodium hamiltonii Spreng., Syst. Veg. **5**: 492 (1828); Clarke: 590 (1880); Iwatsuki: 166 (1987); Gurung: 6 (1986).

Lycopodium obtusifolium Ham. ex D. Don., Prodr. Fl. Nepal.: 18 (1825), non Sw. (1806).

Lycopodium aloifolium Wall. ex Hook. and Grev., Ic. Fil.: t. 233 (1831).

Lycopodium empetrifolium Dalzell, Hook. J. Bot. (1852).

Phlegmariurus hamiltonii (Spreng. in L.) A. Love and D. Love, Taxon **26** (2-3): 324 (1977).

Urostachys hamiltonii (Spring) Herter ex Nessel, Lycopod.: 68 (1939), Ind. Lycopod.: 63 (1949).

Rhizome short-creeping, pale and hairy. Stems erect, cylindrical. Leaves simple, thick, elliptic to lanceolate, entire, one nerved, glaucous; lower leaves larger than the upper one. Sporangia free, solitary in the axils, reniform and compressed (Plate V).

Distribution: Uncommon in W. Nepal but common in C. and E. Nepal at lower mid to higher altitudes (850-2500m).

Habitat: Occurs as epiphyte or lithophyte

Frutification: June-Aug.

Voucher specimen: Daman, Rishewor mahadev near gumba, 2389m, Aug 28, 2012, S. Prajapati and S. Rajbhandary and S. Rajbhandary 74 (KATH).

Huperzia pulcherrima (Wall. ex Hook. and Grev.) Pich. Serm., Webbia **25** (1): 219- 297 (1970); Dixit: 60 (1981); Ollgaard: 166 (1987); Nakaïke *et al.* :192 (1990); Fraser-Jenkins: 313 (1997b); DPR: 23 (2002).

Lycopodium pulcherrimum Wall. ex Hook. and Grev., Ic. Fil.: t.38 (1827); Iwatsuki:167 (1975).

Lycopodium setaceum Ham. ex D.Don, Prodr. Fl. Nepal.; 18 (1825); Clarke: 590 (1880), non Lam. (1789).

Lycopodium setaceum Ham. ex D.Don var. *pulcherrimum* (Wall. ex Hook. and Grev.) C.B.Clarke, Trans. Linn. Soc. Lond. II Bot.1: 590 (1880).

Lycopodium taiwanense C.M.Kuo, *Taiwania* **30**: 51 (1985); Tsai and Sheih, *Fl. Taiwan ed.2* **1**: 43 (1994).

Urostachys Pulcherrimus (Wall. ex Hook. and Grev. Herter, *Ind. Lycopod.*: 77 (1949).

Pendent or erect herb. Rhizome short creeping, rhizophore pale and glabrous. Stems dichotomously branched. Leaves arranged spirally, sessile or subsessile, small, acicular, entire. Sporangia solitary in the axils of the modified leaves, compressed (Plate V).

Distribution : Common in W. and C. Nepal, and probably found in E. Nepal at lower mid to upper mid altitudes (750-2300m).

Habitat : Occurs as lithophytes .

Frutification : June-Aug.

Voucher specimen: Mahavir, Namtar, 1803m, Jun 23, 2013, S. Prajapati and S. Rajbhandary and S. Rajbhandary, 128 (KATH).

Huperzia serrata (Thunb. in A.Murray) Trevis., *Atti Soc. Ital. Sci. Nat.* **17**: 248 (1875); Dixit: 55(1981), 8 (1984); Naikaike and Gurung: 64 (1988b); Nakaike *et al.*: 192 (1990); DPR: 23 (2002)

Lycopodium serratum Thunb. in Murray, *Fl. Jap.*: 341, t.38 (1784); D.Don:19 (1825); Clarke : 591(1880); Tagawa: 199 (1971); Iwatsuki: 237 (1988); Tsai and Shieh, *Fl. Taiwan ed.2* **1**: 42 (1944).

Urostachys serratus (Thunb. in Murray) Herter, *Bot. Arch.* **3**:13 (1923),*Ind. Lycopod.*:81(1949).

Stems erect, 6-20 cm long, simple or slightly forked at the top, loosely leafy. Leaves lanceolate, acuminate to short cuspidate, subsessile, spreading to sub-deflexed, thin, spinulately serrated. Strobili not pedunculate; sporangia axillary on the leaves, reniform, sessile.

Distribution: Common in C, Nepal and occasional in E. Nepal at mid to upper mid altitudes (1350-2400m).

Habitat: Terrestrial, growing abundantly on shady forest floor and on dry slopes or as lithophytes.

Frutification: June-Aug.

Voucher specimen: Daman, 1917m, Aug 27, 2012, S. Prajapati and S. Rajbhandary and S. Rajbhandary, 58 (KATH).

Huperzia subulifolia (Wall. ex Hook. and Grev.) Trevis., *Atti Soc. Ital. Sci. Nat.* **17**: 248 (1875); Sen and Sen, *Fern. Gaz.* **11** (6): 417, f.2a-k (1978); Dixit: 8 (1981), 57 (1984); Nakaike *et al.*: 192 (1990).

Lycopodium subulifolium Wall. ex Hook and Grev., *Ic. Fil.*: t.49 (1831); Tagawa: 199 (1971); Iwatsuki: 238 (1988).

Lycopodium setaceum Ham. ex D.Don var. *subulifolium* Wall. *apud* C.B. Clarke, *Trans. Linn. Soc. Lond. II Bot.***1**: 590 (1880).

Urostachys subulifolius (Wall. ex Hook and Grev.) Herter, Ind. Lycopod.: 84 (1949).

Pendent herb. Rhizome short creeping, rhizophore dark and hairy. Stems dichotomously branched. Leaves arranged spirally, sessile or subsessile, small, acicular slightly narrower than that of *Huperzia pulcherrima*, entire. Sporangia solitary in the axils of the modified leaves, compressed.

Distribution: Scattered in C. and E. Nepal at lower mid to upper mid altitudes (1000- 1950m).

Habitat: Epiphytic on mossy tree trunks

Frutification: June-Aug.

Voucher specimen: Daman, Rishewor mahadev near gumba, 2352m, Aug 28, 2012, S. Prajapati and S. Rajbhandary and S. Rajbhandary, 72 (KATH).

Lycopodiella Holub.

Terrestrial herb. Rhizome creeping. Stem erect or creeping, much branched. Leaves arranged spirally, small, flat, linear-lanceolate. Sporophylls quite different from leaves, broadly ovate to lanceolate. Sporangia in distinct cones.

Lycopodiella cernua (L.) Pich. Serm., *Webbia* **23**: 166 (1968); Nakaike: 17 (1996); DPR: 24 (2002).

Lycopodium cernuum L., Sp. Pl. **2**: 1103 (1753); Clarke: 591 (1880); Herter: 10 (1949); Tagawa: 197 (1971); Iwatsuki: 166 (1975); Gurung: 5 (1986).

Lycopodium capillaceum Willd., Sp. Pl. **5**: 31 (1810).

Lycopodium cernuum L. var. *sikkimense* (O.F. Mull.) H.S. Kung, *Acta Phytotax. Sin.* **18** (2): 239 (1980), *Fl. Sichuanica* 6: (1988).

Palhinhaea cernua (L.) Franco and Vasc. in Vasc. and Franco, *Bol. Soc. Broter. ser. 2.* **41** : 25 (1967); Nakaike *et al.*: 195 (1990).

Palhinhaea cernua (L.) Franco and Vasc. in Vasc. and Franco var. *curvata* (Sw.) N.C. Nair and S.R. Ghosh, *Acta Bot. Indica* **2**: 77-78 (1974).

Palhinhaea cernua (L.) Franco and Vasc. in Vasc. and Franco var. *pendula* (Hook.) N.C. Nair, *Indian Forest.* **94**: 169 (1968).

Rhizome creeping with long roots. Stems erect, 20-40 cm long, slender, tufted, branched and leafy. Leaves linear-subulate. Strobili on the tips of branches, cylindrical.

Distribution : Abundant in W. C. and E. Nepal at lower to mid altitudes (500-1550m)

Habitat : Terrestrial, frequently growing along sunny and shady places.

Fructification : June- Sep.

Voucher specimen: Fakhel, 1824m, Sep 7, 2012, S. Prajapati and S. Rajbhandary and S. Rajbhandary, 98 (KATH).

Lycopodium L.

Lithophytic as well as terrestrial herbs, stems creeping, much branched. Leaves arranged spirally, small, flat, linear-lanceolate, mostly all alike, sometimes dimorphic. Sporophylls quite different from leaves, broadly ovate to broadly lanceolate; sporangia solitary in the axils of the modified leaves or bracts, compressed, coriaceous, unilocular, 2-valved, reniform to subglobose, opening at apex.

Lycopodium japonicum Thunb. ex A.Murray, Linnaeus Syst.Veg. ed.14: 94 (May-Aug 1784); Dixit: 9 (1984); Fraser-Jenkins: 175 (1997b); Thapa: 8 (2000); DPR: 24 (2002).

Lycopodium pseudoclavatum Ching, Acta Bot. Yunnan. **4** (3): 222 (1982).

Misapplied Name:

Lycopodium clavatum sensu Clarke, Trans. Linn. Soc. Lond. II. Bot. **1**. 592(1880); Herter, Ind. Lycopod. (1949); Tagawa: 198 (1971); Iwatsuki: 166 (1975); Gurung : 5 (1986); Nakaike *et al.* : 193 (1990).

Stems long creeping, rooting at regular intervals, densely leafy with long armed and adpressed leaves. Branches ascending, mostly dichotomously forked, with linear, subulate, flat, scale like and tip incurved leaves, leaves spirally arranged. Strobili with long peduncle, cylindrical, stramineous, bracteate. Sporophylls broad, ovate to lanceolate; sporangia solitary in the axils of the sporophyll, compressed, coriaceous, unilocular, 2-valved, reniform to subglobose.

Distribution: Abundant in W. C. and E. Nepal at lower to mid altitudes (1350-3600m).

Habitat: Terrestrial, growing abundantly on shady forest floor and on dry rocky slopes.

Frutification: June-Aug.

Voucher specimen: Daman, 1917m, Aug 27, 2012, S. Prajapati and S. Rajbhandary, 76 (KATH).

Selaginellaceae Milde (Spike-moss family)

Terrestrial or lithophytic herbs, very occasionally epiphytic. Stems tufted, erect or prostrate, much branched and may bear rhizophores or absent. Branches alternate or dichotomous. Leaves simple, small, dimorphic or monomorphic, one nerved with a adaxial ligule. Heterosporous; sporangia grouped in strobili. Sporangia short-stalked, solitary in axil of sporophylls, opening by distal slits; megasporangia at the base and microsporangia at the apex of the strobilus, megasporangia large; microspores numerous minute.

Selaginella P. Beauv.

Stems tufted, erect or prostrate, much branched, bearing rhizophores or may be absent. Branches alternate or dichotomous. Leaves small, dimorphic or monomorphic, Heterosporous; sporangia grouped in strobili. Sporangia solitary in axil of sporophylls, opening by distal slits; megasporangia

at the base and microsporangia at the apex of the strobilus, megaspores 1- 4, large; microspores numerous minute.

Key to the species

- 1.(a) Sporophyll dimorphic..... (2)
- 1.(b) Sporophyll monomorphic or nearly so..... (3)
- 2.(a) Rhizophore restricted to rhizome only..... *Selaginella involvens*
- 2.(b) Rhizophore arising from the stem at the points of branching..... *Selaginella pallida*
- 3.(a) Primary branch more than 5 in pairs..... (4)
- 3.(b) Primary branch not more than 2- 5 in pairs..... *Selaginella vaginata*
- 4.(a) Stem stoloniferous at base..... *Selaginella chrysocaulos*
- 4.(b) Stem not stoloniferous at base..... *Selaginella subdiaphna*

Selaginella chrysocaulos (Hooker & Grev.) Spring, Bull. Acad. Roy. Sci. Brux. **10**: 232. (1843); Alston: 225 (1945); Tagawa: 200 (1971); Chowdhury: 6 (1973); Iwatsuki :167 (1975); Dixit: 12 (1984); Gurung: 8 (1986); Nakaike and Gurung : 155 (1995); Thapa: 8 (2000); DPR: 25 (2002).

Lycopodium chrysocaulos Hook. and Grev., Hook. Bot. Misc. **2**: 401. 1831;

Selaginella philippina Spring var. *khasiensis* Bak., J.Bot. **22**: 298 (1884).

Plant green, erect, (5-25) cm, with rooting restricted to base of stem and stoloniferous at the base. Main stems covered by scalelike leaves, pinnately branched, stramineous; branches alternate, primary leafy branches 6-12 pairs, once or twice pinnately branched, adjacent primary branches on main stem 1-3 cm apart. Dorsal leaves on main stems asymmetrical, narrowly ovate, apex acuminate or aristate. Ventral leaves asymmetrical, slightly ascending or spreading, ovate-lanceolate. Strobili solitary, terminal, compact, dorsiventrally complanate.

Distribution: Abundant in W., C. and E. Nepal at lower mid to high altitude (700-2600m)

Habitat: Terrestrial.

Frutification: June-Aug.

Voucher specimen: Daman, on the way to Palung, 2177m, Aug 28, 2012, S. Prajapati and S. Rajbhandary, 80 (KATH).

Selaginella involvens (Swartz) Spring, Bull. Acad. Roy. Sci. Brux. **10**: 136. 1843; Alston: 220 (1945); Tagawa: 200 (1971); Iwatsuki : 168 (1975); Dixit: 14 (1984); Nakaike and Gurung : 156 (1995); DPR: 27 (2002).

Lycopodium involvens Sw., Syn. Fil.: 182(1806).

Lycopodium caulescens Wall., List no. 137 (1829), *nom.nud.*; Hook and Grev., Hook, Bot. Misc.**2**: 382 (1831).

Selaginella caulescens (Wall. ex Hook. and Grev.) Spring, Bull. Acad. Roy. Sci. Brux. **10**: 137 (1843).

Selaginella pennula Spring, Mem. Acad. Sci. Belg. **24** (2): 160 (1850).

Misapplied Name:

Lycopodium circinale sensu D. Don, Prodr. Fl. Nepal.: p.18, no.3 (1825). *non* L.

Plants green, erect, 15-30 cm, with creeping subterranean rhizome and stolons; leaves on rhizome and stolons scalelike, pale yellow. Rhizophores restricted to creeping rhizomes and stolons. Main stems branched from middle upward, pinnately branched, terete, primary leafy branches 7-12 pairs, 2 or 3 times pinnately branched. Dorsal leaves ovate-triangular apex long acuminate to shortly aristate, parallel to axis. Ventral leaves overlapping, slightly ascending, ovate to triangular, apex subacute or apiculate; Strobili solitary, terminal, microspores yellowish orange, megaspores whitish or brown (Plate V).

Distribution: Abundant throughout W., C. and E. Nepal at low to higher altitudes (650- 3000m)

Habitat: Epiphyte

Frutification: June-Aug.

Voucher specimen: Aghor bazaar, 1844m, June 23, 2013, S. Prajapati and S. Rajbhandary, 133 (KATH).

Selaginella pallida (Hooker & Grev.) Spring, Bull. Acad. Roy. Sci. Brux. **10**: 234. (1843); Alston : 218 (1945); Iwatsuki : 241 (1988); Gurung: 8 (1986); Nakaïke and Gurung : 156 (1995); Fraser-Jenkins (1997b); DPR: 27 (2002).

Lycopodium pallidum Hook and Grev., Hook. Bot. Misc. **2**: 389 (1831), *non* Bory ex Gaudich. (1886) [*nom. illeg.* for *Lycopodium brasiliense* Raddi (1825)].

Lycopodium tennellum D. Don, Prodr. Fl. Nepal.: 18 (1825), *non* (P. Beauv.) Desv. (1814).

Selaginella nepalensis Spring, Bull. Acad. Roy. Sci. Brux. **10**: 234 (1843); Dixit : 58 (1984)

Selaginella plumosa var. *pallida* (Hook. and Grev.) Bak., J. Bot. **21**: 16 (1883).

Plants green, creeping, 15-30 cm, with rhizophore arising from the stem at points of branching. Rhizophore with adventitious roots. Main stems stramineous, grooved, pinnately branched, terete, primary leafy branches 1 or 2 times pinnately branched. Dorsal leaves small ovate. Ventral leaves slightly ascending, ovate to triangular, apex subacute; Strobili solitary or in pairs terminal, microspores yellowish orange, megaspores whitish or brown.

Distribution: Rare in W. Nepal but common in C. and E. Nepal at lower mid to upper mid altitude (1200-2200m).

Habitat: Lithophyte.

Frutification: June-Aug.

Voucher specimen: Palung, 974m, June 21, 2013, S. Prajapati and S. Rajbhandary, 121 (KATH).

Selaginella subdiaphana (Wall. ex Hook. & Grev.) Spring, Bull. Acad. Roy. Sci. Brux.**10**: 232. (1843); Alston: 230 (1945); Chowdhury: 6 (1973); Dixit: 12 (1984); Iwatsuki: 243 (1988); Gurung: 9 (1986); Nakaike and Gurung: 156 (1995); DPR: 29 (2002)

Lycopodium subdiaphanum Wall. ex Hook. and Grev., Hook. Bot. Misc. **2**: 401 (1831)

Selaginella aggesta Spring, Mem. Acad. Sci. Belg. **24** (2): 89 (1850)

Rhizomes short, only rooting at the base. Main stem slender, erect, 12-24 cm long and non stoloniferous at the base, covered by scalelike leaves, pinnately branched, adjacent primary branches on main stem, more than 5 pairs, 1-3 cm apart. Primary branches, dense with rather short, secondary branches. Leaves on the main stem ascending, oblique, ovate, much dilated, and imbricated over the stem at the base. Dorsal leaves much smaller than ventral ones. Strobilus short, with similar bracts; sporophylls ascending and ovate.

Distribution: Abundant in at low to high altitudes (350-2500m) in W., C. and E. Nepal.

Habitat: Lithophytes.

Frutification: June-Aug.

Voucher specimen: Daman, Gairigaun, 1555m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 4 (KATH)

Selaginella vaginata Spring, Mém. Acad. Roy. Sci. Belg. **24**: 87 (1850); Alston: 245(1945); Tagawa: 201 (1971); Iwatsuki: 169 (1975), 240 (1988); DPR: 30 (2002).

Selaginella thomsonii Hieron., Hedwigia **43**: 38 (1904)

Misapplied Name:

Selaginella imbricata J.Scott, J. Agr. Hort. Soc. India, n.s., **2**: 270 (1860); *excl. syn.* Roxburgh (1844).

Plants creeping, 5-10 cm, fertile stems erect. Rhizophore arising from the the stem at the points of branching. Main stems branched throughout, branches few; erect fertile stems pinnately branched throughout, stramineous; primary leafy branches 2-5 pairs, once or twice forked, branchlets sparse, Dorsal leaves symmetrical, very small,. Ventral leaves asymmetrical, ovate with cordate base. Strobili solitary or in pairs, terminal, compact, dorsiventrally complanate, sporophylls dimorphic, microspores orange-red, megaspores pale yellow or yellowish orange.

Distribution: Abundant throughout in W., C. and E. Nepal at low to higher altitudes (600- 2650m).

Habitat: Lithophyte

Frutification: June-Aug.

Voucher specimen: Aghor bazaar, 1844m, June 23, 2013, S. Prajapati and S. Rajbhandary, 135 (KATH).

Equisetaceae Rich. ex DC. (Horsetail Family)

Perennial herbs with creeping rhizome and jointed stems, stem may be simple or branched with distinct nodes intervals, all alike or of two kinds, the sterile ones green, fertile ones without chlorophyll, grooved, hollow and bearing whorls of very small, connate, scale like leaves, tips remaining free, toothlike and forming a sheath above the nodes. Spikes terminal, Sporangia borne on peltate sporophylls spirally arranged in a axis forming a cones 0.3-10 cm. Spores green all 1 kind.

Equisetum L.

Perennial herb. Rhizomes much branched. Stems erect, ribbed, hollow, except at the node and bearing a whorl of toothed, foliar leaves united into a sheath at the base of the node. Homosporous; sporangiophores in cones; sporangia borne on the adaxial side of the peltate heads of sporangiophore.

Equisetum diffusum D.Don, Prodr. Fl. Nepal.: 19 (1825); Clarke: 594(1880); Tagawa:197 (1971); Chowdhury:12 (1973); Iwatsuki: 166 (1975); Hauke, Nova Hedwigia **30**: 428 (1978); Dixit: 19 (1984); Gurung: 155 (1995); DPR: 31 (2002).

Rhizome much branched. Stipes erect, tufted, much scabrous. Leaves reduced to teeth of a foliar loose sheath, arising from an internode and embracing the next; branches densely whorled, short, arising from the base of the leaf sheath.

Distribution: Abundant throughout W., C. and E. Nepal at low to higher altitudes (80- 2800m).

Habitat: Terrestrial, common in sandy soil.

Frutification: June-July

Voucher specimen: Eksathivir, Aghor mahavir khanda, Namtar, 1881m, Jun 25, 2013, S. Prajapati and S. Rajbhandary, 136 (KATH).

Botrychiaceae Nakai

Terrestrial herbs, rarely epiphytic. Rhizomes short, fleshy, erect, glabrous. Frond simple to compound, consisting of sterile foliar parts as well as a fertile spike. Sporangia large, sessile

Botrychium Sw.

Terrestrial herbs, rarely epiphytic. Rhizome erect with rather fleshy roots. Stipes slender, erect and fleshy. Sterile as well as fertile blades of the frond compound; sterile segments much dissected and toothed. Veins free. Fertile segments with globose, free, subsessile sporangia.

Botrychium lanuginosum Wall. ex Hook. and Grev., Ic. Fil.: 1, t. &9 (1831); Iwatsuki: 169 (1975); Dixit: 21 (1984); Gurung: 10 (1986); Thapa: 8 (2000); DPR: 32 (2002).

Botrychium lanuginosum Wall. ex Hook. and Grev. var. *nepalensis* (Nishida) N.C.Nair and R.D.Dixit, J. Bomb. Nat. Hist. Soc. **78** (3): 447 (1981)

Botrypus lanuginosus (Wall. ex Hook, and Grev.) Holub var. *nepalensis* (Nishida) S.R.Ghosh, J. Econ. Taxon. Bot. **5** (1): 246 (1984).

Japonobotrychium lanuginosum (Wall. ex Hook, and Grev.) Nishida ex Tagawa, J. Jap. Bot. **33**: 198 (1958); Nishida: 453 (1966); Nakaike *et al.*: 192 (1990); Sahashi : 61 (1999).

Japonobotrychium lanuginosum var. *nepalense* Nishida, J. Jap. Bot. **41**: 319 (1966).

Rhizome very short, bearing fleshy roots. Frond subdeltoid with acute to acuminate apex up to 30 cm long, 25 cm wide; lateral pinnae with 3 or more in opposite pairs below the terminal ones Stipes 8- 20 cm long, hairy. Sterile blade and fertile stalk on the same frond, sterile portion tripinnate, sessile; lower pinnae larger; pinnules oblong-ovate, sparsely hairy. Fertile branch placed on rachis higher than atleast the basal pair of lateral, 6 to 12 cm in length but shorter than that of sterile blades. Veins forked and free. Spikes bi-tripinnate. Sporangia sessile on the ultimate axes, globose. Distribution: Scattered in W. Nepal and common in C. and E. Nepal, at lower mid to high altitudes (1000-4100m).

Habitat: Lithophyte.

Fructification: June-Aug.

Voucher specimen: Simbhanjyang, 2454m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 15 (KATH).

Osmundaceae Berch. and C.Presl (Royal Fern Family)

Plants terrestrial, herbaceous, rhizome erect or ascending. Frond monomorphic or dimorphic. Blades 1-2 pinnate (2-pinnatifid); rachis grooved. Pinnae monomorphic or dimorphic. Indument of reddish to light brown hairs. Veins dichotomous, free, forked running to margins. Sori absent; sporangia born on slightly modified fertile segments of blades also possessing fully expanded pinnae, or sporangia covering blades lacking green expanded pinnae, clustered in marginal zones, indusia lacking. Spores all alike.

Osmunda L.

Rhizome erect or ascending. Fertile frond wholly, on the upper or middle portion, contracted, forming simple or compound sporangiferous panicles; veins forked, free; Frond pinnate or bipinnate, articulated with the rachis. Veins free forked.

Osmunda japonica Thunb ex Murray, Nov. Acta Regn. Soc. Sci. Upsal. **2**: 209 (1780); Inbc: 455 (1966); DPR: 35 (2002).

Osmunda regalis L. subsp. *japonica* (Thunb.ex A.Murray) A.Love and D.Love, Taxon **26** (2-3): 328 (1977).

Misapplied Name:

Osmunda regalis L. var. *spectabilis sensu* Banerji., Candollea **27**: 268 (1972), *non* (Willd.) A. Gray.

Rhizome erect, ascending, or shortly creeping. Frond, dimorphic, bipinnate. Stipe green or straw-colored, 12-18 cm long glabrous; sterile frond oblong-subdeltoid, 30-50cm*25-40 cm, bipinnate; opposite appearing not to be, lowest pinnae largest, pinnules spreading, oblong-lanceolate to lanceolate, 5-10*1-2.5 cm, papery, base truncate to subtruncate, sessile to sub sessile, margin minutely dentate, apex acute. Veins all free, forked. Fertile frond placed between the sterile basal pinnae and emerging from the rachis, bipinnate; pinnae linear, opposite, covered throughout with sporangia except on costa, pinnae becomes broader and margin appears to be serrulate soon after spore dispersal (Plate V).

Distribution: Occasional in E. Nepal and C. Nepal at lower mid to higher altitudes (1200- 2060m).

Habitat: Terrestrial, rarely occurs as lithophytes.

Frutification: June-Aug.

Voucher specimen: Daman, 1917m, Aug 28, 2012, S. Prajapati and S. Rajbhandary, 52 (KATH).

Plagiogyriaceae Bower

Plants terrestrial, small to medium-sized. Rhizomes short, erect. Frond dimorphic. Stipes long. Sterile frond herbaceous, leaf blade 1-pinnate; pinnae sessile. . Fertile frond erect at middle of plant, with proportionally longer stipes and shorter blade; leaf blade pinnate or deeply pinnatifid. Veins simple or paired at base, mostly 1- or 2-forked.

Plagiogyria (Kunze) Mett

Rhizomes short, erect. Frond dimorphic. Stipes long. Sterile frond herbaceous, leaf blade 1-pinnate; pinnae sessile, shortly stalked, falcate to linear-lanceolate, widest near base or below middle, glabrous or abaxially sparsely glandular pubescent, margin entire to serrulate, apex minutely serrulate to dentate. Fertile frond erect at middle of plant, with proportionally longer stipes and shorter blade; leaf blade pinnate or deeply pinnatifid; pinnae sessile, shortly stalked, or adnate to rachis; apical pinnae usually pinnatifid or pinnalike, margin entire, subentire, or erose-toothed. Veins simple or paired at base, mostly 1- or 2-forked.

Plagiogyria euphlebia (Kunze) Mett., Farngett. II: 274 (1858); Beddome, Handb. Ferns Brit. India: 129 (1892); Iwatsuki: 247 (1988); Nakaike and Gurung: 195 (1988a); Zhang and Nooteboom, Bl. **43** (2): 433 (1998); DPR: 36 (2002).

Lomaria euphlebia Kunze, Bot. Zeit. (Berlin) **6**: 521 (1848); Clarke: 473 (1880).

Plagiogyria triquetra Wall. ex Mett., Farngett. II: 274 (1858); Dixit: 29 (1984).

FronD dimorphic. Stipes on sterile frond smaller than on fertile frond. Sterile blade pinnate, not glaucous, apically with a pinnalike segment; pinnae 7-25 pairs; proximal pinnae shortly stalked or rarely sessile. Veins mostly simple to as many simple as forked. Fertile blade pinnate, pinnae 7-25 pairs, shortly stalked or sessile (Plate V).

Distribution: Occasional in E. Nepal and C. Nepal at lower mid to higher altitudes (1200- 2000m).

Habitat: Terrestrial,

Frutification: June-Aug.

Voucher specimen: Daman, 1917m, Aug 20, 2013, represented only by photograph (Plate V).

Gleicheniaceae (R.Br.) C.Presl (Forking Fern Family)

Plants terrestrial or lithophytes. Rhizome long creeping, forked apex covered with stiff hairs or scales. Frond at long intervals. large, scrambling or trailing, monomorphic, dichotomously branched; Stipes cylindrical, slightly pubescent, firm, often dichotomous, and scaly in young ones. Leaf blade bipinnate, rachis bearing opposite pairs of lateral branches, the growth of the rachis arrested during the development of the each pair, with the apical bud protected by hairs or scales and by stipule like leaflets; the rachis later continue the branching process producing 2 or more pairs of opposite pinnae and only the ultimate branches leafy; pinnae lobed almost to the costa; lobes short, rounded or long and narrow; texture coriaceous; veins forked and free. Indument of simple, branched, or stellate hairs. Sori round on the veins and exindusiate.

Key to the genera

1. Rhizomes and buds with jointed hairs; Frond dichotomously divided; pinnules much larger*Dicranopteris*
1. Rhizome and buds with flattened scales; Frond bipinnate or more compound; pinnules very small*Gleichenia*

Dicranopteris Bernh.

Rhizomes creeping, apex covered with jointed hairs. Frond pinnate, upper pair of lateral branches repeatedly dichotomously branched with a pair of foliaceous stipule- like outgrowths at the base of each fork, only the ultimate branches leafy and larger; pinnae pinnatipartite. Veins repeatedly forked and veinlets several. Sori mostly with more than 6 sporangia.

Dicranopteris linearis (Burm. f.) Underw., Bull.Torrey Bot. Cl. **34** : 250 (1907); Tagawa: 78 (1955); Ito : 456 (1966); Iwatsuki: 170 (1975); Nakaike and Gurung: 192 (1988a); DPR: 36 (2002).

Polypodium linearis Burm.f., Fl. India: 235, t.67, f.2 (1768).

Gleichenia lanigera D.Don, Prodr. Fl. Nepal.: 17 (1825).

Gleichenia linearis (Burm.f.) C.B.Clarke, Trans. Linn. Soc. Lond. II Bot. **1**: 428 (1880); Beddome: 4, f. 1 (1883).

Misapplied Name:

Gleichenia dichotoma sensu Hope: 25 (1900), *non* Willd. (1810).

Rhizomes creeping. Stipes slender, glabrous stramineous, repeatedly dichotomously branched; dichotomy develops from the axils of the forks; ultimate branches bearing a pair of forked pinnae with a bud covered with scales together with a distinct pair of the pinnae on its base. Frond simply pinnate; pinnae linear to oblong-lanceolate, pinnatiparted, 15-35*3-9 cm, gradually acute, horizontally spreading, entire, sparsely hairy beneath, margin recurved; veins 2-4 times forked, slightly raised on both sides. Sori creamy yellow, small, rounded, placed on the middle portion of the uppermost vein.

Distribution: Abundant throughout W., C. and E. Nepal at lower mid to upper mid altitudes (700-2450m)

Habitat: Lithophytes.

Fructification: June-Aug.

Voucher specimen: Palung, 1926m, Aug 28, 2012, S. Prajapati and S. Rajbhandary, 81 (KATH).

Gleichenia J.Sm.

Terrestrial herbs, forming thickets in open places and on the edges of forests. Rhizomes stout , creeping, apex covered with scales. Stipes strong and stout, pubescent. Frond usually dichotomously branched; the rachis branch of the frond stops soon of its growth and bears a pair of branches, thus the rachis usually proliferous from the axils of the forks, bipinnate or more compound, ultimate pinnules very small and roundish; texture coriaceous. Sori solitary, seated at the middle of the veins, exindusiate; sporangia a few and large.

Gleichenia gigantea Wall. ex Hook. and Bauer, Gen. Fil.: t. 39 (1840); Hook., Sp. Fil. **1**: 5, t.3a (1844); Beddome: t.30(1865); Holttum, Phytomorph. **24** (3-4): 314-321 (1974); Iwatsuki: 17(1975); Thapa: 9(2000); DPR: 37 (2002).

Diploterygium giganteum (Wall. ex Hook. and Bauer) Nakai, Bull. Natn. Sci. Mus. Tokyo **29**: 50 (1950); Nakaike and Gurung: 192 (1988a).

Misapplied Names:

Gleichenia glauca sensu Clarke: 428 (1880); Beddome: 2 (1883), *non* (Thunb.) Hook.

Diploterygium volubile sensu Ito: 456(1966), non (Jungh.) Nakai

Rhizomes long creeping. Fronds large, 60-90 cm long, scaly. Stipes stout and strong, sparsely pubescent. Leaf blade with very long rachis; pinnae placed apart, opposite, deeply pinnatifid, 12-20*3-5 cm, lanceolate; texture coriaceous. Sori median in between costule and edge of the pinnule, each with 2- 4 large sporangia (Plate V).

Distribution: Abundant throughout W.,C.and E. Nepal at mid to upper mid altitudes (1400-2400m).

Habitat: Terrestrial forming thickets

Frutification: Aug- Nov.

Voucher specimen: Daman, 2067m, Nov 23, 2013, S. Prajapati and S. Rajbhandary, 105 (KATH).

Polypodiaceae Berch. & C. Presl

Mostly epiphytic, lithophytic rarely terrestrial, erect or occasionally pendent. Rhizomes creeping or sometimes ascending, with usually hair-like scales. Frond monomorphic to dimorphic. Stipes mostly articulate. Leaf blade simple or more or less deeply lobed or pinnate, very rarely more compound, usually jointed at the base of stipe, scaly or hairy or glabrous; texture usually firm. Veins free or often anastomosing with free veinlets in the areoles. Sori borne abaxially on veins, strictly exindusiate, either almost round, small or large. Spores homosporous, usually transparent or yellowish rarely greenish.

Key to the genera

- 1.(a) Frond dimorphic. *Drynaria*
- 1.(b) Frond isomorphic.....(2)
- 2.(a) Leaf blade simple, margin entire.(3)
- 2.(b) Leaf blade pinnatifid to pinnate margin deeply lobed.....(5)
- 3.(a) Stellate hairs present on the lower surface of the blade..... *Pyrrhosia*
- 3.(b) Stellate hairs absent.(4)
- 4.(a) Sori in a single row on either side of the rachis..... *Lepisorus*
- 4.(b) Sori in many rows on either side of the rachis and 2-3 between main costules..... *Microsorium*
- 5.(a) Veins anastomosing to form many irregular areole, included veinlets simple or forked. (6)
- 5.(b) Veins anastomosing to form a single row of areole on either side of the costa, costal areole with one included veinlets, marginal veins free..... (7)
- 6.(a) Leaf blade simple, deeply pinnatifid (palmatifid) or pinnatisect; areole with or without free included veinlets with swollen tips..... (8)

- 6.(b) Leaf blade pinnate; arcolae with simple or forked included veinlets, running on all sides.
*Arthromeris*
- 7.(a) Leaf blade pinnate at least in the major lower half of blade, the remaining upper pinnatifid.
*Goniophlebium*
- 7.(b) Leaf blade simple, deeply pinnatifid, margin deeply lobed to the rachis, sometimes the lower
 1-2 pairs of lobes free..... *Polypodiodes*
- 8.(a) Frond pinnatifid, margin undulate.....*Selliguea*
- 8.(a) Frond pinnatisect, margin serrate to serrulate..... *Pichisermollia*

Arthromeris J.Sm.

Rhizome long-creeping, thick, densely scaly; scales brown, peltate, non-clathrate, narrow, lanceolate, attenuate. Frond isomorphic. Stipes long, glabrous. Leaf blade pinnate, glabrous; pinnae opposite, usually sessile, prominently articulated to rachis, lanceolate, margin undulate, lower pinnae usually the largest; terminal pinnae similar to lateral ones. Veins conspicuous, costules distinct, veinlets anastomosing to form many irregular areole, included veinlets simple or forked, running on all sides. Sori exindusiate, without paraphyses, 1 or 1-2-seriate, between each pair of main costules, superficial.

Arthromeris wallichiana (Spreng. in L.) Ching, Contrib. Inst. Bot. Natn. Acad. Peiping **2**: 92 (1933); Tagawa: 490 (1966); Iwatsuki: 196 (1975); Gurung: 91 (1986); Nakaike and Gurung: 152 (1995); DPR: 38 (2002).

Polypodium wallichianum Spreng., Linnaeus Syst.Veg. **4**: 53 (1827).

Polypodium juglandifolium D. Don., Prodr. Fl. Nepal: 3 (1825); Clarke: 566 (1880); Hope: 96 (1903), non Humb. and Bonpl. ex Willd. (1810).

Pleopeltis juglandifolia T. Moore, Ind. Fil.: 78 (1857); Beddome: 370, f.210 (1883).

Arthromeris wardii (C.B. Clarke) Ching, Bull. Fan Mem. Inst. Biol. (Bot.) **4**: 94 (1993); Tagawa: 216 (1971); Iwatsuki: 196 (1975).

Polypodium wardii C.B. Clarke, J. Linn. Soc. (Lond.) Bot. **25**: 99, t.43 (1889).

Rhizomes long creeping, stout and strong, woody, covered with bright brown, lanceolate, scale. Frond 33- 90 cm long. Stipes 19-35 cm long, glabrous, glossy, brown, grooved laterally. Blade 30-60*16-30 cm, simply pinnate with 2-13 pairs of pinnae, pinnae articulated with the rachis, sub-opposite, elliptic-oblong, base obtuse, apex acuminate, margin sub-entire to undulate, thick and hyaline; rachis glabrous, glossy; texture more or less coriaceous. Main veins raised on both the surfaces, pinnate, conspicuous to the margin, costules anastomosing forming a number of areoles

with free included veinlets sori brown, round, conspicuous, placed single row on either side and much more nearer to the costa than the margin.

Distribution: Common throughout W., C. and E. Nepal at upper mid to higher altitude (2100-3300m).

Habitat: Lithophyte.

Frutification: June-Aug.

Voucher specimen: Simbhanjyang, 2451m, Aug 27, 2012, S. Prajapati and S. Rajbhandary, 61 (KATH)

Drynaria (Bory) J.Sm.

Rhizomes long-creeping, strong and stout, woody clothed with linear- lanceolate, hairy scales. Frond dimorphic, sterile ones quite different in shape from the fertile ones, short, broad, sessile, soon turning brown, long persisting, erect, rather a little inclined to the supporting tree, fertile Frond pinnate without stellate hairs, stipe long; blade green, deeply lobed or pinnate; margin hairy, texture coriaceous. Venation copiously reticulate forming quadrate or hexagonal areoles with free included veinlets. Sori conspicuous, yellowish-brown, round, in a single series in between and close to the midrib.

Drynaria mollis Bedd., Ferns Brit. India: t.216(1867); Tagawa: 81 (1955); Iwatsuki: 198(1975); Nakaike and Gurung: 192 (1988a); Fraser-Jenkins : 313(1997b); DPR: 41 (2002).

Polypodium rivale Mett. ex Bak., Syn. Fil. ed.2: 368(1867); Clarke: 556(1880).

Drynaria tibetica Ching and S.K.Wu in C.Y.Wu, Fl. Xizangica **1**: 342(1983).

Rhizomes creeping, stout, covered with dense, brown scales. Frond dimorphic, sterile ones much smaller than fertile ones, sterile ones 7-18 cm long, ovate, sessile, glabrous, blunt lobes. Fertile Frond 22-42*4-12 cm, with a distinct stipe. Stipe 1-12 cm long, sparsely scaly. Blade lanceolate, pinnae deeply cut to the rachis into lanceolate segments, lower ones dwarfed and gradually reduced to decurrent wing; margin hairy, texture herbaceous; main veins pinnate, costules anastomosing forming 3-4 series of fine, regular areoles with the free included veinlets. Sori conspicuous, brown, round, placed single series close to the costa.

Distribution: Very common at higher altitudes in W., C. and E. Nepal.

Habitat: Epiphyte.

Frutification: June-Aug.

Voucher specimen: Daman, 2472m, Aug 28, 2012, S. Prajapati and S. Rajbhandary, 69 (KATH).

Goniophlebium (Bl.) C.Presl

Rhizome long-creeping, scaly; scales dark-brown, small, deciduous, clathrate, base ovate, apex acuminate. Frond isomorphic. Stipes distinct. Leaf blade pinnate or the remaining upper pinnatifid; pinnae sessile, articulated to the rachis. Veins anastomosing to form a single row of areole on either side of the costa but marginal veins free; areole with a free included veinlet. Sori superficial, not immersed. Spores light-brown or yellowish.

Goniophlebium argutum (Wall. ex Hook.) J. Sm. in Hook., Gen. Fil.: t.51 (1840); Bedd.: t.6 (1865), 323, t.174 (1883), Nakaike *et al.*: 191 (1990); Fraser-Jenkins: 313 (1997b); Rodl-Linder: 410 (1990); Thapa: 10 (2000); DPR: 41 (2002).

Polypodium argutum Wall. ex Hook., Sp. Fil. **5**: 32 (1863); Clarke: 551 (1880); Hope: 87 (1903); Tagawa: 497 (1966); Iwatsuki: 202 (1975); Gurung: 105 (1986).

Polypodiastrum argutum (Wall. ex Hook.) Ching, Acta Phytotax. Sin. **16**(4): 28 (1978); Dixit: 51 (1984); Lu: 37 (1999).

Rhizome long-creeping, thick, scaly; scales dark-brown to blackish, spreading, ovate-lanceolate or linear-lanceolate. Frond large, pinnate, 30-50 cm long. Stipes 8-10 cm long, light-brown, glossy, sparsely hairy, hairs light-brown. Blade pinnate or major lower half pinnate and terminal part pinnatifid, 30- 40*10-12 cm; texture herbaceous, glabrous; pinnae many, 10-15*1.5-2 cm, lower ones opposite, upper alternate, sessile, more or less adnate and decurrent, lanceolate, base broad, auricled or nearly round, apex acute, basiscopic side prominently auricled on both sides, margin serrate, terminal pinna similar to lateral ones. Main veins prominent on both sides, anastomosing to form a series of large costal areole, with simple included veinlets, marginal veins all free or rarely united, costa very sparsely scaly, scales dark-brown, small caducous. Sori superficial, round, at the ends of free included veinlets in the costal areole, in a single row on either side of costa and one between each main costule.

Distribution: Abundant in W., C. and E. Nepal at mid to upper mid altitudes.

Habitat: Epiphyte.

Frutification: June-Aug.

Voucher specimen: Simbhanjyang, 2454m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 14 (KATH).

Lepisorus (J.Sm.) Ching

Rhizome long or sometimes short-creeping, thick or thin, branched, scaly; Frond generally in 2-rows on rhizome. Stipes generally short, often winged due to the decurrent bladebase, glabrous or scaly. Leaf blade simple, lanceolate or linear-lanceolate, base cuneate and often decurrent on stipe, apex acute, long acuminate or abruptly attenuated, margin entire, revolute in a few; texture thick or

thin, coriaceous to subcoriaceous or herbaceous, glabrous or scaly; scales lanceolate; rachis often prominent on lower side, glabrous or scaly. Veins prominent or obscure forming series of areole with or without free single or forked included vein lets. Sori exindusiate, Spores hyaline to yellowish.

Key to the species

- 1.(a) Frond coriaceous, costa and costules visible.*Lepisorus scolipendrium*
- 1.(b) Frond leathery, costa and costules obscure.....(2)
- 2.(a) Frond scaly.*Lepisorus mehrae*
- 2.(b) Frond scaleless..... (3)
- 3.(a) Rhizome scale blackish..... *Lepisorus nudus*
- 3.(b) Rhizome scale pale brown.....*Lepisorus contortus*

Lepisorus contortus (Christ) Ching, Bull. Fan Mem. Inst. Biol. (Bot.) **4**: 90 (1933); Nakaike *et al.*: 192 (1990); Fraser-Jenkins: 324 (1997b); Thapa: 10 (2000); DPR: 43 (2002).

Polypodium lineare Thunb. var. *contortum* Christ, Nuov. Giorn. Bot. Soc. Ital. n.s. **4**: 98 (1897).

Polypodium contortum (Christ) Christ, Bot. Gaz. (Chicago) **51**: 347 (1911).

Rhizomes creeping, 1.5-2.5 mm in diameter, densely scaly when young, rhizome later naked; scales pale brown. Fronds 0.5-2 cm apart. Stipe normally straw-colored, less often brown, 0.8-1.5 mm in diameter. Leaf blade abaxially grayish yellow-green, adaxially greenish, linear-lanceolate to lanceolate, 9-15*0.4-1.5 cm, widest at middle, softly thinly leathery, apex shortly acuminate. Veins not distinct but costa raised on both sides, costules obscure. Sori submedial, restricted to distal half, slightly closer to costa.

Distribution: Abundant throughout W., C. and E. Nepal at mid altitude.

Habitat: Epiphyte

Frutification: Aug-Nov.

Voucher specimen: Daman, risheswor mahadev, 2358m, Nov 23, 2012, S. Prajapati and S. Rajbhandary, 101 (KATH).

Lepisorus mehrae Fras.-Jenk., New Sp. Syndrome : 157, 159, 312 (1997); Thapa: 10 (2000); DPR: 43 (2002).

Lepisorus kashyapii (Mehra) Mehra in Bir, Res. Bull. Punjab Univ. (n. s.) **13**: 24 (1962), *comb. inval.*

Lepisorus kashyapii (Mehra) Mehra in Bir var. *major* Bir and Tirkha, Amer. Fern J. **71**: 55 (1981).

Lepisorus kashyapii (Mehra) Mehra in Bir var. *minor* Bir and Tirkha. Amer. Fern J. **71**: 55 (1981).

Polypodium kashyapii Mehra, Punjab Univ.Publ.: 24 (1939), *nom. nud.*

Rhizome long-creeping, thick, with long straight hairy roots, scaly; scales brown. Fronds monomorphic, 20-35 cm long. Stipes 1-2 cm, distant on rhizome, usually clustered towards growing tip, yellowish, scaly; scales brown. Leaf blade 15-35*1.5-2 cm, lanceolate, base gradually decurrent on stipe, apex acute, margin entire or slightly wavy; texture thick, subcoriaceous, bright brown on drying, lower surface scaly, scales dark-brown. Rachis prominent on lower surface, scaly, scales dark-brown. Veins inconspicuous, anastomosing to form many irregular areole with free simple or forked included veinlets. Sori not deeply immersed, round, large, submedial. Spores yellowish.

Distribution: Fairly common in W., C. and E. Nepal at mid to upper mid altitudes.

Habitat: Epiphyte.

Frutification: June-Aug.

Voucher specimen: Simbhanjyang, 2454m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 16 (KATH).

Lepisorus nudus (Hook.) Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 83 (1933); Tagawa: 494 (1966); Iwatsuki: 200 (1975); Gurung: 99 (1986); Nakaike *et al.*: 193 (1990); Thapa: 10 (2000); DPR: 44 (2002).

Pleopeltis nuda Hook., Exot. Fl. **1**: t.63 (1823); D. Don, Prodr. Fl. Nepal.: 3 (1825);

Polypodium nudum (Hook.) Kunze, Linnaea **23**: 281 (1850); Chowdhury: 69 (1973).

Rhizome long-creeping, thin, scaly; scales blackish. Frond simple, 25-30*1cm. Stipes 0.5-1.5 cm distant on rhizome, short, 0.5-3.0 cm long, sparsely scaly, scales as on rhizome; rachis prominent, sparsely scaly, scales deciduous. Blade with long acute apex, entire, narrowly linear-lanceolate, base gradually attenuated and decurrent on stipe, texture thick. Veins obscure. Sori round-oval, medial but closer to the rachis, more than half of the blade fertile. Spore brownish.

Distribution: Common throughout W., C. and E. Nepal at mid altitude.

Habitat: Lithophyte.

Frutification: June-Aug.

Voucher specimen: Palung, 949m, Jun 21, 2013, S. Prajapati and S. Rajbhandary, 117 (KATH).

Lepisorus scolopendrium (Buchanan-Hamilton ex Ching) Mehra & Bir, Res. Bull. Punjab Univ. Sci., n.s., **15**: 168 (1964) ["scolopendrius"].

Lepisorus excavatus (Bory ex Willdenow) Ching var. *scolopendrium* Buchanan-Hamilton ex Ching, Bull. Fan Mem. Inst. Biol. **4**: 69 (1933).

Rhizomes creeping, 3-6 mm in diam., densely scaly; scales brown, lanceolate. Fronds 35-45*2-4cm, 0.2-2 cm apart on rhizome. Stipe straw-colored, 2-5 cm, 1-2 mm in diam., sparsely scaly at

base. Leaf blade narrowly lanceolate, widest at or below middle, herbaceous or thinly papery, abaxially with small, lanceolate, scales on costa, apex acute. Main vein raised on both sides, costules visible forming many irregular areoles with free or forked veins included. Sori usually along distal half of blade, close to costa, orbicular or elliptic, 2–3 mm in diameter.

Distribution: Common throughout W., C. and E. Nepal at mid altitude.

Habitat: Epiphyte.

Frutification: June-Aug.

Voucher specimen: Daman, 2304m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 7 (KATH).

Microsorium Link

Rhizome large, creeping, woody, clothed with peltate, clathrate scales margin entire or shortly toothed. and bearing Frond well spaced, simple, texture usually thin. Stipe prominent. Leaf blade long and broad, entire. Veins usually prominent, smaller transverse veins anastomosing to form areole which contain smaller included areole, with many free veinlets. Sori rather small, irregularly scattered, exindusiate.

Microsorium membranaceum (D. Don) Ching, Bull. Fan Mem. Inst. Biol. (Bot.) **4**: 309 (1933); Tagawa: 80 (1955); Roy *et al.*: 195 (1971); Iwatsuki: 201 (1975); Gurung: 103 (1986); Nakaike *et al.*: 194 (1990); Fraser-Jenkins: 324 (1997b) ; DPR: 47 (2002).

Polypodium membranaceum D. Don, Prodr. Fl. Nepal. : 2 (1825).

Polypodium hymenodes Kunze, Linnaea **23**: 279, 319 (1850), *non* Wall. [List no. 283 (1829), *nom. nud.*]

Colysis membranacea (D. Don) J. Sm., Calt. Cult. Ferns: 11 (1857), *non* C. Presl (1851).

Microsorium hymenodes (Kunze) Ching, Bull. Fan Mem. Inst. Biol. (Bot.) **4**: 301 (1933); Tagawa: 218 (1971); Dixit: 45 (1984); Iwatsuki: 334 (1988); Nakaike *et al.*: 194 (1990).

Rhizomes short-creeping, stout, covered with scales; scales blackish to dark-brown, lanceolate, margin entire, apex acuminate. Frond simple, large, ovate-lanceolate, acuminate, base gradually attenuated at the base, entire; texture thin, membranaceous, and much gradually decurrent on the stipes. Stipe prominent, 10-12 cm long. Blade 40-50*7-11 cm, glabrous. Veins distinct, costules alternate, almost parallel reaching up to margin, transverse veinlets many anastomosing to form many primary areole which further contain smaller, irregular areole, ultimate areole includes free, simple or branched veinlets in all directions. Sori round, brown, scattered irregularly on either side of the costa, exindusiate.

Distribution: Very common throughout W., C. and E. Nepal at mid altitude.

Habitat: Occurs as epiphyte or lithophytes.

Frutification: June-Aug.

Voucher specimen: Daman, near gumba, 2389m, Aug 28, 2012, S. Prajapati and S. Rajbhandary, 75 (KATH).

Pichisermollia Pich.Serm.

Rhizome creeping, scaly; scales brown or black, linear-lanceolate or broad lanceolate. Frond isomorphic. Stipes articulated to the rhizome, stramineous to light-brown; rachis usually glabrous or sometimes scaly. Blade simple, deeply pinnatifid (simple, or pinnate) or pinnatisect, deeply lobed to the rachis; texture coriaceous or herbaceous, lower surface glabrous, sometimes hairy. Costa and costules distinct; veinlets anastomosing to form irregular areole with or without free included veinlets with swollen tips. Sori exindusiate, large, distinct, oval or round, in a row on either side of the main vein and one between the costules.

Key to the species

- 1.(a) Rhizome scales black(2)
- 1.(b) Rhizome scales brown.(3)
- 2.(a) Pinnae tip acute.*Pichisermollia ebinipes*
- 2.(b) Pinnae tip caudate. *Pichisermollia stewartii*
- 3.(a) Rhizome scales ovate.*Pichisermollia subebenipes*
- 3.(b) Rhizome scales lanceolate.....*Pichisermollia quasidivariata*

Pichisermollia ebinipes (Hook.) Fras.-Jenk., *comb. nov.*; basionym : *Polypodium ebenipes* Hook. Sp. Fil. 5: 88 (1863).

Phymatopteris nakaikei P. C. Pande & H. C. Pande (2003).

Polypodium ebinipes (Hook.) Pich.Serm., *Webbia* 28: 462(1973); Dixit: 48 (1984); Fraser- Jenkins: 313 (1997b); Thapa: 11 (2000); DPR: 49 (2002).

Pleopeltis ebenipes (Hook.) Bedd., *Fern Brit. India*: t.138 (1866).

Phymatodes ebenipes (Hook.) Ching, *Bull. Fan Mem. Inst. Biol. (Bot.)* 4: 86 (1933).

Crypsinus ebinipes (Hook.) Copel., *Gen. Fil.*: 206 (1947); Tagawa: 491(1966); Iwatsuki: 196 (1975); Nakaike, *Bull. Nat. Sci. Mus. (Bot.) Tokyo* 13 (3): 89-105 (1987).

Rhizome stout creeping, densely imbricated with intensely black ovate scales. Frond ovate in outline, closely placed on rhizome, 30-40*12-20 cm. Stipes 12-15 cm long, 2-3cm in diameter, glabrous. Leaf blade pinnatisect, cut down to less winged rachis, bearing 6-20 pairs of pinnae; pinnae 7-10*1-2 cm, margin serrate, apex acute, lowest pair of pinnae deflexed. Veins distinct, costa

opposite or subopposite running almost parallel. Sori exindusiate, in a single row near midrib. Sori brown.

Distribution: Common in W., C. and E. Nepal at upper mid altitudes.

Habitat: Epiphyte.

Frutification: June-Aug.

Voucher specimen: Simbhanjyang, 2454m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 19 (KATH).

Pichisermollia quasidivariata (Hayata) Fras.-Jenk., *comb. nov.*; basionym: *Polypodium quasidivariatum* Hayata, Mater. Flor. Formos.: 446 (1911); Fraser-Jenkins: 53 (2008).

Phymatopteris stracheyi (Ching) Pich.Serm.

Phymatopteris intermedia (Ching) Pich.Serm.

Phymatopteris quasidivariata (Hayata) Pich.Serm., *Webbia* **28**:464 (1973); Fraser-Jenkins:313 (1997b); Thapa: 11(2000); DPR: 51 (2002).

Polypodium quasidivariatum Hayata, Mat. Fl. Formos.:446 (1911).

Polypodium divariatum Hayata, Bot.Mag.Tokyo 23: 78 (1909),non E.Fourn.(1872).

Phymatodes quasidivariata (Hayata) Ching, Bull.Fan Mem .Inst.Biol.(Bot.) 4:87 (1933)

Crypsinus quasidivariatus (Hayata)Copel., Gen.Fil.: 206 (1947); Tagawa: 492 (1966; Iwatsuki: 197 (1975); Nakaike and Gurung : 191 (1988a); Sheih, DeVol and Kuo, Fl. Taiwan ed.2 **1**: 480 (1994)

Phymatopteris stracheyii (Ching) Pich. Serm., *Webbia* 28: 464(1973).

Phymatodes stracheyii Ching, Contrib.Inst.Bot.Natm.Acad.Peiping 2: 83 (1933).

Rhizome long-creeping, thin, with hairy roots, scaly; scales brown lanceolate. Frond ovate in outline, placed 1-2 cm distant on rhizome, 20- 25*10-14 cm. Stipes 8-10 cm long, thin, firm, glabrous but extreme base scaly, scales as on rhizome; rachis glabrous. Blade simple, pinnatisect, ovate or narrowly elongate, pinnae deeply lobed, glabrous; pinnae triangular lanceolate, base broad, apex acuminate, margin minutely serrate or serrulate, terminal lobe 7-9*1 cm, or as long as lateral ones, lateral pinnae 3-4 pairs, opposite to alternate, lowest pair downwardly deflexed. Veins distinct and raised on both sides, costules opposite or alternate. Sori round, close to the costa, in a row on either side of it. Spores dark – brown.

Distribution: Very common in W., C. and E. Nepal at upper mid to higher altitudes.

Habitat: Epiphyte.

Frutification: June-Aug.

Voucher specimen: Aghor bazaar, 1844m, June 26, S. Prajapati and S. Rajbhandary, 138 (KATH).

Pichisermollia stewartii (Bedd.) Fras.-Jenk., *comb. nov.*; basionym: *Pleopeltis stewartii* Bedd., Ferns Brit. India: t. 204 (1867); Fraser-Jenkins: 54 (2008).

Polypodium cyrtolobum J.Sm. ex C.B.Clarke (1880)

Phymatopteris stewartii (Bedd.) Pich.Serm., *Webbia* **28**:464 (1973); Dixit: 50 (1984); Fraser-Jenkins: 313 (1997b); Thapa: 11 (2000); DPR: 51 (2002).

Pleopeltis stewartii Bedd., Ferns Brit.India: t.204(1867)

Polypodium stewartii (Bedd.) C.B.Clarke, Trans. Linn. Soc. Lond, II Bot. **1**: 563 (1880); Hope: 96 (1903).

Pleopeltis malacodon (Hook.) Bedd. Var. *majus* (Hook.) Bedd., Handb. Ferns. Brit. India: 363 (1883).

Phymatodes stewartii (Bedd.) Ching. Bull. Fan Mem. Inst. Biol. (Bot.) **4**: 81, 87 (1933).

Crypsinus stewartii (Bedd.) Copel., Gen. Fil.: 206 (1947); Tagawa: 492 (1966); Iwatsuki: 197 (1975); Nakaike and Gurung : 191 (1988a).

Rhizome short creeping, 2- 4 mm in diameter, whitish, scaly with roots covered by brown hairs; scales black, lanceolate. Frond 20- 26cm long, placed remote or closely on rhizome. Stipe light brown, 7–10cm long, glabrous. Leaf blade pinnatisect, 15-20 cm long, pinnae all raised, terminal pinnae longest of all, margin serrate, caudate - acuminate apex, glabrous. Lateral pinnae in 2- 4 pairs, 10–15*1–2 cm. Mibrib and costules distinct, but costules not reaching margin, veinlets obscure. Sori exindusiate, orbicular, near costa.

Distribution: Common in W.C. and E. Nepal at upper mid altitudes

Habitat: Epiphyte

Frutification: June-Aug.

Voucher specimen: Simbhanjyang, 2453m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 17 (KATH).

Pichisermollia subebenipes Ching, Act. Phytotax. Sinica **9** (2): 193 (1964), Fraser-Jenkins (2008).

Polypodium ebenipes var. *oakesii* C. B. Clarke.

Crypsinus nepalensis Nakaike

Crypsinus ebenipes var. *subebenipes* (Ching) K. Iwats., S. K. Wu, Mitsuta & X. Cheng.

Rhizome stout creeping, densely imbricated with brown ovate scales. Frond ovate in outline, 30- 35*12-16 cm. Stipes 12-15 cm long, 1.5-2 cm in diam., glabrous. Leaf blade pinnatisect, cut down to less winged rachis, bearing 3 or more pairs of pinnae; pinnae 7- 10*1-2 cm, margin serrate, apex acute, lowest pair of pinnae deflexed. Veins distinct, costa opposite or subopposite running almost parallel. Sori exindusiate, in a single row near mibrib. sori brown.

Distribution: Common in W., C. and E. Nepal at upper mid altitudes.

Habitat: Epiphyte.

Frutification: June-Aug.

Voucher specimen: Daman, 2226m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 42 (KATH)

Polypodiodes Ching

Rhizome long creeping, clothed with dark-brown to blackish, ovate-lanceolate or subulate-lanceolate, glaucous, long pointed scales. Frond isomorphic, deeply pinnatifid. Stipes distant on rhizome. Leaf blade simple, pinnatifid, imparipinnate, triangular-lanceolate to linear-lanceolate; texture herbaceous to subcoriaceous, glabrous or more or less hairy; lobes simple, confluent at their bases, lower 1 or 2 rarely free, reduced, distant towards deflexed, broadly adnate, articulated or not to the rachis pinnae; rachis hairy and/or scaly or glabrous. Veins forked, free or generally anastomosing to form one (rarely two) rows of costal areole; areole subhexagonal with one free simple excurrent veinlet, marginal veins free. Sori exindusiate, generally in a row on either side of the costa, round or oblong, terminal on a distinct free veinlet. Spores light-brown or yellowish.

Key to the species

1.(a) Leaf blade ovate- lanceolate in outline, lateral pinnae usually less than 20 pairs, rachis generally scaly throughout*Polypodiodes amoena*

1.(b) Leaf blade linear- lanceolate in outline, lateral pinnae usually more than 20 pairs, rachis sparsely scaly or glabrous..... (2)

2.(a) Rhizome scales hair-like, many black; lateral pinnae often more than 30 pairs.*Polypodiodes lachnopus*

2.(b) Rhizome scales narrow but not hair-like, all brown; lateral pinnae less than 30 pairs *Polypodiodes microrhizoma*

Polypodiodes amoena (Wall. ex Mett.) Ching, Acta Phytotax. Sin. **16** (4): 27 (1978); DPR : 52 (2002).

Goniophlebium amoenum (Wall. ex Mett.) Bedd., Ferns Brit. India: t. 5 (1865); Hope: 85 (1903); Rodl-Linder: 387 (1990).

Polypodium amoenum Wall. ex Mett., Abh. Senck. Naturf. Ges. (Frankfurt) **2**: 80 (1857); Clarke: 550 (1880); Tagawa: 496 (1966); Iwatsuki: 202 (1975); Gurung: 105 (1986); Nakaike *et al.*: 195 (1990); Thapa: 11 (2000).

Polypodium amoenum Wall. ex Mett. forma *pilosum* C.B. Clarke, Trans. Linn. Soc. Lond. II Bot **1**: 417 (1880); Tagawa: 219 (1971).

Rhizome long-creeping, densely clothed with linear-lanceolate, light brown scales. Frond monomorphic, 30-46*6-12 cm. Stipes slender, 6-15 cm long. Frond pinnatifid, with broadly

winged rachis, pinnae serrate, rachis scaly underneath, hairy when young; texture membranous. Costa distinct. Sori conspicuous, brown, round, single row on either side of the costa.

Distribution: Very common in W., C. & E. Nepal at mid altitudes.

Habitat: Epiphytic on tree trunks and mossy rocks.

Fructification: June- Aug.

Voucher specimen: Daman, 2304m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 6(KATH).

Polypodiodes lachnopus (Wall. ex Hook.) Ching, Acta Phytotax. Sin. **16**(40): 27 (1978); Dixit: 52 (1984); Lu: 42 (1999); DPR: 53 (2002).

Goniophlebium lachnopus (Wall. ex Hook) Bedd., Handb. Ferns Brit. India: 319 (1883); Rodl Linder: 393 (1990)

Polypodium lachnopus Wall. ex Hook., Ic. Pl.: t.952 (1854), Sp. Fil. **5**: 32 (1863); Clarke: 551 (1880); Hope: 86 (1903); Tagawa : 497 (1966); Iwatsuki : 203 (1975).

Polypodium vulgare D.Don, Prodr. Fl. Nepal.: 2 (1825), *non* L. (1753).

Rhizome long-creeping, thin, densely scaly; scales black, hair like. Frond 20-30 cm long. Stipes 6-8cm long, thin. Blade simple, pinnatifid, linear-lanceolate, margin deeply lobed nearly to the rachis; texture herbaceous, lateral pinnae more than 30 pairs, margin crenate-serrate, apex subacuminate, lower most pinnae deflexed downwards; veins anastomosing to form a series of large costal areole with simple included veinlets, marginal veins free rarely united, such marginal areole without free included veinlets. Sori small, round, in a single row on either side of the costa and one between each costal areole. Spores pale.

Distribution: Abundant in W., C. and E. Nepal at mid to upper mid altitudes.

Habitat: Epiphyte on *Quercus Semicarpefolia*

Fructification: June-Aug.

Voucher specimen: Daman, 2226m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 40(KATH).

Polypodiodes microrhizoma (C.B.Clarke) Ching, Acta Phytotax. Sin. **16** (4): 27 (1978); Dixit: 52 (1984); Lu: 41 (1999); DPR: 53 (2002).

Goniophlebium microrhizoma (C.B.Clarke ex Bak.) Bedd., Suppl. Ferns South. India Brit. India.: t.384 (1876); Rodl- Linder: 395 (1990); Thapa: 10 (2000).

Polypodium microrhizoma Clarke ex Bak. in Hook. and Bak., Syn. Fil. ed.2:511 (1874); Clarke: 551 (1880); Hope: 86 (1903); Tagawa: 497 (1966); Iwatsuki: 203 (1975).

Rhizome long-creeping, thin, scaly; scales dark-brown. Frond 25-35 cm long, lanceolate. Stipes 10-15 cm long, brown, thin, glaucous, glabrous; rachis brown, glaucous, generally glabrous or occasionally very sparsely scaly, scales few scattered, brown, small. Blade simple, pinnatifid, 15-20*5-8 cm, apex acuminate, texture membranaceous, glabrous; lateral pinnae less than 30 pairs, margin serrate or distantly incised, lower most pinnae distant, slightly smaller than the next two or

three pairs above; veins anastomosing to form a single series of costal areole but free towards apex of the lobes, Sori round or oval, medial on the included or free veinlets, nearer the costa, in a single row on either side of costa; Spores light-yellowish.

Distribution: Abundant in W., C. and E. Nepal at mid to upper mid altitudes

Habitat: epiphyte

Frutification: June-Aug.

Voucher specimen: Simbhanjyang, 2454m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 23(KATH).

Pyrrosia Mirb.

Rhizomes slender, creeping, scaly. Stipes short. Frond simple, entire, fleshy, both the surfaces covered by hairs, conspicuous on the upper surface. Veins anastomosing. Sori many, round, usually confined on the apical half of the frond in several rows on either side of the costa, protected by stellate hairs.

Key to the species

1.(a) Fronds obovate to oblanceolate, 20–35 long, 2.5–6 cm broad..... *Pyrrosia costata*

1.(b) Fronds elongated, narrowly lanceolate, less than 30 cm long, 0.5-1 cm broad..... *Pyrrosia porosa*

Pyrrosia costata (C. Presl ex Bedd.) Tagawa & K. Iwats., Acta Phytotax. Geobot. Kyoto **22**: 100 (1967); Tagawa: 219 (1971); Iwatsuki: 203 (1973); Hovenkamp: 171, f.17 (1986); DPR: 54 (2002).

Niphobolus costatus C. Presl ex Bedd., Ferns Brit. India: t.120 (1868).

Niphobolus beddomeana Gies., Farng. Niphobolus: 101 (1901).

Pyrrosia beddomeana (Gies.) Ching, Bull. Chin. Bot. Soc. **1**: 68 (1935); Tagawa: 498 (1966).

Misapplied Names:

Polypodium stigmatosum sensu Clarke: 553 (1880); Hope: 88 (1903), *non* Sw.

Polypodium stigmatosum sensu Chowdhury: 73 (1973), *non* (Sw.) Desv.

Rhizome short, up to 5 mm in diameter, black in colour. Fronds monomorphic. Stipe 1-5 cm. Leaf blade obovate to oblanceolate, widest at middle, 20-35*2.5-6 cm, base very gradually narrowed, apex acuminate. Veins pinnately arranged, costa and costules distinct. Sori superficial, confined to upper half of the blade.

Distribution: Very common in W., C. and E. Nepal at lower to mid altitudes.

Habitat: Lithophyte.

Frutification: June-Aug.

Voucher specimen: Bhaise 1, 707, June 23, 2013, S. Prajapati and S. Rajbhandary, 129 (KATH).

Pyrrosia porosa (C. Presl) Hovenkamp, *Blumea* **30**: 208 (1984); Nakaike & Gurung: 196 (1988a); Fraser-Jenkins: 324 (1997b)); DPR: 55 (2002).

Niphobolus porosus C. Presl, *Tent. Pterid.*: 202 (1836).

Niphobolus mollis Kunze, *Bot. Zeit.* **6** : 121 (1848).

Pyrrosia mollis (Kunze) Ching, *Bull. Chin. Bot. Soc.* **1**: 53 (1935); Sledge: 134 (1960); Tagawa: 498 (1966).

Pyrrosia penangiana (Hook.) Holttum, *Rev. Fl. Mal.* **2**: 146, f.62 (1955); Hovenkamp: 218, f.18 (1986).

Pyrrosia stictica (Kunze) Holttum, *Novit. Bot.* **1968**: 30 (1969).

Rhizome short-creeping, covered with brown scales. Frond simple, elongate, narrowly lanceolate. Stipes not distinct, appears as decurrent continuation of leaf blade. Leaf blade up to 25*0.5-1 cm; densely clothed with dark-brown indumentums; texture coriaceous. Veins inconspicuous. Sori rather quite sunk, in many rows on either side of the mid rib.

Distribution: Abundant in W., C. and E. Nepal at low to mid altitudes

Habitat: Occur as epiphyte and as lithophyte.

Frutification: June-Aug.

Voucher specimen: Bhaise 1, 707, June 23, 2013, S. Prajapati and S. Rajbhandary, 130 (KATH).

Selliguea Bory

Rhizome creeping, scaly; scales brown or black, linear-lanceolate or broad lanceolate. Frond isomorphic. Stipe articulated to the rhizome, stramineous to light-brown; rachis usually glabrous or sometimes scaly. Leaf blade deeply pinnatifid or palmatifid, deeply lobed to the rachis; texture coriaceous or herbaceous, lower surface glabrous, sometimes hairy, margin undulate. Costa and costules distinct; veinlets anastomosing to form irregular areole with or without free included veinlets with swollen tips. Sori exindusiate, large, distinct, oval or round, in a row on either side of the main vein and one between the costules.

Selliguea oxyloba (Wall. ex Kunze) Fras.-Jenk., *comb. nov.*; basionym: *Polypodium oxylobum* Wall. ex Kunze, *Linnaea* **24**: 255 (1851); Fraser-Jenkins: 44 (2008).

Phymatopsis oxyloba (Wall. ex Kunze) Ching var. *thunbergii* (C.B. Clarke).

Phymatopteris oxyloba (Wall. ex Kunze) Pich.Serm., *Webbia* **28**:464 (1973); Fraser-Jenkins: 313 (1997b); DPR: 51 (2002).

Polypodium trifidum D. Don. *Prodr. Fl. Nepal.*: 3 (1825), *non* Hoffm. (1790);

Polypodium hastatum Thunb. var. *oxylobum* (Wall. ex Kunze) C.B. Clarke, *Trans. Linn. Soc. Lond. II Bot* **1**: 563 (1880)

Phymatodes oxyloba (Wall. ex Kunze) C.Presl ex Ching, Bull. Fan Mem. Inst. Biol. (Bot.) **4**: 67 (1933)

Crypsinus oxylobus (Wall. ex Kunze) Sledge, Bull. Brit. Mus. Nat. Hist. (Bot.) **2**: 145 (1960); Tagawa: 492 (1966); Iwastuki: 197 (1975); Nakaike and Gurung : 191 (1988a).

Misapplied Name:

Phymatopteris hastate sensu auct. Ind., non (Thunb.) Pich. Serm.

Phymatopteris hastatum sensu Clarke: 562 (1880), *non* Thunb. (1784).

Rhizome long-creeping, thick, scaly; scales brown, linear-lanceolate. Stipes distant on rhizome, 9-11 cm long, never longer than the blade, stramineous, firm, erect, glabrous but extreme base scaly; scales as on rhizome. Blade simple, pinnatifid, ovate-lanceolate, texture subcoriaceous, glabrous; pinnae linear-lanceolate, apex acuminate, margin undulate, terminal lobe 6-9*1-2 cm, as long as the lateral ones, lateral pinnae in 3-8 pairs; rachis glabrous. Veins anastomosing, areole with or without included veinlets. Sori round, submedial, in a row on either side of the costa and one in between the costules. Spores yellowish-brown.

Distribution: Very common in W., C. and E. Nepal at mid to upper mid altitudes.

Habitat: Occurs as terrestrial, epiphyte or lithophytes.

Frutification: June-Aug.

Voucher specimen: Simbhanjyang, 2454m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 18 (KATH).

Hymenophyllaceae Link (Filmy Fern Family)

Epiphytic, terrestrial, or lithophytic. Rhizome short, slender, erect or long-creeping, often threadlike. Roots sparse or absent. Frond very small, simple to fairly large and compound, often forming dense mats; main rachis simple or winged. Stipes short, threadlike, often winged partly or entire length. Blade ovate or oblong to lanceolate, simple to decompose, usually 1 cell thick between veins, entire or dentate; ultimate divisions mostly very small, and one veined; scales or stellate hairs often borne on veins or leaf margins. Veins free and divergent. Sori terminal on the ultimate lobes or marginal on vein ends, enclosed tubular or cylindrical indusium with the apical part more or less deeply divided into two lips. Sporangia sessile or short-stalked; Spores green, globose.

Hymenophyllum J.Sm.

Epiphytic as well as terrestrial ferns. Rhizomes slender, long creeping and very scantily hairy. Frond compound with pinnately divided, brownish - green, entire margined. Stipes short winged. Leaf blade usually bipinnate and the ultimate pinnae entire, with single vein to each of them; costa

and costules covered with brown hairs; texture thin herbaceous. Veins free. Sori marginal on rather elongated receptacle; indusium cup shaped and two lipped.

Key to the species

1.(a) Fronds hairy on stipes and veins. *Hymenophyllum exsertum*

1.(b) Fronds glabrous..... *Hymenophyllum polyanthus*

Hymenophyllum exsertum Wall. ex Hook., Sp. Fil. **1**: 109, t.38a (1844); Clarke: 436 (1880); Beddome: 30, f.16 (1883); Hope: 25 (1900); Iwatsuki: 250 (1988); Thapa: 9 (2000); DPR: 58 (2002).

Mecodium exsertum (Wall. ex Hook.) Copel., Philip. J. Sci. **67**: 23 (1938); Iwatsuki: 457 (1966); Nakaike and Gurung: 194 (1988a).

Rhizomes long creeping, fine clothed with hairs. Stipes 1.5-3.5 cm long , hairy. Frond 10-18*1.5-3 cm, lanceolate-oblong, bipinnatifid; pinnae close, slightly obliquely spreading, sometimes overlapping, ovate-oblong; pinnules linear with short, close, entire lobes; rachis broadly winged throughout and hairy underneath; texture thin and transparent, terminal pinnae sometimes very wooly. Veins free. Sori 1-3 to pinnae, terminal on the lower pinnae; indusium bivalve up to the base with ovate lips (Plate V).

Distribution: Common throughout W., C. and E. Nepal at mid altitude.

Habitat: Growing profusely on tree trunks and mossy rocks.

Fructification: June-Aug.

Voucher specimen: Daman, Risheswor mahadev, 2466m, Aug 28, 2012, S. Prajapati and S. Rajbhandary, 71(KATH).

Hymenophyllum polyanthus (Sw.) Sw., Schrad. J. Bot. **1800** (2): 102 (1800); Clarke: 436 (1880); Beddome: 30 (1883); Hope: 25 (1900); Iwatsuki: 250 (1988); Thapa: 9 (2000); DPR: 58 (2002)..

Trichomanes polyanthus Sw., Prodr. Fl. Ind. Occ.: 137 (1788).

Hymenophyllum tenellum D.Don, Prodr. Fl. Nepal.: 12 (1825)

Mecodium polyanthus (Sw.) Copel., Philip. J. Sci. **67**: 19 (1938); Iwatsuki: 457 (1966); Nakaike and Gurung: 194 (1988a)

Mecodium blumeanum (Spreng. in L.) Nayar and Kaur, Comp. Bedd Handb. Ferns Brit. India: 11 (1974).

Mecodium minor (Bedd.) S. Kaur and Subh. Chandra, Nomencl. Guide Bedd. Ferns South. India Brit. India: 74 (1987)

Mecodium osmundoides (Bosch) Ching, Fl. Reip. Pop. Sin. **2**: 147, t.10, f.7-11(1959)

Rhizomes creeping, glabrous. Fronds 6-12*1.3-2.8 cm, ovate or oblong. Stipes 1-6 cm long, glabrous, scarcely winged above. Leaf blade tripinnatifid, glabrous; pinnae obliquely spreading, cut down to a narrow crisped rachis into several pinnules on either side; ultimate lobes with entire margin and smooth; main rachis less winged to the base; texture thinly herbaceous. Veins free. Sori 6-14 to a pinna, terminal or axillary on the segments; lips of indusium about equal to the hollow basal part.

Distribution: Common throughout W., C. and E. Nepal at mid to high altitudes (1300- 3500m)

Habitat: Growing profusely on tree trunks and mossy rocks.

Fructification: June-Aug.

Voucher specimen: Simbhanjyang, 2454m, 20 Aug 2012, S. Prajapati and S. Rajbhandary, 22 (KATH)

Schizaeaceae Kaulf. (Climbing Ferns)

Terrestrial, climbers. Rhizome subterranean. Frond vinelike, of indeterminate growth. Stipes slender and twinning. Leaf blade dichotomously pinnate. Pinnae in a pair, placed oppositely on a raised rachis. Pinnules usually with an often dormant apical bud. Veins free or anastomosing. Sporangia in 2 rows, 1 on each side of midvein of contracted, oblong, marginal lobes of ultimate segments, covered by hoodlike flap of tissue serving as indusium. Spores tetrahedral-globose.

Lygodium Sw.

Terrestrial, climbers. Rhizomes creeping and hairy. Fronds of indeterminate growth, compound; Stipes slender and twinning. Fertile blade smaller than the sterile ones. Fertile ones fringed with short, narrow lobes; veins forked, usually free or uniting at their tips. Sporangia large, two rows on each lobe and each of them protected by false indusium formed by the reflexed edges of the lobes.

Key to the species

1.(a) Pinnule broad, 1.5-2 cm. *Lygodium flexuosum*

1.(b) Pinnule less broad, less than 1 cm..... *Lygodium japonicum*

Lygodium flexuosum (L.) Sw., Schrad. J. Bot. **1800** (2): 106 (1801); Clarke: 584 (1880); Beddome: 457, f. 283 (1883); Ito: 455 (1966); Iwatsuki: 170 (1975); DPR: 60 (2002).

Ophioglossum flexuosum L., Sp. Pl. **2**: 1663 (1753).

Rhizomes creeping. Frond dimorphic, glabrous, tri-quadripinnate, thin, pinnae opposite with a pair of pinnate pinnules placed alternately; fertile pinnules narrower than the sterile ones, all serrulate. Pinnules long, 1.5- 2cm broad. Veins obliquely ascending, once to thrice forked, ending in

marginal teeth. Sporangia arranged in two compact rows on margin underneath the ultimate pinnules.

Distribution: Abundant in W. C. & E Nepal at low to high altitudes (60- 2400 m).

Habitat: Terrestrial.

Fructification: June-Aug.

Voucher specimen: Naubise, 961m, June 21, 2013, S. Prajapati and S. Rajbhandary, 118 (KATH).

Lygodium japonicum (Thumb. in A. Murray) Sw., Schrad. J. Bot. **1800** (2):106 (1801); Clarke: 584 (1880); Beddome : 457 (1883); Hope : 106 (1903); Ito : 455 (1966); Chowdhury : 20 (1973); Iwatsuki : 170 (1975); Nakaike & Gurung : 194 (1988a); DPR: 60 (2002).

Ophioglossum japonicum Thunb. in A. Murray, Linnaeus Syst. Veg. ed.14: 926 (1784).

Rhizomes creeping. Frond sparsely hairy, tri-quadripinnate, thin, pinnae opposite with a pair of pinnate pinnules placed alternately; fertile pinnules narrower than the sterile ones; Pinnules long, 0.5- 1cm broad. Veins free forked and hairy. Sporangia arranged in two compact rows on margin underneath the ultimate pinnules.

Distribution: Abundant in W. C. & E Nepal at low to high altitudes (60-3850 m).

Habitat: Terrestrial.

Fructification: June-Aug

Voucher specimen: Naubise, 961m, June 21, 2013, S. Prajapati and S. Rajbhandary, 113(KATH).

Adiantaceae (C. Presl) Ching

Terrestrial. Rhizomes creeping or erect, protected by scales or hairs. Stipes usually glossy, glabrous or hairy. Frond pinnate, rarely simple, rather entire; costa and costules sometimes covered with fine scales. Sori typically marginal and protected by an indusium opening towards the margin or by a reflexed margin.

Adiantum L.

Terrestrial. Rhizomes short-creeping, sub erect, clothed with brown scales. Stipes erect, slender, scaly at the base and glabrous above, purplish, glossy. Frond simply pinnate to multipinnate, mostly glabrous, occasionally hairy, texture herbaceous or firm. Veins free. Sori marginal, globose to linear; indusium of same shape as the sorus, formed of the reflexed margin of the pinnae.

Key to the species

1.(a) Leaf blade hairy. *Adiantum incisum*

1.(b) Leaf blade glabrous. *Adiantum philippense*

Adiantum incisum Forssk., Fl. Aegypt. Arab.: 187 (1775); Pich. Serm., Webbia **12**: 669, f.6 (1957); Alston and Bonner: 201 (1956); DPR: 61 (2002).

Misapplied Name:

Adiantum caudatum sensu Bedd., Ferns South. India: t.2 (1863), 83, t.44 (1833), non L.

Rhizome short, thin, densely scaly; scales brown. Frond curled, 40-50*2-2.5 cm. Stipes 2-5 cm long, brown, hairy. Leaf blade pinnate, 40-45 cm long, herbaceous, pinnae scantily hairy, alternate, up to 35 pairs or more, varying in shape and size, shortly petiolate, dimidiate, lower margin slightly concave and upper margin convex, deeply lobed, rachis hairy. Veins numerous free, and forked. Sori indusiate, indusia light brown.

Distribution: Abundant in W., C. & E. Nepal, at low to mid altitudes.

Habitat: Terrestrial, commonly growing on rock crevices.

Fructification: June-Aug.

Voucher specimen: Palung, 949m, June 21, 2013, S. Prajapati and S. Rajbhandary, 119(KATH).

Adiantum philippense L., Sp. Pl. **2**: 1094 (1753); Tagawa: 79 (1955); Ching: 318 (1957); Ito: 459 (1966); Iwatsuki: 172 (1975); Nakaike & Gurung: 189 (1988 a); DPR: 62 (2002).

Adiantum lunulatum Burm. f., Fl. India: 235 (1768); Don: 16 (1825); Clarke: 452 (1880); Beddome: 82 (1883); Hope: 236 (1900).

Rhizomes short, clothed with light brown scales and hairs. Frond 8-26*4-7 cm, Stipes 5-15cm long, blackish-brown, glossy, sparsely scaly at the base. Leaf blade simply pinnate; pinnae alternate, 2-2.5*1-1.6 cm, petiolate, glabrous, semilunar shaped lower margin slightly oblique with the petiole, upper margin more or less lobed; texture herbaceous, rachis glabrous and glaucous. Veins prominent, free and forked. Sori brown, continuous all along the edge and protected by reflexed margin of the pinnae.

Distribution: Very common throughout W., C. & E. at low to upper mid altitudes (60-2400 m).

Habitat: Terrestrial, commonly growing on rock crevices, brick walls.

Fructification: June-Aug.

Voucher specimen: Damchaur, 1501m, Aug 29, 2012, S. Prajapati and S. Rajbhandary, 2(KATH).

Pteridaceae Ching (Maidenhair Fern Family)

Terrestrial or lithophytic. Rhizomes short creeping or erect, may be branched or unbranched, protected by scales or hairs. Frond monomorphic to dimorphic, circinate or noncircinate in bud, clustered or close together. Stipe usually glossy, glabrous or scaly or hairy proximally lacking spines. Leaf blade mostly pinnate, occasionally deltoid in form, decompose to simple, rather

entire. Veins free or anastomosing, costa with small appendages. Sori typically marginal and protected by the indusium opening towards the margin or by a reflexed margin or naked..

Key to the genera

- 1.(a) Indusia present..... (2)
- 1.(b) Indusia absent. (3)
- 2.(a) Leafblade with white farina on the abaxial surface..... *Pityrogramma*
- 2.(a) Leaf blade lacking white farina. *Coniogramme*
- 3.(a) Costules jointed *Cheilanthes*
- 3.(b) Costules free..... (4)
- 4.(a) Frond once pinnate..... *Pteris*
- 4.(a) Frond multipinnate..... *Onychium*

Cheilanthes Sw.

Terrestrial ferns. Rhizomes short creeping, sub erect scaly. Stipes slender, erect, purplish, glossy. Frond mostly clustered, small, pinnate to decompounds, hairy or scaly; texture sub-coriaceous. Veins free. Sori marginal, placed on the apex of the veins at first small, globose afterwards more or less confluent; indusium formed by the reflexed margin.

Key to the species

- 1.(a) Stipes tomentose. *Cheilanthes rufa*
- 1.(b) Stipes scaly. (2)
- 2.(a) Costa and costules scaly. *Cheilanthes dalhousiae*
- 2.(b) Costa and costules glabrous. (3)
- 3.(a) Scales restricted to stipe only, rachis glabrous. *Cheilanthes bicolor*
- 3.(b) Scales on both stipe and rachis. *Cheilanthes formosana*

Cheilanthes bicolor (Roxb. in Griff.) Griff. ex Fras.-Jenk., Pak. Syst.: **5** (1-2): 94(1991 publ. 1992), 144 (1993); DPR: 64 (2002).

Pteris bicolor Roxb. in Griff., Calc. J. Nat. Hist.: **4**: 507 (1844).

Aleuritopteris bicolor (Roxb. in Griff.) Kholia and Punetha, J. Indian Bot. Soc. **74**:185 (1995), *comb. inval.*

Aleuritopteris kathmanduensis Ching and S.K.Wu in C.Y.Wu, Acta Bot. Yunnan. **5** (2):167 (1983).

Misapplied Names:

Aleuritopteris pulveracea sensu Saiki, J. Phytogeogr. Taxon. **32** (2): 85 (1984); Nakaike *et al.* : 188 (1990), *non* (C. Presl) Fee.

Cheilanthes farinosa sensu auct. Ind., *non* (Forssk.) Kaulf.

Rhizome short, tufted, clothed with lanceolate scales. Frond deltate, pentagonal 15-25 cm long. Stipes very long, 8- 15 cm long, glossy, deciduously scaly. Leaf blade 8- 12*4- 8 cm, bipinnatifid, covered with whitish farina powder on the under surface; pinnae opposite, 16 to 22 pair or more, lowest pair very broad at the base with the lowest inferior pinnules much longer than the rest; rachis glabrous; texture herbaceous. Veins pinnate, costa and costules glabrous. Sori on the margins of the ultimate lobes; indusium irregularly cleft towards the margin.

Distribution: Abundant throughout W., C. and E. Nepal lower to upper mid altitudes (200-2200m).

Habitat: Terrestrial.

Fructification: June-Aug.

Voucher specimen: Gairigaun, Tistung, 1555m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 5 (KATH).

Cheilanthes dalhousiae Hook., Sp. Fil. **2**: 80, t.78b (1852); Fraser-Jenkins, Pak. Syst. **5** (1-2): 89 (1991 publ.1992); DPR: 65 (2002).

Cheilanthes albomarginata C.B.Clarke, Trans.Linn.Soc.Lond. II Bot. **1**:456, t. 52 (1880).

Cheilanthes farinosa var. *albomarginata* Bedd., Suppl. Ferns Brit.India: 22 (1892).

Aleuritopteris albomarginata (C.B.Clarke) Ching, Hong Kong Nat. **10**: 199 (1941); Nakaike *et al.*: 187 (1990).

Rhizomes tufted, clothed with ovate-lanceolate scales. Frond deltoid to deltoid-lanceolate 10-12 cm long. Stipes 4-5 cm long, glossy, deciduously scaly. Leaf blade 6-8*4-6 cm, bipinnatifid, covered with white farina powder on the under surface; pinnae upper ones lanceolate, pinnatifid, pinnae opposite, 8-10 pairs, lowest pair very broad at the base with the lowest inferior pinnules much longer than the rest and margin crenated; rachis sparsely scaly; texture herbaceous. Veins pinnate, costa and costules scaly. Sori on the margins of the ultimate lobes; indusium irregularly cleft towards the margin.

Distribution: Common in W., C. and E. Nepal at mid to higher altitudes (1500-2800m)

Habitat: Occurring on dry open rocky places

Fructification: June-Aug.

Voucher specimen: Daman, 2226m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 37(KATH).

Cheilanthes formosana Hayata in Matsum. and Hayata, Enum. Pl. Formos.: 612 (1906); Fraser-Jenkins: 73 (1977b); DPR: 65 (2002).

Cheilanthes anceps Blanf. var. *brevifrondis* Khullar and Mehra, Res. Bull. Punjab Univ. n.s. **23** (3-4); 189 (1972).

Cheilanthes anceps Blanf. Var. *brevifrons* Khullar, Amer. Fern J. **66** (1): 24 (1976).

Cheilanthes brevifrons (Khullar) Khullar, Indian Fern J. **1** (1-2): 90 (1984 publ. 1985).

Aleuritopteris formosana (Hayata) Tagawa, acta Phytotax. Geobot. **14**: 191 (1952).

Rhizomes short, erect, clothed with brown lanceolate scales. Frond bipinnate, 5-10*3- 4 cm, lanceolate-oblong lanceolate. Stipes 3–6 cm long, glossy, deciduously scaly. Leaf blade 6-8*3-4 cm, bipinnatifid, dark green, covered with white farina powder on the under surface; pinnae opposite, narrowly lanceolate 8-10 pairs, lowest pair very broad at the base with the lowest inferior pinnules much longer than the rest and margin crenated; rachis scaly; texture herbaceous. Veins pinnate, costa and costules glabrous. Sori on the margins of the ultimate lobes; indusium irregularly cleft towards the margin (Plate V).

Distribution: Very common at mid and upper mid altitudes (1400- 2400m) throughout W., C. and E. Nepal.

Habitat: Terrestrial.

Fructification: June- Nov.

Voucher specimen: Daman, 2258m, Nov 23, 2013, S. Prajapati and S. Rajbhandary, 109 (KATH).

Cheilanthes rufa D.Don, Prodr. Fl. Nepal.: 16 (1825); Clarke: 457 (1880); Beddome: 94 (1883); Hope: 247 (1900); Ito: 460 (1966); Gurung: 25 (1986); Iwatsuki: 267 (1988); DPR: 67 (2002).

Aleuritopteris rufa (D.Don) Ching, Hong Kong Nat. **10**: 200 (1941); Nakaike *et al.*: 188 (1990)

Rhizomes short creeping, clothed with linear, dark-brown scales. Frond 4-16 cm long, bipinnate, deltoid-lanceolate. Stipes tufted, 8-12 cm long, clothed with ferruginous, wooly tomentum. Leaf blade covered with waxy powder underneath; pinnae sub opposite to alternate, oblong, pinnatifid, the lowest pinnae becoming less developed, rachis wooly with hair like scales. Sori brownish, continuous along the margin; indusium ciliated, scarious.

Distribution: Common through out W., C. and E. Nepal at mid altitudes

Habitat: Occurring on dry open rocky places

Fructification: June-Aug.

Voucher specimen: Daman, Gairigaun, 1555m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 1 (KATH).

Coniogramme Fee

Terrestrial. Rhizomes creeping, clothed with brown scales. Frond large, pinnate to bipinnate. Stipes erect. Leaf blade with pinnae, entire or serrulate, glabrous; texture herbaceous or firm. Veins free or rarely anastomosing without included veinlets. Sori elongate along the veins except near the margins, exindusiate.

Coniogramme pubescens Hieron., Hedwigia **57**: 265- 328 (1916); Fraser- Jenkins: 89 (1997b); DPR: 69 (2002).

Coniogramme caudata (Wall. ex Ettingsh.) Ching in C.Chr. var. *nepalia* R.D.Dixit and A.Das, New Bot. **5**: 45-56 (1977).

Coniogramme spinulosa (Christ) Hieron., Hedwigia **57**:311 (1916).

Misapplied Name:

Coniogramme caudata sensu Ito: 460 (1966); Roy *et al.*: 194 (1971); Iwatsuki: 173 (1975); Dixit: 77 (1984); Gurung.: 27 (1986); Nakaike *et al.*: 189 (1990), *non* (C.Presl *ex* Ettingsh.) Ching.

Rhizome long creeping, thick, densely scaly; scale brown, lanceolate. Frond pinnate, 50-60*7-9 cm. Stipe straw-colored, longer than the leaf blade 30-35 cm long, 3-4 mm broad. Leaf blade pinnate, 2- pinnate at base, 20-25 cm long, brownish green, narrowly oblong or narrowly ovate, papery when dry, glabrous, Pinnae 2-4 pairs, stalked, opposite, petiolate, petiole 1-1.5 cm, base narrowly cuneate, margin serrate apex abruptly caudate to caudate-acuminate; terminal pairs of pinnae as basal ones but slightly reduced, shortly stalked. Veins distinct, free and forked. Sori extending from costa along the costules to the margins. Sori exindusiate, brown.

Distribution: Common in W.,C.and E. Nepal at upper mid altitude.

Habitat: Terrestrial, occurs in shady places.

Fructification: June-Nov.

Voucher specimen: Daman, Risheswor mahadev, 2326m, Nov 23, 2013, S. Prajapati and S. Rajbhandary, 109 (KATH).

Onychium Kaulf.

Terrestrial. Rhizomes creeping, clothed with brownish scales. Frond tripinnate to more compound. Stipes erect, more or less glabrous. Leaf blade rather finely dissected; pinnules small, narrow and glabrous; texture herbaceous. Veins free except at the tips. Sori placed on a continuous linear receptacles connected by the apices of several veins; indusial consisting of the reflexed margin of the segments and opening inwards.

Key to the species

- 1.(a) Stipes scaly only at the base; stipe straw coloured above and black at base.
.....*Onychium cryptogrammoides*
- 1.(b) Stipes scaleless; stipe reddish brown*Onychium siliculosum*

Onychium cryptogrammoides Christ, Not. Syst. (Paris) **1**: 52. 1909; Fraser-Jenkins: 145 (1993), Singh and Panigrahi, Pterid. Fl. Arunachal Prad. (1999); Thapa: 9(2000); DPR: 71 (2002).

Onychium japonicum (Thunb.) Kunze var. *intermedia* C.B.Clarke, Trans.Linn. Soc. Lond. II Bot 1: 459 (1880).

Misapplied Names:

Onychium contiguum sensu auct. Ind., non Wall. ex C. Hope

Onychium japonicum sensu Beddome: 96 (1883), *p.p., non* (Thunb.) Kunze.

Rhizomes long creeping; scales dark brown, lanceolate. Frond monomorphic, closely or widely spaced. Stipe 30-50cm long, 2-3 mm broad, straw-colored above and black at base. Blade ovate to ovate-deltoid or often broadly ovate, 20-30*10-26 cm, apex acuminate, finely 4-pinnate-pinnatifid, thinly papery when dry, green to grayish green. Lateral pinnae 10-14 pairs, basal pair largest. Veins forked. Sori 1-3 mm. False indusia linear to oblong, extending nearly to costa, entire.

Distribution: Common in W., C. and E. Nepal at upper mid to high altitude (2000- 3500m).

Habitat: Occurring on dry open rocky places.

Fructification: June-Aug.

Voucher specimen: Simbhanjyang, 2448m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 24(KATH).

Onychium siliculosum (Desv.) C.Chr., Ind. Fil.: 468 (1906); Ito: 464 (1966); Chowdhury: 37 (1973); Iwatsuki: 176 (1975); Dixit: 67 (1984); Nakaike and Gurung: 195 (1988a); Fraser- Jenkins: 317 (1997b); DPR: 71 (2002).

Pteris siliculosa Desv., Berl.Mag. 5:324 (1811)

Onychium auratum Kaulf., Enum. Fil.;14491824); Clarke: 458(1880); Beddome: 96, f.49 (1883); Hope:443 (1901)

Rhizomes short, erect, clothed with linear, dull brown scales. Frond 15-57*6-14cm. Stipes 9-26 cm long, stramineous, laterally grooved, glabrous throughout. Leaf blade quadripinnatifid, ovate-lanceolate; pinnae lower ones sub deltoid; pinnules numerous, mostly deltoid; ultimate division of the sterile frond more or less obovate or cuneate; rachis grooved and glabrous; texture subcoriaceous. Veins forked. Sori marginal, conspicuous and golden yellow; indusium papery reflexed margin.

Distribution: Very common throughout W.,C.and E. Nepal at lower to mid altitude.

Habitat: Occurring on dry open rocky places

Fructification: June-Aug.

Voucher specimen: Daman, naya gaun, 1999m, June 22, 2013, S. Prajapati and S. Rajbhandary, 123(KATH).

Pityrogramma Link

Terrestrial. Rhizomes short, ascending or erect, clothed with brown, linear or narrow, entire membranous scales. Stipes erect, dark purplish, plished, scaly at the base and naked above. Frond tufted, bi-pinnate, narrowly ovate, lower surface of the pinnae covered with the waxy powder; rachis grooved; texture herbaceous or subcoriaceous. Veins free. Sori placed along all length of the veins, exindusiate.

Pityrogramme calomelanos (L.) Link, Handb. Gew. **3**: 20 (1883); Ito: 454 (1996); Iwastuki: 176(1975); Nakaïke and Gurung: 195 (1988a); DPR: 72 (2002).

Acrostichum calomelanos L., Sp. Pl. **2**: 1072 (1753)

Rhizomes short, erect, stout, clothed with narrow, entire, membranous, light-brown, peltate based scales. Stipes usually tufted, 20-30 cm long, erect, dark purplish, glossy, scaly at the base, laterally grooved. Frond bipinnate, 35-60*7-16 cm, linear or narrowly oblong; pinnae 7-14 *2-3 cm, short petiole, sub opposite or alternate, linear- lanceolate, pinnatifid; pinnules oblique, narrowly deltoid, with toothed margin, lower surface covered with white waxy powder; rachis conspicuously grooved on the upper surface; texture subcoriaceous. Veins forked and free. Sori borne all along the veins, exindusiate.

Distribution: Abundant throughout W., C. & E. Nepal at low to upper mid altitudes (70-2000m).

Habitat: Terrestrial, growing mostly on rocky slopes.

Fructification: Aug-Sep.

Voucher specimen: Kulekhani, kalanki, 1596m, Sep 7, 2012, S. Prajapati and S. Rajbhandary, 88 (KATH).

Pteris L.

Terrestrial. Rhizome short, erect or creeping, scaly. Stipes erect. Frond tufted, pinnate, glabrous; rachis grooved; texture herbaceous or coriaceous. Veins free. Sori continuous along the margin; indusium formed by the reflexed margin of the pinnae or segments.

Key to the species

- 1.(a) Veins fusing to form series of areoles along costa and costules. (2)
- 1.(a) Veins free, not forming areoles..... (3)
- 2.(a) Leaf blade pinnate, basal pair of pinnae, each with basioscopic pinnule forming a pinnae.*Pteris biaurita*
- 2.(a) Leaf blade divided into distinct branch, without basioscopic pinnule.....*Pteris wallichiana*
- 3.(a) Costa without spines. (4)
- 3.(b) Costa with spines. (5)

- 4.(a) Lateral pinnae forked or basiscopically branched. *Pteris cretica*
 4.(b) Lateral pinnae not forked. *Pteris vittata*
 5.(a) Apex mucronate.*Pteris aspercaulis*
 5.(a) Apex not mucronate.*Pteris puberula*

Pteris aspericaulis Wall. ex Agardh, Rec. Sp. Gen. Pteridis: 22 (1839); Iwatsuki: 176 (1975); Dixit: 276 (1984); Gurung: 38 (1986); Nakaike *et al.*:195 (1990); Fraser Jenkins: 317 (1997b); DPR: 71 (2002).

Pteris quadriaurita Retz., var. *aspercaulis* (Wall. ex J. Agardh) Bedd. Handb. Ferns Brit. India: 111 (1883).

Pteris pseudoquadriaurita Khullar, An Illust. Fern Fl. W. Himal. 1: 285(1994).

Rhizomes short creeping, stout, clothed densely with linear, deep brown scales. Frond 23-50*11-30cm, with ovate-lanceolate. Stipes erect 23-40cm long, reddish or pinkish in colour, asperous, rather glabrous, and glossy, rigid. Leaf blade bipinnatiparted pinnae; pinnae up to 13 in pairs, opposite, lanceolate, subsessile or sessile, sparsely spreading; pinnules numerous, spreading, linear-oblong, apex mucronate; rachis, costa and costules reddish or pinkish and asperous with minute tooth at the junction of the costa and costule of each pinnules; texture sub coriaceous. Veins conspicuous, once forked. Sori marginal, mostly partial on the segments rarely continued up to the apex; protected by membranous, reflexed margin of the ultimate segment.

Distribution: Common at mid to higher altitude (1400- 2600m) in W., C. and E. Nepal.

Habitat: Terrestrial.

Fructification: June-Aug.

Voucher specimen: Simbhanjyang, 2437m, Aug 27, 2012, S. Prajapati and S. Rajbhandary, 65(KATH).

Pteris biaurita L., Sp. Pl. 2: 1076 (1753); Clarke: 469 (1880); Hope: 455 (1901); Ito: 465 (1966); Iwatsuki: 177 9(1975); Gurung:39 (1986); Nakaike *et al.*: 195 (1990); DPR: 73 (2002).

Pteris pectinata D.Don. Prodr. Fl. Nepal.:15 (1825).

Pteris nemoralis Willd., Enum. Pl.: 1073 (1890); Alston and Bonner, Candolle **15**: 202 (1956).

Campteria biaurita (L.) Hook., Gen. Fil.: t.65a(1841); Beddome: 116 (1883).

Rhizomes short, stout, clothed scales. Frond large, 15-35*8-12 cm. Stipes 12-15 cm long, glabrous. Leaf blades ovate-lanceolate, 18-20 cm long, basal pair of pinnae often with 1 or 2 basiscopic pinnules similar to main part of pinna, pinnae opposite, with 3pair of lateral pinnae, above which a pinnae is reduced much more in length than the rest of pinnae distally; pinnae sessile, falcate, texture more or less coriaceous. Veins fusing to form series of areoles along costa and costules.

Sori running partially along the margin of the pinnules, rarely continued to the tip, and by covered reflexed margin.

Distribution: Abundant throughout W.,C.and E. Nepal at low to upper mid altitudes (70-2000 m).

Habitat: Terrestrial, growing on shady moist parts of the forest.

Frutification: June-Aug.

Voucher specimen: Kulekhani, kalanki, 1596m, Sep 7, 2012, S. Prajapati and S. Rajbhandary, 90 (KATH).

Pteris cretica L., Mant. Pl.: 130 (1771); D.Don: 15 (1825); Clarke: 462 (1880); Beddome: 106 (1883); Hope: 449 (1901); Tagawa: 78 (1955); Iwatsuki: 177 (1975); Roy *et al.*: 194 (71); Gurung: 39 (1986); Nakaike *et al.*: 196 (1990); DPR: 73 (2002).

Pteris nervosa Thunb., Fl. Jap.: 332 (1784); Ching and S.K.Wu in C.Y.Wu, Fl. Xizangica 1: 68 (1983).

Rhizomes short-creeping or suberect, clothed with deep-brown, scales. Frond once pinnate, 16-36*4-18 cm. Stipes tufted, erect, 14-25 cm long. Leaf blade glabrous with 2-5 pairs of pinnae, simple, sessile, some of the lower forked or basiscopically brached, sterile ones broadly linear-lanceolate, serrated with white teeth, fertile ones linear with serrated and pointed apex; rachis glabrous; texture herbaceous. Veins once forked and free, costa without spines. Sori linear, running continuously all along the margin except the apex, protected by the reflexed margin.

Distribution: Abundant throughout W.,C. & E. Nepal at mid to higher altitudes (1300-3000 m).

Habitat: Terrestrial, commonly growing on shady moist or exposed dry places.

Frutification: June-Aug.

Voucher specimen: Palung, 2197m, Aug 28, 2012, S. Prajapati and S. Rajbhandary, 79 (KATH).

Pteris puberula Ching, Bull. Fan Mem. Inst. Biol., Bot. 11: 52 (1941); Ching and S.K.Wu in C.Y.Wu, Fl. Xizangica 1: 71, t.18, f.5-8 (1983); Iwatsuki: 276 (1988); Fraser-Jenkins: 225 (1997b); Thapa: 9 (2000); DPR: 74(2002).

Pteris nepalensis H.Ito in Hara, Fl. East. Himal.: 466, t.26 (1966); Iwatsuki: 177 (1975).

Rhizome erect, short, clothed with brown scales. Frond clustered, ovate in outline. Stipe brown shiny, 17-40 cm, 2-3 mm in diameter, glabrous. Leaf blade 2- or 3-pinnatipartite, 30-44*22-27 cm ; lateral pinnae 5-7 pairs, broadly lanceolate opposite, basal pair shortly stalked, remaining subsessile to sessile towards distal side, 14-19*3.2-4.5 cm, apex acuminate, basal pair of pinnae often with 1 or 2 basiscopic pinnules similar to main part of pinna but smaller; pinnules 25-30 pairs in a pinnae, alternate or subopposite broadly linear, base conspicuously expanded, margin entire, apex obtuse; rachis similar in color as stipe. Vein free, costa prominent abaxially, light straw-colored, slightly lustrous, sparsely gray strigose, with soft flat spines along grooves adaxially, veins

conspicuous on both sides, costules forked once or twice. Sori running partially along the margin of the pinnules, rarely continued to the tip, and by covered reflexed margin.

Distribution: Fairly common in W., and C. Nepal but very common in E. Nepal at upper mid to high altitude (2000-3500m).

Habitat: Occurring on dry open rocky places.

Fructification: Aug- Nov.

Voucher specimen: Simbhanjyang, 2409m, Nov 23, 2012, S. Prajapati and S. Rajbhandary, 106 (KATH).

Pteris vittata L., Sp.Pl. 2: 1074 (1753); Ito: 467 (1966); Iwatsuki: 178 (1975); Roy *et al.* 10: 194 (1971); Gurung: 42 (1986); Nakaike *et al.*: 196 (1990); DPR: 76 (2002).

Misapplied Name:

Pteris longifolia sensu D.Don, Prodr. Fl. Nepal.: 15 (1825), Clarke: 461 (1880); Beddome: 106, f.55 (1883); Hope: 148 (1900), *non* L.

Rhizomes short, stout, densely covered with scales. Frond once pinnate 40-70*14- 36 cm. Stipes tufted, erect, 10-25 cm long. Leaf blade with 10 or more pairs of pinnae, lanceolate: pinnae simple, subopposite or alternate, sessile, linear, pointed apex with truncate base and none of the lower pinnae divided or pinnatifid; but gradually shorter; rachis scaly; texture subcoriaceous. Veins once forked and free. Sori linear, running all along the margin leaving the apical portion; indusium membranous reflexed margin of the pinnae.

Distribution: Abundant throughout W., C. and E. Nepal at low to upper mid altitudes (60- 2100m)

Habitat: Occurring on dry open rocky places

Fructification: June-Sep.

Voucher specimen: Kulekhani, kalanki, 1596m, Sep 7, 2012, S. Prajapati and S. Rajbhandary, 91 (KATH).

Pteris wallichiana Agardh, Rec. Sp. Gen. Pteridis. 69 (1839); Clarke: 469 (1880); Hope: 456 (1901); Ito: 467 (1966); Iwatsuki: 178 (1975); Dixit: 73 (1984); Gurung: 194 (1986); Matsumoto and Nakaike: 165 (1990) DPR : 76 (2002).

Campteria wallichiana (J.Agardh) T.Moore, Ind. Fil.: 221 (1861); Beddome: 118 (1883).

Rhizomes short-creeping, stout, clothed with lanceolate, bright-brown, membranous scales. Frond much large, divided into 3 branches of which 2 lateral branches further once; large pinnae. Stipes erect, strong, 30-80 cm long, purplish or deep-brown, grooved underside, glabrous and glossy. Leaf blade 50-65 cm long, glabrous, pinnae numerous, subopposite, linear-lanceolate, deeply pinnatifid; pinnules linear lanceolate, obtuse, sterile ones with sparsely serrulate margin; rachis, costa and costules smooth and glossy; texture membranaceous. Veins fusing to form series of areoles along

costa and costules. Sori linear, running along the margin of the segments except the apical parts and protected by pale and papery, reflexed margin.

Distribution: Abundant throughout W., C. & E. Nepal at mid to higher altitudes (850-3000m).

Habitat: Terrestrial, profusely occurring on shady and exposed areas of the forest floor.

Frutification: June-Aug.

Voucher specimen: Simbhanjyang, 2454m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 11 (KATH).

Vittariaceae (C. Presl) Ching

Epiphytic rarely terrestrial. Rhizomes creeping to sub-erect, covered with clathrate scales, roots abundant, covered with brown hairs. Frond simple, entire or rarely notched at the apex, elongated to linear, glabrous, petioles indistinct. Veins anastomosing on each side of costa in row of long, polygonal areole without without free included veinlets. Sori elongate along veins, intramarginal/submarginal groove on each side of costa. Indusia absent, sporangia interspersed with branched soral paraphyses.

Vittaria J.Sm.

Epiphytic ferns. Rhizomes short creeping, clothed with dark-brown, narrowly linear, scales. Frond adherent to the caudex, crowded, narrowly linear, entire, glabrous and costate. Veins forming a single row of the areole between the costa and the submarginal fertile vein. Sori continuous along the fertile vein and intramarginal.

Vittaria taeniophylla Copel., Philip. J. Sci. **1** Suppl. II: 157 (1906); Ito: 500 (1966); Dixit: 82 (1984); Nakaike *et al.*: 197 (1990); Thapa: 10 (2000); DPR: 79 (2002).

? *Vittaria revolute* D.Don, Prodr. Fl. Nepal.: 15 (1825), *non* Willd. ex Kaulf. (1824)

Misapplied names:

Vittaria himalayensis sensu Tagawa: 81 (1955); Ito: 220 (1971), *p.p.*, *non* Ching.

Vittaria mediosora sensu Ito: 500 (1966), *non* Hayata.

Vittaria elongata sensu Gurung: 110 (1986), *non* Sw.

Rhizomes short creeping, clothed with linear- lanceolate shiny brown scales. Frond simple, linear and densely densely crowded. Stipes tufted with linear scales. Leaf blade 15- 35*3-4 cm, lustrous, flexuose, narrowed gradually downwards, margin reflexed; texture thick and firm. Costa never raised on the upper surface, but strongly raised beneath; veins simple, immersed and parallel. Sori immersed in intramarginal groove, and more or less protected by the reflexed margin.

Distribution: Common throughout uppermid to high altitudes (2000-3500m).

Habitat: Epiphytic on mossy tree trunks of quercus

Fructification: June -Aug.

Voucher specimen: Simbhanjyang, 2454m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 21(KATH).

Dennstaedtiaceae Pich. Serm.

Plants perennial and terrestrial. rhizomes creeping, hairy. Frond monomorphic, circinate in bud. Stipes long, erect, not articulate. Frond rather large, pinnately decomposed, glabrous or pubescent; pinnules oblique and pubescent. Veins free. Sori typically marginal and placed usually in the sinuses at the ends of the veinlets; indusium fused with a minute tooth of the frond to form an entire or slightly bivalve, sometimes deflexed cup. Spores not green.

Key to the genera

1.(a) True indusium present *Dennstaedtia*

1.(b) Indusium formed by reflexed margin of pinnule lobes..... *Pteridium*

Dennstaedtia Bernh.

Terrestrial often forming colonies. Rhizomes creeping, hairy. Frond large, ovate to lanceolate to deltate. Stipes long, erect. Leaf blade pinnately decomposed, glabrous or pubescent; pinnules oblique and pubescent, rachis without prickles. Pinnae pinnately divided, pinnules ovate to lanceolate, margins dentate or lobed. Veins free, pinnately branched. Sori marginal at vein tips, distinct, round or cylindrical; indusia formed by fusion of true indusium and minute blade tooth to form circular or slightly 2-valvate cup.

Key to the species

1.(a) Rachis scabrous, pinnules pinnatifid into oblong- deltoid lobes... *Dennstaedtia scabra*

1.(b) Rachis not scabrous, pinnules pinnatifid into linear lobes.. *Dennstaedtia appendiculata*

Dennstaedtia appendiculata (Wall. ex Hook.) J. Sm., Hist. Fil.: 265 (1875); Beddome: 26, f.15 (1883); Ito: 462 (1966); Iwatsuki: 174 (1975); DPR: 80 (2002).

Dicksonia appendiculata Wall. ex Hook., Sp. Fil. 1:79 (1844); Clarke: 436 (1880); Hope: 29 (1900).

Emodipteris appendiculata (Wall. ex Hook.) Ching and S.K. Wu in Ching, Acta Phytotax. Sin. 16 (4): 21 (1978); Nakaike and Gurung: 193 (1988a).

Emodipteris elwesii (Beddome) Ching and S.K. Wu in C.Y. Wu, Fl. Xizangica 1 : 58 (1983).

Rhizomes creeping, clothed densely with fine hairs. Frond 32-65*11-24 cm. Stipes 15-60 cm long, densely hairy, conspicuously ribbed. Leaf blade lanceolate, bipinnate; pinnae 7.5-14*1.6-2.3 cm, closely placed, opposite, linear- lanceolate, oblique to main rachis; pinnules pinnatifid into numerous linear lobes, under surface glandulosely pilose; main rachis not scabrous and non-waxy,

texture herbaceous. Veins free. Sori 2- 12 to a pinnule, placed at the base of the sinuses, indusium cup shaped, persistent.

Distribution: Common in W., C. & E. at mid to higher altitudes (1500-3000 m).

Habitat: Terrestrial, found on shady and also on open places.

Fructification: June-Aug.

Voucher specimen: Simbhanjyang, 2467m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 29(KATH).

Dennstaedtia scabra (Wall. ex Hook.) T.Moore, Ind. Fil.: 307 (1861); Beddome 24, f.12 (1883); Ito: 462 (1966); Iwatsuki: 174 (1975); Nakaike and Gurung: 192 (1988a); Thapa: 10 (2000); DPR: 80 (2002).

Dicksonia scabra Wall ex Hook., Sp.Fil. 1:80 (1844); Clarke: 436 (1880); Hope: 28 (1900).

Dennstaedtia deltoidea Bedd., Ferns South. India: t.258 (1863)

Rhizomes long creeping, villous. Frond large, deltoid or ovate 30- 45*11- 22cm. Stipes erect, 25- 40 cm long, reddish-brown, with fine spreading hairs, rather dense at the base, grooved on the upper side. Leaf blade bi-tripinnate, under surface with scattered glistening hairs; pinnae ovate - lanceolate, short petiolate; pinnules sessile, pinnatifid into oblong-deltoid lobes; main rachis scabrous and often waxy. Veins free. Sori terminal on the veinlet of the ultimate lobe; indusium cup shaped, slightly cleft at the top.

Distribution: E. Himalaya, W. China; in Nepal, common in W., C. & E. at mid to higher altitudes (1500-3000 m).

Habitat: Terrestrial, found on shady and also on open places.

Fructification: June-Aug.

Voucher specimen: Aghor bazaar, 1844m, June 26, 2013, S. Prajapati and S. Rajbhandary, 139 (KATH).

Pteridium Gled. ex Scopoli

Typically terrestrial. Rhizomes long creeping, strong and stout, clothed with fine hairs. Fronds large with long continued growth, tripinnate- quadripinnatifid. Stipes erect, dull-brown, hairy at the base and glabrous above. Leaf blade densely hairy on the lower surface rather nearly glabrous above; rachis, costa and costules grooved on the upper surface; texture sub coriaceous. Veins forked and free. Sori marginal, and linear, continuous along the margin, protected by double indusium, the thin one formed by the reflexed margin of the ultimate lobe and the thinner one attached below the receptacle.

Pteridium revolutum (Bl.) Nakai, Bot. Mag. Tokyo **39**: 176-203 (1925); Brownsey, Austral. Syst. Bot. **2** (1): 113- 128 (1989); Fraser-Jenkins: 216- 222 (1997b); Thapa: 10 (2000); DPR: 83 (2002).

Misapplied Names:

Pteris aquilina sensu Clarke: 468 (1880); Beddome: 115 (1883), *non* L.

Pteridium aquilinum sensu auct. *Ind.*, *non* (L.) Kuhn.

Pteridium aquilinum var. *wightianum* sensu Ito: 465 (1966); Iwatsuki: 176 (1975); Nakaike *et al.*: 195 (1990), *non* (Wall. ex J.Agardh) R.M.Tryon.

Rhizomes creeping, woody, clothed with fine , pale brown hairs. Frond large, with long continued growth. Stipes erect, 20-58 cm long, dark-brown , stout, covered with dirty- brown, fine hairs at the base and more or less glabrous above. Leaf blade tripinnate-quadripinnatifid, 25-100*24-60 cm, densely hairy underneath; pinnae the lowest pair larger than the rest with oblong pinnules; ultimate lobes small and narrow; rachis, costa and costules grooved on the upper surface; texture subcoriaceous. Veins forked, free and raised beneath, usually hairy. Sori marginal, linear or continuous along the margin, indusium membranaous, formed by the reflexed margin of the ultimate lobe.

Distribution: Abundant throughout W., C. and E. Nepal at lower mid ti higher altitudes (800-3400m)

Habitat: Terrestrial, thicket forming.

Fructification: June-Aug.

Voucher specimen: Daman, 2235m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 35 (KATH).

Lindsaeaceae Pich.Serm.

Terrestrial as well as lithophytic ferns. Rhizomes short creeping, slender, covered with stiff, narrow brownish scales. Frond simple pinnate to tripinnate to quadripinnatifid Stipes erect , slender, grooved on the adaxial surface. Leaf blade glabrous rachis grooved on the upper surface; texture herbaceous. Veins mostly free, forked once or twice, sometimes anastomosing with a series of narrow areoles. Sori marginal or sub-marginal, linear, placed on the apex of two or more veinlets of the pinnules. Indusium generally cup shaped or borne as a narrow flap attached along the base of te receptacle opening exteriorly.

Key to the genera

1.(a) Frond unipinnate. *Lindsaea*

1.(b) Frond tripinnate to quadripinnatifid. *Sphenomeris*

Lindsaea Dry.

Terrestrial as well as epiphytic ferns. Rhizomes short creeping, slender, covered with stiff, narrow brownish scales. Frond simple unipinnate Stipes erect , slender, grooved on the adaxial surface. Leaf blade glabrous rachis grooved on the upper surface; texture herbaceous; veins mostly free, sometimes anastomosing with a series of narrow areoles. Sori sub-marginal, linear, placed on the apex of two or more veinlets; indusium a narrow flap attached along the base of the receptacle opening exteriorly.

Lindsaea odorata Roxb. in Griff., Calc. J. Nat. Hist. **4**: 511(1844); Kramer, Gard. Bull. Sing. **26**: 40 (1972); Iwatsuki: 175 (1975); Nakaike and Gurung: 194 (1988a); DPR: 84 (2002).

Lindsaea odorata Roxb. var. *darjeelingensis* T.Sen and U. Sen, Amer. Fern J. **61**: 14, f.1-8 (1971).

Misapplied Name:

Lindsaea cultrata sensu Clarke: 45 (1880); Beddome: 72, f.36 (1883); Ito: 463 (1966), *non* (Willd.) Sw.

Rhizomes short creeping, clothed with narrow, hair-like, brown scales. Frond simply pinnate, 12-18*1-2 cm. Stipes 3-5cm long, slender, erect, glabrous and glossy. Leaf blade linear-lanceolate; pinnae distant, basal ones larger, the upper ones gradually reduced, half crescent shaped, with upper margin shallowly lobed; texture thinly herbaceous. Veins free forked or simple, 1-2 veins anastomosing towards the upper margin of the pinnae. Sori on the anterior margin of the pinnae and placed terminal to the veins; indusium firm, with thin and uni sparsely irregular margin.

Distribution: Common in C. and E. Nepal at mid to high altitude (1400- 3600m).

Habitat: Terrestrial, growing profusely on shady moist parts of the forest and along streams.

Fructification: June-Aug.

Voucher specimen: Daman, 1917m, 20 Aug 2012, S. Prajapati and S. Rajbhandary, 53 (KATH)

Sphenomeris Maxon

Terrestrial ferns. Rhizomes short - creeping, clothed with deep - brown , hair like scales. Frond tripinnate to quadripinnatifid with cuneate ultimate pinnules. Stipes erect, grooved on the adaxial surface. Leaf blade glabrous, rachis grooved; texture herbaceous. Veins free, forked once or twice. Sori marginal and placed terminally on the veins of the ultimate segments; indusium cup shaped.

Sphenomeris chinensis (L.) Maxon, J. Wash. Acad. Sci. **3**: 144 (1913); Kramer, Gard. Bull. Sing. **26**: 4 (1972); Iwatsuki: 178 (1975); Nakaike and Gurung: 196 (1988a); DPR: 84 (2002).

Trichomanes chinensis L., Sp. Pl. **2**: 1099 (1753).

Hymenophyllum ramosissimum Ham. ex D.Don., Prodr. Fl. Nepal.: 12 (1825)

Davallia chinensis (L.) Sm., Mem. Ac. Turin **5**: 414 (1793); Clarke: 449(1880).

Davallia tenuifolia (Lam.) Sw., Schrad. J. Bot. **1880** (2): 88 (1801)

Stenoloma chinensis (L.) Bedd., Handb. Ferns Brit. India: 70, f.34 (1883).

Sphenomeris chusana (L.) Copel., Bull. Bishop Mus. **59**: 69 (1929); Ito: 467 (1966).

Adiantum tenuifolium Lam., Encycl. Bot. **1**:44 (1783).

Rhizomes short creeping, clothed with deep brown, stiff, hair like scales. Frond tripinnate to quadripinnatifid, 9-42*3.5- 13 cm. Stipes erect, mostly tufted, 7-34 cm long, brownish, grooved on the adaxial sides. Leaf blade rather smooth. lanceolate to ovate; pinnate alternate, short stalked, oblique, deltoid, 3-13*2-7cm; pinnules numerous, oblique, gradually growing wider from the base to the apex; ultimate segments cuneate, and the larger ones mostly shallowly lobed, both on the surfaces naked; the upper surface glossy; rachis grooved underneath ; texture rather herbaceous. Veins mostly 2- 3 in each ultimate segments. Sori marginal, broader than long, placed terminally either on a single vein or on fusion of more veins, covering the entire upper margin; indusium attached by the base and shortly by the sides living the rest part free, and finely toothed at the top.

Distribution: Abundant throughout W.C. and E. Nepal at low to upper mid altitude (200- 2000m).

Habitat: Terrestrial, growing profusely on rocky areas.

Fructification: June-Aug.

Voucher specimen: Daman, 1917m, 20 Aug 2012, S. Prajapati and S. Rajbhandary, 56 (KATH).

Aspleniaceae Mett. ex Frank (Spleenwort Family)

Terrestrial, lithophytic and epiphytic ferns. Rhizomes creeping to suberect, covered with dark-brown clathrate scales. Leaves monomorphic. Stipes non-articulate. Frond simple to decomposed, small to large; texture usually firm; commonly with tiny glandular hairs and a few linear scales, rarely with spreading hairs. Veins forked, free or anastomosing without included veinlets. Sori elongate along the veinlets; indusium membranous, attached to the veinlets rarely exindusiate. Sporangia with stalk of 1 row of cells, annulus vertical, interrupted by sporangial stalk. Spores monoletic; perispore typically winged, spiny, reticulate, or perforate.

Asplenium L.

Terrestrial or epiphytic. Rhizomes mostly short-creeping or erect, clothed with dark, linear-lanceolate, clathrate scales. Frond simple and entire to pinnate or decomposed. Stipes not jointed. Leaf blade glabrous or sparsely scaly. Veins usually forked, free or anastomosing. Sori dorsal or submarginal, linear to oblong along one side of the veins; indusium attached along the veins and opening towards the costa of the leaflet.

Key to the species

- 1.(a) Leaf blade simple, entire margin. *Asplenium ensiforme*
- 1.(b) Leaf blade compound. (2)
- 2.(a) Leaf simply pinnate. *Asplenium yoshinaga*

2.(a) Leaf bipinnatifid. *Asplenium laciniatum*

Asplenium ensiforme Wall. ex Hook. and Grev., Ic. Fil. **1**: t.71 (1828); Clarke: 476 (1880); Beddome: 141, f.71 (1883); Hope: 460 (1901); Sledge: 242 (1965); Ito: 487 (1966); Iwatsuki: 194 (1975). Nakaike and Gurung: 189 (1988a); Thapa: 15 (2000); DPR: 85 (2002).

Rhizomes creeping, slender, clothed with blackish brown, membranous, lanceolate, scales. Frond simple, 15-25*1-1.5 cm. Stipes 2-3 cm long, erect, scaly at the base and naked above. Leaf blade lanceolate - linear, margin entire, apex acuminate; texture coriaceous. Veins immersed and indistinct. Sori broadly linear, in two oblique rows in between the costa and the margin; indusium membranous and curved back in mature. Sori elongated, brown.

Distribution: Common throughout W., C. & E. at lower mid to higher altitudes (1250-3050 m).

Habitat: Terrestrial on mossy rock.

Fructification: June-Aug.

Voucher specimen: Simbhanjyang, 1917m, Aug 27, 2012, S. Prajapati and S. Rajbhandary, 63 (KATH).

Asplenium laciniatum D. Don, Prodr. Fl. Nepal.: 8 (1825); Clarke: 481 (1880); Beddome: 154 (1883), *p.p.*; Ito: 488 (1966); Iwatsuki: 194 (1975); DPR: 86 (2002).

Asplenium varians Wall. ex Hook. and Grev., Ic. Fil.: t.172 (1829); Clarke: 485 (1880); Beddome: 158 (1883); Hope: 667, t.20 (1901); Sledge: 272 (1965); Ito: 489 (1966); Iwatsuki: 195 (1975); Nakaike and Gurung: 190 (1988a).

Rhizome short, erect, densely covered with blackish scales. Frond compound. Stipe very short 2-3cm long. Leaf blade bipinnatifid; pinnae numerous, shortly petiolate, opposite, distant, linear-lanceolate in shape, texture sub-coriaceous. Veins forked, one veinlet to each lobe. Sori obliquely placed along the veins, indusium light brown, persistent.

Distribution: Fairly common throughout W., C. & E. at mid to higher altitudes (1700-2900 m).

Habitat: Terrestrial, commonly grows on wall

Fructification: June-Sep.

Voucher specimen: Fakhel, 1791m, Sep 7, 2012, S. Prajapati and S. Rajbhandary, 92 (KATH).

Asplenium yoshinage Makino subsp. *indicum* (Sledge) Fras.-Jenk., Pak. Syst. **5**: 85-120 (1991 publ. 1992); Fraser-Jenkins: 324 (1997 b); DPR: 89 (2002).

Asplenium planicaule Wall. ex Mett. Asplen. Tonkin: 157 (1859); Hope: 659 (1901), *non* Lowe (1858).

Asplenium indicum Sledge, Bull. Brit. Mus. Nat. Hist. (Bot.) **3**: 264 (1965); Ito: 487 (1966).

Asplenium laciniatum D. Don var. *planicaule* Bedd., Handb. Ferns Brit. India: 482 (1883).

Asplenium yoshinage var. *planicaule* (C.B. Clarke) C.V. Morton.

Rhizomes erect, stout and strong, covered with dark-brown, lanceolate scales. Frond compound, 10-40 cm long, lanceolate. Stipes 2-10 cm long. Leaf blade simply pinnate, pinnae numerous, shortly petiolate, subopposite to alternate, upper base deeply and lower base narrowly incised into cuneate segments; rachis scaly; texture coriaceous. Veins free. Sori elongate, more or less reaching the margin; indusium conspicuous.

Distribution: Common throughout W., C. & E. at lower mid to higher altitudes (1000-2500 m).

Habitat: Terrestrial and epiphytic on tree trunks and mossy rocks.

Fructification: June-Aug.

Voucher specimen: Daman, 1917m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 50 (KATH).

Thelypteridaceae Pich.Serm. (Marsh Fern Family)

Terrestrial. Rhizome creeping to erect, scaly at apex. Frond monomorphic or somewhat dimorphic. Petiole in cross section with 2 crescent-shaped vascular bundles at base united to form a single U shaped one. Blade pinnate to pinnate-pinnatifid, rarely more than 2-pinnate rachis grooved adaxially or not. Veins free or anastomosing, running to margin, areoles with or without included free veinlets. Sori inframedial to supramedial, occasionally nearly marginal, round or oblong, rarely elongate along veins; indusia reniform or sometimes absent.

Key to the genera

- 1.(a) Indusium present.*Thelypteris*
1.(b) Indusium absent. *Pseudophegopteris*

Pseudophegopteris Ching

Rhizomes erect short or long creeping, clothed with brown scales. Frond generally bipinnatifid, lanceolate with short hairs. Stipes erect, brown. Leaf blade with numerous pinnae; pinnae opposite, costa not grooved, texture herbaceous. Veins forked. Sori sub globose or globose, dorsal or on the veinlet; indusium absent.

Pseudophegopteris pyrrhorhachis (Kunze) Ching, Acta Phytotax. Sin. **8**: 313 (1963); Holttum, Blumea **17**: 24 (1969); Dixit: 113 (1984); Nakaike and Gurung: 196 (1988a).

? *Polypodium pyrrhorhachis* Kunze, Linnaea **24**: 257 (1851), *s.l*

Pseudophegopteris pyrrhorhachis (Kunze) Ching.

? *Thelypteris pyrrhorhachis* (Kunze) Nayar and Kaur, Comp. Bedd. Handb. Ferns Brit. India: 72 (1974, *comb. inval.*; Iwatsuki: 304 (1988).

Macrothelypteris pallida (Ching) Pich.Serm., Webbia **24**: 71 (1970).

Pseudophegopteris pallida (Ching) Ching, Acta Phytotax. Sin. **8**: 315 (1963).

Lastrea microstegia Bedd., Ferns Brit. India: t.39 (1865).

Pseudophegopteris microstegia (Hook.) Ching, Fl. Xizangica **1**: 162 (1983).

Rhizomes suberect and short or long creeping. Fronds large, clustered or distant on rhizome. Stipes long, brownish. Leaf blade oblong-lanceolate, bipinnate pinnatifid, acuminate at apices, opposite, sessile, spreading. Veins conspicuous, raised and forked. Sori exindusiate, yellow to brown in colour.

Key to the subspecies

1.(a) Rhizomes suberect and short creeping, fronds clustered..... *Pseudophegopteris pyrrhorhachis* subsp. *distans*

1.(b) Rhizomes long creeping, fronds distant on rhizome..... *Pseudophegopteris pyrrhorhachis* subsp. *laterepens*

Pseudophegopteris pyrrhorhachis subsp. **distans** Fras.-Jenk., New Sp.Syndrome etc.: 6, 213 (1997); DPR: 91 (2002).

Phegopteris distans Mett., Abh. Senck. Naturf. Ges. (Frankfurt) **2** (4):16 (1858).

Polypodium distans D.Don, Prodr. Fl. Nepal.: (1825), *nom. illeg, non* Kaulf. (1824).

Rhizomes suberect and short creeping. Fronds clustered. Stipes 20-45 cm, brownish and glabrous. Leaf blade oblong-lanceolate, 40-80*13-25 cm, bipinnate pinnatifid, acuminate at apices; pinnae opposite, sessile, spreading; ; pinnules opposite to subopposite. Veins conspicuous, raised on both sides and forked, 8-12 pairs of veinlets per segment. Abaxial sides with acicular hairs, adaxially sparsely setaceous along costa. Sori exindusiate, yellow to brown in colour.

Distribution: Scattered in W., common in C. and E. Nepal at low to mid altitudes (1700-3500m).

Habitat: Terrestrial

Fructification: Aug- Nov

Voucher specimen: Shikharkot, 1830m, Nov 23, 2013, S. Prajapati and S. Rajbhandary, 112 (KATH).

Pseudophegopteris pyrrhorhachis subsp. **laterepens** (Trotter and C.Hope) Fras.-Jenk., New Sp. Syndrome etc.: 6, 215 (1997); Thapa: 11 (2000); DPR: 91 (2002).

Polypodium laterepens (Trotter and C. Hope) C. Hope, J. Bomb. Nat. Hist. Soc. **12**: 628 (1899).

Thelypteris laterpens (Trotter and C. Hope) R.Stewart in Nasir and Ali, Fl. W. Pakistan:16 (1972).

Rhizomes long creeping. Fronds large, distant on rhizome. Stipes 20- 45 cm long, reddish brown. Leaf blade oblong-lanceolate, 40- 75*20-36 cm, bipinnate pinnatifid-acuminate at apices; pinnae opposite, sessile, spreading; pinnules opposite to subopposite. Veins conspicuous and forked. Adaxial sides of rachis, costa, and veins all with acicular hairs, Sori exindusiate, yellowish-brown.

Distribution: Common in W., C. and E. Nepal at higher altitudes (2500-3000m).

Habitat: Terrestrial.

Fructification: Aug-Nov.

Voucher specimen: Daman, 2162m, 23 Nov, 2013, S. Prajapati and S. Rajbhandary, 110 (KATH).

Thelypteris Schmid.

Rhizomes erect or creeping, clothed with brownish scales. Frond generally bipinnatifid, lanceolate with short hairs. Stipes erect, usually pubescent and grooved. Leaf blade with numerous pinnae; pinnae pubescent, texture herbaceous. Veins simple, reaching margin. Sori sub globose or globose, dorsal or on the veinlet; indusium orbicular-reniform, hairy or glabrous persistent or deciduous.

Key to the Species

- 1.(a) Pinnules cut down about half way to the costa into ovato-oblong segments.....*Thelypteris dentata*
1.(b) Pinnules cut deep down near to the costa into ovato-oblong segments.
.....*Thelypteris cana*

Thelypteris cana (J.Sm.) Ching, Bull. Fan Mem. Inst. Biol (Bot.) **6**: 287(1936)

Thelypteris repens (Hope) Ching, Bull. Fan Mem. Inst. Biol. **6**: 304(1936)

Nephrodium repens Hope **12**: 535, pl. 8 (1899).

Nephrodium canum Baker, Syn. Fil.: 267 (1867); Clarke (1880) 515

Rhizomes suberect and subglabrous. Fronds clustered and bipinnatifid. Stipes erect, grooved, 15-20 cm, brownish, with sparse brown scales and dense setae. Leaf blade oblong-lanceolate, 40-80*13-25 cm, grass green, pinnatifid-acuminate at apices,; proximal pairs of pinnae reduced and hastate or auriculate; normal pinnae 20-25 pairs; pinnae sub opposite to alternate, sessile. Abaxial sides of rachis, costa, and veins all with acicular hairs, adaxially with dense appressed setae along grooves, sparsely setaceous along veins, shortly hairy on intercostal areas on both surfaces. Pinnules cut deep down near to the costa into ovato-oblong segments. Veins simple. Sori orbicular, attached on middle veinlets; indusia orbicular-reniform, brown, persistent, hairy.

Distribution: Himalaya; in Nepal, rare in C. at mid to upper mid altitudes (1400-2200 m).

Habitat: Terrestrial, growing on shady area.

Fructification: June-Aug.

Voucher specimen: Daman, 2122m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 46 (KATH).

Thelypteris dentata (Forssk.) E.St.John, Amer. Fern J. **26** (2): 44 (1936); Iwatsuki: 483 (1966), 308 (1988); DPR: 93 (2002).

Christella dentata (Forssk.) Brownsey and Jermy, Brit. Fern Gaz. **10**: 338 (1973); Holttum, Kew Bull. **31**: 314 (1976); Dixit; 104 (1984); Nakaike and Gurung: 190 (1988a).

Polypodium dentatum Forssk., Fl. Aegypt. Arab.: 185 (1775).

Rhizomes short creeping to ascending, sparsely scaly. Frond, clustered, bipinnatifid. Stipes tufted, erect, grooved, 20-28 cm long, brown and pubescent. Leaf blade lanceolate 25-70*9-11 cm, dark green, pinnatifid-acuminate at apices, proximal pairs of pinnae reduced, normal pinnae 10-15 pairs; pinnae alternate, sessile, 5-11*1-1.5 cm, caudately acuminate, rather truncate at the base. Both the surfaces densely hairy; rachis, costa and costules fibrillose. Pinnules cut down about half way to the costa into ovato-oblong segments. Veins simply pinnate, costa grooved. Sori conspicuous, single row on the either side of the costule; indusium persistent and densely hairy in young sori.

Distribution: Common in W., C. and E. Nepal at low to mid altitudes (80-2150m).

Habitat: Terrestrial, growing on shady area.

Fructification: June-Aug.

Voucher specimen: Naubise, 961m, June 21, 2013, S. Prajapati and S. Rajbhandary, 115 (KATH).

Woodsiaceae (Diels) Ching ex Herter

Terrestrial. Rhizome short creeping, erect, thick or thin, scaly; scales brown. Frond small or large, pinnately decomposed. Stipes scaly at the base, higher up glabrous. Leaf blade mostly glabrous except rachis, costa and costules. Veins free, forked. Sori indusiate.

Athyrium Roth

Rhizomes erect, stout clothed with pale or dark uniform coloured or black margined, scales. Frond small to large, generally pinnately decomposed. Stipes stout, scaly throughout or at the base only. Leaf blade occasionally simple pinnate, mostly glabrous except rachis, costa and costules; rachis, costa and costules grooved on the upper surface and sparsely scaly underneath; texture herbaceous-coriaceous. Veins mostly free, occasionally anastomosing without free included veinlets. Sori usually linear, reniform or round, along one or both sides of the veins, rarely roundish; indusium narrow and curved or horse shoe shaped.

Key to the species

- 1.(a) Frond unipinnate, pinnatifid. (2)
- 1.(b) Frond bipinnate, pinnatifid. *Athyrium fimbriatum*
- 2.(a) Pinnae with shallow lobed pinnules, not more than 8 in pairs..... *Athyrium foliolosum*
- 2.(b) Pinnae with deep lobed pinnules, more than 10 in pairs..... *Athyrium drepanopterum*

Athyrium drepanopterum (Kunze) A. Br. ex Milde, Fil. Eur. Atlant.: 49 (1867); Tagawa: 471 (1966); Iwatsuki: 182 (1975); Nakaike and Gurung: 152(1995); DPR: 100 (2002).

Polypodium drepanopterum Kunze, *Linnaea* **23**: 278, 318 (1850).

Asplenium oxyphyllum Hook., *Sp. Fil.* **3**: 221 (Nov. 1860), *nom. superfl.* (for *Athyrium drepanopterum*); Clarke: 493 (1880); Hope: 254 (1902)

Rhizomes suberect or erect, densely clothed with linear, brown scales. Frond unipinnate-pinnatifid, 6-36*2-16 cm. Stipes up to 25 cm long, erect, sparsely scaly. Leaf blade lanceolate; pinnae sub opposite-alternate, slightly curved upwards, with the basal anterior pinnule distinctly larger than the rest; pinnules ovate-oblong, dentately serrated and recurved, rachis, costa and costules grooved on the upper surface; texture coriaceous. Veins once or twice forked. Sori small, placed at the forking of the veinlets; indusium more or less reniform.

Distribution: Common throughout W., C. and E. Nepal at lower mid to high altitudes (900-3100m).

Habitat: Terrestrial

Fructification: Aug- Nov

Voucher specimen: Shikharkot, 1962m, Nov 23, 2012, S. Prajapati and S. Rajbhandary, 111(KATH).

Athyrium fimbriatum T. Moore, *Ind. Fil.*: 185 (June 1860), basionym *non* Dulac (1867); Beddome: t. 295 (1967), 37 (1892); Nakaike and Gurung: 152 (1995); Thapa: 12 (2000); DPR: 101 (2002).

Asplenium fimbriatum Wall. ex Hook., *Sp. Fil.* **3**: 234 (Nov. 1859-Apr. 1860), *non* Kunze (1844); Clarke: 494 (1880); Hope: 254 (1902).

Aspidium fimbriatum Wall., *List no. 339* (1828), *p.p.*, *nom. nud.*, *non* Willd. (1810).

Athyrium Yaklaense (Bedd.) Panigrahi and S.K. Basu, *J. Econ Taxon. Bot.* **5**: (1984)

Rhizomes stout, erect, apex densely dark brown or reddish brown, linear - lanceolate scales. Frond lanceolate, 15-50*20-30 cm, apex long acuminate. Stipe 12- 16 cm long, pinkish, scaly, linear-lanceolate scales. Leaf blade bipinnate, pinnatifid, pinnae 20 or more in pairs, alternate. Veins on the two back pinnae pinnate, costules single. Leaf dry papery, pale brownish green, smooth. Sori oval and horse shoe shaped.

Distribution: Quite common in W., C. & E. Nepal at lower mid to high altitudes (1800- 2600m).

Habitat: Terrestrial

Fructification: Aug-Sep.

Voucher specimen: Simbhanjyang, 2409m, Sep 7, 2012, S. Prajapati and S. Rajbhandary, 100 (KATH).

Athyrium foliolosum Wall. *apud* T. Moore ex R. Sim, *Priced Catl. Ferns* **6**: 22 (1859); T. Moore, *Ind. Fil.*: 185 (1860); Beddome: 37 (1892); Thapa: 12 (2000); DPR: 101 (2002).

Asplenium foliolosum Wall., List no. 205 (1828), *p.p., nom. nud.*

Asplenium fimbriatum var. *foliolosum* (Wall. *apud* T.Moore *ex* R.Sim), C.B.Clarke, Trans. Linn. Soc. Lond. II Bot. 1:495 (1880).

Misapplied names:

Athyrium puncticaule sensu Bir *et auct. Plur., non* (Bl.) T. Moore.

Athyrium macrocarpon sensu Bir *et auct. Plur., non* (Bl.) Bedd.

Rhizomes more or less ascending, with lanceolate, brownish scales. Frond bipinnate pinnatifid, 18-25*9-14 cm. Stipes straw coloured 8-12 cm long, sparsely scaly at the base. Leaf blade lanceolate; pinnae pinnatifid, alternate, sub sessile, 3-4*1-1.2 cm, ovate-lanceolate, sub deltoid pinnules, with the basal anterior pinnule distinctly larger than the rest; pinnules ovate-oblong, dentately serrated and recurved; rachis, costa and costules slightly pubescent; texture herbaceous. Veins forked and free. Sori roundish, placed along both sides of the veins; indusium reniform.

Distribution: Very common in W., C. & E. Nepal at lower mid to high altitudes (1200-3500m).

Habitat: Terrestrial.

Fructification: Aug-Nov.

Voucher specimen: Daman, Risheswor mahadev, 2336m, Nov 23, 2012, S. Prajapati and S. Rajbhandary, 107 (KATH).

Dryopteridaceae Ching

Terrestrial. Rhizome erect or creeping, scaly. Frond simply pinnate or bipinnate to decompose, circinate in bud. Stipe densely scaly usually persistent at base, sparsely scaly higher up on stipe. Leaf blade simple to commonly 1-5- pinnate or more divided, pinnules generally unequal sized at the base; rachis glabrous or pubescent; texture herbaceous or coriaceous. Veins free or anastomosing. Sori superficial, dorsal or sometimes terminal on the veins with or without indusium, indusium variously linear, falcate, or reniform, sometimes hoodlike, cuplike, or round. Spores all of 1 kind.

Key to the genera

- 1.(a) Frond simple pinnate. *Tectaria*
- 1.(b) Frond multipinnate. (2)
- 2.(a) Indusium stalked. *Peranema*
- 2.(a) Indusium without stalk. (3)
- 3.(a) Indusium round-reniform. *Dryopteris*
- 3.(b) Indusium peltate. *Polystichum*

Dryopteris Adanson

Terrestrial large ferns. Rhizomes short, erect or sometimes creeping, strong and stout, densely clothed with broadly lanceolate, bright-brown entire or toothed margined scales. Frond bipinnate to decompose, glabrous. Stipes fascicled, scaly. Leaf blade broadly ovate to oblong-lanceolate, texture firm. Veins forked and free. Sori globose, dorsal or terminal on the veins. Indusium round-reniform.

Key to the species

- 1.(a) Frond dimorphic.*Dryopteris cochleata*
- 1.(b) Frond monomorphic. (2)
- 2(a) Frond bipinnate.(3)
- 2.(a) Frond tripinnate.*Dryopteris carolihopei*
- 3.(a) Lateral pinnae alternate, stipe and rachis densely scaly..... *Dryopteris chrysocoma*
- 3.(b) Lateral pinnae opposite to subopposite, stipe and rachis almost naked, scale if present limited to the stipe base only..... *Dryopteris juxtaposita*

Dryopteris carolihopei Fras.-Jenk., Bull. Brit. Mus. Nat. Hist.(Bot.) **18** (5): 422 (1989); DPR: 121 (2002).

Aspidium marginatum Wall., List no. 391 (1828), *p.p. min., nom. nud., non* Schk. (1809).

Aspidium dilatatum var. *patuloides* Christ, Mem. Soc. Bot. France **1** (1): 41 (1905).

Dryopteris pseudomarginata Ching, Sporae Pterid. Sin.: 327 (1976), *nom. nud.*

Rhizomes short, densely covered with lanceolate, brownish scales. Frond lanceolate tripinnate. Stipes 35-40 cm long, tufted, straw coloured, scaly at the base only. Leaf blade 50-52*45- 50 cm; pinnae, alternate, lanceolate, cut down into oblong, serrate margined pinnules; rachis scaleless, grooved; texture herbaceous. Veins repeatedly forked. Sori 1-6 to a pinnule; indusium reniform.

Distribution: Common in W., C. and E. at low mid to high altitudes (1000-2200 m)

Habitat: Terrestrial.

Fructification: June -Aug.

Voucher specimen: Aghor bazaar, 1844m, June 23, 2013, S. Prajapati and S. Rajbhandary, 132 (KATH).

Dryopteris chrysocoma (Christ) C.Chr., Ind.Fil.: 257 (1905); Ito: 476 (1966); Iwatsuki: 185 (1975); Dixit:149 (1984); Fraser-Jenkins: 370 (1989); Thapa: 13 (2000); DPR: 121 (2002).

Aspidium filix-max var. *chrysocoma* Christ, Bull.herb.Boiss. **6**: 966 (1898).

Aspidium chrysocoma (Christ) Christ, Bull. Acad. Int. Geogr. Bot. **11**: 253 (1902).

Nephrodium chrysocoma (Christ) Hand.- Mazz., Symb.Sin. **6**:24 (1929).

Dryopteris chrysocoma var. *major* Ching, Bull.Fan Mem. Inst. Biol. (Bot) **8**: 438 (1938).

Dryopteris macrocarpa Stewart, Bull. Torrey Bot. Cl. **72**: 406 (1945).

Dryopteris parachrysocoma Ching and Z.R. Wang in Wang, Acta Phytotax. Sin. **23** (5): 344-351 (1985).

Misapplied Names;

Dryopteris barbiger sensu Ito: 475 (1966), non (T. Moore) Kuntze.

Dryopteris marginata sensu Ito: 475 (1966), non (C. Hope) Christ.

Dryopteris odontoloma sensu Ito: 475 (1966), non (T. Moore) C. Chr.

Rhizomes short, ascending, densely covered with lanceolate, brownish scales. Frond lanceolate bipinnate. Stipes 9- 10 cm long, tufted, scaly throughout. Leaf blade 12-18*6-7 cm; pinnae more or less sessile, alternate, lanceolate, cut down nearly to the rachis into oblong, serrated margined pinnules; rachis scaly; texture herbaceous. Veins repeatedly forked. Sori 1- 6 to a pinnule, confined only on the basal part and placed on lower branches of the veinlet; indusium reniform.

Distribution: Common in W., C. and E. at upper mid to high altitudes (1900- 3500 m)

Habitat: Terrestrial, most commonly as lithophyte

Fructification: June-Aug.

Voucher specimen: Simbhanjyang, 2448m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 25 (KATH).

Dryopteris cochleata (Ham. ex D. Don) C. Chr., Ind. Fil.: 258 (1905); Ito: 476 (1966); Roy *et al.*: 194 (1971); Iwatsuki: 187 (1975); Dixit: 149 (1984); Gurung: 68 (1986); Fraser-Jenkins: 408 (1989); Nakaike *et al.*: 190 (1990); DPR: 121 (2002).

Nephrodium cochleatum Ham. ex D. Don, Prodr. Fl. Nepal.: 6 (1825); Clarke: 521 (1880); Hope: 734, t. 30 (1903).

Lastrea cochleata (Ham. ex D. Don) T. Moore, Ind. Fil.: 88 (1858).

Nephrodium filix-max var. *cochleatum* (Ham. ex D. Don) Hook., Sp. Fil. **4**: 116 (1862).

Lastrea filix-mas var. *cochleata* (Ham. ex D. Don) Beddome., Suppl. Ferns South. India Brit. India: 33 (1876).

Dryopteris filix-max var. *cochleata* (Ham. ex D. Don) Alderw., Mal. Ferns: 193 (1909).

Rhizomes short, erect, stout, and strong, clothed with broadly lanceolate, scales. Frond large, usually dimorphic, truncate at the base, sterile ones rather pinnate, or bipinnatifid, fertile ones bipinnate, 25-40*10-15 cm, oblong-lanceolate or ovate-lanceolate, pinnae many pairs, 6-12*1.5-3.5 cm, short petioled, broadly lanceolate, gradually attenuated at the apex, lower ones gradually reduced in fertile frond. Stipes tufted, 12-45 cm long, scaly below, rather glabrous above, glossy. Leaf blade with pinnules, oblong, serrated; rachis mostly glabrous; texture more or less coriaceous; veins repeatedly forked. Sori prominently large, covering completely the lower surface of the

fertile pinnules, placed single row on either side of the costa; indusium conspicuously large, reniform, persistent.

Distribution: Common in W., C. and E. at low to mid altitudes (500-1800 m).

Habitat: Terrestrial.

Fructification: Aug-Sep.

Voucher specimen: Kulekhani, 1507m, Sep 7, 2012, S. Prajapati and S. Rajbhandary, 86 (KATH).

Dryopteris juxtaposita Chirst, Bull. Acad. Inst. Geogr. Bot. **17**: 138 (1907); Fraser- Jenkins: 393 (1989); Nakaike *et al.*: 190 (1990); Thapa: 13 (2000); DPR: 122 (2002).

Lastera odontoloma T. Moore, Ind. Fil.: 90 (1858), *nom. nud.*, *non* Bedd. (1864), *nec Dryopteris odontoloma* (Bedd.) C.Chr. (1924).

Nephrodium filix-mas var. *normalis* C.b.Clarke, Trans. Linn. Soc. Lond. II Bot. **1**: 519, t.68, f.2 (1880).

Misapplied Name:

Dryopteris odontoloma sensu Iwatsuki: 187 (1975); Gurung: 70 (1986), *non* (T. Moore) C.Chr.

Rhizomes short, ascending, densely covered with lanceolate, brown scales; dark brown root with scarce root secondary roots. Frond lanceolate bipinnate. Stipes 15- 20 cm long, tufted, scale on at the base. Leaf blade 30-45*12-16 cm; pinnae more or less sessile, opposite to subopposite, lanceolate, cut down to the rachis into oblong, serrated margined pinnules; rachis scaleless; texture herbaceous. Veins repeatedly forked. Sori 1- 10 to a pinnule, confined only on the basal part of the pinnule and upper half of the blade.on lower branches of the veinlet; sori small, round, indusium reniform.

Distribution: Common in W., C. and E. at mid to higher altitudes (1600-3200 m)

Habitat: Terrestrial.

Fructification: Aug-Sep.

Voucher specimen: Daman, Risheswor mahadev, 2430m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 34 (KATH).

Peranema D.Don

Terrestrial. Rhizome erect covered with large scales; scales dark brown. Frond large, decompose. Stipe with dark brown scales. Leaf blade narrowly ovate, tripinnate to quadripinnatifid, papery. Veins free, forked Sori globose, on the back of a vein or veinlet, pedicellate, enclosing the whole sorus, later burst vertically into two spreading lips.

Peranema cyatheoides D.Don, Prodr. Fl. Nepal.: 12 (1825); Clarke: 435 (18880); Beddome: 22 (1883); Ito: 479 (1966); Iwatsuki: 189 (1975); Dixit: 146 (1984); Nakaike and Gurung: 195

(1988a); Shieh, DeVol and Kuo, Fl. Taiwan ed.2 **1**: 333 (1994); Thapa: 14 (2000); DPR: 128 (2002).

Sphaeropteris barbata Wall., Plant. Asiat. Rar.: 42 (1830); Hope: 28 (1900).

Rhizome erect covered with clathrate scales; scales dark brown. Frond large, up to 90-100cm long stipitate, deltoid decompounds. Stipes very long, 45-55cm long, densely scaly; scales as on rhizome but narrower higher up on stipe. Leaf blade tripinnate, 50-55*30-35 cm, ultimate pinnules sessile, linear-oblong, obtuse, crenate; rachis scaly, narrower than on stipe. Veins free, simple or forked. Sori indusiate, prominently stalked, globose, large.

Distribution: Common in W., C. and E. at upper mid to higher altitudes (2000- 3000 m)

Habitat: Terrestrial, rather scattered, growing on shady as well as on open area.

Fructification: June-Aug.

Voucher specimen: Daman, 2206m, June 22, 2013, S. Prajapati and S. Rajbhandary, 127 (KATH).

Polystichum Roth

Terrestrial. Rhizomes generally short, stout and strong, ascending or erect, usually clothed with scales. Frond usually large, pinnate to decompound. Stipes mostly densely clustered and scaly throughout. Leaf blade with numerous pinnae; ultimate pinnules usually mucronate, and with fibroid scales; texture rather coriaceous; veins all free. Sori round, dorsal or subterminal on the veinlets; indusium peltate.

Polystichum squarrosus (D. Don) Fee, Gen. Fil.: 279 (1852); Tagawa: 481 (1966); Iwatsuki: 191 (1975); Nakaike: 145, t.5 , f.2 (1982); Matsumoto and Nakaike : 182 (1988); Fraser-Jenkins : 270 (1991), 30 (1997 a); DPR : 134 (2002).

Aspidium squarrosus D. Don, Prodr. Fl. Nepal.: 4 (1825); Hope: 470 (1902).

Polystichum brachypterum (Kunze) Ching, Fl. Xizangica 1: 209 (1983).

Polystichum rufobarbatum (Wall. ex Bedd.) Schott ex Diels in Engl. and Prantl, Natl. Pfl.-Fam. **1** (4): 194 (1899).

Polystichum apicisterile Ching and S.K. Wu in C.Y. Wu, Fl. Xizangica **1**: 212 (1983).

Rhizomes erect, short, stout, densely covered with broadly lanceolate blackish-brown scales. Frond larger, more than 100*12-18 cm. Stipes tufted, strong, erect 20-25 cm long, grooved adaxially, densely scaly; scales extending to rachis, size of scale decreases higher up to the rachis. Leaf blade bipinnate ovate-lanceolate; pinnae numerous, alternate, subsessile; pinnules more or less ovate, auricled; texture subcoriaceous. Veins forked; sori dorsal and placed single row close to each side of the costa. Indusium peltate.

Distribution: Common throughout W., C. and E. Nepal at lower mid to higher altitudes (1150-2500 m).

Habitat: Terrestrial, found on shady and open exposed area.

Fructification: June-Aug.

Voucher specimen: Simbhanjyang, 2451m, Aug 27, 2012, S. Prajapati and S. Rajbhandary, 62 (KATH).

Tectaria Cav.

Terrestrial. Rhizome creeping or erect, clothed with lanceolate, entire, membranous, brown scales. Frond pinnate, sub deltoid with the pinnatifid apex. Stipe erect sparsely scaly. Leaf blade glabrous; pinnae large, more or less lobed; rachis glabrous, herbaceous. Veins pinnate. Sori large, roundish, placed dorsally or terminally on the veinlets; indusium rather reniform.

Tectaria coadunata (Wall. ex J.Sm.) C. Chr., Contrib. U.S. Natn. Herb. **26**: 331 (1931); Ito: 481 (1966); Iwatsuki : 191 (1975); Nakaike and Gurung: 196 (1988)); DPR: 136 (2002).

Sagenia coadunata Wall. ex J.Sm., J. Bot. **4**: 184 (1841).

Aspidium coadunatum Wall. ex Hook. and Grev., Ic. Fil. **2**: 202 (1831); *non* Kaulf.

Nephrodium cicutarium Hook. ex Bak. var. *coadunatum* (Wall. ex Hook. and Grev.) C.B. Clarke, Trans. Linn. Soc. Lond. II Bot. **1**: 540 (1880).

Tectaria macrodonta (Fee) C.Chr., Ind. Fil. Suppl. III: 181 (1934), *nom. nov. superfl.*; Dixit: 143 (1984).

Rhizome erect, stout, woody, clothed with lanceolate, entire, membranous brown scales. Frond simple pinnate, 30-60*10-16 cm, Stipes erect, sparsely scaly, purplish. Leaf blade deltoid-oblong, with the pinnatifid apex, glabrous; texture thinly herbaceous; pinnae large, more or less lobed; rachis glabrous. Veins pinnate, costa with alternate costule, costules anastomosing. Sori large, roundish, indusium more or less reniform.

Distribution: Very common throughout W., C. and E. Nepal at low to upper mid altitudes (150-2200 m)

Habitat: Terrestrial, occurring on shady as well as exposed area.

Fructification: June-Aug.

Voucher specimen: Daman, Gairigaun, 1555m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 3 (KATH).

Oleandraceae Ching ex Pich.Serm.

Epiphytic or lithophytic occasionally terrestrial . Rhizomes creeping or erect, long and branching, clothed scales and bearing slender roots. Frond simple , entire,.Stipes at a longer or shorter

distance from the rhizome. Leaf blade usually linear-lanceolate, acuminate glabrous or pubescent; costa sometimes scaly with cartilaginous margin. Veins simple or forked. Sori dorsal on the acroscopic branch of a vein, placed close row on each side of the costa; indusium reniform, persistent.

Oleandra Cav.

Rhizomes creeping or erect, long and branching, clothed with thick broad, peltate based and acute apexed scales and bearing slender roots. Frond simple, entire. Stipes articulate at a longer or shorter distance from the rhizome. Leaf blade usually linear-lanceolate, acuminate glabrous or pubescent; costa sometimes scaly; texture firm, with cartilaginous margin. Veins simple or forked. Sori dorsal on the acroscopic branch of a vein, placed close row on each side of the costa; indusium reniform, persistent.

Oleandra wallichii (Hook.) C. Presl, Tent. Pterid.: 78(1836); Clarke: 542 (1880); Beddome: 287, f.147(1883); Hope: 749 (1903); Ito: 469 (1966); Iwatsuki: 180(1975); Nakaike and Gurung: 194 (1988a); Fraser-Jenkins: 313 (1997b); Thapa: 14 (2000); DPR: 137 (2002).

Aspidium wallichii Hook., Exot. Fl. **1**: t.5 (1823)

Neuronia asplenoides D.Don, Prodr. Fl. Nepal.:7 (1825)

Rhizomes creeping, whitish butdensely clothed with narrow, subulate, spreading, ferruginous, brown-black scales. Frond 21-44*1.6-5 cm. Stipes 1.4-5 cm long, scaly, jointed close to the base and distant above. Leaf blade simple, sub elliptical- oblong, base obtuse, apex suddenly contracted and acuminate; rachis and costa sparsely scaly; texture papery. Veins free, forked, very close and running parallel. Sori large, single row placed close on either side of the costa; indusium reniform, fixed by the base, opening towards margin.

Distribution: Common throughout w., C. and E. Nepal at upper mid to higher altitudes (2000-2900m)

Habitat: Occurs as an epiphyte, lithophytes and as terrestrial.

Frutification: June-Aug.

Voucher specimen: Simbhanjyang, 2477m, Aug 27, 2012, S. Prajapati and S. Rajbhandary, 59 (KATH).

Nephrolepidaceae (Ching) Pich.Serm.

Terrestrial. Rhizomes short, erect, clothed with fine haired scales. Frond polystichous, crowded. Stipes scaly. Leaf blade simply pinnate, pinnae articulate to the rachis, spreading, scaly and usually hairy, sessile usually closely placed and unequal at the base, margin sparsely crenate, the lowest ones reduced and more widely spaced, the apical ones short and small; rachis slightly grooved

above and rounded below. Veins free and ending distinctly within the margin. Sori elongate. Indusium usually round-reniform.

Nephrolepis Schott

Rhizome short-erect, usually producing long stolons. Frond in tufts. Stipes articulated shortly above rhizome. Leaf blade pinnate, pinnae articulated, margin entire or finely serrate. Veins free, not reaching the margin. Sori indusiate, reniform.

Nephrolepis cordifolia (L.) C.Presl, Tent. Pterid.:79 (1836); Clarke: 540 (1889); Beddome: 282, f.144 (1883); Hope: 748 (1903); Tagawa: 79 (1955); Ito: 469 (1966); Iwatsuki: 179 (1975); DPR: 137 (2002).

Polypodium auriculatum L., Sp.Pl. 2: 1088 (1753)

Polypodium cordifolium L., Sp. Pl. 2: 1089 (1753)

Aspidium auriculatum Wall. ex D.Don, Prodr. Fl. Nepal.: 3 (1825)

Nephrodium edule D.Don, Prodr. Fl. Nepal.: 5 (1825)

Nephrolepis auriculata (L.) Trimen, J. Linn. Soc. (Lond.) Bot. 24: 152(1887); Nakaike and Gurung: 194 (1988a).

Rhizomes short, sub erect, densely clothed with thin, shining, light brown, scales and very long root bearing runners with watery tubers; roots numerous, scarcely scaly. Frond 50-90*5-6 cm. Stipes 10-18 cm long, tufted, shining dark olive- brown and scaly. Leaf blade simply pinnate, linear - lanceolate; main rachis grooved with linear scales; pinnae numerous, sessile, crowded, usually imbricate at the base, horizontally spreading, lower base rounded and upper base auricled, apex rounded or bluntly pointed, margin entire or slightly crenate; texture more or less coriaceous. Veins simple or once forked. Sori single row, placed about the mid-way between the costa and margin, indusium persistent, reniform, opening towards the apex of the pinnae.

Distribution: Very common in W., C. and E. Nepal at low to upper mid altitudes (500- 1900m).

Habitat: Terrestrial

Frutification: June-Aug.

Voucher specimen: Dam chaur, 1501m, Aug 29, 2012, S. Prajapati and S. Rajbhandary, 82(KATH).

Davalliaceae Mett. ex Frank

Epiphytic as well as terrestrial. Rhizomes long creeping, clothed with peltate based scales. Frond simple to decomposed. Stipes glabrous and articulated to the rhizome. Leaf blade finely dissected; rachis narrowly winged on either side of raised upper surface. Veins free. Sori submarginal or

dorsal and placed terminal on the veins; indusium usually basal, sometimes attached along its sides, opening towards the margin.

Key to the genera

- 1.(a) Rhizome bearing scales and hairs, sori large..... *Leucostegia*
1.(b) Rhizome bearing scales only, sori small. (2)
2.(a) Rachis not winged, fronds finely dissected.*Araiostegia*
2.(b) Rachis winged, frond dissected. *Davallodes*

Araiostegia Copel.

Epiphytic as well as terrestrial herbs. Rhizomes creeping, densely clothed with entire, obtuse to acuminate, peltate based brown scales. Frond pinnately decomposed, ovate or deltoid. Stipe articulate to rhizomes, scaly or naked. Leaf blade large or small, quadripinnate pinnatifid, finely dissected with narrow pinnules, glabrous; texture thin. Sori small, dorsal on the blade and terminal on the acroscopic branch of a forked vein; indusium thin, more or less round, attached by the base.

Araiostegia pulchra (D.Don) Copel., Philip. J. Sci. **34**: 241 (1927); Tagawa: 79 (1955); Ito: 468 (1966); Iwatsuki: 179 (1975); Dixit: 169 (1984); Nakaike *et al.*: 189 (1990); Fraser-Jenkins: 324 (1997b); DPR: 139 (2002).

Davallia pulchra D.Don., Prodr. Fl. Nepal.: 11 (1825); Clarke: 444 (1880), Gurung: 47 (1986).

Leucostegia pulchra (D.Don) J.Sm., Lond. J. Bot. **1**: 426 (1842); Beddome: 52, f.25 (1883).

Misapplied Names:

Araiostegia perdurans sensu Ito: 207 (1971), *non* (Christ) Copel.

Davallia trichomanoides sensu Ito: 207 (1971), *non* Bl.

Rhizomes long creeping, covered with spreading, obtuse, peltate, brown scales. . Frond 8.5-30*7-20 cm, lanceolate-deltoid. Stipes 5- 10 cm long, erect, firm, glabrous or sparsely covered with deciduous scales Leaf blade quadripinnate; pinnae ovate-lanceolate , 4-10*2-8 cm, the lower ones the largest; pinnules cut down deeply to a narrowly winged rachis into deeply pinnatifid segments; ultimate pinnules narrowly lanceolate, non-distant and non acute; texture membranous. Veins free. Sori copious, mostly as broad as the segments and placed at the base of the teeth; indusium prominent, opening towards the margin (Plate V).

Distribution: Common throughout W., C. and E. Nepal at lower mid to higher altitudes (800-2700m).

Habitat: Epiphyte.

Fructification: June-Aug.

Voucher specimen: Simbhanjyang, 2462m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 28 (KATH).

Davallodes Copel.

Epiphytic ferns. Rhizomes long creeping, clothed with broad, peltate based yellow scales and bearing roots usually on the lower surface only. Frond pinnate, simple to decomposed. Stipes articulate to the rhizome. Leaf blade lanceolate, dissected; pinnae cut down to winged rachis incised pinnules, pubescent; texture herbaceous; veins free. Sori small, submarginal, 2- 8 to a segment and placed obliquely in between the costa and margin; indusium of various form of sporangia small.

Davallodes membranulosum (Wall. ex Hook.) Copel., Philip.J. Sci. **34**: 245 (1927); Iwatsuki: 179 (1975); Gurung: 48 (1986); Nakaike *et al.*: 190 (1990); DPR: 140 (2002).

Davallia membranulosa Wall. ex Hook., Sp. Fil. **1**:58, t. 53a (1846); Clarke: 442 (1880); Hope: 29 (1900).

Leucostegia membranulosa (Wall. ex Hook) J.Sm., Hist. Fil.: 84 (1875); Beddome: 50 (1883)

Araiostegia membranulosa (Hook.) Holttum ex T.Sen, U.Sen and Holttum, Kew Bull. **27**: 230 (1972).

Rhizomes long creeping, clothed with broad, peltate based, linear, brown to yellow scales. Frond bipinnatifid. Stipes 3-7 cm long, scaly. Leaf blade pubescent; rachis slightly winged above; pinnae decurrent, ovate-lanceolate, pinnatifid, lower ones cut down to narrowly winged rachis into numerous, oblong, toothed segments, texture thinly herbaceous. Veins not distinct but costa distinctly black abaxially. Sori dorsal, 2-8 to a segment, placed obliquely in between the costa and margin; indusium small, fixed by broad base only.

Distribution: Common throughout W., C. and E. Nepal at lower mid to higher altitudes (800-2500m).

Habitat: Epiphyte

Fructification: June-Aug.

Voucher specimen: Aghor bazaar, 1844m, Jun 25, 2013, S. Prajapati and S. Rajbhandary, 139 (KATH)

Leucostegia C.Presl

Epiphytic as well as lithophytic. Rhizomes creeping, fleshy, clothed with numerous, ovate thin entire margined scales and brown hairs, and bearing roots of all sides of old rhizomes. Stipes bearing short hairs and scales while young, glabrescent and smooth in old ones. Frond large, with broad base, tri-quadric pinnate, deltoid, glabrous; pinnae deltoid with more or less rhomboidal, bluntly toothed pinnules; rachis and costa grooved on the upper surface; texture thin. Veins forked and veinlets free. Sori large, impressed, terminal on a vein and sub marginal; indusium sub orbicular, and fixed by the lower half of the sides.

Leucostegia immersa (Wall. ex Hook.) C.Presl, Tent. Pterid.: 95, t.4, f.11 (1836); Beddome: 51 (1883); Ito: 469(1996); Chowdhury: 43 (1973); Iwatsuki: 179 (1975); Nakaike and Gurung: 193 (1988a); Fraser-Jenkins: 313 (1997b); DPR: 140 (2002).

Davallia immersa Wall. ex Hook., Sp. Fil. 1: 156 (1846); Clarke: 443 (1880); Hope: 29 (1900).

Rhizomes creeping, clothed with fibrillose scales and hairs. Frond 20-60*8-24 cm. Stipes 12-21 cm long, erect, glossy, grooved on the upper surface and scaly. Leaf blade tripinnate pinnatifid, deltoid, glabrous, yellowish-green; pinnae 6.5- 16*2.7-7 cm, alternate, ovate-lanceolate; pinnules roundly lobed, with the lobes crenulate above; texture herbaceous. Veins forked. Sori large, 1-2 to a pinnule. Indusium semiorbicular, impressed and close to the margin, fixed at the base.

Distribution: Common throughout W., C. and E. Nepal at lower mid to higher altitudes (800-2500m).

Habitat: Terrestrial or on rock.

Fructification: June-Aug.

Voucher specimen: Simbhanjyang, 2454m, Aug 20, 2012, S. Prajapati and S. Rajbhandary, 27 (KATH)

Lomariopsidaceae Alston

Terrestrial, lithophytic. Rhizome creeping, ascending or erect, densely scaly. Fronds dimorphic, similar when young. Stipes scaly, long. Leaf blade simple, entire. Sterile frond much larger than fertile ones. Veins free, simple or forked, almost parallel to each other. Sori exindusiate, irregularly distributed.

Elaphoglossum Schott ex J.Sm.

Rhizome creeping, scaly, scales brown. Frond dimorphic. Stipe close or distant, stipe of the fertile frond almost equal. Leaf blade simple, entire, leathery. Veins free, simple or forked. Sori on lower surface of fertile frond covered entirely.

Elaphoglossum stelligerum (Wall. ex Bak. in Hook. and Bak.) T. Moore in Sal. Ind. Fil.: 89 (1857); Sledge: 92 (1967); Iwatsuki: 189 (1975); Nakaike and Gurung: 193 (1988a); DPR: 142 (2002).

Acrostichum stelligerum Wall. ex Bak. in Hook and Bak., Syn. Fil. Ed.2: 521 (1874).

Elaphoglossum yunnanense (Bak.) C.Chr., Contrib. U.S. Natn. Herb. 26: 327 (1931); Ito: 479 (1966).

Acrostichum yunnanense Bak., Kew Bull. Misc. Inf. **1898**: 233 (1898).

Elaphoglossum khasianum A. Biswas and S.R.Ghosh, Proc. Indian Acad. Sci., Plant Sci .**93** (6): 606 (1984).

Misapplied Names :

Acrostichum viscosum sensu Clarke, Trans. Linn. Soc. Lond. II Bot. **1**: 577 (1880), *non* Sw.

Elaphoglossum viscosum sensu Beddome: 420, f.250 (1883), 67, t.196 (1864), 40 (1883), *p.p.*, *non* (Sw.) J.Sm.

Rhizome short creeping, densely scaly throughout; scales light brown, stellate, roots with brown hairs. Fronds dimorphic, Sterile fronds 25- 35 cm in length much more larger than fertile frond, densely scaly throughout; scales minute and hair-like, or stellate. Stipe of both fronds almost equal and alike. Leaf blade of both frond linear-lanceolate, gradually narrowing towards both ends, leathery. Veins simple or a few times forked, parallel, costa raised on both surfaces, densely covered with scales. Sori on lower surface of fertile frond covered entirely. Sori exindusiate and brown.

Distribution: Common in W.C. and E. Nepal at lower mid altitudes (900- 1100m)

Habitat: Lithophyte, growing profusely on shady moist parts of the forest.

Fructification: June-Aug.

Voucher specimen: Palung, 974m, Jun 21, 2013, S. Prajapati and S. Rajbhandary, 120 (KATH).

Blechnaceae C. Presl (Chain Fern Family)

Large terrestrial ferns. Rhizomes creeping or erect, apex clothed with scales. Frond large generally greater than 30 cm. Stipes non articulate at the base. Leaf blades pinnatifid or pinnate, sometimes more compound; texture coriaceous. Rachis frequently grooved adaxially. Veins anastomosing. Sori elongate, placed near the costa of pinna or the costules of its lobes with indusium attached on the sides of the sorus and opening inwards.

Woodwardia J.Sm.

Rhizomes short, erect and stout, the apex densely covered with scales. Frond typically bipinnatifid, large, uniform. Stipe long and scaly at the base. Leaf blade with firm texture, pinnae with entire or serrulate margin. Veins anastomosing to form a single row of narrow areoles along the costa and costules. Sori elongate, along the costular areole due to which the upper surface raised. indusium opening inward.

Woodwardia biserrata C.Presl, Rel. Haenk.**1**: 53 (1825); Fraser-Jenkins: 287 (1997b).

Woodwardia unigemmata (Makino) Nakai, Bot. Mag. Tokyo **39**: 103 (1925); Tagawa: 80 (1955); Ito in Fl. E. Himal. 486 (1966); Iwatsuki : 282 (1988); Nakaike and Gurung: 197 (1988a); DPR: 142 (2002).

Woodwardia radicans (L.) J.Sm. var. *unigemmata* Makino, J. Jap. Bot. **2**: 7 (1918).

Woodwardia himalaica Ching and S.K.Wu in C.Y.Wu, Fl. Xizangica **1**: 191 (1983)

Misapplied Name:

Woodwardia radicans sensu D.Don, Prodr. Fl. Nepal.: 12 (1825); Clarke: 475 (1880); Beddome: 135, f. 68 (1883); Hope: 459(1901), *non* Sw.

Rhizomes short, stout and strong, clothed scales. Frond large, bipinnatifid, 30-100*20-50 cm. Stipes 30-50 cm long, with lanceolate, brown scales at the base and almost glabrous above. Leaf blade ovate-lanceolate, 17-28*6-12 cm, with few scaly germinating gemmae on their axils; pinnae distant, alternate, ovate-lanceolate or deltoid-lanceolate, short petiolate, deeply pinnatifid; pinnules obliquely spreading, minutely spine toothed; rachis sparsely scaly; texture coriaceous. Veins anastomosing close to the main costa forming a single series of areoles and then free to the margin. Sori oblong, placed parallel with and close to the costule; indusium arched over the sori.

Distribution: Common throughout W., C. & E. Nepal, at lower mid to higher altitudes (1350-2500 m).

Habitat: Terrestrial, commonly growing on rock crevices.

Fructification: June-Sep.

Voucher specimen: Fakhel, 1780m, Sep 7, 2012, S. Prajapati and S. Rajbhandary, 94 (KATH).

4. DISCUSSION

From the present study, a total of 128 specimens of Pteridophytes belonging to 24 families, 47 genera and 85 species were recorded. Most of the species reported from Daman and its adjoining areas has also been listed by Phuyal *et al.* (2011), in the enumeration list of Makwanpur district as a whole recognizes altogether 100 species of pteridophytes belonging to 26 families and 48 genera.

The present list when compared with the list prepared by Phuyal *et al.* (2011) (comparative list provided in Appendix V) it lacks the representation of family Ophioglossaceae, Marattiaceae, Cyatheaceae, which is reported from lower altitude and Grammitidaceae, but as Daman covers mostly the temperate region, the species belonging to these family was not found. The present study represents 15.91% of total Pteridophyte Flora of Nepal.

Polypodiaceae is the largest family representing 9 genera and 18 species, followed by Pteridaceae representing 5 genera and 14 species, and Dryopteridaceae with 4 genera and 7 species. Among 85 species of pteridophyte, *Pteris* is the largest genera with six species, followed by *Selaginella* with five species. Other large genera are *Cheilanthes*, *Dryopteris*, *Huperzia*, *Lepisorus*, *Pichisermollia* with four species each. *Pteris* is a large genus, found in very diverse habitat. Most species of *Pteris* are found in shady areas which were shaded by tree or shrub canopy, or they are also found in the exposed areas along the margins of the forests, along stream banks, or disturbed areas resulting from log cutting or road construction. Because of which the no of species in these genera are high due to suitable habitat for them in Daman and adjoining areas.

New addition to the Flora of Makwanpur

From the present study and comparing the species reported by Phuyal *et al.* (2011), from Makwanpur District, altogether 35 species which were not reported previously has been enlisted. The species are *Araiostegia pulchra*, *Asplenium yoshinaga*, *Asplenium laciniatum*, *Athyrium drepanopterum*, *Davallodes membranulosum*, *Dennstaedtia scabra*, *Dryopteris carolihopei*, *Drynaria mollis*, *Elaphoglossum stelligerum*, *Gleichenia gigantea*, *Huperzia pulcherrima*, *Huperzia serrata*, *Huperzia subulifolia*, *Hymenophyllum polyanthus*, *Lepisorus nudus*, *Lepisorus scolipendrium*, *Leucostegia immersa*, *Lindsaeae odorata*, *Microsorium membranaceum*, *Onychium Cryptogrammoides*, *Osmunda japonica*, *Peranema cyatheoides*, *Pichisermollia quasidivaticata*, *Pichisermollia stewartii*, *Pichisermollia subebinipes*, *Plagiogyria euphlebia*, *Polypodiodes lachnopus*, *Pseudophegopteris pyrhorhachis* subsp. *distans*, *Pseudophegopteris pyrhorhachis* subsp. *laterepens*, *Pteridium revolutum*, *Selaginella involvens*, *Selaginella pallida*, *Selaginella vaginata*, *Vittaria taeniophylla*, and *Woodwardia biserrata* are all the new report of pteridophytes

for Makwanpur District. While species *Osmunda japonica* belonging to the family Osmundaceae and *Plagiogyria euphlebia* belonging to the family Plagiogyraceae are the new records for central Nepal as they were only reported previously from east Nepal. More collection at the right time of sporulation may still bring new records for the areas as well as for Nepal.

Distribution of species

In course of this study, three distinct types of habitats of pteridophytes were identified namely epiphytes, lithophytes and terrestrial. In case of habitat diversity of pteridophytes, terrestrial habitat can be considered the most preferable in comparison to the epiphytic and lithophytic habitat for lower altitude. But in case of higher altitude there are more epiphytes as the mixed forest and *Quercus semicarpifolia* forms a very suitable habitat for epiphytes. Most of the species (14 species viz. *Drynaria mollis*, *Goniophlebium argutum*, *Lepisorus contortus*, *Lepisorus mehrae*, *Lepisorus nudus*, *Lepisorus nudus*, *Lepisorus scolopendrium*, *Microsorium membranaceum*, *Pichisermollia ebinipes*, *Selliguea oxyloba*, *Pichisermollia quasidivaticata*, *Pichisermollia stewartii*, *Polypodiodes amoena*, *Polypodiodes lachnopus*, and *Pyrrosia porosa*) belonging to the family Polypodiaceae are epiphytes, while species belonging to the family Pteridaceae, Dryopteridaceae and some species of Polypodiaceae are lithophytes. In case of terrestrial habitat, most of the species belongs to the family Dennstaedtiaceae, Dryopteridaceae, Pteridaceae, Selaginellaceae, Thelypteridaceae, and Woodsiaceae.

In case of lithophytes there are species like *Adiantum phillipense*, *Arthromeris wallichiana*, *Athyrium fimbriatum*, *Dryopteris juxtaposita*, *Dryopteris cochealata*, *Dicranopteris linearis*, *Huperzia serrata*, *Leucostegia immersa*, *Lycopodium japonicum*, *Onychium cryptogrammoides*, *Onychium siliculosum*, *Osmunda japonica*, *Polystichum squarrosum*, *Pteris aspercaulis*, *Pteris vittata*, *Sphenomeris chinensis* and *Tectaria coadunata* which is found both as terrestrial and also in rock crevices or on mossy rocks in mid altitude. Gurung (1991) and Iwatsuki (1998) have reported most of these terrestrial species both as terrestrial and lithophytes. While, *Araiostegia pulchra*, *Huperzia hamiltonii*, *Huperzia subulifolia*, *Lepisorus nudus*, *Microsorium membranaceum*, *Oleandra wallichii*, *Polypodiodes amoena*, *Polypodiodes lachnopus*, *Pyrrosia porosa* and *Selliguea oxyloba* was found growing as epiphytic and lithophytes. Similar composition was also reported by Mehra and Bir (1964) and Iwatsuki (1988).

Distribution of species along the altitudinal gradient, according to this study is maximum in between the altitude of 2200 to 2400m. Distribution of species in different forest types based on

quadrat studies also reveals the maximum species richness in mixed forest. The result of these two different analyses is same as mixed forest lies in the altitudinal range of 2200-2400m. The mixed forest area is dense, moist and shady which aids in species richness of pteridophytes as these conditions are favourable for them. Though the quadrat studies shows less species richness in *Rhododendron* and *Quercus* forest, it is not so, it favours good number of species. The reason for this result might be the altitude of the study area, which has suitable climate from temperature to humidity that favours the growth of most pteridophytic species. Rakotondrainibe and Raharimalada (1998) also reported similar results that the higher number of epiphytes above 1000 m altitude was due to altitude and composition of forest.

The highest point of the study area is 2488m, and the lower altitudinal limit of *Rhododendron* is 2400m and it starts to appear only from this range or a little below. The quadrat could be laid only once as the elevational interval was 100m, and the gradient ended at 2488m. The minimum species richness is shown by Pine forest, because Pine tree having thin bark and leaf being acidic in nature don't support under growth of other vegetation as it accelerates acidification of soil thus halting the species diversity of pteridophytes as well as other plants. Similarly, it is more prone to forest fire during dry season thus destroys the vegetation thereafter.

About the Phytosociological attributes of Pteridophytes, the maximum relative density, frequency and Important Value Index (IVI) is shown by *Selaginella chrysocaulos*. The reason for this might be, it's small plant size and it's altitudinal distribution range.

Economic importance

Pteridophytes are economically important group of plant. From the present study 30 species have been recorded as economically important plants. Out of these species, young and tender shoots of five species *Tectaria coadunata*, *Dryopteris cochleata*, *Dryopteris chrysocoma*, *Pteris aspercaulis*, *Nephrolepis cordifolia* are used as vegetable, while, two species of young plants of *Polypodiodes argutum* and *Polystichum squarrosom* are used as fodder for cattles. Beside, food and fodder, twelve species *Arthromeris wallichiana*, *Asplenium laciniatum*, *Bortyichium lanuginosum*, *Cheilanthes dalhousiae*, *Drynaria mollis*, *Equisetum diffusum*, *Lepisorus*, *Oleandra wallichi*, *Pityrogramme calomelanos*, *Pteridium revolutum*, *Cheilanthes bicolor*, and *Sphenomeris chinensis* are medicinally important. These medicinal ferns have also been reported by Rajbhandary (2010), which supports the present finding. The use of *Asplenium laciniatum* and *Cheilanthes bicolor* as medicinal plant is reported for the first time from this region which is also additional information

for medicinal fern species. Three species of pteridophytes are used as ornamental and many other are used for various purposes. Decoction of roots and rhizomes of *Adiantum phillipense* used in fever and dysentery have also been mentioned by Srivastava (2007).

Many ferns are directly linked with economy of the local people. Rhizome of *Drynaria mollis* is another major source of income for local people. Huge amount of rhizome of *Oleandra wallichii* locally called 'bisphile' or 'bisfeg' is exploited from the community forest and exported to different places. They did not reveal the actual purpose for the export. The export of rhizome from Daman is reported for the first time from this region, which can be considered as new information. *Gleichenia gigantea* is used for building animals sheds. *Pteridium revolutum*, *Pteris wallichiana*, *Nephrolepis cordifolia* and *Gleichenia gigantea* are preferred to plant for preventing landslides. This have been also been discussed by Gurung (1988), which supports the present findings.

5. CONCLUSIONS AND RECOMMENDATION

5.1 Conclusions

A total of 128 specimens of Pteridophytes belonging to 24 families, 47 genera and 85 species are recorded from the study area. Polypodiaceae is the largest family representing 9 genera and 18 species, followed by Pteridaceae representing 5 genera and 14 species, and Dryopteridaceae with 4 genera and 7 species. Among 58 species, *Pteris* is the largest genera with 6 species, followed by *Selaginella* with 5 species, *Pichisermollia*, *Lepisorus*, *Huperzia*, *Cheilanthes* and *Dryopteris* with 4 species each.

Altogether 35 species which were not reported previously has been enlisted, but two species *Polypodiodes amoena*, and *Osmunda japonica* belonging to the family Polypodiaceae and Osmundaceae respectively are the new records for central Nepal as they were only reported previously from east Nepal only.

The highest point of the study area is 2488m, and the lower altitudinal limit of *Rhododendron* is 2400m and it starts to appear only from this range or a little below. Distribution of species along the altitudinal gradient, according to this study is maximum in between the altitude of 2200 to 2400m, which is covered by mixed forest. In the mixed forest area, there is dense, moist and shady place which aids in species richness of pteridophytes as these conditions are favourable for them.

With the present information it is clear that in hills and forests where majority of ferns and fern allies grow, natives frequently use their young fronds as source of food, dried rhizomes and extracts of different parts and their decoction as medicine for various ailments. From the collected species, 7 species of pteridophytes have food and fodder value, while more than 11 species are medicinally important, while 3 species of pteridophytes are used as ornamental and decorative purpose. Besides these, some species were considered as soil conserving agents. *Asplenium laciniatum* and *Cheilanthes bicolor* are newly reported medicinal plants. The export of rhizome of *Drynaria mollis* and *Oleandra wallichii* from Daman is also new information.

5.2 Recommendations

From the number of pteridophytes obtained from the study area, it would be very useful to recommend that studies regarding the status of pteridophytes should be carried out not only in one place but all over the country, which will not only give additional information regarding the species but one might find new species and new record. The study also highlighted the traditional uses of ferns by the locals in the treatment of their diseases and ailments. These data on the medicinal use

obtained from the study area may be useful for phytochemists and pharmacologists to determine their true therapeutic compounds. This may bring light to new sources of drugs of herbal origin. It is therefore recommended to collect more information regarding the medicinal use.

Pteridophytes of this area are very much linked with the livelihood and economy of local people, because of this, conservation of these species should be done immediately. Due to various threats in the study area, many species are reported to be threatened. Of course, large numbers of fern and fern allies are endangered or are under immediate danger of loss, while various species are vulnerable mainly due to indiscriminate collection as well as excessive trade from natural population for commercial purpose as *Drynaria mollis* and *Oleandra wallichii*. It is therefore, an urgent need for their conservation. Community forest should not only exploit the pteridophytes commercially but also pay attention in its conservation too. The people should also be made aware about the uses and benefits of this flora by awaring them formally and informally. Thus, much emphasis should be given to conserve the ferns which are important for academic, medicinal and ornamental values. For this purpose, proper counseling and awareness program on conservation and importance of natural resources, sustainable utilization, harvesting and management of the valuable plant species like pteridophytes should be conducted at the local level.

For academic purpose, there is great need of taxonomic and revisionary work for the correct identification of Pteridophytes, so researchers should be encouraged. More taxonomic work more source for identification of Pteridophytes.

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Appendix I: Species diversity along with family.

| Family | Name of the species |
|------------------|---|
| Adiantaceae | <i>Adiantum incisum</i> Forssk. |
| Adiantaceae | <i>Adiantum phillipense</i> L. |
| Aspleniaceae | <i>Asplenium ensiforme</i> Wall. ex Hook. and Grev. |
| Aspleniaceae | <i>Asplenium laciniatum</i> D.Don |
| Aspleniaceae | <i>Asplenium yoshinage</i> Makino |
| Blechnaceae | <i>Woodwardia biserrata</i> C.Presl |
| Botrychiaceae | <i>Botrychium lanuginosum</i> Wall. ex Hook. and Grev |
| Davalliaceae | <i>Araiostegia pulchra</i> (D.Don) Copel |
| Davalliaceae | <i>Davallodes membranulosum</i> (Wall. ex Hook.) Copel |
| Davalliaceae | <i>Leucostegia immersa</i> (Wall. ex Hook.) C.Presl |
| Dennstaedtiaceae | <i>Dennstaedtia appendiculata</i> (Wall. ex Hook.) J. Sm. |
| Dennstaedtiaceae | <i>Dennstaedtia scabra</i> (Wall. ex Hook.) T.Moore |
| Dennstaedtiaceae | <i>Pteridium revolutum</i> (Bl.) Nakai |
| Dryopteridaceae | <i>Dryopteris juxtaposita</i> Chirst. |
| Dryopteridaceae | <i>Dryopteris carolihopei</i> Fras.-Jenk. |
| Dryopteridaceae | <i>Dryopteris chrysocoma</i> (Christ) C.Chr. |
| Dryopteridaceae | <i>Dryopteris cochealata</i> (Ham. ex D.Don) C.Chr. |
| Dryopteridaceae | <i>Peranema cyatheoides</i> D.Don |
| Dryopteridaceae | <i>Polystichum squarrosus</i> (D. Don) Fee |
| Dryopteridaceae | <i>Tectaria coadunata</i> (Wall. ex J.Sm.) C. Chr. |
| Equisetaceae | <i>Equisetum diffusum</i> D.Don |
| Gleicheniaceae | <i>Dicranopteris linearis</i> (Burm. f.) Underw |
| Gleicheniaceae | <i>Gleichenia gigantea</i> Wall. ex Hook. and Bauer |
| Hymenophyllaceae | <i>Hymenophyllum polyanthus</i> (Sw.) Sw |
| Hymenophyllaceae | <i>Hymenophyllum exsertum</i> Wall. ex Hook |
| Lindsaeaceae | <i>Lindsaea odorata</i> Roxb. |
| Lindsaeaceae | <i>Sphenomeris chinensis</i> (L.) Maxon |
| Lomariopsidaceae | <i>Elaphoglossom stelligerum</i> (Wall. ex Bak. in Hook. and Bak.) T. Moore |
| Lycopodiaceae | <i>Huperzia subulifolia</i> (Wall. ex Hook. and Grev.) Trevis |
| Lycopodiaceae | <i>Huperzia hamiltonii</i> (Spreng.) Trevis. |
| Lycopodiaceae | <i>Huperzia pulcherrima</i> (Wall. ex Hook. and Grev.) Pich. Serm |
| Lycopodiaceae | <i>Huperzia serrata</i> (Thunb. in A.Murray) Trevis |
| Lycopodiaceae | <i>Lycopodiella cernua</i> (L.) Pich. Serm. |
| Lycopodiaceae | <i>Lycopodium japonicum</i> Thunb. ex A.Murray |
| Nephrolepidaceae | <i>Nephrolepis cordifolia</i> (L.) Trimen |
| Oleandraceae | <i>Oleandra wallichii</i> (Hook.) C. Presl |
| Osmundaceae | <i>Osmunda japonica</i> Thunb ex Murray |

| | |
|-----------------|---|
| Plagiogyraceae | <i>Plagiogyria euphlebia</i> (Kunze) Mett |
| Polypodiaceae | <i>Arthromeris wallichiana</i> (Spreng. in L) Ching |
| Polypodiaceae | <i>Drynaria mollis</i> Bedd |
| Polypodiaceae | <i>Goniophlebium argutum</i> (Wall. ex Hook.) J. Sm |
| Polypodiaceae | <i>Lepisorus contortus</i> (Christ) Ching |
| Polypodiaceae | <i>Lepisorus mehrae</i> Fras.-Jenk |
| Polypodiaceae | <i>Lepisorus nudus</i> (Hook.) Ching |
| Polypodiaceae | <i>Lepisorus scolopendrium</i> (Buchanan-Hamilton ex Ching) Mehra & Bir |
| Polypodiaceae | <i>Microsorium membranaceum</i> (D. Don) Ching |
| Polypodiaceae | <i>Pichisermollia ebinipes</i> Hook.) Fras.-Jenk |
| Polypodiaceae | <i>Pichisermollia quasidivariata</i> (Hayata) Fras.-Jenk |
| Polypodiaceae | <i>Pichisermollia stewartii</i> (Bedd.) Fras.-Jenk |
| Polypodiaceae | <i>Pichisermollia subebinipes</i> Ching |
| Polypodiaceae | <i>Polypodiodes amoena</i> (Wall. ex Mett.) Ching |
| Polypodiaceae | <i>Polypodiodes lachnopus</i> (Wall. ex Hook.) Ching, |
| Polypodiaceae | <i>Polypodiodes microrhizoma</i> (C.B.Clarke) Ching |
| Polypodiaceae | <i>Pyrrosia costata</i> (C. Presl ex Bedd.) Tagawa & K. Iwats |
| Polypodiaceae | <i>Pyrrosia porosa</i> (C. Presl) Hovenkamp |
| Polypodiaceae | <i>Selliguea oxyloba</i> (Wall. ex Kunze) Fras.-Jenk. |
| Pteridaceae | <i>Cheilanthes bicolor</i> (Roxb. in Griff.) Griff. ex Fras.-Jenk. |
| Pteridaceae | <i>Cheilanthes dalhousiae</i> Hook. |
| Pteridaceae | <i>Cheilanthes formosana</i> Hayata. |
| Pteridaceae | <i>Cheilanthes rufa</i> D. Don |
| Pteridaceae | <i>Coniogramme pubescens</i> Hieron. |
| Pteridaceae | <i>Onychium cryptogrammoides</i> Christ |
| Pteridaceae | <i>Onychium siliculosum</i> (Desv.) C.Chr. |
| Pteridaceae | <i>Pityrogramme calomelanos</i> (Linn.) Link |
| Pteridaceae | <i>Pteris aspercaulis</i> Wall. ex J.Agardh |
| Pteridaceae | <i>Pteris baurita</i> L. |
| Pteridaceae | <i>Pteris cretica</i> L. |
| Pteridaceae | <i>Pteris puberula</i> Ching |
| Pteridaceae | <i>Pteris vittata</i> L. |
| Pteridaceae | <i>Pteris wallichiana</i> Agardh |
| Schizaeaceae | <i>Lygodium flexuosum</i> (L.) Sw. |
| Schizaeaceae | <i>Lygodium japonicum</i> (Thumb. in a. Murray) Sw. |
| Selaginellaceae | <i>Selaginella chrysocaulos</i> (Hooker & Grev.) Spring |
| Selaginellaceae | <i>Selaginella involvens</i> (Swartz) Spring |
| Selaginellaceae | <i>Selaginella pallida</i> (Hooker & Grev.) Spring |
| Selaginellaceae | <i>Selaginella subdiaphna</i> (Wall. ex Hook. & Grev.) Spring |
| Selaginellaceae | <i>Selaginella vaginata</i> Spring |

| | |
|------------------|--|
| Thelypteridaceae | <i>Pseudophegopteris pyrhorhachis subsp. distans</i> Fras.-Jenk. |
| Thelypteridaceae | <i>Pseudophegopteris pyrhorhachis subsp. laterepens</i> (Trotter and C.Hope) Fras.-Jenk. |
| Thelypteridaceae | <i>Thelypteris cana</i> (J.Sm.) Ching |
| Thelypteridaceae | <i>Thelypteris dentata</i> (Forssk.) E.St.John |
| Vittariaceae | <i>Vittaria taeniophylla</i> Copel |
| Woodsiaceae | <i>Athyrium drepanopterum</i> (Kunze) A. Br. ex Milde |
| Woodsiaceae | <i>Athyrium fimbriatum</i> T. Moore |
| Woodsiaceae | <i>Athyrium foliolosum</i> Wall. apud T.Moore ex R.Sim |

Appendix II: Habitat diversity of collected Pteridophytes.

| Family | Name of the species | Habitat | | |
|------------------|-----------------------------------|----------|------------|-------------|
| | | Epiphyte | Lithophyte | Terrestrial |
| Adiantaceae | <i>Adiantum incisum</i> | - | + | - |
| Adiantaceae | <i>Adiantum phillipense</i> | - | + | + |
| Aspleniaceae | <i>Asplenium ensiforme</i> | + | - | - |
| Aspleniaceae | <i>Asplenium laciniatum</i> | - | + | - |
| Aspleniaceae | <i>Asplenium yoshinaga</i> | - | + | - |
| Blechnaceae | <i>Woodwardia biserrata</i> | - | + | - |
| Botrychiaceae | <i>Botrychium lanuginosum</i> | - | + | - |
| Davalliaceae | <i>Araiostegia pulchra</i> | + | + | - |
| Davalliaceae | <i>Davallodes membranulosum</i> | + | - | - |
| Davalliaceae | <i>Leucostegia immersa</i> | - | - | + |
| Dennstaedtiaceae | <i>Dennstaedtia appendiculata</i> | - | - | + |
| Dennstaedtiaceae | <i>Dennstaedtia scabra</i> | - | - | + |
| Dennstaedtiaceae | <i>Pteridium revolutum</i> | - | - | + |
| Dryopteridaceae | <i>Dryopteris juxtaposita</i> | - | + | + |
| Dryopteridaceae | <i>Dryopteris carolihopei</i> | - | - | + |
| Dryopteridaceae | <i>Dryopteris chrysocoma</i> | - | + | - |
| Dryopteridaceae | <i>Dryopteris cochealata</i> | - | + | + |
| Dryopteridaceae | <i>Peranema cyatheoides</i> | - | - | + |
| Dryopteridaceae | <i>Polystichum squarrosom</i> | - | + | + |
| Dryopteridaceae | <i>Tectaria coadunata</i> | - | + | + |
| Equisetaceae | <i>Equisetum diffusum</i> | - | - | + |
| Gleicheniaceae | <i>Dicranopteris linearis</i> | - | + | + |
| Gleicheniaceae | <i>Gleichenia gigantea</i> | - | - | + |
| Hymenophyllaceae | <i>Hymenophyllum polyanthos</i> | + | - | - |
| Hymenophyllaceae | <i>Hymenophyllum exsertum</i> | - | + | - |
| Lindsaeaceae | <i>Lindsaea odorata</i> | - | - | + |
| Lindsaeaceae | <i>Sphenomeris chinensis</i> | - | + | + |
| Lomariopsidaceae | <i>Elaphoglossom stelligerum</i> | - | + | - |
| Lycopodiaceae | <i>Huperzia hamiltonii</i> | + | + | - |
| Lycopodiaceae | <i>Huperzia pulcherrima</i> | - | + | - |
| Lycopodiaceae | <i>Huperzia subulifolia</i> | + | + | - |
| Lycopodiaceae | <i>Huperzia serrata</i> | - | + | + |
| Lycopodiaceae | <i>Lycopodiella cernua</i> | - | - | + |
| Lycopodiaceae | <i>Lycopodium japonicum</i> | - | + | + |
| Nephrolepidaceae | <i>Nephrolepis cordifolia</i> | + | + | + |
| Oleandraceae | <i>Oleandra wallichii</i> | + | + | - |
| Osmundaceae | <i>Osmunda japonica</i> | - | + | + |
| Plagiogyraceae | <i>Plagiogyria euphlebia</i> | - | - | + |

| | | | | |
|------------------|--|---|---|---|
| Polypodiaceae | <i>Arthromeris wallichiana</i> | - | + | + |
| Polypodiaceae | <i>Drynaria mollis</i> | + | - | - |
| Polypodiaceae | <i>Goniophlebium argutum</i> | + | - | - |
| Polypodiaceae | <i>Lepisorus contortus</i> | + | - | - |
| Polypodiaceae | <i>Lepisorus mehrae</i> | + | - | - |
| Polypodiaceae | <i>Lepisorus nudus</i> | + | + | - |
| Polypodiaceae | <i>Lepisorus scolopendrium</i> | + | - | - |
| Polypodiaceae | <i>Microsorium membranaceum</i> | + | + | - |
| Polypodiaceae | <i>Pichisermollia ebinipes</i> | + | - | - |
| Polypodiaceae | <i>Pichisermollia quasidivariata</i> | + | - | - |
| Polypodiaceae | <i>Pichisermollia stewartii</i> | + | - | - |
| Polypodiaceae | <i>Pichisermollia subebinipes</i> | - | + | - |
| Polypodiaceae | <i>Polypodiodes amoena</i> | + | + | - |
| Polypodiaceae | <i>Polypodiodes lachnopus</i> | + | + | - |
| Polypodiaceae | <i>Polypodiodes microrhizoma</i> | - | + | |
| Polypodiaceae | <i>Pyrrosia costata</i> | - | + | - |
| Polypodiaceae | <i>Pyrrosia porosa</i> | + | + | - |
| Polypodiaceae | <i>Selliguea oxyloba</i> | + | + | - |
| Pteridaceae | <i>Cheilanthes bicolor</i> | - | + | - |
| Pteridaceae | <i>Cheilanthes dalhousiae</i> | - | + | - |
| Pteridaceae | <i>Cheilanthes formosana</i> | - | + | - |
| Pteridaceae | <i>Cheilanthes rufa</i> | - | + | - |
| Pteridaceae | <i>Coniogramme pubescens</i> | - | - | + |
| Pteridaceae | <i>Onychium cryptogrammoides</i> | - | + | + |
| Pteridaceae | <i>Onychium siliculosum</i> | - | + | + |
| Pteridaceae | <i>Pityrogramme calomelanos</i> | - | + | - |
| Pteridaceae | <i>Pteris aspercaulis</i> | - | + | + |
| Pteridaceae | <i>Pteris biaurita</i> | - | - | + |
| Pteridaceae | <i>Pteris cretica</i> | - | - | + |
| Pteridaceae | <i>Pteris puberula</i> | - | - | + |
| Pteridaceae | <i>Pteris vittata</i> | - | + | + |
| Pteridaceae | <i>Pteris wallichiana</i> | - | - | + |
| Schizaeaceae | <i>Lygodium flexuosum</i> | - | - | + |
| Schizaeaceae | <i>Lygodium japonicum</i> | - | - | + |
| Selaginellaceae | <i>Selaginella chrysocaulos</i> | - | - | + |
| Selaginellaceae | <i>Selaginella pallida</i> | - | + | - |
| Selaginellaceae | <i>Selaginella subdiaphna</i> | - | + | |
| Selaginellaceae | <i>Selaginella vaginata</i> | + | - | - |
| Selaginellaceae | <i>Selaginella involvens</i> | + | - | - |
| Thelypteridaceae | <i>Thelypteris cana</i> | - | - | + |
| Thelypteridaceae | <i>Thelypteris dentata</i> | - | - | + |
| Thelypteridaceae | <i>Pseudophegopteris pyrrhorhachis</i> | - | - | + |

| | | | | |
|------------------|--|---|---|---|
| | <i>subsp. distans</i> | | | |
| Thelypteridaceae | <i>Pseudophegopteris pyrrhorhachis</i> <i>subsp. lateropens</i> | - | - | + |
| Vittariaceae | <i>Vittaria taeniophylla</i> | + | - | - |
| Woodsiaceae | <i>Athyrium drepanopterum</i> | - | - | + |
| Woodsiaceae | <i>Athyrium fimbriatum</i> | - | + | + |
| Woodsiaceae | <i>Athyrium foliolosum</i> | - | - | + |

Appendix V: Comparison of species diversity of Daman and Adjoining areas of Makwanpur District.

| S.No. | Families | No. of genera | | No. of species | |
|-------|------------------|---------------|-------|----------------|-------|
| | | Makwanpur | Daman | Makwanpur | Daman |
| 1 | Adiantaceae | 1 | 1 | 3 | 2 |
| 2 | Aspleniaceae | 1 | 1 | 1 | 3 |
| 3 | Blechnaceae | 1 | 1 | 1 | 1 |
| 4 | Botrychiaceae | 1 | 1 | 3 | 1 |
| 5 | Cyatheaceae | 1 | 0 | 1 | 0 |
| 6 | Davalliaceae | 1 | 3 | 2 | 3 |
| 7 | Dennstaedtiaceae | 3 | 2 | 5 | 3 |
| 8 | Dryopteridaceae | 5 | 4 | 7 | 7 |
| 9 | Equisetaceae | 1 | 1 | 2 | 1 |
| 10 | Gleicheniaceae | 1 | 2 | 1 | 2 |
| 11 | Grammitidaceae | 1 | 0 | 1 | 0 |
| 12 | Hymenophyllaceae | 1 | 1 | 1 | 2 |
| 13 | Lindsaeaceae | 1 | 2 | 1 | 2 |
| 14 | Lomariopsidaceae | 1 | 1 | 2 | 1 |
| 15 | Lycopodiaceae | 3 | 3 | 4 | 6 |
| 16 | Marattiaceae | 1 | 0 | 1 | 0 |
| 17 | Nephrolepidaceae | 1 | 1 | 2 | 1 |
| 18 | Oleandraceae | 1 | 1 | 1 | 1 |
| 19 | Ophioglossaceae | 1 | 0 | 1 | 0 |
| 20 | Osmundaceae | 0 | 1 | 0 | 1 |
| 21 | Plagiogyraceae | 0 | 1 | 0 | 1 |
| 22 | Polypodiaceae | 9 | 9 | 20 | 18 |
| 23 | Pteridaceae | 5 | 5 | 17 | 14 |
| 24 | Schizaeaceae | 1 | 1 | 2 | 2 |
| 25 | Selaginellaceae | 1 | 1 | 3 | 5 |
| 26 | Thelypteridaceae | 2 | 2 | 11 | 4 |
| 27 | Vittariaceae | 1 | 1 | 1 | 1 |
| 28 | Woodsiaceae | 2 | 1 | 6 | 3 |

Appendix III: Altitudinal range of collected Pteridophytes.

| Family | Name of the species | 700 m | 800 m | 900 m | 1000 m | 1100 m | 1200 m | 1300 m | 1400 m | 1500 m | 1600 m | 1700 m | 1800 m | 1900 m | 2000 m | 2100 m | 2200 m | 2300 m | 2400 m | 2500 m |
|------------------|-----------------------------------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Adiantaceae | <i>Adiantum incisum</i> | - | - | + | + | + | + | + | + | + | - | - | - | - | - | - | - | - | - | - |
| Adiantaceae | <i>Adiantum philippense</i> | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - | - | - | - |
| Aspleniaceae | <i>Asplenium ensiforme</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + |
| Aspleniaceae | <i>Asplenium laciniatum</i> | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - | - |
| Aspleniaceae | <i>Asplenium yoshinaga</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - |
| Blechnaceae | <i>Woodwardia biserrata</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Botrychiaceae | <i>Botrychium lanuginosum</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + |
| Davalliaceae | <i>Araiostegia pulchra</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | - |
| Davalliaceae | <i>Davallodes membranulosum</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | - | - | - | - | - | - |
| Davalliaceae | <i>Leucostegia immersa</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + |
| Dennstaedtiaceae | <i>Dennstaedtia appendiculata</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + |
| Dennstaedtiaceae | <i>Dennstaedtia scabra</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | - | - | - | - | - | - |
| Dennstaedtiaceae | <i>Pteridium revolutum</i> | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + | + | + | + | + |
| Dryopteridaceae | <i>Dryopteris juxtaposita</i> | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + | + |
| Dryopteridaceae | <i>Dryopteris</i> | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - |

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|------------------|----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| eridaceae | <i>eris carolihopei</i> | | | | | | | | | | | | | | | | | | | | |
| Dryopteridaceae | <i>Dryopteris chrysocoma</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + |
| Dryopteridaceae | <i>Dryopteris cochealata</i> | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - | - | - | - | - |
| Dryopteridaceae | <i>Peranema cyatheoides</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | |
| Dryopteridaceae | <i>Polystichum squarrosum</i> | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + | + | + | + |
| Dryopteridaceae | <i>Tectaria coadunata</i> | - | - | + | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Equisetaceae | <i>Equisetum diffusum</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | - | - | - | - | - | - | - |
| Gleicheniaceae | <i>Dicranopteris linearis</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - |
| Gleicheniaceae | <i>Gleichenia gigantea</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | - | - | - | - | - |
| Hymenophyllaceae | <i>Hymenophyllum polyantios</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + |
| Hymenophyllaceae | <i>Hymenophyllum exsertum</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + |
| Lindsaeaceae | <i>Lindsaea odorata</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - |
| Lindsaeaceae | <i>Sphenomeris chinensis</i> | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + | + | - |
| Lomariopsidaceae | <i>Elaphoglossum stelligerum</i> | - | - | + | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Lycopodiaceae | <i>Huperzia subulifolia</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | - |

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|------------------|--------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lycopodiaceae | <i>Huperzia hamiltonii</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - |
| Lycopodiaceae | <i>Huperzia pulcherrima</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + |
| Lycopodiaceae | <i>Huperzia serrata</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - |
| Lycopodiaceae | <i>Lycopodiella cernua</i> | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + | + | - |
| Lycopodiaceae | <i>Lycopodium japonicum</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Nephrolepidaceae | <i>Nephrolepis cordifolia</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - |
| Oleandraceae | <i>Oleandra wallichii</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + |
| Osmundaceae | <i>Osmunda japonica</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - |
| Plagiogyriaceae | <i>Plagiogyria euphlebica</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - |
| Polypodiaceae | <i>Arthromeris wallichiana</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | - |
| Polypodiaceae | <i>Drynaria mollis</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + |
| Polypodiaceae | <i>Goniophlebium argutum</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + |
| Polypodiaceae | <i>Lepisorus contortus</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - |
| Polypodiaceae | <i>Lepisorus mehrae</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + |
| Polypodiaceae | <i>Lepisorus nudus</i> | - | - | + | + | + | + | + | + | + | - | - | - | - | - | - | - | - | - | - |
| Polypodiaceae | <i>Lepisorus scolipendrium</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - |
| Polypodiaceae | <i>Microsorium</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - |

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|---------------|--------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| diaceae | <i>orum membranaceum</i> | | | | | | | | | | | | | | | | | | | |
| Polypodiaceae | <i>Pichismollia ebinipes</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + |
| Polypodiaceae | <i>Pichismollia quasidi varicata</i> | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - | - |
| Polypodiaceae | <i>Pichismollia stewartii</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + |
| Polypodiaceae | <i>Pichismollia subebinipes</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | - |
| Polypodiaceae | <i>Polypodiodes amoena</i> | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + | + | - |
| Polypodiaceae | <i>Polypodiodes lachnopus</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + |
| Polypodiaceae | <i>Polypodiodes microrhizoma</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - |
| Polypodiaceae | <i>Pyrrisia costata</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + |
| Polypodiaceae | <i>Pyrrisia porosa</i> | - | - | + | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Polypodiaceae | <i>Selliguea oxyloba</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + |
| Pteridaceae | <i>Cheilanthes bicolor</i> | - | - | + | + | + | + | + | + | + | + | - | - | - | - | - | - | - | - | - |
| Pteridaceae | <i>Cheilanthes dalhousiae</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - |
| Pteridaceae | <i>Cheilanthes formosana</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | - |
| Pteridaceae | <i>Cheilanthes rufa</i> | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - | - | - | - |
| Pteridaceae | <i>Coniogramme pubescens</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + |

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|---------------------|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pterida ceae | <i>Onychium cryptogrammoides</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + |
| Pterida ceae | <i>Onychium siliculosum</i> | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + | + | - | - | - | |
| Pterida ceae | <i>Pityrogramma calomelanos</i> | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - | - | - | - | |
| Pterida ceae | <i>Pteris aspercaulis</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | - | |
| Pterida ceae | <i>Pteris biaurita</i> | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + | + | + | |
| Pterida ceae | <i>Pteris cretica</i> | - | - | - | - | - | - | - | + | + | + | + | + | + | + | - | - | - | - | | |
| Pterida ceae | <i>Pteris puberula</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | | |
| Pterida ceae | <i>Pteris vittata</i> | + | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Pterida ceae | <i>Pteris wallichiana</i> | + | + | + | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Schizae aceae | <i>Lygodium flexuosum</i> | - | - | + | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Schizae aceae | <i>Lygodium japonicum</i> | - | - | + | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Selagin ellaceae | <i>Selaginella chrysoaulos</i> | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - | - | - | - | |
| Selagin ellaceae | <i>Selaginella involveans</i> | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - | |
| Selagin ellaceae | <i>Selaginella pallida</i> | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - | |
| Selagin ellaceae | <i>Selaginella subdiaphna</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | - | - | - | - | - | - | |
| Selagin ellaceae | <i>Selaginella vaginata</i> | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | - | - | - | - | |
| Thelypteridaceae | <i>Pseudopteris pyrrhorrhachis</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | - | - | |

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|------------------|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | <i>subsp. distans</i> | | | | | | | | | | | | | | | | | | | |
| Thelypteridaceae | <i>Pseudophegopteris pyrrhorhachis subsp. laterensis</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + |
| Thelypteridaceae | <i>Thelypteris cana</i> | - | - | - | - | - | - | - | - | - | - | - | + | + | + | + | + | + | + | - |
| Thelypteridaceae | <i>Thelypteris dentate</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | + | - | - |
| Vittariaceae | <i>Vittaria taeniophylla</i> | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - | + | + |
| Woodsiaceae | <i>Athyrium drepanopterum</i> | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - | - | - | - | - |
| Woodsiaceae | <i>Athyrium fimbriatum</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + |
| Woodsiaceae | <i>Athyrium foliolosum</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | + | + | - |

Appendix IV: Phytosociological Attributes of Pteridophytes in Quadrat studies.

| S. No. | Name of the species | Total No. individuals | Total No. of Plot of Occurrence | Total No. of Plots studied | Frequency | Frequency class | Density | Abundance | Relative Frequency | Relative Density | Relative Abundance | Important Value Index |
|--------|-----------------------------------|-----------------------|---------------------------------|----------------------------|-----------|-----------------|---------|-----------|--------------------|------------------|--------------------|-----------------------|
| 1 | <i>Pteris puberula</i> | 589 | 9 | 40 | 22.5 | B | 3.68 | 65.44 | 9 | 16.55 | 8.37 | 33.92 |
| 2 | <i>Selaginella chrysocaulos</i> | 1406 | 17 | 40 | 42.5 | C | 8.79 | 82.71 | 17 | 39.52 | 10.57 | 67.09 |
| 3 | <i>Pteris wallichiana</i> | 45 | 4 | 40 | 10 | A | 0.28 | 11.25 | 4 | 1.26 | 1.44 | 6.70 |
| 4 | <i>Lepisorus mehrae</i> | 156 | 1 | 40 | 2.5 | A | 0.98 | 156.00 | 1 | 4.38 | 19.94 | 25.33 |
| 5 | <i>Athyrium foliolosum</i> | 148 | 8 | 40 | 20 | A | 0.93 | 18.50 | 8 | 4.16 | 2.37 | 14.52 |
| 6 | <i>Pteris aspercaulis</i> | 170 | 7 | 40 | 17.5 | A | 1.06 | 24.29 | 7 | 4.78 | 3.10 | 14.88 |
| 7 | <i>Dryopteris juxtaposita</i> | 98 | 9 | 40 | 22.5 | B | 0.61 | 10.89 | 9 | 2.75 | 1.39 | 13.15 |
| 8 | <i>Polypodium lachnopus</i> | 5 | 2 | 40 | 5 | A | 0.03 | 2.50 | 2 | 0.14 | 0.32 | 2.46 |
| 9 | <i>Asplenium ensiforme</i> | 12 | 1 | 40 | 2.5 | A | 0.08 | 12.00 | 1 | 0.34 | 1.53 | 2.87 |
| 10 | <i>Polystichum squarrosulum</i> | 185 | 6 | 40 | 15 | A | 1.16 | 30.83 | 6 | 5.20 | 3.94 | 15.14 |
| 11 | <i>Arthromeris wallichiana</i> | 132 | 5 | 40 | 12.5 | A | 0.83 | 26.40 | 5 | 3.71 | 3.38 | 12.09 |
| 12 | <i>Drynaria mollis</i> | 56 | 2 | 40 | 5 | A | 0.35 | 28.00 | 2 | 1.57 | 3.58 | 7.15 |
| 13 | <i>Pichisermollia subebinipes</i> | 52 | 2 | 40 | 5 | A | 0.33 | 26.00 | 2 | 1.46 | 3.32 | 6.79 |
| 14 | <i>Araiostegia pulchra</i> | 44 | 3 | 40 | 7.5 | A | 0.28 | 14.67 | 3 | 1.24 | 1.88 | 6.11 |
| 15 | <i>Pteris cretica</i> | 25 | 1 | 40 | 2.5 | A | 0.16 | 25.00 | 1 | 0.70 | 3.20 | 4.90 |

| | | | | | | | | | | | | |
|----|---|-----|---|----|-----|---|-------|--------|---|------|------|-------|
| 16 | <i>Coniogramme pubescens</i> | 20 | 1 | 40 | 2.5 | A | 0.13 | 20.00 | 1 | 0.56 | 2.56 | 4.12 |
| 17 | <i>Oleandra wallichii</i> | 20 | 2 | 40 | 5 | A | 0.13 | 10.00 | 2 | 0.56 | 1.28 | 3.84 |
| 18 | <i>Cheilanthes formosana</i> | 72 | 2 | 40 | 5 | A | 0.45 | 36.00 | 2 | 2.02 | 4.60 | 8.63 |
| 19 | <i>Polypodiodes amoena</i> | 1 | 1 | 40 | 2.5 | A | 0.01 | 1.00 | 1 | 0.03 | 0.13 | 1.16 |
| 20 | <i>Selliguea oxyloba</i> | 14 | 2 | 40 | 5 | A | 0.09 | 7.00 | 2 | 0.39 | 0.89 | 3.29 |
| 21 | <i>Huperzia hamiltonii</i> | 1 | 1 | 40 | 2.5 | A | 0.01 | 1.00 | 1 | 0.03 | 0.13 | 1.16 |
| 22 | <i>Dennstaedtia appendiculata</i> | 105 | 4 | 40 | 10 | A | 0.66 | 26.25 | 4 | 2.95 | 3.36 | 10.31 |
| 23 | <i>Thelypteris cana</i> | 22 | 1 | 40 | 2.5 | A | 0.14 | 22.00 | 1 | 0.62 | 2.81 | 4.43 |
| 24 | <i>Lycopodium japonicum</i> | 6 | 2 | 40 | 5 | A | 0.04 | 3.00 | 2 | 0.17 | 0.38 | 2.55 |
| 25 | <i>Pteridium revolutum</i> | 68 | 2 | 40 | 5 | A | 0.43 | 34.00 | 2 | 1.91 | 4.35 | 8.26 |
| 26 | <i>Athyrium drepanopterum</i> | 18 | 1 | 40 | 2.5 | A | 0.11 | 18.00 | 1 | 0.51 | 2.30 | 3.81 |
| 27 | <i>Onychium siliculosum</i> | 47 | 1 | 40 | 2.5 | A | 0.29 | 47.00 | 1 | 1.32 | 6.01 | 8.33 |
| 28 | <i>Pseudopteris pyrhorhachis subsp. laterrepens</i> | 37 | 2 | 40 | 5 | A | 0.23 | 18.50 | 2 | 1.04 | 2.37 | 5.40 |
| 29 | <i>Pseudopteris pyrhorhachis subsp. distans</i> | 4 | 1 | 40 | 2.5 | A | 0.03 | 4.00 | 1 | 0.11 | 0.51 | 1.62 |
| | Total | | | | 250 | | 22.24 | 782.22 | | | | |