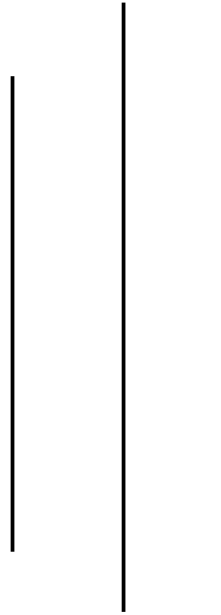


**PTERIDOPHYTES OF NUBRI VALLEY, MANASLU
CONSERVATION AREA, CENTRAL NEPAL**



**A DISSERTATION SUBMITTED FOR THE PARTIAL FULFILLMENT OF
THE MASTER'S DEGREE OF SCIENCE IN BOTANY**

BY

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ROLL NO.- 23/066/67

SYMBOL NO.- 13023

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CENTRAL DEPARTMENT OF BOTANY

TRIBHUVAN UNIVERSITY

KATHMANDU

2013



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Ref No:

KIRTIPUR, KATHMANDU
NEPAL

RECOMMENDATION

This is to certify that M. Sc. Dissertation work entitled "**Pteridophytes of Nubri Valley, Manaslu Conservation Area, Central Nepal**" has been carried out by Shreehari Bhattarai under my supervision. The entire work is based on field study and lab work performed by the student and the same work has not been submitted for any other degree. I recommend this dissertation work to be accepted as a partial fulfillment for Master's Degree of Science in Botany, Tribhuvan University.

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LETTER OF APPROVAL

This dissertation work submitted by Shreehari Bhattarai entitled "Pteridophytes of Nubri Valley, Manaslu Conservation Area, Central Nepal" has been accepted as a partial fulfillment of the requirements for Masters of Science in Botany (Plant Systematics and Biodiversity).

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ACKNOWLEDGEMENTS

I would like to express my sincere gratitude and deep respect to my supervisor Dr. Sangeeta Rajbhandary for her enormous suggestions and continuous encouragement throughout the research work.

I am grateful to Prof. Dr. Pramod K. Jha, Head of Department, for providing research environment in the department.

I am thankful to Prof. Dr. K. K. Shrestha, Prof. Dr. R. P. Chaudhary, Prof. Dr. M. Siwakoti, and Dr. S. K. Ghimire for valuable suggestions throughout the study.

I am greatly thankful to University Grant Commission, Nepal (Institutional Grant 2067/2069), for providing financial support for this work.

I am indebted to Dr. C. B. Baniya, Dr. D. P. Poudel and my friends Rajesh, Ajay, Til Bikram, Resham, Shova & Dipendra for their valuable cooperation throughout the field, without their help and support this research work would not be presented in this form. I am extremely grateful to C. R. Fraser-Jenkins, TUCH and KATH for identification of taxa and also for necessary facilities for this assignment. Likewise, I appreciate for the help of Mr. J. P. Gajurel, Mr. N. Shrestha, Mr. D. R. Kandel and all staffs of DPR, NTNC-MCAP, Rupa, Rosa, Kusum & all my friends and many known and unknown figures who directly or indirectly helped in this study.

At last, but not least, I would like to express my sincere thanks to my respected Acharya Kapildev Subedi and Jayanti Subedi, my parents Jhanknath Bhattarai and Meen K. Bhattarai and all my family members for their kind cooperation, continuous support and encouragement.

4th September, 2013

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SUMMARY

This study is an inventory based research work carried out in Nubri valley of Manaslu Conservation Area (MCA), Central Nepal. A total of 105 species of Pteridophytes was collected belonging to 45 genera and 20 families. Out of 105 species of pteridophytes two species viz. ***Selaginella vardei*** Lev. and ***Athyrium contingens*** Ching are new records for Nepal. Based on the number of taxa belonging to particular rank Polypodiaceae and Dryopteris are the largest family and genera respectively with 8 and 12 taxa.

On the basis of habitat, majority of the species are terrestrial (65) followed by epiphytic (28) and lithophytic (34). Similarly, a few species are also recorded growing in more than one particular habitat as 16 species growing in both epiphytic and lithophytic conditions. Similarly, one species as epiphytic as well as terrestrial whereas only four species growing in terrestrial and lithophytic habitats.

All together there are some 8 distinct forest types, 1 cropland and 1 meadow in the present study. The species show quite distinct relationship with each other based on these forest types. The species are differentiated into 5 distinct main clades. Almost all of the species of cropland are quite closer in the dendrogram. However, even being the members of the same genera, the species show not closure relationship with each other due to their associate forest types so they get departed. Similarly, the species limited to a particular forest type are closer whereas the species diversified well in more than one forest types are also linked to the species of other genera having the same type of distribution along various forest types.

The study presented here does not show uniform species richness all along the altitudinal gradient. Highest number of species (43) was found between the altitude 2400-2800 m followed by 36 species at 1500-2200 m, likewise 13 species at 3000-3400 m and 10 species at 3600-3800m. The lowest number of four species was found at 4000 m. Similarly, *Notholaena himalaica* and *Onychium contiguum* are with highest distribution range almost from 2200-3600 m followed by *Lepisorus loriformis* and *Osmunda claytoniana* having the range of 2400-3400 m and 2600-3600 m respectively.

Among economically important species, out of total 105 species so far collected 5 species like *Diplazium esculentum*, *Tectaria coadunata*, *Dryopteris cochleata*, *Cythea spinulosa* and water ball of *Nephrolepis cordifolia* species have been found widely used as food; 3 as medicine, one of which also being an important good for export; 1 as ornamental and few others like *Dennstaedtia appendiculata*, *Pteridium revolutum*, *Pteris biaurita*, *Pteris cretica*, *Osmunda claytoniana* mainly for agriculture composting and animal fodder and litters.

ACRONYMS AND ABBREVIATIONS

Alt.	-	Altitude
<i>auct. non</i>	-	<i>auctorum non</i> (misapplication of a name)
C	-	Central Nepal (between 83°-86°30'E)
c.	-	Circa (about)
CDB	-	Central Department of Botany
<i>comb. nov.</i>	-	<i>combinatio nova</i> (taxon has recently been transferred to a new rank)
DPR	-	Department of Plant Resources
E	-	Eastern Nepal (83 ⁰ Eastward)
<i>et al.</i>	-	and others
<i>ex</i>	-	validly published by
Fig.	-	Figure
Fl.	-	Flora
<i>gen. nov.</i>	-	<i>genus novum</i> (new genus name)
HMG	-	His Majesty's of Government (Now Government of Nepal)
In	-	In the publication of
KATH	-	National Herbarium and Plant Laboratories, Godavari
Lat.	-	Latitude
Long.	-	Longitude
m	-	Meter
MCAP	-	Manaslu Conservation Area Project
no.	-	Number
<i>nom. nov.</i>	-	<i>nomen novum</i> (a new name)
<i>nom. nud.</i>	-	<i>nomen nudum</i> (published without description)
<i>non</i>	-	not
NTNC	-	National Trust for Nature Conservation
Pl.	-	Plate
Sp.	-	Species (singular)
<i>sp. nov.</i>	-	<i>species nova</i> (species is new to science)
Spp.	-	Species (Plural)
TU	-	Tribhuvan University
TUCH	-	Tribhuvan University Central Herbarium
var.	-	Varieties
viz.	-	namely
W	-	Western Nepal (86.3 ⁰ Westward)
?	-	Uncertain

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1. INTRODUCTION

1.1 Background

The living world about us is interestingly and infinitely complex. To capture the complexity of life is the notion of biodiversity, the variability among living organism which, in turn, is documented with the floristic study. Within the plant kingdom, life ranges from unicellular algae and bacteria so small that are invisible to naked eye to the large and largest plant that are almost the largest organism ever known today. In such a complex and large ranges of life, exist somewhere between the two extremes, both in structure and life-cycle, the group of plants known as Pteridophytes. It has been established that some 225 million years ago the Pteridophytes were the dominant part of the vegetation of the planet (Gurung, 1991). They share both seed plants in possessing the well developed conducting tissues and lower plants in lacking the seed habit. Moreover, these are quite distinctive from other plants in possessing sporophyte and gametophyte stages independently, reproducing by spores and being well flourished in moist shady areas, where most of other plants fail to flourish, in subtropical and temperate zone.

The Pteridophytes comprising ferns and fern allies constitute an important part in Nepalese flora. Pteridophyte flora of the Himalayan region is considered to be the basic requirements for the knowledge of pteridology (Gurung, 1994). Though they are frequently used for various purposes since prehistoric time, they are equally neglected in terms of exploration. As such though non-flowering by nature, it has a special share in the indoor gardening or decoration, food purpose and medicinal value as well. Ferns show a range of variation in size, form and habit of growth. Some species like the tree ferns (*Cyrtia*) are considerably bigger in size and grow to a height of 3-5 m bearing a long trunk and large fronds at the top. On the other hand, there are minute ones such as *Hymenophyllum*, *Azolla* and *Salvinia* not more than 2-3 cm (Gurung, 1991).

Nepal, though being small in area, is rich in biodiversity. This is because of high variable climate and mountainous habitat creating microclimates. As a result, 534 species of pteridophytes comprising 102 genera belonging to 35 families has been reported from Nepal (DPR, 2002). However, according to recent information, there exist some 556 taxa with extra subspecies and sub-specific ranks are accepted from Nepal (Fraser-Jenkins, 2010). This shares about 4.45% of the world flora of pteridophytes. Probably about 12,000 species of ferns are reported in the world (World Conservation Monitoring Centre, 1992).

Systematic study includes description, identification, nomenclature & classification and reconstruction of phylogeny. Hence, exploration is the first and foremost step of systematic

treatment of an organism which comes under description. Floristic or inventory is the systematic documentation of all plant species in a given geographic region (Simpson, 2006). An inventory is a systematic enumeration of plant species occurring in a given region and ideally provides keys, descriptions and often illustrations (Naik, 1998). This helps in the determination of plant species distributed in that area. A flora may cover any suitable areas from a small patch of forest to a city, district, state, country or even a continent; the main emphasis is given on providing suitable keys and diagnostic descriptions (Naik, 1998).

A flora almost always contains scientific names, and it may also include common names, literature references, descriptions, habitats, geographical distribution, illustrations, flowering times, and notes, they often also include devices called 'keys' that enable the user to identify an unknown plant (www.flora.huh.harvard.edu).

1.2 History and Contribution on Pteridophytes of Nepal

The pioneer plant-exploration and taxonomic study on Nepalese pteridophytes, along with other groups of plants, started since the work of British botanists. The history of Nepalese Pteridophytes provided here is based on DPR (2002); Fraser-Jenkins (2010) and literatures consulted by researcher himself. The first collections of Pteridophytes from Nepal came about at the beginning of the 19th Century. The famous botanist Francis Buchanan (later Francis Hamilton) was the first collector of Nepalese plants and he made collection in 1802-03 on two hills in the Kathmandu Valley, the famous Swayambhunath, or 'Monkey Temple' hillock, at c. 1550 m. alt., and the much higher Shivapuri hill, at c. 2500 m. alt., one of the Valley's surrounding ramparts to the north, with a very rich flora, including many ferns, some of which he collected and had illustrated. Hamilton collected some 31 specimens of pteridophytes in this collection.

Following Hamilton, the second Botanist to bring about study of Nepalese ferns was Dr. Nathaniel Wallich who was able to visit three hills in the Valley, Swayambhunath, Shivapuri and Nagarjun, all well known fern-rich localities today, and Wallich had adroitly sent up to him two collectors to work under him, Frances de Silva and Bharat Singh. With their help Gardner obtained between 1817 and 1819, a large number of plants from around the Valley, including from on the pilgrimage route up into the 'snowy mountains' or Himalayan mid-range, at Gossainkund, above Dhunche, near Langtang Himal, where Singh and de Silva were able to go.

Although the collection of Nepalese pteridophytes started earlier, the taxonomic and biogeographic study started since David Don when he published a book *Prodromus florum*

Nepalensis in 1825 consisting of some 87 pteridophytes mainly based on collection made by Hamilton and Wallich, being the first ever treatment on Himalayan pteridophytes.

Isaac Henry Burkill visited Kathmandu valley in 1907 and published 'Notes from a journey to Nepal in Records of the Botanical Survey of India' in 1910 included 15 species of ferns.

Index Filicum (1857-1862) of Moore and *A Priced Catalogue of Hardy Exotic and British Ferns 6* by Robert Sim (1859) also contain many Nepalese ferns.

Hooker published *Icones Plantarum* (1837-1854), *Species Filicum* (1844-1864), *Filices Exoticae* (1857-1859), *A Second Century of Ferns* (1861) and many other papers which include Nepalese ferns.

Hooker (1855) published *Himalayan Journals including Nepal* (167-275 p.) described many flowering plants and few ferns.

Clarke (1880) published *A Review of the Ferns of Northern India, in Trans. Lin. Soc. London* II. 1.

Beddome (1883) published *Handbook to the Ferns of British india, Ceylon and the Malaya Peninsula* and many other well-known books including many species collected from Nepal in between 1863-1883.

Hope (1899-1904) elucidated many pteridophytes of Nepal in his publication *The Ferns of North-western India*.

Landon (1928) published *Nepal* in which he has listed 135 species of ferns in the appendix, *Flora of Nepal*.

Raizada and Vaid (1952) compiled a list of 46 species of ferns in *Indian Forester* collected by Fleming from western parts of Nepal.

Tagawa (1955) reported a list of 34 species of pteridophytes from Nepalese collections of Nakao *et al.*

A series of eight important expeditions to the eastern Himalaya made by Hara *et al.* in between 1960 and 1985 compiled thousands of plants including many pteridophytes. Besides these collections, the expeditions resulted three volumes of *Flora of the east Himalayas*.

Pandey (1962) compiled a list of 65 species of pteridophytes collected from Kathmandu valley in 1948 to 1949.

Nishida (1966) reported three species of Himalayan *Botrychium* and published a supplementary note on *Himalayan Pteridophytes* (1968) and also 85 species of ferns collected by Shakya & Ohsawa.

Sleep (1968) published major and detailed cytological revisions of the genus *Asplenium*, collected from central Nepal.

Benerji (1972) listed 84 species of pteridophytes from east Nepal, based on collection made by himself along with members of KATH in between 1948 and 1967, out of which 24 were new to Nepal.

Stainton (1972) besides collecting the specimens published the famous book *The Forests of Nepal* providing the clear picture of phytogeography of Nepal.

Vartak (1975) reported 48 species of pteridophytes from the Annapurna and Dhaulagiri Ranges, central Nepal.

Lancaster (1981) published superb and lavishly illustrated book, *A Plantsman in Nepal*.

Sinha and Gurung (1985) published an account on the *Phytogeographical distribution of Pteridophytes of central Nepal*.

Fraser-Jenkins, one of the major contributors of Nepalese Pteridophyte flora, published many authoritative and detailed monographic papers on the pteridology of the Indian subcontinent. His important publications *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) and many more authentic papers have provided nomenclature and taxonomic treatment of the Nepalese species.

The exploration of Nepalese ferns by Nepalese researchers started with the establishment of Department of Medicinal Plants (now Department of Plant Resources) in 1960.

Department of Plants Resources published books on flora viz. *Flora of Phulchoki & Godavari* (1969); *Medicinal Plants of Nepal* (1970); *Flora of Nagarjun* (1973); *Flora of Langtang and Cross Section Vegetation Survey, central Zone* (1976); *Catalogue of Nepalese Vascular Plants* (1976); *Nepali Khadya Kandamulharu* (1981); *Keys to the Pteridophytes, Gymnosperms and Monocotyledonous Generas of Nepal* (1981), *Wild Edible Plants of Nepal* (1982); *Flora of Kathmandu Valley* (1986); *Pteridophytes of Nepal* (2002). Besides these floras, the department has published pteridophyte based research papers in regular bulletins.

Shakya (1965 & 1968) published cytotaxonomical works on ferns of the Kathmandu valley included 42 species of ferns.

Gurung (1977) published *Distribution of Pteridophytes flora in Nepal Himalaya*, a check-list of Nepalese pteridophytes containing 582 species and over a dozen articles. Similarly *The Beautiful Ferns of Nepal* is another contribution made by Gurung (1986) with illustrations.

Khwaunju (1979) carried out cytotaxonomical studies on members of the Polypodiaceae. He published cytological results on the genus *Lepisorus* collected from Bagmati zone, central Nepal in 1982.

Shrestha & Gurung (1989) published an ecological survey of eusporangiate ferns of the Nepal Himalaya.

Manandhar (1996) listed 72 species of ferns with their local names, habitat, distribution and ethnobotanical uses.

Bhattarai (1997) reported 41 species of ferns and fern-allies belonging to 10 families from the area of Pokhara valley.

Siwakoti & Sharma (1998) recorded 95 species of ferns belonging to 50 genera and 32 families of Eastern Nepal (Koshi zone).

Baral (2000) reported 128 species of Pteridophytes belonging to 27 families and 62 genera in *Pteridophytes of Arun River Basin of Makalu-Barun National Park and Buffer Zone*, eastern Nepal on his master's degree dissertation.

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

Pathak et al. (2012) recorded 133 species of fern and fern allies belonging to 59 genera and 26 families from Sankhuwasabha District, eastern Nepal with notes on medicinal values.

NTNC-MCAP (2013) reported some 36 species of Pteridophytes from Manaslu Conservation Area in five-year management plan.

Thapa (2013) revised 27 taxa with sub-specific rank of the genus *Pteris* L. on her master's degree dissertation.

1.3 Justification

In fact, the wealth of a country is the natural and cultural diversity it embodies. Exploration and proper management of these resources become the basis of identity and richness of the country. Flora is needed to allow us to evaluate the diversity of the country's plants resources, to identify materials that are being tested for potential uses, to document geographic ranges and abundance, and to provide access to international databases on plant properties. Regarding this fact, Nepal though having lots of natural paradise, is waiting to be explored till date. Exploration and documentation of these resources with publication in regional as well as global level will obviously be profitable in the course of biodiversity management and conservation of ethnic knowledge. Pteridophyte, though used overwhelmingly since prehistoric time, is also one of the neglected groups of flora. It is very useful in medicine, food and also ecological perspectives. Not only that, larger sized ferns like *Pteridium*, *Cythea*, *Pteris*, *Diplazium* etc. are very much useful in soil conservation. Moreover, the research work on pteridophytes has been done very less in comparison to other higher plants. In this scenario, this study may step up the knowledge of pteridophytes of this locality. Similarly, the use of this flora in local level may provide a key for further research in any area.

1.4 Hypothesis

Diversity of Pteridophytes of Nubri Valley of Manaslu Conservation Area depend on altitude, forest types, habitats and important role in community.

1.5 Research Questions

- Is there any correlation between species with altitude, forest types and habitats?
- Are there any economic values of collected species?

1.6 Objectives

The major objectives of the study was to document the Pteridophyte flora of Nubri Valley of Manaslu Conservation Area whereas the general objectives were as-

- Prepare taxonomic account of Pteridophyte flora with keys and discription.
- Deduce the distribution patterns with respect to altitude, forest types, habitats.
- Document the economic importance of collected fern and fern allies.

1.7 Limitations

The limited time period was the major limitation of the study. Due to remote study area from the district head quarter and no transport walking was the only option which took much time, was another constrain. Similarly most of the areas were not physically accessed so some of the information about the habitat and even some voucher specimens could not be gathered. Due to the lack of relevant fern literatures and poor collections of specimens in both the herbaria of TUCH and KATH, identification became both difficult and time consuming.

2. MATERIALS AND METHODS

2.1 Study Area

2.1.1 Location

The Manaslu Conservation Area (MCA), declared on December 28, 1998 is the second conservation area under NTNC management. MCA, a mountainous region in northern part of Gorkha district covers 1,663 sq. km. with 7 VDCs viz. Samagaun, Lho, Prok, Bihi, Sirdibas, Chumchet and Chhekampar extending between 28⁰21' to 28⁰45' latitude and 84⁰30' to 85⁰12' longitude and ranging from 1400m (Jagat) to 8163m (Mt. Manaslu) altitude. MCA is situated in the northern part of Gorkha district bordering with the Tibetan plateau of the people's republic of China to the north-east, Annapurna Conservation Area to the west and mid part of Gorkha district to the south. The altitudinal variation (1,400-8,163 m asl) has provided various micro climatic habitat that offer shelter to unique biodiversity.

The seven VDCs located in MCA are culturally divided into three valleys namely Nubri, Kutang and Tsum. Of these, Nubri meaning 'The Western Mountains' in local language, comprises of the section of the Budi Gandaki Valley west of Namrung. The research was carried out in Nubri valley of Manaslu conservation area (MCA). Similarly a few collections were also made from Philim, outside the valley. The collection point is shown with dots in the study area (Fig. 2). The major ethnic group in the study area is Bhote (also known as Lama). Gurung and Karki are other major casts in lower belt. Majority of the people follow Budism. Tumba, Nhubria, Kutangba and Gurung are major languages spoken by the local inhabitants.



Fig. 1. Photograph of study area

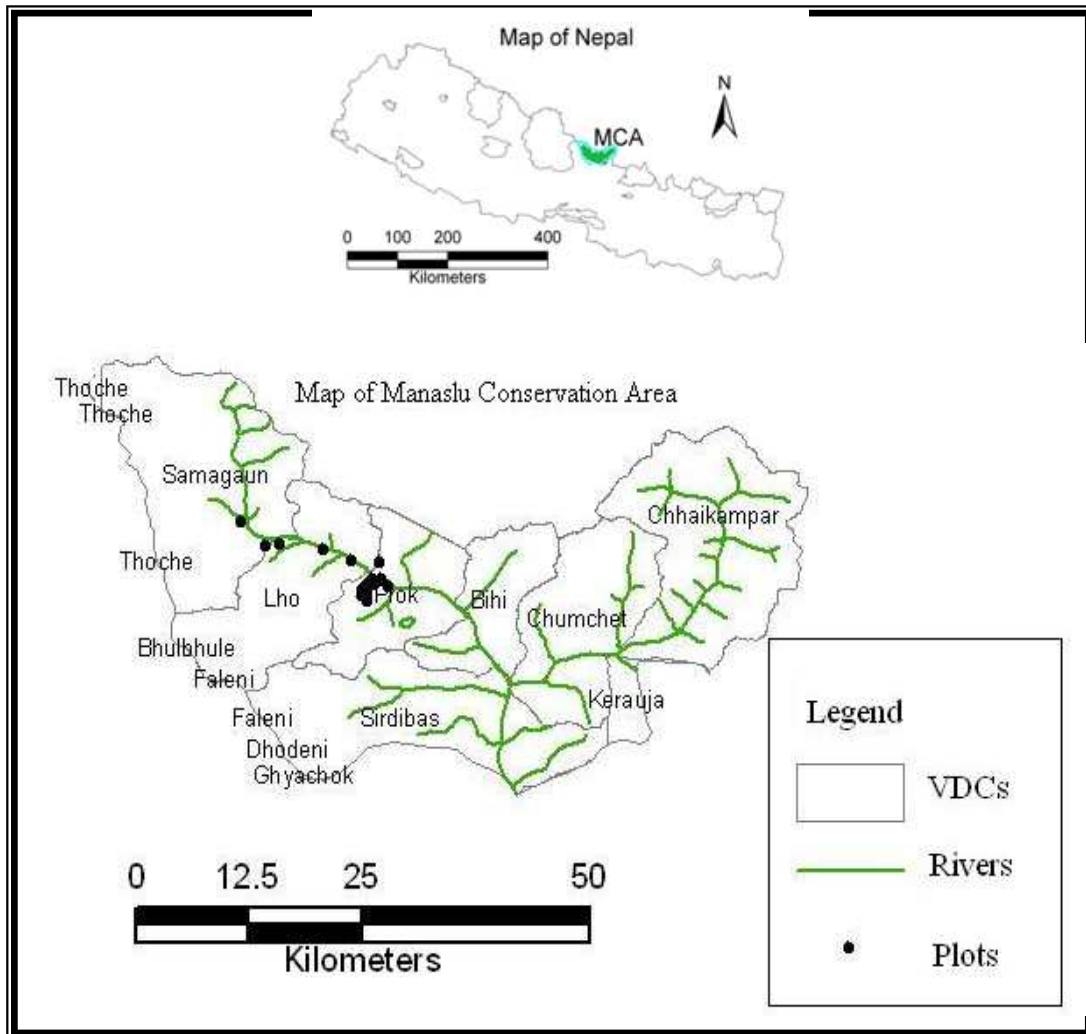


Fig. 2. Dots representing the collection point in the study area.

2.1.2 Vegetation

Vegetation of the study area was quite distinct from low (c. 1500 m) to high altitudes (4000 m) ranging from farm-land (c. 1500 m) to almost alpine meadow (4000 m) including various forest types like Laurels, *Picea*, *Larix*, *Quercus*, *Pinus*, *Rhododendron*, *Acer*, *Juniperus*, Birch as distinct forest with other associated species based on dominance observed in the field.

Picea-Laurels forest (at 2200 m) has dominant *Litsea* and *Neolitsea* species and *Picea*, *Betula* etc. as associated species of the forest. This forest does not exceed higher up along altitudinal gradient.

Larix forest (at 2400 m) is dominated by *Larix* and *Cinnamomum* and *Pyrus* being associated with the dominant *Larix* species.

Quercus forest (at 2600 m) is predominated by *Quercus* and seems to be a pure stand of the monotypic forest of *Quercus* except few no. of *Lyonia* and *Pyrus*.

Quercus-Ilex forest (at 2800 m) is the continuation of the pure stand of *Quercus* forest. Here, besides *Quercus*, *Ilex* is also equally dominant whereas *Abies*, *Vibarnum* and *Acer* are also confined in this forest as associated species.

Pinus forest (at 3000 m) occurs in the form of almost pure patch of *Pinus wallichina*, however, few no. of *Betula*, *Quercus* and *Acer* are also scattered as associated ones.

Rhododendron-Acer forest (at 3200 m) comprises Rhododendron and Acer as dominant species associated with *Berberis*, *Vibarnum*, *Sorbus*, *Salix*.

Rhododendron-Juniperus forests (at 34-3600 m) occurs as scrubs of *Juniperus* mixed with *Rhododendron*.

Rhododendron-Birch forest (38-4000 m) is dominated by *Rhododendron*, *Betula* along with *Sorbus*.

Meadow or open pasture (at above 4000 m) comprises *Anemone*, *Caltha*, *Potentilla*, *Senecio*, *Primula*, *Fritillaria* as dominant herbs. This area is beyond the treeline so no tree species could be found.

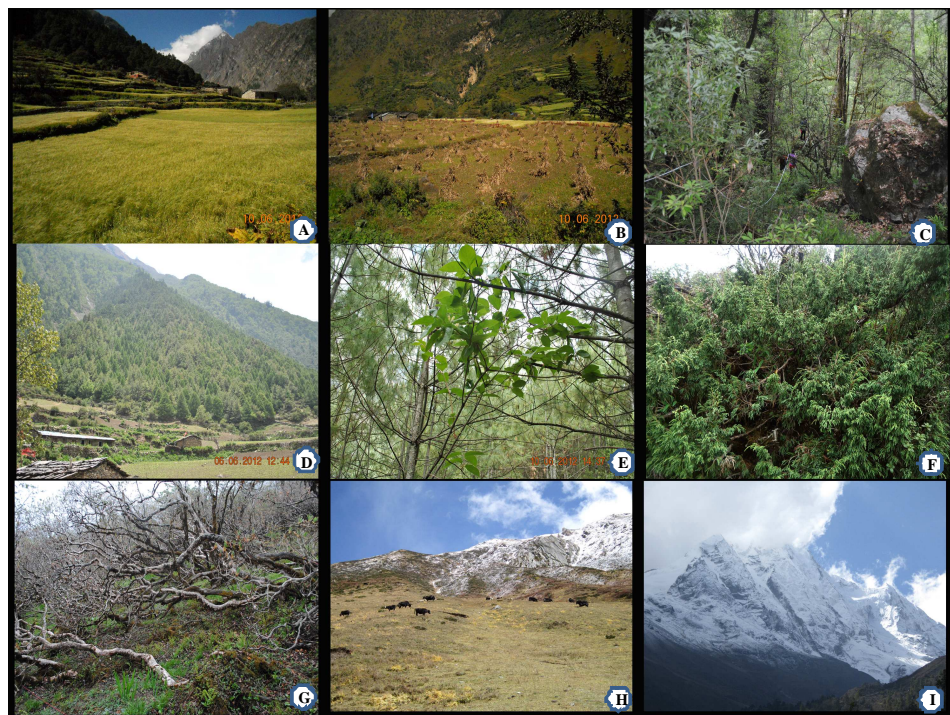


Fig. 3. A-B. Cropland; C. *Picea*-Laurels forest; D. *Larix* forest; E. *Pinus* forest; F. *Juniperus* bushes; G. *Rhododendron* forest; H. Meadow; I. Dry rocks and snow-covered mountain.

2.1.3 Climate

Climate, the long term weather of an area, is the outcome of various factors like water condition, temperature, rainfall, evaporation, sunlight, wind and so on. Of them, temperature and rainfall are the most crucial factor determining the whole set of climate.

Temperature, the hotness or coldness of a body or environment, is influenced by latitude, altitude and distance from the water body. Similarly, topography, cloud cover, vegetation and slope aspect also contribute to influence the temperature of an area. Though the study area lies at the northern part of the district, we could not have the temperature data of the exact study area so here the data of district head quarter (Gorkha) was used to give only the general information. The maximum temperature of the area ranges from 20.6°C in January to 33.1°C in June whereas minimum temperature varies from 7.1°C in January to 22.9°C in July.

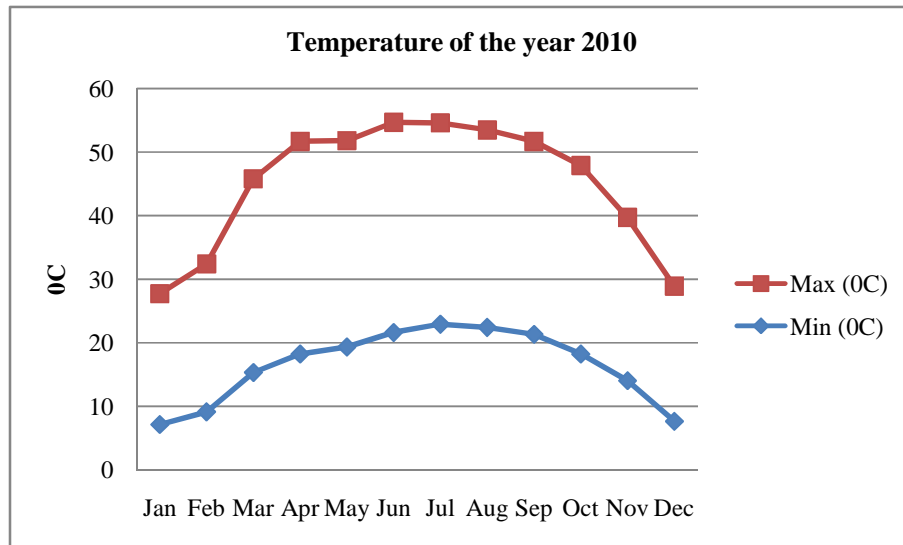


Fig. 4. Minimum and maximum temperature of the year 2010.

(Source : Meterology Department, GN, Nepal)

Similarly, rainfall is another important factor influencing the climate & vegetation. The annual rainfall data used here is from the area (Setibas, 1334 m) quite nearer to the study area. Apart from the amount, seasonal pattern of precipitation and its kind affect the vegetation. Mountain range, latitude, elevation, topography affect the rainfall pattern markedly. While analyzing the data of the year 2010, the maximum rainfall is in July (545.8 mm) followed by September (418.3 mm) and minimum in January and December (0 mm) being completely dried period.

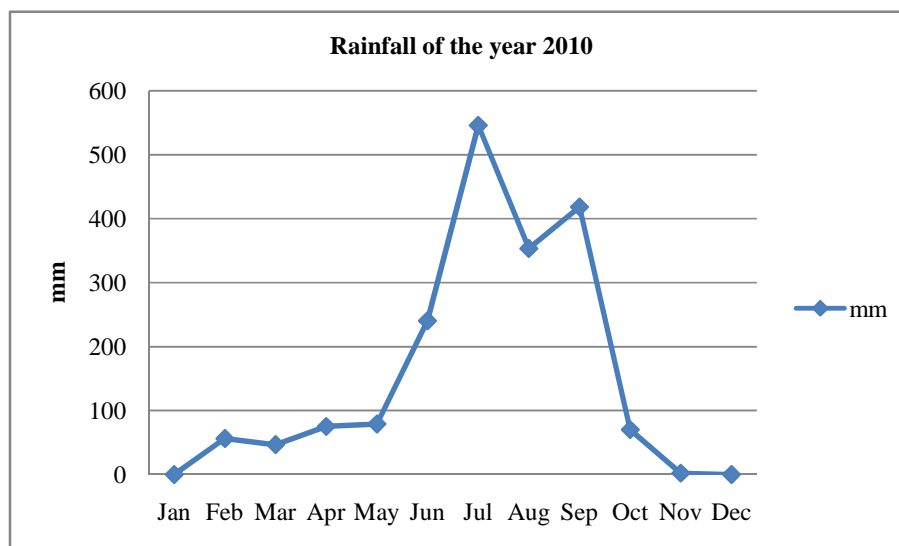


Fig. 5. Rainfall of the year 2010

(Source : Meterology Department, GN, Nepal)

2.2 Field visit to the study area

The field was visited twice pre and post-monsoon in 2012. First visit was on May-June and second Sept-Oct. to cover both major growing and flourishing seasons. The species immature in pre monsoon season were well flourished in post monsoon season so maximum information about the species could be gathered.

2.3 Collection and preparation of herbarium

Mature and healthy plants were selected for herbarium. The specimens were collected with rhizome, hairs and/or scales and fertile portion as far as possible. Before collecting the plant, all the information like color of fertile parts and their arrangement in natural habitat were noted down. The specimens were collected in polythene bags and pressed in herbarium press as soon as possible. Photographs of the specimens were taken in their natural habitat and immediately after collecting from the habitat to examine the sori and scales as well. Photographs were very much useful in delimiting the taxa especially at species level.

Drying the specimens is another vital process of herbarium preparation. All the materials should well be dried to be protected from fungal attack. The plant specimens were dried form the same day of preparation. For pteridophyte specimens simple drying was enough just by properly pressing, regularly checking the specimens during drying and changing paper to obtain neat and clean herbarium. The dried specimens were then mounted on the herbarium sheet and filled the herbarium level.

2.3 Identification

The specimens collected from the field were identified using available relevant literatures like Smith (1879); Beddome (1865-70, 1883, 1892); Schneider (1894); Blatter & d'Almeida (1922); DPR (1976); Iwatsuki (1988); Gurung (1991); Khullar (1994); Khullar (2000); Borthakur *et al.* (2001); DPR (2002); Fraser-Jenkins (2008); Fraser-Jenkins *et al.* (2010) etc. Some specimens were verified as well as identified comparing with specimens deposited at TUCH & KATH and also personal contact with C. R. Fraser-Jenkins.

The morphological studies of the specimens were done in natural habitat as well as in the laboratory. However, to observe minute attribute, such as scales, hairs and soral characters, stereomicroscope was used.

The species are treated based on morpho-geographical discription i.e. focused on morphological characters and geographical distribution. The major characters of morphology used for the taxonomic treatment and identification for the fern and fern allies are rhizome type (creeping or suberect or erect), scales or ramenta (colour, concolorour or bicolorous, shape) of rhizome, stipe and rachis; stipes (articulated or non articulated, colour, length, glabrous or pubescent and/or scaly, texture); lamina (simple or pinnate or compound, shape, size, apex, textuer) pinnae and pinnules (number, arrangement, shape, size, margin, apex); veins (simple or forked, distinctness); sori (indusiate or exindusiate, number, shape, position, arrangement, colour) and colour of spores. Similarly, the distribution range of species along altitudinal gradient was also consulted to make identification easy.

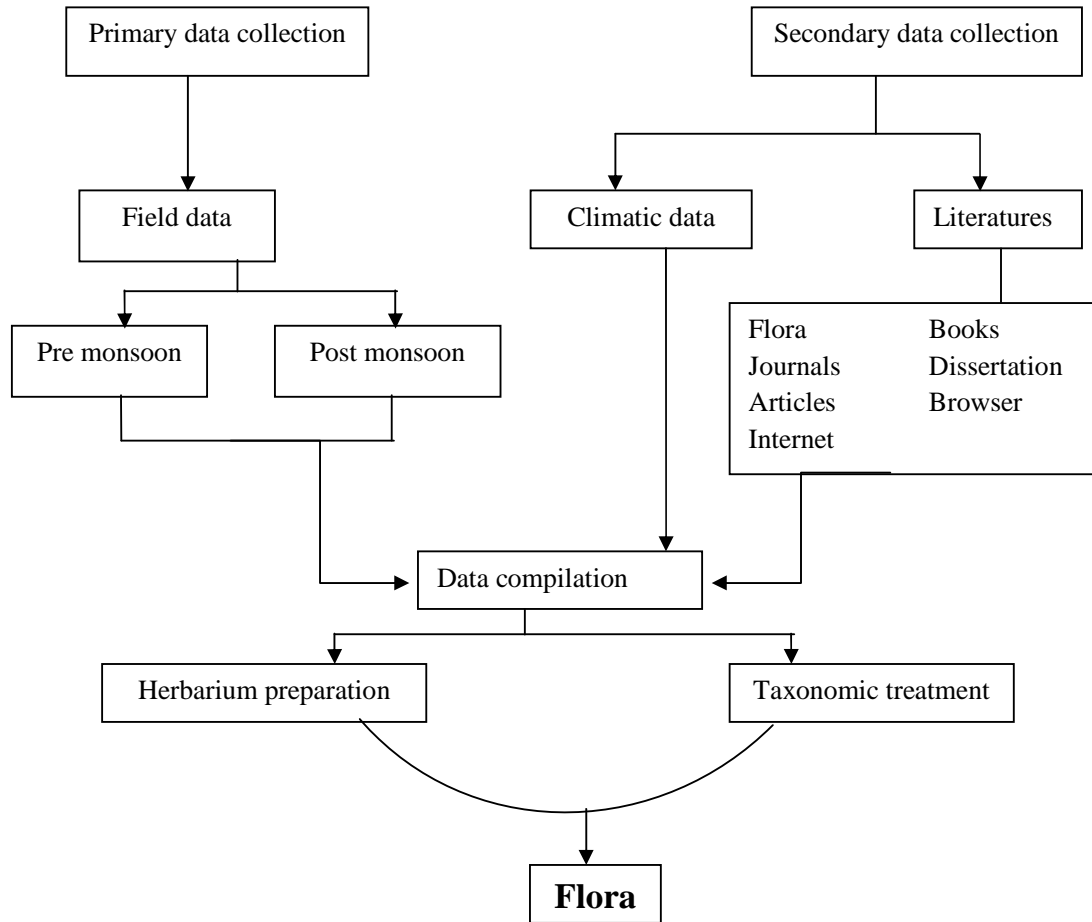
Identification keys for all the taxa containing more than one lower taxa were prepared for ease identification. Distinct character states of the major characters as mentioned above observed in each species were used for making contrasting pair of characters as far as possible.

2.4 Data analysis

The data collected in the field as well as by studying the specimens in the laboratory were analyzed on the basis of habitat type, forest type, distribution range along altitudinal gradient, utility and taxonomic treatment. The total species collected from the field were categorized on the basis of major habitat type viz. epiphytic, terrestrial and lithophytic. The relationship between species based on forest type was constructed in the dendrogram to show the closeness of species. Distribution range of each species along altitudinal gradient was found out. The utility of species used for food, medicine, ornamental and other various purposes were grouped. Under taxonomic analysis the specimens were treated under the family and genera category with morpho-geographic description.

2.5 Flow chart of Methodology

The whole processes of methodology is shown in a flow chart as-



3. RESULTS

3.1 Total no. of families, genera and species

A total no. of one hundred five (105) species of pteridophytes belonging to twenty (20) families and forty-five (45) genera were recorded (Appendix 1). Among the twenty families, Polypodiaceae was the largest family with eight genera followed by Pteridaceae and Woodsiaceae each having six genera each, Dryopteridaceae with five genera and Dennstaedtiaceae with three genera, while many other families were monotypic (Fig. 6).

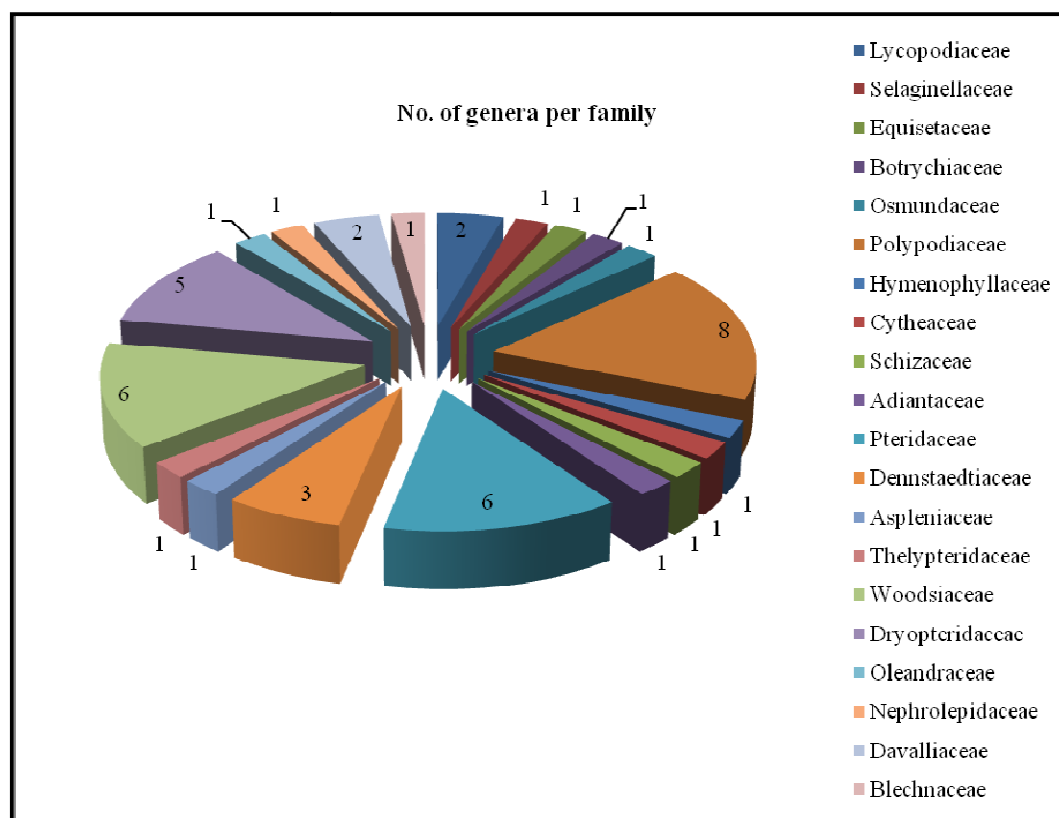


Fig. 6. Total no. of families with the no. of genera

Among the total forty-five genera, *Dryopteris* was the largest genera with twelve species followed by *Athyrium* with ten species. Other large genera are *Polystichum* and *Pteris* with six species each, followed by *Lepisorus* and *Asplenium* (five species each), *Polypodiodes* (four species), *Adiantum*, *Cheilanthes*, *Notholaena*, *Pichisermollia*, and *Selaginella* (three species each), *Araiostegia*, *Botrychium*, *Coniogramme*, *Deparia*, *Diplazium*, *Drynaria*, *Onychium*, and *Thelypteris* (two species each), while rest of the genera are monotypic or containing only one species each (Fig.7).

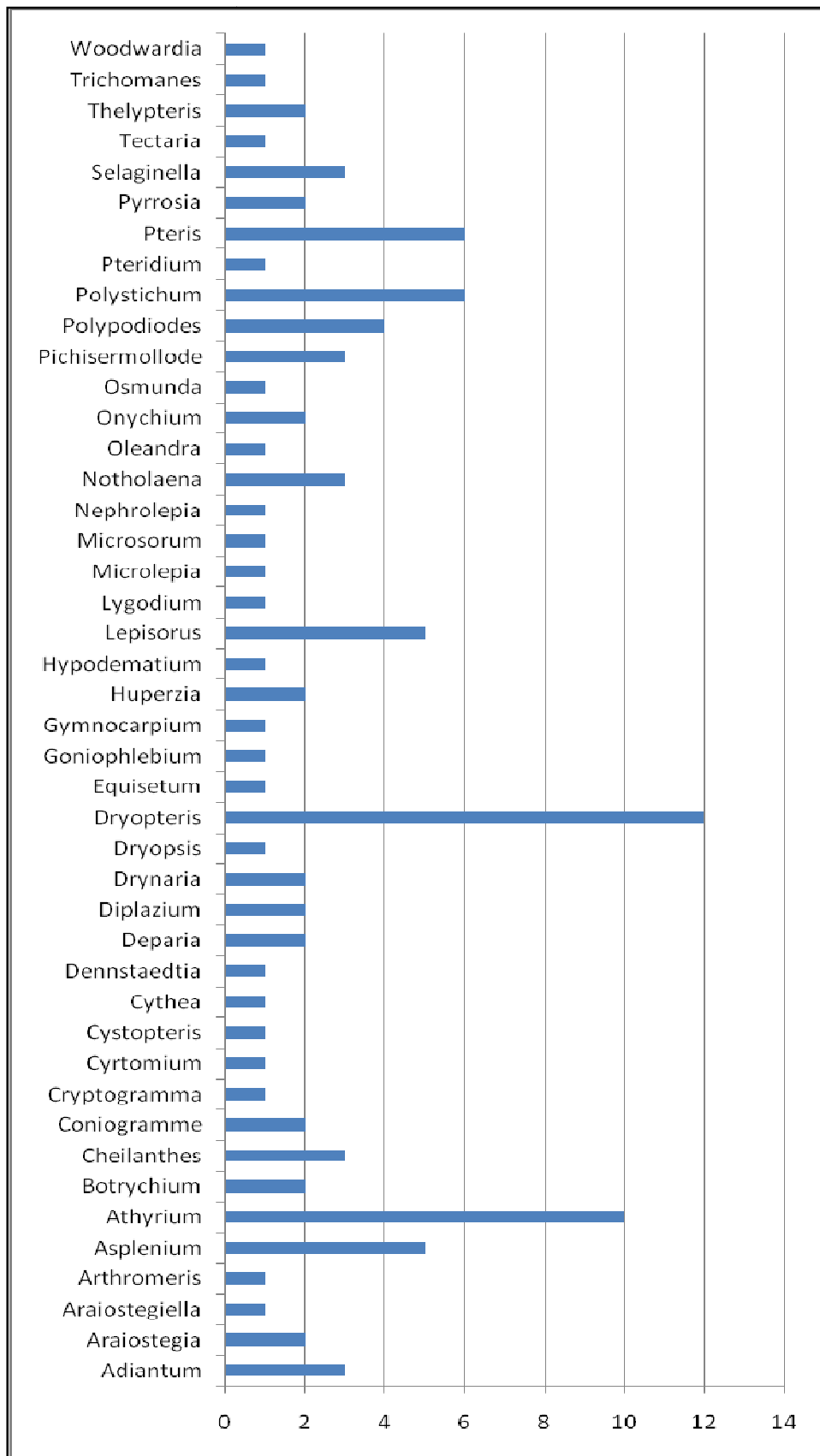


Fig. 7. Species composition by genera.

3.2 Distribution of species among various habitats

Nepal is bestowed with a wide range of climatic and altitudinal variations, because of which the pteridophytes in Nepal are distributed in different biogeographic regions, from the tarai to the high Himalaya. Fern and fern species are found in wide variety of habitats, from high mountain elevations, to rock crevices, in water or in open space. In general they are found in marginal habitats or places where flowering plants cannot survive. There are three particular types of habitats that ferns are found in: moist, shady forests floors, forest edges; in rock crevices and temperate trees as epiphytes.

On the basis of habitat, out of 105 species of pteridophytes 65 species were terrestrial, 28 species epiphytic, and 34 as lithophytes (Fig. 8). Similarly, some of the species were found growing in more than one habitat. Out of the total species one species *Nephrolepis cordifolia* was found growing as terrestrial as well as epiphytic, four species *Adiantum capillus-veneris*, *Nephrolepis cordifolia*, *Polystichum prescottianum* and *Tectaria coadunata* were found as terrestrial as well as lithophytes. While, 16 species (*Asplenium laciniatum* subsp. *kukkonenii*, *Asplenium laciniatum* subsp. *tenuicaule*, *Goniophlebium argutum*, *Lepisorus mehrae*, *Lepisorus scolopendrium*, *Lepisorus thunbergianus*, *Microsorium membranaceum*, *Oleandra wallichii*, *Pichisermollia ebinipes*, *Pichisermollia malacodon*, *Pichisermollia nigrovenia*, *Pichisermollia subebenipes*, *Polypodiodes microrhizoma*, *Polypodiodes amoena*, *Polypodiodes hendersonii*, *Asplenium yoshinagae* subsp. *indicum*) were well flourished as epiphytic and as lithophytes.

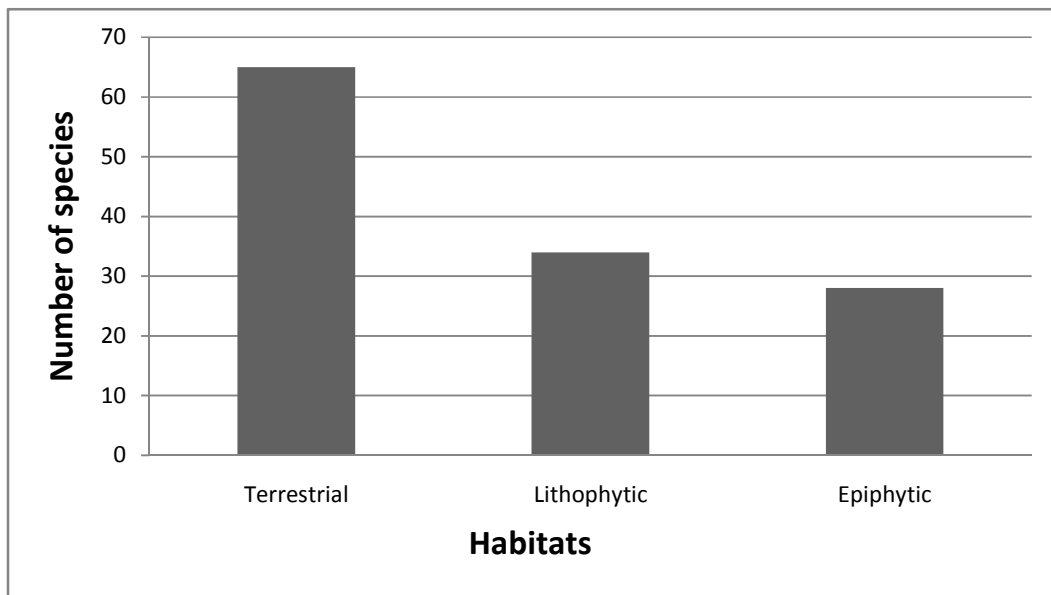


Fig. 8. Diversity of ferns and fern allies with regards to habitats.

3.2.1 Epiphytes

Out of 20 families identified from the study area, species of 6 families (Aspleniaceae, Davalliaceae, Hymenophyllaceae, Lycopodiaceae, Oleandraceae, Polypodiaceae) were found as epiphytes and found mostly on tree trunks in shady and moist part of the forest. Among these families, Polypodiaceae is the largest family with 18 species as epiphytes followed by Aspleniaceae with four species, Davalliaceae with three species and rest of the families with only one species each. Most of the epiphyte species was dominant in *Picea*, *Quercus*, and *Ilex* trees. The species found on the *Picea*, *Quercus*, and *Ilex* trees were epiphytic as was lithophytes.

Common epiphytic pteridophyte species of Nubri valley includes *Araiostegia pulchra*, *Drynaria mollis*, *Asplenium ensiformis*, *Asplenium laciniatum* subsp. *kukkonenii*, *Asplenium laciniatum* subsp. *tenuicaule*, *Lepisorus loriformis*, and *Pichisermollia malacodon*.

3.2.2 Terrestrial

Fern and fern allies were most commonly found in terrestrial habitat. The largest number of 65 species of fern and fern allies was terrestrial. Similarly, majority of species belonging to 15 families (Adiantaceae, Blechnaceae, Botrychiaceae, Cytheaceae, Dennstaedtiaceae, Dryopteridaceae, Equisetaceae, Lycopodiaceae, Nephrolepidaceae, Osmundaceae, Pteridaceae, Schizaceae, Selaginellaceae, Thelypteridaceae, and Woodsiaceae) were found as terrestrial on open shady areas and near streams. Dryopteridaceae, Woodsiaceae are largest families having terrestrial species each with 15 species, followed by Pteridaceae with 14 species. Adiantaceae, Dennstaedtiaceae, and Selaginellaceae, comprises of three species each and rest of the family with one species each.

Athyrium fimbriatum, *Deparia boryana*, *Diplazium esculantum*, *Diplazium maximum*, and *Equisetum raven* are commonly found growing on shady streams. While *Adiantum tibeticum*, *Athyrium flabellulatum*, *Athyrium spinulosum*, *Cystopteris moupinensis*, *Deparia allantodioides*, *Dryopsis apiciflora*, *Dryopteris basisora*, *Dryopteris juxtaposita*, *Dryopteris komarovii*, *Dryopteris redactopinnata*, *Dryopteris sublacara*, *Dryopteris xanthomelas*, *Dryopteris zayuensis*, *Dryopteris fructuosa* were common on shaded and moist forest floor.

Among the terrestrial species *Dryopteris sublacara*, *Notholaena himalaica*, *Onychium cryptogrammoides*, *Osmunda claytoniana*, *Pteridium revolutum*, and *Thelypteris levingei*, was common in most of the forest floor.

3.2.3 Lithophytes

Species of eight families (Aspleniaceae, Adiantaceae, Dryopteridaceae, Nephrolepidaceae, Oleandraceae, Polypodiaceae, Pteridaceae, Woodsiaceae) were found as lithophytes growing in rock crevices under shady areas. Among the lithophytes Polypodiaceae is the largest family with 13 species followed by Dryopteridaceae with 7 species, Aspleniaceae (4 species), Pteridaceae (3 species), and Woodsiaceae with two species.

Asplenium ensiformis, *Asplenium laciniatum* subsp. *kukkonenii*, *Asplenium laciniatum* subsp. *tenuicaule*, *Lepisorus loriformis*, *Pichisermollia malacodon*, *Dryopteris acutodentata*, *Polystichum stenophyllum* are some of the common species as lithophytes found in various forest types but at the same time species like *Asplenium ensiformis*, *Asplenium laciniatum* subsp. *kukkonenii*, *Asplenium laciniatum* subsp. *tenuicaule*, *Lepisorus loriformis* are also found as epiphytes.

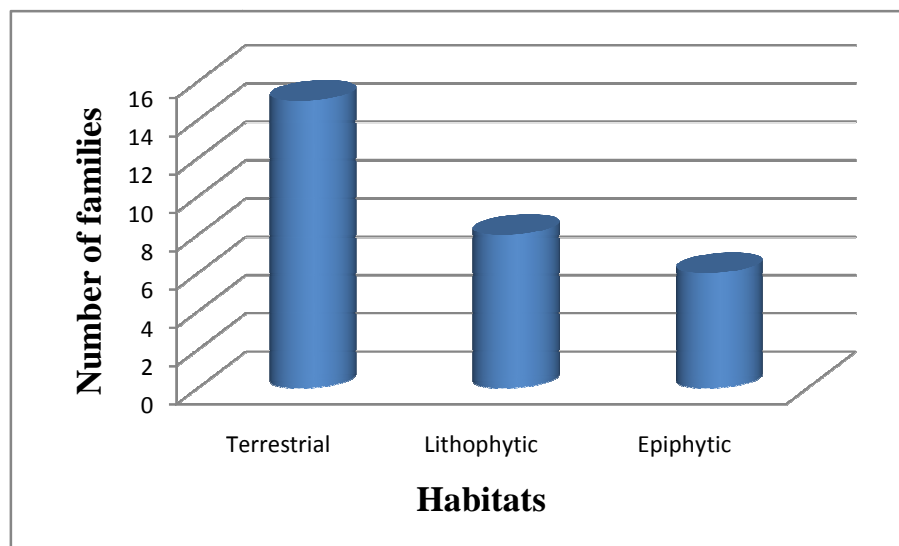


Fig. 9. Number of families representing each habitat.

3.3 Relationship of species based on forest type

On the basis of forest types, the relationship between species found in the area is shown in dendrogram (Fig. 10). In the beginning, the species are splitted into clades '1' representing the species distributed well in more than one forest types and '2' representing the species dominant in specific forest types. The clade '2' again splits into subclades 'A' and 'B'. Of them 'A' represents the species from *Quercus* dominant forest whereas 'B' again splits into subclades 'I', 'II' and 'III' consisting the species of quite higher altitudes in 'I' and 'II' whereas species of lower altitudes in 'III'. Of them, 'I' seems to consist the species from *Juniperus* dominant forest

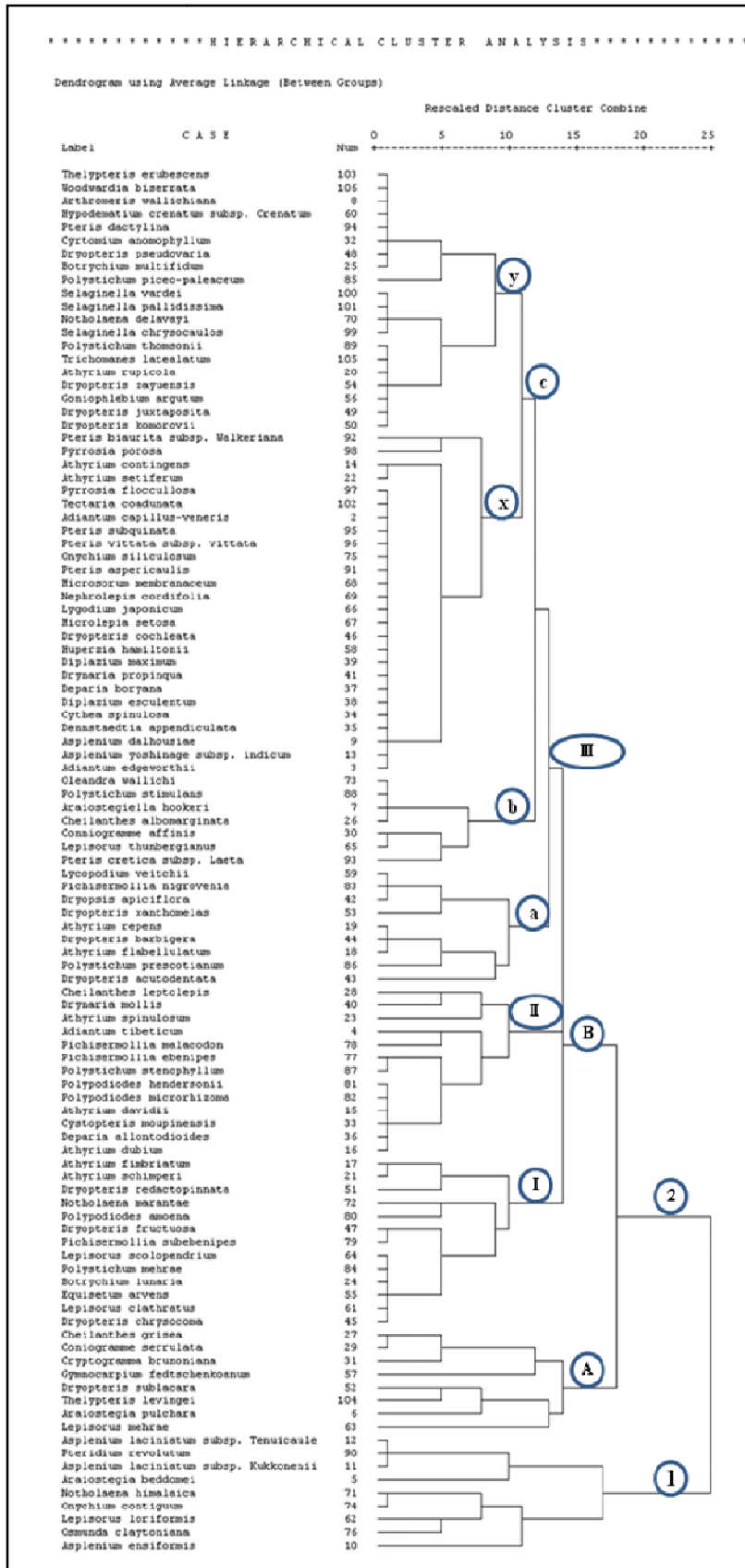


Fig. 10. Relationship of species based on forest types.

whereas 'II' from *Rhododendron-Acer* forest. The subclade 'III' ultimately splits into 'a', 'b' and 'c' subclades of which 'a' gives 'x' containing species from crop land and 'y' from *Picea-Laurales* forest.

3.4 Distribution of species along altitudinal gradient

Altitude plays a very important role in the distribution pattern of ferns. There is great variation in the distribution of fern species (Appendix III) in the study area. Ferns are found abundant between 2400-2800 m having 41% followed by the distribution between an altitude 1500-2200 m with 34% and around 12% between 3000-3400 m and 13% between 3600-4000 m respectively of the total collection. It was also observed that the distribution of ferns is dependent on the floristic composition and structure of the woody vegetation along the slope. The forest between 2400-2800 m is *Larix* and *Quercus* forest which 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. Due to farmland around 1500 m followed by *Laurales* and *Quercus* forest above 2400 m most of the species are terrestrial followed by epiphytes and very few lithophytes. While in high altitude above 3000 m the tree species slowly decreases so the number of epiphytes slowly decreases and there are more number of terrestrial and lithophytes.

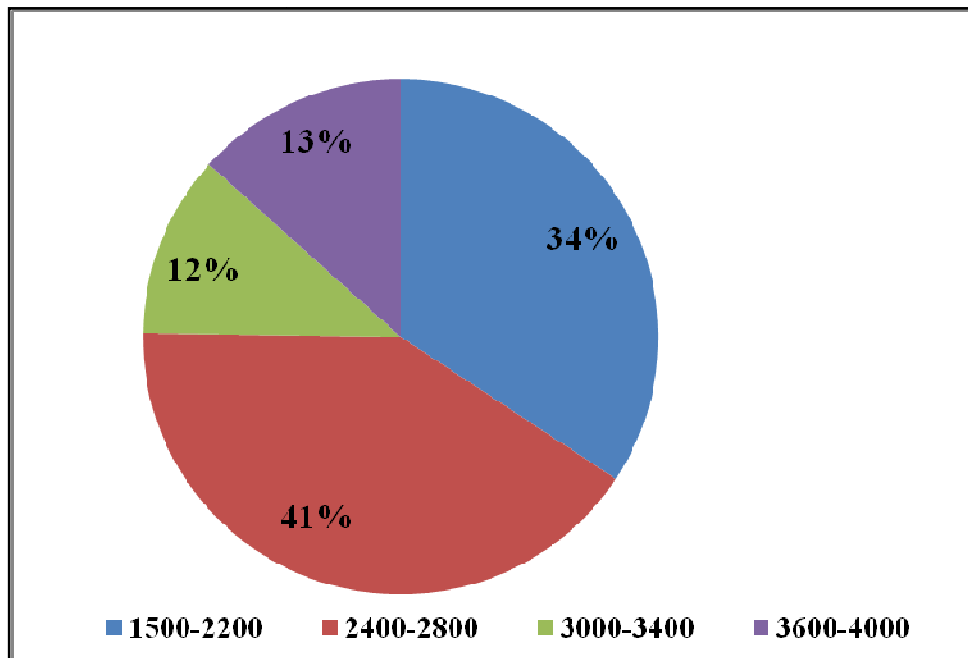


Fig. 11. Diversity of fern and fern allies in regards to different altitude.

Presence of terrestrial and lithophytes in the higher altitude and epiphytes being completely absent at high altitude indicates that the tree species are gradually decreasing towards the tree line, which supports the physiography of the country.

3.5 Economic importance

The economic uses of the species are categorized under the following headings.

- I. **Edible** - A total 5 species have been found widely used as food. The immature shoot of *Diplazium esculentum*, *Tectaria coadunata*, *Dryopteris cochleata*, *Cyrtia spinulosa* and water ball of *Nephrolepis cordifolia* are widely used as vegetable. Of them, *Diplazium esculentum* was the most widely used species for vegetable almost for 2-3 months and some of the areas are already become cleared due to over harvesting.
- II. **Medicinal** - Rhizome of *Drynaria* spp. is one of the major medicinal plants used not only on local level but also a major source of income through export. Huge amount of dried rhizome of *Drynaria* spp. is exported to Tibet. Similarly *Pteris subquinata* is usually used for cut and wound. Likewise, Roots and leaves used as an expectorant. Among them the use of *Pteris subquinata* is reported for the first time.
- III. **Ornamental** - *Nephrolepis cordifolia*, *Drynaria* spp. are widely used for decorative purposes.
- IV. **Others** - Besides the major food and medicinal uses, there are some other utilities too. As the major occupation of locals is mainly agriculture, they need lots of green manure for making compost, fodder and litter for animals. Species like *Dennstaedtia appendiculata*, *Pteridium revolutum*, *Pteris biaurita*, *Pteris cretica*, *Osmunda claytoniana*, *Dryopteris redactopinnata*, *Dryopteris sublacra*, few species of *Athyrium*, *Diplazium maximum*, *Onychium contiguum*, *Coniogramme*, *Deparia* and *Woodwardia* are mainly used.



Fig. 12. A-B. Researcher taking information with local people (photo by Rajesh); C-F. *Diplazium esculentum*, widely used species for vegetable; G. *Tectaria coadunata*; H. Dried rhizome of *Drynaria*; I. *Pteris subquinata*

3.6 Taxonomic Treatment

The pteridophytes collected from the study area are arranged according to Pichi Sermolli, R.E.G. (1996) as followed in DPR (2002). Key to the genera and species found in the field are prepared with the help of available relevant literatures for ease identification. Each taxon with its recent name, author citation, basionym, widely used few synonyms and distribution based on DPR (2002) and Fraser-Jenkins (2008), taxonomic description, ecology and voucher specimen are given.

Lycopodiaceae P. Beauv. *ex* Mirb.

Perennial, evergreen herbs, terrestrial or epiphytic. Stems erect or prostrate, rather branched; more or less elongated. Leaves microphyllous, simple, without ligule. Homosporous; sporangia solitary in the axils of the sporophylls or in terminal spikes.

Key to the genera

- 1a. Epiphytic, plant small, roots in a single basal clump..... *Huperzia*
1b. Terrestrial, plant large, roots emerging at intervals along horizontal stem *Lycopodium*

Huperzia Bernh.

Epiphytic herb. Stems erect, branched. Leaves arranged spirally, small, linear-lanceolate. Sporangia solitary in the axils of the modified leaves, compressed.

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

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

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

Rhizome short-creeping, tufted in a basal point. Stems erect, simple, cylindrical, c. 7 cm long. Leaves simple, elliptic-lanceolate, thick, leathery, margin entire, apex obtuse, midrib distinct, one nerved, lower leaves larger than the upper one. Sporophylls sparsely arranged, elliptic-lanceolate, midrib distinct, base cuneate, margin entire. Sporangia free, solitary in the axils, reniform and compressed, yellowish. (Pl. 1. A).

Distribution : Nepal, uncommon in W. but common in C. & E. at lower mid to higher altitudes (850-2500m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand.

Ecology : Epiphytic on mossy tree trunks.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 30th September, 2012, S. Bhattarai, 950 (KATH).

Lycopodium L.

Plants small to large. Main stems creeping or erect, leafy. Lateral branches ascending or erect, dichotomously branched. Leaves spirally arranged, lanceolate or linear, papery to leathery, midrib indistinct, margin entire or toothed, apex acuminate. Strobili solitary or aggregated.

Lycopodium veitchii Christ, Bull. Geogr. Bot. Mans **1906** : 141 (1906); Herter, Ind. Lycopod.: 46 (1949); Tagawa : 200 (1971); Iwatsuki : 167 (1975); Tsai & Shieh, Fl. Taiwan ed. 2 1 : 43 (1994).

Rhizome long-creeping. Aerial shoots creeping, c. 60 cm long. Lateral branches suberect, 10-15 cm tall, dichotomously branched with well-differentiated lateral branchlets much branched, small stem together with leaves. Leaves spirally arranged, dense, linear-lanceolate, herbaceous, base not adnate to branchlet, sessile, margin entire, apex acuminate. Strobili solitary, terminal, 2-2.5 cm long, pale yellow, sporophylls broadly ovate, imbricate, apex long acuminate. Sporangia enclosed. (Pl. 1. B-C).

Distribution : Nepal, rare in E. & (C. now onward) at high altitudes (3000-3700 m); Myanmar; Tibet; Bhutan; Sikkim; Darjeeling.

Ecology : Rare, growing on Rhododendron-Birch forest floor.

Voucher specimen : Gorkha, Above Samagaun, 4000 m, 9th October, 2012, S. Bhattarai, 1610 (KATH; TUCH)

Selaginellaceae Milde

Terrestrial herbs. Stems tufted, erect or prostrate, much branched and bearing rhizophores. Branches alternate or dichotomous. Leaves simple, small, one nerved with a ligule. Heterosporous; sporangia grouped in strobili.

Selaginella P. Beauv.

Terrestrial, annual herb. Stems suberect, branched, dichotomous. Leaves simple, small, entire with a mid-vein, either all similar and spirally arranged or dimorphic and tetrastichous, a

minute ligule at the adaxial surface. Heterosporous; sporangia borne in the axils of specialized leaves; megasporangia at the base and microsporangia at the apex of the strobilus.

Key to the species

- 1a. Sterile leaves monomorphic, spirally arranged*S. vardei*
1b. Sterile leaves dimorphic, arranged in dorsal and ventral ranks2
2a. Smaller sporophylls in the same plane as the dorsal leaves *S. pallidissima*
2b. Smaller sporophylls in the same plane as the ventral leaves *S. chrysocaulos*

Selaginella chrysocaulos (Hook & 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 & Gurung : 155 (1995); Thapa : 8 (200); DPR : 25 (2002).

Lycopodium chrysocaulos Hook. & Grev., Hook. Bot. Misc. **2** : 401 (1831).

Rhizome long-creeping. Stem tufted, thin, slender, erect, bright yellow, usually rooting at base only and stoloniferous at the base. Lamina 15-18 cm long, 3-5 cm broad, branches short, pinnately decomposed and glabrous. Lateral leaves rather distant, oblique, ovate, closely arranged towards the apex, bright-green, texture membranous, finely serrulate and imbricated over the stem at the base. (Pl. 1. D).

Distribution : Nepal, abundant in W., C. & E. at lower mid to higher altitudes (700-2600 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

Ecology : Common, growing on damp and shady forest floors.

Voucher specimen : Gorkha, Gapsya, 2200 m, 5th June, 2012, S. Bhattarai, 57/11 (KATH; TUCH).

Selaginella pallidissima Spring. Bull. Acad. Roy. Sci. Brux. **10** : 231 (1843); Alston : 216 (1945); Iwatsuki : 168 (1975); Fraser-Jenkins : 319 (1997); Thapa : 8 (2000); DPR : 28 (2002)

Selaginella integerrima sensu Strachey, Gaz. North-West Prov.: 66 (1882); *non* Spring (1850).

Rhizome long-creeping. Stem much branched, creeping or suberect, c. 15 cm long, tufted, thin, slender, rhizophore arises from the base as well as apex of main stem, bright yellow, usually rooting at base only and stoloniferous at the base. Lamina up to 5 cm long, c. 0.5 cm broad,

branches short, pinnately decompose and glabrous. Lateral leaves distant, but closely arranged on ultimate branches, oblique, ovate, bright-green, texture membranous, finely serrulate and imbricated over the stem at the base. (Pl. 1. E).

Distribution : Nepal, scattered W., C. & E. at higher altitudes (2700-3300 m); S.W.China; Uttarakhand.

Ecology : Common, growing on damp and shady forest floors.

Voucher specimen : Gorkha, Gapsya, 2200 m, 1st October, 2012, S. Bhattarai, 973 (KATH; TUCH).

Selaginella vardei H. Leveille, Cat. Pl. Yun-nan, 172 (1917).

Selaginella vardei var. *gracilis* Ching.

Xerophytic habit. Rhizome creeping, aerial shoots creeping, up to 10 cm long. Rhizophores at intervals throughout the length of creeping stem and branches, borne on dorsal side in axils of branches. Main stems anisotomously branched throughout, glabrous; leafy branches glabrous, radially symmetrical. Leaves spirally arranged on all sides of stem and branches, monomorphic throughout, linear-lanceolate, apex acuminate. (Pl. 1. F-G).

Distribution : Nepal, new record in C. at mid altitude (2200 m); S Gansu, Sichuan, Xizang; Yunnan.

Ecology : Uncommon, growing on exposed dry rocks.

Voucher specimen: Gorkha, Gap, 2200 m, 1st October, 2012, S. Bhattarai, 971(KATH; TUCH).

Note: This species was collected from 2200 m which after cross check with all the species of *Selaginella* from Nepal didn't match. Comparing with the morphological characters, the habit and habitat with *Selaginella vardei* from Yunnan Province of China which showed distinct characteristic features having spirally arranged leaves, monomorphic throughout and xerophytic habitat did match the species. The species has therefore, been identified as *Selaginella vardei* new record for Nepal.

Equisetaceae Rich. ex DC.

Perennial herb. Rhizomes creeping. Stems branched, grooved with distinct nodes at intervals, hollow and bearing whorls of very small, scale like leaves and forming a sheath above the nodes; the foliar leaves with many teeth. Spikes terminal.

Equisetum L.

Perennial rather evergreen herb. Rhizomes much branched. Stems erect, ribbed, hollow, except at the nodes and bearing a whorl of toothed, sheathed. Homosporous; sporangiophores in cones.

Equisetum arvens L., Sp. Pl. **2** : 1016 (1753); Hauke, Nova Hedwigia **30** : 435 (1978); Dixit : 19 (1984); Iwatsuki : 243 (1988); Nakaike & Gurung : 155 (1995); DPR : 30 (2002);

Rhizome long, creeping. Stipes erect, green, single stem-ridge, hollow except at nodes, tufted with a narrow central lamina, much scabrous. Leaves reduced to teeth of a foliar loose sheath, simple, whorled, arising from one internode and embracing the next; branches densely whorled, short, arising from the base of the leaf sheath. (Pl. I. H).

Distribution : Nepal, rare in W., C. & E. at low to higher altitudes (1350-3800 m); Tibet; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan.

Ecology : Terrestrial, often growing along the streams of river.

Voucher specimen : Gorkha, Shyalla, way to Lho, 3400 m, 9th June, 2012, S. Bhattarai, 35/16 (KATH; TUCH).

Botrychiaceae Nakai

Rhizome short, erect. Fronds consist of a common stipe of variable length from arise a sterile lamina and a fertile segment. Common stipe thick, fleshy, glabrous or hairy. Sterile lamina pinnately compound; veins free, simple or forked. Fertile segment with a stipe of variable length; fertile spike usually a panicle. Sporangia distinct, large.

Botrychium Sw.

Rhizome short, erect, unbranched. Fronds short, thick, fleshy, consisting of a fertile and a sterile segment. Lamina pinnate; veins free, simple or forked. Fertile segment generally arises towards the base of the common stipe and with a stipe of variable length but longer than the sterile lamina; fertile spike either simple or branched. Sporangia distinct, globular, large. Spores yellowish.

Key to the species

- 1a. Lamina 1-pinnate, pinnae fan shaped *B. lunaria*
- 1b. Lamina 2-3 pinnate *B. multifidum*

Botrychium lunaria (L.) Sw., Schrad. J. Bot. **1800** (2) : 110 (1801); Clarke : 587 (1880); Beddome : 469, f. 293 (1883); Tagawa : 78 (1955); Iwatsuki : 169 (1975); DPR : 32 (2002).

Osmunda lunaria L., Sp. Pl. **2** : 1004 (1753).

Rhizome small, short, erect, apex hairy. Stipes 5-10 cm long, greenish, cylindrical, hollow, succulent. Sterile lamina pinnate 3-5 cm long, 1-2 cm broad, sessile, narrowly triangular lanceolate or oblong, fleshy, coriaceous, glabrous; pinnae 4-5 pairs, close, often overlapping; flabellulate, margin entire, veins free, glabrous. Fertile segment glabrous, panicle, racemose; sporangia large, sessile. Spores yellowish. (Pl. 1. I).

Distribution : Nepal, rare in W. C. & E. at higher to high altitudes (2450-3650 m); Tibet; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan.

Ecology : Terrestrial, growing in meadows.

Voucher specimen : Gorkha, Samagaun, 2230 m, 8th June, 2012, S. Bhattarai, 15/13 (KATH; TUCH).

Botrychium multifidum (S.G. Gmel.) Rupr., Beitr. Pfl. Russ. Reich. **11** : 40 (1859); Iwatsuki : 169 (1975); Fraser-Jenkins : 311 (1997b); DPR : 32 (2002).

Osmunda multifida S. G. Gmel., Nov. Comm. Acad. Sci. Pter. **12** : 517, t. 11 (1768).

Rhizome short, erect. Common stipe medium, 10-13 cm long, sparsely hairy at base. Lamina bipinnate to tripinnatifid, 10-12 cm long, 8-10 cm broad, deltate to broadly triangular, texture herbaceous, glabrous; pinnae 3-4 pairs, 6-7 cm long, 2-3 cm broad, alternate, petiolate, petiole 0.5-1 cm long; ultimate lobes crowded giving the sterile lamina the appearance of a 'ball', acute with their margin, slightly hyaline; veins free, glabrous. Fertile stipes 10-12 cm long, much longer than the sterile one; panicle 2-3 cm long. Spores yellowish. (Pl. 2. A).

Distribution : Nepal, W. C. & E. at mid to higher altitudes (1350-3000 m); Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Rare, growing on forest floor.

Voucher specimen : Gorkha, Gapsya, 2200 m, 30th May, 2012, S. Bhattarai, 58/1 (KATH)

Osmundaceae Berch. & C. Presl

Rhizome erect, hairy. Stipes thick, hairy when young. Lamina 1-2 pinnate, large, fertile pinnae usually devoid of lamina, intermediate; veins free, forked. Sporangia large, free, short-stalked, borne either in clusters along the veins or in tassels. Spores green turning brown at maturity.

Osmunda L.

Rhizome erect or sub-erect, short, thick, hairy. Fronds generally isomorphic. Stipes arranged spirally, stipes bases swollen; rachis hairy like the stipe, narrowly winged. Lamina 1-2 pinnate, usually thick leathery, glabrous on maturity; veins free, forked. Sporangia globose. Spores brown on maturity, globose.

Osmunda claytoniana L. subsp. **vestita** (Wall. ex Milde) A. Love & D. Love, *Taxon* **26** (2-3); 324 (1977); Fraser-Jenkins : 186 (1997); DPR : 35 (2002).

Osmunda claytoniana L. var. *vestita* Wall. ex Milde, *Monogr. Gen. Osmund.*: 102 (1868); Ito : 455 (1966).

Rhizome erect, thick. Fronds isomorphic. Stipes long, 20-50 cm long, stramineous, hairy. Lamina pinnate, 20- 50 cm long, 10-15 cm broad, narrowly triangular lanceolate, texture thick, herbaceous, glabrous; pinnae up to 20 pairs, 7-10 cm long, 2-4 cm broad, alternate to subopposite, shortly petiolate, lanceolate, margin deeply lobed to the costa, rarely pinnate; middle 3-7 pairs of pinnae fertile, the rest sterile, sterile pinnules 0.8-2 cm long, close, oblong, apex rounded or obtuse, margin entire. Fertile pinnae shorter than the sterile ones bearing dense cluster of sporangia; costae of the fertile pinnae hairy, long sporangia produced in dense clusters, attached to the surface of veins. Spores globose. (Pl. 2. B).

Distribution : Nepal, abundant throughout W., C. & E. at mid to high altitudes (1400-3600 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Growing in the forest or in open meadows.

Voucher specimen : Gorkha, Namrung, 2600 m, 12th June, 2012, S. Bhattarai, 29 (10) (KATH; TUCH).

Polypodiaceae Berch. & C. Presl

Mostly epiphytic, rarely terrestrial. Rhizomes creeping or sometimes ascending, with usually broad and peltate based, very rarely bristle-like or hair-like scales. Stipes mostly articulate. Fronds simple and entire 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 reticulate with free veinlets in the areoles. Sori strictly exindusiate, either almost round, small or large, sometimes sunk in cavities in the surgace of the frond, or elongated, parallel to the main veins or parallel to the margin, or acrostichoid on all or part of the frond.

Key to the Genera

- 1a. Fronds dimorphic *Drynaria*
- 1b. Fronds isomorphic 2
- 2a. Fronds pinnatifid to pinnate 3
- 2b. Fronds simple 6
- 3a. Sori one or more rows in between the main veins 4
- 3b. Sori terminal on a free veinlet in an areole 5
- 4a. Lamina pinnate *Arthromeris*
- 4b. Lamina simple, deeply pinnatifid *Phymatopteris*
- 5a. Pinnae fusing, adnate *Polypodiodes*
- 5b. Pinnae separate and articulated *Goniophlebium*
- 6a. Sori round, placed in a single row on either side of the midrib *Lepiorus*
- 6b. Sori scattered all over the leaf surface 7
- 7a. Stellate hairs not present *Microsorum*
- 7b. Stellate hairs present *Pyrrhosia*

Arthromeris J. Sm

Rhizome long-creeping, thick, somewhat fleshy, densely scaly. Stipes rather long, articulated to the rhizome. Lamina pinnate, imparipinnate, glabrous; pinnae opposite to subopposite to alternate, sessile, lanceolate, margin almost entire; veins distinct; veinlets anastomosing to form areolae. Sori exindusiate. Spores bilateral.

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

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

Rhizome long-creeping, thick, somewhat fleshy, densely scaly; scales brown. Stipes distant on rhizome, c. 20 cm long, stramineous to pale-brown, glabrous. Lamina pinnate, c. 15 cm long, c. 8 cm broad, ovate-lanceolate, texture coriaceous, glossy, glabrous; pinnae c. 2 pairs,

subopposite to alternate, sessile, base cuneate or rounded, lower surface pale-green, margin with a thick cartilaginous line; veins prominent, reaching the margin, almost parallel, smaller veins anastomosing to form many irregular areolae.

Distribution : Nepal, common throughout W., C. & E. at upper mid to higher altitudes (2100-3300 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Uncommon, epiphytic on mossy tree trunk.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 12th June, 2012, S. Bhattarai, 21/19 (KATH).

Drynaria (Bory) J. Sm

Rhizomes long-creeping, fronds always of two kinds, sterile ones quite different with characteristic humus collecting nest-leaves, foliage long-stalked, green; rachis hairy, coriaceous; reticulate. sori yellowish-brown, round, in a single row.

Key to the Species

1a. Rhizome-scales papyraceous, imbricate; foliage leaves oblong to oblong-subobovate; lateral pinnae rarely more than 12 pairs *D. propinqua*

1b. Rhizome-scales membranous, patent; foliage leaves oblong-lanceolate; lateral pinnae commonly more than 15 pairs *D. mollis*

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

Rhizome long-creeping, thick, densely scaly; scales light-brown. Fronds dimorphic. Sterile fronds : Stipes very short, base scaly, rachis brown, hairy. Lamina simple, pinnatifid, 8-14 cm long, 5-8 cm broad, elliptical ovate, deeply lobed. Fertile fronds : Stipes 3-7 cm long, light-brown, sparsely scaly, scales as on sterile fronds. Lamina simple, pinnatifid, 25-30 cm long, c. 10 cm broad, ovate, deeply lobed almost to the rachis, margin entire, hairy, apex acute, texture herbaceous, lower lobes gradually much reduced in size, almost half the length of middle ones; lowermost lobe decurrent on stipe; veins anastomosing to form areoles. Sori small, round. Spores brown. (Pl. 2. C-D).

Distribution : Nepal, very common in W., C. & E. at higher altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Epiphytic

Voucher specimen : Gorkha, Gapsya, 2200 m, 30th May, 2012, S. Bhattarai, 4/1 (KATH).

Drynaria propinqua (Wall *ex* Mett.) J. Sm. apud Bedd., Ferns Brit. India : t. 160 (1866); Tagawa : 493 (1966); Iwatsuki : 198 (1975); Nakaïke & Gurung : 192 (1988 a)); DPR : 41 (2002).

Polypodium propinquum Wall. *ex* Mett., Abh. Senck. Naturf. Ges. (Frankfurt) **2** : 120, t. 2, f. 50 (1857); Clarke : 556 (1880); Hope : 89 (1903)

Rhizome long, creeping, strong, covered with bright-brown hairy scales. Fronds distinctly dimorphic, pinnate, sterile ones 10-15 cm long, 8-12 cm broad, sessile, scale-like; fertile ones green, becomes yellowish on maturation, 30-40 cm long, 8-10 cm broad, cut down nearly to the rachis, glabrous, lobes linear, acuminate; rachis raised above and grooved below; texture subcoriaceous; main vein distinct, lateral veins anastomosing; sori conspicuous, bright, round, in a single row on either side of the midrib. (Pl. 2. E).

Distribution : Nepal common throughout W., C. & E. at lower mid to mid altitude; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand.

Ecology : Epiphytic, growing on tree-trunks.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 10th June, 2012, S. Bhattarai, 945 (KATH; TUCH).

Goniophlebium (Bl.) C. Presl

Rhizomes long-creeping, clothed with dark-brown scales. Fronds in two ranks, jointed to short outgrowths from the rhizome, deeply pinnatifid or pinnate; pinnae or lobes shallowly toothed; veins free, veinlets unite to form areoles with a free included veinlets running towards the margin. Sori round, on the terminal end of the included veinlets.

Goniophlebium argutum (Wall. *ex* Hook.) J. Sm. in Hook., Gen. Fil.: t. 51 (1840); Beddome : t. 6 (1865), 323, t. 174 (1883), Nakaïke *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).

Rhizome long-creeping, thick, scaly; scales dark-brown to blackish. Stipes 13-20 cm long, sparsely hairy to glabrous. Lamina pinnate or distal part deeply pinnatifid, 35-50 cm long, 15-

20 cm broad, texture herbaceous, glabrous; pinnae 10-15 cm long, 1.5-2 cm broad, opposite to sub-opposite, sessile, lanceolate, margin shallowly toothed, acuminate; veins prominent, running mid-way to margin, anastomosing to form a series of large costal areolae, with free single included veinlets; veins ends thickened, glabrous. Sori superficial, round, at the ends of free included veinlets in the costal areolae, in a single row on either side of the costa and one between each main lateral veins. Spores yellowish. (Pl. 2. F).

Distribution : Nepal, common in W., C. & E. at mid to upper mid altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Growing as epiphytic and terrestrial on shady parts of the forests.

Voucher specimen : Gorkha, Tallo Rupal, 3200 m, 7th October, 2012, S. Bhattarai, 1469 (KATH).

Lepisorus (J. Sm.) Ching.

Rhizomes long-creeping, covered with dull brown, lanceolate scales. Fronds simple, entire, coriaceous; midrib raised on both surfaces, lateral veins anastomosing. Sori conspicuous, large, round, bright-brown, in a single row on either side of the midrib.

Key to the species

- 1a. Lamina narrow (usually less than 2 cm broad)2
- 1b. Lamina broad (usually more than 2 cm broad)4
- 2a. Rhizome thin, lamina small, c. 5 cm, often broad and slightly blunt-tipped *L. clathratus*
- 2b. Rhizome thick, lamina not so small, apex acuminate.....3
- 3a. Rhizome scales concolorous, sori marginal *L. loriformis*
- 3b. Rhizome scales bicolorous, sori medial, large *L. thunbergianus*
- 4a. Lamina thick, sub-coriaceous, veins obscure *L. mehrae*
- 4b. Lamina thin, herbaceous to membranaceous; veins apparent *L. scolopendrium*

Lepisorus clathratus (C. B. Clarke) Ching, Bull. Fan Mwm. Inst. Bio. (Bot.) **4** : 71 (1933); iwatsuki : 232 (1988); Shieh, De Vol & Kuo, Fl. Taiwan ed. 2 **1** : 489 (1994); DPR : 42 (2002).

Polypodium clathratum C.B. Clarke, Trans. Linn. Soc. Lond. II Bot. **1** : 559, t. 82, f. 1 (1880).

Rhizome long-creeping, thin, scaly. Stipe c. 1 cm long, stramineous, thin, glabrous; rachis prominent. Lamina short, deciduous in winter, often broad and usually slightly blunt-tipped, texture herbaceous; scaly, scales deciduous, becoming glabrous, margin entire, generally middle parts of the frond fertile, herbaceous; glabrous; veins distinct on both surfaces, anastomosing. Sori round, large, medial. Spores yellowish. (Pl. 2. H).

Distribution : Nepal, fairly common in W., C. & E. at high altitudes on rocks; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Jammu & Kashmir; Pakistan.

Ecology : Growing on rocks.

Voucher specimen : Gorkha, Near Birendra Tal, Samagaun, 3600 m, 7th June, 2012, S. Bhattarai, 44/15 (KATH).

Lepisorus loriformis (Wall. ex Mett.) Ching, Bull. Fan Mem. Inst. Biol. (Bot.) **4** : 81 (1933); Tagawa : 494 (1966); Iwatsuki : 198 (1975); Gurung : 99 (1986); Nakaike *et al.* : 192 (1990); DPR : 10 (2000); DPR : 43 (2002).

Polypodium loriforme Wall. ex Mett., Abh. Senck. Naturf. Ges. (Frankfurt) **2** : 92 (1857).

Rhizome short-creeping, thin, densely scaly; scales black, concolorous. Stipes approximate 1-3 cm long. Lamina simple, long, hanging from tree trunks, 30-40 cm long, 1-2 cm broad, narrowly linear, base gradually attenuate, apex long, acuminate, margin entire, texture subcoriaceous, sparsely scaly, persistent in winter; veins obscure. Sori round, small, submarginal. Spores yellow. (Pl. 2. I).

Distribution : Nepal, common in W., C. & E. at upper mid to higher altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand.

Ecology : Common, epiphytic on mossy tree trunks, hanging down.

Voucher specimen : Gorkha, Namrung, 2600 m, 6th October, 2012, S. Bhattarai, 1092 (KATH; TUCH).

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

Rhizome long-creeping, thick, loosely attached to the substratum by long roots, scaly; scales brown. Stipes slightly distant on rhizome, usually crowded towards growing tip, stramineous, scaly, scales brown, rachis prominent on lower surface, stramineous, scaly, scaly dark-brown, decreasing towards the apex, margin with prominent filamentous projections, apex acuminate. Lamina simple, 15-25 cm long, 1.5-3 cm broad, broadly lanceolate, base gradually decurrent on

stipe, apex acute, margin entire, texture thick, subcoriaceous; veins inconspicuous. Sori not deeply immersed, round, large, submedial. Spores yellowish. (Pl. 3. A).

Distribution : Nepal, fairly common in W., C. & E. at mid to upper mid altitudes; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Common, growing as epiphytic or lithophytic.

Voucher specimen : Gorkha, Namrung, 2600 m, 6th October, 2012, S. Bhattarai, 1425 (KATH; TUCH).

Lepisorus scolopendrium (Ham. ex D. Don), Mehra ex Bir, Res. Bull. Panjab Univ. (n. s.) 15 : 168 (1964).

Polypodium scolopendrium Ham. ex D. Don, Prodr. Fl. Nepal.: 1 (1825), non Burm. f. (1768).

Rhizome long-creeping, thick, woody, scaly, scales dark-brown, concolorous. Stipes c. 0.3 mm distant on rhizome, c. 5 cm long, stramineous, sparsely scaly; scales as on rhizome; rachis prominent, scaly, scales as on stipe, gradually decreasing in size on higher up. Lamina simple, c. 40 cm long, 5 cm broad, broad lanceolate, base decurrent on stipe, apex acute, margin entire, texture herbaceous to membranaceous, lower surface scaly; veins distinct, anastomosing to form 4-5 areolae between margin and rachis. Sori immersed forming pustules on the surface, round, sub-medial. Spores yellowish-brown. (Pl. 3. B).

Distribution : Nepal, abundant in W., C. & E. at mid to higher altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

Ecology : Common, growing mostly as epiphytic and sometimes lithophytic.

Voucher specimen : Gorkha, Namrung, 2600 m, 6th October, 2012, S. Bhattarai, 1432 (KATH; TUCH).

Lepisorus thunbergianus (Kaulf.) Ching, Bull. Fan Mem. Inst. Biol. (Bot.) 4 : 88 (1933); Thapa : 11 (2000); DPR : 45 (2002);

Lepisorus stewartii Ching, Acta Bot. Asutro-Sin. 1 : 23 (1983).

Rhizome creeping, thin, scaly; scales very dark-brown with narrow pale edge, bicolorous, broad lanceolate. Stipes distant on rhizome, 1-3 cm long, sparsely scaly, scales as on rhizome, small; rachis distinct, sparsely scaly on lower surface. Lamina simple, 10-20 cm long, 0.5-1.5 cm broad, lanceolate, narrowly linear, base decurrent on stipe, apex attenuate, acuminate,

margin entire, texture lightly cartaceous, lower surface sparsely scaly, upper one glabrous; veins obscure. Sori round, sub-medial, large. Spores pale-yellow. (Pl. 3. C).

Distribution : Nepal, fairly common in W., C. & E. at upper mid altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim Uttarakhand; Jammu & Kashmir; Pakistan.

Ecology : Common, growing as epiphytic or lithophytic on mossy habitat.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 6th October, 2012, S. Bhattarai, 1313 (KATH; TUCH).

Microsorium Link

Rhizome large, creeping, woody, clothed with peltate, clathrate scales and bearing fronds well spaced. Fronds simple and entire, glabrous, texture usually thin, main . Sori round, brown, scattered irregularly on either side of the midrib.

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 (1997)); DPR : 47 (2002).

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

Rhizomes short-creeping, stout, covered with scales. Fronds simple, size variable, large up to 10-70 cm long, 4-11 cm broad, ovate-lanceolate, acuminate, base gradually attenuate, entire, wavy, glabrous; texture herbaceous; veins anastomosing. Sori rather small, yellowish, irregularly scattered. (Pl. 3. D).

Distribution : Nepal, very common in W., C. & E. at mid altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

Ecology : Terrestrial or epiphytic on shady area.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 30th September, 2012, S. Bhattarai, 953 (KATH; TUCH).

Pichisermollia Fraser-Jenkins

Rhizome long-creeping, thick, scaly. Stipe articulated to the rhizome. Lamina simple, deeply pinnatifid, deeply lobed to the rachis, texture coriaceous or herbaceous, lower surface glabrous, sometimes hairy, upper surface glabrous; veins distinct. Sori exindusiate, large, in a row on either side of the main vein.

Key to the species

- 1a. Lamina ovate-lanceolate, pinnae entire, 5-10 pairs 2
- 1b. Lamina deltate, pinnae prominently serrulate, 3-5 pairs3
- 2a. Frond herbaceous, narrow, pinnae deeply lobed to the rachis, dark-reddish to black scales usually present on lower rachis *P. ebenipes*
- 2b. Fronds corser, wide, less deeply seperated pinnae, scales almost absent *P. subebenipes*
- 3a. Fronds pubescent on one or both surfaces *P.nigrovenia*
- 3b. Fronds glabrous on both surfaces*P. malacodon*

Pichisermollia ebinepes (Hook.) Fraser-Jenkins : 49 (2008).

Polypodium ebenipes Hook. Sp. Fil. 5 : 88 (1863).

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

Rhizome long-creeping, thick, scaly, scale dark-brown. Stipes 13-20 cm long, stramineous, thick, very sparsely scaly; rachis sparsely scaly, scales brown. Lamina simple, pinnatifid, 25-30 cm long, 12-15 cm broad, ovate-lanceolate, base cordate, margin deeply lobed almost to the rachis, texture sub-coriaceous, glabrous; lobes oblong-lanceolate, base broad; lateral lobes many, 8-10 pairs, opposite to alternate; lowest pair generally deflexed. Sori oval, sub-medial, in one row on either side of the main vein. Spores brown. (Pl. 3. E).

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

Ecology : A fern of shaded wet rock surfaces or on tree trunks.

Voucher specimen : Gorkha, Down after Kharka, way to Namrung, 3400 m, 4th October, 2012, S. Bhattarai, 1218 (KATH; TUCH).

Pichisermollia malacodon (Hook.) Fraser-Jenkins : 50-51 (2008).

Polypodium malacodon Hook., Sp. Fil. **5** : 87 (1863).

Phymatopteris malacodon (Hook.) Pich. Serm., *Webbia* **28** : 463 (1973); Dixit : 49 (1984); Thapa : 11 (2000); DPR : 50 (2002).

Rhizome long-creeping, thin, scaly. Stipes 8-11 cm long, stramineous, thin, fragile, glabrous; rachis as long as stipe, glabrous. Lamina simple, pinnatifid 10-15 cm long, 8-10 cm broad,

dentate or triangular lanceolate, base subcordate to cordate, margin deeply lobed to the rachis, texture sub-coriaceous, glabrous; lobes ovate lanceolate, base not broad, apex acuminate, margin very prominently and acutely serrulate, teeth many, long and sharp; terminal lobe largest, all drawn upwards, opposite to alternate; veins anastomosing. Sori oval or round, submedial, in one row on either side of the main-vein. Spores light-brown. (Pl. 3. F-G).

Distribution : Nepal, common in W., C. & E. at upper mid altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Lithophytic on mossy rocks or epiphytic on tree trunks (*Sorbus* sp. and *Rhododendron* sp.)

Voucher specimen : Gorkha, Down after Kharka, way to Namrung, 3000 m, 4th October, 2012, S. Bhattarai, 1151 (KATH; TUCH)

Pichisermollia nigrovenia (Christ) Fras.-Jenk. : 51 (2008)

Polypodium shensiense var. *nigrovenium* Christ, Bull. Acad. Int. Geogr. Bot Le Mans **15** : 106 (1906); Fraser-Jenkins : 51 (2008).

Rhizome long creeping, scaly, scales brown, lanceolate. Stipes straw-coloured, 5-10 cm long, slender, glabrous. Lamina simple, pinnatifid deeply to the lobe, 5-9 cm long, 4-6 cm broad, lobes usually not more than 4 pairs, lanceolate, 2-3 cm long, 1-1.5 cm broad, margin shallowly serrate, apex obtuse, lowest pairs usually largest and slightly deflexed, texture papery, pubescent on both surfaces. Veins distinct on both surfaces. Sori orbicular, on either side of the midrib. Spores dark-brown. (Pl. 3. H).

Distribution : Nepal, rare at high altitudes (3500 m); Tibbet; Sikkim.

Ecology : Uncommon, growing as lithophytic or epiphytic on mossy habitat.

Voucher specimen : Gorkha, above Samagaun, 4000 m, 9th October, 2012, S. Bhattarai, 1621 (KATH; TUCH).

Pichisermollia subebenipes (Ching) Fras.-Jenk. : 49-50 (2008).

Phymatopsis subebenipes Ching, Act. Phytotax. Sinica **9** (2) : 193 (1964).

Rhizome long-creeping, thick, scaly, scale dark-brown. Stipes 11-20 cm long, stramineous, thick, very sparsely scaly; rachis glabrous. Lamina simple, pinnatifid, c. 20 cm long, 15-22 cm broad, lobes less dissected, pinnae taper more from a wider base, texture sub-coriaceous, coarser, glabrous; lobes oblong-lanceolate, base broad; lateral lobes c. 5 pairs, opposite to

subopposite; lowest pair largest. Sori oval, sub-medial, in one row on either side of the main vein. Spores brown. (Pl. 3. I).

Distribution : Nepal, in C. and E. at upper mid altitudes; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling.

Ecology : Common fern of shaded wet rock surfaces or on tree trunks.

Voucher specimen : Gorkha, Down after Kharka, way to Namrung, 2800 m, 6th October, 2012, S. Bhattarai, 1421 (KATH; TUCH).

Polypodiodes Ching

Rhizome long-creeping, scaly, scales brown. Fronds isomorphic. Stipes articulated to the rhizome, rachis generally glabrous or sometimes scaly. Lamina simple, deeply pinnatifid, deeply lobed to the rachis, texture herbaceous to subcoriaceous, glabrous; veins anastomosing to form areolae with one free simple excurrent veinlets. Sori exindusiate, in a row on either side of the veins. Spores light-brown.

Key to the species

- 1a. Segment margins incised or incised-serrate *P. amoena*
- 1b. Segment margins densely serrate 2
- 2a. Lamina with basal lobes not deflexed *P. microrhizoma*
- 2b. Lamina with basal lobes deflexed *P. hendersonii*

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

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).

Rhizome long-creeping, thick, densely scaly, scales dark-brown. Stipes distant on rhizome, c. 20 cm long, stramineous to light-brown, lower surface scaly throughout, scales on rhizome but smaller on upper surface. Lamina simple, pinnatifid, large, up to 45 cm long, 25 cm broad, triangular lanceolate, apex acuminate, texture thick, herbaceous to subcoriaceous; lobes many, c. 30 pairs, c. 10 cm long, 1 cm broad, horizontal, lanceolate, base broad, apex acuminate; veins prominent, anastomosing to form a row of costal areolae. Sori round on the included veinlet in the costal areolae, in a single row on either side of the costa. Spores light brown. (Pl. 4. A-B).

Distribution : Nepal, very common in W., C. & E. at mid altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

Ecology : Common, growing as epiphytic or lithophytic.

Voucher specimen : Gorkha, below Namrung, 2400 m, 1st October, 2012, S. Bhattarai, 1030 (KATH; TUCH).

Polypodiodes hendersonii (Bedd.) Fraser-Jenkins, New Sp. Syndr. Indian Pteridol. 202, (1997); DPR : 53 (2002).

Goniophlebium hendersonii Bedd., Suppl. Ferns. South. India Brit. India : 21, t. 384 (1876); Rodl-Linder : 410 (1990).

Rhizome long creeping densely covered with scales, scales black, Fronds remote. Stipe straw-coloured, 5-8 cm long, glabrous . Lamina simple, pinnatifid 10-15 cm long, 3-5 cm broad, lanceolate, base cordate, apex acuminate, lanceolate, lobes c. 15 pairs, subopposite to alternate, margin serrate, apex acute, upper segments spreading or oblique, lowest pairs deflexed, veins distinct, forming a row of areolae containing a simple included veinlet, lamina papery. Sori orbicular, in 1 row on each side of costa, terminal on included veinlets, medial. Spores brown. (Pl. 4. C-D).

Distribution : Nepal, scattered and uncommon in C. & E. at higher altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling.

Ecology : Common, growing as epiphytic or lithophytic on mossy habitat.

Voucher specimen : Gorkha, above Gumba, Namrung, 2800 m, 4th October, 2012, S. Bhattarai, 1253 (KATH; TUCH).

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

Polypodium microrhizoma C. B. Clarke ex Bak. in Hook. & 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. Stipes distant on rhizome, c. 10 cm long, stramineous, thin, glabrous, rachis castaneous brown, thin, generally glabrous, or occasionally very sparsely scaly. Lamina simple, pinnatifid, c. 20 cm long, 5-6 cm broad, linear lanceolate, apex acuminate, deeply lobed almost to the rachis, texture membranaceous, herbaceous, glabrous, lobes c. 20 pairs, 3-4 cm long, 0.3-0.7 cm broad, lanceolate, margin serrate, lower lobe slightly smaller than the subsequent ones; veins anastomosing to form a

single series of costal areolae, but free towards apex of lobe. Sori round, medial, in single row on either side of the costa. Spores light-yellowish. (Pl. 4. E).

Distribution : Nepal, abundant in W., C. & E. at mid to upper mid altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

Ecology : Occasional, growing on tree trunk or on mossy rocks.

Voucher specimen : Gorkha, above Gumba, Namrung, 2800 m, 6th October, 2012, S. Bhattarai, 1318 (KATH).

Pyrrosia Mirb.

Rhizomes slender, creeping, scaly. Stipes short. Fronds simple, entire, fleshy, both the surfaces covered by hairs, hydathodes present, 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 midrib, protected by stellate hairs.

Key to the species

1a. Stipes 5-13 cm long, lamina base rounded or unequally hastate*P. flocculosa*

1b. Stipes short, rarely 2 cm long, lamina base gradually tapered *P. porosa*

Pyrrosia flocculosa (D. Don) Ching, Bull. Chin. Bot. Soc. **1** : 66 (1935); Tagawa : 498 (1966); Iwatsuki : 203 (1975); Dixit : 54 (1984); Hovenkamp : 179, f. 19 (1988); Nakaike & Gurung : 196 (1988a).

Polypodium flocculosum D. Don, Prodr. Fl. Nepal.: 1 (1825); Clarke : 554 (1880); Hope : 88 (1903).

Rhizome short-creeping, thick, densely scaly, scales brown. Stipes distant on rhizome, 5-13 cm long, shorter than lamina, stout, thick, densely hairy, hairs light-brown; rachis hairy, hairs as on stipe. Lamina simple, 6-20 cm long, 1-3 cm broad, lanceolate, base rounded or unequally hastate, one half-ending before the other, apex acuminate, margin entire, texture carnosely coriaceous; lower surface brown, or greyish white, densely hairy, upper surface bright green, hairy; veins immersed; main lateral veins faintly raised on lower surface, oblique, anastomosing. Sori immersed, many, round, small. Spores yellowish. (Pl. 4. F).

Distribution : Nepal, abundant in W., C. & E. at low to lower mid altitudes; Assam.

Ecology : Occasional, epiphytic, growing on *Sapium* trees.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 30th September, 2012, S. Bhattarai, 951 (KATH; TUCH).

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

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

Rhizome short-creeping, covered with hairs-pointed scales. Stipe short. Fronds simple, elongate, narrowly lanceolate, arising slightly apart; 3-20 cm long, 0.5-1 cm broad; densely clothed with dark-brown indumentums; texture coriaceous; veins inconspicuous. Sori rather quite sunk amongst the tomentum; on either side of the mid rib. (Pl. 4. G).

Distribution : Nepal, abundant in W., C. & E. at low to mid altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Epiphytic on tree-trunks.

Voucher specimen : Gorkha, Above Gumba, Namrung, 2800 m, 4th June, 2012, S. Bhattarai, 102/9 (KATH; TUCH).

Hymenophyllaceae Link

Rhizome long-creeping, thin, hairy. Stipes thin, length variable, rachis generally winged. Lamina simple to 2-pinnate, texture thin; pinnae number variable; veins free or forked. Sori usually indusiate.

Trichomanes

Rhizome long-creeping, thin, rootless. Fronds small. Lamina pinnate, glabrous, margin of ultimate lobe entire; pseudo-veinlets present. Involucre elongated, trumpet-shaped, receptacle extruded.

Trichomanes latealatum (Bosch) Copel, Fraser-Jenkins : 79 (2008).

Didymoglossum latealatum Bosch, Ned. Kruid. Arch. 5 : 138 (1863).

Crepidomanes latealatum (Bosch) Copel., Philip. J. Sci. **67** : 70 (1938); Iwatsuki : 456 (1966); Dixit : 91 (1984); Nakaike & Gurung : 191 (1988a); Thapa : 9 (2000); DPR : 56 (2002).

Rhizome long-creeping, thin, hairy. Stipes 1-2 cm long, dark-brown, thin, glabrous; rachis winged. Lamina 2-pinnate, 1-3 cm long, 1-2 cm broad, ovate, texture thin, glabrous, pinnae up to 7 pairs, alternate, sessile, margin deeply lobed to the costa or becoming pinnate; lobes

narrow, margin entire, apex acute, lower pinnae slightly reduced; veins free with a single veinlet in each ultimate lobe. Sori indusiate. (Pl. 4. H-I).

Distribution : Nepal, W., C. & E at upper mid to higher altitudes (2100-2800 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Rare, growing as epiphytic.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 5th June, 2012, S. Bhattarai, 23/11 (TUCH).

Cytheaceae Kaulf

Mostly tree, radial trunk clothed with hairy scales at the top and often with characteristics scars of fallen leaves and adventitious roots; leaves spirally arranged in a crown, rarely partially dimorphous, pinnately divided, the stipes often spiny and densely scaly; veins simple or forked.

Cythea J. Sm.

Tree fern, trunk erect derived from an upright erect thick, massive, rhizomere; apex densely clothed with scales, spiny; Lamina bipinnate or tripinnatifid, large, texture subcoriaceous to coriaceous; veins free. Sori dorsal on the veins or on their axils, indusium cup shaped at first wholly embracing the sorus.

Cythea spinulosa Wall. *ex* Hook., Sp. Fil. **1** : 25, t. 12c (1844); Clarke : 429, t. 49, f. 1 (1880); Beddome : 6, f. 3 (1883); Holttum, Kew bull. **19** : 471 (1965); Tagawa : 470 (1966); Iwatsuki : 208 (1971), 180 (1975); Nakaike & Gurung : 191 (1988a); Shieh, fl. Taiwan ed. **2** **1**: 148 (1994); DPR : 60 (2002).

Tree ferns; trunk up to 7 m tall, thick, spiny throughout, rachis similar to stipe, sparsely scaly on lower surface. Lamina 2-pinnate, large, c. 2 m long, texture sub-coriaceous; pinnae many pairs. 15-35 cm long, alternate, short petiolate, lanceolate, lowest pinnae the largest; pinnules many, margin deeply lobed to the costa; lobes many, acute, margin crenate, serrate, more or less recurved; veins free. Sori indusiate, large, in a single row on either side of the costa; indusial brown. (Pl. 5. A).

Distribution : Nepal, fairly common throughout low to upper mid altitudes (500-2000 m); Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand.

Ecology : Rare, growing near by the farm land.

Common name : Rukh unyun

Schizaeaceae Kaulf.

Terrestrial, climbing herb. Rhizomes long-creeping. Fronds long with twining rachises. Sporangia confined to very narrow fertile lobes of the leaflets and each of them covered with false indusium formed by the outgrowth of the leaf margin.

Lygodium Sw.

Terrestrial, climbing. Rhizomes creeping and hairy. Stipes slender and twinning. Fronds compound; rachis short. Fertile lamina smaller than the sterile ones. Fertile ones fringed with short, narrow lobes; veins forked. Sporangia large, protected by false indusium formed by the reflexed edges of the lobes.

Lygodium japonicum (Thunb.) 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 (1988 a)); DPR : 60 (2002).

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

A climbing fern. Rhizomes long, creeping. Stipes variable, up to 30 cm long, rachis length indeterminate, stramineous, thin, glabrous, narrowly winged. Lamina tri-quadrifid, length indeterminate, pinnae 5-10 cm long, 3-4 cm broad, texture thin, herbaceous, upper surface glabrous, lower surface sparsely hairy, pinnae many pairs, alternate, petiolate, distant, alternate, lateral pinnules palmate, 4-7 pairs of pinnules, middle lobe longest, 3-5 cm long, base auricled, apex blunt; fertile pinnules narrower than the sterile ones; texture herbaceous; veins obliquely ascending, forked. Sporangia arranged in two compact rows on margin. (Pl. 5. B).

Distribution : Nepal, abundant in W. C. & E at low to high altitudes (60-3850 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : On dry and exposed areas.

Uses : Roots and leaves used as an expectorant.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 30th September, 2012, S. Bhattarai, 962 (KATH; TUCH).

Adiantaceae (C. Presl) Ching

Terrestrial. Rhizomes creeping or erect, protected by scales or hairs. Stipes usually glossy, glabrous or hairy. Fronds pinnate, rarely simple, rather entire; costae 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, clothed with brown scales. Stipes erect, slender, purplish, glossy. Fronds simply pinnate, glabrous, texture herbaceous, veins free. Sori marginal, linear; indusium linear, formed of the reflexed margin of the pinnae.

Key to the species

- 1a. Lamina pinnate, rachis usually extended at the tip *A. edgeworthii*
- 1b. Lamina more than 1-pinnate, rachis not extended at the tip 2
- 2a. Pinnules large (1-2 cm long), upper outer margin usually 3-6 lobed, sori one to each pinnule lobe *A. capillus-veneris*
- 2b. Pinnules small (c. 0.5 cm long), usually 1-2 sori to a pinnule *A. tibeticum*

Adiantum capillus-veneris L., Sp. Pl. 2 : 1096 (1753); Clarke : 453 (1880); Beddome : 84 (1883); Hope : 239 (1900); Tagawa : 79 (1955); Ching : 341 (1957); Ito : 458 (1966); Iwatsuki : 172 (1975); Nakaike & Gurung : 188 (1988a); DPR : 61 (2002).

Rhizome long-creeping, thin, scaly. Stipes 5-15 cm long, thin, base scaly, higher up glabrous, glossy; rachis glabrous. Lamina 2-pinnate in lower part, but simply pinnate at distal part, 10-25 cm long, 5-10 cm broad, deltate or ovate, texture light-green, herbaceous, glabrous, pinnae 8-13 pairs, alternate, petiolate, oblique, glabrous, deltate, lowest pinnae the largest, flabellate 'fan shaped', base cuneate, upper outer margin often irregularly lobed; veins numerous, free, distinct. Sori indusiate, elliptic or linear, indusia light-brown. (Pl.5. C).

Distribution : Nepal, super-abundant throughout W. C. & E. at low to upper mid altitudes (100-2300 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan.

Ecology : Terrestrial, commonly growing on rock crevices.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 1st October, 2012, S. Bhattarai, (KATH)

Adiantum edgeworthii Hook., Sp. Fil. 2 : 14, t. 81b (1851); Beddome : 17 (1892); Hope : 237 (1900); Ching : 315 (1957); Ito : 459 (1966); Iwatsuki : 270 (1988); Nakaike & Gurung : 188 (1988a); DPR : 61 (2002).

Rhizome erect, scaly. Fronds uniform, generally erect or pendant. Stipes proximate or distant, dark-brown to blakish, hairy or scaly; rachis generally similar to the stipe; Lamina pinnate, texture herbaceous, glabrous, pinnae shortly petiolate; veins usually free. Sori linear or globose, marginal, short, absent at sinus of the segments, present on the distal part of the veins, sometimes also between them on the lower side of the leaf-lobe which is exerted from the margin of the lamina and sharply reflexed on to the indusi, indusia glabrous. Spores brownish. (Pl. 5. D).

Distribution : Nepal, fairly common in W., C. & E. at mid to higher altitudes (1500-3000 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

Ecology : Usually met with on sandy slopes of shady moist places.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 1st October, 2012, S. Bhattarai, 969 (KATH).

Adiantum tibeticum Ching & Y. X. Lin, Act. Phytotax. Sinica **18** (1) : 104 (1980); Fraser-Jenkins : 151, 419-420 (2008).

Rhizome long-creeping, thin, scaly. Stipes 2-10 cm long, dark-brown to blakish, glabrous, glossy; rachis glabrous. Lamina 3-pinnate, 5-15 cm long, 3-5 cm broad, deltate, texture thin, herbaceous, glabrous; pinnae c. 5 pairs, 2-5 cm long, 0.5-2 cm broad, deltate-ovate, alternate, petiolate, pinnules 3-5 pairs, small, 0.5-1 cm long, 0.3-0.8 cm broad, obcuneate to obovate, alternate, petiolate, basal lateral margins entire, upper outer margin rounded or irregularl, rarely 2-3 lobed, regularly toothed with small teeth, fertile pinnules with 2-3 notches; veins free. Sori indusiate, 1-2 rarely 3 per ultimate lobe borne in a deep notch in the upper outer margin; indusia reniform. Spores light-brown. (Pl. 5. E).

Distribution : Nepal, fairly common in W., C. at upper mid to higher altitudes (2100-3000 m); Tibet; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan.

Ecology : Fairly common on forest floors.

Voucher specimen : Gorkha, Down after Kharka, way to Namrung, 3000 m, 10th June, 2012, S. Bhattarai, 45/18 (KATH; TUCH).

Pteridaceae Ching

Typically terrestrial. Rhizomes creeping or erect, protected by scales or hairs. Fronds mostly pinnate, decompose to simple, rather entire; veins free or anastomosing. Sori typically

marginal and protected by the indusium opening towards the margin or by a reflexed margin or naked; coenosori borne on a commissure connecting the vein ends; sporangia usually short stalked.

Key to the Genera

- 1a. Indusia absent2
- 1b. Indusia present3
- 2a. Lamina lower surface glabrous or sparsely hairy *Coniogramme*
- 2b. Lamina lower surface hairy or scaly *Notholaena*
- 3a. Veinlets jointed in the sori 4
- 3b. Veinlets free everywhere 5
- 4a. Fronds at least once pinnate *Pteris*
- 4b. Fronds rather multipinnate *Onychium*
- 5a. Fronds often dimorphic *Cryptogramma*
- 5b. Fronds all alike *Cheilanthes*

Cheilanthes Sw.

Terrestrial. Rhizomes short creeping, scaly. Stipes slender, erect, purplish, glossy. Fronds small, pinnate to decompounds, hairy or scaly; texture sub-coriaceous; veins free. Sori marginal, placed on the apex of the veins; indusium formed by the reflexed margin.

Key to the species

- 1a. White farina absent *C. leptolepis*
- 1b. White farina visibly present on lower surface of lamina 2
- 2a. Scales dark-brown, bicolorous (central dark-brown, margin pale).....*C. albomarginata*
- 2b. Scales light-brown, concolorous *C. grisea*

Cheilanthes albomarginata C. B. Clarke, Trans. Linn. Soc. Lond. II Bot. 1 : 456, t. 52 (1880); DPR : 65 (2002).

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

Rhizome short, erect, thick, scaly, scales dark-brown, bicolorous (central region dark-brown, margin pale). Stipes 3-10 cm long, both stipe and rachis densely scaly, scales as on rhizome but progressively smaller, densely scaly, scales as on rhizome but progressively smaller on higher up. Lamina 1(-2)-pinnate, 3-12 cm long, 2-5 cm broad, lanceolate, texture herbaceous, lower surface generally farinose, farina yellowish white turning pale towards the maturity, upper surface dark-green, glabrous; pinnae 5-7 pairs, opposite, sessile, margin deeply lobed, apex acute, basiscopic lobes larger. Sori indusiate, marginal. Spores dark-brown. (Pl. 5. F).

Distribution : Nepal, common in W., C. & E. at higher altitudes; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : A common fern along walking sides.

Voucher specimen : Gorkha, Namrung, 2600 m, 6th October, 2012, S. Bhattarai, 1296 (KATH; TUCH).

Cheilanthes grisea Blanf., J. Simla Nat. Hist. Soc. 1 : 21 (1888); DPR : 66 (2002).

Aleuritopteris grisea (Blanf.) Panigrahi, Bull. Bot. Surv. India 2 : 34 (1961); *non sensu* Panigrahi

Rhizome ascending, scaly, scales light-brown, concolorous. Stipes many, 3-8 cm long, thin, glossy, stipe base scaly, dark red, thin, concolorous, lanceolate scales borne on the basal part only; rachis dark-brown to bluish, glossy, glabrous. Lamina 1-2 pinnate, 4-9 cm long, 2-4 cm broad, narrow, lanceolate or deltate, texture herbaceous, lower surface farinose, farina thick, greyish-white, upper surface sparsely farinose, pinnae 5-6 pairs, triangular opposite to subopposite, margin deeply lobed, basiscopic lobe larger than the acroscopic ones; pinnule apex acute. Sori indusiate, marginal, indusia light-brown. Spores dark-brown. (Pl. 5. G).

Distribution : Nepal, fairly common in W., C. & E. at higher altitudes; Tibet; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Common, growing on shaded rocks.

Voucher specimen : Gorkha, Tallo Rupal, 3000 m, 10th June, 2012, S. Bhattarai, 105/18 (KATH; TUCH).

Cheilanthes leptolepis Fraser-Jenkins, Bot. Helv. 102 : 144 (1993); DPR : 66 (2002).

Cheilanthes dalhousiae sensu auct. Ind., non Hook.

Rhizome short, erect, scaly. Stipes 10-15 cm long, shorter than lamina, dark-brown, thick, brittle, glossy, sparsely scaly at base, scales brown, concolorous, spreading, broad lanceolate; rachis glossy, glabrous. Lamina 1-2 pinnate, 20-35 cm long, 5-17 cm broad, subdeltate to lanceolate, texture herbaceous, farina absent, glabrous; pinnae 10-20 pairs, 3-9 cm long, 2-5 cm broad, sub-opposite to alternate, sessile, margin deeply lobed almost to the costa becoming pinnate in lower pinnae; pinnules lanceolate, apex acute, margin lobed, basiscopic pinnules larger than acroscopic pinnule; subdeltate to lanceolate; veins simple. Sori indusiate, marginal; indusia light-brown. Spores dark-brown. (Pl. 5. H).

Distribution : Nepal, common in W., C. & E. at higher altitudes; Tibet; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : A common fern growing along walking sides.

Voucher specimen : Gorkha, below Namrung, 2400 m, 4th October, 2012, S. Bhattarai, 1249 (KATH; TUCH).

Coniogramme Fee

Terrestrial. Rhizomes short-creeping, scaly. Stipes erect, stramineous. Fronds large, pinnate to bipinnate; pinnae few, large, entire, glabrous; texture herbaceous; veins free. Sori elongate along the veins, exindusiate.

Key to the species

1a. Stipes with brownish tinge, veins extend well in to the marginal teeth*C. affinis*

1b. Stipes glabrous, veins extend in to the bases of marginal teeth *C. serrulata*

Coniogramme affinis Wall. *ex* Hieron., *Hedwigia* **57** : 297 (1916); Tagawa : 78 (1955); Ching & S. K. Wu in C. Y. Wu, *Fl. Xizangica* **1** : 99 (1983); Dixit : 77 (1984); DPR : 68 (2002).

Grammitis affinis Wall., List no. 11 (1828), *nom. nud.*

Rhizome long-creeping, thick. Stipes long, c. 35 cm long, brownish or stramineous with a brownish tinge, thick. Lamina 1-2 pinnate, lower pinnae 2-pinnate, rest simply pinnate, up to 1 m long, 20-35 cm broad, upper surface dark olive-green, lower surface yellowish-green, texture herbaceous, pinnae up to 10 pairs, alternate to sub-opposite, petiolate, upper lamina up to 18 cm long, 1.5-3 cm broad, linear lanceolate, base sub-cuneate to rotundate, apex caudate, margin

toothed with sharp teeth; veins free, ending in hydathodes the apices of which extend well in to the marginal teeth. Sori exindusiate. Spores brownish. (Pl. 5. I).

Distribution : Nepal, fairly common in W., C. & E. at upper mid to higher altitudes; Tibet; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Terrestrial, on wet places.

Voucher specimen : Gorkha, below Namrung, 2400 m, 6th October, 2012, S. Bhattarai, 1310 (KATH).

Coniogramme serrulata (Bl.) Fee, Gen. Fil.: 167, t. 14b, f. 2 (1850-52); Fraser-Jenkins : 89 (1997); DPR : 69 (2002).

Gymnogramme serrulatum Bl., Enu. Pl. Jav.: 113 (1828), *non* Fee (1857).

Rhizome long-creeping, thick. Stipes c. 45 cm long, stramineous, thick, glabrous but extreme base scaly. Lamina pinnate, 2-pinnate at base; c. 50 cm long, c. 20 cm broad, narrowly triangular lanceolate, texture thick, chartaceous, lower surface sparsely pubescent, pinnae c. 6 pairs besides the terminal one, alternate, petiolate, the lowest basal pair of pinnules somewhat smaller than the others, base attenuate cuneate, apex abruptly caudate, margin regularly and acutely serrate-spinulose with deltate, cartilaginous teeth. Veins extending into the bases of the marginal serrations. Sori linear. Spores light-brown. (Pl. 6. A).

Distribution : Nepal, common in W., C. & E. at mid to high altitudes (1700-3650 m); Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Growing on moist and shaded area in the forest.

Voucher specimen : Gorkha, Below Namrung, 2600 m, 3rd June, 2012, S. Bhattarai, 38/8 (KATH).

Cryptogramma R. Br.

Rhizome short, ascending or long-creeping, thin. Fronds small, dimorphic; sterile fronds many, small, spreading; fertile fronds few, long, stiff, erect. Stipes proximate or distant, dark-brown, longer in fertile fronds than in the sterile ones; rachis similar to the stipe. Lamina 2-3 pinnate, herbaceous, glabrous; veins free. Sori indusiate, sporangia borne at the ends of forked veins, indusia flase.

Cryptogramma brunoniana Wall. ex Hook. & Grev., Ic. Fil.: t. 158 (1829); Tagawa : 79 (1955); Ito : 461 (1966); Iwatsuki : 175 (1975); Thapa : 9 (2000); DPR : 69 (2002).

Rhizome creeping, thin, scaly. Fronds dimorphic; sterile fronds many, short and spreading, fertile fronds a few having longer stipes and erect. Lamina 2-3 pinnate, texture herbaceous, glabrous, sterile lamina 3-pinnate, texture herbaceous, glabrous, 3-5 cm long, 2-4 cm broad, alternate, shortly petiolate, pinnules obovate, base cuneate, margin deeply lobed, lobes toothed; fertile lamina 4-7 cm long, 3-5 cm broad, terminal pinnule as long as the lateral ones, pod-like, linear, shortly petiolate, margin entire; veins free. Sori indusiate, sporangia on vein ends, almost covering the entire length, indusial false, brown. Spores light-brown. (Pl. 6. B).

Distribution : Nepal, common in W., C. & E. at high altitudes (3400-4300 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan.

Ecology : A small fragile fern growing in rock crevices.

Voucher specimen : Gorkha, Near Birendra Tal, Samagaun, 3600 m, 4th October, 2012, S. Bhattarai, 1154 (KATH; TUCH).

Notholaena R. Br.

Rhizoem short, ascending, densely scaly. Stipe and rachis densely hairy and scaly. Lamina simple to bipinnate, lower surface scaly, upper surface hairy or glabrous; pinnae petiolate or sessile; pinnules few; veins free. Sori exindusiate, marginal, along the veins, extending from margin inwards, covered by scales. Spores dark brown.

Key to the species

- 1a. Lamina bipinnate but pinnate in distal part and young plants*N. marantae*
- 1b. Lamina pinnate throughout 2
- 2a. Pinnae ovate-cordate and covered in silky hairs*N. himalaica*
- 2b. Pinnae lanceolate, lower pinnae with acroscopic auricles or lobed*N. delavayi*

Notholaena delavayi (Bak.) C. Chr., Contrib. U. S. Natn. Herb. **26** : 307 (1931); Fraser-Jenkins : 181 (1997); DPR : 70 (2002).

Gymnogramma delavayi Bak., Ann. Bot. **5** : 484 (1891).

Rhizome short-creeping, thick, woody, densely scaly; scales linear, ferrugineous. Stipes 4-10 cm long, tufted, thin, castaneous, pilose. Lamina pinnate, 2-5 cm long, 1-2.5 cm broad, oblong-lanceolate, sub-coriaceous, green, upper surface glabrous, lower surface densely scaly, scales brown, lanceolate, membranaceous; pinnae 0.5-1.5 cm long, 0.3-0.5 cm broad; lower pinnae with acroscopic auricles or lobed on both sides at their bases only. Sori oblique hidden by the scales. (Pl. 6. C).

Distribution : Nepal, rare in W. (also in C. now onward) at higher altitudes; Tibet; Bhutan; Uttarakhand.

Ecology : Terrestrial, growing on exposed area.

Voucher specimen : Gorkha, Gapsya, 2200 m, 3rd June, 2012, S. Bhattarai, 940 (KATH).

Notholaena himalaica Fraser-Jenkins, New Sp. Syndrome etc.: 183 (1997); DPR : 70 (2002).

Gymnogramma vestita Hook., Ic. Pl. 2 : t. 115 (1837); Clarke : 568 (1880).

Rhizome short, obliquely ascending, thick, scaly; scales light-brown. Stipes 7-10 cm, thin, hairy; hair long, fine, brownish, stipe base scaly. Lamina pinnate, 10-12 cm long, 2-3 cm broad, lanceolate, thick, herbaceous, lower surface densely covered with fine pale brownish or whitish hairs; pinnae 5-6 pairs, distant, alternate to sub-opposite, long, ovate-cordate, simple, covered in silky hairs, basal pinnae short-petiolate, upper one gradually becoming sessile, margin entire, apex obtuse; veins free, forked, hairy. Sori exindusiate, along the veins, completely hidden by the hairs. Spores dark-brown. (Pl. 6. D).

Distribution : Nepal, fairly common throughout W., C. & E. at upper mid to higher altitudes (2000-3300 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh; Pakistan.

Ecology : Terrestrial, growing on exposed area.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 3rd June, 2012, S. Bhattarai, 104/8 (TUCH; TUCH).

Notholaena marantae (L.) R. Br., Prodr. Fl. Nov. Hollandae : 146 (1810); Clarke : 567 (1880); Beddome : 373, f. 213 (1883); Hope : 98 (1903); Ito : 464 (1966); Iwatsuki : 176 (1975); DPR : 70 (2002).

Acrostichum marantae L., Sp. Pl. 2 : 1071 (1753).

Rhizome short, ascending, densely scaly. Stipes 8-15 cm long, dark-brown to blakish, densely scaly of linear -lanceolate type. Rachis same scaly as stipe. Lamina pinnate (distal part and young frond) to bipinnate, 3-5 cm long, 1-2 cm broad, lanceolate, texture coriaceous, lower surface densely scaly, oblong-lanceolate, upper surface glabrous; pinnae few, 7-10 pairs, alternate to subopposite, petiolate, pinnae margin deeply lobed, apex obtuse, margin entire. Veins distinct, extending up to the margin. Sori exindusiate, along the vein, covered by scales on lower surface of lamina. Spores dark brown. (Pl. 6. E-F).

Distribution : Nepal, fairly common in W., C. & E. at mid to high altitudes (1500-4000 m); Tibet; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh.

Ecology : Uncommon, growing on under canopy of Juniperus-Rhododendron bushes.

Voucher specimen : Gorkha, Above Samagaun, 3800 m, 9th October, 2012, S. Bhattarai, 1582 (KATH; TUCH).

Onychium Kaulf.

Terrestrial. Rhizomes creeping, clothed with brownish scales. Stipes erect, more or less glabrous. Fronds quadripinnate, 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.

Key to the species

1a. Rhizome short, thick; lamina lower surface densely covered with bright-lemon yellow waxy powder; sori more than 1 cm long *O. siliculosum*

1b. Rhizome long, thin; waxy powder absent on lower surface of lamina, sori less than 1 cm long *O. contiguum*

Onychium contiguum Wall. *ex* Hope, J. Bombay Nat. Hist. Soc. **13** : 444 (1901)

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

Rhizome long-creeping, apex densely scaly, scales light-brown. Stipes 20-30 cm long, as long as the lamina, stramineous, base invariably black, extreme base scaly, higher up stipe glabrous. Lamina 5 (rarely more) pinnate, large up to 60 cm long, 10-25 cm broad, broadly ovate, very finely dissected, texture herbaceous, glabrous; pinnae 5-10 pairs, 7-15 cm long, 4-8 cm broad, alternate, shortly petiolate; deltate. Pinnules 0.2-0.3 cm long, but fertile lobes slightly broader

than sterile ones; vein-ends clavate. Sori indusiate, linear, grey at maturity, indusial flaps overlaps on the costule, do not open at maturity. Spores light-brown. (Pl. 6. G-H).

Distribution : Nepal, common in W., C. & E. at upper mid to high altitudes (2000-3500 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Very common of the forest floor and open places forming colonies.

Voucher specimen : Gorkha, Shyo, 3000 m, 3rd October, 2012, S. Bhattarai, 1094 (KATH; TUCH).

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

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

Rhizomes long-creeping, covered with brownish, lanceolate scales. Stipes erect, tufted, purplish brown, scaly. Fronds quadripinnate, 10-30 cm long, 8-15 cm broad, finely lobed, ovate, petiolated, distant, alternate, lowermost pinnae with pinnules and segments; sterile and fertile segments somewhat similar, rather shinign; rachises glabrous; texture sub-coriaceous; veins pinnate. Sori elongate, marginal, indusium papery; sori deep brown. (Pl. 6. I).

Distribution : Nepal, very common in W., C. & E. at mid to higher altitudes (1300-3000 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling ; Uttarakhand.

Ecology : Terrestrial, on dry and exposed area.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 15th June, 2012, S. Bhattarai, 958 (KATH).

Pteris L.

Terrestrial. Rhizome short, erect or creeping, scaly. Stipes erect. Fronds tufted, pinnate, glabrous; rachises 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

1a. Pinnae all simple, entire or at most serrate at apical margin, basal pinnae not branched
..... *P. vitata* subsp. *vittata*

- 1b. Pinnae deeply lobed, or each of the lowest pinnae with branch/es near the base2
- 2a. Lower acroscopic and basiscopical veins fuse to form a series of costal aerolae along the costa, remaining veins free*P. biaurita* subsp. *walkeriana*
- 2b. All veins free 3
- 3a. Pinnae mostly toothed, fertile pinnae narrower than sterile ones 4
- 3b. Pinnae entire, deeply lobed 5
- 4a. Leaves palmate in appearance with 1-2 pairs of lateral pinnae*P. dactylina*
- 4b. Leaves pinnate with more than 3 pairs of lateral pinnae..... *P. cretica* subsp. *laeta*
- 5a. Pinnae few, 2-3 pairs, widely deltate *P. subquinata*
- 5b. Pinnae 10-12 pairs, ovate-lanceolate *P. aspericaulis*

Pteris aspericaulis Wall. ex J. Agardh, REc. Sp. Gen. Pteridis : 22 (1839); Iwatsuki : 176 (1975); Dixit : 276 (1984); Gurung : 38 (1986); Nakaike *et al.* : 195 (1990); Fraser-Jenkins : 317 (1997); DPR : 72 (2002).

Rhizome short-creeping, stout, clothed with scales. Stipes erect 20-25 cm long, reddish, asperous, and glossy, rigid. Fronds 25-30 cm long, 10-12 cm broad, with ovate-lanceolate, bipinnatifid, texture sub-coriaceous, glabrous, pinnae many, 10-12 pairs, opposite, lower pinnae shortly stalked, upper sessile, margin deeply lobed to the costa, lobes many, lowest pair of pinnae always the largest and forked at least once; veins free, the lowest veins from either side of the costa reaching the sinus but never fusing. Sori indusiate, indusial membranaceous, whitish green. Spores dark-brown. (Pl. 7. A-B).

Distribution : Nepal, common in W. C. & E at mid to higher altitudes (1400-2600 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Terrestrial, generally growing with on shady places.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 1st October, 2012, S. Bhattarai, 972 (KATH; TUCH).

Pteris biaurita L. subsp. ***walkeriana*** Fraser-Jenkins & Dominic Rajkumar, Fraser-Jenkins : 115-116 (2008).

Rhizomes short, creeping, stout, clothed with reddish-brown with dark-brown with dark-brown centered, linear scales. Stipes 20-40 cm long, stramineous, glabrous; fronds large, 35-50 cm long, 18-26 cm broad; blades ovate-lanceolate, with basely branched and not larger pinnae; pinnae subopposite to alternate, sessile, 10-30 cm long, 2-5 cm broad and not much deeply cut to the rachis; segments oblong, falcate, with rather rounder apex; rachises, costae and costules not reddish or pinkish but with minute tooth at the junction of the mid rib of each segment; texture more or less coriaceous; veins inarching near the base. Sori running partially along the margin of the segment, rarely continued to the tip, and covered by reflexed margin. (Pl. 7.C-D).

Distribution : Nepal, abundant throughout W., C. & E. at low to upper mid altitudes (70-2000 m); Arunachal Pradesh; Bhutan; Sikkim; Darjeeling, Uttarakhand.

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

Litter : Litter

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 30th September, 2012, S. Bhattarai, 974 (KATH).

Pteris cretica L. subsp. ***laeta*** (Wall. *ex* Ettingsh.) Fraser-Jenkins : 100-101 (2008).

Pteris laeta Wall. *ex* Ettingsh., Farnkr. Jetzwelt etc.: 96, t. 57, f. 8-11, t. 58 f. 4, 12 (1865).

Rhizomes short-creeping or suberect, clothed with deep-brown, linear-lanceolate scales. Stipes tufted, erect, 14-25 cm long, stramineous, glabrous. Fronds once pinnate, 16-32 cm long, 4-18 cm broad with 2-5 pairs of pinnae simple, sessile, some of the lower ones bi-trifid, sterile ones linear-lanceolate, serrated with white teeth or teeth connected into white margin, fertile ones broadly linear; rachises glabrous; texture herbaceous; veins once forked and free. Sori linear, running continuously all along the margin except the apex, protected by the reflexed margin. (Pl. 7. E-F).

Distribution : Nepal, abundant throughout W., C. & E. at mid to higher altitudes (1300-3000 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan; Iran; Turkey.

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

Use : Litter

Voucher specimen : Gorkha, Gapsya, 2200 m, 1st October, 2012, S. Bhattarai, 1009 (KATH; TUCH).

Pteris dactylina Hook., Sp. Fil. 2 : 160, t. 130 a (1858); Clarke : 463 (1880); Beddome : 107, f. 56 (1883); Hope : 451 (1901); Ito : 465 (1966); Gurung : 40 (1986); Nakaike *et al.* : 196 (1990); DPR : 73 (2002).

Rhizome short-creeping, clothed with blackish-brown scales. Stipes erect, tufted, slender, 7-25 cm long, pale-brown, glabrous. Fronds dimorphic, only a few fertile once pinnate, pinnae simple, 5-7, usually 5, up to 15 cm long, narrow, shortly stalked, linear-lanceolate, margin crenate-serrate (in fertile only in upper part), apex elongated; veins far apart. Sori indusiate, marginal, indusial broad, continuous. Spores dark-brown. (Pl. 7. G).

Distribution : Nepal, scattered in W. C. & E. at upper mid to high altitudes (1450-3500 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh.

Ecology : A rare fern growing on dry open rock crevices.

Voucher specimen : Gorkha, Gapsya, 2200 m, 12th June, 2012, S. Bhattarai, 21/21 (KATH; TUCH).

Pteris subquinata Wall. *ex* J. Agardh, Rec. Sp. Gen. Pteridis : 21 (1839); Hope : 453, t. 17 (1901); Ito : 467 (1966); Iwatsuki : 275 (1988); Nakaike *et al.* : 196 (1990); DPR : 75 (2002).

Pteris quadriaurita Retz. var. *subquinata* (Wall. *ex* J. Agardh) Bedd., Suppl. Ferns Brit. India : 23 (1892).

Rhizome short, erect, woody, scaly. Stipes erect, tufted, pinkish at the base. Fronds lanceolate or ovate-lanceolate, pinnate to bipinnatifid, pinnae few and widely deltate lamina, linear-lanceolate, sub-opposite, sub-sessile; lower 1-2 pairs of pinnae generally with 1 or 2 branches; pinnules close, slightly oblique, rachises rather smooth; texture subcoriaceous; veins prominent, mostly once forked. Sori linear placed partially along the margin; covered by the reflexed margin. (Pl. 7. H).

Distribution : Nepal, common in W., C. & E. at low to upper mid altitudes; Bhutan; Sikkim; Darjeeling; Uttarakhand.

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

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 15th June, 2012, S. Bhattarai, 955 (KATH; TUCH).

Pteris vittata L. subsp. **vittata**, Fraser-Jenkins : 96-98 (2008).

Pteris vittata subsp. *bengalensis* Fraser-Jenkins (1997).

Rhizome creeping, thick, scaly. Stipe 5-7 cm long, scaly, scales abundant at stipe base. Lamina pinnate, 50-90 cm long, 20-35 cm broad, oblong-obovate, texture herbaceous to subcoriaceous, upper surface glabrous; pinnae many, 40-60 pairs, alternate to sub-opposite, sessile, linear, base truncate or cordate; lower 5-7 pairs of pinnae gradually reduced and distant, usually sterile; veins free, simple. Sori marginal, continuous from the base of pinnae, stopping a little short of the apex, indusiate, indusial whitish, membranaceous, margin irregularly serulate, Spores light-brown. (Pl. 7. I).

Distribution : Nepal, abundant throughout W. C. & E. at low to upper mid altitudes (60-2100 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand.

Ecology : Fairly common, often growing on open road-sides and on walls.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 16th June, 2012, S. Bhattarai, 954 (KATH).

Dennstaedtiaceae Pich. Serm.

Terrestrial. Rhizomes clothed with hairs. Fronds mostly pinnate. Sori round, terminal on the veins borne on transversely oblong receptacles protected by double and indistinctly two lipped or single indusium.

Key to the Genera

- 1a. Sori all along the margin of pinnae*Pteridium*
- 1b. Sori not all along the margin.....2
- 2a. Sori subglobose, marginal, indusial cup-shaped *Dennstaedtia*
- 2b. Sori round, submarginal; indusial half cup-shaped*Microlepia*

Dennstaedtia Bernh.

Rhizomes erect or creeping, hairy. Stipes thick, long, erect. Fronds large, pinnately decomposed, glabrous or pubescent; pinnules oblique and pubescent; veins free. Sori typically marginal, subglobose, terminal on the vein; indusia formed by the fusion of the true indusium and a minute tooth resulting a cup-shaped, and placed usually in the sinuses at the ends of the veinlets.

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

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

Rhizomes short, creeping, scaly and hairy. Stipes long, up to 20 cm, thick, hairy. Lamina bi- to tripinnate; finely dissect, erect, 30-65 cm long, lanceolate, bright green; pinnae opposite to alternate; shortly petiolate, margin deeply lobed pinnules linear to oblong, texture herbaceous; lower surface hairy, upper surface glabrous; pinnules many, apex acute; veins free; texture herbaceous. Sori single and marginal on each pinnule segment; indusium cup shaped, globose, persistent. (Pl. 8. A).

Distribution : Nepal, common in W., C. & E. at mid to higher altitudes (1500-3000 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand.

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

Voucher specimen : Gorkha, Near by Philim, c.1500 m, 16th June, 2012, S. Bhattarai, 965 (KATH; TUCH).

Microlepia C. Presl

Terrestrial. Rhizomes creeping, covered with hairs. Stipes erect with short hairs. Fronds pinnate to decompounds; lanceolate to narrowly deltoid; ultimate pinnules always unequal-sided at the base, lobed, pubescent; Rachises and costae grooved; texture herbaceous; veins free. Sori intramarginal, terminal on the veins; indusium cup-shaped, hairy.

Microlepia setosa (Sm.) Alston, Fraser-Jenkins : 82 (2008).

Rhizome creeping, clothed with short hairs. Stipes long, hairy throughout. Fronds 50-80 cm long, tripinnate but distal and young parts bipinnate, ovate, hairy throughout, pinnules ovate-lanceolate, deeply pinnatifid, acuminate; unequal at the base, entire, rachis densely hairy; texture herbaceous. Sori rather large, placed close to the base of the sinuses between the lobes; indusium half cup-shaped, hairy. (Pl. 8. B).

Distribution : Nepal, C. and E.; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Terrestrial, usually on shady, flooded area.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 16th June, 2012, S. Bhattarai, 966 (KATH; TUCH).

Pteridium Gled. ex Scopoli

Rhizome long-creeping, hairy. Fronds large. Lamina 2-3 pinnate, texture subcoriaceous, densely hairy all over; veins free. Sori submarginal, borne on the connecting veins; indusial double, outer one formed by reflexed margin. Sori globose, trilete, exine smooth.

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).

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

Typically terrestrial fern. Rhizomes long-creeping, woody, clothed with fine pale-brown hairs. Stipes erect, 20-50 cm long, dark-brown, stout; fine hairs at the base and more or less glabrous above. Fronds large, deltate, stiff lamina, somewhat densely hairy below, tripinnate-quadrripinnatifid, 30-90 cm long, 20-50 cm broad, densely hairy underneath; pinnae the lowest pair larger; rachises, costae and costules grooved on the upper surface; texture subcoriaceous; veins forked, free and raised beneath, usually hairy. Sori marginal, continuous along the margin, indusium double, inner one true membranous, outer one formed by the reflexed margin of the ultimate lobe. (Pl. 8. C-D).

Distribution : Nepal, abundant throughout W., C. & E. at lower mid to higher altitudes (800-3400 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Terrestrial, abundantly growing on dry open areas.

Use : Litter but poisonous if eaten.

Voucher specimen : Gorkha, Namrung, 2600 m, 6th October, 2012, S. Bhattarai, 1408 (KATH; TUCH).

Aspleniaceae Mett. ex Frank

Terrestrial and epiphytic. Rhizomes creeping to suberect, covered with dark-brown scales. Stipes non-articulate. Fronds simple to decomposed, small to large; texture usually firm; veins forked, free or anastomosing. Sori elongate along the veinlets; indusium membranous, attached to the veinlets.

Asplenium L.

Terrestrial or epiphytic. Rhizomes mostly short-creeping or erect, clothed with dark scales. Stipes not jointed. Fronds simple-decompound, entire or serrate; glabrous; veins usually free.

Sori dorsal or submarginal, linear to oblong; indusium attached along the veins and opening towards the midrib.

Key to the species

- 1a. Leaves simple, entire at margin, veins free.....*A. ensiformis*
- 1b. Leaves pinnatifid, pinnate or pinnately decomposed2
- 2a. Leaves pinnatifid, deeply lobed with 4-8 pairs of lobes*A. dalhousiae*
- 2b. Leaves pinnate or pinnately decomposed3
- 3a. Leaves pinnate, Stipes and rachis dark green to brownish*A. yoshinaga* subsp. *indicum*
- 3b. Leaves more than 1-pinnate, soft and delicate..... 4
- 4a. Fronds long, narrow with small rounded segments with acute teeth and a long narrow frond apex with few segments *A. laciniatum* subsp. *kukkonenii*
- 4b. Fronds broader, with larger ovate segments; pinna apex shorter and more dissected *A. laciniatum* subsp. *tenuicaule*

Asplenium dalhousiae Hook., Ic. Fil.: t. 105 (1837); Ito : 487 (1966); Iwatsuki : 194 (1975); Nakaike & Gurung : 189 (1988a); DPR : 85 (2002).

Rhizome short, erect, scaly, scales brown. Stipes short, 1-3 cm long; rachis brown, straight or wavy, scaly, scales as on stipe. Lamina simple but deeply pinnatifid, linear-lanceolate, 10-15 cm long, 2-3 cm broad, narrowed towards base, texture thick, subcoriaceous, apex acuminate, margin variously lobed almost to the rachis, lobes c. 10-15 pairs, 0.5-2 cm long, 0.3-0.8 cm broad, triangular-oblong, alternate from one side to the other, apex obtuse, margin entire, widest lobes gradually reduced and becoming distant towards base; veins forked, free, glabrous. Sori indusiate, extending from the costa almost to the margin. Spores brown. (Pl. 8. E-F).

Distribution : Nepal, scattered throughout W. C. & E. at low to upper altitudes (500-2200 m); Sikkim; W. Bengal; Uttarakhand; Himachal Pradesh; Haryana; Jammu & Kashmir; Pakistan.

Ecology : Growing under canopy of *Arundnaria* (Nigalo).

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 1st October, 2012, S. Bhattarai, 968 (KATH).

Asplenium ensiformis Wall. *ex* Hook. & 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 & Gurung : 189 (1988a); Thapa : 15 (2000); DPR : 85 (2002).

Rhizome short, covered with persistent stipe bases, sub-erect, scaly, scales dark brown. Stipes short, 1.5-2 cm long, scales as on rhizome, deciduous, rachis lower surface sparsely scaly, confined to the lower half of rachis, distal parts glabrous. Lamina simple and entire, up to 35 cm long, 1-2 cm broad, narrow oblong or elliptic, lower part of lamina narrowed gradually into the stipe, apex acuminate, margin entire, texture leathery, stiff, subcoriaceous; veins free. Sori indusiate, 0.5-1.5 cm long, indusia light brown. Spores dark-brown. (Pl. 8. G).

Distribution : Nepal, quite common but scattered throughout W., C. & E. at low to upper mid altitudes (500-2200 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Common fern growing epiphytic or lithophytic.

Voucher specimen : Gorkha, Above Gumba, Namrung, 2800 m, 6th October, 2012, S. Bhattarai, 1412 (KATH; TUCH).

Asplenium laciniatum D. Don subsp. **kukkonenii** (Reichst.) Fraser-Jenkins : 169-170 (2008); Fraser-Jenkins (2010).

Asplenium kukkonenii Reichst., Fraser-Jenkins : 309 (1997); DPR : 86 (2002); Viane & Reichstein (2004).

Rhizome short, erect, apex scaly, scales dark-brown. Stipe short, 1-4 cm long, green, thin, sparsely scaly at base, higher up glabrous; rachis thin. Lamina 2-pinnate, 5-9 cm long, 1-1.5 cm broad, broadest about the middle, narrowly lanceolate, apex long, narrow, often fused with apical segments, texture herbaceous, glabrous; pinnae many, up to 13 pairs, subopposite to alternate, margin deeply pinnate, pinnules small, rounded, with acute teeth; lowest acroscopic segment the largest, very shortly stalked; veins free. Sori indusiate, c. 2 mm long, 1-2 in each segment. Spores dark-brown. (Pl. 8. H-I).

Distribution : Nepal, rare in W. & C. at higher altitudes (c. 2450 m); Arunachal Pradesh; Bhutan; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Common, growing as epiphytic and lithophytic.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 1st October, 2012, S. Bhattarai, 1007 (KATH; TUCH).

Asplenium laciniatum D. Don subsp. **tenuicaule** (Hayata) Fraser-Jenkins : 169 (2008); Fraser-Jenkins (2010).

Asplenium tenuicaule Hayata, Ic. Pl. Formos. 4 : 228, f. 158 (1917); Fraser-Jenkins : 309 (1997); DPR : 88 (2002).

Rhizome short, erect, apex scaly, scales dark-brown. Stipe short, 1.5-5 cm long, green, thin, sparsely scaly at base, higher up glabrous; rachis thin. Lamina 2-pinnate, 5-10 cm long, 2-3 cm broad, oblong lanceolate, delicate, thin, herbaceous, glabrous, apex short; pinnae 5-8, subopposite to alternate, margin deeply pinnate, pinnules small, rounded ovate, pinnules borne on long, thin, delicate stalks, base cuneate, apex toothed; lowest pair of pinnae usually smaller; veins free. Sori indusiate, c. 2 mm long, 1-2 in each segment, indusia whitish. Spores dark-brown. (Pl. 9. A-B).

Distribution : Nepal, uncommon in W., C. & E. at upper mid to higher altitudes (2250-2750 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Common, growing as epiphytic and lithophytic.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 1st October, 2012, S. Bhattarai, 1025 (KATH; TUCH).

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

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

Rhizomes erect, stout and strong, covered with dark-brown, lanceolate scales. Stipes 2-10 cm long. Fronds compound, 10-40 cm long, lanceolate; lamina simply pinnate; pinnae numerous, shortly stalked, 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. (Pl. 9. C-D).

Distribution : Nepal, common throughout W., C. & E. at lower mid to higher altitudes (1000-2500 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir

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

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 1st October, 2012, S. Bhattarai, 967 (KATH; TUCH).

Thelypteridaceae Pich. Serm.

Terrestrial. Rhizome and leaves as a rule sparsely paleaceous; veins free and generally simple or united in pairs, reaching the margin. Sori mostly small, round, rarely elongated with reniform; indusiate or exindusiate; sporangia often setose.

Thelypteris Schmid.

Terrestrial. Rhizomes erect or creeping, scaly. Stipes erect, usually scaly. fronds generally bipinnatifid, lanceolate; pinnae pinnatifid; texture herbaceous; veins pinnate. Sori globose, dorsal; indusium orbicular-reniform, hairy or glabrous.

Key to the Species

8a. Lamina coriaceous, sori close to costules *T. erubescens*

8b. Lamina herbaceous, sori submarginal..... *T. levingei*

Thelypteris erubescens (Wall. *ex* Hook.) Ching, Bull. Fan Mem. Inst. Biol. (Bot.) **6** : 293 (1936); Iwatsuki : 483 (1966), 213 (1971), 192 (1975), 305 (1988); DPR : 93 (2002).

Polypodium erubescens Wall. *ex* Hook., Sp. Fil. **4** : 236 (1862); Clarke : 543 (1880); Hope : 78 (1903).

Rhizome stout, decumbent, woody. Fronds clustered; stipes c. 50 cm long, thick, glabrous, stramineous. Lamina c. 1 m long, 40 cm broad, pinnate to pinnatifid, acuminate and pinnatifid at apices; pinnae 30-40 pairs, opposite to subopposite, sessile, acuminate, bases truncate, texture coriaceous; veins evident, costae grooved adaxially, pubescent, abaxially rounded and raised, glabrous or sparsely hairy. Sori exindusiate, orbicular, 10-15 pairs per segment, attached at bases of veinlets, in a single row on each side of the lobes. Spores dark-brown. (Pl. 9. E).

Distribution : Nepal, common in W., C. & E. at mid to higher altitudes (1350-3200 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Common, growing along the streams.

Voucher specimen : Gorkha, Gap, 2200 m, 1st October, 2012, S. Bhattarai, 975 (KATH).

Thelypteris levingei (C. B. Clarke) Ching, Acta Phytotax. Sin. **8** : 314 (1963), DPR : 90 (2002);

Rhizome long, creeping, thin, hairy. Stipes distant on rhizome, 15-20 cm long, stramineous, base bluish, hairy, sparsely scaly. Lamina pinnate, c. 30-40 cm long, 8-12 cm broad, texture herbaceous, lower surface hairy, hairs white, hairs only on the costules on the upper surface; pinnae 15-20 pairs, 4-7 cm long, 1.5-2 cm broad, subopposite to alternate, sessile, lanceolate, apex acuminate, margin lobed almost to the costae; unequal at the base, acroscopic lobe longer than basiscopic one, apex acute or round, lower 2-4 pairs of pinnae distant and gradually reduced; veins simple or forked. Sori exindusiate, small, round. Spores brown. (Pl. 9. F).

Distribution : Nepal, very common in E. (in C. now onward) at mid to upper mid altitudes (1500-2400 m); Tibet; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan.

Ecology : Very common, growing on forest floor.

Voucher specimen : Gorkha, Down after Kharka, way to Namrung, 3000 m, 7th October, 2012, S. Bhattarai, 1510 (KATH; TUCH).

Woodsiaceae (Diels) Ching *ex* Herter

Terrestrial. Fronds large, pinnately decomposed, mostly glabrous except rachis, costae and costule. Sori on receptacles.

Key to the genera

- 1a. Sori usually exindusiate *Gymnocarpium*
- 1b. Sori generally indusiate2
- 2a. Articulated hairs present on stipe, rachis and pinnae costae3
- 2b. Articulated hairs absent4
- 3a. Indusia rotundo-reniform, densely setose *Hypodematum*
- 3b. Indusia not as above, sparsely setose *Deparia*
- 4a. Sori round *Cystopteris*
- 4b. Sori linear or 'J' shaped5
- 5a. Sori generally only on the acroscopic side of the vein, never double, usually 'J' shaped *Athyrium*
- 5b. Sori sometimes double on both sides of the veins, usually linear*Diplazium*

Athyrium Roth

Rhizome long-creeping or short-erect, usually covered with persistent bases. Stipe variable, scaly at the base. Lamina usually 1-2 (rarely 3) pinnate, size variable, lanceolate to triangular, texture usually herbaceous, upper surface usually glabrous; veins free, never anastomosing. Sori indusiate, rarely exindusiate, shapes variable. Spores brown.

Key to the species

- 1a. Pinnule-midrib with prominent setae on upper surface *A. setiferum*
- 1b. Pinnule-midrib without setae on upper surface2
- 2a. Sori exindusiate *A. davidii*
- 2b. Sori indusiate3
- 3a. Lamina triangular, basal pinnae longest..... *A. spinulosum*
- 3b. Lamina ovate to oblanceolate, basal pinnae shorter than upper4
- 4a. Lamina ovate-oblong, basal 1-2 pairs of pinnae slightly shortened *A. repens*
- 4b. Lamina oblanceolate5
- 5a. Rhizomes shortly creeping or suberect, fronds distant or approximate *A. rupicola*
- 5b. Rhizomes erect or ascending; fronds caespitose.....6
- 6a. Lamina 2-3 pinnate, scales reddish brown; ultimate pinnules acute at apex*A. fimbriatum*
- 6b. Lamina 1- or 2-pinnate; stipe stramineous, scales at base brown or dark brown; pinnae and ultimate lobes rounded at apex7
- 7a. Pinnae deltoid-ovate or deltoid-lanceolate, c. 3-4 cm long *A. contingens*
- 7b. Pinnae linear-lanceolate, more than 4 cm, spaced apart from each other.....8
- 8a. Spines on adaxial surface of costae sharp and long..... 9
- 8b. Spines on adaxial surface of costae very short..... *A. dubium*
- 9a. Fronds arise separately along the rhizome *A. schimperi*
- 9b. Fronds arising together at the apices of the rhizome *A. flabellatum*

Athyrium contingens Ching & S. K. Wu in C. Y. Wu, Fl. Xizang. **1** : 134 (1983); Fraser-Jenkins : 238 (2008).

Rhizome short, erect. Stipes c. 22 cm, stramineous, scaly; scales brown, narrowly ovate. Lamina 2-pinnate to 3-pinnatifid, broadly lanceolate, c. 60 cm long, 12 cm broad, gradually narrowed toward both ends, pinnae c. 23 pairs, up to c. 10 cm long, 1.5 cm broad, alternate, sessile, spreading, broadly lanceolate, lower few pairs of pinnae gradually shortened, basal pinnae oblong, less than 1 cm, apex shortly acuminate, margin deeply lobed to the costa and lower part becoming pinnate, pinnules c. 12 pairs (middle); margin lobed apex rounded with 2-3 small teeth, texture herbaceous, glabrous on both surfaces; veins simple or forked. Sori oblong, medial, 3-6 pairs on either side of the costule. Spores dark-brown. (Pl. 9. G-I).

Distribution : Nepal, new record in C. at higher altitude; W. Schiuan; Xizang.

Ecology : Rare, growing on forest floor.

Voucher specimen : Grokha, Rupal, 3600 m, 4th October, 2012, S. Bhattarai, 1149 (KATH).

Note: This species was collected from 3600 m which after cross check with all the species of *Athyrium* from Nepal didn't match. Comparing with the morphological characters, the habit and habitat with *Athyrium contingens* from Western Sichuan, China which showed distinct characteristics features having Pinnae deltoid-ovate or deltoid-lanceolate did match the species. The species has therefore, been identified as *Athyrium contingens* new record for Nepal.

Athyrium davidii (Franch.) Christ, Bull. Soc. Fr. **52** Mem. 1 : 50 (1905).

Polypodium davidii Franch., Nouv. Arch. Mus. II (Paris) **10** : 119 (1887).

Athyrium duthiei (Bedd.) Bedd., Suppl. Ferns Brit. India : 34 (1892); Iwatsuki : 182 (1975).

Rhizome long-creeping. Stipes distant on rhizome, c. 11 cm long, pinkish, sparsely scaly, scales dark-brown, concolorous. Lamina 1-2 pinnate, c. 15 cm long, 4-6 cm broad, narrowly ovate-lanceolate, apex attenuate; texture herbaceous, upper surface glabrous; pinnae c. 15 pairs, 2-4 cm long, 1-1.5 cm broad, crowded, alternate, short petiolate, lanceolate, margin deeply lobed to the costa or becoming pinnate; lobes 6-10 pairs, ovate or lanceolate, alternate, sessile, crowded, margin serrate, lower pinnae gradually reduced and distant, lowest pinnae about half as long as the middle largest pinnae. Sori exindusiate, circular or oval, medial. Spores dark-brown. (Pl. 10. A-B).

Distribution : Nepal, fairly common but scattered in W., C. & E. at high altitudes (3400-4300 m); Tibet; Arunachal Pradesh; Sikkim; Uttarakhand.

Ecology : Rare, growing in rock-crevices.

Voucher specimen : Gorkha, Above Gumba, Namrung, 2800 m, 5th October, 2012, S. Bhattarai, 1191 (KATH).

Athyrium dubium Ching, Bull. Fan Mem. Inst. Biol. (Bot.) II 1 : 281 (1949); Fraser-Jenkins : 218-219 (2008).

Rhizome short, erect, scaly. Stipes 10-20 cm long, base clothed with scales, upward glabrous, scales ovate, acuminate, concolorous. Lamina pinnate, oblong, 20-40 cm long, 7-20 cm broad at middle, base slightly narrowed, apex acuminate; pinnae pinnatifid to pinnate, 15-20 pairs, lower pinnae subopposite, upper ones alternate, sessile, basal pinnae slightly shortened, middle pinnae 5-10 cm long, 1.5-2 cm broad, base subtruncate, decurrent, apex obtuse; pinnules 7-12 pairs, obtuse-rounded, toothed at apex, texture herbaceous, glabrous on both surfaces; veins inconspicuous adaxially, visible abaxially. Sori 'J' shaped, 2-4 pairs on either side of the veinlet; indusia brownish. Spores brown. (Pl. 10. C-D).

Distribution : Nepal, occasional in C. & E. at higher to high altitudes (2400-3500 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling.

Ecology : Common, growing on moist, forest floor.

Voucher specimen : Gorkha, Above Gumba, Namrung, 2800 m, 5th October, 2012, S. Bhattarai, 1188 (KATH; TUCH).

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

Rhizome thick, long-creeping, covered with persistent old leaf bases, scaly. Stipes 25-35 cm long, arise close together, reddish, thick, scaly, scales light-brown, concolorous, lanceolate, fibrillose. Lamina 3-4 pinnate, large to huge, up to 60 cm long, 25 cm broad, deltate to subdeltate, texture herbaceous, upper surface glabrous; pinnae c. 20 pairs distant, petiolate, triangular-lanceolate, sloping, obliquely inserted, markedly asymmetrical, acroscopic pinnules larger than the basiscopic ones, ultimate pinnules 5-7 pairs, alternate to subopposite, base broadly adnate, apex acute with few teeth, costae sparsely hairy. Sori large, indusiate, medial, in a single row on either side of the veinlet, straight or 'J' shaped. Spores brown. (Pl. 10. E-F).

Distribution : Nepal, quite common in W., C. & E. at upper mid to higher altitudes (1800-2600 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Very common, growing along streams and forest floor.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 6th October, 2012, S. Bhattarai, 1295 (KATH; TUCH).

Athyrium flabellulatum (C. B. Clarke) Tardieu, Asplen. Tonkin : 85, t 13 (1932); Thapa : 12 (2000); DPR : 101 (2002).

Asplenium filix-femina var. *flabellulatum* C. B. Clarke, Trans. Linn. Soc. Lond. II Bot. **1** : 493, t. 60 (1880).

Rhizome creeping. Stipes c. 15 cm long, stramineous, scaly at base, higher up stipe glabrous; rachis glabrous. Lamina 2-pinnate c. 40 cm long, 8 cm broad, lanceolate; texture herbaceous, upper surface glabrous; pinnae c. 20 pairs, c. 6 cm long, 1.5 cm broad, subopposite to alternate, lanceolate, lower 2-3 pairs gradually shortened and sometimes downwards deflexed; pinnules 8-12 pairs, narrow, alternate, sessile, linear lanceolate, symmetrical, base cuneate, apex rounded with short teeth, margin lobed less than half to the costa into deeply incised lobes; veins free. Sori indusiate, round, sub-medial, close to costule; margin fimbriate. Spores yellowo-brown. (PL. 10. G-H).

Distribution : Nepal, quite common in W., C. & E. at high altitudes (3500 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; W., C. and E. Nepal; Uttarakhand; Himachal Pradesh.

Ecology : Uncommon, growing on forest floor.

Voucher specimen : Gorkha, Rupal, 3200 m, 4th October, 2012, S. Bhattarai, 1131 (KATH; TUCH).

Athyrium repens (Ching) Fraser-Jenkins : 238 (2008).

Pseudocystopteris repens Ching, Acta Phytotax. Sin. **8** : 324 (1964).

Rhizome long-creeping. Stipes bluish-brown at base, scaly, scales brownish, ovate-lanceolate, sparsely scaly on higher up, 10-20 cm long, Lamina 2-pinnate, ovate-oblong, 20-30 cm long, 8-15 cm broad at middle; pinnae 12-15 pairs, shortly petiolate, broadly lanceolate, lowest pairs of pinnae slightly reduced apex shortly acuminate, pinnales 10-12 pairs, oblong-ovate, base broadly cuneate, margin biserrate, lobed, apex obtuse with triangular short teeth, segments with 2-3 short teeth, texture herbaceous; veins visible abaxially, 1 veinlet per tooth. Sori small, linear to 'J' shaped, 1-6 per ultimate pinnule, medial. Spores light-brown. (Pl. 10. I, 11. A).

Distribution : Nepal, C., E. at high altitudes; Tibet; Bhutan; Sikkim.

Ecology : Common, growing on forest floor.

Voucher specimen : Gorkha, Rupal, 3200 m, 4th October, 2012, S. Bhattarai, 1134 (KATH; TUCH).

Athyrium rupicola (Edgew. ex C. Hope) C. Chr., Ind. Fil. **1** : 145 (1905); Alston & Bonner : 213 (1956); Thapa : 12 (2000); DPR : 113 (2002).

Asplenium rupicola Edgew. ex C. Hope, J. Bomb. Nat. Hist. Soc. **12** : 531-532, t. 5 (1899).

Rhizome short, suberect to erect. Stipes 10-15 cm long, stramineous, thin, base densely scaly, higher up stipe almost glabrous; rachis stramineous, sparsely scaly. Lamina pinnate, 30-40 cm long, narrow, 7-10 cm broad, texture herbaceous, glabrous, pinnae c. 25 pairs, 2-5 cm long, 1-1.5 cm broad, alternate, sessile, derurrent on rachis, slightly curved upwards, margin deeply lobed to the costa; lobes 6-10 pairs, small, apex acute, margin faintly serrate, lowest acroscopic lobe usually the largest, lower 3-4 pairs of pinnae gradually much reduced, downwards deflexed. Sori indusiate, large, occupying almost the entire lower portion of the lobe, 3-4 pairs on either side of the costule, insudia light-brown. Spores dark-brown. (Pl. 11. B-C).

Distribution : Nepal, fairly common in W., C. & E. at higher to high altitudes (2000-3000 m); Tibet; Arunachal Pradesh; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Fairly common along road sides and in rock-crevices.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 8th October, 2012, S. Bhattarai, 1549 (KATH; TUCH).

Athyrium schimperi subsp. **biserrulatum** (Christ) Fraser-Jenkins, New Sp. Syndrome etc.: 60 (1997); DPR : 104 (2002).

Athyrium biserrulatum Christ, Bull. Acad. Int. Geogr. Bot. Mans **1907** : 135 (1907).

Rhizome long-creeping. Stipes shortly distant on rhizome, 15-20 cm long, pale or stramineous, invariably with a dark-purplish to brown base, scaly at base, scales brown, concolorous, higher up sparsely scaly, becoming glabrous, glossy; rachis stramineous. Lamina 2-pinnate, 30-40 cm long, 10-15 cm broad, deltate lanceolate, texture firm, herbaceous, upper surface glabrous; pinnae c. 20 pairs, 8-10 cm long, 1-2 cm broad, alternate, shortly petiolate, lower 1-2 pairs generally slightly reduced and distant, pinnules 10-15 pairs, alternate, sessile, linear-lanceolate, symmetrical, margin shallowly to deeply lobed; veins simple. Sori indusiate, large, 4-6 pairs to each lobe of the pinnule. Spores dark-brown. (Pl. 11. D-E).

Distribution : Nepal, very common in W., C. & E. at upper mid to high altitudes (1800-3500 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; W. Africa.

Ecology : Common on shady places.

Voucher specimen : Gorkha, Rupal, 3200 m, 7th October, 2012, S. Bhattarai, 1493 (KATH; TUCH).

Athyrium setiferum C. Chr., Ind. Fil. **1** : 146 (1905); Chowdhury : 49 (1973); Iwatsuki : 183 (1975); Thapa : 12 (2000); DPR : 104 (2002).

Rhizome short, erect. Stipes 15-25 cm long, stramineous, base blakish, thin, sparsely scaly, higher up stipe almost glabrous; rachis stramineous, almost glabrous. Lamina 2-pinnate, 25-35 cm long, 15-19 cm broad, lanceolate, widest just below the middle, texture thinly membranaceous; lower surface glabrous; pinnae c. 13 pairs, 5-7 cm long, 1.5-2 cm broad, alternate, petiolate, narrowly triangular-lanceolate, auriculate, lower 1-2 pairs of pinnae shorter than next, pinnules 7-10 pairs, small, up to 0.5-1.2 cm long, alternate, basal one petiolate, elliptic or rhombic, apex rounded with a few short teeth; costae and costules with scattered, long, weak setae on upper surface. Sori indusiate, in a single row on either side of the costule; indusia brown, mostly straight or J-shaped. (Pl. 11. F-G).

Distribution : Nepal, common in W., C. & E. at mid to high altitudes (1400-3550 m); Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Rare species growing in shady places.

Voucher specimen : Gorkha, Down after Kharka, way to Namrung, 3000 m, 4th October, 2012, S. Bhattarai, 1127 (KATH).

Athyrium spinulosum (Maxim.) Milde, Bot. Zeit.: 376 (1866); Bedd., Handb. Ferns Brit. India : 161 (1883); DPR (2002).

Cystopteris spinulosa Maxim., Mem Acad. St. petersb. **9** : 340 (1850).

Rhizome long-creeping, blackish-brown, scaly, scales brown, broadly ovate. Stipes blakish brown at base, upward stramineous, 15-35 cm long, base clothed with broadly ovate to lanceolate scales. Lamina triangular, 2-3 pinnate, 15-30 cm long, nearly as broad as long, shortly acuminate; pinnae 10-20 pairs, basal pinnae largest c. 15-20 cm long, 5-8 cm broad, shortly petiolate, alternate, elliptic, basal pinnae with 15-20 pairs of pinnules, lower pinnules gradually shorter, obtuse or acuminate narrow, acute, margin with thin long, sharp teeth; veins

distinct. Sori indusiate, orbicular on abaxial veins, 1 to several pairs per ultimate lobe. Spores dark-brown. (Pl. 11. H-I).

Distribution : Nepal, scattered in W., common in C. & E. at higher to high altitudes (3200-3700 m); Tibet; Bhutan; Sikkim.

Ecology : Common, growing on damp and moist forest floors.

Voucher specimen : Gorkha, Above Gumba, Namrung, 2800 m, 4th October, 2012, S. Bhattarai, 1546 (KATH; TUCH).

Cystopteris Bernh.

Rhizome long or short-creeping, thin. Stipes brown or stramineous. Lamina 2-3 pinnate, usually small, texture herbaceous, sparsely hairy or glabrous; pinnule lowest pairs usually slightly smaller; veins free. Sori indusiate, round, indusia inferior, attached at its base to the receptacle, cup-shaped or ovate-lanceolate, thin. Spores light to dark-brown.

Cystopteris moupinensis Franch., *Nouv. Arch. Mus. II (Paris)* **10** : 111 (1887); Fraser-Jenkins : 951 (1997); DPR : 107 (2002).

Rhizome long-creeping, slender. Stipes distant on rhizome, delicate, thin, stramineous, 10-18 cm long, sparsely scaly at the base. Lamina 2-3 pinnate, ovate, glabrous, 10-12 cm long, 4-6 cm broad; pinnae c. 10 pairs, shortly petiolate, alternate, 4-7 cm long, 1-2 cm broad; pinnules c. 10 pairs, cuneate at base, lobes incised at apex. Sori indusiate, round, indusia thin, at basiscopic side of sorus, attached at its base to the receptacle, cup-shaped. Spores light brown. (Pl. 12. A).

Distribution : Nepal, uncommon in W., fairly common in C. & E. at higher altitudes (3100-4800 m); Tibet; Bhutan; Sikkim.

Ecology : Fairly common on shaded and moist forest floor.

Voucher specimen : Gorkha, Above Gumba, Namrung, 2800 m, 5th October, 2012, S. Bhattarai, 1216 (KATH; TUCH).

Deparia Hook. & Grev.

Rhizome short, thick, scaly or glabrous. Stipes long, fleshy, scaly at least at base, rachis slightly or prominently grooved on the upper surface, fibrillose and hairy. Lamina 1-2 rarely 3-pinnate, size variable, broadly ovate, texture herbaceous; pinnae many, grooved on upper surface; veins free. Sori indusiate, size variable. Spores bilateral.

Key to the species

1a. Fronds smaller, pinnate to bipinnate, sori linear or 'J' shaped *D. allantodioides*

1b. Pinnae large to huge, bipinnate to tripinnatifid; sori round *D. boryana*

Deparia allantodioides (Bedd.) M. Kato, J. Fac. Sci. Univ. Tokyo III Bot. **13** : 393, f. 15 (1984); Iwatsuki : 321 (1988); Thapa : 12 (2000); DPR : 107 (2002)

Athyrium allantodioides Bedd., Ferns Brit. India : t. 221 (1867); Iwatsuki : 181 (1975).

Rhizome short, erect, scaly. Stipes 20-30 cm long, brown, thick, scaly at base, fibrillose and hairy; rachis colored like stipe, fibrillose. Lamina bipinnate, large, 60-100 cm long, 15-20 cm broad, lanceolate, texture herbaceous; pinnae many, c. 30 pairs, 7-10 cm long, 1-2 cm broad, alternate, sessile, lanceolate, margin deeply lobed to the costa; lobes many, 15-20 pairs, apex rounded, margin almost entire, lower pinnae gradually reduced at times to mere auricles, distant, downwards deflexed; veins simple. Sori indusiate, extending from the costule to almost the margin, at maturity almost touching each other, in 3-6 pairs on either side of the costule; indusia linear to 'J' shaped, large. Spores dark-brown. (Pl. 12. B-C).

Distribution : Nepal, common in W., C. & E. at upper mid to high altitudes (1900-4000 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : A common fern growing on shaded floor in forests.

Voucher specimen : Grokha, Above Gumba, Namrung, 2800 m, 5th October, 2012, S. Bhattarai, 1245 (KATH; TUCH).

Deparia boryana (Wild.) M. Kato, Bot. Mag. Tokyo **90** : 36 (1977), J. Fac. Sci. Univ. Tokyo III Bot. **13** : 386, f. 9 (1984); Iwatsuki : 320 (1988); Nakaike & Gurung : 153 (1995); DPR : 107 (2002)

Aspidium boryanum Willd., Sp. Pl. **5** : 285 (1810).

Rhizome short, ascending. Stipes c. 1 m long stramineous, thick, sparsely scaly, higher up stipes almost glabrous. Lamina 2-3 pinnate, large 50 cm-1 m long, 30-50 cm broad, triangular lanceolate, texture herbaceous, sparsely hairy, pinnae many pairs, alternate, petiolate, lanceolate, margin deeply lobed to the costa or becoming pinnate in large fronds, sessile, symmetrical, broadly oblong, adnate, apex round or acute, margin subentire. Sori indusiate, round, fimbriate. Spores dark-brown. (Pl. 12. D).

Distribution : Nepal, common throughout W., C. & E. at low to higher altitudes (500-3200 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

Ecology : Fairly common along streams.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 30th September, 2012, S. Bhattarai, 959 (KATH).

Diplazium Sw.

Terrestrial. Rhizomes erect, clothed with scales. Stipes erect, slender, slightly scaly. Fronds solitary and distant, simple to tripinatifid, ovate-lanceolate; pinnae with with deeply pinnatifid lobes; texture herbaceous-coriaceous; veins free or anastomosing. Sori indusiate, elongate; indusium oblong, membranous, persistent.

Key to the Species

- 1a. Basal 2-3 pairs of veinlets of adjacent lobes fuse *D. esculantum*
1b. Veins all free *D. maximum*

Diplazium esculantum (Retz.) Sw., Schrad. J. Bot **1801** (1) : 312 (1803); Sledge, Bull. Brit. Mus. Nat. Hist. (Bot.) **2** : 310 (1962); Tagawa : 474 (1966); roy *et al.* : 194 (1971); Iwatsuki : 186 (1975); Gurung : 62 (1986); Nakaike & Gurung : 154 (1995)); DPR : 109 (2002).

Hemionitis esculenta Retz., Obs. Bot. **6** : 38 (1791).

Rhizome suberect, stout, clothed with lanceolate scales. Stipes tufted, long, slender, minutely scaly, brownish higher up stipe glabrous. Lamina pinnate to partially bipinnate, size variable lanceolate, pinnae distant, subopposite to alternate, short stalked, cut down one-third to half of the costae, segments broad; texture herbaceous to subcoriaceous; veins pinnate, basal 2-3 pairs of veinlets of adjacent lobes fuse to form an irregular excurrent veinlet, remaining pairs arising from a central main veinlet in a segment free. Sori indusiate, linear. (Pl. 12. E).

Distribution : Nepal, very common throughout W., C. & E. at low to mid altitudes (60-1700 m); Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Common, growing along streams.

Use : Food.

Local name : Niuro.

Diplazium maximum (D. Don) C. Chr. Prodr. Fl. Nepal.: 8 (1825); DPR : 111 (2002)

Asplenium maximum D. Don, Prodr. Fl. Nepal.: 8 (1825).

Rhizome ascending, thick. Stipes 30-40 cm long, ribbed, scaly on lower part, glabrous on upper part. Fronds large, bipinnate to tripinnatifid, glabrous; pinnae large, many pairs, distant, alternate, petiolate, second basal pairs the largest, lanceolate, acuminate, obliquely spreading, deeply pinnatifid; margin minutely serrulate, segments oblong, crenate; texture herbaceous; veinlets forked. Sori indusiate, indusia linear, thin, in two oblique rows, oblong, along the veinlets; indusium deciduous. Spores light-brown. (Pl. 12. F).

Distribution : Nepal, uncommon in W., fairly common in C. & E. at lower mid to mid altitudes (700-1500 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan.

Ecology : Terrestrial, growing on shady streams.

Voucher specimen : Gorkha, Near by Philim, 30th September, 2012, S. Bhattarai, 960 (KATH).

Gymnocarpium Newman

Rhizome long-creeping, stipes long, thin, glabrous, sometimes scantily glandular or at least at the pinnae junction. Lamina 2-3 pinnate, texture thin, herbaceous, base truncate, bent, slender stipe, lower pinnae the largest. Sori exindusiate or rarely indusiate, round, light-brown. Spores bilateral.

Gymnocarpium fedtschenkoanum Pojark., Soobsch. Tadzhih. Fil. Akad. Nauk U. S. S. R. **22** : 9 (1950); Fraser-Jenkins, Bot. Helv. **102** : 146 (1993); DPR : 113 (2002)

Rhizome long-creeping, sparsely scaly, scales pale-brown, cocolorous. Stipes distant on rhizome, 15-30 cm long, longer than lamina, stramineous, thin, sparsely scaly or glabrous. Lamina 2-3 pinnate, 10-15 cm long, 8-13 cm long, , deltate, texture herbaceous, pale-yellow, glabrous, pinnae c. 5-8 pairs, 6-10 cm long, 2-5 cm broad, opposite, petiolate, triangular lanceolate, lobes many, margin lobed, basal basiscopic pinnule ion the lowest pinnae the largest, apex rounded. Sori exindusiate, round, submarginal, 4-6 pairs in a single row on either side of costules. Spores dark-brown. (Pl. 12. G).

Distribution : Nepal, quite common in W., becoming scattered in C. at high altitudes;

Ecology : Terrestrial, growing on shaded forests.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 7th October, 2012, S. Bhattarai, 1534 (KATH; TUCH).

Hypodematium Kunze

Rhizome short, creeping, thick. Fronds typically arranged in two rows on the dorsal side of the rhizome, close. Stipes clustered, base conspicuously swollen, scaly. Lamina 2-3 pinnate, hairy, hairs white, both surfaces hairy; veins free. Sori indusiate, round or reniform, hairy.

Hypodematium crenatum (Forssk.) Kuhn in Deck., Reis. Bot. 3 : 37 (1879); Iwatsuki : 323 (1988); DPR : 114 (2002).

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

Rhizome short, creeping. Stipes c. 20 cm long, glabrous. Lamina 3-pinnate, c. 25 cm long, deltate, texture herbaceous, pale-green, both surfaces hairy, hairs white, straight, pinnae c. 10 pairs, alternate, very shortly petiolate, becoming sessile on distal parts, oblong, base rotundo-cuneate, equal, excurrent, apex blunt, margin deeply lobed; veins free, distinct, costae and costules hairy, hairs white. Sori indusiate, large, reniform, 1-3 per ultimate lobe, indusia greyish, large, rotundo-reniform, attached by a deep sinus, densely setose, persistent. Spores dark-brown. (Pl. 12. H).

Distribution : Nepal, common in W., & C. (?E.) at lower to upper mid altitudes (500-2600 m); Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan; Rajasthan; Arabia.

Ecology : Uncommon, growing on exposed area.

Voucher specimen : Gorkha, Gapsya, 2200 m, 1st October, 2012, S. Bhattarai, 980 (KATH).

Dryopteridaceae Ching

Terrestrial. Rhizome erect or creeping. Fronds simply pinnate or bipinnate to decomposed; usually uniform; pinnules generally unequal sided at the base; rachis glabrous or pubescent; texture herbaceous or coriaceous; veins free or anastomosing. Sori superficial, dorsal or sometimes terminal on the veins.

Key to the Genera

- 1a. Fronds simply pinnate2
- 1b. Fronds more than 1-pinnate3
- 2a. Sori orbicular, fronds coriaceous, veins pinnate *Cyrtomium*

- 2b. Sori globose, fronds herbaceous, veins sagenioid *Tectaria*
- 3a. Indusium peltate *Polystichum*
- 3b. Indusium reniform 4
- 4a. Sori only borne near apex of pinnules, 2-3 pairs on each costa *Dryopsis*
- 4b. Sori not restricted only to the tip of pinnules *Dryopteris*

Cyrtomium C. Presl

Rhizome short, erect, densely scaly. Stipes scaly and fibrillose. Lamina pinante, texture coriaceous, glabrous, upper surface glossy or matt; pinnae simple, falcate, often with basal acroscopic auricle; veinlets anastomosing formins several aeroles, each aerolet with 1-3 inwardly directed free veinlets. Sori many, indusiate, scattered. Spores bilateral.

Cyrtomium anomophyllum (Zenker) Fraser-Jenkins : 330 (2008).

Aspidium anomophyllum Zenker, Plant. Ind. Coimbatour. Nilagiri Coll. B. Schmid 1 : t.1 (1835).

Cyrtomium microindusium Kurata, J. Geobot. 10 : 37 (1961); DPR : 118 (2002).

Rhizome, short, erect, thick, covered with persistent stipe bases, densely scaly. Stipes 8-15 cm long, stramineous, thick, scaly and fibrillose, scales light to dark brown, concolorous. Lamina pinnate, 15-20 cm long, 10-15 cm broad, lanceolate, texture thick, slightly coriaceous, lower surface pale-green, upper surface dark-green, glabrous, matt or often slightly gossy, pinnae 2-3 pairs, large, 8-10 cm long, 3-4 cm broad, alternate to sub-opposite, shortly petiolate, basiscopic margin very rounded, margins finely toothed from about half-way up with very short teeth, terminal pinna large, strongly auricled; veins slightly prominent. Sori indusiate, large, round, indusia lilght-brown, circular. Spore brown. (Pl. 12. I).

Distribution : Nepal, scattered in C. & E. (presembly also in W.); Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Growing in very moist, well-shaded places in forest.

Voucher specimen : Gorkha, Gapsya, 2200 m, 2nd October, 2012, S. Bhattarai, 1045 (KATH; TUCH).

Dryopsis Holttum & P. J. Edwards

Rhizomes short, erect, stout and scaly. Stipes fascicled, scaly. Fronds large, bipinnate to decompounds; glabrous; pinnules the lowest ones always on the basiscopic side, generally

broad at the base; texture firm; veins forked and free. Sori only borne near apex of pinnules, 2-3 pairs on each costa; indusium reniform.

Dryopsis apiciflora (Wall. ex Mett.) Holttum & P. J. Edwards, Kew Bull. **41** (1) : 189 (1985).

Aspidium apiciflorum Wall. ex Mett., Frangatt IV : 54 (1858).

Rhizome short, erect, scaly, scales brown. Stipes scaly, c. 15 cm long. Fronds bipinnate, c. 30 cm long, c. 10-15 cm broad; pinnae many, c. 20 pairs, sessile, c. 10 cm long, 2 cm broad, widely spreading, acuminate at apex; lower pinnae often shortened and somewhat deflexed; basiscopic pinnules not longer than acroscopic ones; stipe, rachis densely covered with brown lanceolate scales, but sparsely on upper part. Sori indusiate, indusia mostly reniform, only borne near apex of pinnules, 2-3 on each side of the end of the costa. Spores dark-brown. (Pl. 13. A).

Distribution : Nepal, common in (?W.), C. & E. at upper mid to higher (1800-3350 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand.

Ecology : Uncommon, growing on forest floor and on meadows.

Voucher specimen : Gorkha, Rupal, 3800 m, 2nd October, 2012, S. Bhattarai, 1139 (KATH; TUCH).

Dryopteris Adanson

Terrestrial. Rhizomes short, erect, strong and stout, clothed with scales. Stipes fascicled, scaly. Fronds large, bipinnate to decompounds; glabrous; pinnules the lowest ones always on the basiscopic side, generally broad at the base; texture firm; veins forked and free. Sori globose, dorsal or terminal on the veins; indusium round-reniform.

Key to the species

- 1a. Lamina triangular-lanceolate, lowest pair of pinnae generally largest2
- 1b. Lamina lanceolate, lowest pairs of pinnae generally reduced6
- 2a. Fronds dimorphic *D. cochleata*
- 2b. Fronds not dimorphic.....3
- 3a. Stipes and rachis scaly throughout, scales brown, stipes muricate *D. sublacera*
- 3b. Stipes scaly but rachis sparsely scaly above.....4

- 4a. Indusia membranous, flat, not enveloping mature sori, scales dark-brown to black..... *D. juxtaposita*
- 4b. Indusia corneous, almost completely enveloping mature sori, stipe rough.....5
- 5a. Pinnules wide,often pinnatifid, ultimate segments sharply serrate at apex*D. pseudovaria*
- 5b. Pinnules narrow, ultimate segments with 1-2 coracoid teeth at apex *D. frutuosa*
- 6a. Stipe scales predominantly ovate, pinnules side-margin not markedly parallel; lamina herbaceous, scales and fibrills all pale to pale-brown *D. chrysocoma*
- 6b. Stipe scales predominantly narrow, pinnules with markedly parallel sides, lamina usually coriaceous7
- 7a. Mid and lower stipe scales ovate to lanceolate8
- 7b. Mid and lower stipes scales lanceolate to narrowly lanceolate9
- 8a. Rachis scales grey-brown to yellowish brown *D. redactopinnata*
- 8b. Rachis scales black, lamina markedly tapering below *D. zayuensis*
- 9a. Stipe and rachis very densely scaly, scales light-brown; both surfaces fibrillose10
- 9b. Stipe and rachis scaly, scales pale to black; upper surface of lamina glabrous11
- 10a. Fronds large, pinnae c. 20 pairs, apex terminating abruptly.....*D. barbiger*
- 10b. Fronds smaller, pinnae c. 15 pairs, apex terminating acutely *D. komarovii*
- 11a. Pinnae distant, lamina broad-lanceolate *D. acutodentata*
- 11b. Pinnae closed, lamina narrow-lanceolate *D. xanthomelas*

Dryopteris acutodenta Ching, Bull. Fan Mem. Inst. Biol. (Bot.) **8** : 432 (1938); Fraser-Jenkins : 350 (1989); Thapa : 13 (2000); DPR : 120 (2002).

Rhizome short, erect, scaly. Stipes 7-15 cm long, light-brown, scaly, scales dense at base, scales very dark-brown, concolorous, broad-lanceolate, rachis sparsely scaly. Lamina pinnate to bipinnatifid or bipinnate, 20-35 cm long, 7-14 cm broad, lanceolate, texture thinly herbaceous, upper surface glabrous, pinnae 10-20 pairs, 4-8 cm long, 1.5-2 cm broad, distant on lower half, alternate, almost sessile, deeply pinnatifid or becoming pinnate, lowest pair of pinnae almost as long as the pair above, pinnules 10-15 pairs, apex rounded or acute teeth. sori indusiate, small, round, 2-4 pair on either side of the costa. Spores dark-brown. (Pl. 13. B).

Distribution : Nepal, scattered in W., C. & E. at high altitudes (3700-4200 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

Ecology : Common, usually growing among rock crevices.

Voucher specimen : Gorkha, Rupal, 3800 m, 9th October, 2012, S.Bhattarai, 1596 (KATH; TUCH).

Dryopteris barbiger (T. Moore *ex* Hook.) Kuntze, Rev. Gen. Pl. **2** : 812 (1891); Tagawa : 80 (1955); Iwatsuki : 187 (1975); Thapa : 13 (2000); DPR : 120 (2002).

Nephrodium barbigerum T. Moore *ex* Hook., Sp. Fil. **4** : 113 (1862).

Rhizome horizontal, scaly. Stipes c. 35 cm long, base brown, stramineous higher up, thick, very densely scaly and fibrillose; scales pale, broadly ovate-lanceolate, large, 1-1.5 cm long, apices long-acuminate, rachis densely scaly and fibrillose, scales brown, concolorous. Lamina 2-pinnate, large, c. 50 cm long, c. 15 cm broad, lanceolate, texture thickly herbaceous, both surfaces scaly, upper one sparsely scaly; pinnae many, c. 20 pairs, 10-15 cm long, c. 3 cm broad, close, alternate, shortly petiolate, lanceolate, lower 2-3 pairs of pinnae gradually reduced in size, sessile, symmetrical, apices acute or rounded, with several long teeth radiating around the apices. Sori indusiate, small, round, 3-6 pairs in row on either side of the costule. Spores dark-brown. (Pl. 13. C-D).

Distribution : Nepal, common throughout W., C. & E. at higher to high altitudes (3000-4250m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Fairly common, terrestrial, growing on meadows.

Voucher specimen : Gorkha, Tallo Rupal, 3200 m, 4th October, 2012, S. Bhattarai, 1135 (TUCH).

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

Aspidium filix-mas var. *chrysocoma* Christ, Bull. Herb. Bioss. **6** : 966 (1898).

Rhizome long, thick. Stipes 20-35 cm long, stramineous, thick, cylindrical, stipe base bearing a tuft of dense scales, scales at the base pale to pale-brown, concolorous, large, broadly ovate-lanceolate. Lamina 2-pinnate, size variable, 25-65 cm long, 15-30 cm broad, lanceolate, base slightly truncate, widest about the middle, texture thickly herbaceous, turning yellowish towards the end of growing season, upper surface glabrous, pinnae many, 20-30 pairs, 9-15 cm

long, 2-4 cm broad, almost sessile, subopposite to alternate, basal 1-2 pairs of pinnae smaller, pinnules 10-15 pairs, apex rounded truncate, margin toothed, decurrent obscurely toothed. Sori indusiate 2-4 pairs in a single row on either side of the costule, crowded, indusia light brown to grey. Spores dark-brown. (Pl. 13. E-F).

Distribution : Nepal, common in W., C. & E. at upper mid to high altitudes (1900-3500 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Common, usually growing on rock crevices or steep steep slopes along streams.

Voucher specimen : Gorkha, Rupal, 3600 m, 5th October, 2012, S. Bhattarai, 1407 (KATH; TUCH).

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); Nakaïke *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).

Rhizome long, ascending, thick, scaly. Fronds dimorphic with distinct fertile and sterile ones. Stipe c. 30 cm long, stramineous, thick, cylindrical, base densely scaly, sparsely scaly or nearly glabrous on higher up, scales light brown, concolorous, lanceolate. Lamina bipinnate, c. 30 cm long, 15 cm broad, lanceolate, pinnae c. 15 pairs, shortly petiolate, subopposite to alternate, coriaceous; pinnules c. 10 pairs, costae sparsely fibrillose, fibrils long; veins most forked. Sori indusiate, large, markedly crowded, occupying almost the entire lower surface of the fertile lobe, 4-6 pairs in a single row on either side of the costule, indusia reniform, prominent, pale-brown. Spores brown. (Pl. 13. G).

Distribution : Nepal, common in W., C. & E. at low to mid altitudes (500-1800 m); Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Common, usually growing on rock crevices or steep steep slopes along streams.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 30th September, 2012, S. Bhattarai, 963 (TUCH).

Dryopteris fructuosa (Christ) C. Chr., Ind. Fil.: 267 (1905); Fraser-Jenkins : 402 (1989); DPR : 122 (2002).

Aspidium varium var. *fructuosum* Christ, Bull. Herb. Bioss. **6** : 967 (1898).

Rhizome short, erect, densely scaly; scales light brown, ovate-lanceolate, with apicular tips. Stipes 25-30 cm long, stramineous, clothed with lanceolate, dark brown scales leaving distinct scars, scales smaller and sparse on higher up. Lamina bipinnate, c. 30 cm long, 15 cm broad, oblong-lanceolate, widest at the base, pinnae 8-10 pairs, c. 10 cm long, 4 cm broad, alternate, lower pinnae shortly petiolate, pinnule 10-15 pairs, lower ones pinnatifid, basiscopic pinnules larger than acroscopic ones, apex with teeth, texture herbaceous to subcoriaceous; veins conspicuous on both surfaces, mostly forked. Sori 2-5 pairs on each pinnule, borne on lower part of pinnules, nearer to costa, indusia reniform. Spores brown. (Pl. 13. H).

Distribution : Nepal, W., C. & E. at upper mid to high altitudes (1850-3600 m); Tibet; Arunachal Pradesh; Bhutan.

Ecology : Common, growing on shaded forest floor.

Voucher specimen : Gorkha, above Gumba, Namrung, 2800 m, 5th October, 2012, S. Bhattarai, 1409 (KATH; TUCH).

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

Rhizome long, erect, thick, scaly. Stipes 20-30 cm long, stramineous, scaly and fibrillose, base densely scaly, scales brownish, glossy, concolorous, lanceolate; rachis sparsely scaly. Lamina 2-pinnate, 25-30 cm long, 10-15 cm broad, texture subcoriaceous, upper surface bright green, glabrous, lower surface pale green, pinnae c. 20 pairs, 7-10 cm long 1-3 cm broad, triangular-lanceolate, distant, alternate, apex acuminate, rather broad and markedly parallel sided, base truncate, apex rounded-truncate, margin almost entire. Sori indusiate, small, round, medial, 4-7 pairs per pinnule, indusia light-brown. Spores dark-brown. (Pl. 13. I).

Distribution : Nepal, common in W., C. & E. at mid to higher altitudes (1600-3200 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Common, growing on forest floor and walking sides.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 12th June, 2012, S. Bhattarai, Ad. 21 (KATH; TUCH).

Dryopteris komarovii Kossinsky, Bot. Mater. Gerb. Glavn. Bot. Sada **2** : 1 (1921); DPR : 123 (2002).

Rhizome short, erect, densely scaly. Stipes dark-brown, c. 20 cm long, densely scaly, scales large, ovate-orbicular, brown. Lamina oblong-lanceolate, c. 25 cm long, 10 cm broad, bipinnate, apex obtuse, pinnae c. 15 pairs, middle pinnae c. 6 cm long, 2 cm broad, lanceolate, sessile, apex rounded, regularly dentate, pinnae fibrillose on both surfaces, rachis and costa densely clothed with lanceolate and linear-lanceolate brown scales; texture herbaceous; veins distinct on both surfaces. Sori indusiate, indusia brown, membranous, 2-4 on each side of costule. Spores dark-brown. (Pl. 14. A).

Distribution : Nepal, rare in W., C. & E. at high altitudes (3500-4800 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Uncommon, growing on forest floor and on meadows.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 8th October, 2012, S. Bhattarai, 1548 (KATH; TUCH).

Dryopteris pseudovaria (Christ) C. Chr.

Dryopteris basisora Christ, Notul. Syst. (Paris) **1**: 44 (1909).

Rhizome short, erect, scaly. Stipe c. 30 cm long, densely scaly at base but sparsely on higher up; scale light brown, ovate-lanceolate, apex hairy-shaped, usually twisted. Lamina tribinnatifid at base, bipinnate at middle and distal part bipinnatifid, oblong-lanceolate c. 35 cm long, c. 20 cm broad, texture subcoriaceous, pinnae c. 14 pairs, shortly petiolate, alternate, apex acuminate, pinnule c. 10 pairs, 1.5-2.5 cm long, 0.6-1 cm broad, sessile, basiscopic pinnule larger than acroscopic one, apex obtuse with sharp deltoid teeth; veins conspicuous on both surfaces, mostly forked. Sori indusiate, indusia orbicular-reniform, 1-2 pairs on each pinnule, borne on lower parts of pinnule. Spores brown. (Pl. 14. B-C).

Distribution : Nepal, rare in C.; Bhutan, Uttarakhand.

Ecology : Rare, growing on forest floor.

Voucher specimen : Gorkha, Gapsya, 2200 m, 1st October, 2012, S. Bhattarai, 1027 (KATH; TUCH).

Dryopteris redactopinnata S. K. Basu & Panigrahi in Panigrahi & Basu, Indian J. Forest. **3** (3) : 270 (1980); Fraser-Jenkins : 346 (1989); DPR : 124 (2002).

Rhizome long, suberect, thick, scaly. Stipes c. 12 cm long, thick, very densely scaly, scales dark brown to blackish, concolorous, large, 1-1.5 cm long, ovate-lanceolate, scales higher up on stipe becoming linear and smaller, rachis densely scaly and fibrillose, scales as on stipe.

Lamina pinnate, c. 50 cm long, 15 cm broad, lanceolate, gradually tapering towards the base, texture herbaceous, both surfaces sparsely fibrillose, pinnae c. 30 pairs, c. 10 cm long, 1.5-2 cm broad, apex truncate, unequally toothed, lower few pairs of pinnae gradually reduced but not deflexed downwards; veins most forked. Sori indusiate, 3-5 pairs, in a single row on either side of costa; indusia light brown. Spores brown. (Pl. 14. D-E).

Distribution : Nepal, uncommon in W. & C. at upper mid to higher altitudes (2000-3300 m); Tibet; Bhutan; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : A common basket fern of the forest floor.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 5th October, 2012, S. Bhattarai, 1286 (KATH; TUCH).

Dryopteris sublacara Christ in Lecomte, Not. Syst. (Paris) **1** : 35 (1909); Fraser-Jenkins : 389 (1989); DPR : 126 (2002).

Rhizome short, erect, thick, scaly. Stipes 8-30 cm long, stramineous, base densely scaly, scales light to mid brown, concolorous, slightly muricate at the base of fallen scales at the point of attachment of the rachis; rachis less scaly than the stipe, muricate like the stipe. Lamina 2-pinnate, 15-50 cm long, 8-15 cm broad, narrowly triangular-lanceolate, texture tickly herbaceous, pinnae up to 30 pairs, lanceolate, subopposite to alternate, lower pinnae shortly petiolate, lower pair of pinnae not reduced, not downwards deflexed, pinnules c. 15 pairs, alternate, apex rounded with small teeth. Sori indusiate, crowded, medial, 2-4 pairs in a single row on either side of costule, upper ½ or 1/3 part fertile. Spores dark-brown. (Pl. 14. F).

Distribution : Nepal, scattered in W., C. & E. at upper mid to higher altitudes (2200-3000 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh.

Ecology : Very common, growing on forest floor and also on exposed area.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 6th October, 2012, S. Bhattarai, 1285 (KATH; TUCH).

Dryopteris xanthomelas (Christ) C. Chr., Ind. Fil. Suppl. I : 41 (1913); DPR : 127 (2002).

Rhizome short, erect, thick, scaly. Stipes short, 6-10 cm long, base dark-brown, densely scaly and fibrillose, scales very dark-brown to bluish, concolorous, thick, glossy, scales decreasing in size higher up on stipe; rachis densely scaly and fibrillose, scales smaller than on stipe. Lamina 1-2 pinnate, 20-30 cm long, 5-10 cm broad, narrowly lanceolate, tapering towards both ends, texture subcoriaceous, lower surface sparsely fibrillose, upper surface almost glabrous;

pinnae 15-20 pairs, alternate, sessile, lanceolate, margin deeply lobed, rarely becoming pinnate; pinnules 10-15 pairs, apex truncate or rounded, margin minutely serrulate, lower few pairs of pinnae gradually reduced; veins simple. Sori indusiate, round, small, 3-5 pairs on either side of the costa, terminal parts of pinnae fertile. Spores dark-brown. (Pl. 14. G).

Distribution : Nepal, common throughout W., C. & E. at upper mid to high altitudes (2200-3800 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Common on shaded and moist forest floor.

Voucher specimen : Gorkha, Tallo Rupal, 3400 m, 5th October, 2012, S. Bhattarai, 1217 (KATH; TUCH).

Dryopteris zayuensis Ching & S. K. Wu in C. Y. Wu, Fl. Xizangica **1** : 255 (1983); Fraser-Jenkins : 128 (1997b); DPR : 127 (2002).

Dryopteris incislobata Ching & S. K. Wu in C. Y. Wu, Fl. Xizangica **1** : 253 (1983).

Rhizome short, erect, thick, scaly. Stipe 7-15 cm long, markedly densely scaly and fibrillose; scales all black, large, lanceolate or ovate, rachis densely scaly, similar to the stipe, upper stipe and lower to mid rachis bearing very dense all black scales. Lamina 1-2 pinnate, 30-50 cm long, 10-15 cm broad, lanceolate, very markedly tapering to a narrow base, herbaceous, pinnae c. 30 pairs, 5-10 cm long, 1-1.5 cm broad, margin deeply lobed or becoming pinnate; pinnules 10-20 pairs, apex rounded, almost entire; veins simple. Sori 3-6 pairs small, medial, 3-6 pairs per pinnule, on either either side of the costa; indusia round to reniform. Spores rather small. (Pl. 14. H-I).

Distribution : Nepal, rare in W. & C. (?E.) at upper mid to higher altitudes (2000-3000 m); Tibet; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

Ecology : Common, growing on shaded forest floor.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 6th October, 2012, S. Bhattarai, 1319 (KATH; TUCH).

Polystichum Roth

Terrestrial. Rhizomes short, stout and strong, erect, usually clothed with scales. Stipes mostly densely clustered and scaly throughout. Fronds pinnate; pinnae numerous; texture rather oriateous; veins all free. Sori round, dorsal or subterminal on the veinlets; indusium peltate.

Key to the species

- 1a. Lamina strictly pinnate *P. stenophyllum*
- 1b. Lamina bipinnatifid, bipinnate or more2
- 2a. Lamina bipinnatifid, only lower few pinnae bipinnate, pinnule few.....3
- 2b. Lamina distinctly bipinnate, stipe & rachis densely scaly*P. piceopaleaceum*
- 3a. Lamina herbaceous, fibrillose4
- 3b. Lamina coriaceous 5
- 4a. Plants small, narrow, fronds fragile *P. thomsonii*
- 4b. Lamina broad, light-brown scales on stipes and rachis *P. prescottianum*
- 5a. Stipes thick, stipe and rachis densely scaly; lamina curved sidewise*P. mehrae*
- 5b. Stipes thin, scaly, lamina generally straight*P. stimulans*

Polystichum mehrae Fraser-Jenkins & Khullar, Indian Fern. J. **2** (1-2) : 10 (1985), **3** (1-2) : 121 (1986); Fraser-Jenkins : 269 (1991), 28 (1997a); DPR : 131 (2002);

Rhizome short, erect, woody, densely scaly. Stipe short, 1.5-2 cm long, stramineous, thick, densely scaly and fibrillose; scales light-brown, concolorous ovate-lanceolate. Lamina pinnate, often 2-pinnate at matured base, c. 15 cm long, c. 4 cm broad, narrowly lanceolate, very slightly narrowed towards base, characteristically never straight but curved sideways spreading out and pressed flat on the surface of rocks, texture very coriaceous, lower surface paler, scantily fibrillose, upper surface dark-green, glossy, glabrous; pinnae c. 18 pairs, c. 2 cm long, c. 0.6 cm broad, alternate, petiolate, close, oblong, lanceolate, apices somewhat abrupt, margin deeply lobed almost to the costa. Sori indusiate, large, medial, 4-7 on each pinna, in a single row on either side of the costa. Spores pale-brown. (Pl. 15. A).

Distribution : Nepal, quite common in W., C. & E. at upper mid to higher altitudes (2300-2750 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : A rock dwelling fern, dark green fronds curved sideways.

Voucher specimen : Gorkha, Tallo Rupal, 3400 m, 3rd October, 2012, S. Bhattarai, 1093 (KATH).

Polystichum piceo-paleaceum Tagawa, Acta Phytotax. Geobot. Kyoto **5** : 255 (1936); Matsumoto & Nakaike : 182 (1988); Nakaike & Gurung : 81 (1988b); Fraser-Jenkins : 271 (1991), 31 (1997a); Wang & Shieh, Fl. Taiwan ed. 2 **1**: 347 (1994); Thapa : 14 (2000); DPR : 133 (2002);

Rhizome short, erect, thick, densely scaly. Stipes 8-14 cm long, brown, robust, very densely scaly and fibrillose, scales broad ovate to ovate-lanceolate; rachis densely scaly and fibrillose, scales as on stipe but scales acuminate. Lamina 2-pinnate, 25-40 cm long, 10-15 cm broad, lanceolate, slightly narrowed towards base, broadest in the middle, texture subcoriaceous, lower surface sparsely scaly and fibrillose, upper surface almost glabrous, pinnae many, 20-25 pairs, 5-8 cm long, 1.5-2 cm broad, close, alternate, shortly petiolate, lanceolate, apices slightly curved upwards, lower pinnae generally downwards deflexed; pinnules 10-15 pairs; margin serrate, each lobe ending in a long spine. Sori indusiate, medial, 5-6 pairs on either side of the costule; indusia pale-brown. Spores brown. (Pl. 15. B).

Distribution : Nepal, common in W., C. & E. at upper mid to higher altitudes (2100-2800 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Growing on forest-floor in luxuriant and moist area.

Voucher specimen : Gorkha, Above Gumba, Namrung, 2800 m, 1st October, 2012, S. Bhattarai, 1026 (KATH; TUCH).

Polystichum prescottianum (Wall. ex Mett.) T. Moore, Ind. Fil.:101 (1858); Beddome : 210 (1883); Tagawa : 480 (1966); Iwatsuki : 190 (1975); Nakaike : 144, t. 5 f. 2 (1982); Fraser-Jenkins : 258 (1991), 13 (1997a); Wang & Shieh, Fl. Taiwan ed. 2 **1** : 347 (1994); Thapa : 14 (2000); DPR : 133 (2002);

Aspidium prescottianum Wall. ex Mett., Abh. Senck. Naturf. Ges. (Frankfurt) **2** : 48 (1858); Clarke : 510 (1880); Hope : 477 (1902).

Rhizome short, erect, scaly. Stipes 5-10 cm long, stramineous to light-brown, soft, flaccid, densely scaly and fibrillose; scales light-brown, concolorous, large, broad-lanceolate; rachis very densely scaly and fibrillose. Lamina pinnate, 25-35 cm long, 3-5 cm broad, narrowly lanceolate, broadest in the middle, narrowed towards the base, erect, texture herbaceous to subcoriaceous, both surfaces densely fibrillose with long fibrils, pinnae 25-35 pairs, 1.5-2.5 cm long, 0.5-1 cm broad, alternate, sessile, elongate-lanceolate, distant, base truncate, margin deeply lobed, margin spinulose, serrate with each lobe ending in an awn or spine, lower pinnae

slightly reduced. Sori indusiate, small, sub-medial, 4-6 pairs in a single row on either side of the costa. Spores yellowish. (Pl. 15. C-D).

Distribution : Nepal, common throughout W., C. & E. at upper mid to high altitudes (2250-4000 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan.

Ecology : Growing in open places, near by tree line amongst rocks.

Voucher specimen : Gorkha, Tallo Rupal, 3200 m, 4th October, 2012, S. Bhattarai, 1133 (KATH; TUCH).

Polystichum stenophyllum Christ, Bull. Soc. Fr. 52 Mem. **1** : 27 (1905); Tagawa : 481 (1966); Iwatsuki : 191 (1975); Nakaike : 145 (1982); Fraser-Jenkins : 255 (1991), 10 (1997a); Wang & Shieh, Fl. Taiwan ed. 2 **1** : 349 (1994); DPR : 134 (2002).

Polystichum stenophyllum var. *abbreviatum* Tagawa, Acta Phytotax Geobot. **3** : 92 (1934).

Rhizome short-erect, densely covered with small brown scales. Stipe stramineous, 4-6 cm long, thin, scaly, scales as on rhizome. Lamina pinnate, linear-lanceolate, 10-12 cm long, 1.5-2 cm broad, pinnae 15-20 pairs, alternate, lower pinnae slightly smaller, deflexed downwards, margin serrulate, apices acute and shortly spinulose; acroscopic bases auriculate, basiscopic side cuneate, texture thickly papery; veins distinct. Sori terminal on veinlets of pinnae, in a single row usually on the acroscopic side of midrib, submedial; indusia present, brown. Spores brown. (Pl. 15. E).

Distribution : Nepal, rare in C. & E. Nepal at mid to high altitudes (1350-3000 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling.

Ecology : Rare growing moist shaded area.

Voucher specimen : Gorkha, Above Gumba, Namrung, 2800 m, 5th October, 2012, S. Bhattarai, 1208 (KATH; TUCH).

Polystichum stimulans (Kunze ex Mett.) Bedd., Ferns Brit. India : t. 31 (1865); Tagawa : 80 (1955); Iwatsuki : 191 (1975); Nakaike : 145 (1982); Fraser-Jenkins : 268 (1991), 28 (1997a); DPR : 134 (2002).

Aspidium stimulans Kunze ex Mett., Abh. Senck. Naturf. Ges. (Frankfurt) **2** : 327 (1858).

Rhizome short, erect, scaly. Stipes 2-4 cm long, stramineous, fragile, thin, scaly and fibrillose; scales light-brown, concolorous, linear-lanceolate. Rachis fibrillose. Lamina pinnate, 10-15 cm

long, 1.5-2 cm broad, linear to linear-lanceolate, straight or slightly curved, but never side-ways curved, texture coriaceous, both surface glabrous; pinnae 15-25 pairs, small, 1-1.5 cm long, 0.5-1 cm broad, closed, alternate, shortly petiolate, triangular or sub-rhomboidal, margin deeply lobed, lobes 2-3, small, apex spiny tipped, basal lobes well developed, auricled, margin spinulose dentate. Sori indusiate, medial 3-5 pairs in a single row on either side of the costa; indusia light-brown. Spores light-brown. (Pl. 15. F-G).

Distribution : Nepal, common throughout W., C. & E. at upper mid to high altitudes (1800-3000 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Uttarakhand; Himachal Pradesh.

Ecology : Rare, growing on shaded moist rock-crevices.

Voucher specimen : Gorkha, Namrung, 2600 m, 5th June, 2012, S. Bhattarai, 20/11 (KATH; TUCH).

Polystichum thomsonii (Hook. f.) Bedd., Ferns Brit. India **1** : t. 126 (1865), 206 (1883); Tagawa : 481 (1966); Iwatsuki : 191 (1975); Nakaike : 148, t. 7 f. 2 (1982); Nakaike & Gurung : 84 (1988b); Fraser-Jenkins : 259 (1991), 16 (1997a); Wang & Shieh, Fl. Taiwan ed **2** **1** : 350 (1994); Thapa : 14 (2000); DPR : 135 (2002).

Aspidium thomsonii Hook. f. in Hook., 2nd Cent. Ferns : t. 25 (1860); Clarke : 508 (1880); Hope : 466 (1902).

Rhizome short, erect, scaly. Stipes 3-5 cm long, stramineous, thin, fragile, sparsely scaly and fibrillose; scales light-brown, concolorous. Rachis fibrillose. Lamina pinnate, small, 7-10 cm long, narrow, 1.5-2 cm broad, linear-lanceolate, broadest in the middle, slightly narrowed towards base, texture sub-coriaceous to herbaceous, both surfaces sparsely fibrillose; pinnae many, 20-25 pairs, short, 0.5-1 cm long, 0.3-0.5 cm broad, alternate to sub-opposite, shortly petiolate, asymmetrical, broadest at the very unequal base, acroscopic margin lobed almost the the costa, acroscopic lobes larger, very obliquely inserted lobes towards the apex. Sori indusiate, sub-medial, 3-5 pairs, in a single row on either side of the costa, complete frond fertile; indusia pale-brown. Spores yellowish-brown. (Pl. 15. H-I).

Distribution : Nepal, fairly common throughout W., C. & E. at upper mid to higher altitudes (2000-3050 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan.

Ecology : Rare, small, delicate growing on crevices in shaded damp rocks.

Voucher specimen : Gorkha, Below Namrung, 2400 m, 6th October, 2012, S. Bhattarai, 1314 (KATH).

Tectaria Cav.

Terrestrial. Rhizome erect, clothed with brownish scales. Stipe tufted, erect. Fronds pinnate, glabrous; rachis glabrous, purplish; texture thinly herbaceous; veins anastomosing. Sori large, round.

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

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

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

Rhizome erect, stout, woody, clothed with brown scales. Stipes erect. Fronds pinnate, size variable, 30-50 cm long 10-15 cm broad, deltoid-oblong, glabrous, with pinnatifid apex, pinnae large; stipes and rachis deep brown, rachis glabrous; texture thinly herbaceous; main veins not distinct upto the margin, lateral veins anastomosing. Sori large, roundish, indusium more or less reniform. (Pl. 16. A).

Distribution : Nepal, very common throughout W. C. & E. at low to upper mid altitudes (150-2200 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

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

Use : Food.

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 30th September, 2012, S. Bhattarai, 961 (KATH).

Oleandraceae Ching ex Pich. Serm.

Rhizome creeping, scaly. Stipes articulated. Fronds dimorphic or uniform, solitary; rachis sometimes scaly. Lamina simple, lanceolate, margin entire, cartilaginous, texture herbaceous, glabrous or hairy; veins free, forked. Sori indusiate, solitary, superficial, close to the rachis to form a compact row on either side; indusial persistent, reniform.

Oleandra Cav.

Epiphytic or terrestrial. Rhizomes creeping or erect, long and branching, scaly. Stipes articulate. Fronds simple, entire, usually linear-lanceolate, acuminate, glabrous or pubescent;

costae sometimes scaly; texture firm; veins simple or forked. Sori dorsal on the acroscopic branch of a vein on each side of the midrib; 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 (1875); Nakaike & Gurung : 194 (1988a); Fraser-Jenkins : 313 (1997b); Thapa : 14 (2000); DPR : 137 (2002).

Aspidium wallichii Hook., Exot. Fl. 1 : t. 5 (1825).

Rhizome long-creeping, thin, densely scaly, scales dark-brown. Stipes short, 5-7 cm long, stramineous, shortly articulated to the rhizome, hairy, scaly at base. Rachis densely hairy and scaly. Lamina simple, 35-45 cm long, 3-5 cm broad, sub-elliptic-oblong, base subround or cunate, apex suddenly and sharply acuminate, both surfaces hairy, margin entire, both sides somewhat parallel; veins free, forked at base, hairy. Sori indusiate, in a single row on either side, close and almost parallel to the rachis; indusial brown. Spores dark-brown. (Pl. 16. B).

Distribution : Nepal, common throughout W., C. & E. at upper mid to higher altitudes (2000-2900 m); Tibet; Arunachal Pradesh; Bhutan; Uttarakhand; Himachal Pradesh.

Ecology : Occasional, growing on tree trunks (*Pyris* sp.) and mossy rocks of shady places.

Voucher specimen : Gorkha, Namrung, 2600 m, 7th October, 2012, S. Bhattarai, 12/8 (KATH; TUCH).

Nephrolepidaceae (Ching) Pich. Serm.

Rhizome short-erect, usually producing long stolons. Fronds arise in tufts. Stipes articulated shortly above rhizome. Lamina pinnate, pinnae articulated, margin entire or finely serrate; veins free, not reaching the margin. Sori indusiate, reniform.

Nephrolepis Schott

Rhizome short, erect. Rachis shallowly grooved on upper side. Lamina pinnate, long, narrow, glabrous; pinnae many pairs, close together, sessile, articulated, auricled on the acroscopic side, margin crenate or entire, lowest pair of pinnae reduced and distant; veins free. Sori indusiate, terminal, round-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).

Polypodium cordifolium L., Sp. Pl. 2 : 1089 (1753).

Nephrolepis auriculata (L.) Trimen, J. Linn. Soc. (Lond.) Bot. **24** : 152 (1887); Nakaike & Gurung : 194 (1988a); DPR : 137 (2002).

Rhizome erect. Stipes long, 10-20 cm long, dark brown, scaly. Rachis similar to stipe, scaly and fibrillose. Lamina pinnate, 50-70 cm long, 4-7 cm broad, narrowly linear elliptic, not parallel sided, gradually narrowed upwards and downwards from the middle, thin, texture herbaceous, deep-green, glabrous; pinnae many, 3-4 cm long, close together, alternate, sessile, falcate, base asymmetric, triangular, an acute auricle on the acroscopic side, overlapping the rachis and covering it on the lower side, basiscopic side rounded; margin coarsely serrate, lower pinnae gradually reduced; veins free, not reaching the lamina margin. Sori indusiate, reniform, submarginal. (Pl. 16. C).

Distribution : Nepal, very common in W., C. & E. at low to upper mid altitudes (500-1900 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand.

Ecology : Terrestrial, growing on rock crevices or tree trunks on exposed area.

Use : Ornamental

Voucher specimen : Gorkha, Near by Philim, c. 1500 m, 30th September, 2012, S. Bhattarai, 952 (KATH).

Davalliaceae Mett. *ex* Frank

Rhizome long-creeping. Stipes articulated, scaly at the base, glabrous; rachis narrowly winged on either side which are the continuation of the thickened pinna margin. Lamina pinnately compound, finely dissected, lanceolate or deltate, ultimate segments always unequal at base, decurrent on rachis; veins free. Sori indusiate, terminal on veins or submarginal.

Key to the genera

1a. Rhizome scales gradually narrowing towards acuminate apex*Araiostegiella*

1b. Rhizome scales rounded to acute apex*Araiostegia*

Araiostegia Copel.

Rhizome creeping, densely scaly. Stipes articulated to rhizome. Lamina 3-pinnate, small to large, lanceolate, ovate or deltate, texture herbaceous, glabrous; ultimate segments narrow, linear, pinnules not decurrent; veins free, glabrous. Sori indusiate, small, terminal on veinlet; indusia round thin, membranaceous, basifixed, upwards free. Spores bilateral.

Key to the species

1a. Lamina lanceolate, lower pair of pinnae as long as the next pair above*A. beddomei*

1b. Lamina deltate, stipe less than half the length of lamina *A. pulchra*

Araiostegia beddomei (C. Hope) Ching. Fl. Reip. Pop. Sin. **2** : 288 (1959); DPR : 138 (2002).

Rhizome long-creeping, thick, scaly. Stipes 12-15 cm long, less than half the length of lamina, stramineous or pinkish, scaly at base; rachis grooved, glabrous. Lamina 3-4 pinnate, 30-40 cm long, 10-14 cm broad, deltate or subdeltate, texture thin, herbaceous, glabrous; pinnae c. 25 pairs, 5-8 cm long, 3-4 cm broad, alternate, petiolate, lowest pinnae the largest, basal basispic pinnules larger than the acroscopic pinnules, lobes 8-10 pairs, margin lobed into small narrow segments, a single vein to each ultimate segment, apex acute, glabrous. Sori indusiate, at the base of the narrow ultimate segments; indusial yellowish-brown, small, semiorbicular. Spores light-brown. (Pl. 16. D).

Distribution : Nepal, common throughout W., C. & E. at lower mid to higher altitudes (800-2700 m); Tibet; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Common, epiphytic on tree trunks.

Voucher specimen : Gorkha, Above Gumba, Namrung, 2800 m, 5th October, 2012, S. Bhattarai, 1215 (KATH; TUCH).

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 (1997); DPR : 139 (2002);

Davallia pulchra D. Don, Prodr. Fl. Nepal.: 11 (1825); Clarke : 444 (1880), Gurung : 47 (1986).

Rhizome long-creeping, branched, scaly. Stipes 10-15 cm long, almost as long as or shorter than the lamina, stramineous, thin, stipe base scaly, rachis grooved on upper side, glabrous. Lamina tri- to tetrapinnate, 15-25 cm long, 10-15 cm broad, broadly deltate, texture thin, submembranaceous, glabrous; pinnae up to 10 pairs, 8-13 cm long, 4-6 cm broad, alternate, petiolate, lower pinnae more distant; pinnules of the basispic side in the lowest pinnae slightly longer than the acroscopic one, alternate, acuminate; veins free, each ultimate segment with veinlet, glabrous. Sori indusiate, small; indusial large, ovate, membranaceous. (Pl. 16. E-F).

Distribution : Nepal, very common throughout W., C. & E. at lower mid to higher altitudes (700-2700 m); Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; W., C. and E. Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

Ecology : Common, growing on tree trunks.

Voucher specimen : Gorkha, Namrung, 2600 m, 5th October, 2012, S. Bhattarai, 1419 (KATH; TUCH).

***Araiostegiella* Kato & Tsutsumi**

Rhizome creeping, densely scaly, scales gradually narrowing towards acuminate apex. Stipes base scaly. Lamina 3-pinnate, texture herbaceous, glabrous; ultimate segments narrow, linear, pinnules not decurrent; veins free. Sori indusiate, small, indusia thin.

***Araiostegiella hookeri* (T. Moore ex Bedd.) Fraser-Jenk., Fraser-Jenkins : 355-356, 633 (2008)**

Acrophorus hookeri T. Moore ex Bedd., Ferns Brit. India : t. 95 (1865).

Araiostegia hookeri (T. Moore ex Bedd.) Ching, Fl. Reip. Pop. Sin. **2** : 291 (1959); Iwatsuki : 178 (1975); DPR : 138 (2002).

Rhizome long-creeping, thick, densely scaly; scales overlapping, not adpressed, dark-brown, lanceolate. Stipes 3-5 cm long, reddish-brown, thin, base scaly, scales as on rhizome, upper part of stipes sparsely scaly or glabrous. Lamina 3-4 pinnate, finely dissected, 5-10 cm long, 4-7 cm broad, narrowly deltate-oblong, thin, texture herbaceous, glabrous, pinnae up to 10 pairs, alternate, short petiolate, deltate; a single vein in the ultimate segment. Sori indusiate, small; indusia small, membranous, persistent. Spores brown. (Pl. 16. G).

Distribution : Nepal, rare in W. & C. but common in E. at higher to high altitudes (2900-3500 m); Tibet; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh.

Ecology : Uncommon, epiphytic on mossy tree trunks.

Voucher specimen : Gorkha, Above Gumba, Namrung, 2800 m, 11th June, 2012, S. Bhattarai 113 (KATH).

Blechnaceae (C. Prens) Copel.

Rhizome usually erect, thick. Fronds usually large, either uniform or dimorphic. Stipes non-articulated, with 2 broad lateral and 1-3 or more small dorsal strands. Lamina usually pinnate, texture thick, sub-coriaceous or coriaceous, glabrous. Sori indusiate, elongated distrete, indusial flap-like. Spores bilateral.

Woodwardia J. Sm.

Rhizome short, erect or ascending, thick, densely scaly. Fronds rather large. Stipes fasciculated. Lamina pinnate, margin deeply lobed to the costa, margin of the lobes entire or serrulate; veins anastomosing to form 1 costal and 1-3 costular areolae, generally free beyond that or forming additional areolae. Sori indusiate, present on the outside of the costular areolae, discrete, deeply sunken. Spores bilateral.

Woodwardia biserrata C. Presl, Rel. Haenk. **1** : 53 (1825); Fraser-Jenkins : 287 (1997); DPR : 143 (2002).

Woodwardia unigemmata (Makino) Nakai, Bot. Mag. Tokyo **39** : 103 (1925); Tagawa : 80 (1955); Ito : 486 (1966); Iwatsuki : 282 (1988); Nakaike & Gurung : 197 (1988a).

Rhizome short, ascending, thick, scaly; scales golden-brown. Stipes 25-40 cm long, brown, thick, scaly at base, higher up stipe glabrous, ; rachis similar to stipe. Lamina pinnate, large, up to 1.5 m long, texture sub-coriaceous, glabrous; pinnae many, distant, alternate, petiolate, upper pinnae sessile, lanceolate, margin deeply lobed, base unequal; lobes many, ovate-lanceolate, apex acuminate, margin backwards reflexed, spinulose serrate, cartilaginous, apex acute; veins anastomosing. Sori indusiate, rectangular or oblong, deeply sunk in a cavity with raised margin, in a single row on either side. Spores light-brown, faintly loose. (Pl. 16. H-I.)

Distribution : Nepal, common throughout W., C. & E. at lower mid to higher altitudes (1350-2500 m); Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

Ecology : Terrestrial, growing in the beds of hilly ravines, on damp cliffs next to water flows

Use : Litter

Voucher specimen : Gorkha, Gap, 2200 m, 1st October, 2012, S. Bhattarai, 970 (KATH).

4. DISCUSSION

Manaslu Conservation Area (MCA), in Central Nepal provides a unique habitat for both flowering and non flowering plants. A total of 105 species of Pteridophytes belonging to 45 genera and 20 families have been found in the study area. On the basis of number of genera Polypodiaceae is the largest family consisting of some eight genera followed by Pteridaceae and Woodsiaceae each having about six genera, Dryopteridaceae with five, Dennstaedtiaceae with three, Lycopodiaceae, and Davalliaceae each having two genera whereas Selaginellaceae, Equisetaceae, Botrychiaceae, Osmundaceae, Hymenophyllaceae, Cytheaceae, Schizaceae, Adiantaceae, Aspleniaceae, Thelypteridaceae, Oleandraceae, Nephrolepidaceae and Blechnaceae are monotypic.

Among 45 genera, *Dryopteris* is the largest genera with twelve species followed by *Athyrium* with ten species, *Pteris* and *Polystichum* each with six species, *Asplenium* with five species and *Polypodiodes* with four species. While, most of the genera like *Araiostegiella*, *Arthromeris*, *Cryptogramma*, *Cythea*, *Equisetum*, *Goniophlebium* etc. are monotypic.

New records

From the present study, based on the morphological characters and habitat two species ***Athyrium contingens*** Ching & S. K. Wu and ***Selaginella vardei*** Lev. have been considered as new record for Nepal. This will now add two species to the pteridophyte flora of Nepal.

Distribution of species

From the present study, the pteridophytes based on the habitat where they were found either growing on other plant, on land or on rocks have been broadly categorized into three major habitats viz. terrestrial, epiphytic and lithophytes. Besides these three types, some of the species were also found in more than one habitat i.e. overlapping habitat.

Of the total 105 species collected, majority of the species i.e. 65 species were terrestrial, 28 species epiphytic, and 34 as lithophytes. Most of these terrestrial species were also recorded from similar habitats as described by Gurung (1991) and Iwatsuki (1988). Some 12 species like *Araiostegia pulchra*, *Araiostegia beddomii*, *Araiostegiella hookeri*, *Asplenium ensiformis*, both species of *Drynaria*, *Huperzia hamiltonii*, *Lepisorus loriformis* both species of *Pyrrosia*, and *Trichomanes latealatum* are pure epiphytic i. e. growing usually on the mossy tree trunks and branches of trees or shrubs both in open and shaded places. Similarly, about 13 species viz. *Arthromeris wallichiana*, *Athyrium davidii*, *Athyrium rupicola*, *Cheilanthes grisea*, *Cryptogramma brunoniana*, *Dryopteris acutodonta*, *Dryopteris chrysocoma*, *Dryopteris cochleata*, *Lepisorus clathratus*, *Adiantum tibeticum*, *Polystichum mehrae*, *Polystichum*

stimulans, *Polystichum thomsonii* and *Pteris dactylina* are found well flourished on rocky habitats.

Besides the species growing on distinct habitats, some species like *Nephrolepis cordifolia* is both terrestrial as well as epiphytes. While, there are other species found growing in more than one habitat as some 16 species *Asplenium laciniatum* subsp. *kukkonenii*, *Asplenium laciniatum* subsp. *tenuicaule*, *Goniophlebium argutum*, *Lepisorus mehrae*, *Lepisorus scolopendrium*, *Lepisorus thunbergianus*, *Microsorium membranaceum*, *Oleandra wallichii*, *Pichisermollia ebinepes*, *Pichisermollia malacodon*, *Pichisermollia nigrovenia*, *Pichisermollia subebenipes*, *Polypodiodes microrhizoma*, *Polypodiodes amoena*, *Polypodiodes hendersonii*, *Asplenium yoshinagae* subsp. *indicum* are growing both as epiphytes and lithophytes whereas *Adiantum capillus-veneris*, *Nephrolepis cordifolia*, *Polystichum prescottianum* and *Tectaria coadunata* are growing in terrestrial and as lithophytes.

Distribution of species on the basis of forest types

"The forest is a peculiar organism of unlimited kindness that makes no demand for its sustenance and extends generously the products of its activity: it affords protection to all beings, offering shade even to the axe man who destroys it" (Gautam Buddha). As has been said, forest ultimately provides the basic needs to sustain life not only to animals but also to the plants which flourish well only in associating with the particular forest types. In this study, there are some 8 quite distinct forest types, 1 cropland and 1 meadow. The species show quite distinct relationship with each other on the basis of forest types. The species are differentiated into 5 distinct main clades. Almost all of the species of cropland are quite closer in the dendrogram. Similarly, the species limited to a particular forest type are closer whereas the species diversified well in more than one forest types are also linked to the species having the same type of distribution along various forest types.

Distribution of species along altitudinal gradient

Altitude, one of the major factors determining the climatic condition, affects directly the vegetation of an area. Along with the increasing altitudinal gradient, the temperature and rainfall differs markedly so the species should adapt to the particular condition to sustain the life. However, majority of the species cannot adapt the major change in climatic conditions and become restricted to a limited elevation. In the present study, only few species have shown high distribution range. *Notholaena himalaica* and *Onychium contiguum* are with highest distribution range almost from 2200-3600 m followed by *Lepisorus loriformis*, *Dryopteris redactopinnata* within the range of 2400-3400 m and *Osmunda claytoniana* having the range 2600-3600 m respectively.

The study presented here does not show uniform species richness all along the altitudinal gradient. Highest number of 43 species was collected between 2400-2800 m followed by 36

species between 1500-2200 m and 26 species between 3000-3800 m. The lowest number of four species was found at 4000 m. This result clearly shows that the number of species is quite low either in the area quite closure to the settlement, or pasture land or farmland. The area between the altitude 2400-2800 m located relatively far from the settlement are quite rich in species composition with rich tree diversity from Laurals, *Quercus*, *Ilex* etc really supports the growth of epiphytes along with terrestrial species and few lithophytes. Due to dense forest it provided shaded moist forest floor for the terrestrial species and due to thick bark lots of deposition on the tree trunk with suitable growth of moss also supports the growth of epiphytes. 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. Similar composition was also reported by Iwatsuki (1988) and Mehra and Bir (1964). But in case of the high altitude the trees decreases with the decreases in the epiphytic number as well as in terrestrial species growing on shaded forest floors.

Economic importance

Since prehistoric times, people have been depending on nature, especially on plants, to sustain their basic needs. Pteridophytes are well known and widely used as ornamental, decorative, food, medicine and other common uses. The attractive ferns have been used in decoration of gardens, popularly called as 'Pteris garden', public parks, super stores, buildings and houses as well. In the present study too, many ferns are directly linked with daily life of the local people. The immature shoot of species like *Diplazium esculentum*, *Tectaria coadunata*, *Dryopteris cochleata*, *Cythea spinulosa* and water ball of *Nephrolepis cordifolia* are used for food. Of them, *Diplazium esculentum* is the most widely used species for vegetable and sustain livelihood of some locals. Similarly, rhizome of *Drynaria* is another major source of income for local people. Huge amount of dried rhizome of *Drynaria* is exported to Tibet. Another species used frequently for medicine is *Pteris subquinata* for cut and wound. Beside these food and medicine values, there are other species using for different purposes. *Nephrolepis cordifolia* and *Drynaria* are frequently used for decoration. Gurung (1991) have also reported these ferns being used for ornamental purposes supporting our results.

As agriculture being the major occupation of local people, lots of species like *Dennstaedtia appendiculata*, *Pteridium revolutum*, *Pteris biaurita*, *Pteris cretica*, *Osmunda claytoniana*, *Dryopteris redactopinnata*, *Dryopteris sublacara*, *Athyrium*, *Diplazium maximum*, *Onychium contiguum*, *Coniogramme*, *Deparia* and *Woodwardia* are mainly used for fodder and litter for animals and making green manure. Based on these uses, personal communication and information gathered from the field, ferns and fern allies of this area are entirely linked with the livelihood of local people and are economically important. Used of the above mentioned species as fodder can be considered as new information, this has not been mentioned so far.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

A total of 105 species of Pteridophytes were collected belonging to 45 genera and 20 families. On the basis of number of genera Polypodiaceae is the largest family consisting of some eight genera followed by Pteridaceae and Woodsiaceae each having about six genera each. Among 45 genera, *Dryopteris* is the largest genera with twelve species followed by *Athyrium* with ten species, *Pteris* and *Polystichum* each having six species each. Out of 105 species of pteridophytes two species viz. *Selaginella vardei* Lev. and *Athyrium contingens* Ching, based on the morphological characters are new records for Nepal.

On the basis of habitat, majority of the species are terrestrial (65) followed by lithophytic (34) and epiphytic (28). Besides the species growing on distinct habitats, some species like *Nephrolepis cordifolia* is both terrestrial as well as epiphytes, while, 16 species are found growing both as epiphytes and lithophytes. Whereas, *Adiantum capillus-veneris*, *Nephrolepis cordifolia*, *Polystichum prescottianum* and *Tectaria coadunata* are growing in terrestrial and as lithophytes.

Highest number of species (43) was found between the altitude 2400-2800 m followed by 36 species at 1500-2200 m, likewise 13 species at 3000-3400 m and 10 species at 3600-3800m. The lowest number of four species was found at 4000 m. The area between the altitude 2400-2800 m located relatively far from the settlement are quite rich in species composition with rich tree diversity from Laurals, *Quercus*, *Ilex* etc really supports the growth of epiphytes along with terrestrial species and few lithophytes. Due to dense forest it provided shaded moist forest floor for the terrestrial species and due to thick bark lots of deposition on the tree trunk with suitable growth of moss also supports the growth of epiphytes.

Notholaena himalaica and *Onychium contiguum* are with highest distribution range almost from 2200-3600 m followed by *Lepisorus loriformis* and *Osmunda claytoniana* having the range of 2400-3400 m and 2600-3600 m respectively.

The immature shoot of species like *Diplazium esculentum*, *Tectaria coadunata*, *Dryopteris cochleata*, *Cythea spinulosa* and water ball of *Nephrolepis cordifolia* are used for food. Similarly, *Nephrolepis cordifolia*, *Drynaria* spp., *Dennstaedtia appendiculata*, *Pteridium revolutum*, *Pteris biaurita*, *Pteris cretica*, *Osmunda claytoniana*, *Dryopteris redactopinnata*, *Dryopteris sublacara*, few species of *Athyrium*, *Diplazium maximum*, *Onychium contiguum*, *Coniogramme*, *Deparia*, *Woodwardia* and many others have important economic role in the local community being used for various purposes.

5.2 Recommendations

The present study focuses on the exploration of Pteridophytes especially of Nubri valley of Manaslu Conservation Area and following recommendations have been made.

- As the present study was conducted being focused to a particular area of Manaslu Conservation Area, so similar inventory researches should be conducted in other areas of Manaslu and all other parts of the country as well.
- Many ferns are destroyed by habitat loss and over exploitation, thus deforestation should be controlled and public awareness program should be conducted to manage the resources.
- There is a great need of taxonomic revision on Nepalese ferns as there is already a gap of up to date information and nomenclatural changes.

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Appendix I (List of species)

Coll no.	Date	Scientific name	Family	Location	Altitude	Latitude °N	Longitude °E	Remarks
950	2012.09.30	Huperzia hamiltonii (Spreng.) Trevis.	Lycopodiaceae	Near by Philim	c. 1500 m			Epiphytic on mossy tree trunks.
1610	2012.10.09	Lycopodium veitchii Christ	Lycopodiaceae	Above Samagaun	4000 m	29.3985°	85.6143°	Terrestrial
57/11	2012.06.05	Selaginella chrysocaulos (Hook & Grev.) Spring	Selaginellaceae	Gapsya	2200 m	28.5582°	84.77604°	Common, growing on damp and shady forest floors.
973	2012.10.01	Selaginella pallidissima Spring.	Selaginellaceae	Gapsya	2200 m	28.5582°	84.77604°	Common, growing on damp and shady forest floors.
971	2012.10.01	Selaginella vardei Lev.	Selaginellaceae	Gap	2200 m	28.5582°	84.77604°	Terrestrial, on exposed area.
35/16	2012.06.09	Equisetum arvens L.	Equisetaceae	Shyalla, way to Lho	3400 m	28.57553°	84.66673°	Terrestrial, often growing along the streams of river.
15/13	2012.06.07	Botrychium lunaria (L.) Sw.	Botrychiaceae	Near by Birendra Tal, Samagaun	3600 m	28.59524°	84.63871°	Terrestrial, growing in meadows.
58/1	2012.05.30	Botrychium multifidum (S.G. Gmel.) Rupr.	Botrychiaceae	Gapsya	2200 m	28.5582°	84.77604°	Rare, growing on forest floor.
29 /10	2012.06.02	Osmunda claytoniana L. subsp. vestita (wall. ex Milde) A. Love & D. Love	Osmundaceae	Namrung	2600 m	28.54123°	84.77660°	Growing in the forest or in open meadows.
21/19	2012.06.12	Arthromeris wallichiana (Spreng. in L.) Ching	Polypodiaceae	Below Namrung	2200 m	28.5582°	84.77604°	Uncommon, epiphytic on mossy tree trunk.
4/one	2012.05.30	Drynaria mollis Bedd.	Polypodiaceae	Gapsya	2400 m	28.5582°	84.77604°	Epiphytic, growing on tree-

								trunks.
945	2012.10.01	Drynaria propinqua (Wall ex. Mett.) J. Sm. apud Bedd.	Polypodiaceae	Near by Philim	c. 1500 m			Epiphytic, growing on tree-trunks.
1469	2012.10.07	Goniophlebium argutum (Wall. ex Hook.) J. Sm. in Hook.,	Polypodiaceae	Tallo Rupal	3200 m	28.53453°	84.76092°	Growing as epiphytic and terrestrial on shady parts of the forests.
44/15	2012.06.07	Lepisorus clathratus (C. B. Clarke) Ching,	Polypodiaceae	Near by Birendra Tal, Samagaun	3600 m	28.59524°	84.63871°	Lithophytic
1092	2012.10.04	Lepisorus loriformis (Wall. ex Mett.) Ching,	Polypodiaceae	Gap-Namrung	2400 m	28.52651°	84.75089°	Common, epiphytic on mossy tree trunks, hanging down.
1425	2012.10.06	Lepisorus mehrae Fras.-Jenk.	Polypodiaceae	Namrung	2600 m	28.54106°	84.77641°	Common, growing as epiphytic or lithophytic.
1432	2012.10.06	Lepisorus scolopendrium (Ham. ex D. Don), Mehra ex Bir,	Polypodiaceae	Namrung	2600 m	28.54106°	84.77641°	Common, growing mostly as epiphytic and sometimes lithophytic.
1313	2012.10.06	Lepisorus thunbergianus (Kaulf.) Ching	Polypodiaceae	Below Namrung	2400 m	28.5355°	84.78331°	Common, growing as epiphytic or lithophytic on mossy habitat.
953	2012.09.30	Microsorium membranaceum (D. Don) Ching,	Polypodiaceae	Near by Philim	c. 1500 m			Terrestrial or epiphytic on shady area.
1218	2012.10.04	Pichisermollia ebinepes (Hook.) Fras.-Jenk.,	Polypodiaceae	Down after Kharka, Way to Namrung	3400 m	28.52651°	84.75089°	A fern of shaded wet rock surfaces or on tree trunks.
1151	2012.10.04	Pichisermollia malacodon (Hook.) Fras.-Jenk.	Polypodiaceae	Down after Kharka, Way to Namrung	3000 m	28.53844°	84.76531°	Lithophytic on mossy rocks or epiphytic on tree trunks (<i>Sorbus</i> sp. and <i>Rhododendron</i> sp.)
1621	2012.10.09	Pichisermollia nigrovenia (Christ) Fras.-Jenk.	Polypodiaceae	Above Samagaun, Namrung	4000 m	29.3985°	85.6143°	Common fern of shaded wet rock surfaces or on tree trunks.

1421	2012.10.06	Pichisermollia subebenipes (Ching) Fras.-Jenk.	Polypodiaceae	Down after Kharka, Way to Namrung	2800 m	28.53728°	84.77090°	Common fern of shaded wet rock surfaces or on tree trunks.
1030	2012.10.01	Polypodiodes amoena (Wall. <i>ex</i> Mett.) Ching	Polypodiaceae	Below Namrung	2400 m	28.5355°	84.78331°	Common, growing as epiphytic or lithophytic.
1253	2012.10.04	Polypodiodes hendersonii (Bedd.) Fraser-Jenkins,	Polypodiaceae	Above Gumba, Namrung	2800 m	28.53728°	84.77090°	Common, growing as epiphytic or lithophytic on mossy habitat.
1318	2012.10.06	Polypodiodes microrhizoma (C. B. Clarke) Ching,	Polypodiaceae	Above Gumba, Namrung	2800 m	28.53728°	84.77090°	Occasional, growing on tree trunk or on mossy rocks.
951	2012.09.30	Pyrrosia flocculosa (D.Don) Ching	Polypodiaceae	Near by Philim	c. 1500 m			Occasional, epiphytic, growing on <i>Sapium</i> trees.
102/9	2012.06.04	Pyrrosia porosa (C. Presl) Hovenkamp	Polypodiaceae	Above Namla Gumba, Namrung	2800 m	28.53728°	84.7709°	Epiphytic on tree-trunks.
23/11	2012.06.05	Trichomanes latealatum (Bosch) Copel.	Hymenophyllaceae	Below Namrung	2400 m	28.5355°	84.78331°	Rare, growing as epiphytic.
Plate	2012.09.30	Cythea spinulosa Wall. <i>ex</i> Hook.	Cytheaceae	Near by Philim	c. 1500 m			Rare, growing near by the farm land.
962	2012.09.30	Lygodium japonicum (Thumb. in a. Murray) Sw.	Schizaceae	Near by Philim	c. 1500 m			On dry and exposed areas.
Plate	2012.09.30	Adiantum capillus-veneris L.	Adiantaceae	Near by Philim	c. 1500 m			Terrestrial, commonly growing on rock crevices.
969	2012.10.01	Adiantum edgeworthii Hook.	Adiantaceae	Near by Philim	c. 1500 m			Usually met with on sandy slopes of shady moist places.
45 /18	2012.06.10	Adiantum tibeticum Ching & Y. X. Lin	Adiantaceae	Down after Kharka, Way to Namrung	3000 m	28.53844°	84.76531°	Fairly common on forest floors.

1296	2012.10.06	Cheilanthes albomarginata C. B. Clarke	Pteridaceae	Namrung	2600 m	28.54123°	84.77660°	A common fern along walking sides.
105/18	2012.06.10	Cheilanthes grisea Blanf.	Pteridaceae	Tallo Rupal	3000 m	28.53844°	84.76531°	Common, growin on shaded rocks.
1249	2012.10.04	Cheilanthes leptolepis Fras.- Jenk	Pteridaceae	Below Namrung	2400 m	28.5355°	84.78331°	A common fern growing along walking sides.
1310	2012.10.06	Coniogramme affinis Wall. <i>ex Hieron.</i>	Pteridaceae	Below Namrung	2400 m	28.5355°	84.78331°	Terrestrial, on wet places.
38/8	2012.06.03	Coniogramme serrulata (Bl.) Fee,	Pteridaceae	Below Namrung	2600 m	28.54123°	84.77660°	Growing on moist and shaded area in the forest.
1154	2012.10.04	Cryptogramma brunoniana Wall. <i>ex Hook. & Grev.</i>	Pteridaceae	Samagaun	3600 m	28.57388°	84.66238°	A small fragile fern growing in rock crevices.
940	2012.06.03	Notholaena delavayi (Bak.) C. Chr.	Pteridaceae	Gapsya	2200 m	28.5582°	84.77604°	Terrestrial, growing on exposed area.
104/8	2012.06.03	Notholaena himalaica Fras.- Jenk.,	Pteridaceae	Below Namrung	2400 m	28.5355°	84.78331°	Terrestrial, growing on exposed area.
1582	2012.10.09	Notholaena marantae (L.) R. Br.	Pteridaceae	Above Samagaun	3800 m	29.3985°	85.6143°	Uncommon, growing on under canopy of Juniperus-Rhododendron bushes.
1094	2012.10.03	Onychium contiguum Wall. <i>ex Hope</i>	Pteridaceae	Shyo	3000 m	28.53844°	84.76531°	Very common of the forest floor and open places forming colonies.
958	2012.06.15	Onychium siliculosum (Desv.) C. Chr.	Pteridaceae	Near by Philim	c. 1500 m			Terrestrial, on dry and exposed area.
972	2012.10.01	Pteris aspericaulis Wall. <i>ex J.</i>	Pteridaceae	Near by Philim	c. 1500 m			Terrestrial, generally growing with on shady places.
974	2012.09.30	Pteris biaurita L. subsp. walkeriana Fras.-Jenk	Pteridaceae	Near by Philim	c. 1500 m			Terrestrial, growing on shady moist parts of the forest.

1009	2012.10.01	Pteris cretica L. subsp. laeta (Wall. ex Ettingsh.) Fras.- Jenk.,	Pteridaceae	Gapsya	2200 m	28.5582°	84.77604°	Terrestrial, commonly growing on shady moist or exposed dry places.
21/21	2012.06.12	Pteris dactylina Hook	Pteridaceae	Gapsya	2200 m	28.5582°	84.77604°	A rare fern growing on dry open rock crevices.
955	2012.06.15	Pteris subquinata Wall. ex J.Agardh	Pteridaceae	Near by Philim	c. 1500 m			Terrestrial, profusely occurring on shady and exposed areas of the forest floor.
954	2012.06.16	Pteris vittata L. subsp. vittata , Fraser-Jenkins	Pteridaceae	Near by Philim	c. 1500 m			Fairly common, often growing on open road-sides and on walls.
965	2012.06.16	Dennstaedtia appendiculata (Wall. ex Hook.) J. Sm,	Dennstaedtiaceae	Near by Philim	c. 1500 m			Terrestrial, found on shady and also on open places.
966	2012.06.16	Microlepia setosa (Sm.) Alston, Fraser-Jenkins	Dennstaedtiaceae	Near by Philim	c. 1500 m			Terrestrial, usually on shady, flooded area.
1408	2012.10.06	Pteridium revolutum (Bl.) Nakai	Dennstaedtiaceae	Namrung	2600 m	28.54123°	84.77660°	Terrestrial, abundantly growing on dry open areas.
968	2012.10.01	Asplenium dalhousiae Hook.	Aspleniaceae	Near by Philim	c. 1500 m			Growing under canopy of <i>Arundnaria</i> (Nigalo).
1412	2012.10.06	Asplenium ensiformis Wall. ex Hook. & Grev.	Aspleniaceae	Above Namla Gumba, Namrung	2800 m	28.53728°	84.77090°	Common fern growin epiphytic or lithophytic.
1007	2012.10.01	Asplenium laciniatum D. Don subsp. kukkonenii (Reichst.) Fraser-Jenk.	Aspleniaceae	Below Namrung	2400 m	28.5355°	84.78331°	Common, growing as epiphytic and lithophytic.
1025	2012.10.01	Asplenium laciniatum D. Don subsp. tenuicaule (Hayata) Fraser-Jenk.	Aspleniaceae	Below Namrung	2400 m	28.5355°	84.78331°	Common, growing as epiphytic and lithophytic.

967	2012.10.01	Asplenium yoshinagae Makino subsp. indicum (Sledge) Fras.-Jenk.,	Aspleniaceae	Near by Philim	c. 1500 m				Terrestrial and epiphytic on tree trunks and mossy rocks.
975	2012.10.01	Thelypteris erubescens (Wall. <i>ex</i> Hook.) Ching	Thelypteridaceae	Gap	2200 m	28.5582°	84.77604°		Common, growing along the strems.
1510	2012.10.07	Thelypteris levingei (C. B. Clarke) Ching	Thelypteridaceae	Down after Kharka, Way to Namrung	3000 m	28.53844°	84.76531°		Very common, growing on forest floor.
1149	2012.10.04	Athyrium contingens	Woodsiaceae	Rupal	3600 m	28.59524°	84.63871°		Rare, growing on forest floor.
1191	2012.10.05	Athyrium davidii (Franch.) Christ	Woodsiaceae	Above Gumba, Namrung	2800 m	28.53728°	84.77090°		Rare, growing in rock- crevices.
1189	2012.10.05	Athyrium dubium Ching	Woodsiaceae	Above Gumba, Namrung	2800 m	28.53728°	84.77090°		Common, growing on moist forest floor
1295	2012.10.06	Athyrium fimbriatum T. Moore	Woodsiaceae	Below Namrung	2400 m	28.5355°	84.78331°		Very common, growing along streams and forest floor.
1131	2012.10.04	Athyrium flabellulatum (C. B. Clarke) Tardieu,	Woodsiaceae	Rupal	3200 m	28.53453°	84.76092°		Uncommon, growing on forest floor.
1134	2012.10.04	Athyrium repens (Ching) Fras.-Jenk	Woodsiaceae	Rupal	3200 m	28.53453°	84.76092°		Common, growing on forest floor.
1549	2012.10.08	Athyrium rupicola (Edgew. <i>ex</i> C. Hope) C. Chr	Woodsiaceae	Below Namrung	2400 m	28.5355°	84.78331°		Fairly common along road sides and in rock-crevices.
1493	2012.10.07	Athyrium schimperi subsp. biserrulatum (Christ) Fras- Jenk	Woodsiaceae	Rupal	3200 m	28.53453°	84.76092°		Common on shady places.
1127	2012.10.04	Athyrium setiferum C. Chr	Woodsiaceae	Down after Kharka, Way to Namrung	3000 m	28.53844°	84.76531°		Rare species growing in shady places.

1136	2012.10.04	Athyrium spinulosum (Maxim.) Milde,	Woodsiaceae	Above Gumba, Namrung	2800 m	28.53728°	84.77090°	Common, growing on shaded forest floor.
1216	2012.10.05	Cystopteris moupinensis Franch.	Woodsiaceae	Above Gumba, Namrung	2800 m	28.53728°	84.77090°	Fairly common on shaded and moist forest floor.
1245	2012.10.05	Deparia allantodioides (Bedd.) M. Kato	Woodsiaceae	Above Gumba, Namrung	2800 m	28.53728°	84.77090°	A common fern growing on shaded floor in forests.
959	2012.09.30	Deparia boryana (Wild.) M. Kato	Woodsiaceae	Near by Philim	c. 1500 m			Fairly common along streams.
Plate	2012.09.30	Diplazium esculantum (Retz.) Sw.	Woodsiaceae	Near by Philim	c. 1500 m			Common, growing along streams.
960	2012.09.30	Diplazium maximum (D. Don) C. Chr.	Woodsiaceae	Near by Philim	c. 1500 m			Terrestrial, growing on shady streams.
1534	2012.10.07	Gymnocarpium fedtschenkoanum Pojark.	Woodsiaceae	Below Namrung	2400 m	28.5355°	84.78331°	Terrestrial, growing on shaded forests.
980	2012.10.01	Hypodematium crenatum (Forssk.) Kuhn	Woodsiaceae	Gapsya	2200 m	28.5582°	84.77604°	Uncommon, growing on exposed area.
1045	2012.10.02	Cyrtomium anomophyllum (Zenker) Frez.-Jenk	Dryopteridaceae	Gapsya	2200 m	28.5582°	84.77604°	Growing in very moist, well-shaded places in forest.
1039	2012.10.02	Dryopsis apiciflora (Wall. ex Mett.) Holttum & P. J. Edwards	Dryopteridaceae	Rupal	3800 m	28.52603°	84.76371°	Uncommon, growing on forest floor and on meadows.
1596	2012.10.09	Dryopteris acutodenta Ching,	Dryopteridaceae	Rupal	3800 m	28.52603°	84.76371°	Common, usually growing among rock crevices.
1135	2012.10.04	Dryopteris barbiger a (T. Moore ex Hook.) Kuntze	Dryopteridaceae	Tallo Rupal	3200 m	28.53453°	84.76092°	Fairly common, terrestrial, growing on meadows.

1407	2012.10.05	Dryopteris chrysocoma (Christ) Christ	Dryopteridaceae	Rupal	3600 m	28.59524°	84.63871°	Common, usually growing on rock crevices or steep slopes along streams.
963	2012.09.30	Dryopteris cochleata (Ham. <i>ex</i> D. Don) C. Chr.	Dryopteridaceae	Near by Philim	c. 1500 m			Common, usually growing on rock crevices or steep slopes along streams.
1409	2012.10.05	Dryoptersi fructuosa (Christ) C. Chr.	Dryopteridaceae	Above Gumba, Namrung	2800 m	28.53728°	84.77090°	Common, growing on shaded forest floor.
Ad-21	2012.06.12	Dryopteris juxtaposita Christ	Dryopteridaceae	Below Namrung	2400 m	28.5355°	84.78331°	Common, growing on forest floor and walking sides.
1548	2012.10.08	Dryopteris komarovii Kossinsky	Dryopteridaceae	Below Namrung	2400 m	28.5355°	84.78331°	Uncommon, growing on forest floor and on meadows.
1027	2012.10.01	Dryopteris basisora Christ	Dryopteridaceae	Gapsya	2200m	28.5582°	84.77604°	Rare, growing on forest floor.
1286	2012.10.05	Dryopteris redactopinnata S. K. Basu & Panigrahi	Dryopteridaceae	Below Namrung	2400m	28.5355°	84.78331°	A common basket fern of the forest floor.
1285	2012.10.06	Dryopteris sublacara Christ	Dryopteridaceae	Below Namrung	2400 m	28.5355°	84.78331°	Very common, growing on forest floor and also on exposed area.
1217	2012.10.05	Dryopteris xanthomelas (Christ) C. Chr.	Dryopteridaceae	Tallo Rupal	3400 m	28.53089°	84.75796°	Common on shaded and moist forest floor.
1319	2012.10.06	Dryopteris zayuensis Ching & S. K. Wu	Dryopteridaceae	Below Namrung	2400 m	28.5355°	84.78331°	Common, growing on shaded forest floor.
1093	2012.10.03	Polystichum mehrae Fras.- Jenk. & Khullar	Dryopteridaceae	Tallo Rupal	3400 m	28.53089°	84.75796°	A rock dwelling fern, dark green fronds curved sideways.

1026	2012.10.01	Polystichum piceo-paleaceum Tagawa	Dryopteridaceae	Above Gumba, Namrung	2800 m	28.53728°	84.77090°	Growing on forest-floor in luxuriant and moist area.
1133	2012.10.04	Polystichum prescottianum (Wall. ex Mett.) T. Moore	Dryopteridaceae	Tallo Rupal	3200 m	28.53453°	84.76092°	Growing in open places, near by tree line amongst rocks.
1208	2012.10.05	Polystichum stenophyllum Christ	Dryopteridaceae	Above Gumba, Namrung	2800 m	28.53728°	84.77090°	Rare, under shaded canopy.
20/11	2012.06.05	Polystichum stimulans (Kunze ex Mett.) Bedd.	Dryopteridaceae	Namrung	2600 m	28.5355°	84.78331°	Rare, growing on shaded moist rock-crevices.
1314	2012.10.06	Polystichum thomsonii (Hook. f.) Bedd.	Dryopteridaceae	Below Namrung	2400 m	28.5355°	84.78331°	Small, delicate growing on crevices in shaded damp rocks.
961	2012.09.30	Tectaria coadunata (Wall. ex J. Sm.) C. Chr.	Dryopteridaceae	Near by Philim	c. 1500 m			Terrestrial, occurring on shady as well as exposed area.
12-Aug	2012.10.07	Oleandra wallichii (Hook.) C. Presl,	Oleandraceae	Namrung	2600 m	28.54123°	84.77660°	Occasional, growing on tree trunks (<i>Pyris</i> sp.) and mossy rocks of shady places.
952	2012.09.30	Nephrolepis cordifolia (L.) C. Presl	Nephrolepidaceae	Near by Philim	c. 1500 m			Terrestrial, growing on rock crevices or tree trunks on exposed area.
1215	2012.10.05	Araiostegia beddomei (C. Hope) Ching.	Davalliaceae	Above Gumba, Namrung	2800 m	28.53728°	84.77090°	Common, epiphytic on tree trunks.
1419	2012.10.05	Araiostegia pulchra (D. Don) Copel	Davalliaceae	Namrung	2600 m	28.54123°	84.77660°	Common, growing on tree trunks.
113	2012.06.11	Araiostegiella hookeri (T. Moore ex Bedd.) Fraser-Jenk.	Davalliaceae	Above Gumba, Namrung	2800 m	28.55962°	84.74779°	Uncommon, epiphytic on mossy tree trunks.

970	2012.10.01	Woodwardia biserrata C. Presl	Blechnaceae	Gap	2200 m	28.5582°	84.77604°	Terrestrial, growing in the beds of hilly ravines, on damp cliffs next to water flows
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Appendix II (Forest and habitat wise distribution of species)

Species	Forest type										Habitat type
	Crop land	Picea-Laurales	Larix	Quercus	Quercus-Ilex	Pinus	Rhodo-Acer	Rhodo-Juniper.	Betula-Rhodo.	Meadow	TEL*
<i>Adiantum capillus-veneris</i>	+										T L
<i>Adiantum edgeworthii</i>	+										T
<i>Adiantum tibeticum</i>					+	+					T
<i>Araiostegia beddomei</i>			+	+	+	+				+	E
<i>Araiostegia pulchra</i>			+	+		+	+	+			E
<i>Araiostegiella hookeri</i>				+							E
<i>Arthromeris wallichiana</i>		+									L
<i>Asplenium dalhousiae</i>	+										T
<i>Asplenium ensiformis</i>					+	+	+	+			E
<i>Asplenium laciniatum</i> subsp. <i>kukkonenii</i>		+	+	+	+	+					EL
<i>Asplenium laciniatum</i> subsp. <i>tenuicaule</i>		+	+	+	+	+					EL
<i>Asplenium yoshinaga</i> subsp. <i>indicum</i>	+										EL
<i>Athyrium contingens</i>											T
<i>Athyrium davidii</i>					+						L
<i>Athyrium dubium</i>					+						T
<i>Athyrium fimbriatum</i>			+				+	+			T
<i>Athyrium flabellulatum</i>							+				T

<i>Drynaria mollis</i>			+	+	+						E
<i>Drynaria propinqua</i>	+										E
<i>Dryopsis apiciflora</i>									+		T
<i>Dryopteris acutodentata</i>							+		+	+	L
<i>Dryopteris barbigera</i>							+				T
<i>Dryopteris chrysocoma</i>								+			T
<i>Dryopteris cochleata</i>	+										L
<i>Dryopteris frutuosa</i>					+			+			L
<i>Dryopteris juxtaposita</i>			+								T
<i>Dryopteris komarovii</i>			+								T
<i>Dryopteris pseudovaria</i>							+				T
<i>Dryopteris redactopinnata</i>			+					+			T
<i>Dryopteris sublacara</i>			+	+		+		+			T
<i>Dryopteris xanthomelas</i>					+				+		T
<i>Dryopteris zayuensis</i>			+								T
<i>Equisetum arvens</i>								+			T
<i>Goniophlebium argutum</i>			+								EL
<i>Gymnocarpium fedtschenkoanum</i>			+			+	+				T
<i>Huperzia hamiltonii</i>	+										E
<i>Hypodematium crenatum</i> subsp. <i>Crenatum</i>		+									T
<i>Lepisorus clathratus</i>								+			L

<i>Lepisorus loriformis</i>			+	+	+	+	+	+			E
<i>Lepisorus mehrae</i>			+				+		+	+	EL
<i>Lepisorus scolopendrium</i>								+			EL
<i>Lepisorus thunbergianus</i>			+	+							EL
<i>Lycopodium veitchii</i>									+		T
<i>Lygodium japonicum</i>	+										T
<i>Microlepia setosa</i>	+										T
<i>Microsorium membranaceum</i>	+										EL
<i>Nephrolepis cordifolia</i>	+										TLE
<i>Notholaena delavayi</i>		+	+								T
<i>Notholaena himalaica</i>		+	+	+	+	+	+	+			T
<i>Notholaena marantae</i>								+	+		T
<i>Oleandra wallichii</i>				+							EL
<i>Onychium contiguum</i>		+	+	+	+	+	+	+			T
<i>Onychium siliculosum</i>	+										T
<i>Osmunda claytoniana</i>				+	+	+	+	+			T
<i>Pichisermollia ebenipes</i>					+		+				EL
<i>Pichisermollia malacodon</i>					+	+	+				EL
<i>Pichisermollia nigrovenia</i>					+						EL
<i>Pichisermollia subebenipes</i>					+			+			EL
<i>Polypodiodes amoena</i>			+					+	+		EL

Appendix III (Distribution of species along altitudinal gradient)

<i>Thelypteris erubescens</i>		+									T
<i>Thelypteris levingei</i>				+		+		+			T
<i>Trichomanes latealatum</i>				+							E
<i>Woodwardia biserrata</i>		+									T

*T = Terrestrial; E = Epiphytic; L = Lithophytic

Species	c. 1500 m	2200 m	2400 m	2600 m	2800 m	3000 m	3200 m	3400 m	3600 m	3800 m	4000 m	Pre. National range
<i>Adiantum capillus-veneris</i>	+											100-2300 m
<i>Adiantum edgeworthii</i>	+											1500-3000 m
<i>Adiantum tibeticum</i>					+	+						2100-3000 m
<i>Araiostegia beddomei</i>			+	+	+	+					+	2100-3500 m
<i>Araiostegia pulchra</i>			+	+		+	+		+			800-2700 m
<i>Araiostegiella hookeri</i>					+							
<i>Arthromeris wallichiana</i>		+										2100-3300 m
<i>Asplenium dalhousiae</i>	+											500-2200 m
<i>Asplenium ensiformis</i>					+	+	+	+	+			1250-3050 m
<i>Asplenium laciniatum</i> subsp. <i>kukkonenii</i>		+	+	+	+	+						c. 2450 m
<i>Asplenium laciniatum</i> subsp. <i>tenuicaule</i>		+	+	+	+	+						2250-2750 m
<i>Asplenium yoshinaga</i> subsp. <i>indicum</i>	+											1000-2500 m
<i>Athyrium contingens</i>									+			
<i>Athyrium davidii</i>					+							3400-4300 m
<i>Athyrium dubium</i>					+							2400-3500 m
<i>Athyrium fimbriatum</i>			+				+		+			1800-2600 m
<i>Athyrium flabellulatum</i>							+					c. 3500 m
<i>Athyrium repens</i>							+					3000-4000 m
<i>Athyrium rupicola</i>			+									2000-3000 m
<i>Athyrium schimperi</i>			+				+		+			1800-3500 m
<i>Athyrium setiferum</i>						+						1400-3550 m
<i>Athyrium spinulosum</i>			+		+		+					3200-3700 m

<i>Botrychium lunaria</i>								+	+			2450-3650 m
<i>Botrychium multifidum</i>		+										1350-3000 m
<i>Cheilanthes albomarginata</i>				+								1500-2800 m
<i>Cheilanthes grisea</i>						+						c. 3200 m
<i>Cheilanthes leptolepis</i>			+		+							2500-3000 m
<i>Coniogramme serrulata</i>						+						1700-3650 m
<i>Coniogramme affinis</i>			+	+								1700-3000 m
<i>Cryptogramma brunoniana</i>						+			+			
<i>Cyrtomium anomophyllum</i>		+										2000-2400 m
<i>Cystopteris moupinensis</i>					+							3100-4800 m
<i>Cythea spinulosa</i>	+											500-2000 m
<i>Dennstaedtia appendiculata</i>	+											1500-3300 m
<i>Deparia allontodioides</i>					+							1900-4000 m
<i>Deparia boryana</i>	+											500-3200 m
<i>Diplazium esculentum</i>	+											60-1700 m
<i>Diplazium maximum</i>	+											700-1500 m
<i>Drynaria mollis</i>			+	+	+							2500-3000 m
<i>Drynaria propinqua</i>	+											700-2500 m
<i>Dryopsis apiciflora</i>										+		1800-3550 m
<i>Dryopteris acutodentata</i>						+				+	+	3700-4200 m
<i>Dryopteris barbiger</i>						+						3000-4250 m
<i>Dryopteris chrysocoma</i>									+			1900-3500 m
<i>Dryopteris cochleata</i>	+											500-1800 m
<i>Dryopteris fructuosa</i>					+				+			1850-3600 m

