FERNS AND FERN ALLIES OF PALPA DISTRICT, CENTRAL NEPAL

A DESSERTATION SUBMITTED FOR THE PARTIAL FULFILMENT OF MASTER'S DEGREE IN BOTANY

Submitted by

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DECLARATION

I, **Sabita Neupane**, student of M.Sc. Botany hereby declare that the research work entitled " FERNS AND FERN ALLIES OF PALPA DISTRICT, CENTRAL NEPAL" submitted by me at Institute of Science and Technology, Tribhuvan University" for the partial fulfilment of master's degree in Botany is a record of legitimate work carried out by me under supervision of **Prof. Dr. Sangeeta Rajbhandary**.

I further declare that the work reported in this research work has not been or will be submitted to any other partial or in full for the award of any degree in this or any other institute or university.

Sabita Neupane

June, 2023

TRIBHUVAN UNIVERSITY
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Kirtipur, Kathmandu
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RECOMMENDATION

This is to certify that M.Sc. Dissertation work entitled "**FERNS AND FERN ALLIES OF PALPA DISTRICT, CENTRAL NEPAL**" has been carried out by **Ms. Sabita Neupane** under my supervision. This work has been accomplished on the basis of the candidate's original research work based on self collection. This work has not been submitted for any other academic degree. I recommend this dissertation work to be accepted as a partial fulfilment for Master's Degree in Botany at Institute of Science and Technology, Tribhuwan University.

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LETTER OF APPROVAL

The M.Sc. Dissertation entitled **"FERNS AND FERN ALLIES OF PALPA DISTRICT, CENTRAL NEPAL"** submitted by **Ms. Sabita Neupane** has been accepted for the partial fulfilment of Master's Degree in Botany (Plant Systematics and Biodiversity Conservation Unit).

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Sabita Neupane

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ABSTRACT

Flora includes both flowering and non-flowering vascular plant life, including Pteridophytic flora. Pteridophytes (Ferns and fern allies) are spore bearing non-seeded vascular plants having well-developed root, stem and leaves. They are the most primitive first vascular plant that appeared on the Earth in the mid-Paleozoic era, during the Silurian period which began 438 million years ago. At present day, globally there are 13,300 species of ferns and fern allies are recorded. Similarly, in Nepal altogether 583 taxa (550 spp. and 33 subsp.) are recorded with 99 genera and 32 families. Pteridophytic flora in Nepal are cosmopolitan in distribution, from East to West including Central and from lowland Terai to highland Himalayas. They are habitat specialists can thrive in cool, moist, humid and shaddy places of tropical, sub-tropical, temperate and alpine forests. They are also considered as economically important as well as ethnobotanically important for their food value, ornamental, medicine and many other purposes.

The present study aimed for documenting floristic information of ferns and fern allies of Palpa district, Central Nepal. Altogether, 86 species of fern and fern allies belonging to 43 genera and 20 families are recorded. Among 20 families, Pteridaceae was the largest family with 9 genera and 19 species. Among 43 genera, *Thelypteris* was the largest genera having 10 species. On the basis of habitat, 63 species were terrestrial, 16 species were epiphytic and 7 species were lithophytic. Among them, maximum species found growing in terrestrial habitat. Similarly, on the basis of forest types, *Schima-Castanopsis* forest has the maximum number of species i.e. 34 which is due to the proper canopy and moisture content in this forest low number of species in *Pinus roxburghii* forest. In addition, for ethnobotanical use 21 species were recorded, having highest use for medicinal purposes. From the study, two species *Athyrium falcatum* and *Antrophyum reticulatum* were determined as the Nepalese threatened status. Thus, frequent floristic survey is crucial for the new documentation and to know the conservation status of ferns and fern allies.

ACRONYMS AND ABBREVIATIONS

C	Central Nepal
ca.	Circa (about)
comn. nov	*combination novum*
cm	Centimeter
DPR	Department of Plant Resource
E	Eastern Nepal
ex	Validly published
et al.	and others
Fl.	Flora
gen. nov.	*genus novum*
GIS	Geographic Information System
IUCN	International Union for Conservation of Nature
m	Meter
no.	number
N	North
NTFPs	Non-Timber Forest Products
sp.	Species (singular)
spp.	Species (plural)
S	South
TU	Tribhuvan University
TUCH	Tribhuvan University Central Herbarium
viz.	namely
var.	Varieties
VU	Vulnerable
W	Western Nepal

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CHAPTER 1: INTRODUCTION

1.1 Background

Floristic survey is referred as documentation of all plant species in a specific geographic area (Simpson, 2006). This type of survey aids in the enumeration of plants, revision of species names, addition of herbarium specimens to existing herbaria, comparison of closely and distantly related plants as well as helps to know the conservation status and provide effective management strategies for given species. In the same way, floristic composition or species composition is termed as the total number of species found in a given area with a particular geographical makeup. It gives the clear picture of floristic content of that region. For this, it is important to conduct floristic surveys.

The term "flora" refers to all plant-life that exists in a specific geographic area, with taxonomic treatment, that creates through account. A complete description of the families, genera and species together with identification keys and images is included in the flora of a nation or a particular geographic region (Siwakoti and Rajbhandary, 2015). Flora includes both flowering and non-flowering vascular plant life, including Pteridophytic flora.

Pteridophytes (fern and fern allies) are spore bearing non-seeded vascular plants having developed root, stem and leaves (Kumar, 2014). They are the connecting link, between the non-vascular plants and higher group of seeded plants. Dominant sporophyte reduced gametophytes, jacketed sex organs, requirement of water during fertilization, alternation of generation; generally characterize them (Pandey *et al*. 1977). Due to the presence of a well-developed vascular system: xylem for water and phloem for food transport, they are referred as 'Vascular Cryptogams.' This interesting group of plants continue to occupy numerous niches on the land, marshes, swamps, trees trunks and even in water bodies. Ferns and its allies generally constitute the substantial biomass of many tropical and subtropical forests of the world (Yusuf, 2010). They can thrive well in cool, moist, humid and shady places of tropical and temperate forests of different geographical regions around the world.

Pteridophytes are the primitive vascular land plants that appeared on the Earth, in the mid-Paleozoic era during the Silurian period, which began 438 million years ago. A very rapid rate of evolution was stimulated, after establishing themselves as land plants with which they dominated most of the forests on earth's surface by the approach of Carboniferous period. With the evolution and beginning of dominance of flowering plants, in the late Cretaceous period,

the decline of pteridophytes began (Dudani *et al.* 2011). They originated from the old world tropics and have colonized other regions of the world (Mehltreter *et al*. 2010). At present, 13,300 species of pteridophytes are documented (Borsch *et al*. 2020; Hassler, 2020). In the same way, in Nepal 583 taxa (550 species and 33 subspecies) of pteridopytes belonging to 99 genera and 32 families are recorded (Fraser-Jenkins *et al.* 2015, Fraser-Jenkins and Kandel 2019, Kandel and Fraser-Jenkins, 2020). Linnaeus (1753) started the history of Pteridophytes from the publication of "Species Plantarum" having 140 genera with 182 species of Pteridophytes. The pioneer plant exploration and taxonomic study of Nepalese Pteridophytes along with other group of plants started since the work of British botanists. After that, many exploratory work has been done and being done till date by many foreigners and Nepalese botanists in the field of documentation.

In Nepal, Pteridophytes are distributed from low altitude (50m) towards high Himalayan (5000m) (Kandel, 2020). Pteridophytes are known to be an essential part of the biodiversity, which includes the vegetation of various forest types within different habitats and ecosystems along different elevation. The pteridophytic flora are highly distributed in different forest types from tropical to sub-alpine zone including *Bombax* and *Schima-Castanopsis* forest at lower altitude, Oak-Laurels-Rhododendron forest at mid and *Acer-Juglans*, Shrubland, Sub-alpine forest at higher altitude (Shrestha and Rajbhandary, 2019). They prefer to grow on different habitats depending on moisture, humidity, soil types, temperatures, light intensity, pH, etc. and often regarded as specific indicators for the conditions they require (Shaikh and Dongare, 2009).

Pteridophytes are referred as habitat specialists. They form an attractive component of forests showing different ecological habitat types as epiphytic, lithophytes, hydrophytes, terrestrial and climbers (Hogan, 2004). They are found commonly in ponds, lakes, perennial streams as hydrophytes, on rock crevices and rocky wall with moss as lithophytes, on open or shaded floors or in edges and slopes of forests as terrestrial and on mossy tree trunks and branches as epiphytes (Dixit, 2000). They are also considered economically important for their food value, ornamental decorative value as well as for medicinal value (Upadhya and Bastakoti, 2019). In addition, pteridophytes has been used as folklore medicine in different systems like Unani, Ayurvedic, Homeopathic, etc. (Perumal, 2010). In Nepal, many ethnic communities of rural areas depend on traditional medicine, food, fuel and other requirements from forest plants including Pteridophytes. Many pteridophyte species were used by ethnic groups for food, fodder, manure, ornamental, medicinal and many purposes (Manandhar, 1996). Thus,

ethnobotanical study is important to know the ethnomedicinal value, food value and other essential uses.

These essential and valuable florae are very easily vulnerable to various abiotic and biotic influences. Even the conservation of pteridophytes has received comparably less attention than the other plant groups including in the IUCN Red List for the first time in 2003 (PPG I, 2016). Thus, frequent floristic survey is necessary for the conservation of pteridophytic flora of Nepal.

1.2 Justification of study

The vegetation of Nepal consists of diverse and rich floristic composition of fern and fern allies but most of the exploration has been done in flowering plants. As pteridophytes were the dominating vegetation in the past history, they are in degrading condition at present context. They are not given priority for the conservation and enumeration. Palpa district has diversified vegetation including fern flora with remarkable altitudinal range and rainfall pattern, availability of suitable habitat, supports high species diversity of fern and fern allies. Similarly, the diversity and comprehensive study on ferns and fern allies in the Palpa district is not conducted till date, so the study can get new species record for this area. In addition, people in many localities from this area may be unaware about the importance of ferns and fern allies and the conservation of such flora. So, the study can reflect the richness pattern, species composition and distribution of Pteridophytes of the study area as well as conservation status of the collected species of that area which is very helpful for making conservation strategies and address the deficiency of flora and representative herbarium specimens to the national herbaria.

1.3 Research Questions

- How does the distribution pattern of species varies with habitat and forest types?
- What are the ethnobotanical uses of fern and fern allies?

1.4 Research Objectives

The specific objective of the study is to document each and every species of ferns and fern allies of Palpa district.

The general objectives of this study are given below:

- To prepare the taxonomic account of ferns and fern allies with keys and description.

- To deduce the distribution pattern of ferns and fern allies with respect to habitat and forest type.
- To elicit the ethnobotanical knowledge of ferns and fern allies of collected species.

1.5 Limitations

The study could not cover the entire forest area because of the time constraint and complex landscape. Due to the pandemic situation, pre-monsoon season was missed and have to wait for the next season for the collection of pteridophytes. Similarly, during collection time, some pteridophytes, which have no spore formation, could not add in the herbarium. The other limitation of the study is the landslides in the study area due to heavy rainfall. Due to landslide, the main inner forest could not enter as the way was blocked for the collection. Lastly, as few research work on pteridophytic flora have been carried out, due to which lack of specimens deposited in herbaria in unmanaged way, and not enough varied regarding literatures it became difficult in identifying.

CHAPTER 2: LITERATURE REVIEW

2.1 Floristic Survey

In the past history, Linnaeus (1753) was the beginner in the documentation of Pteridophytes after the publication of " *Species Plantarum*" who recorded 140 genera with 182 species. The pioneer exploration on Nepalese Pteridophytes along with other group of plants, their collection, publication and taxonomic work has started since the work of British botanists. The study on the history of pteridophytes provided here is based on the Bista *et al. (*2002), Fraser-Jenkins *et al. (*2015), Rajbhandary (2016) and other related literatures.

Pteridophytes of Nepal have been collected at first by the famous botanist Franchis Buchanan (later Franchis Hamilton) during his visit to Kathmandu in 1802-1803. He collected around 50 ferns in the route from Raxaul to Kathmandu. Later in 1819, he published a book entitled "*An account of Kingdom of Nepal*" containing 34 species collected by him. Likewise, the second botanist to study the Nepalese ferns was Dr. Nathaniel Wallich who collected many species of pteridophytes in 1820-1821 from various places like Birgunj, Hetauda, Bhimphedi, Pharping, etc. (Bista *et al*. 2002). The collection of Hamilton and Wallich were later worked by D. Don who published "*Prodromus florae of Nepalensis*" in 1825 consisting of 86 species of pteridophytes from Nepal (Don, 1825).

Similarly, some European botanists also has contributed for the Nepalese ferns. Sir Joseph Dalton Hooker, the first European to visit East Nepal and collected some ferns in 1848-1852.The other European, Thomas Moore has also given a big contribution in study of Nepalese fern by publishing *Index Filicum* (1857-1862) and *A Priced Catalogue of Hardy Exotic and British Ferns* by Robert Sim (1859) also contained a large number of Nepalese ferns. Likewise, Hooker published *Icons Plantarum* (1837-1854), *Species Filicum* (1844-1864), *Filices Exoticae* (1857-1859), *A second Century of Ferns* (1861) which contains many Nepalese ferns.

Beddome (1883) published Handbook to the ferns of 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 Northern Western India".

During 1950s, Nepal was opened to botanists from abroad, due to which a new era of research in Nepalese ferns began. Many Japanese botanists have visited and have collected Nepalese ferns. Prof. Horoshi Har, made several botanical excursion in Nepal and collected more than 1000 plant including fern species from 1960-1985. Many species of ferns have been described by Nakaike (1982, 1986, 1987) in *Enumeration of the ferns of Nepal*. Tawaga (1995) described 34 species of ferns and fern allies of Nepal Himalaya belongingto 11families. Likewise, Iwatsuki (1988) published Enumeration of Nepalese Pteridophytes, which consisted 383 species of ferns and fern allies.

Simillarly, Christopher Roy Fraser-Jenkins one of the famous Pteridologist, has made many botanical expeditions throughout Nepal since 1980 and collected approximately 400 pteridophytic species from Nepal. Some publications published by him are New species syndrome in Indian Pteridology and the Ferns of Nepal (1997), Taxonomic Revision of Three Hundred Indian subcontinental Pteridophytes with a Revised Census-List (2008), Ferns and Fern allies of Nepal Vol. 1, 2 & 3 (2015, 2019 & 2020).

Many other British and Indian botanists have made expeditions to Nepal. Hara (1966, 1971) and Ohasi (1975) has made eight important expeditions to Eastern Himalaya, which resulted in the compilation of many plants including pteridophytes. Likewise, Banerji (1972) listed 84 species of pteridophytes from East Nepal based on collection made by himself along with the members of KATH in between 1948 and 1967, out of which 20 species were new to Nepal.

Similarly, Pandey (1962) has collected 65 species of pteridophytes from Kathmandu Valley in 1948-1949. Chowdhury (1973) reported 15 species of ferns from Nepal. In addition, Das (1973) has reported 23 species of ferns and mentioned the presence of fern allies in Daman, Makwanpur district, Central Nepal. Vartak (1975) has published 48 species of ferns from Annapurna and Dhaulagiri ranges of Central Nepal. Dixit & Vohra (1984) reported availability 129 speciesof Nepalese ferns in *Census of Indian Pteridophytes.*

Since the Department of Plant Resources (DPR) was established in 1960, numerous botanists in Nepal have begun the mission of collecting and conserving Pteridophytes. Some of the important ones that include Pteridophyte flora. *Flora of Fulchowki and Godavari* (Malla *et al.* 1974) includes 80 species of ferns and fern allies belonging to 40 genera and 14 families. *Royal Botanical Gardens Godawari* (Malla, 1975) incorporates 60 species of living ornamental ferns

of 37 genera and 14 families. *Flora of Langtang and Cross Section Vegetation Survey, Central Zone* (Malla *et al.* 1976) included 75 species of ferns and fern allies of 40 genera and 13 families. *Catalogues of Nepalese Vascular Plants* (Malla *et al.* 1976) includes 308 species of pteridophytes belonging to 82 genera and 19 families. *Flora of Kathmandu Valley* (Malla *et al.* 1986) have described 172 species belonging to 57 genera and 17 families. *Keys to the Pteridophytes, Gymnosperm and Monocotyledonous Generas of Nepal* (Malla *et al.* 1981) includes a list of 84 genera and 21 families of pteridophytes. Most recently *Ferns and Fern Allies of Nepal* Vol. 1 (Fraser-Jenkins *et al.* 2015), Vol. 2 (Fraser-Jenkins and Kandel, 2019) and Vol. 3 (Kandel & Fraser-Jenkins, 2020) are published which has described 580 taxa of pteridophytes recorded in Nepal.

Sakya (1965, 1968) published cytotaxonomical works on the ferns of Kathmandu Valley including 42 species. Gurung (1984) reported distribution of Pteridophytic flora in Nepal Himalaya, a checklist of Nepalese Pteridophytes containing 582 species and various articles. Nakaike and Gurung (1988) reported 80 species of pteridophytes from Kathamandu with place of collection, habitat and distribution maps. Bhattarai (1997) has published Fern and Fern Allies of Pokhara Valley, which covers nearly 50% of the known taxa of the area belonging to 10 families.

Likewise, Siwakoti and Sharma (1998) reported 95 species of ferns belonging to 50 genera and 32 families of Eastern Nepal (Koshi zone). Baral (2000) has described 128 species of pteridophytes belonging to 62 genera and 27 families in Pteridophytes of Arun River Basin of Makalu-Barun National Park and Buffer Zone, Eastern Nepal. Jha (2000) reported 61species of Pteridophytes belonging to 44 ggenera and 23 families from Morang district. Again, Thapa (2000) reported 79 species of ferns from Milke-Jaljale area of eastern Nepal. Bhagat and Shrestha (2010) reported 35species of pteridophytes from Eastern Terai. Phuyal *et al.* (2011) has recorded 100 species of Pteridophytes from Makwanpur district. Pathak *et al.* (2012) described 133 species of Pteridophytes belonging to 59 genera and 26 families from Sankhuwasabha district.

Similarly, Bhattarai (2013) has described 105 species of Pteridophytes belonging to 45 genera and 20 families from Manaslu Conservation Area. Likewise, Prajapati (2013) reported 85 species of Pteridophytes from Daman and their adjoin areas in Makwanpur district. Again, Kandel and Pathak (2013) collected 25 species of Pteridophytes belonging to 12 genera and 8 families from subtropical broad leaved forests of Pyuthan district. Adhikari *et al.* (2017)

reported 41 species of vascular epiphytes, including 33 orchids and 8 fern species from Kathamandu.

Most recently, Thakur & Rajbhandary (2018) has recorded 94 species of Pteridophytes belonging to 50 genera and 22 families from Panchase Protected Forest, Central Nepal. Similarly, Shrestha and Rajbhandary (2019) has described about 99 species of Pteridophytes belonging to 48 genera and 20 families from Besishar to lower Manang, Central Nepal. Likewise, Upadhya & Bastakoti (2019) recorded 27 species of Pteridophytes belonging to 19 genera and 11 families from Bhimkalipatan, Pokhara. Then, Nepali *et al.* (2020) reported 75 species of Pteridophytes belonging to 36 genera and 18 families from Arghakhanchi district, West Nepal. At last, Ojha & Niroula (2021) has recorded 50 species of ferns and fern allies belonging to 19 families and 32 genera from Raja-Rani Wetland and adjoining forest , Eastern Nepal.

2.2 Ethnobotanical Study

Pteridophytes are well known for more than 2000 years for their medicinal value, (Parihar and Parihar, 2006). The Greek botanist Theophrastus had referred the ethnomedicinal use of ferns in one of his books *'Enquiry into Plants* and *On the Causes of Plants'* around 327-287 B.C. Dioscorides (50 A.D.) included a number of ferns as *Pteridium aquilinum* and male fern *Dryopteris filixas* having medicinal value in his book "*De Materia Medica*". In ancient Ayurvedic medicines, many pteridophytes were in use Shushruta Samhita and Charaka Samhita (Chandra, 2000).

In Nepal, very few botanists have mentioned and documented the ethnobotanical study of Pteridophytes. Rijal (1994) described 10 species of pteridophytes used by Tharus of Pdampur. Chaudhary *et al.* (1995) reported 5 species of pteridophytes from Parsa Wildlife Reserve Nepal. Similarly, Manandhar (1996) listed 72 species of ferns with their local names, ethnobotanical use, habitat and distribution. Again, Nepal (1999) reported the use of 7 species of pteridophytes from the Makalu-BarunConservation Area and Sapkota (2000) reported 5 species of pteridophytes of ethnobotanical use in Mallika forest of Baglung district, West Nepal. In the same way, Shrestha and Shrestha (2005) has recorded 35 species of pteridophytes belonging to 7 families as ethnobotanical use in Langtang National Park. In recent, Thakur & Rajbhandary (2018) recorded 51 species of pteridophytes for ethnobotanical uses from Panchase forest and Bista (2021) recorded 10 species of pteridophytes as ethnobotanical uses East Rukum.

CHAPTER 3: MATERIALS AND METHOD

3.1 Study Area

3.1.1 Location

The study was carried out in Palpa district, which is located in Lumbini Province in the center of Nepal. Palpa is the hilly region; it has remarkable altitudinal range from 152m to 1936m from sea level (DFO, 2019). It extends from 27º34'N to 27º57'N latitude and 83º15'E to 84º22'E longitude. Similary, it covers an area of 1463.3 sq. km (1,46,330 ha.) (DFRS, 2017). Palpa is bounded by the districts of Nawalparasi and Tanahu in the East, Arghakhanchi and Gulmi in the West, Gulmi, Syangja and Tanahu in the North and Nawalparasi and Rupandehi district in the South. The study has been carried out on six local bodies (5 Rural Municipality and 1 Municipality) (Fig. 1). The study was started from the lower elevation i.e from Dobhan which lies at an elevation of 300m towards the higher elevation i.e. Chhahara which lies at an elevation of around 1800m. Thus, the research work on fern and fern allies was studied within the given elevational range with varied forest types and habitat types.

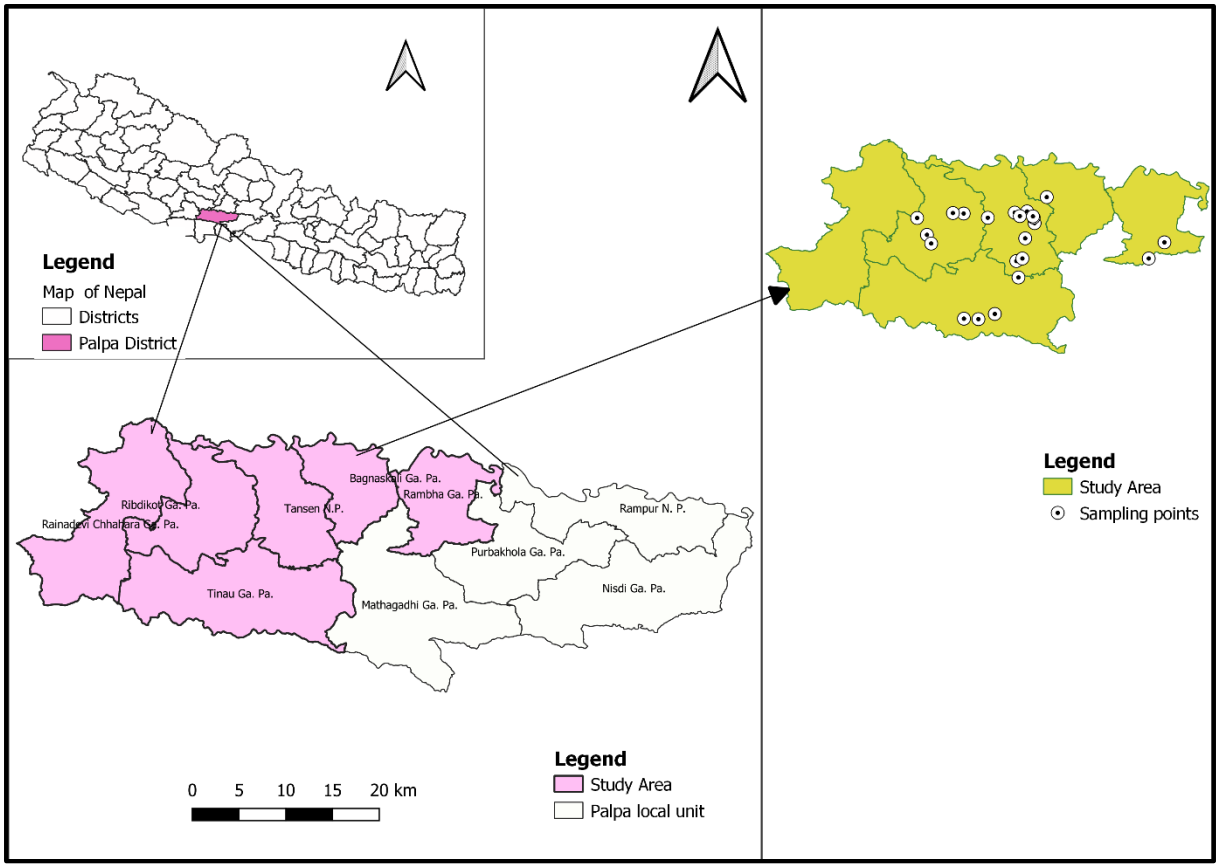

Figure 1: GIS Map showing Study Area within Palpa district including Sampling sites.

3.1.2 Climate

The climate of a region is the average weather there over a longer time span. It includes the factors like temperature, rainfall, wind, snow, sunshine etc. However, the major factors for determining the climatic condition of any area are the average temperature and rainfall.

The data of temperature of the Tansen station of Palpa district during 30 years (1991-2021) was taken. The maximum temperature of the area ranges from 19.06ºC in January to 30.37ºC in May whereas the minimum temperature varies from 6.78ºC in January to 19.90ºC in July.

Similary, the rainfall of an area is another factor which determines the climate and vegetation of that area. The rainfall pattern during the 30 years of the study area has been taken. The maximum rainfall was 461.83mm in July and the minimum rainfall was 8.30mm in December.

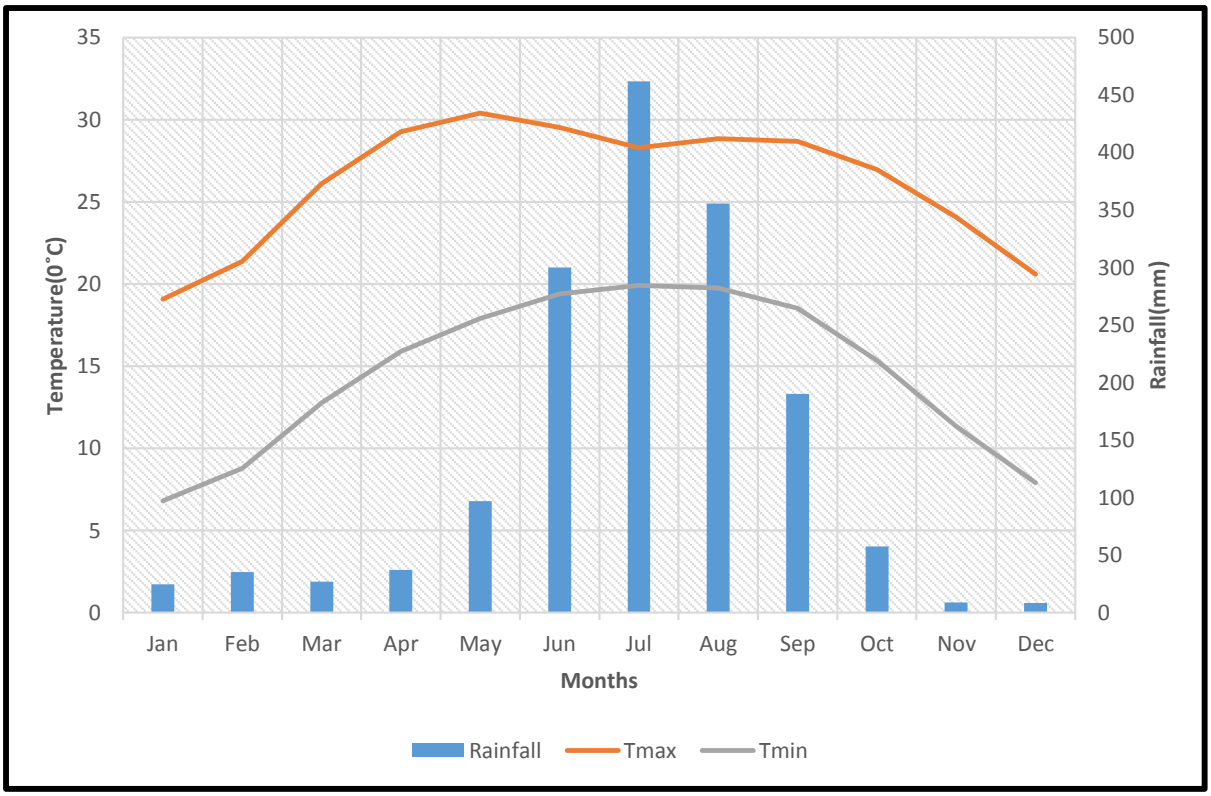

Figure 2: Climatic data of Tansen Station of Palpa district for 30 years (1991-2021)

Source: DHM, 2022)

3.1.3 Vegetation

Vegetation of an area is determined by the plant diversity of that area. Palpa district is rich in diversity in terms of higher and lower vascular plants. The district covers an area of 71213 ha. (i.e. 52%) by forest; and among total forest cover, 18% lies in Chure range and remaining 82% lies in Mahabharat range (DFO, 2019). The dominant forest types in this area are: *Shorea robusta* forest and lowland mixed forest (*Terminalia alata, Lagerstroemia parviflora, T. bellirica, Aegle marmelos, Bombax ceiba*) in the lower elevation, *Pinus roxburghii* forest and *Schima-Castonopsis* forest in mid-elevation and *Rhododendron-Quercus* forest in the higher elevation. The given forest types are based on Stainton (1972) except Lowland Mixed forest is based on observation. These forest types includes other mixed species like *Adina cordifolia, Michelia champaca, Acacia catechu, Dalbergia sisso, Mangifera indica, Myrica esculenta* along with many NTFPs and medicinal plants. Thus, the forest types of this area includes the diverse group of pteridophytic flora in the different habitats including epiphytic, terrestrial and lithophytic.

3.2 Field visit of the Study Area

Field visit was carried out many times in different seasons from lower to higher elevation of Palpa district. At first, the field visit was done in Post monsoon (October, November & March, 2021), then in Pre-monsoon (July, 2022) and during Monsoon (August-September, 2022). The field was visited in different seasons at different intervals of period to include and collect all the species with matured spores.

3.3 Plant collection and preparation of herbarium

The field visit was carried out in different seasons in the study area. The sample was collected mainly from the place as Dobhan, Tansen, Shreenagar hill, Barangdi, Khaseuli, Chhahara and many forests of other places. The protocol for the preparation of herbarium was taken from Siwakoti and Rajbhandary (2015). At first, the photograph of the plant from ventral and dorsal view with its habitat was taken. Then, the plant was pulled out with rhizome using a digger. After that, the plant was labelled with tag with a code number and kept in air-tight polythene bag. The field information was noted in the field notebook with the information like date of collection, latitude, longitude, elevation, slope, aspect, habitat and special character of plant.

3.3.1 Materials required for plant collection

During plant collection we need following important materials: Camera, GPS, Digger, Secateur, Altimeter, Polythene bags, Tags, Fieldnote book, Pen, Pencil, Plant Press, Newspapers, Cartoon sheets, Literatures.

3.3.2 Pressing of the Specimens

Before pressing large size plants were cut into required size without losing any important features and some are folded in V, N or Z shape for not letting lose any part of plant. Then, the collected specimens were pressed using newspaper and cartoon sheets were kept between every specimens for quick drying, in the size of herbarium press and tied with rope. The newspapers were changed daily or within 2-3 days until the plants were dried.

3.4 Preservation

The well dried specimens were mounted in the herbarium sheets having standard size (45cm length and 30cm width). The plant specimens are made clean by removing soil particles from rhizome and other dirts using brush. Then knitted with cotton thread by making knot on regular intervals on the reverse side of sheets and remaining parts again glued using fevicol. If some

important parts like rhizome, spores or other pieces left over were kept in the envelope called capsule on the side of herbarium sheet.

3.5 Identification

For the identification of fern and fern allies, study of morphological features play an important role. The study of morphological characters were done with the help of Jewelry lens (30×22MM, 60×12MM) and Stereomicroscope. The major morphological characters that were used for identification and taxonomic treatment of pteridophytes (Shrestha, 2017) are:

a. Plant: Habitat
b. Rhizome: Type (Erect, Suberect, Creeping), Short or long, Color, Presence or absence of scales.
c. Scales: Color, Shape, Apex, Margin
d. Stipe: Length, Diameter, Color, Grooved or not, Glabrous or hairy, Short or long, Articulated or not, Base (Scaly or not).
e. Fronds: Type (Simple or pinnately compound), Shape, Size, Uniform or not, Pattern, Single or in Cluster.
f. Lamina: Simple or Pinnate or Pinnately compound, Shape, Margin, Color, Texture.
g. Pinna and Pinnules: Length, Width, Shape, Base, Margin, Apex, Texture, Costa and Costule, Surface (Glabrous or Pubescent).
h. Rachis: Color, Grooved or not, glabrous or pubescent.
i. Veins: Simple or forked, free or anastomosing, distinct or not distinct.
j. Sori: Induciate or Exinduciate, Shape, Number, Position, Arrangement, Color.
k. Spores: Color

The plant specimens collected were identified with the help of relevant taxonomic literatures such as Beddome (1865-70, 1883, 1892); Iwatsuki (1988); Gurung (1991); Khullar (2000); Bista *et al.* (2002); Fraser- Jenkins (2008); Fraser-Jenkins *et al.* (2015); Fraser-Jenkins and Kandel (2019); Kandel & Fraser-Jenkins (2020). Some of the unidentified specimens were also identified by comparing with the herbarium deposited in TUCH and by consulting with the expert (Prof. Dr. Sangeeta Rajbhandary, TU).

3.6 Taxonomic Study

Artificial keys were prepared based on given morphological characters or distinct character present on the species, which were used for easy identification. The keys were prepared for all

genera having more than one species. Keys are arranged in bracketed format. Family, genera and species were separated. The description of each species was done using detailed information as author citation, synonyms, morphological characters, ecology, distribution and voucher specimens by using Fraser-Jenkins *et al.* (2015); Fraser-Jenkins and Kandel (2019); Kandel & Fraser-Jenkins (2020). Families are arranged according to the Smith *et al.* (2006) classification system.

3.7 Ethnobotanical study

The study was based on the local inabitants of major ethnic groups as Magar, Newar, Chhetri, Brahmin and other various groups in the Palpa district. The study was done during the field trip by interview method asking questions to the people randomly on the way and in some households.

3.8 Data Analysis

The data collected in the field were analyzed based on floristic composition, habitat, forest types, ethnobotanical uses and taxonomic treatment. For the analysis of habitat, total species collected were categorized based on major habitat type i.e. terrestrial, epiphytic and lithophytic in the form of pie-chart. Similarly, five forest types were recognized for the analysis of species distribution based on forest types in the form of table and bar graph and for the analysis of ethnomedicinal uses of pteridophytes, categorized into five different uses in the form of bar graph using Microsoft Excel 2016. For the taxonomic treatment, analysis was done with the help of plant description using keys and morphological characters.

CHAPTER 4: RESULTS

4.1 Floristic Composition of Ferns and Fern Allies

The floristic survey on fern and fern allies was carried out in Palpa district in different habitat and forest types within six local bodies. From the present study, a total of 86 species of fern and fern allies, belonging to 43 genera and 20 families is reported. Among 20 families, Pteridaceae is the largest family comprising 9 genera and 19 species and Polypodiaceae is the second largest family with 8 genera and 13 species. Simlilarly, Dennstaedtiaceae, Woodsiaceae and Dryopteridaceae families comprise 3 genera with 4, 10 and 8 species respectively in each. Likewise, Ophioglossaceae and Davalliaceae famililes comprise 2 genera including 2 and 3 species respectively. In the same way, Thelypteridaceae, Selaginellaceae, Lygodiaceae and Tectariaceae families comprise single genera with 10, 4, 2 and 2 species respectively. The other

remaining families viz., Lycopodiaceae, Equisetaceae, Glecheniaceae, Lindsaeaceae, Aspleniaceae, Blechnaceae, Lomariopsidaceae, Nephrolepidaceae and Oleandraceae are monotypic (Table 1 & Figure 3).

Table 1: Total number of family, genera & species

Family	Genera	Species
Pteridaceae	9	19
Polypodiaceae	8	13
Woodsiaceae	3	10
Dryopteridaceae	3	8
Dennstaedtiaceae	3	4
Davalliaceae	2	3
Ophioglossaceae	2	2
Thelypteridaceae	1	10
Selaginellaceae	1	4
Lygodiaceae	1	2
Tectariaceae	1	2
Lycopodiaceae	1	1
Equisetaceae	1	1
Glecheniaceae	1	1
Lindsaeaceae	1	1
Aspleniaceae	1	1
Blechnaceae	1	1
Lomariopsidaceae	1	1
Nephrolepidaceae	1	1
Oleandraceae	1	1

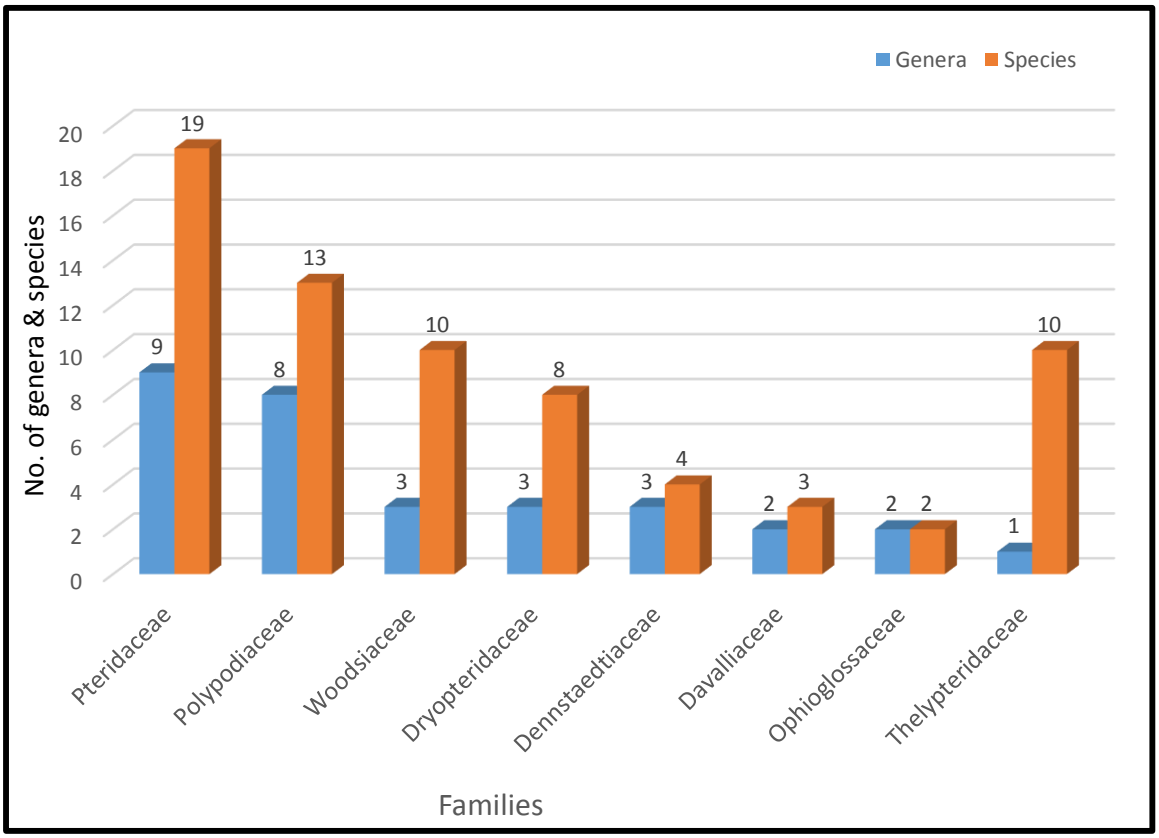

Figure 3: Graph showing top 8 families with genera and species

4.1.1 Species composition by families

Among total 20 families, Pteridaceae was the largest family with 19 species (22%) followed by Polypodiaceae having 13 species (15%), Woodsiaceae and Thelypteridaceae with 10 species (12%) each and Dryopteridaceae with 8 species (9%). Similarly, Dennstaedtiaceae and Selaginellaceae with 4 species (5%) each followed by Davalliaceae with 3 species (3%) and Ophioglossaceae, Lygodiaceae and Tectariaceae with 2 species (2%) each.

The other remaining families Lycopodiaceae, Equisetaceae, Glecheniaceae, Lindsaeaceae, Aspleniaceae, Blechnaceae, Lomariopsidaceae, Nephrolepidaceae and Oleandraceae are all monotypic (Figure 4.).

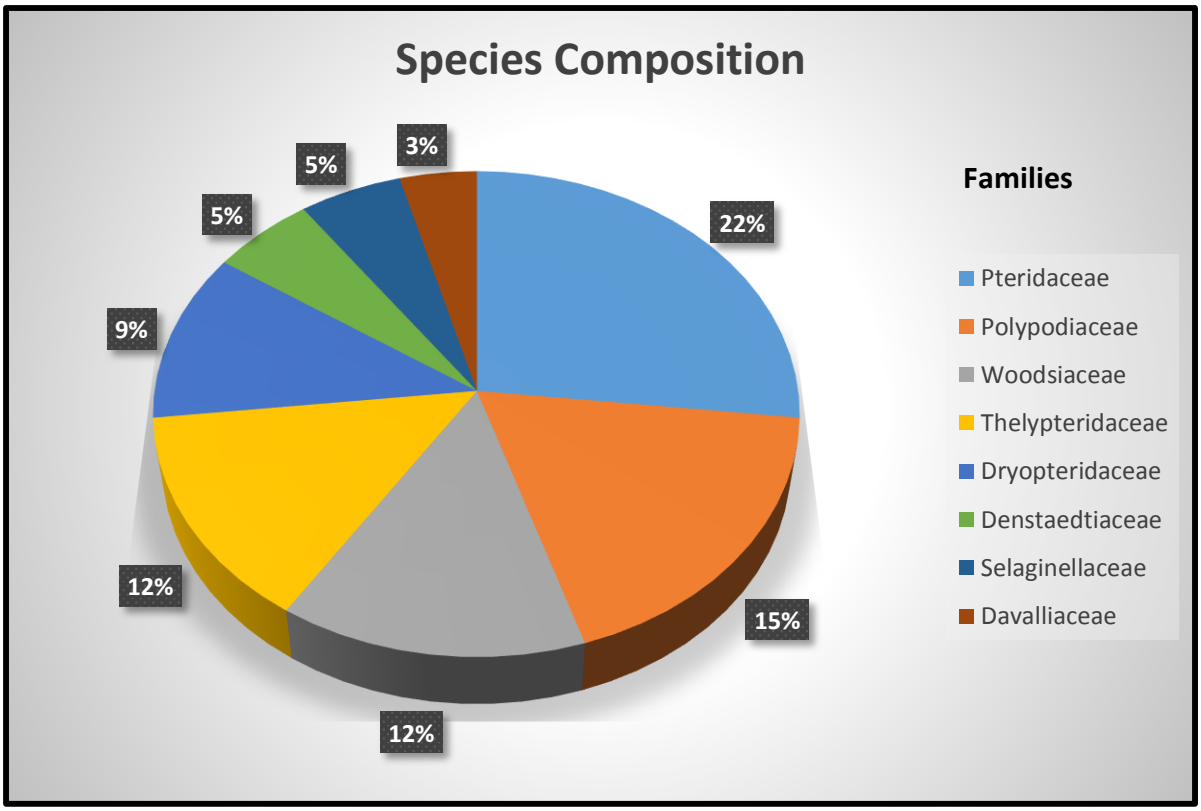

Figure 4: Species composition by families

4.1.2 Species composition by genera

Among the total 43 genera, *Thelypteris* was the largest genus with 10 species (12%) followed by *Athyrium* and *Pteris* with 6 species (7%) each. Likewise, *Dryopteris*, *Selaginella* and *Pyrrosia* with represented by 4 species (5%) each followed by *Adiantum*, *Aleuritopteris*, *Diplazium* and *Polystichum* with 3 species (3%) each.

The other genera *Lygodium*, *Microlepia*, *Onychium*, *Tectaria*, *Katoella*, *Lepisorus*, *Microsorum* with 2 species (2%) each. The remaining genera like Palhinhaea, Botrychium, *Ophioglossum*, *Equisetum*, *Dicranopteris*, *Odontossoria*, *Hypolepis*, *Pteridium*, *Antrophyum*, *Cheilanthes*, *Coniogramme*, *Pityrogramma*, *Vittaria*, *Asplenium*, *Deparia*, *Blechnum*, *Elaphoglossum*, *Nephrolepis*, *Oleandra*, *Leucostegia*, *Arthromeris*, *Drynaria*, *Loxogramme*, *Polypodiodes* and *Selliguea* were monotypic (Figure 5).

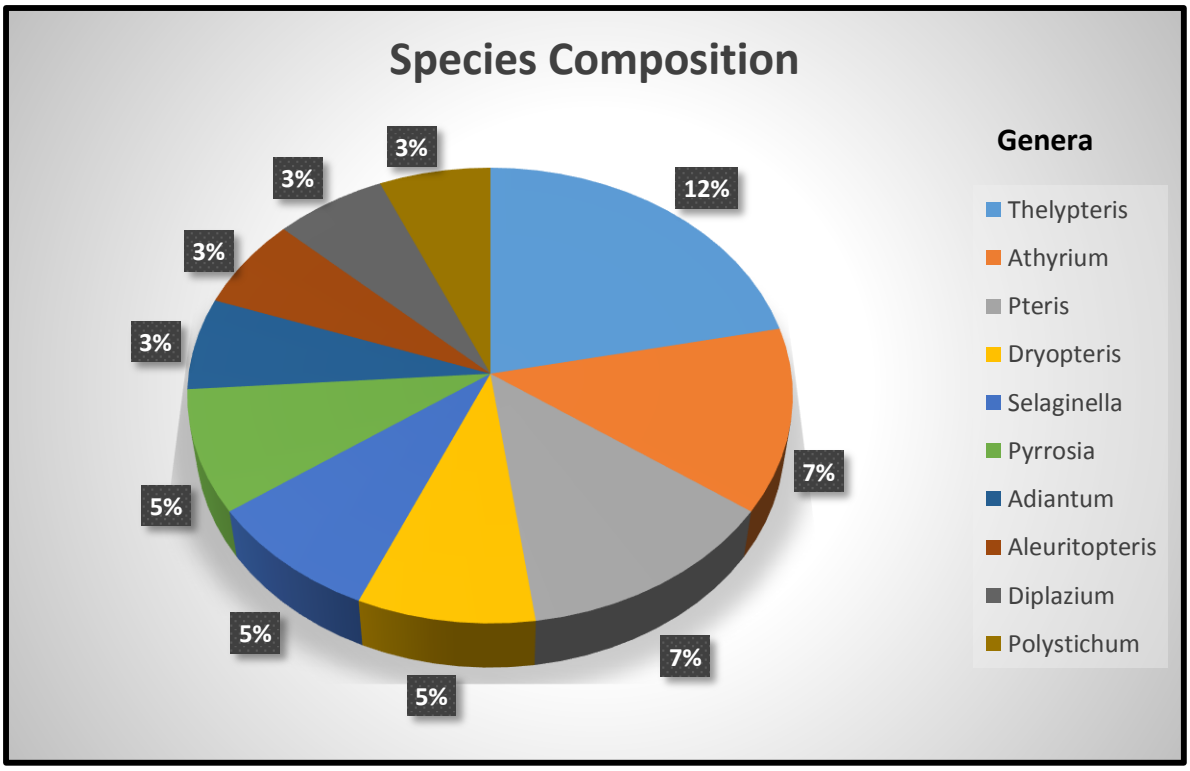

Figure 5: Species composition by genera

4.2 Distribution of species based on habitat types

Pteridophytes can be grown in different habitats from lower plains to higher mountain elevations and among various forest types. They are found on water as hydrophytes, on moist, shady and open forest floors as well as on forest edges or slopes as terrestrial, on rock crevices or on rocky walls as lithophytic and on barks of tree trunks and branches as epiphytic. From this study, three major types of ferns based on habitat were recognized viz., terrestrial, epiphytes and lithophytes.

Among the total species, 63 species (73%) were terrestrial, 16 species (19%) were epiphytic and 7 species (8%) were lithophytic. Here the highest number of species were found on terrestrial habitat followed by epiphytic and lithophytic. But some of the species were found in growing in more than one habitat. The species like *Nephrolepis cordifolia* and *Elaphoglossum stelligerum* were found growing in terrestrial and epiphytic habitat. Similarly, some species like *Pyrrosia costata, Pyrrosia lanceolate, Lepisorus nudus, Microsorum membranaceum* and *Microsorum cuspidatum* subsp. *cuspidatum* were found growing in epiphytic and lithophytic habitat (Figure 6).

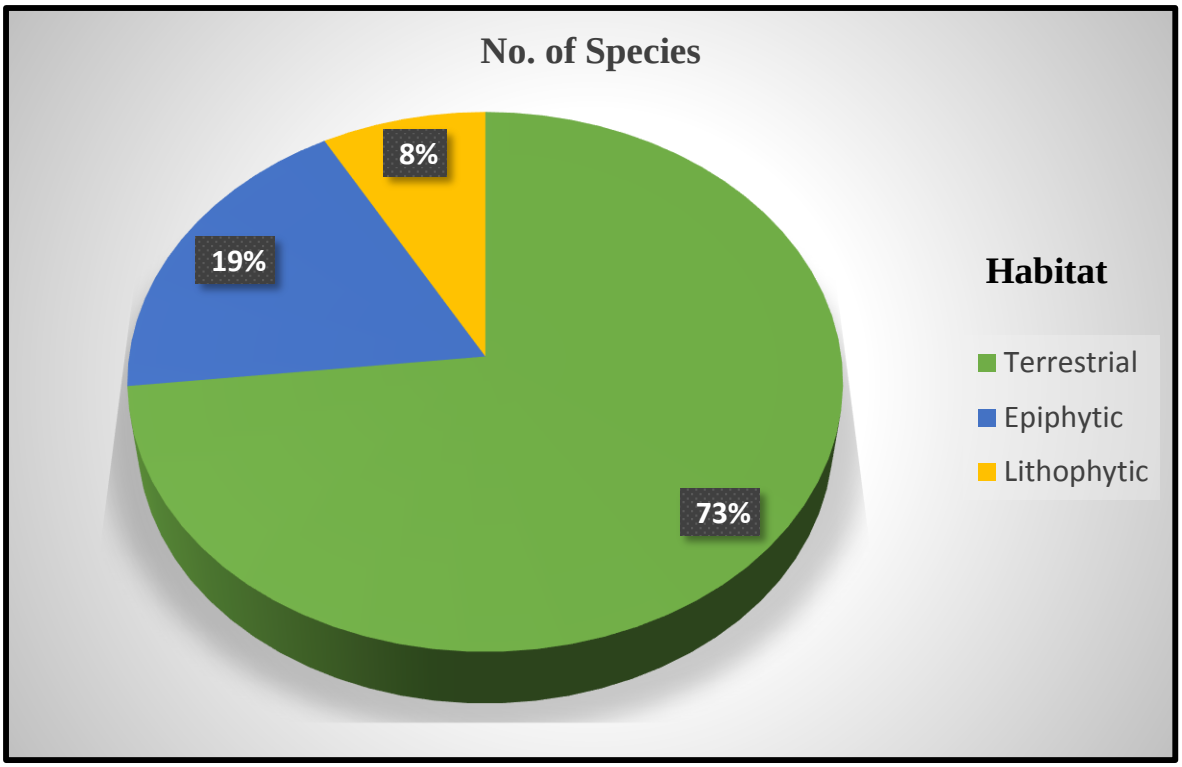

Figure 6: Distribution of species based on habitat types

4.3 Distribution of species in different forest types

Forest types are the essential component for the growth of pteridophytes. They play the key role for the distribution of species along with different habitat. For the study of distribution of pteridophytic flora, five different forest types were recognized as; **Shorea robusta forest, Lowland mixed forest, Pinus roxburghii forest, Schima-Castanopsis forest** and **Rhododendron-Quercus forest.** The maximum number of species were found growing in *Schima-Castanopsis* forest and low number of species were found growing in *Pinus roxburghii* forest. Some of the species were found in more than one forest types. The number of species recorded in five different types of forest are shown in (Table 1) and in Bar graph (Figure 7).

Table 2: Table showing species recorded in five different forest types with number.

S.N.	Forest types	No. of species	Species recorded
1.	*Shorea robusta* forest	8	*Aleuritopteris bicolor, Dryopteris cochleata, Tectaria coadunata, Selaginella chrysorrhizos, Pteris biaurita* subsp. *walkeriana, Adiantum edgeworthii, Thelypteris dentata* and *Thelypteris nudata*.

2.	Lowland mixed forest	18	*Pyrrosia lanceolata, Diplazium esculentum, Adiantum capillus-veneris, Pteris vittata* subsp. *vittata, Thelypteris prolifera, Selaginella subdiaphana, Palhinhaea cernua, Blechnum orientale, Lygodium flexosum, Lygodium japonicum, Pyrrosia costata, Athyrium falcatum, Pityrrogramma calomelos, Adiantum philippenes, etc*.
3.	*Pinus roxburghii* forest	6	*Botrychium multifidum, Thelypteris dentata, Athyrium pectinatum, Onychium vermae, Aleuritopteris bicolor* and *Selaginella fulcrata*.
4.	*Schima-Castanopsis* forest	34	*Lepisorus nudus, Pyrrosia manni, Pyrrosia stenophylla, Drynaria propinqua, Polystichum lentum, Athyrium drepanopterum, Athyrium cuspidatum, Polypodiodes lachnopus, Katoella pulchra, Katoella squamata, Dicranopteris taiwanensis, Microsorum cuspidatum* subsp. *cuspidatum, Microsorum membranaceum, Elaphoglossum stelligerum, Hypolepis polypodiodes, Polystichum squarrosum, Microlepia setosa, Pteridium revolutum, Dryopteris sparsa* subsp. *sparsa, Dryopteris woodsiisora, Pteris normalis, Coniogramme intermedia, Arthromeris tatsiensis, Leucostegia immersa*, etc.
5.	*Rhododendron-Quercus* forest	20	*Loxogramme involuta, Selliguea oxyloba, Pteris wallichiana, Lepisorus scolopendrium, Oleandra wallichii, Pteris aspercaulis, Athyrium foliolosum, Dryopteris juxtaposita, Polystichum discretum, Vittara flexuosa, Asplenium indicum* subsp. *yoshinage, Polystichum squarrosum*, etc.

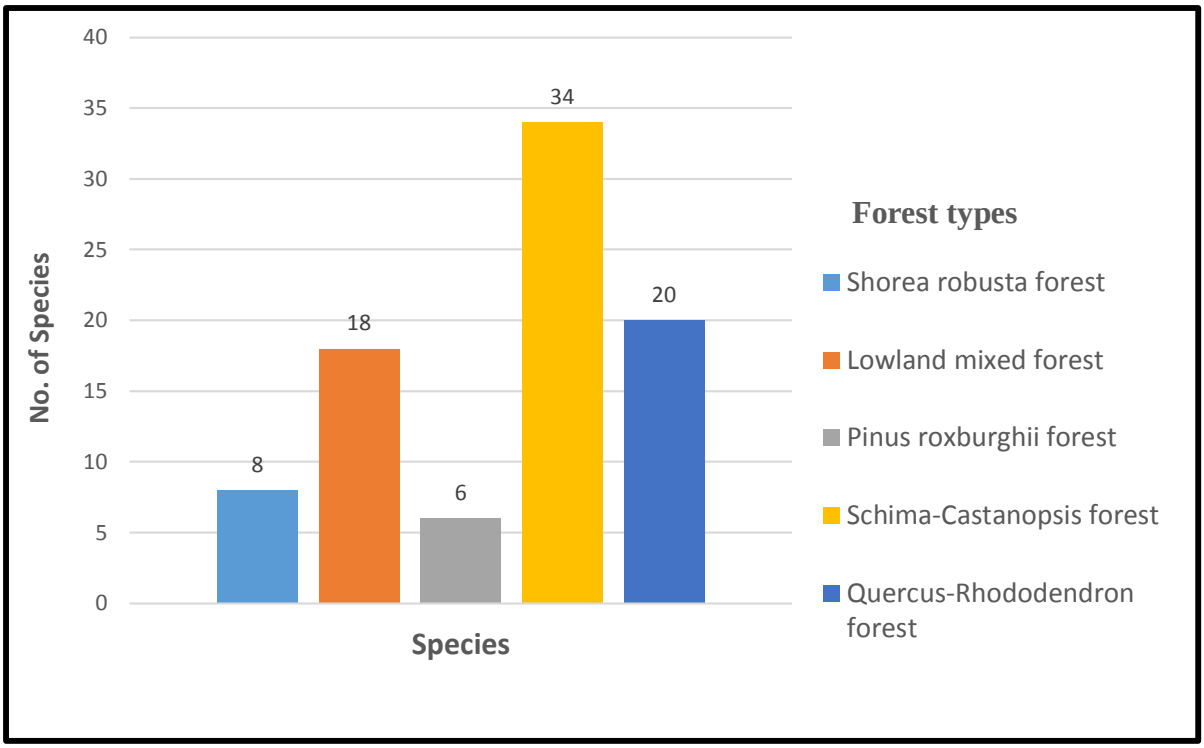

Figure 7: Distribution of species in five different forest types.

4.4 Ethnobotanical uses of Fern and Fern Allies of the collected species

The study enumerates the ethnobotanical uses of fern and fern allies widely used by the local peoples of different ethnic group as Magar, Newar, Chhetri and Brahmin of the Palpa district. Some people were unware about the proper uses, value and application of pteridophytes. However, few people were found to have some knowledge on the uses of ferns for food, medicine, ornamental use, animal bedding and other miscellaneous uses. From the study, a total of 21 species of pteridophytes were documented for the ethnobotanical use. Out of the total species, 10 species were used for medicinal value, 4 species for food, 3 species for animal bedding, 2 for ornamenta use and 2 for miscellaneous uses.

The species used for medicinal purpose were *Dryopteris cochleata, Blechnum orientale, Cheilanthus tenuifolia, Pteris biaurita* subsp. *walkeriana, Lygodium flexuosum, Pteris wallichiana, Adiantum capillus-veneris, Equisetum arvense, Dicranopteris taiwanensis* and *Microsorum membranaceum*. Likewise, species used for food were *Tectaria coadunata, Ophioglossum reticulatum, Diplazium esculentum* and *Diplazium maximum.* Similarly, species used for animal bedding were *Pteris vittata* subsp. *vittata*, *Polystichum lentum* and *Coniogramme intermedia*. In addition, species for ornamental use were *Nephrolepis cordifolia* and *Lygodium japonicum*, and species for other miscellaneous use were *Selaginella*

subdiaphana and *Aleuritopteris bicolor*. Here, the species used for multipurpose is *Nephrolepis cordifolia* for food, medicine and ornamental use (Figure 8).

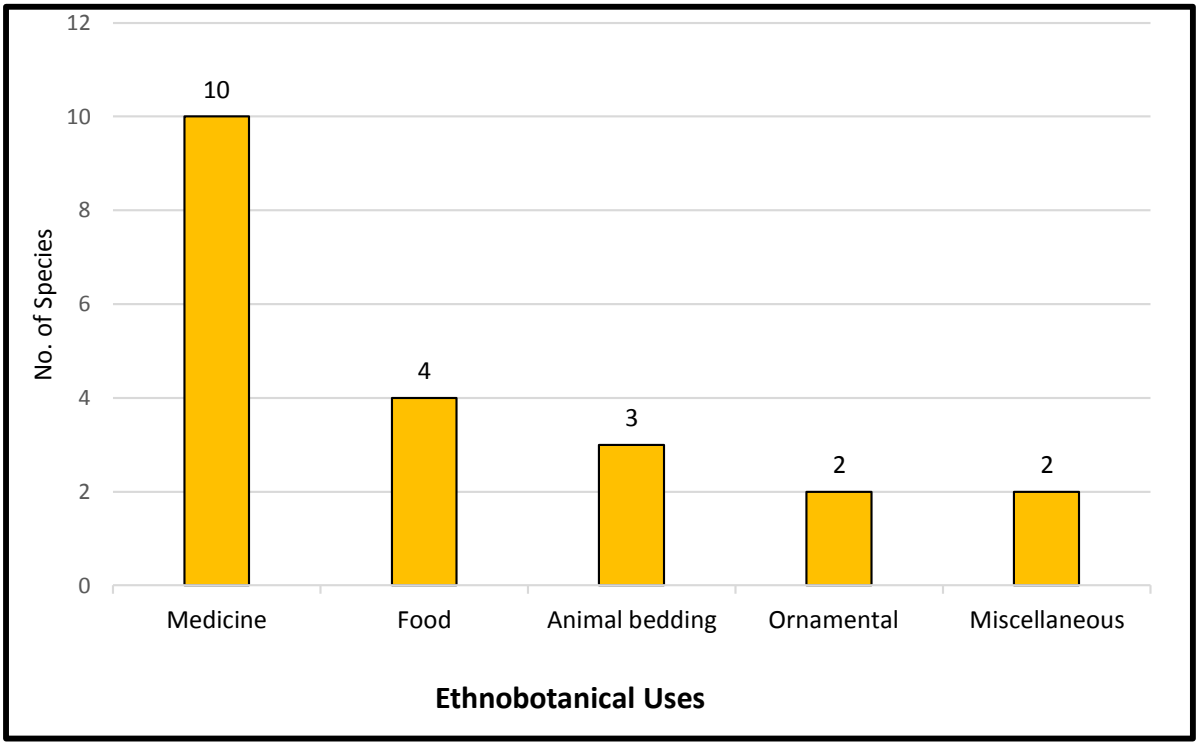

Figure 8: Ethnomedicinal uses of fern and fern allies with number of species

4.5 Taxonomic Treatment

In this study, the pteridophytes collected from the study area are arranged according to Smith *et al.* (2006) followed in Fraser-Jenkins *et al.* (2015), Fraser-Jenkins and Kandel (2019) and Kandel and Fraser-Jenkins (2020). Based on the contrasting characters of genera and species, as well with the help of some relevant literatures, taxonomic keys were prepared. The description of taxon with its recent name, author citation, basionyms, synonyms, distribution, ecology and voucher specimens are given below.

Lycopodiaceae P. Beauv. *ex* Mirb.

Perennial, terrestrial or epiphytic. Stems erect or prostrate, branches leafy, dichotomous or pinnate, leaves small, simple , 1-nerved, without ligule, spirally arranged. Sporangia solitary in the axils of leaf-like sporophylls. Strobili terminal on branches of main stem, sessile or stalked.

Palhinhaea Franco & Vasc.

Stems erect or creeping, sparsely leafy and dichotomously branched. Leaves dimorphic or monomorphic, spirally arranged, papery, lanceolate, linear, sessile. Strobili at the tip of branchlets, club shaped, long or short.

Palhinhaea cernua (L.) Franco & Vasc., Bol. Soc. Brot. Ser. 2, **41**: 24 (1967); Fraser-Jenkins *et al.*: 54 (2015).

Lycopodiella cernua (L.) Pic.Serm., Webbia 23: 166 (1968); Nakaike: 17 (1996).

Terrestrial herb. Stem long from 20-50cm, creeping, slender, densely leafy and rooting at regular intervals. Branches many, 4-18cm long; leaves linear-subulate, spreading to ascending. Strobili solitary on the tips of branches, cylindrical, yellowish white in color. (Plate 1. A).

Distribution: W. & E. Nepal, Tibet, China, Bhutan, Myanmar, Sikkim, Darjeeling, Uttarakhand.

Ecology: Terrestrial growing in open floors and walls of forest.

Voucher specimens: Palpa, Pravas, 840m, 28th Jul, 2022, S. Neupane and S. Aryal, P50 (TUCH).

Selaginaceae Milde

Plant terrestrial, usually herbaceous, annual or perennial. Stems dichotomously branched bearing rhizophores at the lower end. Leaves small, numerous having ligule at base, spirally arranged. Sporangia grouped in strobili, solitary on the axils of sporophylls.

Selaginella P. Beauv.

Mostly terrestrial herb but sometimes lithophytic or epiphytic. Rhizomes erect, or creeping. Stems copiously branched, dichotomous bearing monomorphic or dimorphic, simple, spirally arranged leaves. Leaves bearing single veined ligules on adaxial surface. Sporangia borne in the axils of specialized leaves, arranged in strobili. Spores heterosporus; megasporangia at the base and microsporangia at the apex of strobilus.

Key to Species

1a. Sporophylls monomorphic…….2

1b. Sporophylls dimorphic……...3

2a. Stem erect, widely triangular……...*S. fulcrata*

2b. Stem creeping, prostate…….*S. pallida*

3a. Rhizophores restricted to base of stem…….*S. chrysorrhizos*

3b. Rhizophores restricted to lower one-third part of main stem……..*S. subdiaphana*

Selaginella chrysorrhizos Spring, Mém. Acad. Roy. Sci. Belg. 24 (2): 251 (1850); Alston: 226 (1945); Iwatsuki:168 (1975); Dixit: 13 (1984); Bista *et al.*:26 (2002); Fraser-Jenkins *et al.*: 64 (2015).

Lycopodioides chrysorrhizos (Spring) Kuntze in Revs. Gen. Pl. 2: 826 (1891).

Selaginella lakkidiana Nisha, Nampy & Joby Nordic J. Bot. 28: 665 (2010).

Plant lithophytic, small. Rhizosphore restricted to base of stem. Fronds deltate, 6-12cm long and 3-6cm wide. Stem slender, glossy branched from the single basal point, once or twice pinnately branched. Axillary leaves ovate- oblong, denticulate margin, apex obtuse; Ventral leaves ovate-oblong, margin denticulate, apex acute-obtuse; Dorsal leaves ovate, subfalcate, margin denticulate, apex cuspidate. Strobili solitary, at the tips of branches, 3-7mm long. Sporophylls dimorphic, Megasporophylls longer than central microsporophylls, latter being long or short ciliate at their bases. Megaspores dark-brown and microspores pale-brown. (Plate 1. C).

Distribution: W., C. & E. Nepal, N.E., C. & S. India, Sikkim, Darjeeling, Bhutan, Bangladesh, Thailand, Vietnam.

Ecology: Lithophytic, found on moist rocks in shaded forest beside path.

Voucher Specimen: Palpa, Dobhan, 349m, 6th Nov., 2021, S. Neupane and S. Sharma, P23 (TUCH).

Selaginella fulcrata (Buch.-Haem. ex D. Don) Spring, Bull. Acad. Roy. Sci. Bruxelles, **10**: 231 (1843); Alston: 219 (1945); Dixit: 13 (1984); Fraser- Jenkins: 318 (1997b); Bista *et al.*: 26 (2002); Fraser-Jekins *et al.*: 68 (2015).

Lycopodium fulcratum Buch.-Haem. ex D.Don, Prodr. Fl. Nepal.: 17 (1825)

Lycopodiodes fulcrata (Buch.-Haem. ex D. Don) Kuntze, Revis. Gen. Pl. **2**: 826 (1891)

Plant terrestrial, 30-50cm long with an erect frond looks like feather. Stipe slender, upto 9-16cm long with small leafy ligules. Fronds bipinnate to tripinnate, widely triangular, ovate, apex obtuse, leaf bases overlying the rachis. Pinna alternate, slightly lanceolate, with 3-12cm long and 2.5-11cm width. Strobili small, narrow, cylindrical or slightly tapering, sporophylls monomorphic, ovate, cordate at base, margin denticulate or entire, apex acute. Megaspores reddish-brown, microspores olive-brown.

Distribution: W., C., & E. Nepal, Bihar, Maharashtra, W. Bengal.

Ecology: Terrestrial species mostly found in open space, grounds or walls.

Voucher specimen: Palpa, Shreenagar hill, 1448m, 2nd Nov, 2021, S. Neupane and B. Parajuli P17 (TUCH).

Sellaginella pallida (Hook. & Grev.) Spring, Bull. Acad. Roy.Sci Brux. **10**: 234 (1843); Alston: 218 (1945); Iwatsuki: 241 (1988); Nakaike & Gurung: 156 (1995); Fraser- Jenkins (1997b); Bista *et al.*: 27 (2002); Fraser- Jenkins *et al.*: 74 (2015).

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

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

Plant terrestrial, small to medium sized. Rhizophores at intervals throughout the main stem. Stems 10-20cm long, creeping, prostate, rooting, semi-crispaceous, with narrow apices, short alternate side branches, leaves dark-green. Axillary leaves ovate, dilated at base, dentate-serrulate, margin entire or upper part subentire, apex acuminate; Ventral leaves ovate, margin slightly dentate, acroscopic base dilated at base, margin dentate-serrulate, apex acuminate; dorsal leaves ovate, base cordate, margin serrulate-denticulate, falcate, apex acuminate-aristate. Strobili solitary, terminal, compactly arranged. Sporophylls monomorphic, rather long-acute, margin denticulate, apex acuminate. Megaspores light yellow and microspores red. (Plate 1. D).

Distribution: W., C. & E. Nepal, N.E. India, Arunanchal Pradesh, Uttarakhand, Bhutan, China (Xizang).

Ecology: Terrestrial, found on the slope in shaded forest in the roadside.

Voucher Specimen: Palpa, Batasedada, 1330m, March 1st, 2021, S. Neupane and B. Neupane, P25, (TUCH).

Selaginella subdiaphana (Wall. *e x*Hook. & Grev.) Spring, Bull. Acad. Roy. Sci. Brux. **10**: 232 (1843); Alston; 230 (1945); Chowdhury: 6 919730; Dixit: 17 (1984); Iwatsuki: 243 (1988); Gurung: 9 (1986); Nakaike & Gurung: 156 (1995); Bista *et al.*: 29 (2002); Fraser-Jenkins *et al.*: 82 (2015).

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

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

Plant terrestrial. Rhizophores restricted to lower one-third part of main stems. Stems slender, creeping or suberect, 10-30cm long. Axillary leaves ovate, base cordate, ciliolate margin at base, middle and upper dentate to denticulate, apex acuminate. Ventral leaves ovate to ovate-lanceolate, base slightly auriculate, basiscopic base endlanged, broadly overlapping branches, margin ciliate-dentate at base, entire towards apex,apex sub-obtuse. Dorsal leaves ovate, base obtuse or slightly sub-cordate, margin ciliolate to denticulate, apex acute-shortly acuminate. Strobili solitary, terminal, compactly arranged, 4-8mm long. Sporophylls dimorphic; microsporophylls ciliate, aristate; megaspores bright red, microspores slightly orange-red.

Distribution: W., C. & E. Nepal, Arunanchal Pradesh, Jammu & Kashmir, Sikkim, Darjeeling, Bhutan, China.

Ecology: Terrestrial, found on the walls besides muddy path.

Voucher Specimen: Palpa, Bhairabsthan side, 1420m, 1st Nov., 2021, S. Neupane and B. Parajuli, P04 (TUCH).

Ophioglossaceae (R. Br.) J. Agradh

Terrestrial herbs with fleshy erect branched rhizome. Stipe erect, variable length, slender and fleshy. Fronds simple to compound with sterile foliar parts as well as fertile spike. Sporangia large with globose spores.

Key to genera

1a. Fronds sterile, pinnately compound with free, sub-sessile sporangia…….....*Botrychium*

1b. Fronds sterile, simple with fertile spike…….....*Ophioglossum*

Botrychium Sw.

Plant terrestrial. Rhizome erect with fleshy roots. Stipe erect, slender, glabrous or hairy and somewhat fleshy. Fronds compound with fertile as well as sterile blades. Sterile segment dissected and toothed with free veins while fertile segment with free, sub-sessile sporangia.

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

Sceptridium multifidum (S.G.Gmel.) Nishida *ex* Tagawa, J. Jap. Bot. 33: 200 (1958); Sahasi: 65 (1999).

Terrestrial herb with erect rhizome consisting of fleshy roots. Stipe erect 3-10cm long, thick, slightly hairy, and somewhat fleshy. Sterile frond deltate-triangular, bipinnate-tripinnate, 12-20cm long and 6-12cm wide, pinnae alternate, petiolated, distance between lower pairs more than upper pairs; pinnules obliquely ovate, margin entire to crenate, glabrous, texture herbaceous. Veins free. Fertile stem arising from a little above the base with long stalk (10-15cm) without lamina bearing crowded whitish yellow, free, globose, subsessile sporangia.

Distribution: W. C. & E. Nepal, China, Bhutan, Sikkim, Darjeeling, Uttarakhand, himachal Pradesh, etc.

Ecology: Terrestrial, found in open floor of forest with humus.

Voucher specimen: Palpa, Shreenagar hill, 1448m, 26th Aug, 2022, S. Neupane and S. Aryal, P44, (TUCH).

Ophioglossum L.

Terrestrial small herb. Rhizomes erect, slightly branched and fleshy. Stipe long, slender and glabrous. Frond simple, margin entire, lamina petiolate with acute apex. Fertile spike from sterile segment with lateral row of sporangia on each side.

Ophioglossum reticulatum L., Sp. Pl.: 1063 (1753)- Bedd, Handb. Ferns Brit. Ind. 465 (1883); Frazer-Jenkins *et al.*: 100 (2015)

Ophioglossum timorense Miq., Ann. Mus. Bot. Lugduno-Batavi **4**: 93 (1868)

Ophioglossum austroasiaticum Nishida, J. Japan. Bot. **34**: 46 (1959)

Ophioglossum aletum M. Patel, M. N. Reddy & H. K. Goswami, Indian Fern J. 35: 323 (2018)

Terrestrial herb with short, erect and fleshy rhizome. Stipes ca.6cm long, slender and glabrous. Fronds simple, 3.6cm long and 2.1cm broad, sterile, base slightly cordate, margin entire with blunt or acute apex. Veins free or simply forked but median vein indistinct; Fertile spike arising from the base of the sterile segment with slender stalk bearing a lateral row of sporangia on each side.

Distribution: W. C. & E. Nepal, China, Tibet, Myanmar, Bhutan, Sikkim, Darjeeling, Pakistan, Srilanka, S. America, S.E. and E. Asia.

Ecology: Terrestrial herb found in open areas of forest ground.

Voucher Specimen: Palpa, Madanpokhara, 1117m, 28th Oct, 2022, S. Neupane and N.K. Somai, P86, (TUCH).

Equisetaceae Rich. *ex* DC.

Terrestrial, evergreen perennial herbs. Rhizome creeping. Stems hollow, simple or branched grooved with distinct nodes at certain intervals. Strobili cone like at the terminal end of stem comprising spores.

Equisetum L.

Plant terrestrial, perennial. Rhizomes long, creeping, branched. Stems erect, hollow except at the node bearing a whorl of toothed foliar leaves united into sheath at the base of node. Stobili cone like with sporangia borne on adaxial side.

Equisetum arvense subsp. **diffusum** (D.Don) Fraser-Jenk., Sp. Pl. 2: 1016 (1753); Hauke, Nova Hegwigia 30: 435 (1978); Dixit: 19 (1984); Iwatsuki: 243 (1988); Nakaike and Gurung: 155 (1995); Bista *et al.* 30 (2002); Fraser- Jenkins *et al.* 87 (2015).

Plant terrestrial. Rhizome creeping, and sometimes erect or ascending. Stem 30-45cm long, hardly dimorphic, fertile stems may occasionally start without branches, loose sheaths, later become branched and similar to sterile stems; single- many stem-ridge, hollow except at nodes, tufted with a narrow central lamina, scabrous, sheath-ridges below each tooth deeply grooved as to become double, internodal distance 1-4cm long. Branches densely whorled, short to long, arising from the base of the leaf sheath, sheath teeth 5-8. Fertile stem with strobilus at distal end, cone ovate to linear with rounded apex. (Plate 1. B).

Distribution: W., C. & E. Nepal, China, Tibet, Bhutan, Sikkim, Darjeeling, Uttarakhand, Jammu & Kashmir, Pakistan, N.E. India, Vietnam, Japan.

Ecology: Terrestrial on land besides muddy road.

Voucher Specimen: Palpa, Chhahara, 1737m, Sept. 9, 2022, S. Neupane and B. Neupane, P77, (TUCH).

Gleicheniaceae (R. Br.) C. Presl

Plant terrestrial. Rhizomes creeping. Stipes, slender, cylindrical, glabrous or slighty pubescent, dichotomously branched. Fronds large, simple pinnate to bipinnate, dichotomously branched, main rachis bearing opposite pairs of lateral branches. Pinna lobed upto the costa, lobes short, texture coriaceous, veins forked and free. Sori on the veins and exindusiate.

Dicranopteris Bernh.

Rhizome creeping. Fronds pinnate, upper pair of lateral branches repeatedly dichotomously branched with a pair of foliaceous stipule-like outgrowth at the base of each fork, only the ultimate branches leafy and larger; Mid-vein in pinna distinct, veinlets several.

Dicranopteris taiwanensis Ching & Chiu in Chien & Chun, Fl. Reipubl. Popularis Sin. **2**: 346 (1959); Kuo, Taiwannia **30**: 54 (1985); Fraser-jenkins: 107 (1997b); Fraser- Jenkins *et al.* 128: 2015.

Dicranopteris linearis var. *altissima* Holttum, Reinwardtia **4**: 276 (1959)

Dicranopteris linearis var. *demote* Holttum, Reidwardtia **4**: 275 (1957)

Dicranopteris montana (Holttum*)* S.R.Ghosh, Pterid. Fl. E. India: 210 (2004)

Terrestrial plant. Rhizome creeping. Stipe slender, glabrous, brownish in color, repeatedly di or trichotomously branched from the axils of fork. Fronds simply pinnate, 6- 18cm long and 2.5-5cm broad, adaxial surface bright light green, glabrous; abaxial surface glaucous green without hairs; pinna with unequal lobes; small at base, slightly long at middle and small at apex; a pair of shortish, elliptical accessory branches at each ultimate fork in a X-shaped arrangement. Pinnule 18-39 pairs with unequal length. Sori round, whitish, exindusiate in a single line on each side of mid-rib of pinnule.

Distribution: C., and E. Nepal, China, Myanmar, Assam, Bhutan, Sikkim, Darjeeling, Taiwan, Vietnam, New Guinea, Australia.

Ecology: Terrestrial on land and walls.

Voucher Specimen: Palpa, Shreenagar hill, 1450m, 2nd Nov, S. Neupane and B. Parajuli, P09 (TUCH).

Lygodiaceae K. B. Presl.

Terrestrial climbing fern. Rhizome creeping, hairy. Stipes long, twinning, solid, slender, dichotomously branched bearing alternate pinna. Pinna having a pair of opposite pinnules, and one terminal pinnule. Sori linear, elongate sometimes like strobili, usually on margin of pinnules lobes, covered with false inducium.

Lygodium Sw.

Rhizomes creeping and hairy. Stipes long, slender and twinning, light brown in color, solid and dichotomously branched bearing alternate pinna. Sterile lamina wider and bit large than fertile lamina. Pinnules usually bipinate or tripinnate. Veins free or forked. Sporangia large, green to dark brown or black if matured at the lobes of pinnules, protected by the reflexed edges of the lobes forming false indusia.

Key to species

1a. Pinnules and lobes larger, less pointed fertile spike……..*Lygodium japonicum*

1b. Pinnules and lobes smaller, narrower and pointed spike…….*Lygodium flexosum*

Lygodium flexuosum (L.) Sw., J. Bot. (Schrader) 1800(2): 106 (1801); Clarke: 584 (1880); Beddome: 457, f.283 (1883); Ito: 455 (1966); Iwatsuki: 170 (1975); Bista *et al.* 60 (2002); Fraser-Jenkins: 114 (2015).

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

Plant terrestrial and climber. Stem twinning with pseudo-dichotomous pinnae at interval. Pinna with a dormant apical bud at the dichotomy, bearing a pair of opposite pinnules, each with several alternate pinnulets c. 4-12cm long and similar apical segment. Sterile pinnules seems larger than fertile pinnules. Pinnules with basal and apical lobes, bearing minute teeth around margins and acute at their apices. Fertile lobes bearing short soral spikes around margin which varires in color from light green to blackish in color at maturity, with small indusia. (Plate 7. F).

Distribution: W., C., & E. Nepal, Arunachal Pradesh, Bhutan, Sikkim, Darjeeling, Uttarakhand.

Ecology: Terrestrial climber at forest floor twinning at shrubs or trees, sometimes in open area.

Voucher Specimen: Palpa, Baastari, 864m, 29th July, 2022, S. Neupane and S. Aryal, P48, (TUCH).

Lygodium japonicum (Thunb.) Sw., J. Bot. (Schrader) 1800(2) ; 106 (1801); Clarke: 584 91880); Beddome: 457 (1883); Hope: 106 (1903); Ito: 455 (1966); Chowdhury: 20 (1973); Iwatsuki: 170 (1975); Nakaike & Gurung: 194 (1988a); Bista *et al.*: 60 (2002); Fraser-Jenkins *et al.*: 116 (2015).

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

Hydroglossum japonicum (Thunb.) Wild. in Abh. Kurfurstl.- Mainz. Akad. Nutzl. Wiss. Erfurt 2(4): 26 (1802).

A climbing fern. Stem twinning with dichotomous pinna at interval. Stipe long, hairy, slender bearing a pair of alternate pinnate segments and a hairy bud at the tip of a short petiole. Pinnules and lobes are smaller, narrower, more pointed and more toothed, the basal lobes more spreading and acute. Veins free or forked, hairy fertile segments with more or less narrowed lamina with lobes of fertile spikes with indusial. Spores light yellow to orange.

Distribution: W., C., and E. Nepal, Pakistan, Kashmir, Uttar Pradesh, Bhutan, Japan, Srilanka.

Ecology: Terrestrial climber twinning in the forest shrubs and trees branches, open places like walls.

Voucher Specimen: Palpa, Pravas lake side forest, 840m, 28th July, S. Neupane and S. Aryal, P52, (TUCH).

Lindsaeaceae Pich. Serm.

Terrestrial ferns with short to long creeping rhizome, with short hair like dark brown scales. Stipe smooth, erect. Fronds are pinnate to tripinnate or more divided, glabrous, ovate to lanceolate. Veins free, forked. Sori marginal or submarginal, indusia open towards margin or sometimes attached by side of margin.

Odontosoria Fee

Terrrestrial herb. Rhizome short creeping with tuft of hair like dark brown scales. Stipe slender, erect, smooth with alternate pinna. Fronds pinnate to tripinnate or more divided, generally glabrous, usually lanceolate. Sori marginal on terminal segment of pinnule, indusia attached by side of margin.

Odontosoria chinensis (L.) J. Sm., Bot. Voy. Herald. **10:** 430 (1857); Bista *et al*.: 84 (2002); Frazer-Jenkins *et al*.: 195 (2015).

Davallia chinensis (L.) Sm. in Mem. Acad. Roy. Sci. (Turin) **5**: 414 (1793).

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

Sphenomeris chinensis (L.) Maxon in J. Washington Acad. Sci. **3**: 144 (1913).

Stenoloma chinense (L.) Bedd. in Handb. Ferns Brit. India: 70 (1883)

Terrestrial plant. Rhizomes short creeping with tuft of hair like dark brown scales. Stipe erect, slender, grooved in adaxial side, slightly herbaceous, smooth about 19cm long and 0.3cm wide. Fronds tripinnate- quadripinnate, about 11-48cm long; 3-15cm broad, lanceolate. Pinna alternate, about 2-12cm long ; 1.5-5cm broad. short stalk, ovate-lanceolate. Pinnules numerous, irregularly lobed, ultimate segment cuneate. Veins free and forked 2-3 in each leaf segment continue towards sori. Sori marginal at the apical end, indusia attached by side of margin. (Plate 1. E).

Distribution: W., C., & E. Nepal, China, Tibet, Myanmar, Butan, Sikkim, Darjeeling, Srilanka, Taiwan, E. & S.E. Asia.

Ecology: Terrestrial, found in the wall of forest and roadside.

Voucher Specimen: Palpa, Khaseuli, 1330m, 1st Nov, S. Neupane and B. Parajuli, P12 (TUCH).

Dennstaedtiaceae Pich. Serm.

Terrestrial plant but sometimes epiphytic. Rhizome creeping or erect, hairy. Stipes hairy and not articulated. Fronds large, monomorphic, bipinnate-tripinnate or more divided, covering of hairs. Veins free, forked. Sori marginal or sub-marginal, indusia linear or cup-like at blade margin or reflexed over sori, hairy.

Key to genera

1a. Sori intramarginal, close at the base of sinuses, cup-shaped inducium……*Microlepia*

1b. Sori not on base of sinuses, no cup-shaped inducium……2

2a. Sori orbicular on the terminal veinlets……*Hypolepis*

2b. Sori marginal continuous along the margin……*Pteridium*

Hypolepis Bernh.

Terrestrial plant. Rhizome long-creeping, covered with dense hairs. Stipes long, not articulated to rhizome. Fronds large, lamina bipinnate-tripinnate, surface hairy, texture herbaceous. Veins free. Sori orbicular, almost marginal, protected by reflexed margin,.

Hypolepis polypodiodes (Bl.) Hook., Sp. Pl. 2: 63 (1852); Brownsey, Blumea 32: 227-276 (1987); Fraser-Jenkins: 151 (1997b); Bista *et al.*: 80 (2002); Fraser-Jenkins *et al.*: 163 (2015).

Misapplied name:

Hypolepis punctata sensu Bedd. (1892); Ito (1966); Iwatsuki: 1975), *non* (Thunb.) Mett. *ex* Kuhn.

Plant terrestrial. Rhizome long-creeping, thin, covered with dense brownish hairs. Stipe 25-35cm long, dark-brown base and above stramineous, pale, slightly hairy. Fronds at distant, lamina 40-50cm long and 20-25cm broad, deltate-lanceolate; lowest pinna opposite and above alternate, ovate or triangular; pinnules oblong-narrowly ovate, ultimate pinnule oblong, apex obtuse, sessile; surface covered with pale, glistening jointed hairs but not glands, texture herbaceous. Rachis and costa hairy. Veins free or forked, hairy. Sori orbicular, terminal on veinlets near margin, covered with reflexed margin. Spores yellowish brown.

Distribution: W., C. & E. Nepal, Himachal Pradesh, Sikkim, Darjeeling, Meghalaya, America, Australia, China, Bhutan, Sri Lanka, Taiwan.

Ecology: Terrestrial found on forest floor beside path.

Voucher Specimen: Palpa, Pravas, 845m, 26th Aug., 2022, S. Neupane and S. Aryal, P54, (TUCH).

Microlepia C. Presl.

Terrestrial fern. Rhizome creeping, covered by dense hairs. Stipes erect, with short hairs. Fronds pinnate, lamceolate to narrowely deltoid, ultimate pinnules unequal at the base, hairy. Rachis and costae grooved. Veins free. Sori intramarginal terminal on the veins; indusium cup-shaped, hairy.

Key to species

1a. Large fern, 1-2m tall, widely deltoid……..*M. speluncae*

1b. Medium-large fern, 60-90cm tall, narrowly triangular-lanceolate……*M. setosa*

Microlepia setosa (Sm.) Alston, Philipp. J. Sci. 50: 177 (1933); Fraser-Jenkins *et al.*: 177 (2015).

Davallia hirta Kaulf. in Enum. Filic.: 223 (1824).

Microlepia hirta (Kaulf.) C. Presl in Tent. Pterid.: 125 (1836).

Plant terrestrial. Rhizome creeping, thin, covered firmly with brownish stiff hairs. Stipe 45-51cm long, stramineous, base slightly scaly and above glabrous, adaxially grooved. Fronds at a short distant, singly, lamina ca.60cm long and 20-30cm broad, triangular-lanceolate, bipinnate-tripinnatifid, hairy. Pinna alternate, stalked, narrowly triangular-lanceolate, lowest basiscopic pinnules the longest; pinnules ovate, sessile, base cuneate, apex acute-obtuse, unequal at base, slightly lobed; both surface covered with pale, stiff hairs, texture herbaceous. Rachis and costa hairy, stramineous. Veins free and forked, hairy. Sori large, placed close to the base of sinuses between the lobes, indusium half cup-shaped raised, dark green, hairy. (Plate 1. F).

Distribution: C. & E. Nepal, Cnina, Myanmar, Sikkim, Darjeeling, Uttarakhand, Taiwan, Thailand.

Ecology: Terrestrial found on the shaded forest floor.

Voucher Specimen: Palpa, Tahu, 1411m, 3rd Sep. 2022, S. Neupane and S. N. Khanal, P69, (TUCH).

Microlepia speluncae (L.) T. Moore, Index Fil. (T. Moore) 93 (1857); Beddome: 67 (1883); Ito: 463 (1966); Iwatsuki: 175 (1975); Gurung: 32 (1986); Nakaike *et al.*: 194 (1990); Bista *et al.*: 82 (2002); Fraser-Jenkins *et al.*: 178 (2015).

Davallia speluncae (L.) Baker in W. J. Hooker & J. G. Baker, Syn. Fil.:100 (1867)

Polypodium speluncae L. in Sp. Pl.: 1093 (1753)

Scyphofilix speluncae (L.) in Amer. Midl. Naturalist **12**: 263 (1931)

Terrestrial large fern upto 2m tall. Rhizome creeping, thickish, horizontal with short hairs. Stipes 20-55cm long, erect, hairy. Fronds large, lamina 80-100cm long, 30-40cm broad, tripinnate, ovate or widely deltoid. Pinna 8-22cm long and 3-6cm wide, alternate, obliquely spreading upward, narrowly triangular-lanceolate to linear lanceolate, apex acuminate, densely short hairy; pinnules crowded, apex acute, asymmetrical at base, with the acroscopic basal

pinnulet longer and larger and basiscopic one smaller and more sloping. Pinnulets bearing small apical teeth, variable in size and lobing; texture herbaceous, costa hairy, veins on the lower surface not raised. Sori large. close to base of sinuses between lobes, indusium brownish saucer -shaped, hairy.

Distribution: C. & E. Nepal, China, Tibet, Myanmar, Bhutan, Phillipines, Ceylon, Malay Peninsula.

Ecology: Terrestrial, found in open area.

Voucher Specimen: Palpa, Maadi, 851m, 5th Mar., S. Neupane and B. Neupane, P29, (TUCH).

Pteridium Gled. *ex* Scopoli.

Terrestrial plant. Rhizome long creeping, hairy. Stipes long, erect and somewhat straminous. Fronds large, lamina bi-tripinnate, hairy, coriaceous texture. Veins free. Sori marginal continuous along the margin, two indusium protecting sori, one of which is produced by reflexed margin and other of which is linked to receptacle.

Pteridium revolutum (Bl.) Nakai, Bot. Mag. Tokyo 39: 176-203 (1925); Brownsey, Austral. Syst. Bot. 2 (1): 113-128 (1989); Fraser-Jenkins: 216-222 (1997b); Thapa: 10 (2000); DPR : 83 (2002); Fraser-Jenkins *et al.*: 189 (2015).

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

Pteris revoluta Blume, Enum.Pl. Javae, 2: 214 (1828)

Terrestrial, large fern. Rhizome long creeping, black, sparsely hairy. Stipes erect upto 30-45cm long, stiff, slightly grooved, straminous, nearly glabrous. Fronds large, ca. 40-60cm long and 25-45cm broad, tripinnate, pinna narrowly deltate, opposite, pinnules with rounded base and obtuse apex, densely hairy beneath; rachis and costules grooved at upper surface. Veins free. Sori at margin in ultimate segments with external pseudoindusium and internal outward facing indusium. Spores brown in color.

Distribution: W. E. & C. Nepal, China, India, Tibet, Myanmar, Bhutan, Sri Lanka, S.E. Asia, Australia, New Guinea.

Ecology: Terrestrial, found in ground of forest.

Voucher specimen: Palpa, Barangdi, 1150m, 27th Aug, S. Neupane, S. Bashyal and S. N Khanal, P63, (TUCH).

Pteridaceae Ching

Plant mostly terrestrial, rarely epiphytes and lithophytes. Rhizomes creeping or erect, covered by scales or hairs. Stipes glabrous or scaly or hairy, proximate or distant, sometimes straminous. Fronds monomorphic to dimorphic, not articulated to rhizome; lamina simple to decompound, 1-3 pinnate or more; rachises, costae and blades rarely absent or commonly of hairs and/or scales occasionaly with white or yellow farina. Veins simple or forked, free or anastomosing. Sori marginal, protected by indusium or by false indusium or exinduciate.

Key to Genera

1a. Sori over most of the abaxial surface of lamina or along veins……..2

1b. Sori usually on margin of lamina……..……..3

2a. Lamina simply pinnate, imparipinnate…… *Coniogramme*

2b. Lamina 2-3 pinnate, with white farina……*Pityrogramma*

3a. Fronds simple……4

3b. Fronds compound……5

4a. Lamina short lanceolate, sori along veins, leathery texture……*Antrophyum*

4b. Lamina long linear, sori submarginal, texture papery……..*Vittaria*

5a. Lamina abaxial surface with white farina……..6

5b. Lamina abaxial surface without white farina……...…..7

6a. Lamina margins not or only slightly reflexed, indusia absent……..*Cheilanthes*

6b. Lamina margins with reflexed margin, false indusia present…….*Aleuritopteris*

7a. Fronds large, with basal basiscopic pinnules longer with wider segments……..*Pteris*

7b. Fronds medium, without basal basiscopic pinnules longer with narrow segments.....8

8a. Lamina fan shaped, sori on margins ……..…….*Adiantum*

8b. Lamina finely dissected, sori covering pinnules…….*Onychium*

Adiantum L.

Plant mostly terrestrial; rarely lithophytic or epiphytic. Rhizomes short and erect or long and creeping covered with brown or black scales. Stipes erect, slender, with scales at base and glabrous above. Fronds simple to multipinnate, mostly glabrous, sometimes hairy, texture herbaceous or solid. Veins free. Sori marginal, globose to linear; indusium formed of reflexed margin of the pinna.

Key to Species

1a. Fronds multipinnate……..……..*A. capillus-veneris*

1b. Fronds simply pinnate……..2

2a. Lamina apex enlarge into long whiplike stolon to form new plantlets……*A. edgeworthii*

2b. Lamina apex gives no stolon to form new plantlets…….*A. philippense* subsp. *philippense*

Adiantum capillus-veneris L., Sp. Pl. **2**: 1096 (1753); Clarke: 453 (1880); Beddome: 84 (1883); Hope: 239 (1900); Tawaga: 79 (1955); Ching: 341 (1957); Ito: 458 (1966); Iwatsuki: 172 (1975); Nakaike and Gurung: 188 (1988a); Thapa: 61 (2002); Frazer-Jenkins *et al.*, 201 (2015).

Adiantum affine Wild., Sp. Pl. ed. 4. **5**: 448 (1810)

Adiantum capillus-veneris f. fissum (Christ) Ching., Acta Phytotax. Sin. **6**: 343 (1957)

Maidenhair fern, small to medium-sized from 7-35cm long. Rhizome creeping, slender, covered by dense golden brown scales. Stipe black, shiny and smooth, 2-15cm long, slender, base with scales and distal end glabrous. Fronds clumped, lamina mostly bipinnate below middle and pinnate above middle, ovate- triangular, 6-20cm long and 3.5-12cm wide, thinly herbaceous, surface glabrous. Base cuneate, sides entire margin but sterile pinnules deeply lobed at apical margin of segment into rounded-obtuse lobes, with acute teeth. Veins free and forked upto margins, visible on both surfaces. Sori 3-9 per pinnule, on the apical region of the lobes, false indusia, light yellowish green, dark brown when mature, narrowly reniform. (Plate 5. F).

Distribution: W. C. &E. Nepal, India, China, Tibet, Myanmar, Pakistan, Afghanistan, Africa, America, S. and W. Europe.

Ecology: Mostly lithophytic in the walls.

Voucher specimen: Palpa, Madanpokharara, 804m, 28th Dec, 2021, S. Neupane and S. Gyawali, P24 (TUCH)

Adiantum edgeworthii Hook., Sp. Fil. 2: 14, t. 81b. (1851); Beddome: 17 (1892); Hope: 237(1900); Ching: 315 (1957); Ito: 459 (1966); Iwaatsuki: 270 (1988); Nakaike & Gurung: 188 (1988a); DPR: 61 (2002); Frazer-Jenkins: 205 (2015).

Adiantum guilelmi Hance, J. Bot. 7: 261 (1869)

Adiantum spencerianum Copel., J. Sci. 1 (Suppl.2): 154 (1906)

Terrestrial small-medium plant ca. 12-35cm long. Rhizomes erect and short covered by dark brown scales. Stipe short (to ca. 6cm long), slender, dark brown, base covered by scales and fine hairs towards above. Fronds erect or pendant, pinkish when young, 8-20cm long and 1.5-3cm wide, simply pinnate, linear lanceolate, apex attenuate; rachis brown with fine hairs, slender, apex often enlarge into a long whiplike stolon with small reducing pinna at distant into soil to form new plantlets. Single pinna with lobes at the upper margin; veins free and dichotomously forked. Sori at apex margin, 2-5 per pinna, false indusium, globose or oblong, brownish color. (Plate 2. A).

Distribution: W. C. & E. Nepal, China, Tibet, Bhutan, Sikkim, Darjeeling, Jammu and Kashmir, Myanmar, Uttarakhand.

Ecology: Terrestrial found in the forest floor or forest walls.

Voucher Specimen: Palpa, Tinau, 305m, 6th Nov, 2021, S. Neupane and S. Sharma, P22, (TUCH).

Adiantum philippense L. subsp. **philippense**, Sp. Pl. 2: 1094 (1753); Tagawa: 79: (1955); Bonner: 201 (1956); Banerji: 269 (1972); Nakaike and Gurung: 189 (1988a); Thapa: 62 (2002); Frazer- Jenkins: 214 (2015).

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

Terrestrial plant upto 50cm tall. Rhizome erect with dense rhizoids below and covered with dark brownish scales. Stipes dark brown, smooth and shiny, 10-20cm long, slender, slightly grooved, base with some scales and above glabrous. Frond simply pinnate, 15-28cm long and 3-7cm broad, pinna alternate with distinct petiole (2-2.5cm long). Single pinna flabellate with shallow sinuses or slightly undulate at upper margin and slightly oblique at lower margin with

the petiole; texture herbaceous, glabrous both surfaces. Veins free and forked. Sori all along edge of margin protected by reflexed margin i.e. false indusium; dark brown in color.

Distribution: W. C. &E. Nepal, India, China, Myanmar, Bhutan, Pakistan, Thailand.

Ecology: Terrestrial at the walls and floor of forest.

Voucher Specimen: Palpa, Khaseuli, 1320m, 1st Nov., 2021, S. Neupane and B. Parajuli, P07, (TUCH).

Aleuritopteris Fee.

Plant terrestrial or lithophytic. Usually erect, or sub-erect, short, creeping, scale-covered rhizomes. Scales brown to black, concolorous or bicolorous. Stipes and rachis slender, glabrous, dark brown or black, most oftenly with hairs and scales. Fronds in cluster form, simply pinnate-bipinnate or more, abaxially covered with farina of white or milky yellow in color, basal pinna usually large. Sori marginal, covered by false indusium, dark brown to black colored.

Key to species

1a. Small fronds, stipe and rachis covered with small bicolorous scales…….*A. formosana*

1b. Medium-large frond, stipe and rachis without bicolorous scales except at base……..2

2a. Lamina 30-45cm long and 10-15cm broad, pendant……..….*A. dealbata*

2b. Lamina 10-20cm long and 5-10cm broad, erect……..*A. bicolor*

Aleuritopteris bicolor (Roxb.) Fraser-Jenk. Fern Gaz. 18: 223 (2009); Fraser- Jenkins *et al.*: 232 (2015).

Cheilanthes bicolor (Roxb.) Griff. *ex* Fraser-Jenk., Pak. Syst: 5 (1-2): 94 (1991 publ. 1992), 144 (1993).

Plant terrestrial or lithophytic commonly called Silver fern. Rhizome erect or sub-erect covered with bicolorous scales. Stipes 5-15cm long, thin, dark purplish brown, with very narrow, bicolorous scales at base and upper part glabrous. Fronds tufted, lamina 10-20cm long and 5-10cm broad, bipinnate, deltate-pentagonal, the lowest pinna the longest, with long basal basiscopic pinnules, finely dissected or lobed, pale or yellowish green; lower surface covered with white farinose, texture sub-coriaceous. Veins obscure. Sori marginal, covered by false indusia. Spores dark-brown.

Distribution: W., C. & E. Nepal, W., N. E. & S. India, Rajasthan, Sikkim, Darjeeling, Pakistan, Myanmar, W. Africa.

Ecology: Terrestrial found on the walls in semi-open forest besides path.

Voucher Specimen: Palpa, Khaseuli, 1325m, 1st Nov. 2021, S. Neupane and B. Parajuli, P05, (TUCH).

Aleuritopteris dealbata (C. Presl) Fée, Mém. Foug., 5. Gen. Filic. : 154 (1852); Fraser-Jenkins *et al.*: 237(2015).

Chilanthes dealbata D. Don, Prodr. Fl. Nepal.: 16 (1825), nom. illeg.

Aluritopteris doniana S.K. Wu, Acta. Bot. Yunnan. 5: 169 (1983), nom. superfl.

Terrestrial, or lithophytic. Rhizomes erect, short with bicolorous scales; dark brown to black in the centre and pale in the margin, lanceolate. Stipe dark brown to black, shiny and smooth, 12-16cm long, base with scales. Fronds clustered, pendent, 30-45cm long and 6-10cm wide; lamina lanceolate or oblong lanceolate, bipinnate, oppositely arranged, basal basiscopic pinnules enlarge (3-4cm×0.3-0.6cm), pinnules margin slightly dentate and apex rounded, abaxial surface with white farina densely covered except at thin middle vein, adaxial surface glabrous, dark green in color, pinna apex acuminate. Sori throughout the margin, poorly developed false indusia, very narrow or occasionaly indistinct; Spores brownish in color.

Distribution: W. C. & E. Nepal, China, Myanmar, Bhutan, Sikkim, Darjeeling, Uttarakhand, Thailand.

Ecology: Lithophytic, found on rocky wall in roadside.

Voucher specimen: Palpa, Aaryabhanjyang side, 950m, 12th Mar, 2021. S. Neupane and C. Neupane, P34, (TUCH).

Aluritopteris formosana (Hayat) Tagawa, Acta Phytotax. Geobot. 14: 199 (1952); Fraser-jenkins *et al.*: 241 (2015).

Cheilanthes formosana Hayata in Matsum. & Hayata, Enum. Pl. Formos.: 612 (1906); Fraser-Jenkins: 73 (1997b).

Plant lithophytic, small. Rhizomes erect covered with bicolorous scales. Stipe dark-brown, thin, 3-5cm long, bearing many small bicolorous, pale-edged scales extending up to the rachis. Fronds in cluster, lamina 5-12cm long and 3-5cm broad, bipinnate, oblong-lanceolate, pinna 4-

6 pairs, acroscopic pinnules smaller and basal basiscopic ones largest, second pairs oblong-lanceolate; upper surface dark green and lower surface covered with white farina, texture sub-coriaceous. Veins obscure. Sori marginal, pseudoindusia prominent, light brown divided into crowded lobes around the edge of segments, membranous, broad. (Plate 2. C).

Distribution: W., C. & E. Nepal, China, Tibet, Myanmar, Arunanchal Pradesh, Bhutan, Sikkim, Darjeeling, Taiwan, Philippines.

Ecology: Lithophytic, found on the surface of large rock in shaded forest.

Voucher Specimen: Palpa, Tahu, 1415m, 3rd Sep. 2022, S. Neupane and S. N. Khanal, P67, (TUCH).

Antrophyum Kaulf.

Plant lithophytic or epiphytic. Rhizome erect short or creeping, covered by clathrate scales and numerous hairy roots. Stipe short, narrow or almost absent. Fronds simple, fleshy or leathery; lamina lanceolate or oblanceolate, occasionally linear, obovate and spatulate; apex forked or acute, base narrow like stipe or somewhat cuneate, decurrent. Costa typically present in basal part or sometimes absent; lateral veins are profusely reticulate, free veinlets are absent. Sori creating coenosorus, linear sori on lateral veins, exinduciate, netted or branching with abundant paraphyses, Spores brownish.

Antrophyum reticulatum (G. Forst.) Kaulf., Enum. Filic. 194 (1824); Fraser- Jenkins: 374 (2015).

Hemionitis coriaceae D. Don., Prodr. Flor. Nepal.: 13 (1824)

Lithophytic plant with short and erect rhizome covered by hair like dark brown to black scales. Stipes short or almost absent but rather may be narrow decurrent wing of laminar tissue. Fronds in cluster form, simple, unlobed, somewhat leathery, 10-25cm long and 1-5cm broad, lamina lanceolate, base narrowly decurrent, linearly wide at middle and tapering to an acute apex above; adaxial surface glabrous with striated lines and smooth. Sori in the abaxial surface linearly arranged in a reticulate pattern of lines following the veinlets, exindusiate, with a mass of brown ribbon-like paraphyses. (Plate 2. B).

Distribution: C. & E. Nepal, China, Tibet, Myanmar, Bhutan, Sikkim, Dargeeling, Sri Lanlka, Thailand, S. E. Asia.

Ecology: Lithophytic, found in the large rock.

Voucher Specimen: Palpa, Barangdi, 1164m, 27th Aug, S. Neupane and S. N. Khanal, P60, (TUCH).

Cheilanthes Sw.

Plant terrestrial and lithophytic. Rhizome short and erect, creeping covered by light brown to dark brown, concolorous or bicolorous scales. Stipes erect, dark brown to black, slender, sparsely or densely hairy or scaly. Fronds clustered, monomorphic; lamina lanceolate, oblong or ovate, pinnate-tripinnate, surface hairy or glabrous on both sides. Veins free or forked distally. Sori marginal at vein tips inducia formed by reflex margin or absent.

Cheilanthes tenuifolia (Burm. f.) Sw., Syn. Fil.: 129, 332 (1806); Frazer-Jenkins *et al.*: 263 (2015).

Small terrestrial fern. Rhizome short, bearing small yellowish brown scales and divided roots with many small lateral tips. Stipe erect, thin, dark brown, glossy, base with small scales, 15-25cm long, longer than the lamina. Fronds clustered, lamina deltate-pentagonal, shorter than stipe, 5-14cm long and 4-10cm broad, tripinnate- finely quadripinnatified, the basal pair of pinna and its basal basiscopic pinnule being the largest; abaxial surface glabrous while adaxial surface with some minute glandular hairs; rachis and costa grooved with fine hairs in adaxial surface, margin entire or somewhat undulate, apex acuminate. Sori marginal, false indusia continuous around the margin of lobes or not. Spores black at maturity.

Distribution: W. C. & E. Nepal, China, Myanmar, Arunanchal Pradesh, Sikkim, Darjeeling, W. Bengal, S.E. Asia, Pakistan.

Ecology: Terrestrial, found in the open grassland along with grasses.

Voucher Specimen: Palpa, Dhobidhara, 1150m, 26th Aug, 2022, S. Neupane and S. Aryal, P43, (TUCH).

Coniogramme Fee

Terrestrial plant. Rhizome short-creeping, slightly thick, covered with brown scales. Stipe long, erect, straminous, grooved, base with scales, glabrous above. Fronds monomorphic, large; lamina 1-2 pinnate or sometimes imparipinate, glabrous or hairy on one or both surfaces, shortly petiolated, pinnules lanceolate or oblong-lanceolate, base rounded, apex caudate, margin entire or serrate; veins free or anastomosing. Sori linear along veins, exindusiate.

Coniogramme intermedia Hieron., Hedwigia., 57: 301 (1916); Bista *et al.* : 68 (2002); Frazer-Jenkins *et al.*: 268 (2015).

Coniogramme intermedia var. *villosa* (Ching) Sa. Kurata, Hokuriku J. Bot. **4**: 115 (1955)

Terrestrial large fern. Rhizome short-creeping, thick covered with brownish scales. Stipe erect, straw colored, grooved, 30-45cm long and 0.3- 0.6cm broad, base with scales. Fronds large, 40-50 cm long and 15- 30 cm broad, bipinnate, lamina ovate-deltoid, both surface glabrous, texture slightly leathery, pair of pinna alternate with short prtiole, certain gap in between first to second pair of alternate pinna; basal pinna longer than distal pairs, basal pinna with shorter acroscopic pinnules. Pinnules 10-25 cm long and 2-4cm broad, simple pinna oblong-lanceolate, base rounded, apex long (ca. 2.5-3.5cm long) caudate, margin slightly serrate; rachis and costa with same color pale to whitish, stramineous. Veins free or 1-2 forked. Sori extending from midrib to the margin, continuous to the veins, exindusiate. Spores brown.

Distribution: W. C. & E. Nepal, China, Tibet, Sikkim, Darjeeling, Jammu & Kasmir, Bhutan, Pakistan, Taiwan, Japan, Siberia.

Ecology: Terrestrial, found in the shade area of forest.

Voucher Specimen: Palpa, Khaseuli, 1343m, 8th Mar, 2022, S. Neupane and A. Neupane, P32, (TUCH).

Onychium Kaulf.

Plant terrestrial or sometimes lithophytc. Rhizome erect, short or long creeping, covered by light brown scales. Stipe long, straminous to brownish, base with scales, grooved at abaxial surface. Fronds large, monomorphic or oftenly dimorphic, finely dissected, lamina 3-5 pinnate, ovate- deltoid or lanceolate, alternate pinna, herbaceous texture, glabrous. Veins simple and free. Sori linear along veins, false indusia present except at base or apex.

Key to Species

1a. Rhizome subterranean, creeping, sori oblong, spores brownish……*O. vermae*

1b. Rhizome short-creeping, sori linear, spores golden yellowish…….. *O. siliculosum*

Onychium vermae Fraser-Jenk. & Khullar, Ferns and Fern Allies of Nepal **1**: 300 (2015)

Terrestrial fern. Rhizome subterranean, creeping, covered with brownish scales. Stipe long, erect or sub-erect, grooved, 30-40cm long and 0.3-0.5cm broad, basal region dark brown to

black with scales and above stramineous, equal or longer than lamina. Fronds arising separately, lamina 25-35cm long and 10-15cm broad, triangular-lanceolate, 3-4 pinnate, finely dissected and toothed pinnules in sterile fronds and well-dissected pinnule with separated pinnulets to their bases in fertile fronds, pinna alternate, cuneate base, apex acuminate; rachis slightly grooved and glabrous., texture sub-coriaceous. Veins free and forked. Sori oblong, slightly divergent towards their bases, pseudoindusia whitish to pale brown at maturity, entire, often not opening very widely on soral ripening, membranous, persistent.

Distribution: W. & C. Nepal, China, Bhutan, Sikkim, Darjeeling, Uttarakhand, Jammu and Kashmir, Pakistan.

Ecology: Terrestrial found in the forest slopes and edges of paths in semi-open area.

Voucher Specimen: Palpa, Chandibhangyang, 1409m, 8th Sep. 2022, S. Neupane and S. N. Khanal, P75, (TUCH).

Onychium siliculosum (Desv.) C. Chr., Ind. Fil.: 468 (1906); Ito: 464 (1966); Chowdhury : 37 (1973); Iwatsuki: 176 (1975); Dixit : 67 (1984); Naikaike & Gurung : 195 (1988a); Frazer-Jenkins: 317 (1997b); Bista *et al.*: 71 (2002); Frazer-Jenkins *et al.*: 297 (2015).

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

Onychium auratum Kaulf., Enum. Fil.: 144 (1824); Clarke: 458 (1880); Beddome: 96, f.49 (1883); Hope: 443 (1901).

Terrestrial fern with short-creeping rhizome with light brown scales. Stipe long, erect, 30-45cm long and 0.2-0.3cm broad, straminous to brown, grooved upto rachis. Fronds dimorphic, sterile frond dissected, 25-35cm long and 12-18cm broad; sterile fronds ovate-deltoid, 2-4 pinnate, auminate apex without farina while fertile fronds ovate to lanceolate or oblong to ovate, 2-3 pinnate, long terminal segment, with yellow farina, pinna alternate, margin entire, texture coriaceous. Veins free or forked. Sori covered in whole pinnule of abaxial surface with golden yellow farina, false indusia linear, papery. (Plate 2. D).

Distribution: W. C. & E. Nepal, China, Tibet, Sikkim, Darjeeling, Uttarkhand, Bhutan, Bangladesh, Thailand, Taiwan; S.E. Asia, Pacific Islands.

Ecology: Terrestrial found in roadside wall.

Voucher Specimen: Palpa, Bhairabsthan side, 1414m, 1st Nov. 2021, S. Neupane and B. Parajuli, P02 (TUCH).

Pityrogramma Link, Habdbuch.

Plant terrestrial. Rhizome short and erect, covered with brown, thin, linear-lanceolate scales. Stipes erect, dark purplish, shiny and smooth, slightly grooved, scaly base and above glabrous. Fronds monomorphic and clustered; lamina 2-3 pinnate, ovate-oblong, apex acuminate; pinna lanceolate with many anatropous pinnules, abaxial surface with white waxy farina, texture sub-coriaceous. Veins free. Sori along the veins, exindusiate.

Pityrogramma calomelanos (L.) Link, Handb. Gew. 3: 20 (1883); Ito: 464 (1996); Iwatsuki: 176 (1975); Naikaike and Gurung: 195 (1988a); Bista *et al.*: 72 (2002); Fraser- Jenkins *et al.* : 303 (2015).

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

Terrestrial medium- large fern. Rhizome short and erect, covered with light-brown, narrow, thin scales. Stipes erect, usually tufted, redish-brown, shiny and smooth, 25-35 cm long and 0.2-0.4cm broad, base with scales and glabrous above, grooved. Fronds clustered, 30-50cm long and 8-15 cm wide; lamina bipinnate, triangular-lanceolate; pinna numerous, 5-15×2-5cm, narrowly elongated triangular to lanceolate with acute apices; pinnules 16-20pairs, 1-1.5× 0.2-0.4cm, oblique, narrowly deltoid with serrate margins, apex acute, abaxial surface with dense white farina and above dark green, glabrous, texture sub-coriaceous; rachises and costa reddish-brown, glabrous and grooved adaxially. Veins free and forked. Sori along the veins, covering the abaxial surface of pinnule at maturity, exinduciate. Spores black colored, globose.

Distribution: W. C. & E. Nepal, Myanmar, China, Bhutan, India, Sri Lanka, Bangladesh; Africa, Australasia, Pacific Islands, C. and S. America.

Ecology: Terrestrial, found in roadsides slopes beside stream.

Voucher Specimen: Palpa, Kajipauwa, 1133m, 2nd Aug. 2022, S. Neupane, P56, (TUCH).

Pteris L.

Plant terrestrial. Rhizomes short, erect or ascending, sometimes creeping, covered with brownish, lanceolate, thin scales. Stipes long, erect, grooved on adaxial surface, scales at their base or throughout. Fronds clustered, monomorphic, simply pinnate or binate-tripinnate, glabrous or pubescent, texture herbaceous to coriaceous; rachis grooved. Veins free or anastomosing. Sori marginal except at apex, false indusium, usually formed by reflexed margin of pinna.

Key to Species

1a. Fronds monomorphic……..2

1b. Fronds dimorphic…….*P. cretica* L. subsp. *cretica*

2a. Lamina simply pinnate……*P. vittata* L. subsp. *vittata*

2b. Lamina bipinnate-tripinnate……3

3a. Leaf blade 3-partite, without lower basiscopic pinnules……*P. wallichiana*

3b. Leaf blade with lower basiscopic pinnules…….4

4a. Leaf rachis, costa and costules pinkish……..……..*P. normalis*

4b. Leaf rachis,costa and costules stramineous or green or purplish……5

5a. Sori marginal from base to near apex……*P. biaurita* L. subsp. *walkeriana*

5b. Sori marginal except at base and apex, in mid-way……....*P. aspericaulis*

Pteris aspericaulis Wall. *ex* J. Agardh, Rec. Sp. Gen. Pteridis: 22 (1839); Iwatsuki: 176 (1975); Dixit: 276 (1984); Gurung: 38 91986); Nakaike *et al.*: 195 (1990); Fraser-Jenkins: 317 (1997b); Bista *et al.*: 72 (2002); Fraser-Jenkins *et al.*: 310 (2015).

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

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

Plant terrestrial. Rhizome ascending, short covered with linear-lanceolate, blackish brown scales. Stipe 30-35cm long, color variable from purplish-stramineous, slightly asperous. Fronds clustered, lamina 35-50cm long and 15-25cm broad, bipinnate, oblong-ovate; pinna opposite-sub-opposite, sessile, oblong-lanceolate, base slightly truncate, apex shortly acuminate or caudate, basal pair of pinna with 1 or 2 basiscopic pinnules, mid-rib upper surface with short setae or spines and grooved, lower surface purplish. Pinnules opposite, base linear,apex mucronate or obtuse, with sharp corner; texture sub-coriaceous. Veins forked. Sori marginal except at base and apex, inducia short, light green.

Distribution: W., C. & E. Nepal, China, Tibet, Bhutan, Sikkim, Darjeeling, Jammu & Kashmir, Pakistan.

Ecology: Terrestrial, found in side of path on walls.

Voucher Specimen: Palpa, Chhahara, 1745m, 31st Oct. 2022, S. Neupane and B. Neupane, P84, (TUCH).

Pteris biaurita L. **walkeriana** Fraser-Jenk., Sp. Pl. 2:1076 (1753); Clarke: 469 (1880); Hope: 455(1901); Ito:465 (1966); Iwatsuki: 177 (1975); Gurung: 39 (1986); Nakaike *et al.*: 195 (1990); Bista *et al.*: 73 (2002); Fraser-Jenkins *et al.*: 318 (2015).

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

Pteris nemoralis Willd., Enum. Pl.: 1073 (1809); Alston & Bonner, Candollea 15: 202 (1956).

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

Plant terrestrial. Rhizome erect, covered by brownish scales. Stipe 20-30cm long, light brown at base and apically stramineous to green. Fronds clustered, lamina 30-50cm long and 15-25 cm broad, bipinnate-tripinnate, pinna 4+ pairs opposite pinna, lower pair shortly stalked and upper sessile, base broadly cuneate and apex caudate, lowest pair bearing accessory basal basiscopic pinnules. Pinnules sinuses rounded to obtuse or U shaped, pinnules base slightly enlarged, apex rounded or obtuse; surface glabrous, upper surface mid-vein bearing short spines or sometimes deciduous; texture thickly papery when dried. Veinlets from the costa anastomose to form areoles along costule and the veinlets outward are 2-forked. Sori marginal along the margin from base towards near the apex, indusium light brown, persistent.

Distribution: W., C. & E. Nepal, China, Tibet, Myanmar, Bhutan, Arunanchal Pradesh, Sikkim, Darjeeling, N. E., C. & S. India, Bangladesh, Thailand, Sri Lanka.

Ecology: Terrestrial found on the slopes and floor of the forest beside paths.

Voucher Specimen: Palpa, Bhairabsthan side, 1416m, 1st Nov. 2021, S. Neupane and B. Parajuli, P01 (TUCH).

Pteris cretica L. subsp. **cretica**, Mant. Pl.: 130 (1771); D.Don: 15 (1825); Clarke: 462 (1880); Beddome: 106 (1883); Hope: 449 (1901); Tagawa: 78 (1955); Ito; 465 (1966); Iwatsuki: 177 (1975); Roy *et al.*: 194 (71); Gurung: 39(1986); Nakaike *et al.*: 196 (1990); Bista *et al.*: 73 (2002); Frazer-Jenkins *et al.*: 321 (2015).

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

Terrestrial plant, Rhizomes short- creeping or suberect covered by dark brown scales. Stipe slender, straminous, 15-20 cm long, glabrous. Fronds clustered and dimorphic. Sterile fronds are shorter, 9-12cm long and 5-8cm broad, simply pinnate, more spreading with wider segments, margins serrate, 2-5 pairs of opposite pinna, usually with basiscopic pinna,frond-apex imparipinnate with similar long, unlobed terminal segment, pinna fused to the base of terminal segment. Fertile fronds long, simply pinnate, opoosite, linear, 20-25cm long and 8-14cm broad, narrower segments, margin entire but sometimes apex without sori is serrate, acute apex, surface glabrous, texture herbaceous. Veins free and forked. Sori linear, along margin except at apex, protected by reflexed margin.

Distribution: W. C. & E. Nepal, China, Myanmar, Tibet, Bhutan, Uttarakhand, Himachal Pradesh, Pakistan, Sri Lanka, Taiwan; Africa, Europe, Turkey.

Ecology: Terrestrial plant found in the shaded area of forest near water source.

Voucher Specimen: Palpa, Barangdi, 1160m, 27th Aug. 2022, S. Neupane and S. N. Khanal, P59, (TUCH).

Pteris normalis D. Don, Prodr. Fl. Nep.: 15 (1825); Fraser-Jenkins *et al.*: 338 (2015).

Pteris scabristipes Tagawa, Acta. Phytotax. Geobot. **5**: 103 (1936).

Terrestrial medium-large fern. Rhizome short, erect covered with bright-blackish scales. Stipe brick pink to purplish-brown, grooved adaxially, 35-45cm long and 0.2-0.4cm broad, slightly rough surface. Fronds clustered, 30-50cm long and 20-30cm broad, bipinnate, 4-9 (-10) pairs of pinna, texture brittle, deltoid-lanceolate, larger segments, basal pinna large with 1-2 basiscopic pinnules; base rounded, apex acuminate, many pinnules ;rachis, costa and costule pinkish, slightly grooved; pinkish, short, pointed setae present above the segment-midrib. Veins simply forked. Sori linear towards margin except at apical region, indusium present formed from reflexed margin, light pinkish, membranous. (Plate 2. E).

Distribution: C. & E. Nepal, N. E. India, Sikkim, Darjeeling, Arunanchal Pradesh. China, Bhutan, Taiwan, Myanmar, etc.

Ecology: Terrestrial found in the slope of forest under shaded area.

Voucher Specimen: Palpa, Jogipani, 1490m, 8th Mar. 2021, S. Neupane and A. Neupane, P35 (TUCH).

Pteris vittata L. subsp. **vittata**, Frazer-Jenkins *et al.*; 360 (2015)

Pteris vittata L. Sp. Pl. 2: 1074 (1753)

Terrestrial plant. Rhizome erect or suberect covered with pale brown scales. Stipe straminous, 20-25cm long, dense scales at base and sparsely scaly above. Fronds erect to arching, 70-80cm long and 20-25 cm broad, lamina simply pinnate, alternate to sub-opposite pinna; frond apex imparipinnate, longer and drooping terminal segment. Pinna many 25-30 pairs, linear, base slightly cordate, margin entire and slightly serrate towards apical region of pinna, texture sub-coriaceous; lower 5-7 pairs of pinna reduced and sterile. Veins free and forked. Sori marginal except at apical region, indusium whitish, membranous, formed by reflexed margin.

Distribution: W. C. & E. Nepal, Pakistan, Kashmir, China, Himachal Pradesh, Taiwan, Korea;Africa, Pacific Islands, New Guinea.

Ecology: Terrestrial found in the walls of roadside.

Voucher Specimen: Palpa, Batase, 1485m, 26th Jul. 2022, S. Neupane and S. Aryal, P36, (TUCH).

Pteris wallichiana J. Agardh, Rec. Sp. Gen. Pteridis: 69 (1839); Clarke: 469 (1880); Hope: 456 (1901); Ito: 467 (1966); Iwatsuki: 178 (1975); Dixit: 73 (1984);Gurung: 194 91986); Matsumoto and Nakaike: 165 (1990); Thapa: 9 (2000); Bista *et al.*: 76 (2002); Frazer- Jenkins *et al.*: 368 (2015).

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

Terrestrial large fern ca. 1.5m tall. Rhizome erect, short, thick, stout, covered with bright-brown scales. Stipes erect, slightly extended at base, 40-80 cm long and 1-2.5cm broad, dark purplish to deep brown, glabrous, glossy, grooved adaxial surface, base with scales. Fronds clustered and much large, umbrella-like, lamina 3-partite, broadly ovate- pentagonal in outline, short stalked, large radiating pinna (30-60 cm long and 10-15cm broad), sub-opposite, linear-lanceolate, acuminate, dissected pinnules, oblong-broadly lanceolate, slightly serrate margin with rounded to obtuse apex; rachis and costa straminous, brownish, glabrous and slightly grooved adaxial surface. Veins inarching near the base. Sori linear in margin except at the apical parts, inducium formed by reflexed margin. (Plate 2. F).

Distribution: W. C. & E. Nepal, China, Tibet, Bhutan, Myanmar, Arunanchal Pradesh, Sikkim, Darjeeling, Uttarakhand, Jammu & Kashmir ; Thailand, S.E. Asia.

Ecology: Terrestrial, found in shaded area of forest.

Voucher Specimen: Palpa, Jogipani, 1480m, 4th Sep. 2022, S. Neupane and S. N. Khanal, P72, (TUCH).

Vittaria J. E. Smith, Mem.

Plants usually epiphytic or sometimes lithophytic. Rhizomes short or long creeping covered with brown scales and slightly with hairs. Stipe very short and rachis distinct. Fronds clustered, lamina simple, linearly arranged, grass like, margin entire, surface glabrous, texture coriaceous. Sori linear, along the margin or submarginal vein, exindusiate. Spores dark brown, monolete.

Vittaria flexuosa Fee, Mem. Fan Foug.: 16 (1852); Clarke: 574 (1880); 499 (1966); Iawtsuki: 204 (1975); Dixit: 82 (1984); Gurung: 110 (1986); Nakaike *et al.*: 197(1990); Frazer-Jenkins *et al.*: 379 (2015).

Epiphytic plant. Rhizome short-creeping, thin, covered by dark greyish brown, linear and sometimes clathrate scales. Stipes very short, 0.3-1cm long, winged, dark at the base with some scales. Fronds simple, linear, grass-like, 30-50cm long and 0.3-0.5cm broad, lamina with midrib raised in lower surface and gap between it and sori, indistinct on upper surface, gradually narrowing towards apex and towards stipe, margin narrowly curved. Sori in submarginal grooves, facing downwards with raised inner-lip ridge along inner edge. Spores golden-light brown. (Plate 3. A).

Distribution: W. C.& E. Nepal, Bhutan, China, Tibet, Arunanchal Pradesh, Sikkim, Darjeeling, Uttarakhand, N.E. and S. India; Japan, South Korea , etc.

Ecology: Epiphytic found in the bark of tree-branches in forest.

Voucher Specimen: Palpa, Jogipani, 1424m, 4th Sep 2022, S. Neupane and S. N. Khanal, P70, (TUCH).

Aspleniaceae Mett. *ex* Frank

Terrestrial, epiphytic or rarely lithophytic. Rhizomes short or long creeping, erect or suberect covered with clathrate dark brownish scales. Stipes non- articulate and base with scales. Fronds small to large, simple to decompound, clustered, texture herbaceous or leathery. Veins free, forked or anastomosing. Sori linear along the veinlets, indusium membranous.

Asplenium L.

Plant terrestrial or epiphytic. Rhizomes short creeping or erect, covered densely with dark brown clathrate scales. Stipes slender, green to black, usually free from rhizome, sparsely covered with scales. Fronds simple or decompound, glabrous or scaly, texture herbaceous or leathery, margin entire or serrate, apex obtuse or mucronate. Veins forked, free or anastomosing. Sori linear to subelliptic along the veins protected by membranous indusium.

Asplenium yoshinagae Makino subsp. **indicum** (Sledge) Fraser-Jenk., Pak. Syst. 5: 85-120 (1991 publ. 1992); Fraser- Jenkins: 324 (1997b); Bista *et al.*: 89 (2002); Fraser- Jenkins *et al.*: 39 (2019).

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

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

Plant terrestrial and epiphytic. Rhizomes short and erect covered with dense reddish-brown to dark-black, clathrate scales. Stipe greenish, 3.5-6cm long, slightly grooved in adaxial surface, scaly. Fronds compound, lamina 11-20cm long and 2.5-5cm broad, 1-pinnate, narrowly triangular or oblong-lanceolate, 12-20 pairs, alternate or lower ones opposite, shortly petiolated, acroscopic side more or less deeply lobed than first basiscopic lobe, base narrowly cuneate, apex acute or acuminate, margin irregularly lobed with teeth like projections; rachis sparsely scaly, green, slightly grooved adaxially. Veins free and forked. Sori linear along veins running near to the margin, 0.3-0.6cm long, indusium distinct, whitish. Spores brown.

Distribution: W. C. & E. Nepal, Bhutan, Tibet, Arunanchal Pradesh, Sikkim, Darjeeling, Jammu & Kashmir; China, Japan, Myanmar, Thailand.

Ecology: Epiphytic found in the mossy tree trunks.

Voucher Specimen: Palpa, Chhahara, 1723m, 9th Sep. 2022, S. Neupane and B. Neupane, P80, (TUCH).

Thelypteridaceae Pich. Serm.

Terrestrial ferns. Rhizomes erect, suberect, or creeping, scaly. Stipes slender, stramineous, base scaly, sometimes hairy. Fronds monomorphic or dimorphic. Lamina pinnate to pinnatifid. Rachis and costa grooved adaxially or not, hairy or glabrous. Veins free or anastomosing. Sori round, oblong or shortly linear, rarely elongate along veins, indusiate or exindusiate.

Thelypteris Schmidel

Plant terrestrial. Rhizomes erect, short or long creeping covered with scales. Stipes erect, stramineous,usually scaly, glabrous or hairy. Fronds generally pinnatifid, oblong-lanceolate with fine hairs, pinna many, texture herbaceous. Veins free, pinnate on segments, simply forked veinlets. Sori orbicular, dorsal or on the veinlets between costules and margin, indusia orbicular to reniform, hairy or glabrous, persistent or deciduous.

Key to Species

1a. Rhizome thick, erect……2

1b. Rhzome thin, creeping……3

2a. Stipe with swollen pneumatophores, indusium glabrous……*T. tylodes*

2b. Stipe without pneumatophores, indusium short-hairy……..*T. papilio*

3a. Lamina simply pinnate……..4

3b. Lamina pinnate-pinnatifid…….....5

4a. Pinnae narrow with truncate base…….*T. penangiana*

4b. Pinnae broad with rounded base……..*T. nudata*

5a. Pinna shallowly lobed with mucro at tip of each lobe, texture papery……*T. arida*

5b. Pinna half way or deeply lobed to the costa with acute-rounded apex, texture herbaceous…6

6a. Stipe, rachis, costa and surface hairy……..……*T. dentata*

6b. Stipe, rachis, costa and surface glabrous or sometimes can be hairy……7

7a. Lower 5-6 pairs of pinna reduced to butterfly-like…….*T. ornatipes*

7b. Lower 1-2 pairs reduced slightly or not reduced……..8

8a. Lamina rachis apically with proliferous bulbil, sori exindusiate…….*T. prolifera*

8b. Lamina rachis without proliferous bulbil, sori indusiate……..9

9a. Stipe and pinna narrow, do not form colonies……*T. glanduligera*

9b. Stipe and pinna slightly broad, form colonies…….*T. procera*

Thelypteris arida (D. Don) C. V. Morton, Amer. Fern J. 49: 113 (1959); Iwatsuki: 310 (1988); Bista *et al.*: 91 (2002); Fraser- Jenkins & Kandel: 43 (2019).

Aspidium aridum D. Don, Prodr. Fl. Nepal. 4 (1825)

Christella arida (D. Don) Holttum in Nayr and Kaur, Comp. Bedd. Handb. Ferns Britt. India: 206 (1974), Kew Bull. 31:320 (1976); Dixit : 130 (1984); Nakaike and Gurung : 190 (1988a)

Terrestrial plant. Rhizome long creeping covered with brown lanceolate scales. Stipes 10-15cm long, light brown, slightly grooved adaxial surface, hairy. Fronds 1-pinnate, 60-80cm long and 15-30 cm broad, linear-lanceolate; Pinnae sub-opposite to alternate, sessile, very shallowly lobed at their margins with a prominent mucro at the tip of each lobe, oblong-lanceolate, apex acuminate; texture papery when dry; basal 2-10 pairs of pinna reduced, upper surface slightly glabrous except costa, but lower surface hairy, rachis, costa and costule hairy. Veinlets raised beneath some pairs anastomosing. Sori orbicular, single row along terminal part of veinlets on both sides of costule, indusiate. Spores dark brown to black on maturity.

Distribution: W. C. & E. Nepal, India, Tibet, China, Bhutan, Taiwan; Australasia, S. E. Asia, Pacific Islands.

Ecology: Terrestrial found in the forest floor on the roadside.

Voucher Specimen: Palpa, Barangdi side, 1155m, 27th Aug, 2022, S. Neupane and S. N. Khanal, P64 (TUCH).

Thelypteris dentata (Forssk.) E.P.St. John, Amer. Fern J. 26 (2): 44 (1963); Iwatsuki: 483 (1966), 308 (1988); Bista *et al.*: 93 (2003); Fraser-Jenkins & Kandel: 51 (2019).

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

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

Terrestrial plant. Rhizome short-creeping, ascending covered with brownish lanceolate scales. Stipe light brown, 10-25cm long, hairy, base with scales, grooved adaxial surface. Fronds pinnate-pinnatifid, lamina 35-70cm long and 10-20cm broad, oblong lanceolate; pinna sub-opposite, sessile, lanceolate, base truncate, apex acuminate, margin lobed about half or little more to the costa, lobes slightly oblique, subfalcate, rounded; basal 2-3 pairs of pinna reduced, both surfaces of pinna densely hairy, texture herbaceous; rachis, costa and costules hairy on both surfaces. Veins simply pinnate and free, the lowest one joining with the vein of the

adjacent segment. Sori in single row on either side of costule, indusium reniform, densely hairy in young indusium, persistent. Spores dark brown.

Distribution: W. C. and E. Nepal, India, China, Tibet, Bhutan, Bangladesh, Myanmar, Sri Lanka; Autralasia, Pacific Isles, Arabia, Africa, S. Europe, N. & S. America.

Ecology: Terrestrial, found in the forest floor along roadside.

Voucher Specimen: Palpa, Khaseuli, 1328m, Nov. 1st, 2021, S. Neupane and B. Parajuli, P10, (TUCH).

Thelypteris glanduligera (Kunze) Ching, Bull. Fan Mem. Inst. Biol. (Bot.) **6**: 320 (1936); Bista *et al.*: 94 (2002); Fraser-Jenkins and Kandel: 57 (2019).

Parathelypteris glanduligera (Kunze) Ching, Acta Phytotax. Sin. **8**: 303 (1963); Dixit: 110 (1984); Nakaike & Gurung: 195 (1988a).

Aspidium glanduligerum Kunze, Anal. Pterid.: 44 (1837).

Plant terrestrial. Rhizome long creeping, thin covered with sparse scales. Stipe thin, 15-25cm long, covered with short hairs, grooved adaxially. Fronds erect, arising separately, lamina 15-30cm long and 5-10cm broad, pinnate-pinnatifid, lanceolate or broadly lanceolate. Pinnae sub-opposite at lower pairs and alternate above, sessile, linear-lanceolate, base truncate, apex acuminate, lobed deeply near costa, lobes oblong-lanceolate with acute-obtuse apex. Rachis, costa and costules with acicular short hairs. Lamina herbaceous, dark green when dry. Sori orbicular, small, infra-marginal, indusiate.

Distribution: C. & E. Nepal, Arunanchal, Pradesh, Sikkim, Darjeeling, Uttarakhand, N.E. India, China, Bhutan, Myanmar, Taiwan, Japan, Korea, Vietnam.

Ecology: Terrestrial, found on the edge of the muddy road in forest.

Voucher specimen: Palpa, Pravas, 841m, 26th Aug, 2022, S. Neupane and S. Aryal, P47, (TUCH).

Thelypteris nudata (Roxb.) C.V. Morton, Contr. U. S. Natl. Herb. **38**: 352 (1974); Iwatsuki: 307 (1988); Bista *et al.*: 95 (2002); Fraser-Jenkins & Kandel: 71 (2019).

Pronephrium nudatum (Roxb.) Holttum, Blumea **20**: 111 (1972).

Thelypteris multilineata (Wall. *ex* Hook.) C.V. Morton, Amer. Fern J. **49**: 113 (1959).

Terrestrial plant. Rhizome short or long creeping covered with dark brown to black scales. Stipes straminous, upto 40-50cm long, covered with fine stiff hairs, grooved adaxial surface. Fronds monomorphic, lamina simply pinnate, broadly ovate-oblong, 30-40cm long and 20-30cm broad; pinna sub-opposite to alternate with one terminal pinna or imparpinanate, sub-sessile, texture rough and papery, pinna wide with rounded truncate bases and acuminate apex, shallowly toothed or sharply serrate margin; rachis and costa with stiff hairs, stramineous and grooved adaxially. Many pairs of veinlets anastomosing to form loops connected by a common excurrent vein. Sori orbicular, arranged in 2 rows between costules attached in middle of veinlets, indusiate. Spores dark brown. (Plate 6. F).

Distribution: w. C. & E. Nepal, Tibet, Arunanchal Pradesh, Bhutan, Darjeeling, Sikkim, Bangladesh, China, Myanmar, etc.

Ecology: Terrestrial found in the slopes of forest.

Voucher Specimen: Palpa, Barangdi side, 1155m, 6th Mar. 2021, S. Neupane and S. Bashyal, P55, (TUCH).

Thelypteris ornatipes (Holttum & J. W. Grimes) Fras.-Jenk., New Sp. Syndr. Indian Pteriodol.: 276 (1997) (1936); Bista *et al.*: 96 (2002); Fraser- Jenkins & Kandel: 75 (2019).

Cyclosorus ornatipes (Holttum & J. W. Grimes) Panigrahi, Res. J. Pl. Environ. **9**: (1993).

Terrestrial fern. Rhizome erect, thick, covered with sparse scales. Stipe stramineous, 20-30cm long, glabrous. Fronds large, 40-60 cm and 15-20cm broad, lamina pinnate-pinnatifid, pinnae opposite, sub-sessile, butterfly-like pairs of reduced lower pinna tapering down to the base, pinnae deeply lobed into pinnule with rounded apex; rachis, costa and surface glabrous but can also be slightly hairy, texture thinly herbaceous. Veins free. Sori orbicular, medial, indusiate.

Distribution: W. C. & E. Nepal, Sikkim, Darjeeling, Arunanchal Pradesh, etc.

Ecology: Terrestrial found in the slopes of forest on roadside.

Voucher Specimen: Palpa, Khaseuli, 1325m, 1st Nov, 2022, S. Neupane and B. Parajuli, P15, (TUCH).

Theylipteris papilio (C. Hope) K.Iwats., Mem.coll. Sci. Univ. Kyoto (Bot.) 31: 175 (1965), 309 (1988); Bista *et al.*: 96 (2002); Fraser-Jenkins & Kandel: 76 (2019).

Christella papilio (C.Hope) Holttum in Nayar & Kaur, Comp. Bedd. Handb. Ferns Brit. India: 208 (1974), Kew Bull. 31: 321 (1976); Dixit: 105 (1984); Nakaike & Gurung: 191 (1988a); Fraser-Jenkins: 313 (1997b).

Nephrodium papilio C.Hope, J. Bomb. Nat. Hist.Soc. 12: 625, f.12 (1899).

Plant terrestrial. Rhizome erect, thick, apex covered with brown, lanceolate, acute scales. Stipes stramineous, base scaly, 10-20cm long. Fronds arising together from rhizome, 60-80cm long and 10-18 cm broad, lamina 1-pinnate; pinnae ca.20 pairs, linear-lanceolate, several pairs of reduced pinnae towards base, basal pinnae 3-4cm apart and gradually closer above, opposite basal pairs and sub-opposite above, base cuneate, apex long acuminate, shallowly lobed about 1/3 their depth, rounded-rectangular lobes. Surface glabrous or small hairs appear, texture papery. Veinlets 2-3 pairs anastomosing. Sori rounded, median on veinlets, indusia short-hairy.

Distribution: W.,C. & E. Nepal, Arunanchal Pradesh, Sikkim, Darjeeling, Uttarakhand, Jammu & Kashmir, Tibet, China, Sri Lanka, Taiwan, Thailand, Vietnam, Malaysia.

Ecology: Terrestrial found in the floor besides forest gullies.

Voucher Specimen: Palpa, Barangdi, 1150m, 6th Mar., 2021, S. Neupane and S. Bashyal, P30, (TUCH).

Thelypteris penangiana (Hook.) C. F. Reed, Phytologia **17**: 303 (1968); Iwatsuki: 213 (1971), 308 (1988); Bista *et al.*: 96(2002); Fraser-Jenkins *et al.*: 77 (2019).

Pronephrium penangianum (Hook.) Holttum, Blumea **20**: 110 (1972).

Polypodium penangianum Hook., Sp. Fil. 5: 13 (1863).

Terrestrial pant. Rhizome short creeping, slightly thick covered with dark brown scales. Stipe stramineous, upto 25-35cm long, base with scales, glabrous above, grooved adaxially. Fronds distant, lamina simply pinnate, oblong-lanceolate, 40-50cm long and 15-25cm broad; pinna alternate, 1-imparipinnate, shortly petiolated or sub-sessile, pinna narrow, truncate bases, shallowly pointed-lobed to acutely toothed or sharply serrate margin, acuminate apex, texture papery when dry. Rachis grooved adaxially, stramineous, glabrous. Many pairs of veinlets anastomosing to form loops joining a common excurrent vein. Sori orbicular, attached on middle or proximal middle of veinlets, in 2 rows between veinlets, exindusiate. Spores dark brown. (Plate 3. B).

Distribution: W. C. & E. Nepal, Tibet, Bhutan, Sikkim, Darjeeling, N. E. India, Pakistan, Myanmar, China, etc.

Ecology: Terrestrial, found in the sides of path in forest slope.

Voucher Specimen; Palpa, Khaseuli, 1335m, 1st Nov. 2021, S. Neupane and B. Parajuli, P14, (TUCH).

Thelypteris procera (D.Don) Fraser-Jenk., Taxon. Revis. Indian Subcontinental Pteridophytes: 183 (2008); Fraser-Jenkins & Kandel: 79 (2019).

Nephrodium procerum D.Don in Prodr. Fl. Nepal: 6 (1825).

Cyclosorus procerus (D.Don) L. Lindsay & D. J. Middleton, Nordic J. Bot. 30: 308 (2012)

Plant terrestrial. Rhizome long creeping, with brown scales. Stipes 20-30cm long, hairy, stramineous. Fronds arising separately forming colonies, lamina 40-60cm long and 15-25cm broad, pinnate-pinnatifid lanceolate, base slightly narrowed, apex acuminate, yellowish green, herbaceous, hairy; pinnae opposite to sub-opposite, lowest pinnae narrow and slightly short, base truncate, apex acuminate. deeply lobed into narrow rounded-acute pinnules. Veins basal pair anastomosing. Rachis, costa and veins hairy. Sori small, orbicular, submarginal, indusial hairy. Spores dark-colored on maturity.

Distribution: W., C. & E. Nepal, Tibet, Bhutan, Arunanchal Pradesh, Sikkim, Darjeeling, Uttarakhand, N.C. & N.E. India, Bangladesh, Myanmar, China, Thailand.

Ecology: Terrestrial found on the floor of the shaded forest in colony form,

Voucher Specimen: Palpa, Pravas, 843m, 26th Aug, 2022, S. Neupane and S. Aryal, P46, (TUCH).

Thelypteris prolifera (Retz.) C. F. Reed, Phytologia **17**: 306 (1968); Fraser- Jenkins *et al.*: 81 (2019).

Ampelopteris prolifera (Retz.) Copel., Ann. Cryptog. Phytopathol. **5**: 144 (1947).

Terrestrial fern. Rhizome short or long creeping covered with dark brownish scales. Stipe stramineous, firm, 20-30cm long, base with hairy scales. Fronds straggling, simply pinnate to pinnatifid, 40-60cm long and 6-15cm broad, oblong-acute, pinna long-attenuated, pendent or creeping along the ground at the apex in sterile fronds, with proliferous bulbils along the rachis or subapically, developing into new plants still attached to the main frond. Pinna sub-opposite,

sub-sessile, bases rounded truncate, margins undulate, apex acute pointed, texture herbaceous, adaxial surface glabrous and abaxial surface hairy. Rachis stramineous, proliferous, sulcate adaxially. Veins anastomosing, with 3-4 pairs of veinlets joining a common excurrent vein. Sori elongate, attached on middle of veinlets, usually confluent, exindusiate.

Distribution: W. C.& E. Nepal, Sikkim, Darjeeling, Uttarkhand, Jammu& Kashmir, Pakistan, Bhutan, China, Sri Lanka, Myanmar, Thailand; Australasia, Pacific Isles, Africa, etc.

Ecology: Terrestrial, mostly found in the moist area such as swamps, ponds, marshes and river sides.

Voucher Specimen: Palpa, Pravas lakeside, 836m, 6th Sep. 2022, S. Neupane and S. N. Khanal, P45 (TUCH).

Thelypteris tylodes (Kunze) Ching, Bull. Fan. Mem. Inst. Biol. (Bot.) **6**: 296 (1936); Iwatsuki: 486 (1966), 306 (1988); Bista *et al.*: 97 (2002); Fraser-Jenkins & Kandel: 88 (2019).

Pseudocyclosorus tylodes (Kunze) Ching, Bull. Fan Mem. Inst. Biol. (Bot.) 6: 324 (1963), Holttum & J. W. Grimes, Kew bull. 34: 503 (1979); Nakaike & Gurung: 196 (1988a); Thapa: 11 (2000).

Nephrodium tylodes (Kunze) C. Hope, J. Bomb. Nat. Hist. Soc. **14**: 724 (1903).

Plant terrestrial. Rhizome erect, thick, apical portion with brown scales. Stipes 40-45cm long, brown-stramineous, several alternate pairs of swollen pneumatophores, grooved adaxially, glabrous or sparse stiff short hairs. Fronds clustered, lamina 45-50cm long and 20-25cm broad, oblong-lanceolate, pinnate-pinnatifid; pinnae 20-30 pairs, lanceolate, alternate, sessile, acuminate apex, base broadly cuneate, deeply cut into narrow pinna lobes or pinnules; pinnules obliquely spreading, entire, obtuse-pointed apex. Upper surface costa with acicular hairs, beneath costa and veins glabrous; texture papery when dry. Veins free. Sori orbicular-reniform, medial or near to costule, indusiate; indusium orbicular-reniform, thick, glabrous, persistent. (Plate 3. C, E).

Distribution: W., C. & E. Nepal, Tibet, Arunanchal Pradesh, Sikkim, Darjeeling, Bhutan, Sri Lanka, Myanmar, China, Thailand, Vietnam, Indonesia, etc.

Ecology: Terrestrial, found on the edge of muddy road.

Voucher Specimen: Palpa, Tahu, 1300m, 3rd Sep. 2022, S.Neupane and S.N.Khanal, P71, (TUCH).

Woodsiaceae (Diels) Ching *ex* Herter

Plants usually terrestrial. Rhizome erect, large or small or ascending covered with scales. Stipes shorter than lamina, pubescent or glabrous. Fronds small to large, clustered, lamina pinnately compound, elliptic to lanceolate, herbaceous or papery, hairy or glabrous. Veins free. Sori indusiate or exindusiate, variable in shapes.

Key to Genera

1a. Large fern, mostly lamina with glabrous surface……..2

1b. Small-medium sized fern, mostly hairy lamina, stipe and rachis……..*Deparia*

2a. Fronds ovate-broadly lanceolate, pinnules divided into toothed segements……*Athyrium*

2b. Fronds deltoid-lanceolate, pinnules simply lobed toothed margin or entire…*Diplazium*

Athyrium Roth

Terrestrial plant. Rhizomes short, mostly erect, creeping or ascending, covered with scales. Stipe grooved in adaxial surface, base with scales, glabrous or pubescent. Fronds in tufts, lamina usually 1-3 pinnate, ovate to broadly lanceolate, surface mostly glabrous, herbaceous to coriaceous in texture; rachis, costae and costules grooved on the upper surface. Veins usually free occasionally anastomosing. Sori in variable shapes as orbicular, orbicular-reniform, oblong, shortly linear and more; mostly indusiate, rarely exindusiate.

Key to Species

1a. Lamina simply pinnate…….*A. cuspidatum*

1b. Lamina pinnate-pinnatifid or bipinnate-tripinnatifid……2

2a. Sori oval, exindusiate……..…..*A. drepanopterum*

2b. Sori round, elliptic or J-shaped, indusiate …….....3

3a. Fronds small, 15-30cm long, stipe short, 5-10cm long…….*A. falcatum*

3b. Fronds large, 30-40cm long, stipe 15-20cm long……4

4a. Pinnae slightly falcate, lower 2-3 pairs of pinnae reduced……*A. foliolosum*

4b. Pinna lanceolate, basal pairs not reduced……5

5a. Rhizome short-creeping, without short setae above pinna…….*A. pectinatum*

5b. Rhizome erect, thick, with short setae above pinna……..*A, strigillosum*

Athyrium cuspidatum (Bedd.) M. Kato, Bot. Mag. (Tokyo) 90: 27 (1977); Iwatsuki: 313 (1988); Fraser- Jenkins & Kandel **2**: 97 (2019).

Lastrea cuspidate Bedd.. Ferns Brit. India: t. 118, corr. (1870).

Polypodium elongatum Wall., List no. 309 (1828), *nom. nud.*

Plant terrestrial. Rhizome shortly creeping, thick, woody, densely covered with brown linear scales. Stipe brownish at the base and pale above, 20-25cm long, scales at base and glabrous above, grooved at adaxial surface. Fronds in tufts, simply pinnate, 40-50cm long and 15-25cm broad, lamina oblong-lanceolate, imparipinnate; pinna lanceolate, alternate, shortly petiolated, base rounded cuneate, apex acuminate, margin sharply serrate, surface glabrous both sides, texture papery when dry; rachis and costa pale, glabrous, grooved adaxially. Veins catadromous. Sori small, round, indusiate.

Distribution: W. C. & E. Nepal, Tibet, Arunanchal Pradesh, Sikkim, Uttarakhand.

Ecology: Terrestrial found in the moist forest beside water fall.

Voucher Specimen: Palpa, Barangdi side, 1180m, 6th Mar. 2021, S. Neupane and C. Neupane, P33 (TUCH).

Athyrium drepanopterum (Kunze) A. Br. *ex* Milde, Fil. Eur. 49: (1867); Tagawa: 471 (1966); Iwatsuki: 182 (1975); Nakaike & Gurung: 152 (1995); Fraser-Jenkins & Kandel **2**: 104 (2019).

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

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

Terrestrial medium sized plant. Rhizome short and ascending covered with pale brown linear-lanceolate scales. Stipe blackish brown at base and upward stramineous, 15-30cm long, base scaly. Fronds in cluster, 30-50cm long and 10-20 cm broad, lamina bipinnate, oblong-lanceolate; pinna adjacent, falcate, petiolated, basal pinna not shortened, spreading, middle pinna broadly lanceolate, apex acuminate; pinnules pinnatisect, sub-opposite, basal acroscopic pinnules largest, oblong-lanceolate, base inequilateral, margin shallowly lobed, apex acute and shortly toothed; texture stiffly brittle, surface glabrous. Veins simply pinnate. Sori oval, exindusiate.

Distribution: W. C. & E. Nepal, Bhutan, Tibet, China, India, Myanmar, Thailand, Philippines.

Ecology: Terrestrial found in the forest slopes along roadsides.

Voucher Specimen: Palpa, Shreenagar hill, 1445m, 26th July 2022, S. Neupane and S. Aryal, P06, (TUCH).

Athyrium falcatum Bedd., Ferns S. India: t. 151 (1863), 164 (1883); Fraser- Jenkins: 310 (1997b); Fraser-Jenkins & Kandel **2**: 109 (2019).

Asplenium drepanophyllum Bak. in Hook. & Bak., Syn. Fil. ed.2: 226 (1874), *non* Kunze (1834).

Athyrium drepanophyllum Bedd. Suppl. Ferns Brit. Ind.: 32 (1892), nom. superfl.

Terrestrial small fern. Rhizome short, tufted covered with dense linear-lanceolate golden brownish scales. Stipe brown to stramineous, 5-10cm long, base with scales and sparsely above, grooved. Fronds 1-pinnate to pinnatifid, 15-30cm long and 3-8cm broad, pale green to green, narrowly lanceolate, apex acuminate. Pinna 1.5-5cm long and 1-1.5cm broad, sub-opposite-alternate, sessile, falcate-ovate, lower 1-2 pairs of pinna reduced, deeply to slightly lobed, the basal-opposite pair of lobed abruptly longer or auriculate; lobes rounded, with insignificant small, rather obtuse teeth at the apices, glabrous on both surfaces, herbaceous texture. Veins distinct, forked reaching to the margin. Sori crescent or with prominent curve, median, indusiate; indusium pale-light brown, thin membranaceus with dentate margin. Spores dark brown to blackish. (Plate 3. D, F).

Distribution: Western (Surkhet) & Central (Palpa) in Nepal; Uttarakhand, Himachal Pradesh, C., W. & S. India; Myanmar.

Ecology: Terrestrial, found in the walls besides paths.

Voucher Specimen: Palpa, Dhobidhara, 1140m, 1st Aug. 2022, S. Neupane, P58, (TUCH).

Athyrium foliolosum T. Moore *ex* R.Sim, Nursery Cat. (Sim, Ferns) 6: 22 (1859);T. Moore, Ind. Fil.: 185 (1860); Beddome: 37 (1892); Thapa: 12 (2000); Bista *et al.*: 101(2002); Fraser-Jenkins & Kandel **2**: 114 (2019).

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

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

Misapplied name:

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

Plant terrestrial. Rhizome thick, short, erect, covered with lanceolate dark brown scales. Stipe dark browa at base and upward stramineous, 15- 20cm long, base scaly and upward sparsely scaly. Fronds clumped to form loose crown or in tufts, lamina 30-40cm long and 5-12cm broad, bipinnate-tripinnatifid, lanceolate to broadly oblong-lanceolate, base gradually narrowed, apex long acuminate. Pinnae 12-18 pairs, alternate, stalked, slightly falcate, 2-3 pairs of lower pinnae gradually shortened; pinnules 8-15 pairs, alternate, sub-sessile, asymmetrical with longer, wider lobes at their acroscopic base, deeply lobed in larger fronds with pointed apices and insignificant teeth, pinnule lobes rounded-obtuse, apex acute, 3-4 pairs of segments. Both surface glabrous, texture herbaceous to slightly succulent-herbaceous. Veins pinnate, veinlets simple or forked. Sori orbicular, large, 1 or 2 sori per segment, indusiate; indusia rounded horseshoe-shaped or J-shaped, pale brown.

Distribution: C. & E. Nepal, Himachal Pradesh, Arunanchal Pradesh, Sikkim, Darjeeling, W., N.E. & S. India, Tibet, Bhutan, Myanmar, China, Vietnam.

Ecology: Terrestrial found the forest floor beside path.

Voucher Specimen: Palpa, Shreenagar Hill, 1405m, 31st Aug, 2022, S.Neupane and M.Bakabal, P65, (TUCH).

Athyrium pectinatum (Wall. *ex* Mett.) T. Moore, Ind. Fil.: 152 (Nov. 1859), 186 (June 1860), *non* Fee (1866); Bedd., Suppl. Ferns Brit. India: 36 (1892); Tagawa: 402 (1966); Chowdhury: 49 (1973); Iwatsuki: 183 (1975); Alston & Bonner: 215 (1956); Banerji: 276 (1972); Gurung: 59 (1986); Nakaike & Gurung: 152 (1955); Bista *et al.*: 102 (2002); Fraser-Jenkins & Kandel: 122 (2019).

Asplenium pectinatum Wall. *ex* Mett., Abh. Senck. Naturf. Ges. (Frankfurt) 3 91): (Sept. 1859).

Asplenium pectinatum Wall., List no. 231 (1828),*nom. nud.*

Athyrium pectinatum Wall. *ex* C.Presl, Tent. Pterid.: 98 (1836), *nom. nud.*

Athyrium filix-femina subsp. *pectinatum* (Wall. *ex* Mett.) A.Love & D.Love, Taxon 26 (2-3): 326 (1977).

Plant terrestrial. Rhizome creeping, apex ascending covered with dark brown lanceolate scales. Stipe thin, stramineous, 15-20cm long, glabrous. Fronds with a loose crown on the horizontal apex of rhizome, lamina 30-40cm long and 10-20cm broad, bipinnate-tripinnate, oblong-lanceolate, base slightly narrowed, apex acuminate. Pinnae 15-20 pairs, lower pairs opposite and upper part sub-opposite to alternate, shortly petiolated, basal pinna slightly short, base truncate and apex acuminate. Pinnules around 20 pairs, basal pinnules opposite and upper alternate, deeply lobed into many long, narrow fine lobes each ending in short acute tooth with longer teeth at apex, 3-4 segments. Both surface glabrous, thin delicate, texture herbaceous, yellow green. Rachis, costa and costules stramineous, glabrous, very short setae above the midrib of pinnule. Veins pinnate in ultimate pinnules, 1 vein per tooth in abaxial side. Sori small, straight or elliptic, 3 or 4 pairs per segment, 1sorus per segment, indusia thin, brown.

Distribution: W., C. & E. Nepal, Tibet, Bhutan, Sikkim, Darjeeling, Uttarakhand, Himachal Pradesh, Jammu & Kashmir.

Ecology: Terrestrial found on the forest floor on roadside.

Voucher Specimen: Palpa, Shreenagar, 1453m, 16th July, 2022, S.Neupane & C.Neupane, P20, (TUCH).

Athyrium strigillosum (T.Moore *ex* Lowe) T. Moore *ex* Sal., Nomencl. Gefasskrypt.: 112 (1883); Tagawa: 472 (1866); Iwatsuki: 185 (1975); Nakaike & Gurung: 153 (1995); Bista *et al.*: 105 (2002); Fraser-Jenkins & Kandel: 133 (2019).

Asplenium strigillosum T.Moore *ex* Lowe, Ferns, Brit. Exot. **5**: 107-108, t.36 (1858).

Athyrium tenuifrons Wall. *apud* T.Moore *ex* R.Sim, Priced Catl. Ferns **6**: 17 (1859).

Athyrium setiferum auct.; Gurung, Bull. Dept. Med. Plants Nepal **11**: 59 (1986).

Plant terrestrial. Rhizome erect, thick, short, apex covered with pale brownish scales. Stipe brown at base and upward stramineous, 30 cm long, base scaly and upward glabrous. Fronds in tufts as a crown, lamina 40-50cm long and 20-25cm broad, bipinnate, narrowly triangular-lanceolate, widest shortly below the middle but not at the base, apex acuminate. Pinna 15-20 pairs, alternate, petiolated, narrowly triangular-lanceolate, ascendant, base broadly rounded, apex acuminate. Pinnules 10-15 pairs, alternate, asymmetrical, deeply lobed, lobed to half their depth basal, acroscopic lobes longer, base cuneate and decurrent on basiscopic side, apex acute with long teeth; surface glabrous, dark green, texture herbaceous. Rachis andcosta stramineous,

with pale setae above. Veins pinnate, lateral veins 4-6 pairs. Sori, oblong to slightly J-shaped, indusia thin, brown.

Distribution: W., C. & E. Nepal, China, Pakistan, Bhutan, Myanmar, Tibet, Sikkim, Darjeeling, Uttarakhand, Jammu & Kashmir, N. E. India.

Ecology: Terrestrial, found in the forest slope beside road.

Voucher Specimen: Palpa, Shreenagar Hill, 1440m, 3rd Mar, 2021, S.Neupane, C. Neupane & S. Gyawali, P28, (TUCH).

Deparia Hooker & Greville

Terrestrial plant. Rhizomes short to long creeping, thick covered with black or brown scales. Stipes long, brown to black, hairy, base with scales. Fronds distant or approximate, lamina pinnate to bipinnate, linear-lanceolate or ovate-obong, alternate pinna, mostly sessile, hairy, texture herbaceous. Veins free, lateral veins simple or forked. Sori orbicular, linear or J-shaped, induciate.

Deparia japonica subsp. **petersenii** (Krunz) Fraser-Jenk.; Fraser-Jenkins & Kandel.:157 (2019).

Plant terrestrial. Rhizome long creeping, thin covered with brown to dark brown lanceolate scales. Stipe brownish, 20-35cm long, base scaly, hairy, grooved adaxial surface. Fronds 30-45cm long, lamina bipinnatifid to bipinnate, oblong-lanceolate or sometimes deltate-lanceolate, apex acuminate, widest at the base, succulent-herbaceous, covered with pale hairs. Pinna oblique or occasionally spreading, oblong-lanceolate, base subtruncate, apex long acuminate; pinnules mostly rectangular but lower basiscopic ones often becoming longer and acutely pointed with insignificant teeth. Rachis sparsely scaly, hairy, grooved adaxially and costa, costules with soft hairs. Veins simple or forked. Sori shortly linear, medial, indusiate with thin, strongly fimbriate, pale brownish inducium. Spores brown.

Distribution: W. C. & E. Nepal, China, Tibet, Bhutan, India, Japan, Korea, Myanmar, Sri Lanka, Thailand, Vietnam; Pacific Islands, N. & S. America.

Ecology: Terrestrial, found in the forest floor in shaded area.

Voucher specimen: Palpa, Pravas, 845m, 26th Aug, 2022, S. Neupane and S. Aryal, P51, (TUCH).

Diplazium Sw.

Terrestrial plant. Rhizomes erect, or occasionally creeping covered with blackish to brownish scales. Stipes slender or woody, erect, stramineous, scaly. Fronds distant on rhizomes, monomorphic to dimorphic, simple to tripinnatifid, lamina ovate-deltoid, deeply pinnatifid pinnules, texture herbaceous-coriaceous. Veins free or anastomosing. Sori linear, oblong, on medial, supramedial or from base to end of veinlets; indusium membranous, persistent or caducous.

Key to species

1a. Rhizome ascendant, thick with apical crown of several fronds…….*D. maximum*

1b. Rhizome creeping, horizontal……..…2

2a. Veins pinnate, veinlets of lower 1-2 pairs anastomosing to form zig-zag common vein between each lobe-base……*D. esculentum*

2b. Veins pinnate, veinlets forked or simple……..*D. spectabile*

Diplazium esculentum (Retz.) Sw., J. Bot. (Schrader) 1801 (2): 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 and Gurung: 154 (1995); Bista *et al.*: 109 (2002); Fraser-Jenkins & Kandel: 165 (2019).

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

Terrestrial large fern. Rhizome thick, creeping covered with dense bright brown lanceolate scales. Stipes brown, stramineous, 20-30cm long, base scaly, upward glabrous or hairy, grooved. Fronds large, wide, 60-80cm long and 20-40cm broad, lamina bipinnate-tripinnatifid, deltoid lanceolate, apex acuminate, herbaceous, hairy or glabrous. Pinna simply pinnate-bipinnatifid, subopposite at the base and alternate above, short stalked at lower and upper subsessile-sessile, segments shallowly lobed or merely toothed, basal pair of lobes slightly longer, base truncate, margin serrate or minutely serrate, apex acuminate, texture sub-coriaceous. Rachis near glabrous to rather pale short-hairy, stramineous, grooved. Veins pinnate, veinlets of lower 1-2 pairs conjoined or anastomosing to form a zig-zag common vein between each lobe-base leading upto margin. Sori mostly linear, slightly curved, from near midribs to margin, indusiate. (Plate 4. A).

Diistribution: W. C. & E. Nepal, Tibet, Bhutan, China, Sikkim, Darjeeling, Jammu& Kashmir, Pakistan; Australia, New Guinea, Pacific Islands, S. Africa, N. America.

Ecology: Terrestrial found in the river canal sides.

Voucher Specimen: Palpa, Jarepipal, 801m, 6th Sep. 2022, S. Neupane and S.N. Khanal, P74, (TUCH).

Diplazium maximum (D.Don) C.Chr., Ind. Fil. 235 (1905); Fraser-Jenkins: 112 (1997b); Bista *et al.*: 111 (2002); Fraser-Jenkins & Kandel: 174 (2019).

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

Diplazium flaccidum Christ, Bull. Georgr. Bot. Mans **1906**:125 (1906).

Diplazium giganteum (Bak.) Ching, Ind. Fil. suppl. III: 73 91934); Iwatsuki: 319 (1988); Dixit: 133 (1984); Nakaike & Gurung: 154 91995).

Misapplied Name:

Diplazium polypodioides auct,; Gurung, Bull. Dept. Med. Pl. Nepal **11**: 64 (1986).

Plant terrestrial. Rhizome ascendant, thick with apical crown of several fronds, covered with broadly lanceolate brownish scales. Stipe 45-60cm long, base covered with pale-brown scales and above glabrous, stramineous and grooved adaxially. Lamina 50-100cm long and 30-40cm broad, bipinnate with pinnules pinnatifid, deltoid, apex acuminate,; pinna alternate, lower pinna largest, broadly lanceolate, apex acuminate, with stalk; pinnules pinnatifid in basal pairs, alternate, oblong or sub-rectangular, apex acute-rounded. Veins pinnate, veinlets upto pinnule, simple, distict. Surface glabrous, texture herbaceous, smooth. Sori linear, upto 6 pairs per lobe, often single or double, covering whole segment when ripe, indusiate, brown.

Distribution: W., C. & E. Nepal, Tibet, Arunanchal Pradesh, Bhutan, Sikkim, Darjeeling, Jammu & Kashmir, Pakistan, Afghanistan, China, Myanmar.

Ecology: Terrestrial found in the outlet of near water source.

Voucher Specimen: Palpa, Barangdi, 1160m, 27th Aug. 2022, S. Neupane & S.N.Khanal, P61, (TUCH).

Diplazium spectabile (Wall. *ex* Mett.) Ching, Lingn. Sci. J. 15: 278 (1936); Iwatsuki: 186 (1975), 319 (1988); Gurung: 64 (1986); Nakaike & Gurung: 154 (1995); Fraser-Jenkins: 313 (1997b); Thapa: 13 (2000); Bista *et al.*: 112 (2002); Fraser-Jenkins & Kandel: 178 (2019).

Asplenium spectabile Wall. *ex* Mett., Abh. Senck. naturf. Ges. (Frankfurt) 3: 196 (1859).

Diplazium jerdonii Bedd., Ferns Brit. India: t.327 (1869).

Diplazium multicaudatum (Hook. & Bak.) Mehra, Punjab Univ. Publ.: 24 (1939).

Plant terrestrial. Rhizome creeping, horizontal, thick apex covered with dark-brown to black scales. Stipe 40-50cm long, base with many excerted, narrowly lanceolate black scales, above glabrous. Lamina 50-60cm long and 20-30cm broad, tripinnate, deltoid; pinna alternate, slightly ascending, apex long acuminate, lower pinna oblong-lanceolate, petiolated, lower pinna largest. Pinnules upto ca. 10 pairs, alternate, oblong-lanceolate, lower pinnules shortly stalked, base broadly acuminate, apex acuminate; pinnule lobes oblong or subrectangular, margin dentate, apex rounded or truncate; surface glabrous, texture herbaceous. Veins pinnate, veinlets forked or simple. Sori short, linear-oblong, medial or near the segment mid-rib; indusia brown, membraneous.

Distribution: W., C. & E. Nepal, Tibet, Bhutan, China, Myanmar, Sikkim, Darjeeling, Arunanchal Pradesh, Uttarakhand, N. India.

Ecology: Terrestrial found on the shaded forest near water source.

Voucher Specimen: Palpa, Barangdi, 1162m, 27th Aug. 2022, S. Neupane and S.N. Khanal, P62, (TUCH).

Blechnaceae (C. Presl) Copel.

Plants mostly terrestrial but occasionally lithophytic or epiphytic. Rhizome erect or creeping, scaly. Stipe long, base with scales. Fronds monomorphic or dimorphic, lamina simple, 1-pinnate-bipinnatifid, alternate, glabrous or sometimes with scales, papery to leathery in texture. Veins free or anastomosing and sometimes forked. Sori linear near costa or along secondary vein, mostly indusiate and rarely exindusiate.

Blechnum L.

Plants usually terrestrial, medium to large sized. Rhizomes erect covered with dark brown to brown scales. Stipe long, scaly at base and above glabrous. Fronds singly or in cluster, lamina pinnate with reduced lower pinna, lanceolate, margin entire or serrulate, apex acute to acuminate, texture coriaceous. Veins simple, free, forked or parallel. Sori linear, near or parallel to costa, indusiate.

Blechnum orientale L., Sp. Pl. **2**: 1077 (1753); Clarke: 470 (1880); Beddome: 132, f. 66 (1883); Hope: 459 (1901); Ito: 214(1971); Iwatsuki: 282 (1988); Bista *et al.*: 143 (2002); Fraser-Jenkins & Kandel: 195 (2019).

Terrestrial large fern. Rhizome short, erect covered with dense dark brown scales. Stipes 10-20cm long, scaly at base. Fronds arise singly, 30-50cm long and 15-30cm broad, lamina simply pinnate, imparipinnate, ovate-lanceolate, unlobed, alternate, slightly separate pinna, lower pinna contracted to small rounded auricles, upper ones oblique, margin entire, sessile, base rounded or subtruncate, apex acuminate; texture coriaceous, both surface glabrous. Veins free and forked. Sori linear along midrib of pinna, indusiate.

Distribution: W. C. & E. Nepal, Bhutan, Tibet, India, Bangladesh, Sri-Lanka, china, Taiwan, Japan ; Australia, Pacific Islands.

Ecology: Terrestrial, found in the slopes along roadside.

Voucher Specimen: Palpa, Pravas, 842m, 28th July, 2022, S. Neupane & S. Aryal, P49, (TUCH).

Dryopteridaceae Ching

Plants usually terrestrial, and occasionaly epiphytic or lithophytic. Rhizomes erect or creeping, scaly. Stipes long, scaly, articulated or sometimes not. Fronds monomorphic or dimorphic, lamina simply pinnate to decompound, ovate to oblong-lanceolate, pentagonal, scaly, glabrous or hairy, texture herbaceous to coriaceous. Veins free or anastomosing. Sori small to large globose, reniform, terminal or sub terminal or dorsal on veins, mostly indusiate, rarely exindusiate.

Key to Genera

1a. Mostly lithophytic, hairy indusia……..*Hypodematium*

1b. Mostly terrestrial, glabrous indusia……..2

2a. Pinnules obliquely placed with acroscopic lobes with pointed auricle, indusia mostly orbicular or peltate……..*Polystichum*

2b. Lowest pinnules on the basiscopic side, acroscopic lobes without pointed auricle, indusia mostly reniform.....*Dryopteris*

Dryopteris Adanson

Terrestrial large ferns. Rhizome short, erect or sometimes creeping, thick, woody covered with dense scales. Stipes slender or thick, long, scaly. Fronds in cluster or at distant, monomorphic to dimorphic, simply pinnate to decompound, ovate-lanceolate, glabrous, the lowest pinnules always on the basiscopic side, base broad, texture herbaceous to coriaceous. Veins free and forked. Sori orbicular, dorsal or rarely terminal on veins, indusiate; indusium orbicular-reniform attached by inner end of sinus, mostly persistent.

Key to Species

1a. Fronds dimorphic……*D. cochleata*

1b. Fronds monomorphic……2

2a. Small lithophytic plant in cluster, simply pinnate……..……*D. woodsiisora*

2b. Large terrestrial plant at distant, bipinnate-pinnatifid ……3

3a. Basiscopic pinnules of the lowest pair of pinnae longer……*D. sparsa* subsp.*sparsa*

3b. Basiscopic pinnules of the lowest few pairs equal and curved towards pinna apex….*D. juxtaposita*

Dryopteris cochleata (Ham. *ex* D. Don) C. Chr., Ind. Fil.: 258 (1905); Ito: 476 (1966); Roy *et al.*: 194 (1971); Iwatsuki: 187 (1975); Dixit: 149 (1984); Gurung: 68(1986); Fraser-Jenkins: 408 (1989); Nakaike *et al.*: 190 (1990); Fraser-Jenkins & Kandel.: 227 (2019).

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

Terrestrial plant. Rhizome long or short creeping or ascending, covered with dense linear to lanceolate, bright brown scales. Stipe long, stramineous, 20-25cm long, base with scales, upper surface grooved. Fronds dimorphic, 30-40cm and 15-20cm broad, bipinnate, deltoid-ovate, base cordate, apex acuminate. Pinna oblong-lanceolate, base rounded, apex acuminate; pinnules 10-12 pairs, oblique, margin incised-serrate, apex obtuse, basiscopic pinnules longer than acroscopic ones, texture herbaceous, surface glabrous. Rachis and costa stramineous, with sparse scales. Veins pinnate and forked. Sori in 2 rows on each pinnule covering whole fertile pinna, indusium reniform, brownish. (Plate 4. B).

Distribution: W. C. & E. Nepal, Sikkim, Darjeeling, Uttarakhand, Himachal Pradesh, Jammu & Kashmir, China, Myanmar, Bhutan, Pakistan,

Ecology: Terrestrial found in slopes of forest beside paths.

Voucher Specimen: Palpa, Khaseuli, 1330m, 1st Nov. 2021, S. Neupane & B. Parajuli, P08 (TUCH).

Dryopteris juxtaposita Christ, Bull. Acad. Inst. Geogr. Bot. **17**: 138 (1907); Fraser-Jenkins: 393 (1989); Nakaike *et al.*: 190(1990); Thapa: 13 (2000); Bista *et al.*: 122 (2002); Fraser-Jenkins & Kandel: 234 (2019).

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

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

Misapplied name:

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

Plant terrestrial. Rhizome erect, short covered with brown lanceolate scales. Stipe 20-25cm long, stramineous, base covered with lanceolate dark-brown to nearly black scales and above glabrous. Lamina ovate-oblong, 30-40cm long and 15-25cm broad, ovate-oblong, bipinnate-pinnatifid; pinna slightly distant, sub-opposite, narrowly triangular-lanceolate, shortly stalked, apex acuminate; pinnules 10-15 pairs, mostly shallowly lobed, oblong-rectangular, truncate-rounded apices with sparse flabellate, aristate teeth, the lowest few basiscopic pinnules on the basal pinna often markedly curved towards pinna apex. Both surface glabrous, texture papery. Veins pinnate, veinlets forked. Sori small in two rows, orbicular-reniform, indusiate; indusia slightly curved down at the edges, papery, usually deciduous. (Plate 4. C).

Distribution: W., C. & E. Nepal, Tibet, China, Myanmar, Bhutan, Pakistan, Arunanchal Prdesh, Sikkim, Darjeeling, Uttarakhand, Vietnam.

Ecology: Terrestrial found on the forest slope.

Voucher Specimen: Palpa, Chhahara, 1745m, 31st Oct., 2022, S. Neupane and B. Neupane, P85 (TUCH).

Dryopteris sparsa (D.Don) Kuntze subsp. **sparsa**, Rev. Gen. Pl. 2: 813 (1891); Ito: 478 (1966); Roy *et al.*: 194 (1971); Iwatsuki: 188 (1975); Gurung: 71 (1986); Fraser-Jenkins: 438 (1989); Matsumoto & Nakaike: 166 (1990); Nakaike *et al.*: 191 (1990); Bista *et al.*: 125 (2002); Fraser-Jenkins & Kandel: 248 (2019).

Lastrea sparsa (Ham. *ex* D.Don) T.Moore, Ind. Fil.: 87, 104 (1858).

Nephrodium sparsum D.Don, Prodr. Fl. Nepal.: 6 (1825); Clarke: 523 (1880); Hope: 743 (1903).

Plant terrestrial. Rhizome erect, covered with dense pale brown, ovate-lanceolate scales at the apex. Stipe 20-35cm long, base bearing thin, ovate-lanceolate scales, sparsely just above base and rachis glabrous. Lamina 20-50cm long and 15-25cm broad, bipinnatifid, triangular lanceolate; pinnae 10-20 pairs, slightly distant, sub-opposite basal pair and alternate above, petiolated, base cuneate, apex acuminate. Pinnules contiguous or slightly separate, stalked towards the base of pinna, shallowly lobed towards uppermost pinnae and deeply lobed in the lowermost pinnae; pinnules sloping and asymmetrical, the lobes in the acroscopic side of the pinnules longer and wider than more obliquely inserted ones on basiscopic side, pinnules base cuneate, margin slightly toothed, apex acute. Surface glabrous and texture herbaceous. Veins indistinct above and veinlets forked once or twice. Sori median on the veinlets, indusial reniform, pale brown, glabrous with thin membranous. Spores dark brown.

Distribution: W., C. & E. Nepal, Tibet, Bhutan, N. E. India, Sikkim, Darjeeling, china, Myanmar.

Ecology: Terrestrial, found on the forest slope beside path.

Voucher Specimen: Palpa, Khaseuli, 1330m, 1st Nov, 2022, S. Neupane & B. Parajuli, P13 (TUCH).

Dryopteris woodsiisora Hayata, Ic. Pl. Formos. **6**: 158 (1916); Fraser-Jenkins: 368 (1989); Bista *et al.*: 126 (2002); Fraser-Jenkin & Kandel: 263 (2019).

Dryopteris tenuissima Tagawa, Acta Phytotax. Geobot. Kyoto **1**: 308 (1932).

Misapplied name:

Dryopteris costalisora sensu Ito, Tagawa & Iwatsuki (1966), *non* Tagawa (1934).

Plant small lithophytic. Rhizome erect or ascending covered densely with ovate-lanceolate pale- brown scales. Stipe stramineous, thin, delicate, 4-6cm long, densely scaly at base which becomes smaller, narrower and very scattered further up. Fronds in cluster, lamina 10-20cm long and 3.5-6cm broad, simply pinnate, narrowly lanceolate, somewhat truncate base; pinnae 10-20 pairs,basal 1-2 pairs slightly shortened, subsessile, linear-lanceolate, lobed to two-third of their depth, apex obtuse to shortly acuminate. Surface glabrous, texture herbaceous and papery when dry. Rachis covered with small, black, linear scales, mostly in lower rachis. Veins pinnate, veinlets 2-3 forked. Sori few, bit spaced out, sub-marginal on veinlets; indusia slightly thick, curved down, pale brown, perfectly covering sorus, persistent.

Distribution: W., C. & E. Nepal, Tibet,Bhutan, N.E. India, Sikkim, Darjeeling, Uttarakhand, China, Korea, Mongolia, Myanmar, Taiwan, Thailand, Vietnam.

Ecology: Lithophytic found on the rock on slightly shaded forest.

Voucher Specimen: Palpa, Tahu, 1414m, 3rd Sep. 2022, S. Neupane and S.N.Khanal, P68, (TUCH).

Hypodematium Kunze

Plants mostly lithophytic. Rhizomes short-creeping or ascending, densely scaly, scales light brown. Stipes stramineous, glabrous or pubescent. Fronds sub-clustered, lamina 2-3 pinnate, both surface hairy, pentagonal-ovate, herbaceous texture. Veins free, pinnate, simple or forked. Sori orbicular, indusiate; indusia reniform, membranous, hairy.

Hypodematium crenatum (Forssk.) Kuhn, subsp. **crenatum**, Fraser-Jenkins, Taxon. Revis. Indian Sub-Continental Pteridophytes, 204-206, 612 (2008); Fraser-Jenkins & Kandel: 269 (2019).

Hypodematium hirsutum (Don) Ching. Indian Fern J. 1(1-2): 49 (1985).

Plant lithophytic. Rhizome creeping, finger-thick, dorsiventrally organized, densely covered with long lanceolate reddish-brown, glossy scales. Stipe stramineous, densely scaly at base and glabrous above, 4-8cm long. Fronds sub-clustered, 10-15cm long and 9-12 cm broad, widely deltate-pentagonal, bipinnate-tripinnate, basal half tripinnatifid and distal half base bipinnatifid, distal most part simple pinnatifid; pinnae 6-10 pairs, basal pair sub-opposite and above alternate, stalked, basal basiscopic pinnules longer, base broadly cuneate, apex acute; Pinnules shallowly lobed, apex obtuse, base cuneate; surface hairy, texture herbaceous. Veins

forked 2-3 times, free, reaching upto margin. Sori round, median on the veinlets in two rows; indusial reniform, densely covered with stiff hair.

Distribution: W. & C. Nepal, Bhutan, Sikkim, Uttarakhand, Himachal Pradesh, Jammu & Kashmir, Pakistan, Afghanistan, China, Malayasia, Sri Lanka, Philippines, Yemen, Africa.

Ecology: Lithophytic found in the rock crevices on roadside.

Voucher Specimen: Palpa, Teendhara, 1271m, 2nd Aug. 2022, S.Neupane & M.Bakabal, P57, (TUCH).

Polystichum Roth

Terrestrial ferns. Rhizomes short, erect or ascending covered densely with linear to ovate scales. Stipes stramineous, clustered, dense scales at at base and sparse above. Fronds monomorphic or nearly dimorphic, lamina pinnate to decompound, linear-lanceolate or ovate-lanceolate, pinna numerous, pinnules obliquely placed, with ultimate segments usually muronate, margin spinulose or serrated, texture coriaceous, adaxial surface usually glabrous. Veins free, forked or anastomosing. Sori orbicular on terminal veins of pinna, indusiate; indusium orbicular or peltate.

Key to species

1a. Lamina apex bearing proliferous bulbils……..*P. lentum*

1b. Lamina apex acuminate without proliferous bulbils……2

2a. Pinna adaxial surface dark green, shiny and texture coriaceous……*P. squarrosum*

2b. Pinna surface light green, texture papery…….……*P. discretum*

Polystichum discretum (D.Don) J.Sm. in Engl. & Prantl, Nat. Pfl.-Fam. **1**(4);199 (1899); Iwatsuki: 296 (1988); Matsumoto & Nakaike: 179 (1988); Nakaike & Gurung: 77 (1988b); Fraser-Jenkins: 271 (1991), 31 (1997a); Bista *et al.*: 130 (2002); Fraser-Jenkins & Kandel: 284 (2019).

Polystichum nigropaleaceum (Christ) Diels in Engl. & Prantl, Nat. Pfl.-Fam. **1** (4): 191 (1899); Nakaike: 142 (1982).

Polystichum setiferum var. *crenatum* N.C.Nair, Amer. Fern J. **64**: 15 (1974).

Polystichum indicum Khullar & S. Gupta, Nova Hedwigia **32**: 425 (1980), *nom. nud.*

Polystichum kathmanduense Nakaike in Otani, Misc. Publ. Natn. Sci. Mus. Tokyo: 139 (1982).

Plant terrestrial. Rhizome erect or ascending covered with brown scales. Stipe 20-25cm long, covered with brown narrowly lanceolate to fibrillose scales at base and become almost lanate up on the rachis. Fronds tufted, lamina 40-50cm long and 15-30 cm broad, bipinnate, deltate-ovate; pinna ca. 30 pairs, alternate, shortly stalked, base asymmetrical, apex acuminate; pinnules ca. 25 pairs, acroscopic base with rounded auricles, basal acroscopic pinnules largest, margins toothed, apex acute. Venation pinnate, texture papery. Sori orbicular, 5-8 pairs per pinnule on both sides of costule; indusium present.

Distribution: W., C. & E. Nepal, Arunanchal Pradesh, Bhutan, Sikkim, Darjeeling, Uttarakhand, Jammu & Kashmir, Pakistan, China, Myanmar, Thailand.

Ecology: Terrestrial found in shaded forest along humus.

Voucher Specimen: Palpa, Chhahara, 1731m, 9th Sept. 2022, S. Neupane and B. Neupane, P82, (TUCH).

Polystichum lentum (D. Don) T. Moore, Ind. Fil.: 80 (1858); Tagawa: 480 (1966); Iwatsuki: 190 (1975); Nakaike: 140 (1982); Dixit: 158 (1984); Matsumto & Nakaike: 182 (1988); Nakaike & Gurung: 80 (1988b); Fraser-Jenkins: 261 (1991), 18 (1997a); Bista *et al*.: 131 (2002); Fraser- Jenkins & Kandel: 289 (2019).

Aspidium lentum D. Don, Prodr. Fl. Nepal.: 4 (1825); Hope: 462, t. 28b (1902).

Asidium auriculatum (L.) Sw. var. *lentum* (D. Don) C. B. Clarke, Trans. Linn. Soc. Lond. II Bot. 1: 507 (1880).

Polystichum auriculatum (L.) C. Presl var. *lentum* (D. Don) Bedd., Handb. Ferns Brit. India: 204 (1883).

Terrestrial plant. Rhizome erect, short, densely covered with scales. Scales ovate, blackish to brown, usually dark and thickend at middle with light brown margin. Stipes stramineous, short, 3-6cm long, covered with dense scales as of rhizome scales with mixer of small brown linear-lanceolate scales. Fronds clustered, 30-60cm long and 4-8 cm broad, lamina bipinnatifid, narrowly lanceolate, acuminate, with proliferous bulbil near rachis tip or apex; pinna 20-40 pairs, falcate, alternate, margin slightly serrated, spinulose, with acroscopic base slightly larger and auriculate, shortly stalked; texture sub-coriaceous, both surface glabrous; rachis and costa

with small brown scales,stramineous. Veins forked and free. Sori round on single row on each side of the costa, with peltate indusium.

Distribution: W., C. & E. Nepal, Tibet, Bhutan, China, Myanmar, Arunanchal Pradesh, Uttarakhand, Himachal Pradesh, N. E. & N. W. India, Thailand.

Ecology: Terrestrial, found in the floor of forest in shaded area.

Voucher specimen: Palpa, Shreenagar hill, 1445m, 2nd Nov., 2021, S. Neupane and B. Parajuli, P21, (TUCH).

Polystichum squarrosum (D. Don) Fée, Gen. Fil.: 278 (1852); Tagawa: 481 (1966); Iwatsuki: 191 (1975); Nakaike: 145, t.5, f.2 (1982); Matsumoto & Nakaike: 182 (1988); Fraser- Jenkins: 270 (1991), 30 (1997a); Fraser-Jenkins and Kandel: 313 (2019).

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

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

Polystichum rufobarbatum (Wall. Ex Bedd.) Schott ex Diels in Eng. & Prantl, Natl. Pfl. Fam. 1 (4): 194 (1899).

Terrestrial large fern. Rhizome erect, short, thick densely covered with scales. Scales broadly lanceolate to ovate, blackish to brown. Stipe long, 15-30cm long, covered with broadly lanceolate blackish to brown scales (bicolorous) at base and small subulate brown scales (concolorous) above. Fronds clustered, 30-50cm long and 10-18cm broad, lamina bipinnate, ovate to lanceolate, dark green, acuminate apex without proliferous bulbil; pinna 20-40 pairs, alternate, linear-lanceolate, shortly petiolated, base cuneate, apex shortly acuminate. Pinnules 10-15 pairs, sub-opposite to alternate, more or less ovate to nearly rhombic, base broadly cuneate, acroscopic base pointly auricled, margin entire to few spinulose teeth, apex pointed acute; texture coriaceous, surface glabrous. Rachis, costa and costules with reddish brown fibrillose scales. Veins forked. Sori round placed in single row close to each side of the costules, indusium peltate. (Plate 4. D).

Distribution: W., C. & E. Nepal, Tibet, Pakistan, Arunanchal Pradesh, Sikkim, N., E., C. & S. India, China, Myanmar.

Ecology: Terrestrial found in the middle of forest slope.

Voucher Specimen: Palpa, Shreenagar hill, 1430m, 3rd Mar., 2021, S. Neupane, C. Neupane and S. Gyawali, P27, (TUCH).

Lomariopsidaceae Alston

Plant terrestrial, lithophytic or epiphytic. Rhizomes short, erect or creeping, covered with scales. Stipes long or short, base covered with scales. Fronds monomorphic or dimorphic, simple to decompound, imparipinnate or not, lateral pinna articulate to rachis, sterile pinna linear to lanceolate, fertile pinna with narrow linear pinna, margin serrate or entire, surface usually glabrous. Veins free or anastomosing. Sori in one or more rows on each side of costa, covering all over the abaxial surface of pinna, exindusiate.

Elaphoglossum Schott ex. J. Smith

Plants epiphytic, terrestrial or lithophytic. Rhizomes long or short creeping covered with brownish scales. Stipes short to long, covered with scales, articulated to rhizome. Fronds in cluster, dimorphic, lamina simple, narrowly ovate- lanceolate, margin entire, apex acute or obtuse, texture coriaceous, upper surface glossy and glabrous. Veins simple, free or forked. Sori covering entirely abaxial surface, exinduciate.

Elaphoglossum stelligerum (Wall. ex Baker) T. Moore *ex* Salomon, Nomencl. Gefässkrypt.: 170 (1883); Sledge: 92 (1967); Iwatsuki: 189 (1975); Nakaike & Gurung: 193 (1988a); Bista *et al.*: 142 (2002); Kandel & Fraser- Jenkins : 8 (2020).

Elaphoglossum yunnanense (Baker) C. Chr., U.S. Contr. U. S. Natl. Herb. 26: 327 (1931).

Plant usually epiphytic, rarely terrestrial or lithophytic. Rhizome short- creeping covered densely with light brown linear-lanceolate scales. Stipe thin, slender, about 5-10cm long, slightly grooved, covered with thin scales throughout. Fronds dimorphic, lamina simple, herbaceous. Sterile lamina 20-40 cm long and 1.5-3cm broad, lanceolate, mid-rib raised on both surface covered with scales, base cuneate and apex acute to shortly acuminate, margin entire, loosely with stellate hairs mostly at the edges. Veins simple to forked. Fertile lamina linear, 15-20cm long and 0.5-1.5cm broad, shorter than sterile ones but stipe slightly longer, apex acute, upper surface with stellate hairs and lower surface with sori throught the lamina. Spores dark brown. (Plate 4. E).

Distribution: C. & E. Nepal, Bhutan, N.E. & S. India, China, Vietnam, Thailand.

Ecology: Found in muddy rocks with mosses besides of clayey path in forest.

Voucher Specimen: Palpa, Khaseuli, 1333m, 9th Sep. 2022, S. Neupane and B. Neupane, P76, (TUCH).

Nephrolepidaceae (Ching) Pich. Serm.

Plants usually terrestrial and rarely epiphytic. Rhizomes short or long creeping, erect covered wih scales, and with long stolons. Stipes short, articulated above rhizome. Fronds monomorphic or dimorphic, lamina pinnate, pinna glabrous or hairy. Veins free or forked. Sori round, induciate.

Nephrolepis Schott

Terrestrial or epiphytic plants. Rhizomes short, erect and producing stolens and sometimes tubers giving rise to new plants. Fronds in tufts, lamina pinnate, long, linear, pinna many pairs, sessile, base asymmetrical, margin crenate. Sori orbicular, indusiate.

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 (19660; Iwatsuki: 179 (1975); Bista *et al*.: 137 (2002); Kandel & Fraser- Jenkins: 10 (2020).

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

Polypodium auriculatum L., Sp. Pl. 2: 1088 (1753).

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

Plant usually terrestrial, rarely epiphytic and lithophytic. Rhizome short, erect covered with brownish linear-lanceolate scales and stolons bearing rounded tubers covered with pale scales. Stipes 5-12cm long, slender, dark brown, densely covered with brown scales. Fronds in tufts, 20-50 cm long and 4-8cm broad, lamina linear-lanceolate, pinnate; pinnae many pairs, alternate to sub-opposite, base overlapping rachis, apex obtuse-rounded, margin serrulate to crenate, texture herbaceous, surface glabrous. Rachis dark brown, with fibrillose scales. Veins simple, free or forked. Sori and indusia orbicular-crescent. (Plate 4. F).

Distribution: W. C. & E. Nepal, N.E., N. C., S. & N. W. India, Bhutan, Combodia, China, Korea, Myanmar, Philippines, Indonesia, Bangladesh, Sri Lanka, Vietnam; Australasia, New Guinea, Madagascar, S. America, C. America.

Ecology: Found in the moistened area of forest.

Voucher Specimen: Palpa, Khaseuli, 1328m, 1st Nov, 2021, S. Neupane and B. Parajuli, P11, (TUCH).

Tectariaceae Panigrahi.

Plant terrestrial. Rhizomes erect, short or long, creeping, coveredwith scales. Stipes brown, long, scaly at base or sometimes throughout. Fronds monomorphic to dimorphic, lamina deltoid-oblong, often triangular-pentagonal, pinnate-pinnatifid, usually glabrous, texture herbaceous. Veins simple, free or anastomosing. Sori orbicular, induciate or exindusiate.

Tectaria Cav.

Terrestrial medium-large ferns. Rhizomes erect, short or long, sometimes creeping, scaly. Stipes straminous or brown-black, scaly at base. Fronds monomorphic ordimorphic, lamina simple to pinnate, triangular to pentagonal, pinna entire, glabrous, texture herbaceous. Veins anastomosing. Sori orbicular, indusiate or exindusiate.

Key to Species

1a. Lamina bipinnate-tripinnatifid pinnae, main-veins not prominent to margin…….*T. coadunata*

1b. Lamina simply pinnate, main veins prominent to margin……..…*T. polymorpha*

Tectaria coadunata (Wall. *ex* J. Sm.) C. Chr., Contrib. U. S. Natn. Herb. 26: 331 (1931); Into: 481 (1966); Iwatsuki: 191 (1975); Nakaike & Gurung: 196 (1988); Bista *et al.*: 136 (2002); Fraser- Jenkins & Kandel: 323 (2019).

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

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

Terrestrial large fern. Rhizome erect, thick or shortly creeping covered with dense brown lanceolate scales. Stipes dark brown and glossy, 20-30cm long, base with concolorous dark brown scales and glabrous above. Fronds 40-50cm long 15-30cm broad, lamina deltoid, bipinnate-tripinnatifid, short pale hairs above and along veins beneath, alternate pinna, pinnae decurrent, fusing at base, margin widely dentate, apex acute, texture herbaceous. Veins anastomosing. Sori orbicular present in single row on each side of costa towards ultimate segment of lobes, indusium thin, brown. (Plate 5. B).

Distribution: W. E. &C. Nepal, India, Tibet, China, Bangladesh, Malaysia, Sri Lanka, Taiwan, Thailand, Vietnam.

Ecology: Terrestrial, found in slopes of open forest.

Voucher Specimen: Palpa, Bhairabsthan side, 1420m, 1st Nov, 2021, S. Neupane and B. Parajuli, P04 (TUCH).

Tectaria polymorpha (Wall. *ex* Hook.) Copel., Philipp. J. Sci., C 2; 413 (1907); Fraser-Jenkins & Kandel: 327 (2019).

Aspidium polymorpha Wall., Cat. No. 382 (1828)-Bedd., Handb. Ferns Brit. Ind. 218 (1883).

Plant terrestrial. Rhizome erect, short, thick covered with dark brown scales. Stipe brown, slender, stramineous, 30-50cm long, base covered with scales, grooved. Fronds large, pinnate, pinnae narrowly ovate, 20-40cm long and 10-15cm broad, 4-8 pairs, basal pairs opposite and above pairs sessile, stalked, oblique, basal pairs lobed, apex caudate-acuminate, margin undulate-entire, glabrous on both surfaces, texture herbaceous. Rachis and costa sparsely hairy. Main veins conspicuous up to margin and lateral veins anastomosing with free veinlets. Sori small, orbicular in double lines, one on each side of lateral vein and scattered between them as well, indusiate. (Plate 5. A).

Distribution: W., C. & E. Nepal, Tibet, Bhutan, Sikkim, Darjeeling, Uttarakhand, Bangladesh, China, Myanmar, Sri Lanka, Taiwan, Thailand, Vietnam.

Ecology: Terrestrial found in stream gully.

Voucher Specimen: Palpa, Barangdi side, 1193m, 6th Mar., 2021, S. Neupane and S. Bashyal, P31, (TUCH).

Oleandraceae Ching *ex* Pich. Serm.

Plant terrestrial or epiphytic. Rhizomes long, creeping, or sometimes erect, scaly. Stipes articulated to rhizome. Fronds arise singly or in cluster, monomorphic or dimorphic, lamina simple, linear-lanceolate, entire margin, texture herbaceous, surface glabrous or hairy. Veins simple or forked. Sori on either side of costa in single or irregular row, indusiate.

Oleandra Cav.

Plants usually epiphytic, rarely terrestrial. Rhizomes long, creeping or erect, scaly. Stipes articulated to phyllopods, stramineous, glabrous or scaly. Fronds simple, linear to laceolate or

oblong to elliptic, glabrous or hairy. Veins simple or forked, parallel. Sori on each side of midrib nearthe costae in a row, indusium orbicular to reniform.

Oleandra wallichii (Hook.) C. Presl, Tent. Pterid.: 78 (1836); Clarke: 542(1880); Beddome: 287, f. 147 (1883); Hope: 749 (1903); Ito: 469 (2966); Iwatsuki: 180 (1975); Nakaike & Gurung: 194 (1988a); Fraser-Jenkins: 313 (1997b); Thapa: 14 (2000); Kandel & Fraser-Jenkins: 15 (2020).

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

Neuonia asplenioides D. Don, Prodr. Fl. Nepal.: 7 (1825).

Plant epiphytic. Rhizome long, creeping, branching, aerial, covered densely with brown to dark brown scales. Stipes articulated to base of phyllopodia on rhizome, 2-5cm long, light brownish, glabrous. Fronds singly arise or in small tufts, 10-25cm long and 2-4cm broad, pendent, lamina linear-lanceolate, simple, base cuneate to rounded, margin entire with fine hairs, apex caudate, both surface hairy, texture herbaceous. Costa raised on both sides, abaxially with pale or brown lanceolate scales. Veins forked, free or parallel upto margin. Sori reniform, indusiate, in a line close to and each side of the mid-vein.

Distribution: W., C. & E. Nepal, Sikkim, Himalchal Pradesh, Uttarpradesh, Arunanchal Pradesh, N. E. India, Tibet, China, Myanmar, Vietnam.

Ecology: Epiphytic on the mossy tree trunks.

Voucher Specimen: Palpa, Chhahara, 1734m, 9th Sep. 2022, S. Neupane and B. Neupane, P81, (TUCH).

Davalliaceae Mett. *ex* Frank

Plants usually epiphytic and rarely terrestrial or lithophytic. Rhizome long creeping, thick or thin, covered with peltate scales. Stipes articulated to rhizome, glabrous or scaly. Lamina dissected, simple to decompound, imparipinnate, ultimate segments unequal. Veins free. Sori marginal, indusiate; indusium orbicular or reniform.

Key to Genera

1a. Plant epiphytic, lamina finely dissected, sori small……..*Katoella*

1b. Plant mostly terrestrial and rarely epiphytic, widely dissected, sori medium-large…….*Leucostegia*

Katoella Fraser-Jenk.

Plants epiphytic. Rhizome long- creeping, densely scaly, scales ovate to rounded, brownish. Stipes articulated to rhizome, glabrous, stramineous. Lamina deltate, finely dissected, tripinnate, apex acuminate, pinna alternate, texture herbaceous, glabrous, light green, ultimate segments narrow and small. Veins simple. Sori small, round, indusiate.

Key to Species

1a. Fronds small deltate, lamina finely dissected narrower segments…….*K.pulchra*

1b. Fronds large deltate, lamina finely dissected wider segments……..*K.squamata*

Katoella pulchra (D.Don) Fraser-Jenk., Kandel & Pariyar, Ferns Fern-Allies Nepal1: 34 (2015); Kandel & Fraser-Jenkins: 23 (2020).

Davallodes pulchra (D.Don) M. Kato & Tsutsumi, Acta Phytotax. Geobot. 59: 13 (2008).

Plant epiphytic. Rhizome long-creeping, thin, covered with adpressed ovate bicolorous scales. Stipe slender, stramineous, 9-12cm long, glabrous. Fronds slightly at distant, lamina 20-25cm long and 6-10cm broad, tripinnate, deltoid-lanceolate, apex acuminate. Pinna 10-12 pairs, petiolated, alternate, triangular-lanceolate. Pinnules 8-10 pairs, alternate, petiolated, base cuneate and apex acute; pinnulets narrowly cuneate, apex acute, alternate, deeply lobed and finely dissected to 5 small narrower segments. Surface glabrous, light green and texture herbaceous. Veins simple. Sori small, round, single on a segment at forking point of vein, indusiate; inducium semi-circular, yellowish brown. (Plate 5. C, E).

Distribution: W., C. & E. Nepal, Himachal Pradesh, Uttarakhand, Sikkim, Darjeeling, Tibet, Bhutan, China, Myanmar, Thailand.

Ecology: Epiphytic, found on the mossy branches of tree.

Voucher Specimen: Palpa, Shreenagar hill, 1451m, 16th July, S. Neupane and C.Neupane, P41, (TUCH).

Katoella squamata (Decne.) Fraser-Jenk., Kandel & Pariyar, Ferns Fern Allies Nepal 1: 34 (2015); Kandel & Fraser-Jenkins: 25 (2020).

Davallodes squamata (Decne.), Phytotaxa 158: 297 (2014).

Plant epiphytic. Rhizome long-creeping, knobbly, dark-green, covered throughout, densely with scattered adpressed rounded brownish scales. Stipe stramineous, base scaly and above

glabrous, 20-23cm long, shorter than lamina. Fronds large, 35-40cm long and 30cm wide, 3-4 pinnate, widely deltate-lanceolate. Pinna 12-15 pairs, alternate, petiolated, triangular-lanceolate, apex acuminate. Pinnules 8-10 pairs, alternate, petiolated, base unequally cuneate, apex acute; pinnulets shortly stalked, oblique base, apex acute-obtuse, deeply lobed and dissected to wider segments. Rachis and costa stramineous, glabrous, grooved adaxially. Veins darkened, simple. Sori small, round, single on a segment at forking point of vein, indusiate; indusium semi-circuular, light yellowish brown.

Distribution: C. & E. Nepal, Arunanchal Pradesh, Sikkim, Darjeeling, Uttarakhand, Tibet, Bhutan, China, Sri Lanka, Thailand, Vietnam.

Ecology: Epiphytic found on mossy tree branches.

Voucher Specimen: Palpa, Tahu, 1300m, 3rd Sep. 2022, S.Neupane and S.N.Khanal, P66, (TUCH).

Leucostegia Presl.

Plant epiphytic or terrestrial. Rhizome creeping covered with scales and hairs. Stipes stramineous, long, grooved or not, glabrous. Fronds compound, lamina bipinnate to tripinnate, deltoid to ovate, texture herbaceous, glabrous. Veins simple. Sori semi-orbicular, indusiate.

Leucostegia immersa (Wall. *ex* Hook.) C.Presl, Tent. Pterid.: 95, t.4, f.11 (1836); Beddome: 51 (1883); Ito; 469 (1966); Chowdhury: 43 (1973); Iwatsuki: 179 (1975); Nakaike & Gurung: 193 (1988a); Fraser-Jenkins: 313 (1997b); Bista et al.: 140 (2002); Kandel & Fraser-Jenkins: 26 (2020).

Davallia immerse Wall. Ex. Hook. Sp. Fil. 1: 156 (1846); Clarke, Trans. Linn. Soc. Lond. II Bot. 1. 443. 1880.

Acrophorous immersum (Moore) Bedd. Ferns South. India, t. 11. 1864.

Leucostegia truncata D. Don) Fraser- Jenk. Taxon. Revis. Indian Subcontinental Pteridophytes: 348 (2008).

Plant terrestrial or epiphytic. Rhizome short or long creeping, covered by dark brown lanceolate scales, along with hairs. Stipes stramineous, 20-30cm long, glabrous, grooved adaxially. Fronds wide, 40-50cm long and 15-20cm broad, lamina tripinnate-quadripinnate, ovate or deltoid-lanceolate, apex acuminate; pinnae lanceolate, alternate or sub-opposite, stalked, acuminate; pinnules sessile, obliquely placed, alternate, acute, lower pinnules oblong, upper

ones dichotomize, lobes upto costule, acroscopic lobes larger than basiscopic lobes, truncate apex with toothed segment; glabrous on both surfaces, texture herbaceous. Veins forked ones or twice. Sori sub-marginal, indusium orbicular-reniform, pale. Spores yellowish brown. (Plate 5. D).

Distribution: W., C. & E. Nepal, Arunanchal Pradesh, Sikkim, Darjeeling, Uttarakhand, N.E. & S. India, Tibet, Bhutan, China, Malaysiya, Myanmar, Thailand, Vietnam.

Ecology: Terrestrial found in the forest floor.

Voucher Specimen: Palpa, Shreenagar hill, 1449m, 16th Jul. 2022, S. Neupane & C. Neupane, P42, (TUCH).

Polypodiaceae Berch. and C. Presl

Plants usually epiphytic and rarely terrestrial. Rhizomes short or long, creeping, scaly. Stipes usually articulated. Fronds usually simple and rarely decompound, monomorphic or dimorphic, glabrous or hairy, margin entire or lobed, texture coriaceous or herbaceous. Veins usually anastomosing, and sometimes free. Sori orbicular, linear or oblong, exindusiate.

Key to Genera

1a. Fronds dimorphic…….*Drynaria*

1b. Fronds monomorphic ……..…….2

2b. Lamina simply pinnate, imparipinate …….*Arthromeris*

2b. Lamina simple……..3

3a. Lamina lanceolate slightly broad, with long linear sori…….**.....***Loxogramme*

3b. Lamina narrow, with rounded sori……4

4a. Lamina with stellate hairs below with small pores above……..*Pyrossia*

4b. Lamina glabrous and without small pores above……..5

5a. Lamina simple, linear, texture coriaceous……...…*Lepisorus*

5b.Lamina divided, non-linear……6

6a. Fronds palmately divided, 1 or 2-5 or 8 pairs of pinnae……..*Selliguea*

6b.Lamina pinnately divided with 10-20 pairs of pinnae……..7

7a. Fronds large, margin entire and texture coriaceous……*Microsorum*

7b. Fronds small, margin serrate and texture herbaceous…….*Polypodiodes*

Arthromeris (Moore) J. Smith, Hist.

Plant lithophytic, epiphytic or terrestrial. Rhizome long-creeping, densely scaly, thickor thin, covered with brown-dark brown scales. Stipe straminous or brown, Glabrous or pubescent. Fronds monomorphic. Lamina, simply pinnate, imparipinate or simple, alternate or opposite, sessile, articulated to rachis, labceolate, margin entire, apex acuminate. Texture herbaceous or coriaceous, surface glabrous or pubescent. Lateral veins distinct, veinlets anastomosing to form irregular aerole. Sori orbicular or elongate between each pair of main lateral vein, exindusiate.

Arthromeris tatsienensis (Franch. & Bureau) Ching, Contr. Inst. Bot. Natl. Acad. Peiping 2: 93 (1933); Kandel & Fraser-Jenkins **3**: 34 (2020).

Terrestrial plant. Rhizome short-creeping, subterranean, woody, covered with brown scales. Stipe stramineous to light brown, 20cm long, glabrous. Fronds at distant, lamina imparipinate, ovate-lanceolate, 20-40cm long and 20-25cm broad, pinnae 2-8 pairs, sub-opposite, sessile, facing upwards, oblique, base broadly cuneate to rounded or sub-cordate, ovate-lanceolate,margin entire, apex caudate, terminal pinna larger; lamina herbaceous or sub-leathery, both surface glabrous. Lateral veins darkened. Sori orbicular, in a single row on each side of the costa, one between each lateral vein, exindusiate.

Distribution: C. & E. Nepal, Arunanchal Pradesh, Sikkim, Darjeeling, Bhutan, N. E. India, China.

Ecology: Terrestrial found in the slope of forest.

Voucher Specimen: Palpa, Khaseuli, 1330m, 1st Nov. 2021, S.Neupane and B.Parajuli, P16, (TUCH).

Drynaria (Bory) J. Sm

Plant usually epiphytic. Rhizomes short to long creeping, covered with scales. Stipes small or absent. Fronds mostly dimorphic, lamina simple to pinnatifid, entire or lobed, sessile or stalked, glabrous or hairy, texture coriaceous; rachis upper part grooved, hairy or glabrous. Veins anastomosing. Sori small, round along veins in single or two rows, exindusiate.

Drynaria propinqua (Wall ex. Mett.) J. Sm. apud Bedd., Ferns Brit. India: t. 160 (1866); Tagawa: 493 (1966); Iwatsuki: 198 (1975); Nakaike & Gurung: 192 (1988a); Kandel & Fraser-Jenkins: 41 (2020).

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

Plant epiphytic. Rhizome long, creeping, thick covered with pale brown, narrow, appressed scales. Fronds dimorphic; basal sterile fronds small, sessile, widely ovate, 12cm long and 8cm broad, shallowly lobed, pink-light green when young and light brown when dried, persistent on old rhizomes. Fertile foliage fronds larger, stipe 14-16cm long, stramineous, glabrous, slightly grooved, lamina 30-35cm long and 15-20cm broad, ovate-lanceolate, deeply pinnatifid to pinnate, sessile, pinna deeply lobed towards rachis, texture sub-coriaceous, yellowish when dried, glabrous. Veins anastomosing. Sori small, round, in a single row on each side of main vein, exindusiate. (Plate 7. E).

Distribution: W., C. & E. Nepal, Tibet, Arunanchal Pradesh, Bhutan, Sikkim, Darjeeling, Myanmar, Thailand, Vietnam.

Ecology: Epiphytic found in the trees trunks.

Voucher Specimen: Palpa, Shreenagar hill, 1452m, 16th July, S. Neupane and C. Neupane, P37, (TUCH).

Lepisorus (J. Sm.) Ching.

Plants epiphytic or lithophytic. Rhizome thick or thin, long or short creeping, scaly. Sipes short, stramineous, base with sparse scales and above glabrous. Fronds simple, linear to lanceolate, base cuneate, margin entire, apex acute or sometimes acuminate, glabrous, texture coriaceous. Veins simple or forked. Sori large, round, in single row on each side of costa, Sori dark to yellowish brown.

Key to Species

1a. Lamina narrow, sori from base to near apex, coriaceous texture……..*L.nudus*

1b. Lamina broad, sori on distal half of lamina, herbaceous texture……*L. scolopendrium*

Lepisorus nudus (Hook.) Ching, Bull. Fan Mem. Inst. Biol. (Bot.) **4**: 83 (1933); Tagawa: 494 (1966); Iwatsuki: 200 (1975); Gurung: 99 (1986); Nakaike *et al.*: 193(1990); Thapa: 10 (2000); Bista *et al.*: 44 (2002); Kandel & Fraser-Jenkins: 62 (2020).

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

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

Epiphytic plant. Rhizomes long-creeping, covered with narrowly triangular-lanceolate, dark-brown, exserted scales. Stipe 1-4cm, smooth. Fronds 0.5-1cm apart, lamina simple, 10-30cm long and 0.5-1cm broad, green and pale yellow when dry, base cuneate and decurrent, margin entire, straight or slightly recurved, apex short to long acuminate; texture coriaceous. Costa with small dark scales abaxially. Main veins raised on both sides, veinlets obscure. Sori orbicular, between base and apex, indented on lamina and raised above, exindusiate.

Distribution: W., C. & E. Nepal, Tibet, Myanmar, China, Bhutan, Pakistan, Sri Lanka, N.E. and S. India, Arunanchal Pradesh, Sikkim, Darjeeling, Jammu & Kashmir, Thailand,

Ecology: Epiphytic found on mossy tree branches.

Voucher Specimen: Palpa, Shreenagar hill, 1440m, 2nd Nov. 2021, S. Neupane and B. Parajuli, P19, (TUCH).

Lepisorus scolopendrium (Ching) Mehra & Bir, Res. Bull. Punjab Univ., New Ser., Sci. 15: 168 (1964); Kandel & Fraser-Jenkins: 64 (2020).

Polypodium scolopendrium Buch.-Haem. *ex* D.Don in Prodr. Fl. Nepal.: 1 (1825), non scolopendria.

Plant epiphytic. Rhizome short, creeping, covered with dark brown scales. Stipe very short, stramineous, 2-3cm long, sparsely scaly at base. Fronds arise singly at very short distant, 15-30cm long and 2-3cm wide, broadly lanceolate, widest just below the middle and slightly narrowing above middle towards apices, base attenuate, decurrent, margin entire, apex acute or long caudate-acuminate, costa raised on both surfaces; texture herbaceous or thinly papery, both surface glabrous but costa with small, ovate-acute darrk scales. Lateral veins varying from prominent to mostly hidden, visible veinlets dark. Sori orbicular, large, usually indented well into the lamina and raised above, present in the distal half of lamina between costa and margin or sometimes near costa, exindusiate. (Plate 6. B).

Distribution: C. & E. Nepal, Arunanchal Pradesh, Sikkim, Darjeeling, Uttarakhand, Pakistan, Bhutan, China, Myanmar, Thailand.

Ecology: Epiphytic found in the mossy tree trunks.

Voucher Specimen: Palpa, Chhahara, 1731m, 9th Sep, 2022, S. Neupane and B. Neupane, P83, (TUCH).

Loxogramme (Blume) Presl.

Plant terrestrial or epiphytic. Rhizomes short to long creeping covered with clathrate brownish scales. Fronds simple, monomorphic to dimorphic, lamina linear- narrowly elliptic, sessile, margin entire, apex acuminate, texture thinly to thickly papery, surface glabrous or with short clavate glandular hairs. Veins anastomosing with many, few or without free included veinlets. Sori elongate, oblique or subparallel to costa, exindusiate, with hairlike paraphyses.

Loxogramme involuta (D.Don) C.Presl, Tent. Pterid.: 215 (1836); Beddome: 393, f. 228 91883); Tawaga: 495 (1966); Iwatsuki: 201 (1975); Roy *et al.*: 195 (1971); Gurung: 101 (1986); Fraser- Jenins: 313 (1997b); Bista *et al.*: 46 (2002); Kandel & Fraser-Jenkins.*:* 78(2020).

Grammatis involuta D. Don, Prodr. Fl. Nepal.: 14 (1825).

Gymnogramme involuta (D. Don) Hook., Sp. Fil.: 5; 155 (1864); Clarke: 570 (1880); Hope: 102 (1903).

Loxogramme mussooriensis R. D. Dixit and S. Das, Indian Fern J. 11(1-2): 60 (1995).

Plant epiphytic. Rhizome short creeping covered with broadly lanceolate greyish brown scales. Stipe indistinct or very short about 2-4cm long, winged. Fronds monomorphic, simple, 20-35cm long and 1.5-4cm broad, narrowly elliptic-lanceolate, apex caudate-acuminate, base attenuate, margin entire or curled up when dry; adaxial surface green, glabrous and abaxial surfac pale or cottony soft, texture leathery, coriaceous. Veins obscure. Sori linear, 2-4cm long, oblique to costa, continuous from near costa to margin, paraphyses present. (Plate 6. A).

Distribution: W., C. & E. Nepal, Himachal Pradesh, Uttar Pradesh, Sikkim, Darjeeling, Tibet, Bhutan, China, Thailand, Vietnam.

Ecology: Epiphytic found in the mossy tree trunk.

Voucher Specimen: Palpa, Chhahara, 1813m, 9th Sep. 2022, S. Neupane and B. Neupane, P79, (TUCH).

Microsorum Link

Plants epiphytic and lithophytic. Rhizomes long or short creeping, thick or thin, fleshy or not, covered with peltate or clathrate scales. Stipes long or short, present or absent, glabrous or with scales. Fronds monomorphic, lamina simple or pinnate, surface glabrous, texture herbaceous, leathery, or coriaceous. Veins anastomosing with free included veinlets. Sori round, in single rows on each side of vein or scattered irregularly or sometimes elongated, exindusiate.

Key to species

1a. Fronds simply pinnate……..*M. cuspidatum* subsp. *cuspidatum*

1b. Fronds simple…….…….....*M. membranaceum*

Microsorum cuspidatum (D. Don) Tagawa subsp. **cuspidatum**, Fl. of E. Himalaya [H. Hara] 495 (1966); Kandel & Fraser-Jenkins: 81 (2020).

Polypodium cuspidatum D. Don., Prodr. Fl. Nepal. 2 (1895).

Phymatosorus cuspidatus Pich. Serm., Webbia 31: 249 (1977).

Plant mostly lithophytic and sometimes epiphytic. Rhizome short to long creeping, thick, green, succulent, covered with dark grey, adpressed, peltate scales. Stipe upto 30-35cm long, stramineous to dark brown, base scaly and above glabrous, grooved. Fronds arising separately, lamina 50-65cm long and 15-25cm broad, pinnate, imparipinnate; pinnae 10-20 pairs, linear-lanceolate, stalked, margin entire, base cuneate, apex acuminate; both surface glabrous, texture coriaceous. Mid-vein raised on both surfaces, veinlets obscure. Sori round in single row on each side of costa, exinduciate. (Plate 6. C, E).

Distribution: W., C. & E. Nepal, China, Tibet, Bhutan, N. E. India, Sikkim, Darjeeling, ; Myanmar, Thailand, Vietnam.

Ecology: Lithophytic found in the rocky wall on the roadside.

Voucher specimen: Palpa, Batase danda, 1380m, 4th Sep., 2022, S. Neupane and S.N. Khanal, P73, (TUCH).

Microsorum membranaceum (D. Don) Ching, Bull. Fan Mem. Inst. Biol. (Bot.) 4: 309 (1933); Tagawa: 80 (1955); Roy *et al.*: 195 (1971); Iwatsuki: 201 (1975); Gurung: 103(1986);

Nakaike *et al.*: 194 (1990); Fraser-Jenkins: 324 (1997b); Bista *et al.*: 47 (2002); Kandel & Fraser-Jenkins: 83 (2020).

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

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

Plant epiphytic and lithophytic. Rhizomes short creeping, thick, covered with blackish clathrate scales. Stipe short, 2-5cm long, Fronds isomorphic, lamina simple, 15-60cm long and 5-10cm broad, Ovate-narrowly lanceolate, margin entire, base decurrent, apexacuminate; texture membranaceous, glabrous on both surfaces. Veins distinct, anastomosing. Sori small, round, numerous, irregularly scattered, exindusiate. Spores yellow to light brown. (Plate 6. D).

Distribution: W., C. & E. Nepal, Tibet, China, Bhutan, India, Myanmar, Thailand, Laos, Philippines, Sri Lanka, Vietnam.

Ecology: Epiphytic found in the mossy tree trunks and also in mossy rocks.

Voucher Specimen: Palpa, Shreennagar hill, 1445m, 16th July, 2022, S. Neupane and C. Neupane, P38, (TUCH).

Polypodiodes Ching

Plant epiphytic or lithophytic. Rhizomes long-creeping, densely covered with scales. Stipes stramineous or brown, base scaly. Fronds articulated to rhizome, lamina simple to pinnatisect, linear-lanceolate, margin toothed or serrulate, apex acuminate; surface glabrous or hairy, texture herbaceous to sub coriaceous. Veins forked, free or sometimes anastomosing. Sori round in one row on each side of costa, exindusiate. Spores yellowish brown.

Polypodiodes lachnopus (Wallich *ex* Hooker) Ching, Acta Phytotax. Sin. **16** (40): 27 (1778); Dixit: 52 (1984); Lu: 42 (1999); Bista *et al.*: 53 (2002); Kandel & Fraser-Jenkins: 107 (2020).

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

Polypodium lachnopus Wall. *ex* Hook., Ic. Pl.: t.592 (1854), Sp. Fil. **5**:32.

Plant terrestrial. Rhizome long creeping, thin, densely covered with brown, broad-based ciliated scales with long attenuated, hair-like black apices. Stipe slender, thin stramineous, 4-8cm long. Fronds singly, lamina 9-30cm long and 1.5-5cm broad, simply pinnate, linear-

lanceolate, base cordate, apex acuminate; pinna 15-30 pairs, laceolate, margin toothed, apex obtuse or acute, basal 1-2 pairs slightly shorter and deflexed. Rachis stramineous, and covered with short sparse scales. Surface glabrous, texture herbaceous, light green. Veins reticulate, dark colored. Sori round, terminal on included veinlets, 8-10pairs on each side of costule, exindusiate. Spores yellowish brown.

Distribution: W., C. & E. Nepal, Tibet, Bhutan, Sikkim, Darjeeling, Uttarakhand, Himachal Pradesh, Jammu & Kashmir, N.E. India, China, Myanmar, Thailand.

Ecology: Epiphytic, found on the tree trunk.

Voucher Specimen: Palpa, Shreenagar hill, 1456m, 16th July, S. Neupane and C. Neupane, P39, (TUCH).

Pyrrosia Mirb.

Plant epiphytic and lithophytic. Rhizomes short to long creeping, covered densely by scales. Stipes articulated to rhizome. Fronds monomorphic or dimorphic, distant or clustered, lamina simple, lanceolate-ovate, margin entire, texture thick and coriaceous. Main veins distinct, lateral veins obscure. Sori orbicular, 1 to many scattered rows in regular or irregular way, exindusiate.

Key to Species

1a. Rhizome long-creeping……..….*P.lanceolata*

1b. Rhizome short-creeping……..…..……....2

2a. Lamina broad, thick, rusty tan below without wooly rays……..…..*P. costata*

2b. Lamina narrow, with wooly rays below…….…3

3a. Lamina entire to slightly dentate with long acuminate apex, texture herbaceous…..*P. manni*

3b. Lamina entire with acute-short acuminate apex, texture leathery……*P. stenophylla*

Pyrrosia costata (Wall. *ex* C. Presl) Tagawa & K. Iwats. Acta Phytotax. Geobot. 22: 100 (1967); Tagawa: 219 (1971); Iwatsuki: 203(1973); Hovenkamp: 171, f.17 (1986); Bista *et al.*: 54 (2002); Kandel & Fraser-Jenkins: 112 (2020).

Pyrrosia beddomeana (Giesenh.) Ching, Bull. Chin. Bot. Soc. 1:68 (1935)

Plant epiphytic or lithophytic. Rhizome short creeping covered with basifixed dark brown scales. Stipes slightly stalked about 3-6cm, winged with decurrent base, greenish, grooved. Fronds monomorphic, lamina simple, 20-40cm long and 2.5-6cm broad, base narrowed, widest above the middle, margin entire, apex acute- acuminate; lamina dark green with stellate hairs above and rusty tan below, texture thick, coriaceous. Mid veins raised and distinct and veins simple upto margin. Sori closely packed on abaxial surface throughout and most often on the apical region of lamina.

Distribution: W., C. & E. Nepal, Tibet, Bhutan, Sikkim, Darjeeling, Uttarakhand, N. E. India, China, Malayasia, Myanmar, Thailand.

Ecology: Lithophytic found in the mossy rock.

Voucher Specimen: Palpa, Batase danda below, 1287m, 1st Mar. 2021, S. Neupane and B. Neupane, P26, (TUCH).

Pyrrosia lanceolata (L.) Farw., Amer. Midl. Naturalist. 12: 245 (1930); Kandel & Fraser-Jenkins: 116 (2020).

Plant epiphytic or lithophytic. Rhizome long- creeping, thin covered by pale lacerate scales. Stipe short, slender, greenish, 2-2.5cm long, glabrous. Fronds monomorphic, 8-15cm long and 0.5-0.8cm broad, fertile frond slightly longer than sterile one, lamina simple, base slightly attenuate, margin entire, apex acute to obtuse; texture thick and leathery, glabrous, shiny above and pale rough surface below. Mid-vein conspicuous and lateral veins obscure. Sori small, round, sunken, throughout the abaxial surface, mainly towards apical region. Spores dark brown. (Plate 7. D).

Distribution: W., C. & E. Nepal, Arunanchal Pradesh, Sikkim, Darjeeling, Uttarkhand, N. E. and S. India, Tibet, Bhutan, Bangladesh, Myanmar, Thailand.

Ecology: Found in the rocks and trees.

Voucher Specimen: Palpa, Jordhara side, 615m, 26th Jul., 2022, S. Neupane and S. Aryal, P53, (TUCH).

Pyrrosia mannii (Giesenh.) Ching, Bull. Chin. Bot. Soc. 1: 55 (1935); Tagawa; 498(1966); Iwatsuki: 203(1975); Hivenkamp: 212, f.18 (1986); Nakaike & Gurung: 196 (1988a); Fraser-Jenkins: 324 (1997b); Kandel & Fraser-Jenkins: 117 (2020).

Niphobolus mannii Gies., Farng. Niphobolus: 107 (1901).

Plant epiphytic. Rhizome short creeping rhizome, covered with pale to light brownish scales. Stipe very short about 2-3cm. Fronds monomorphic, with apical tufts, simple, densely indumented, 15-25cm long and 0.5-2cm broad, oblaneolate-lanceolate, base attenuate, margin entire to slightly dentate in mid to apical side, apex acute to long acuminate; texture herbaceous, upper surface slightly hairy with distinct hydathodes and below densely wooly rays. Mid vein distinct and veinlets obscure. Sori immersed, small, round scattered.

Distribution: W., C. & E. Nepal, Uttarpradesh, Sikkim, Darjeeling, Bhutan, China, Thailand, Sri Lanka.

Ecology: Epiphytic found in tree trunks.

Voucher Specimen: Palpa, Shreenagar hill, 1440m, 2nd Nov., 2021, S. Neupane and B. Parajuli, P18, (TUCH).

Pyrrosia stenophylla (Bedd.) Ching, Bull. Chin. Bot. Soc. 1: 55 (1935); Kandel & Fraser-Jenkins: 122 (2020).

Plant epiphytic. Rhizome short creeping, covered with bright brown scales. Stipe short about 1-3cm long, base with scales. Fronds monomorphic, narrow, simple, linear to lanceolate, indumented, 9-20cm long and 0.5-1cm broad, base gradually narrowed, apex acute to shortly acuminate. Hydathodes distinct and midrib yellowish from base to apex along with short stiff hairs on adaxial surface. Indument persistent, dimorphic, brown-whitish on lower layer, with erect-spreading to appressed acicular rays, mixed with woolly rays. Texture thin leathery. Veins obscure, veinlets on adaxial surface hardly distinct, simple, free. Sori orbicular, superficial except on mid-vein, without central bundle of paraphyses. (Plate 7.C).

Distribution: W., C. & E. Nepal, Tibet, Arunanchal Pradesh, Bhutan, Sikkim, N. E. India, china, Myanmar,

Ecology: Epiphytic on tree trunk.

Voucher Specimen: Palpa, Shreenagar hill, 1454m, 26th Aug. 2022, S. Neupane and S. Aryal, P40, (TUCH).

Selliguea Bory.

Plant epiphytic. Rhizome short or long creeping, woody, densely covered with brown to black, ovate-lanceolate scales. Stipe usually glabrous. Fronds articulated to rhizome, monomorphic or dimorphic. Lamina, simple, palmately or pinnately divided, lobed, margin notched or

serrated, base decurrent on stipe, apex acuminate to acute. Sori orbicular, on either side of mid-rib, exindusiate.

Selliguea oxyloba (Wall. *ex* Kunze) Fraser-Jenk. Taxon. Revis. Indian Subcontinental Pteridophytes: 44 (2008); Kandel & Fraser- Jenkins: 125 (2020).

Polypodium trifidum D. Don in Prodr. Fl. Nepal.: 3 (1825), nom. illeg.

Plant epiphytic. Rhizome long-creeping, covered densely with pale-brown scales throughout. Stipe stramineous-brown, 10-20cm long, scaly at base and glabrous above. Fronds monomorphic, slightly distant, lamina deltate-ovate, wide pinna like lobes, lateral lobes (1 or) 2-5(-6) pairs, 15-30cm long and 10-20cm broad, base broadly cuneate and decurrent on stipe, apex caudate-acuminate or rarely acute, margin entire; both surface glabrous and texture herbaceous and papery. Costa and lateral veins raised on both surfaces. Sori orbicular, large, in a single row on each side of the costa, slightly near costa, exinduciate. (Plate 7. D).

Distribution: W., C. & E. Nepal, Tibet, China, Myanmar, Thailand, Vietnam, Bhutan, N. E. India, Sikkim, Darjeeling,Arunanchal Pradesh, Uttarakhand, Himachal Pradesh.

Ecology: Epiphytic found on the tree trunk.

Voucher Specimen: Palpa, Chhahara, 1755m, 9th Sep. 2022, S. Neupane and B. Neupane, P78, (TUCH).

CHAPTER 5: DISCUSSION

5.1 Floristic composition

Palpa being the hilly region occurring on the tropical to sub-tropical region with mild climatic condition, varying topography, altitudinal range and habitat variation, occupies a huge diversity of pteridophytic flora. The present study has recorded an aggregate of 86 species belonging to 43 genera and 20 families, which represents about 14.75% (species), 46.23% (genera) and 62.5% (families) of the total known taxa for Nepal. Similar number of species (85) which is 14.57% of present total number of species of Nepal, recorded from Daman by Prajapati (2013). But, slightly more number of species were recorded from Manaslu Conservation Area by Bhattarai (2013), Besisahar to Manang by Shrestha (2017) and from Panchase Protected forest by Thakur & Rajbhandary (2018). These differences may be due to the variation on altitude along with variable forest types and also the climatic conditions of different study areas.

Among 20 families, Pteridaceae was the largest family with 9 genera and 19 species followed by Polypodiaceae with 8 genera and 13 species. Followed by Dennstaedtiaceae, Woodsiaceae and Dryopteridaceae with 3 genera each. Polypodiaceae was the largest family reported by Prajapati (2013), Bhattarai (2013), Shrestha (2017) and Thakur & Rajbhandary (2018). The differences in the results of present study possibly may be due to differences in the elevation ranges.

Among the genera, *Thelypteris* was the largest genera with 10 species followed by *Athyrium* and *Pteris* with 6 species each. Shrestha (2017) also found the *Thelypteris* as the largest genera with 9 species followed by *Pteris* with 7 species in almost the same range.

5.2 Distribution of Species based on habitat and forest types

The distribution and richness of pteridoflora is dependent on many factors regarding habitat, altitude, rainfall, temperature, seasonality, exposure and soils (Moran, 2002). In addition, some biological factors such as genetic features and their physiological adaptations are also taken as the factors for variations in growth and distribution of such species (Barrington, 1993).

On the basis of habitat types, the present study has identified the three major habitat namely terrestrial, lithophytic and epiphytic habitat for pteridophytes. Similar habitat types were reported by Gurung (1991), Prajapati (2013), Bhattarai (2013) and Rajbhandary (2016) in their study from different parts of Nepal. Thus, out of 86 species of pteridophytes, 73% species (63) were terrestrial, 19% species (16) were epiphytic and 8% species (7) were lithophytic. Some

species were found growing in more than one habitat such as *Nephrolepis cordifolia* and *Elaphoglossum stelligerum* growing as terrestrial and epiphytic, *Pyrrosia costata, Pyrrosia lanceolate, Microsorum membranaceum, Microsorum cuspidatum* subsp. *cuspidatum* and *Lepisorus nudus* growing on epiphytic and lithophytic habitat. In this study, more number of species was found on terrestrial habitat followed by epiphytic and lithophytic were recorded. Preference of terrestrial habitat by most of the species may be due to the suitable soil conditions and adaptive capacity of such species on terrestrial habitat. Similar findings was reported by Bhattarai (2013), Shrestha (2017) and Thakur & Rajbhandary (2018). While low number of epiphytic species may be due to the less suitable tree species and altitude supporting their growth. Shrestha (2017) and Thakur & Rajbhandary (2018) reported the most suitable altitude for the epiphytic species on 2000-2600m, whereas present study is limited with such altitude to support more number of epiphytic species.

The distribution of species largely depends on the types of forest. From the study five types of forest were recognized within six local bodies. Among the total number of species collected the higher number of species was found in *Schima-Castanopsis forest* with 34 species, followed by 20 species from *Quercus-Rhododendron* forest and 18 species from Lowland Mixed forest and other remaing two forest types *Shorea robusta* forest with 8 and *Pinus roxburghii* forest with 6 species.

In this study, *Schiima-Castanopsis* forest attends the best place for the growth of ferns because they have closed canopy, which limits the sun exposure in forest due to which holds the highest moisture content in soil in forest floor and slopes as well as in barks. In addition, this type of forest has been found in Shreenagar hill mostly in North aspect with moist and cold climate, comprise high diversity of ferns. In Himalayas, Northern aspects are relatively moist than Southern slope and pteridophyte species richness was high in North facing slope than South facing slope (Panthi *et al.*, 2007; Sharma, 2012). While Prajapati (2013) reported maximum species richness in Mixed Forest and Shrestha (2017) reported *Quercus-Laurels-Rhododendron* forest with highest diversification on the distribution of pteridophytes. The differences in the results may be due to the different climatic variables, altitudinal pattern and aspects of forests supporting the growth of ferns. Likewise, *Quercus-Rhododendron* forest of the present study area is located in sub-tropical region with few number of individuals due to which the ferns growth is minimum in comparision to the *Schima-Castanopsis* forest.

Similarly, *Shorea robusta* forest in lower tropical zone attends high temperature and open canopy, as a result low moisture content in soil for terrestrial species in the forest and no thick mossy tree barks to hold epiphytic species. Whille, *Pinus roxburghii* forest covers very few number of fern species with no epiphytic species. Mehra and Bir (1964) and Gurung (1994) proposed that the epiphytic species has poor growth on conifers which is due to the inhibitory effect of resinous nature content on the trees as well as dry barks in pine trees limits the growth of epiphytic ferns. Most of the epiphytic species had their host tree species as *Schima wallichii* covering thick, rough, moist mossy bark, which provides suitable habitat for the growth of epiphytic ferns.

5.3 Ethnobotanical Uses

The current study is also focused on the ethnobotanical study regarding the uses of fern and fern allies by the ethnic groups of the Palpa district. Some ethnic groups of this area were still utilizing the forest products including ferns and their allies for the medicinal, economical, ornamental as well as other multipurposes. Thus, from the total species, only 21 species were documented for ethnobotanical use of pteridophytes. Out of them, 10 species were used for medicinal value, 4 species for food, 3 species for animal bedding, 2 for ornamental use and 2 for other miscellaneous use. The species for multipurpose use was *Nephrolepis cordifolia* for ornamental, food and medicinal purpose.

From the collection, local people used a remarkable number of species for various purposes. This shows, some ethnic people with good indigenous knowledge on uses of ferns while some young generations were far backward. For medicinal purpose 10 species were used. Species like *Dryopteris cochleata* young frond is used for vegetable and rhizome powder as medicine to cure leprosy. *Blechnum orientale, Cheilanthes tenuifolia, Equisetum arvense* subsp. *diffusum, Microsorum membranaceum* and *Pteris biaurita* subsp. *walkeriana* are used for antiseptic for wound or cut healing. Whiles` *Adiantum capillus-veneris* leaf used for headache and chest-pain and *Nephrolepis cordifolia* for jaundice and diabetes.

The species used for food are *Diplazium esculentum, Diplazium maximum* and *Tectaria coadunata* crozier or young fronds of these species are used for vegetables, which is a common practice in most part of Nepal. The whole plant of *Ophioglossum reticulatum* for food as vegetable. Likewise, 2 species were used as ornamental i.e *Nephrolepis cordifolia* is used in the gardening, and in making bouquet and *Lygodium japonicum* is also used in garden or home decoration as ornamental. The remaining 2 species: *Aleuritopteris bicolor* stipe is used for the

piercing ear or nose and also used for the treatment of stomach disorders. While *Selaginella subdiaphana* strobilus with orange brown spores is used for coloring purposes and also used by woman as "vermilion" in the past days.

The present study on ethnobotanical use on pteridophytes is slightly low in number compared with the Thakur & Rajbhandary (2018) who have documented 51 species out of 94 species from Panchase Area which shows the people of Panchase regions still depends on forest resources including pteridophytes.

5.4 Conservation Status

Floristic survey of the particular area helps to know the conservation status of the species. In the same way, the present study has found two species to be under Nepalese threatened status described in *Fern and Fern Allies of Nepal* Vol. 1 (Fraser-Jenkins *et al.* 2015) and *Fern and Fern Allies of Nepal* Vol. 2 (Fraser-Jenkins and Kandel 2019). The first one *Athyrium falcatum* is under Nepalese threatened status (VU) was found first time in Surkhet (West Nepal) by Fraser-Jenkins et al. (1997) and now found second time in Palpa (Central Nepal) after 26 years, which is new species for Central Nepal and not reported in Eastern Nepal. Likewise, second one *Antrophyum reticulatum* is in Nepalese threatened status (VU) is reported in Central Nepal in some places including present study area (Palpa) and Eastern Nepal but not reported in Western Nepal. Thus, floristic surveys help to know the species under different IUCN categories so frequent study is essential for the conservation of species before their extinction.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The floristic work carried in Palpa district has recorded altogether 86 species belonging to 43 genera and 20 families. Among 20 families, Pteridaceae was the largest family comprising 9 genera and 19 species followed by family Polypodiaceae with 8 genera and 13 species. Among 43 genera, *Thelypteris* was the largest genera with 10 species followed by *Athyrium* and *Pteris* with 6 species each.

Similarly, based on habitat types, the majority of the species were terrestrial (73%) followed by epiphytic species (19%) and lithophytic species (8%). But, some species like *Nephrolepis cordifolia, Pyrrosia costata, Pyrrosia lanceolata, Microsorum membranaceum, Microsorum cuspidatum* subsp. *cuspidatum, Elaphoglossum stelligerum,* and *Lepisorus nudus* were found growing on more than one habitat.

Among, the forest types, *Schima-Castanopsis forest* supports the highest number of species followed by *Quercus-Rhododendron forest* and lowest number of species found in *Pinus roxburghii* and *Shorea robusta* forest which may be due to the climatic factors like temperature, rainfall and altitude. Some species like *Aleuritopteris bicolor, Thelypteris dentata, Selaginella subdiaphana, Pteris biaurita* subsp. *walkeriana, Dicranopteris taiwanensis* etc. were found in more than one forest types.

In addition, regarding the ethnobotanical use, local people had been using ferns since long back for different purposes including medicine, food, ornamental, animal bedding, and many other uses. Among them, local people mainly use ferns for the medicine (10) species followed by 4 species for food. But, still they are unware of many important species of pteridophytes, due to which conservation of them is difficult.

Among the total species, two species i.e. *Athyrium falcatum* was found to be under Nepalese threatened status (VU), which was only found on West Nepal (Surkhet) and now on Central Nepal (Palpa) after 26 years and *Antrophyum reticulatum* was also found under Nepalese threatened status (VU). Thus, it is crucial to have frequent floristic survey all over the country for the conservation of pteridophytic flora.

6.2 Recommendations

From the present study, following recommendations are proposed:

- Frequent floristic survey should be carried out on fern and fern allies for the documentation of new species and know the conservation status.
- Ethnobotanical study on pteridophytic flora has been neglected in Nepal, very few work has been done so far, thus focus on this topic is essential.
- Awareness should be raised to the local people regarding the importance of pteridophytic flora on economic, cultural, social, medicinal and food value and anthropogenic activities against flora should be reduced.
- The department of forest and district offices should include conservation awareness program in their annual plan so that communities are aware and motivated towards conservation of forest florae including pteridophytes.
- Study on population status of two vulnerable species *Athyrium falcatum* and *Antrophyum reticulatum* is crucial.
- Further study on the remaining local bodies of Palpa is essential to include all floristic content of ferns and fern allies.

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APPENDICES

Appendix I: Table with list of Pteridophytes with family, altitude and habitat found in Palpa District.

C.N.	Scientific Names	Family	Altitude	Habitat
P24	*Adiantum capillus-veneris* L.	Pteridaceae	804	Terrestrial
P22	*Adiantum edgeworthii* Hook.	Pteridaceae	305	Terrestrial
P07	*Adiantum philippense* L. *subsp. philippense*	Pteridaceae	1320	Terrestrial
P05	*Aleuritopteris bicolor*(Roxb.) Fraser-Jenk.	Pteridaceae	1325	Terrestrial
P34	*Aleuritopteris dealbata*(C.Presl) Fee	Pteridaceae	900	Lithophytic
P67	*Aleuritopteris formosana*(Hayat)	Pteridaceae	1415	Lithophytic
P60	*Antrophyum reticulatum*(G.Forst) Kaulf.	Pteridaceae	1164	Lithophytic
P61	*Arthromeris tatsiensis*(Franch. & Bureau) Ching	Polypodiaceae	1330	Epiphytic
P80	*Asplenium yoshinage* Makino *subsp. indicum* (Sledge) Fraser-Jenk.	Aspleniaceae	1723	Epiphytic
P33	*Athyrium cuspidatum* (Bedd.) M.Kato	Woodsiaceae	1180	Terrestrial
P06	*Athyrium drepanopterum*(Kunze) A.Br. *ex* Milde	Woodsiaceae	1445	Terrestrial
P58	*Athyrium falcatum* Bedd.	Woodsiaceae	1140	Terrestrial
P65	*Athyrium foliolosum*T.Moore *ex* R.Sim	Woodsiaceae	1405	Terrestrial
P20	*Athyrium pectinatum*(Wall. e*x* Mett.)	Woodsiaceae	1453	Terrestrial
P28	*Athyrium strigillosum*(T.Moore *ex* Lowe) T.Moore *ex* Sal.	Woodsiaceae	1440	Terrestrial
P49	*Blechnum orientale* L.	Woodsiaceae	842	Terrestrial
P44	*Botrychium multifidum*(S.G.Gmel) Rupr.	Ophioglossaceae	1448	Terrestrial
P43	*Cheilanthes tenuifolia* (Burm.f.) Sw.	Pteridaceae	1159	Terrestrial
P32	*Coniogramme intermedia*Hieron.	Pteridaceae	1343	Terrestrial
P51	*Deparia japonica subsp. Petersenii* (Krunz) Fraser-Jenk.	Woodsiaceae	845	Terrestrial
P09	*Dicranopteris taiwanensis*Ching & P.S.Chiu	Glecheniaceae	1450	Terrestrial
P74	*Diplazium esculentum*(Retz.) Sw.	Woodsiaceae	801	Terrestrial
P61	*Diplazium maximum*(D.Don) C.Chr	Woodsiaceae	1160	Terrestrial
P62	*Diplazium spectabile* (Wall. e*x* Mett.) Ching	Woodsiaceae	1162	Terrestrial
P37	*Drynaria propinqua*(Wall. e*x* Mett.)	Polypodiaceae	1452	Epiphytic
P08	*Dryopteris cochleata* (Haem. e*x* (D.Don) C.Chr.	Dryopteridaceae	1330	Terrestrial
P85	*Dryopteris juxtaposita* Christ.	Dryopteridaceae	1745	Terrestrial
P13	*Dryopteris sparsa* (D.Don) Kuntze subsp. *sparsa*	Dryopteridaceae	1330	Terrestrial
P68	*Dryopteris woodsiisora* Hayata	Dryopteridaceae	1414	Lithophytic
P76	*Elaphoglossum stelligerum* (Wall. e*x* Baker) T.Moore *ex* Salomon	Lomariopsidaceae	1333	Terrestrial

P77	*Equisetum arvens* subsp. *diffusum* (D.Don) Fraser-Jenk.	Equisetaceae	1737	Terrestrial
P57	*Hypodematium crenatum* (Forssk.) Kuhn, subsp. c*renatum*	Dryopteridaceae	1271	Lithophytic
P54	*Hypolepis polypodiodes* (Bl.) Hook.	Dennstaedtiaceae	845	Terrestrial
P41	*Katoella pulchra*(D.Don) Fraser-Jenk.	Davalliaceae	1451	Epiphytic
P66	*Katoella squamata*(Decne.) Fraser-Jenk.	Davalliaceae	1300	Epiphytic
P19	*Lepisorus nudus*(Hook.) Ching	Polypodiaceae	1440	Epiphytic
P83	*Lepisorus scolopendrium* (Ching) Mera & Bir	Polypodiaceae	1731	Epiphytic
P42	*Leucostegia immersa* (Wall. *ex* Hook) C.Presl	Davalliaceae	1449	Terrestrial
P79	*Loxogramme involuta*(D.Don) C.Presl.	Polypodiaceae	1813	Epiphytic
P48	*Lygodium flexuosum* (L.) Sw.	Lygodiaceae	864	Terrestrial
P52	*Lygodium japonicum* (Thunb.) Sw.	Lygodiaceae	840	Terrestrial
P69	*Microlepia setosa* (Sm.) Alston	Dennstaedtiaceae	1411	Terrestrial
P29	*Microlepia speluncae*(L.) T.Moore	Dennstaedtiaceae	851	Terrestrial
P73	*Microsorum cuspidatum* (D.Don) Tagawa subsp. *cuspidatum*	Polypodiaceae	1380	Lithophytic
P38	*Microsorum membranaceum* (D.Don) Ching	Polypodiaceae	1445	Epiphytic
P11	*Nephrolepis cordifolia* (L.) C.Presl.	Nephrolepidaceae	1328	Terrestrial
P12	*Odontossoria chinensis* (L.) J.Sm	Lindsaeaceae	1330	Terrestrial
P81	*Oleandra wallichii* (Hook.) C.Presl.	Oleandraceae	1734	Epiphytic
P02	*Onychium siliculosum* (Desv.) C.Chr.	Pteridaceae	1414	Terrestrial
P75	*Onychium vermae* Fraser-Jenk. & Khullar	Pteridaceae	1409	Terrestrial
P86	*Ophioglossum reticulatum* L.	Ophioglossaceae	1117	Terrestrial
P50	*Palhinhaea cernua*(L.) Franco & Vasc.	Lycopodiaceae	840	Terrestrial
P56	*Pityrogramma calomelanos* (L.) Link	Pteridaceae	1133	Terrestrial
P39	*Polypodiodes lachnopus*(Wallich *ex* Hooker) Ching	Polypodiaceae	1456	Epiphytic
P82	*Polystichum discretum*(D.Don) J.Sm	Dryopteridaceae	1731	Terrestrial
P21	*Polystichum lentum* (D.Don) T.Moore	Dryopteridaceae	1445	Terrestrial
P27	*Polystichum squarrosum* (D.Don) Fee	Dryopteridaceae	1430	Terrestrial
P63	*Pteridium revolutum* (Bl.) Nakai	Dennstaedtiaceae	1150	Terrestrial
P84	*Pteris aspericaulis* Wall. e*x* J. Agardh	Pteridaceae	1745	Terrestrial
P01	*Pteris biaurita* L. subsp. *walkeriana* Fraser-Jenk.	Pteridaceae	1416	Terrestrial
P59	*Pteris cretica* L. subsp. *cretica*	Pteridaceae	1160	Terrestrial
P35	*Pteris normalis* D.Don	Pteridaceae	1490	Terrestrial
P36	*Pteris vittata* L. subsp. *vittata*	Pteridaceae	1485	Terrestrial
P72	*Pteris wallichiana* J.Agardh	Pteridaceae	1480	Terrestrial
P26	*Pyrrosia costata*(Wall. e*x* C.Presl)Tagawa & K.Iwats.	Polypodiaceae	1287	Epiphytic
P53	*Pyrrosia lanceolata* (L.) Farw.	Polypodiaceae	615	Epiphytic
P18	*Pyrrosia manni* (Giesenh.) Ching	Polypodiaceae	1440	Epiphytic
P40	*Pyrrosia stenophylla* (Bedd.) Ching	Polypodiaceae	1454	Epiphytic

P23	*Selaginella chrysorrhizos* Spring	Selaginellaceae	349	Lithophytic
P17	*Selaginella fulcrata* (Buch.-Haem. e*x* D.Don) Spring	Selaginellaceae	1448	Terrestrial
P25	*Selaginella pallida* (Hook. & Grev.) Spring	Selaginellaceae	1330	Terrestrial
P04	*Selaginella subdiaphana* (Wall. e*x* Hook & Griv.) Spring	Selaginellaceae	1420	Terrestrial
P78	*Selliguea oxyloba* (Wall. e*x* Kunze) Fraser-Jenk.	Polypodiaceae	1755	Epiphytic
P03	*Tectaria coadunata (*Wall. *ex* J.Sm) C.Chr.	Tectariaceae	1420	Terrestrial
P31	*Tectaria polymorpha* (Wall. e*x* Hook.) Copel	Tectariaceae	1193	Terrestrial
P64	*Thelypteris arida* (D.Don) C.V. Morton	Thelypteridaceae	1155	Terrestrial
P10	*Thelypteris dentata* (Forssk.) E.P.St. John	Thelypteridaceae	1328	Terrestrial
P47	*Thelypteris glanduligera* (Kunze) Ching	Thelypteridaceae	841	Terrestrial
P55	*Thelypteris nudata*(Roxb.) C.V.Morton	Thelypteridaceae	1155	Terrestrial
P15	*Thelypteri ornatipes*(Holttum & J.W.Grimes) Fras.-Jenk.	Thelypteridaceae	1325	Terrestrial
P30	*Thelypteris papilio* (C.Hope) K.Iwats	Thelypteridaceae	1150	Terrestrial
P14	*Thelypteris penangiana*(Hook.) C.F.Reed	Thelypteridaceae	1325	Terrestrial
P46	*Thelypteris procera* (D.Don) Fraser-Jenk.	Thelypteridaceae	843	Terrestrial
P45	*Thelypteris prolifera* (Retz.) C.F.Reed	Thelypteridaceae	836	Terrestrial
P71	*Thelypteris tylodes* (Kunze) Ching	Thelypteridaceae	1300	Terrestrial
P70	*Vittara flexuosa* Fee	Pteridaceae	1424	Epiphytic

Appendix II: Ethnobotanical uses of Pteridophytes

S.N.	**Scientific Names**	**Local Name**	**Parts Used**	**Uses**
1.	*Adiantum capillus-veneris* L.	Uniu	Fronds	Medicine (headache, chest pain)
2.	*Aleuritopteris bicolor* (Roxb.) Fraser-Jenk.	Rani sinka	Stipe Fronds	Miscellaneous (Piercing ears/nose, Stomach pain)
3.	*Blechnum orientale* L.	Uniu	Rhizome	Medicine (Anticeptic, Typhoid, Fever)
4.	*Cheilanthes tenuifolia* (Burm.f.) Sw.	Kali sinka	Fronds	Medicine (Used as antiseptic)
5.	*Coniogramme intermedia* Hieron.	Uniu	Whole Plant	Animal bedding (Litter composition)
6.	*Dicranopteris taiwanensis* Ching & P.S.Chiu	Uniu	Fronds	Medicine (Asthma)
7.	*Diplazium esculentum* (Retz.) Sw.	Paani Neuro	Crozier, Tender stem	Food (Vegetables and Pickles)

8.	*Diplazium maximum* (D.Don) C.Chr	Paani Neuro	Crozier, Tender stem	Food (Vegetables and Pickles
9.	*Dryopteris cochleata* (Haem. *ex* (D.Don) C.Chr.	Dathe Neuro	Crozier, Rhizome	Young frond as Food and Rhizome powder as Medicine (For leprosy)
10.	*Equisetum arvens subsp. diffusum* (D.Don) Fraser-Jenk.	Aakhle jhar, Kurkure jhar	Whole plant	Medicine (Applied on wounds)
11.	*Lygodium flexuosum* (L.) Sw.	Lahare uniu	Fronds, Roots	Dry leaves (Herbal tea) Roots with mustard oil for rheumatism.
12.	*Lygodium japonicum* (Thunb.) Sw.	Janai laharo	Whole plant	Ornamental and Medicinal (Diuretic, diseases of lungs & kidneys)
13.	*Microsorum membranaceum* (D.Don) Ching	Unieu	Whole Plant	Medicinal (Wound healing)
14.	*Nephrolepis cordifolia* (L.) C.Presl.	Paaniamala	Tubers, Fronds	Ornamental (Decoration) Tubers for food. Leaf & Roots for Jaundice, Diabetes
15.	*Ophioglossum reticulatum* L.	Jibre Saag	Whole Plant	Food (Vegetable)
16.	*Polystichum lentum* (D.Don) T.Moore	Unieu	Whole Plant	Animal Bedding
17.	*Pteris biaurita* L. subsp. *walkeriana* Fraser-Jenk.	Haade uneu	Whole Plant	Medicine (Apply on cuts and wounds)
18.	*Pteris vittata* L. subsp. *vittata*	Chari khutte	Whole Plant	Animal bedding
19.	*Pteris wallichiana* J.Agardh	Unieu	Rhizome	Medicine (Skin infections)
20.	*Selaginella subdiaphana (*Wall. *ex* Hook & Griv.) Spring	Sidure	Strobilus	Miscellaneous (Orange color spores of strobilus for coloring purpose, Women use sindoor)
21.	*Tectaria coadunata* (Wall. *ex* J.Sm) C.Chr.	Kalo niuro	Crozier	Food (Vegetables and Pickles)

Appendix III: Photoplates

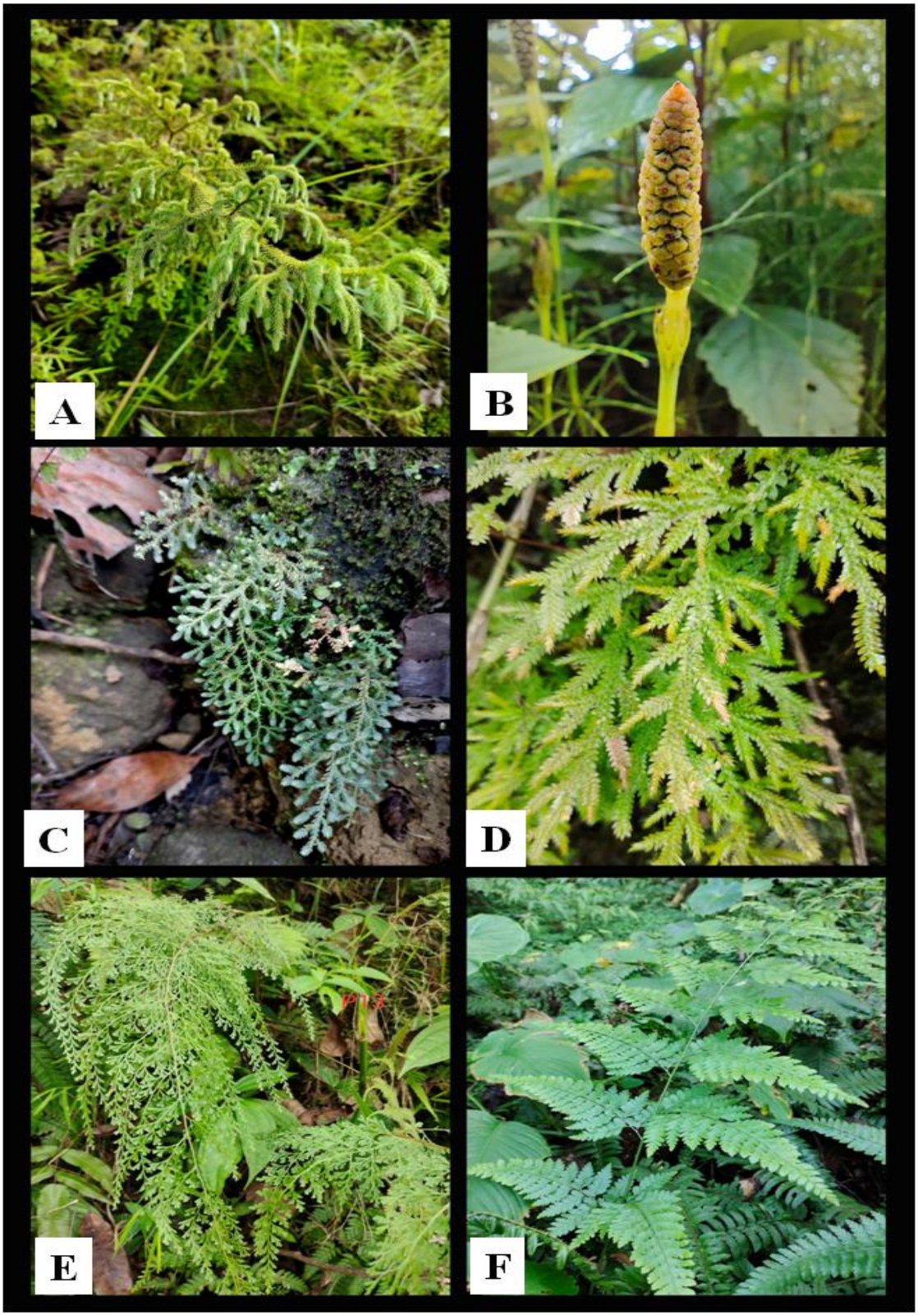

Photo plate 1: A. *Palhinhaea cernua* (L.) Franco & Vasc.
B. *Equisetum arvens* subsp. *diffusum* (D.Don) Fraser-Jenk.
C. *Selaginella chrysorrhizos* Spring D. *Selaginella pallida* (Hook. & Grev.) Spring
E. *Odontossoria chinensis* (L.) J. Sm. F. *Microlepia setosa* (Sm.) Alston

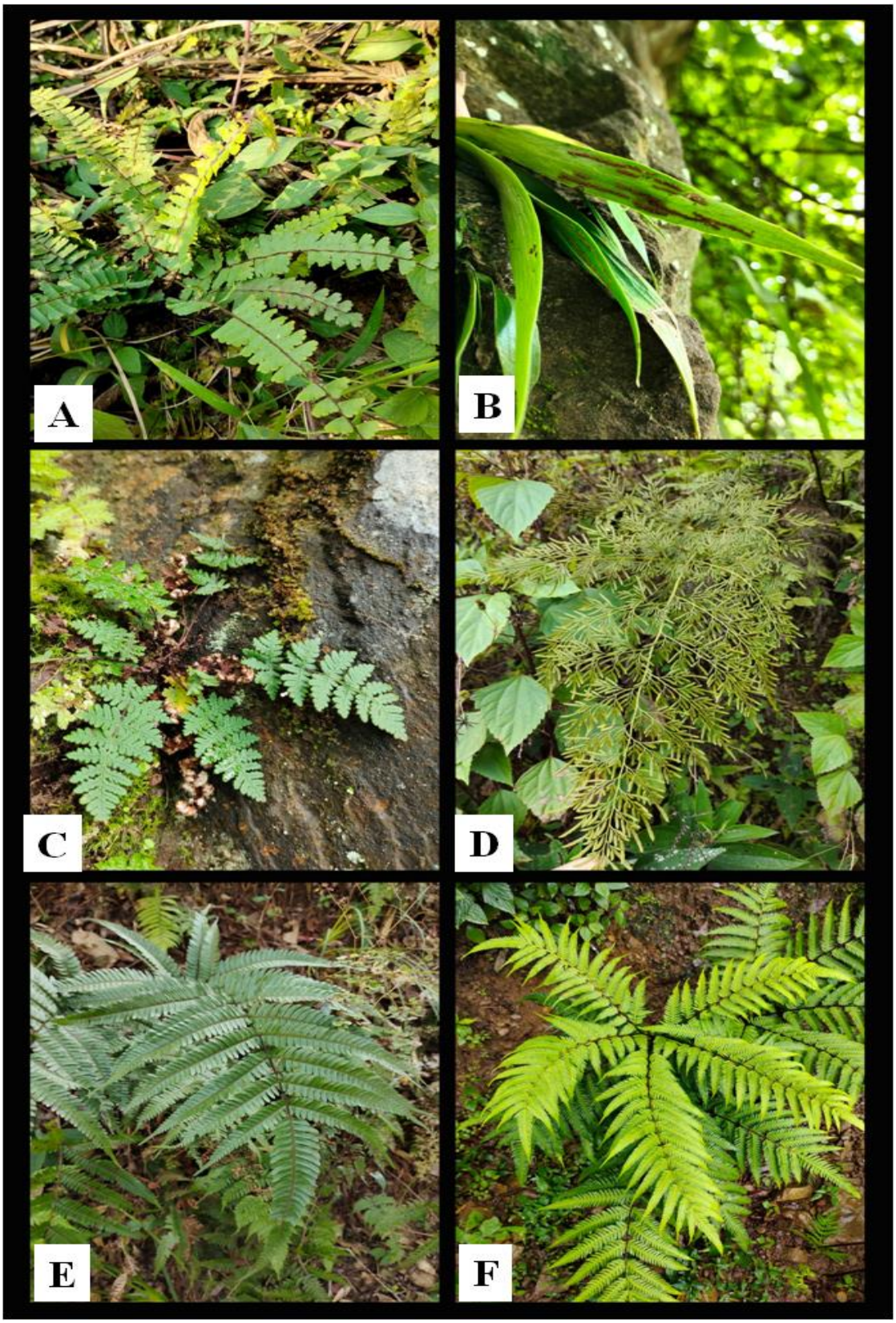

Photo plate 2: A. *Adiantum edgeworthii* Hook. B. *Antrophyum reticulatum* (G.Forst) Kaulf. C. *Aleuritopteris formosana* (Hayat) D. *Onychium siliculosum* (Desv.) C.Chr. E. *Pteris normalis* D.Don F. *Pteris wallichiana* J. Agardh

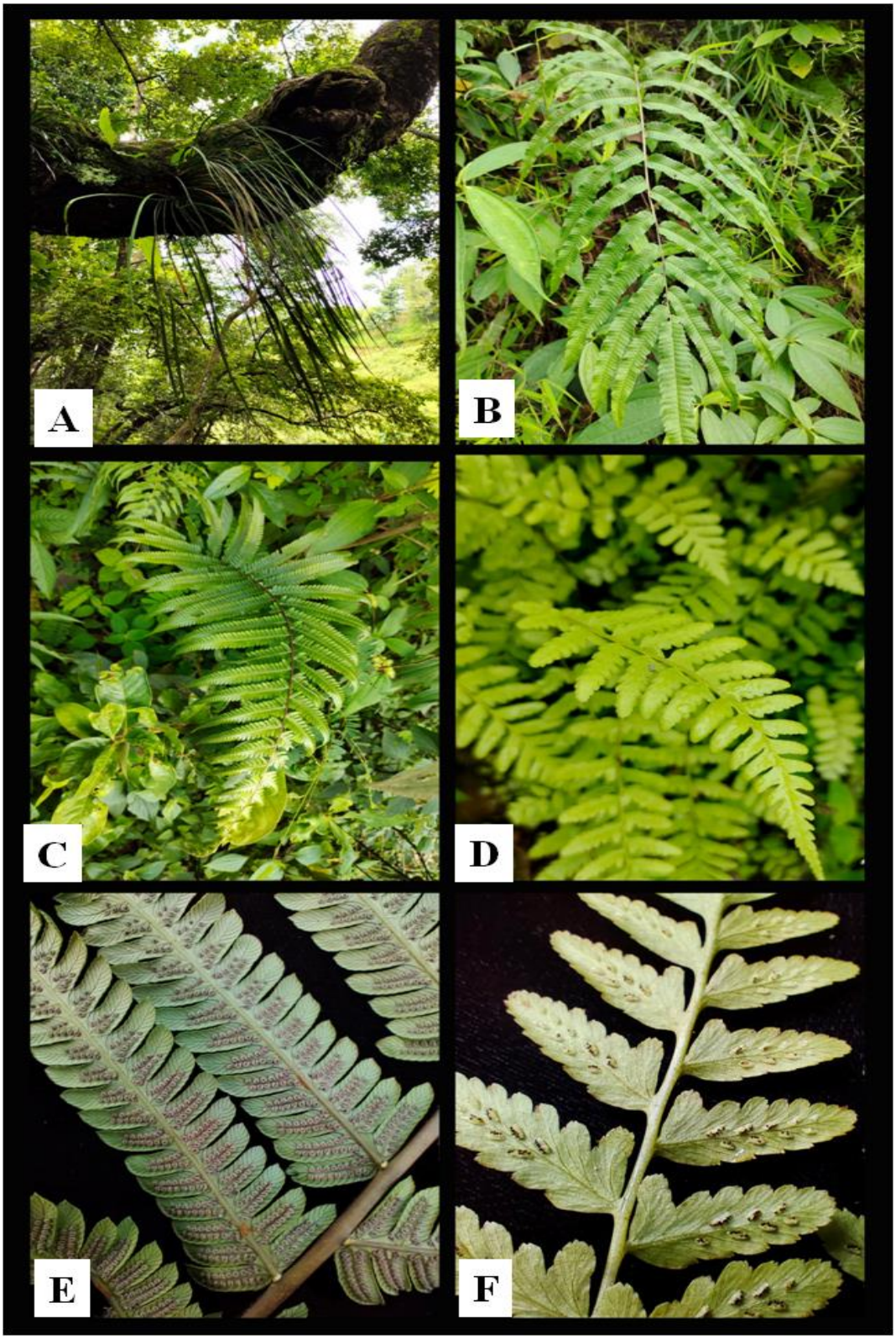

Photo plate 3: A. *Vittaria flexuosa* Fee B. *Thelypteris penengiana* (Hook.) C.F.Reed
C. *Thelypteris tylodes* (Kunze) Ching D. *Athyrium falcatum* Bedd.
E. Sori of *Thelypteris tylodes* F. Sori of *Athyrium falcatum*

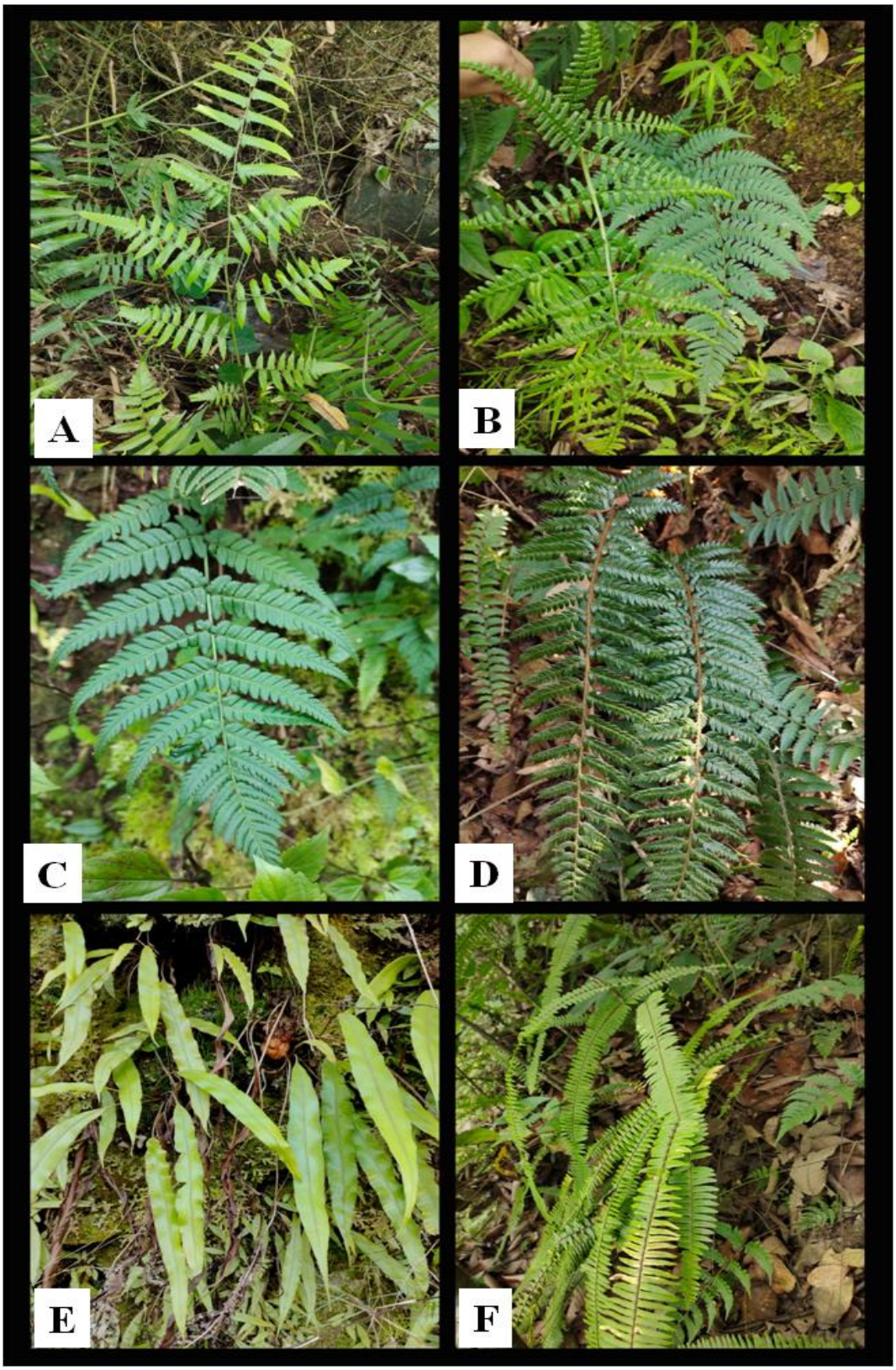

Photo plate 4: A. *Diplazium esculentum* (Retz.) Sw. B. *Dryopteris cochleata* (Ham. *ex* D.Don) C.Chr. C. *Dryopteris juxtaposita* Christ. D. *Polystichum squarrosum* (D.Don) Fee E. *Elaphoglossum stelligerum* (Wall. *ex* Baker) T.Moore *ex* Salomon F. *Nephrolepis cordifolia* (L.) C.Presl

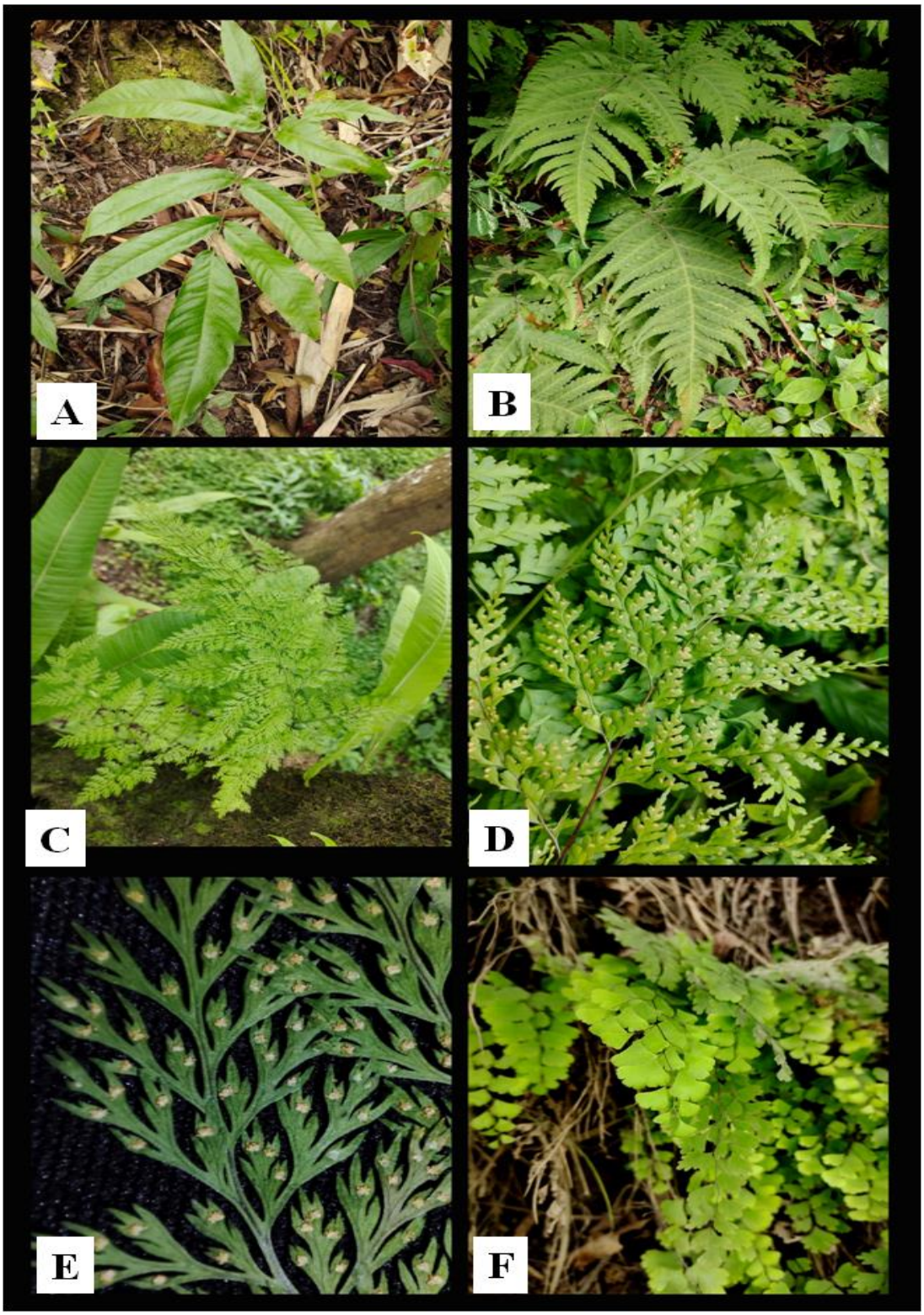

Photo plate 5: A. *Tectaria polymorpha* (Wall. *ex* Hook) Copel
B. *Tectaria coadunata* (Wall. *ex* J.Sm) C.Chr
C. *Katoella pulchra* (D.Don0 Fraser-Jenk.
D. *Leucostegia immersa* (Wall. *ex* Hook) C.Presl
E. Sori of *K. pulchra*
F. *Adiantum capillus-veneris*

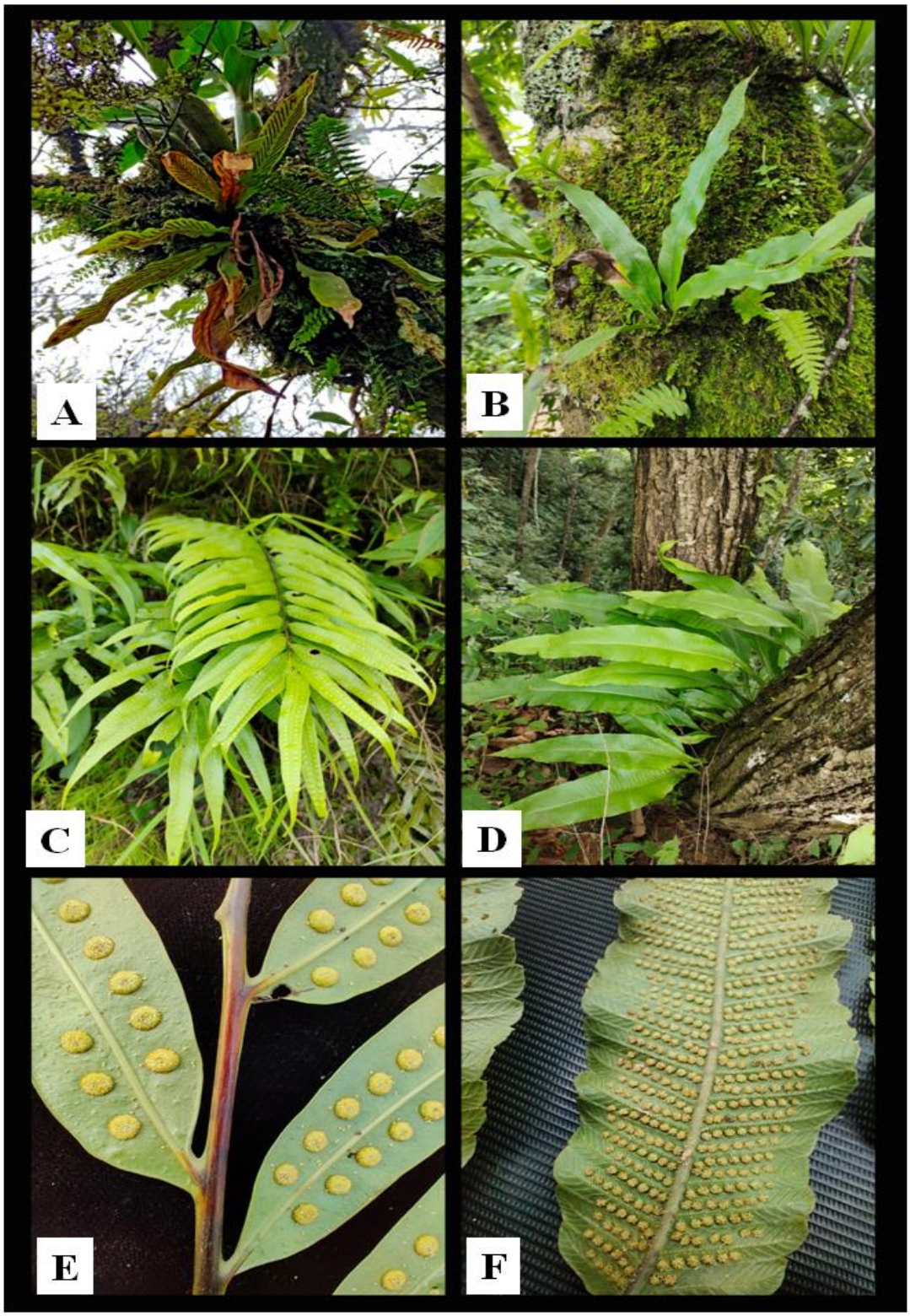

Photo plate 6: A. *Loxogramme involuta* (D.Don) C.Presl.
B. *Lepisorus scolopendrium* (Ching) Mera & Bir
C. *Microsorum cuspidatum* (D.Don) Tagawa subsp. *cuspidatum*
D. *Microsorum membranaceum* (D.Don) Ching
E. Sori of *M. cuspidatum*
F. Sori of *T. nudata*

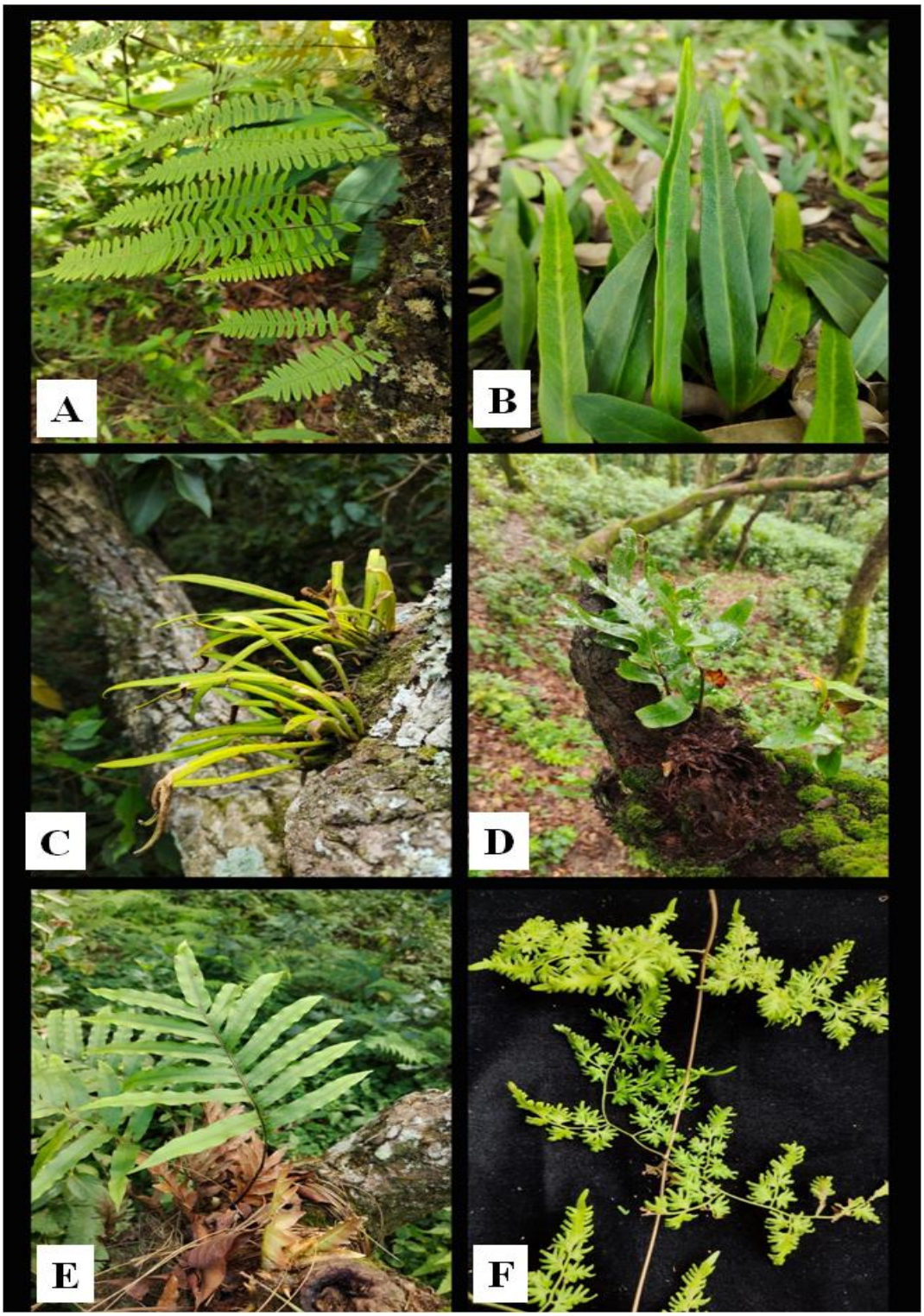

Photo plate 7: A. *Polypodiodes lachnopus* (Wallich *ex* Hooker) Ching
B. *Pyrrosia lanceolata* (L.) Farw.
C. *Pyrrosia stenophylla* (Bedd.) Ching
D. *Selliguea oxyloba* (Wall. *ex* Kunze) Fraser-Jenk.
E. *Drynaria propinqua* (Wall. *ex* Mett.)
F. *Lygodium flexuosum* (L.) Sw.

Photo plate 8: A. Collection of terrestrial fern
B. Collection of lithophytic fern
C. Collection of epiphytic fern
D. Taking field notes during field
E. Drying Herbarium specimens
F. Pressing Herbarium specimens