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Diversity of Common Pteridophytes of Dryopteridaceae Family in District Kangra of Himachal Pradesh (India)

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Abstract: The present account documents eight common pteridophytes of the family Dryopteridaceae **occurring in District Kangra, Himachal Pradesh (India). Field surveys and morpho-taxonomic identification confirmed the presence of six species under the genus** *Dryopteris* **- *D. lepidopoda, D. panda, D. pulvinulifera, D. ramosa, D. redactopinnata,* and *D. subimpressa*— and two species under the genus** *Polystichum* **- *P. nepalense* and *P. thomsonii*. These species were predominantly found in moist, shaded forest habitats and along riparian zones, with maximum representation between 1000–3100 m elevation. The study highlights the ecological significance of these taxa as indicators of habitat quality and microclimatic stability in the lower and mid-Himalayan region. The updated checklist contributes to regional floristic records and provides a baseline for future ecological, taxonomic, and conservation studies of Dryopteridaceae in the Western Himalaya.**

***Keywords*:** *Kangra (Himachal Pradesh), Pteridophytic Flora, Ferns, Habitat, Economic Importance*.

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I. INTRODUCTION

Pteridophytes (ferns and their allies) represent an ancient and ecologically significant lineage of vascular plants that play important roles in terrestrial ecosystems, including soil formation, nutrient cycling, and providing microhabitats for diverse faunal and microbial communities. These are the second largest component of Himalayan plant biodiversity and therefore attempts have been made from time to time to identify them (Dhir 1980, Khullar 1994, 2000; Khullar and Sharma 1987; Seth et al. 2004; Verma et al 1987). Among pteridophytes, the family Dryopteridaceae is one of the largest and most widespread, comprising many taxa that vary in habit from terrestrial to lithophytic and occupy a broad range of microclimates. Their morphological diversity and sensitivity to environmental gradients make Dryopteridaceae valuable indicators of habitat quality and environmental change in montane and submontane landscapes.

The Western Himalaya, particularly the state of Himachal Pradesh, hosts a rich pteridophytic flora due to its complex topography, varied elevations, and climatic heterogeneity. District Kangra, located in the lower to mid-Himalayan belt, between 31°2 to 32°5 N and 75° to 77°45 E with the geographical area of 5,739 km, which constitutes 10.31% of the state, encompasses a mosaic of forests, riparian zones, agricultural lands, and anthropogenically disturbed sites; this creates numerous ecological niches where members of Dryopteridaceae may flourish or decline. Despite the ecological importance and potential conservation value of these ferns, systematic studies that document species composition, distribution patterns, and habitat associations of Dryopteridaceae within Kangra are limited or scattered across older floristic accounts and herbarium records.

This study aims to fill that knowledge gap by conducting a systematic survey of common pteridophytes of the family Dryopteridaceae in District Kangra. In the present paper a general account of of six species belonging to *Dryopteris* genera and two species to that of *Polystichum* of Dryopteridaceae family have been described. The break-up of the genera is based on the classification given by Pichi Sermolli (1977) and adopted with slight modifications by Khullar (1994, 2000). These system are more advantageous as most of the Indian botanists have accepted these systems of classification. Also, adopted by Love *et al* (1977) in "Cytotaxonomical Atlas of Pteridophyta" and most of the pteridophytic floras till date on Himalayas, Himachal Pradesh and on parts or districts of Himachal Pradesh are based on these systems.

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II. MATERIAL AND METHODS

Various species of pteridophytes were collected in the months of July to September from different parts of district Kangra of Himachal Pradesh. Standard procedures were adopted for collecting, preserving and identifying the ferns. In field photographs of the specimens were taken and their characteristic features were noted. Herbarium mounts of these plants were also prepared for record and identification. The terminologies followed in describing and identifying the pteridophytes are in conformity with Beddome (1863-1873, 1865-1870, 1876, 1883, 1908), Bower (1923-1928), Grounds (1974), Harris and Harris (1994), Jain and Rao (1977), Kramer and Green (1990), Khullar (1994, 2000), Lellinger (2002), Smith (1875) and Womersley (1981). International Code of Botanical Nomenclature, Ambasta (1986), and several other references have been followed for correctly naming the plants. For each plant habitat, distribution and coloured photographs has been presented. Metric system has been adopted throughout the work. Eight Pteridophytes of Kangra (Himachal Pradesh) belonging to Dryopteridaceae family have been listed and described alphabetically under Results.

➢ *Key for Identification Of Dryopteridaceae Family*

Rhizome generally erect,fronds arise close on rhizome. Stipes with 5-7 vascular bundles; sori and indusium usually at vein ends; reniform, centrally fixed; indusium shivering up at maturity..... .....*Dryopteridaceae*.

➢ *Key to Genera*

- Indusia reniform or orbicular, but with a sinus, rarely globose, pinnules not or only weakly auricled with ± rounded auricles, usually bearing several spinose teeth around the pinnule tip .... ,,,,,,,,,,,,,,,,,,,,*Dryopteris.*
- Indusia orbicular without a sinus; pinnules strongly auricled, with ± acute pointed auricles, usually bearing a single spinose tooth at the tip and also at the pinnule tip.....*Polystichum.*

➢ *Key to Dryopteris Species*

- Stipes scales bearing lanceolate scales which become linear further up the stipe rachis with linear scales, lamina upper surface markedly glossy, stiffy coriaceous.....*D. lepidopoda*
- Pinna margin generally lobed only 33 to 50 percent to costa (occasionally more in the lowest pinna)..... ....*D. panda*
- Stipes with a tuft of long scales at its very base, scales very narrow, linear.....*D. pulvinulifera*
- Stipes base scales paler, thin, ovate - lanceolate, margin fimbriate, lamina pale green; pinnules narrow (3.0 x 0.7cm), with small lobes, lower 2 - 3 pinnae sterile.....*D. ramosa.*
- Rachis scales grey - brown to yellowish brown.....*D. redactopinnata*
- Texture slightly crispaceous, basal most opposite pair of pinnules markedly longer than the rest, stipes and rachis bearing ± narrow small partly appressed lanceolate scales, sori large, spores large 35.0 - 52.5 µm ....*D. subimpressa*.

➢ *Key Of Polystichum Species*

- Rhizome erect, stipes 10-35 cm long, scaly and fibrillose, Lamina narrowly lanceolate, pinnae 30-50 cm long, margin almost entire or closely dentate-serrate.....*P. nepalense.*
- Rhizome erect, stipes 3-10 cm long, Lmina pinnate, linear lanceolate, lower margin unlobed very obliquely inserted lobe towards the apex..... *P. thosonii*.

III. OBSERVATION AND RESULTS

➢ *Dryopteris Lepidopoda, Syn. Nephrodium Filix-Mas Rich*

Rhizome short, erect, thick, scaly. Stipes 20-30 cm long, base dark-brown, lighter and becoming stramineous higher up and towards the rachis, thin, dia. 0.10-0.15 cm, base densely scaly, stipe fibrillose higher up, scales dark-brown or more usually black, sometimes ± bicolorous (central region dark-brown, margin light-brown,) 0.5-1 cm long (basal scales), lanceolate, margin with long filamentous projections in the basal part of the scales, apex acuminate, deciduous, slightly glossy. Rachis stramineous, fibrillose, fibrils dark-brown. Lamina pinnate (or sub bipinnate), 25-40 cm long, 15-20 cm broad, triangular-lanceolate, base widely truncate, texture subcoriaceous, both surfaces vary Pinnae 9-18 pairs, 8-12 cm long 1.8-2.5 cm broad, alternate, very shortly petiolate or acuminate, margin deeply lobed to the costa (rarely becoming pinnate), lobes (or pinnules) many, c 10 pairs, 1 cm long, 0.4 cm broad, oblong, sessile, apex round, sharply toothed with prominent acute teeth, margin almost entire, basal lobes in pinnae sometimes free, lowest pair of pinnae almost equal in size to the next few pairs above; veins in a pinna lobe 4-5 pairs, mostly forked; costae and costules very sparsely fibrillose on both sides, with small brown fibrils margin with long filamentous projections. Sori indusiate, medium-sized, round, medial, 3-4 pairs in a single regular row on either side of the costa in the lobes; indusia dark-brown, reniform; small, thick, caducous, glabrous, margin entire, sinus broad. Spores brown, 25.5-28 x 31.5-38.5 µm, perinate, perine folded.

- Fertile season: August- October.
- Specimens Examined: R.S. 142, Multhan (2400 m, Kangra)
- Habitat: Grows in shady, moist, humus rich places.
- Distribution: Bhutan China, Nepal, Taiwan, Tibet. India: Assam, Darjeeling hills, Garhwal, Nagaland, Manipur, Meghalaya, Sikkim, Tamil Nadu. Himachal Pradesh: Kangra, Shimla (Chachpur, Panju).
- Altitude: 2000-3000m.

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➢ *Dryopteris Panda (Clarke) Christ. Syn. Nephrodium Filix-Mas Rich*

Rhizome long, erect, thick, scaly. Stipes 15-30 cm long, as long as the lamina or longer, base dark brown, rest stramineous, thick, dia. 0.2 cm, stipe base scaly, higher up stipe becoming very sparsely scaly throughout; scales few, light brown coloured, 3-5 x 1-2 mm, ovate-lanceolate, margin almost entire, apex acuminate. Rachis stramineous, sparsely scaly, scales very small, pale, apex acuminate, higher up on rachis scales fewer and smaller. Lamina unipinnate, 30-50 cm long, 10-18 cm broad, somewhat narrowly lanceolate with a truncate base, texture thickly herbaceous, upper surface glabrous; pinnae 12-15 pairs, 5-11cm long, 2-3 cm broad, close, alternate, shortly petiolate or sessile, lanceolate, falcate, base much broadened, basal pinnae are of equal in size, apex acuminate, margin lobed 1/3rd to 1/2 or slightly more to the costa; lobes 0.5-0.7 cm long, 0.3-0.5 cm broad, rounded-truncate, apex sharply toothed, margin sub-spinulose serrulate, never pinnate, lower pair of pinnae usually slightly smaller and distant, but broader than the next pair above; veins in groups of 4-6 pairs, simple, once forked, costae and costules sparsely scaly, scales light-brown, concolorous, long, linear. Sporangia with broad stalked, 12-14 celled annulus; sori in two rows, indusiate, large, round, almost on the main costa, 1-2 pairs per lobe near its base; indusia light-brown, reniform, large, dia. 0.2 cm, membranaceous, glabrous, margin entire, sinus broad. Spores dark-brown, 35-38.5 x 42-49 µm, perinate, perine folded. Fertile season: August-October.

- Specimens Examined: R.S. 143, Kukargundha (2700 m, Kangra); R.S. 243, Polling (above Lohardi, 2850 m, Kangra)
- Habitat: A beautiful fern, growing in humus rich forest floor.
- Distribution: China, Korea, Mongolia, Nepal, Tibet, Pakistan. India: Himachal Pradesh, Sikkim, Uttar Pradesh, West Bengal. Himachal Pradesh: Chamba (Shaol forest), Kangra, (Dharmsala near Triund) (Clarke), Kullu (Manali, Rohtang Pass), Shimla (Jakhu), Sirmaur.
- Altitude: 2000-3100m.

➢ *Dryopteris Pulvinulifera (Bedd.) Syn. Lastrea Pulvinulifera Beddome*

Rhizome semierect ca 0.3 cm, densely covered with scales, scales ca 1 x 0.2cm, linear, apex acuminate, margin entire, golden-brown, Stipes ca 60 x 0.5 cm, base flattened and scaly glabrous or spasely scaly above, base curved and bearing a dense tuft of long, very narrowly lanceolate, pale or ± russet-brown scales, rest of stipe ± glabrous or with a few scattered narrowly lanceolate smooth margined, concolorous, dark scales; rachis glabrous except for short, dark-brown hair-like scales near the insertion of the pinna-costae of the rachis. Lamina ca 15-60 x 12-40 cm, 4-pinnate (at base), deltate or widely triangular lanceolate, not narrowed at base, herbaceous, dark-green above; pinnae up to c 18 pairs, contiguous or overlapping, deltate to elongated triangular-lanceolate, pinnae arranged subopposite, lower pair opposite or alternate, sessile, largest one ca 8 x 4 cm, pinnae equal or slightly reduced in size; herbaceous; pinnules ca 2.5 x 1.5 cm, c 14 pairs, alternate, elongated, triangular-lanceolate or ovate, margin entire or lobed occasionally dentate, stalked, apices acutely pointed and bearing a few insignificant, small, acute teeth; pinnules on basiscopic side of the lowest pair of pinnae somewhat developed and larger than those on the acroscopic side; ultimate segments slightly longer on the acroscopic side of the pinnulet smaller and more sloping on the basiscopic side, ± asymmetrical, elliptical, narrowed to the base, apices acute ending in a few small acute teeth; costae scaly, scales minute, dark-brown, hair- like in two short rows one on either side of the main vein, mid-way between the centre and margin, indusiate; indusia ± flat or slightly curved, thin, lifting, becoming brown and shrivelling up, deciduous.

- Fertile season: August- October.
- Specimens Examined: R.S. 144, Khaniyara (1300 m, Kangra); R.S. 244, Darini (1280 m, Kangra); R.S. 344, Sansal (1800 m, Kangra).
- Habitat: Grows on shaded moist rocks in thick forest. Distribution: Bhutan, China, Nepal, Philippines, Sri Lanka. India: Darjeeling hills, Himachal Pradesh, Meghalaya, Nagaland, Sikkim, Uttarakhand. Himachal Pradesh: Kangra.
- Altitude: 1000-2500m.

➢ *Dryopteris Ramosa (Hope) C. Chr Syn. Nephrodium Ramosum Hope*

Rhizome underground, prostrate, long, thick, densely scaly, usually with large fronds at a time. Stipes very long, up to 45 cm long, pale-brown to stramineous, thick, dia. 0.2 cm, sclay; base densely scaly, higher up becoming sparsely scaly; scales pale-brown,+ concolorus, c 1 cm long, 0.2 cm broad, narrowly lanceolate, ovate-lanceolate (at stipe base); margin with short filamentous projections, apex acuminate scales becoming darker, more sparse, much smaller and narrower higher up on stipe, stipe-lamina ratio, 1:2; rachis sparsely scaly and fibrillose or glabrous, scales as on the upper part of the stipe, but narrower and smaller, fibrils fight-brown. Lamina 2-3 pinnate, large, 35-60 cm broad, deltate of widely triangular-lanceolate, widest at base, texture thinly herbaceous, pale-green, upper surface glabrous; pinnae 16-30 pairs elongated, 10-25 cm long, 5-12 cm broad, distant, alternate, shortly petiolate, narrowly triangular lanceolate, base deltate, lower pinnae hardly ever reduced almost as large as the 2 or 3 pairs above; pinnules 12-20 pairs (on lower large pinnae), 3-4 cm long, narrow, 0.7-0.8 cm broad (largest), distant, alterate, lanceolate to oblong-lanceolate, slighty asymmetrical, falcate, apex acuminate, margin deeply lobed almost to the costa or in some cases becoming pinnate; lobes narrow, oblong-lanceolate, small, bearing long acute teeth at the tip, veins in a pinnule c 9 pairs, in groups of 2-3 pairs corresponding to a lobe, pinnately divided, forked of simple in the lobes. Costae and costules sparsely scaly, scales light-brown, concolorous, small, apex long acuminate. Sori small not crowded, indusiate, small, medial, up to 6 pairs in a single row on either side of the costule, lower 2-3 pairs of pinnae generally sterile; indusia light-brown, reniform, small, thick, persistent, glabrous, margin entire, sinus +broad. Spores brown, 24.5-28 x 31.5-38.5 µm, perinate, perine with short ridges or verrucae.

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- Fertile season: August-October.
- Specimens Examined: R.S. 145, Multhan (2500 m, Kangra)
- Habitat: Among rocks.
- Distribution: Afghanistan, Bhutan, China, Europe, Kabul, Nepal, Pakistan,Tibet. India: Himachal Pradesh, Jammu & Kashmir, Uttar Pradesh.
- Himachal Pradesh: Chamba (Dalhousie), Kangra (Dharmsala), Kullu (Manali, Rohtang Pass), Shimla (Chachpur. Khadrala, Mt. Huttu). Altitude: 2000-3000 m. Somewhat uncommon in luxuriant forests above the tree line.

➢ *Dryopteris Redactopinnata Basu Et Panigr Syn. Dryopteris Pseudofibrillosa Ching*

Rhizome long, suberect, thick, densely scaly. Stipes short, up to 15 cm long, brownish, thick, dia. 0.1-0.3 cm, very densely scaly; scales light to mid-brown, concolorous, matt, large (at stipe base where some may become dark), 1.5-2 cm long, ovate-lanceolate, margin with few long filamentous projections, apex acuminate, scales higher up on stipe becoming linear and smaller, rachis densely scaly and fibrillose, scales as on stipe. Lamina pinnate, 30-40 cm long, 10-12 cm broad, lanceolate, gradually tapering towards base, texture thinly herbaceous, both surfaces fairly fibrillose, fibrils light-brown, long, hair-like, upper surface becoming glabrous towards maturity; pinnae c 20 pairs, 7-10 cm long, 1-1.5 cm broad, alternate, subsessile, lanceolate, margin deeply lobed to the costa; lobes 10-25 pairs, 0.5-0.6 cm long, 0.3 cm broad, oblong, apex truncate, unequally toothed, sides entire, margin toothed with more teeth towards the apex, lower 4-6 pairs of pinnae gradually reduced but not pairs, most forked; costae and costules scaly, scales brown, lanceolate, basal part with many filamentous projections. Sori in two rows, situated just above the bifurcation of veins; veins passing through the sori not reach in the margin, indusate, medial, 4-6 pairs, in a single row an either side of costa; indusia light brown, reniform, small, persistent, glabrous, margin entire, sinus broad. Spores perisporiate, exine slightly irregular, brown, 31.5-35 x 38.5-49 µm, perinate, perine folded. Fertile season: August- October.

- Specimens Examined: R.S. 146, (between Kukargundha and Plachak, 2900m, Kangra), R.S. 246, Dharamkot (1950 m, Kangra)
- Habitat: Not common, a beautiful high altitude bascket fern of the humus rich forest floor around 2,700 m. Distribution: China, Nepal (CRFJ), Pakistan, Taiwan, Tibet. India: Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttar Pradesh, W. Benal.
- Himachal Pradesh: Chamba (Dalhousie, Pangi, Saras), Kangra (Dharmsala), Kullu (Manali, Parbati valley, Rohtang Pass), Kinnaur (Sangla), Shimla (Baghi, Chaehpur, Matiana, Mt. Huttu, Narkanda). Altitude: 2000-3000m.

➢ *Dryopteris Subimpressa Loyal Syn. Dryopteris Subodontoloma Ching Ex Loyal*

Rhizome long, erect, thick, creeping scaly. Stipes 15-40 cm long, about half of lamina, stramineous, dark-brown at base, thick, dia. 0.3-0.5.cm, scaly, scales at stipe base light-brown, concolorous, 0.5-0.7 cm long, 0.15-0.2 cm broad, broad-lanceolate to lanceolate, margin almost entire with a few projections, apex short acuminate, higher up on stipe scales scattered, sparse or stipe almost glabrous; rachis stramineous, often zig-zag, sparsely scaly, scales light-brown, lanceolate, margin entire, apex short acuminate. Lamina 2-pinnate becoming 3-pinnate at base, 39-45 cm long, 13-18 cm broad (at base), triangular- lanceolate, texture coriaceous, matt, upper surface glabrous, dissected in pinnules; pinnae 10-14 pairs, 12-15 cm long, 6-8 cm broad (at base), distant, alternate, petiolate, petioles 0.5-1.0 cm long, elongated triangular lanceolate, lowermost pinnae generally the largest; pinnules long, broad, triangular, distant, alternate, petiolate near the base of pinnae, becoming adnate half-way up, apex rounded or acute with toothed projections, margin sharply toothed to shallowly lobed, basiscopic pinnules generally longer than the acroscopic ones only in the lowest pinnae, basiscopic basal pinnule in the lowest pair of pinnae the largest, veins in a pinnule c12 pairs (depending upon the length of the pinnule), in groups of 2-4 pairs corresponding to the lobe of the pinnule; costae and costules sparsely fibrillose, fibrils long, brown. Sori indusiate, large, submedial (nearer the costa), 5-6 pairs (depending upon the length of the pinnule), in a single row on either side of the costule; indusia brown, reniform, large, thick, persistent, glabrous, margin entire. Spores light-brown, 35-42 x 49-52.5 µm perinate, perine folded.

- Fertil season: August- October.
- Specimens Examined: R.S. 147, Lohardi (2500 m, Kangra); R.S. 247, Kothi-Sowar (2600 m, Kangra).
- Habitat: A rare fern at rather high altitudes on the forest-floor nearly always beside streams.
- Distribution: China, Nepal. India: Himachal Pradesh, Uttar Pradesh, W. Bengal (Darjeeling hills). Himachal Pradesh: Kangra, Kullu, Shimla.
- Altitude: 2000-3000m.

➢ *Polystichum Nepalense (Spreng) C. Chr. Syn. Polystichum Marginatum Wallich Ex Schott*

Rhizome short, stout, erect to suberect, thick, woody, scaly. Fronds 25-70 cm long, tufted, unipinnate, coriaceous, fertile entirely. Stipes 8-35 cm long, stramineous, robust, thick, dia. 0.1 cm, scaly and fibrillose, scales pale-brown, dark-centred becoming concolorus, and pale higher up on stipe, ovate, glossy, margin with short projections, apex long-acuminate. Rachis sparsely scaly and fibrillose; scales somewhat large, light-brown, ovate, generally confined to the pinnae base. Lamina pinnate, 10-50 cm long, 4-8 cm broad, narrowly lanceolate, texture very coriaceous, lower surface scaly along the veinlets, scales brown, minute, short, ovate, adpressed, upper surface glossy, with a metallic lustre, glabrous; pinnae 8-25 pairs, 3-4.6 cm long, 1 cm broad (largest), 1.1-2.1 cm long, 0.5-1 cm broad (lowermost), close, subopposite to alternate, shortly petiolate, ovate-oblong, falcate, apex shortly acuminate, margin entire or almost entire or closely dentate-serrate, all around the margin is a scarious pale mucronately toothed fringe, the teeth corresponding with the veinlets, auricled, auricle at the base on acroscopic side,

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broad, attached to the rest of the pinna or rarely somewhat deeply lobed lower pinnae slightly reduced in size compared to those above; veins and veinlets numerous, in narrow groups (5-7), seldom extending beyond the sori; costae and costules scaly; scales nearly circular restricted only on veins, bases pale, apices long cuspidate, reddish, appear in rows on lower surface of pinnae. Sori indusiate, many, large, sub-medial (nearer the costa), occasionally medial on a vein which reaches the margin, somewhat irregularly distributed and sometimes in more than one row on either side of costa, diverging away from the costa in the region of auricle. Indusia brown, orbicular, caducous, margin irregularly or shallowly lobed near the bases of the slightly longer pinnae (thus approaching the less-lobed *Polystichum manmeiense*. Spores dark-brown, 28-31.5 x 31.5-35 µm, perinate, papillate.

- Fertile season: July- October.
- Specimens Examined: R.S. 174, Multhan (2500 m, Kangra).
- Habitat: common, growing in moist shaded humus rich places along ravines or water falls.
- Distribution: Afghanistan, Bhutan, Burma, China, Japan, Nepal, Philippines, Sri Lanka, Taiwan, Tibet. India: Arunachal Pradesh, Darjeeling hills, Manipur, Meghalaya, Mizoram,Nagaland, Sikkim, Uttar Pradesh. Himachal Pradesh: Chamba, Kangra (Dharmshala near Triund), Kullu (Manali, Manalsunala, Rahla, Rohtang Pass).
- Altitude: 2000-3000m.

➢ *Polystichum Thomsonii (Hooker F.) Beddome, Syn. Aspidium Thomsonii Hooker F., Lastrea Gracilis Moore Ex Bedd.*

Rhizome short, erect, scaly. Fronds small, length varies from 5-25 cm, caespitose, unipinnate. Stipes 3-10 cm long, stramineous, thin, dia. 0.05 cm, fragile, sparsely scaly and fibrillose; scales light-brown, concolorous, small, broad-lanceolate or linear-lanceolate, margin dentate, apex acute to acuminate, inter-mixed with fibrils, scales gradualy becoming fewer and narrower higher up on stipe. Rachis fibrillose, broad ovate, scales absent. Lamina pinnate, small, 6-16 cm long, narrow, 1.5-2.0 cm broad, linear-lanceolate, broadest in the middle, slightly narrowed towards base, texture sub-coriaceous to herbaceous, both surfaces fibrillose, upper surface sparsely fibrillose; pinnae many, 15-32 pairs, short, 1.5-2 cm long, 0.2-0.5 cm broad (largest), alternate, shortly petiolate, asymmetrical, broadest at the very unequal base, acroscopic margin lobed almost to the costa, spinulose serrate, acroscopic lobes larger, basal acroscopic lobe the largest, basiscopic margin unlobed except for the narrow, very obliquely inserted lobes towards the apex; lobes decurrent, on the pinnae costa, apex of lobes without prominent teeth, lower pinnae not much reduced (1-1.5 cm long); veins in groups of 4-5 pairs, pinnate; costae and costules fibrillose. Sori indusiate, sub-medial, 6-8 pairs, in a single row on either side of the costa, complete frond fertile; indusia pale-brown, orbicular, large, margin irregularly lobed. Spores yellowish-brown, 38.5-42 x 42-49 µm, perinate, perine smooth.

- Fertile Season : July-October.
- Specimens Examined: R.S. 179, Multhan (2400 m, Kangra); R.S. 279, Kukargundha (2600 m, Kangra); R.S. 379, Kothi-Kohr (2600 m, Kangra).
- Habitat: Not common, grows near water courses on wet rocks crevices and rarely shady forest floor.
- Distribution: Afghanistan, Bhutan, China, Nepal, Pakistan, Taiwan, Tibet. India: Darjeeling Hills, Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttar Pradesh. Himachal Pradesh: Chamba (Sach Pass, Dalhousie), Kulu, (Manali, Chiri Chatru forest, Rahla, Manalsu-nala, Babu Pass), Kinnaur (Sangla), Shimla (Baghi, Chachpur, Glen, Khadrala, Matiana, Mashobra, Narkanda, Mt. Hattu).
- Altitude: 2000-3000m.

IV. DISCUSSION

The present study provides an updated account of the diversity and distribution of common pteridophytes belonging to the family Dryopteridaceae in District Kangra, Himachal Pradesh. The findings reveal that the region harbors a moderate to rich diversity of Dryopteridaceae species, reflecting the district's unique geographic position in the lower to mid-Himalayan belt and its heterogeneity in terms of elevation, vegetation types, and microclimatic conditions. The occurrence of multiple taxa across forest edges, riparian zones, shaded moist habitats, and even anthropogenically disturbed areas highlights the ecological adaptability of this family. The distribution patterns observed in this study suggest a clear correlation between species richness and habitat parameters such as moisture availability, canopy cover, and elevation. Most species were found thriving in moist, shaded forest undergrowth and along perennial water sources, supporting earlier studies that identify humidity as a critical factor for fern proliferation. However, certain species demonstrated tolerance to semi-exposed or disturbed sites, indicating their potential role as colonizers and contributors to ecological succession. Comparison with earlier floristic records from Himachal Pradesh shows both continuity and change. Some taxa reported in previous decades were not encountered in the present survey, which could be attributed to habitat loss, deforestation, or shifts in microclimate due to anthropogenic pressure. Conversely, a few species not previously documented for Kangra were recorded, suggesting either earlier under-reporting or recent range expansion possibly linked to changing environmental conditions. This underlines the importance of periodic surveys to maintain accurate and updated biodiversity inventories. The study also highlights emerging threats to Dryopteridaceae diversity. Expanding agriculture, infrastructure development, and grazing pressure were observed to fragment natural habitats, potentially reducing population sizes of habitat-specific taxa. Additionally, climate variability—manifested through irregular rainfall patterns and increased frequency of dry spells—may influence spore germination success and overall fern recruitment. Conservation measures such as protection of moist forest patches, regulation of anthropogenic disturbance in ecologically sensitive areas, and awareness programs for local communities are recommended to mitigate

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these threats. From a broader perspective, the diversity pattern of Dryopteridaceae in Kangra contributes valuable data to Himalayan pteridophyte biogeography. The presence of both widely distributed and locally restricted taxa indicates that Kangra serves as a transitional zone between subtropical and temperate floras. Such transitional regions are often biodiversity hotspots and warrant special attention in regional conservation planning. Future studies integrating molecular taxonomy, ecological niche modeling, and long-term monitoring could provide deeper insights into species resilience and predict responses to climate change.

V. CONCLUSION

Fraser-Jenkins (1986) was the first to record *Dryopteris lepidopoda*, syn. *Nephrodium filix-mas* Rich from the Himalaya. Its chromosome number is diploid 2n = 82 (Gibby 1985) and most probably apomictic. This species is being reported for the first time from District Kangra of Himachal Pradesh. Chromosome number of *Dryopteris panda* (clarke) christ. syn. *Nephrodium filix-mas* Rich is diploid sexual, n = 41 (Khullar, 2000). *Dryopteris pulvinulifera* (Bedd.) syn. *Lastrea pulvinulifera* Beddome is very rare in the Western Himalaya. This species is near to *Dryopteris sparsa* in its asymmetrical pinnules, from which it can be readily separated by the tuft of very narrow linear scales at the stipe base, and the more dissect lamina (Khullar, 2000). According to Fraser-Jenkins (1989) *Dryopteris subimpressa* is only a smaller plant of *"Dryopteris submarginata"* which it grows into on maturity. Its chromosome number is diploid sexual, n = 41 (Loyal in Mehra 1961; Gibby 1985).

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Table 1 Pteridophytic Flora of Kangra, Himachal Pradesh

Plant in field

Herbarium mount

C. Fertile pinnules

Fig 1 *Dryopteris lepidopoda,* syn. *Nephrodium filix-mas* Rich

A. Herbarium mount

B. Fertile pinnules

Fig 2 *Dryopteris panda* (clarke) christ. syn. *Nephrodium filix-mas* Rich

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A.Rhizome and Root, herbarium mount

B. Fertile pinnules

Fig 3 *Dryopteris pulvinulifera* (Bedd.) syn. *Lastrea pulvinulifera* Beddome

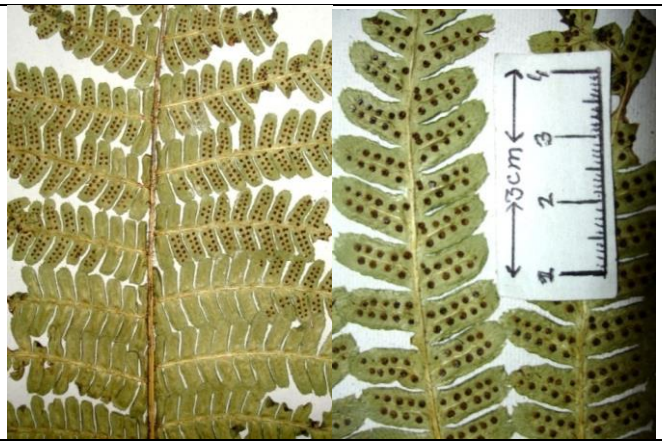

Fig 4 *Dryopteris ramosa* (hope) c. chr syn. *Nephrodium ramosum* Hope

Rachis with pinnae

A. Plant in nature

B. Brownish stipes

Fig 5 *Dryopteris redactopinnata* Basu *et* Panigr syn. *Dryopteris pseudofibrillosa* Ching

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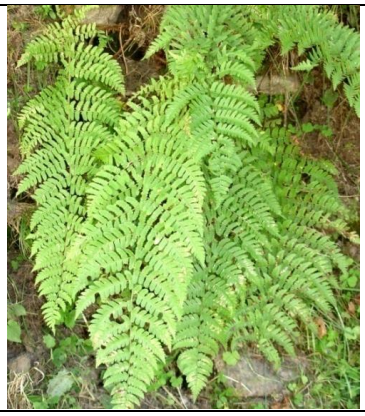

A. Plant in nature

B. Rachis with pinnae

Fig 6 *Dryopteris subimpressa* loyal syn. *Dryopteris subodontoloma* Ching *ex* Loyal

A. Plant in nature

B. Fertile pinnules

C. Herbarium mount

D. Fertile pinnules in herbarium mount

Fig 7 *Polystichum nepalense* (Spreng) C. Chr.

A. plant in nature

B. Fertile pinnules

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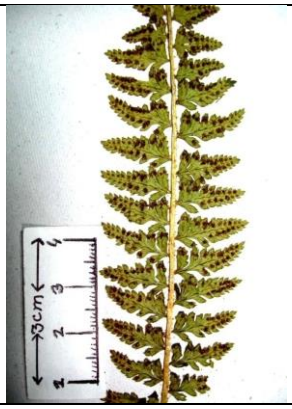
C. Herbarium mount



D. Fertile pinnules in herbarium mount

Fig 8 *Polystichum thomsonii* (Hooker f.) Beddome, syn. *Aspidium thomsonii* Hooker