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## RESEARCH ARTICLE

### HOT-SPOTS AREAS OF FERN DIVERSITY IN DEHRADUN DISTRICT

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#### ABSTRACT

The paper deals with the study of the hot spots of fern distribution in Dehradun district mostly above 1500m altitude. The rich areas harbouring the fern diversity are Lal Tibba, Landour, Cloud's end, Camel's back, Hathipawan, Jabberkhet, Jharipani, Chakrata hills, Deoban, Kanasar. The major concern is the conservation of these areas to protect the natural habitat of these areas.

#### INTRODUCTION

Fern grow in an exceptional diversity of habitat ranging from high altitude as well as from high latitude to the centre of tropical rain forest and from sub-desert continental interior to rocks on sea-coast and mangrove swamps. The most favoured habitat of these plants is tropical mesic environment, where 65% of the living species of ferns thrive vigorously and grow prolific. This group of plants are small but significant element, occurring quite frequently in Dehradun district especially above 1500m elevation like Chakrata and Mussoorie hills. They are mostly evident during the rainy season growing luxuriantly. Most of the fern flora of the district is terrestrial growing in tufts, shade and humus rich areas.

#### MATERIALS AND METHODS

An extensive field exploration of the district is carried during 2008-2011 and the hot spots of the district was marked by visiting the areas frequently during different seasons especially rainy season i.e. from July-October. The altitudinal distribution of the fern as well as the latitude of some areas was noted through the use of GPS. Field observations such as habit, habitat and phenology were recorded

#### RESULTS AND CONCLUSION

The study areas represents good population of ferns but in some of the areas are rich in distribution.

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Some represent unique mode of distribution of ferns in the study area such as in large population or restricted or as individual entity which are as follows- *Polypodium microrhizoma* (C. B. Clarke ex Baker) Ching found in big patches and are extremely common in and around Camels back (2000m) intermixed with *Polypodium lachnopus* (Wall. ex Hook.) Ching and also in Hathipawan (1880m). *Pyrrosia flocculosa* (D. Don) Ching in big patches commonly found on tree trunk of mango tree in the clement town, Sahastradhara, at 14 km from Dehradun. *Pichisermollia malacodon* (Hook.) Fraser-Jenk. found individually on the cliffs in Chakrata (2118m) and Deoban forest. In the moist and shady places may be the crevices of the walls and nullahs in and adjoining areas of Doon valley (600-800m) the most common members of Adiantaceae include *Adiantum capillus-veneris* L., *Adiantum edgeworthii* Hook. and *Adiantum incisium* Forssk. Oak forest covering the area of the Clouds end, Jabberkhet forest (2130 m) is rich in epiphyte *Drynaria mollis* Bedd. is found associated with *Polypodium amonea* (Wall. ex Mett.) Ching *Pellaea nitidula* (Wall. ex Hook.) Baker a extremely rare fern occurring individually on the dry mountain slopes of Chakrata (2118 m). One of the common families of the study area is Pteridiaceae which includes *Pteris vittata* L. is found on road side slope, moist wall and crevices of Dehradun city and in the forest of Dehradun abundantly, while *Pteris cretica* L. in big patches common between in and around Mussoorie (2200-2500 m), 30° 26' 60 N, 78° 4' 60 E and Chakrata (2118 m). A few individuals are seen growing on the calcareous soil of the forest slopes near Company garden, sometimes associated with *Pteris stenophylla* Wall. ex Hook. in small patches in the high peaks of Jharipani forest (2104 m), 30° 6' N, 78° 6' E and also

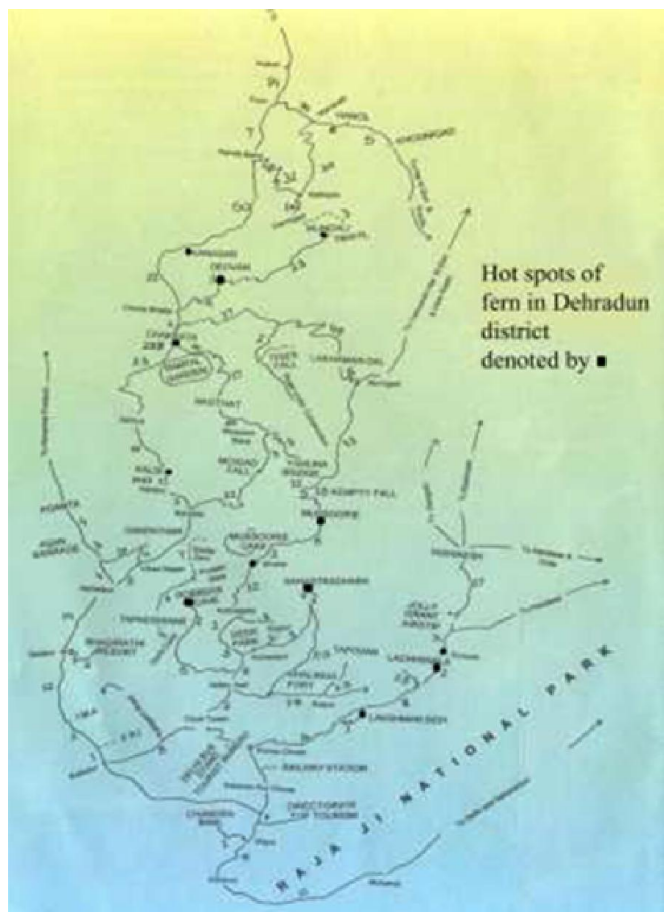
away from Jharipani village way towards Dehradun. In the ravines at moist shady places or in the forest slopes especially at Dhobi khud (1500m), Lal tibba (2290 m) 28° 43' N, 31° 27' E, Chakrata (2118m) and Deoban (3025 m), 30° 75' N, 77° 85' E along the road extensive population of *Pteris aspercularis* Wall. ex J. Agardh found. At times on forest slopes of Cloud end, Mussoorie (2200-2500m) *Pteris aspercularis* Wall. ex J. Agardh is found occurring associated with *Polystichum squarrosus* (D. Don) Fee and *Dryopteris nigropaleacea* (Fraser- Jenk.) Fraser- Jenk. in small patches and also found sharing common area with *Pteris excelsa* Gaud. A rare fern of the district *Cyrtomium macrophyllum* found growing as individually or in small patches of Kanasar (2895 m), Chakrata (2118 m) near natural springs at great height and sometimes *Pronophrium pennangianum* (Hook.) Halft. is found associated, and at such places there is frequent occurrence of snake, while at below storey is present sometimes *Woodwardia ungiemata* C. Presl.

A large patch of *Cyrtomium caryotideum* (Wall. ex Hook. et Grev.) C. Presl found along with *Coniogramme intermedia* Hieron. is also found in the Kimoin forest near Company garden (2003 m), in patches in Chakrata (2118 m) forest and Deoban (3025m) forest. *Polystichum squarrosus* (D. Don) Fee is found extensively growing in the moist and shady and dense forest slopes, forest floor of Hathipaua, Bhatta fall and also on the road side of way away from Cloud end (2104 m), and sometimes *Polystichum discretum* (D. Don) Smith is found sharing with it forest of Cloud's end and Deoban forest. Thus it is the most commonly occurring fern of the Mussoorie region. On the way towards Bhatta fall large population of *Microsorium membranecum* (D. Don) Ching is found on the moist rocks, in the high forest area of Hathipaua while *Polypodium microrhizomma* (C. B. Clarke ex Baker) Ching, *Polypodium lachnopus* (Wall. ex Hook.) Ching, *Araoistegia pseudocystopteris* (Kunze) Copel. is found associated whereas in the forest area of Hathipaua *Loxogramme involuta* (D. Don) C. Presl is also found as independent identity. *Dryopteris nigropaleacea* (Fraser- Jenk.) Fraser- Jenk., *Athyrium schimperi* Moug. ex Fee', *Dryopteris caroli-hopei* Fraser- Jenk. and *Athyrium mackinnonrii* (Hope) C. Chr. share the forest of Chakrata and found growing in abundance. Moist rocks of Landour (2286 m), 30° 28' N 78° 06' E, Deoban and way towards Kanasar (2895m), on the route to Tiger falls, Chakrata, (2118 m) 30° 42' N, 77° 51' E are dominated by *Dryopteris chrysocoma* (H. Christ.) C. Chr. 9 km west of Mussoorie is Hathipaua forest, Cloud end forest, on the on the road side way towards Chakrata 85 km from Dehradun where *Onychium cryptogrammoides* H. Christ., *Araoistegia pseudocystopteris* (Kunze) Copel., are common ferns. The forest of Deoban 10 km trekking from Kanasar towards Deoban forest rest house was dominated by the ferns such as *Araoistegia beddmoniei* (Hope) Ching, *Araoistegia pseudocystopteris* (Kunze) Copel, *Araoistegia hookeri* (Moore ex Bedd.), *Polystichum discretum* (D. Don) J. Smith, *Polystichum stimulan* (Kunze ex Mett.) Bedd., *Polystichum nepalense* (Spreng.) C. Chr, *Onychium siliculosum* (Desv.) C. Chr too is found in Deoban forest, Deoban 16 km from Chakrata and sometimes both *Onychium cryptogrammoides* H. Christ. and *O. siliculosum* (Desv.) C. Chr sharing the same forest area. Thus they are among the most common fern of the Deoban area 16 km from Chakrata entry point. On the way of Deoban way towards Kadhamba (3084 m) , 25° 15' 55" N, 87°

16' 51" E *Polystichum discretum* (D. Don) Smith, *Athyrium fimbriatum* T. Moore, *Pteris excelsa* Gaud., *Athyrium strigulosum* (T. Moore ex E. J. Lowe) T. Moore ex Salmon. were also found growing. On the dry rocky surface, moist wall of road side of Kanasar *Gymopteris vestita* (Wall. ex T. Moore) Underw. found growing and sometimes associated with *Asplenium dalhousiae* Hook. and *Asplenium trichomanes* L. subsp. *quadrivalens* D. E. Meyer is near Kanasar forest rest house 26 km from Chakrata. *Asplenium dalhousiae* Hook. is also observed in dry rocks of Robber's cave 8km from Dehradun, Shastradhara, tourist spots of Dehradun.

In the dense and covered forest of Mussoorie towards Chakrata and trekking route of Deoban *Asplenium yunnanense* Franch. is observed while in some patches *Asplenium trichomanes* L. subsp. *quadrivalens* D. E. Meyer is also seen. Along the road side the moist rocks as well as moist soil in the way of Jharipani 8.5 km from Mussoorie *Woodwardia ungiemata* C. Presl. is found and *Woodwardia ungiemata* C. Presl along with *Polystichum squarrosus* (D. Don) Fee. is found growing in big patch on the rocks in the way from Cloud end 8 km from library towards Mussoorie. In the *Oak* and *Rhododendron* forest of Deoban but in exposed ravines a big patch of *Coniogramme intermedia* Hieron., *Coniogramme affinis* Wall. ex Hieron. Individually while *Coniogramme affinis* Wall. ex Hieron. is also seen along the natural small streams or fall on the way from Kanasar to Chakrata. *Diplazium maximum* (D. Don) C. Chr. is observed in the Kimoni forest, Mossy falls, 7 km om Mussoorie whereas at Landour, Jabberkhet (1532 m) along the streams it forms dominant population and *Diplazium longifolium* T. Moore is also found on the wet rocks in Jabberkhet, Mussoorie. ear Kolukhet khala, 20 km from Dehradun, Mussoorie area dominated by *Christella dentata* (Forssk.) Brown, *Adiantum edgeworthii* Hook., *Glaphyopteridopsis erubescens* (Wall. ex Hook.) Ching.

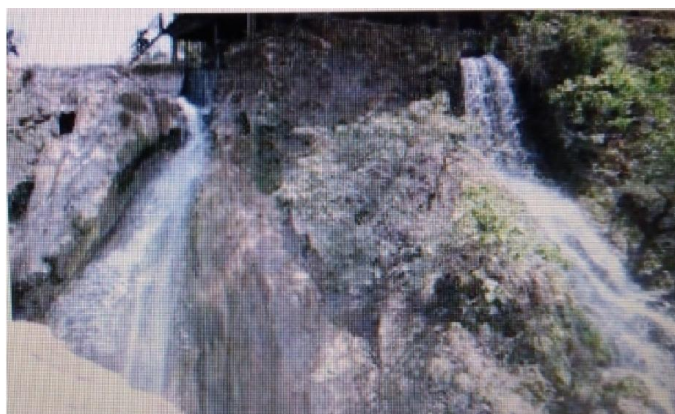
On way from Kolukhet to Bhatta fall, Hathipaua to library area in crevices of dry rocks *Hypodematum crenatum* (Forssk.) Kuhn subsp. *crenatum* is seen and sometimes alongwith it *Athyrium rupicola* (Edgew. ex Hope) C. Chr is also found and also on way towards Landour forest. *Polystichum lentum* (D. Don) T. Moore found growing on moist rocks near Bhatauli on Chakrata route. It is also seen associated in the dense forest of Chakrata with *Asplenium yunnanense* Franch. On the way of Chakrata rest house 19 km to Tiger fall (312 ft) *Woodwardia unigemmata* (Makino) Nakai. patch along with *Glaphyopteridopsis erubescens* (Wall. ex Hook.) Ching. In the marshy area such as Mothuranwala swamp 5 km from Dehradun, Golatappar swamp 35 km from Dehradun a big patch of *Tectaria coadunata* (Smith) C. Chr, *Amelopteris prolifera* (Retz.) Copel., *Diplazium esculentum* (Retz.) Sw., *Pseudocyclosorus canus* (Baker) Holtt. and patch of *Diplazium spectabile* (Wall. ex Mett.) Ching besides stream slopes is also found growing. *Diplazium spectabile* (Wall. ex Mett.) Ching patch is also found on the moist of forest slopes at Mossy falls. In Lacchiwala area *Diplazium esculentum* (Retz.) Sw. along with *Amelopteris prolifera* (Retz.) Copel., is also seen. Laxman siddh 12 km from Dehradun, is dominated by population of *Adiantum capillsveneris* L., *Adiantum edgeworthii* Hook., *Adiantum incisium* Forssk and *Tectaria coadunata* (J. Smith) C. Chr. Climbers on the nearby bushes in the area of Bidholi 10 km, Jhajhara 14 kms west, of Dehradun



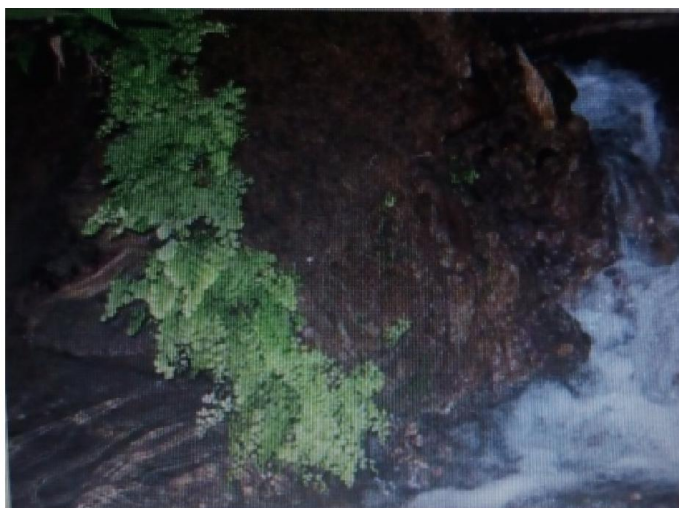
Map showing hot-spots in Dehradun district



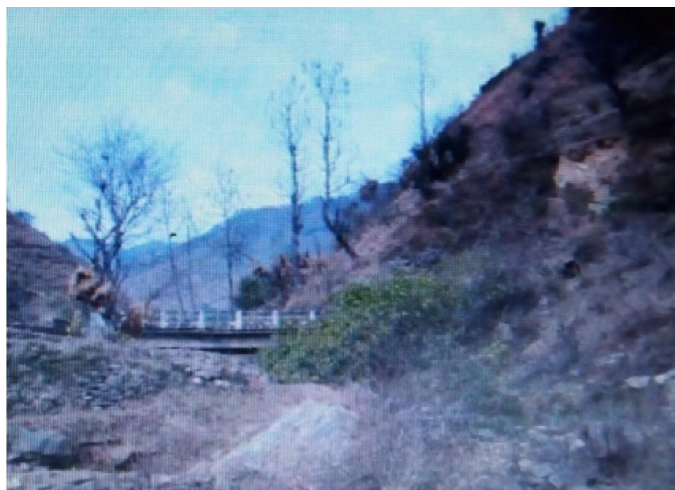
(b)



(c)



(a)

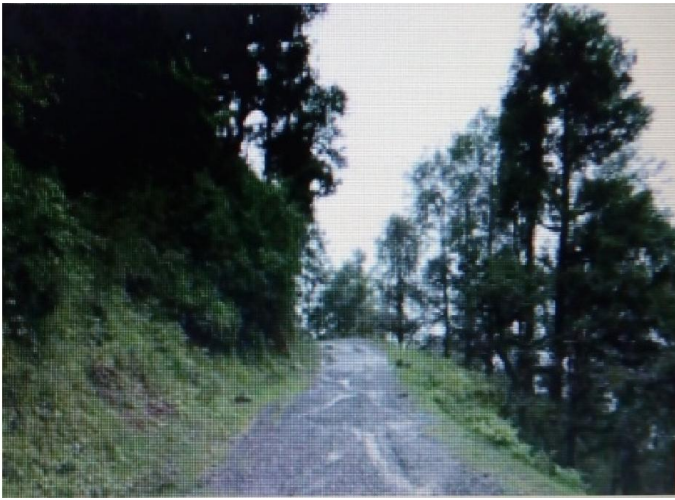


(d)

*Lygodium japonicum* (Thumb.) Sw. and small patch of, *L. flexosum* (L.) Sw. are observed and shared by ferns like *Tectaria coadunata* (J. Smith) C. Chr., *Dryopteris nigropaleacea* (Fraser- Jenk.) Fraser- Jenk., *Pteris vittata* L. The hot-spots of fern diverse forms are below described below and also represented in the images (i-vi). There is need for strict actions to conserve the natural habitat of the ferns as these ferns are sensitive to change in microclimate. *Lal tibba*: mostly at an altitude of 6,800 to 7,500 ft (2,250 to 2,500 m)., *Deodar Cedar*, *Himalayan Oak*, *ChirPine*, *Blue Pine*, *West Himalayan Fir*, *Himalayan Maple*, *Rhododendron*, *Himalayan Manna Ash* and other tree species.

*Landour's* north-facing slopes have more Deodar and Fir than other species; the south-facing slopes have more Oak than other species. Pines are at lower elevations than Deodar and Fir

- *Cloud's end*: Located at a distance of about 6 km west of the Library, the Cloud's end can be reached through the Hathipaon road from Happy Valley
- *Camel's back*: Camel's Back Road is in lower Mussoorie. It is a 3-kilometer (1.86 miles) stretch between Library Chowk and Kulri Bazar.



(e)



(f)

- *Hathipauan*: The place is situated in Mussoorie with dense forests at 1900m
- *Jabberkhet*: located 6000-7000 feet.
- *Jharipani*: located at 30° 26' N latitude 78° 6' E longitude, Altitude: 5,222 feet (1,592 m)
- *Chakrata hills*: 30° 41' N 77 °52' E, abundance of *Conifers*, *Rhododendrons* and *Oaks*. The red *Rhododendrons* are the most abundantly found in this region
- *Deoban*: It is located in the hilly terrains of Chakrata and is placed at height of about 3025 m. This place is surrounded by dense dark deodar green forests supporting large number of pteridophytes.

- *Kanasar*: 25 kms from Chakrata with dense rain forests. It has one of the oldest trees in Asia which are 6.5 meters in circumference.
- a. Water fall in Hathipaon in Mussoorie dominated by *Adiantum-capillus-veneris*
- b. Forest with Deodar, Pine trees in Cloud end Mussoorie
- c. Jharipani fall
- d. Way to Tiger falls, Chakrata
- e. Treking route of Deoban dominated by Deodar trees
- f. Treking route from Kanasar-Deoban near Kanasar-Tiuni highway

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