First report of Pteridophytes from Govind Wildlife Sanctuary, Uttarkashi, Uttarakhand, India

Sandip Kumar Behera* and Prem Behari Khare

Pteridology Laboratory, CSIR-National Botanical Research Institute, Rana Pratap Marg, Lucknow, Uttar Pradesh, India

*Corresponding Author: 16.sandip@gmail.com

Abstract: In the present study 55 species of ferns and fern-allies belonging to 26 genera of 15 families have been collected which is a first and preliminary report from Govind Wildlife Sanctuary. The species belonging to the genera Dryopteris and Polystichum were found maximum. The occurrence of the species Dryopteris caroli-hopei was observed to be at high risk. The populations of Pteridium aquilinum were more in most of the localities. The species compositions were different from place to place depending upon the altitude and topography.

Keywords: Ferns - Fern-allies - Govind Wild Life Sanctuary - Uttarakhand.

INTRODUCTION

The Govind Wildlife Sanctuary is situated in Purola Tehsil in the Uttarkashi district of Uttarakhand. Naitwar is the entrance and starting point of the sanctuary. This wildlife sanctuary was established on 1st March, 1955 and spreads over an area of 957.969 km². It lies between Longitude: 78.05ºE and Latitude: 31.00 to 31.25ºN. This sanctuary forms the upper catchment of the Tons river, which is the most important tributary of River Yamuna in its upper reaches. The area is very rich in plants and its large area along with the forests of the neighbouring forest divisions helps in maintaining genetic diversity. Pteridophytes play an important and significant role in the enrichment of biodiversity of this area. They grow luxuriantly in the moist and shady places. Dixit (1984), Chandra (2000) have reported more than 1200 species of ferns and fern allies from India. Khuller (1994, 2000), Pandey & Pandey (2003) listed the ferns of Himalaya but did not explore and mention the areas of Govind Wildlife Sanctuary. Recently, Shah & Pande (2010) reported 186 species of ferns belonging to 52 genera under 26 families from Uttarkashi district, but they did not touch the areas of Govind Wildlife Sanctuary. The Pteridophytic diversity of this Wildlife Sanctuary has not been explored yet. It has always been a very difficult area to visit. Therefore, the authors have undertaken to document the Pteridophytic flora this area. The present report is the preliminary report on Pteridophytes of Govind Wildlife Sanctuary.

MATERIAL AND METHODS

Several field trips were undertaken in different seasons to different localities of Govind Wildlife Sanctuary to explore and survey the Pteridophytic flora. During the survey the detailed field notes on altitude, latitude, longitude and types of habitat of many plants were recorded. The localities visited are: Sankri, Jakhol, Taluka, Osla, on the way to Kedar Kantha from Sankri, Juda Tal, Ghuiyan Ghati, Badgad dhara, region between between Osla and Gangar and their nearby areas and Dhaula etc. as shown in figure 1. All the specimens were critically studied and identified by first author. All the herbarium specimens were processed and deposited in the Herbarium of the CSIR-National Botanical Research Institute, Lucknow, India (LWG). Each species is listed with author citation followed by the habitat on which it was found growing in the study area, the locality, altitude, latitude and longitude, the collector’s name (acronyms: SKB - Sandip Kumar Behera; SN - Sanjeeva Nayaka; VS - Vinay Sahu), collection number. However, in some species altitude, latitude and longitude could not be noted because of some technical problem in the GPS handset (Gramin-72).

RESULTS

In the present study 55 species of ferns and fern-allies belonging to 26 genera of 15 families have been collected from the studied area. The families with maximum representation of species were Dryopteridaceae,
Pteridaceae and Polypodiaceae, and the families with representation of single species were Blechnaceae, Coniogrammaceae, Equisetaceae, Osmundaceae Pteridaceae, Pteridiaceae, Selaginellaceae, Sinopteridaceae (Table 1). Among the plants collected, genus Dryopteris had maximum, 10 species followed by the genus Polystichum with 8 species, Pteris with 5 species, Asplenium and Athyrium with 3 species, Adiantum, Onichium, Lepisorus, and Polypodiodes with 2 species and rest genus had 1 species each (Table 1). Only 2 species of fern-allies like Equisetum diffusum D. Don and Selaginella kraussiana (Kuntze) A. Braun were found and rest were true ferns. One population of the species Dryopteris caroli-hopei Fraser-Jenkin (Fig. 3E) was found in one locality with single individual, Pteris wallichiana J. Agardh (Fig. 5D) was found to grow luxuriantly in a single patch in single locality. The populations of Pteridium aquilinum (Fig. 5A) were more in most of the localities and were growing like weeds. The families, genus and species identified were listed alphabetically.

**Table 1. List of the genera and total number of species in each genera belonging to different families.**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Families</th>
<th>Name of the Genus</th>
<th>No. of species</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Adiantaceae</td>
<td>Adiantum</td>
<td>2</td>
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<tr>
<td>2.</td>
<td>Aspleniaceae</td>
<td>Asplenium</td>
<td>3</td>
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<tr>
<td>3.</td>
<td>Athyriaceae</td>
<td>Athyrium</td>
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<td></td>
<td>Diplazium</td>
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</tr>
<tr>
<td>4.</td>
<td>Blechnaceae</td>
<td>Woodwardia</td>
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<td>5.</td>
<td>Coniogrammaceae</td>
<td>Coniogramme</td>
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</tr>
<tr>
<td>6.</td>
<td>Cryptogrammaceae</td>
<td>Onichium</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>Dryopteridaceae</td>
<td>Crytomium</td>
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<tr>
<td></td>
<td></td>
<td>Dryopteris</td>
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<tr>
<td></td>
<td></td>
<td>Hypodematum</td>
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<td></td>
<td></td>
<td>Polystichum</td>
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<tr>
<td>8.</td>
<td>Equisetaceae</td>
<td>Equisetum</td>
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<tr>
<td>9.</td>
<td>Osmundaceae</td>
<td>Osmunda</td>
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</tr>
<tr>
<td>10.</td>
<td>Polypodiaceae</td>
<td>Arthromeris</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Drynaria</td>
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<tr>
<td></td>
<td></td>
<td>Lepisorus</td>
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<td></td>
<td></td>
<td>Polypodiodes</td>
<td>2</td>
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<td>Pyrrosia</td>
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<tr>
<td>11.</td>
<td>Pteridaceae</td>
<td>Pteris</td>
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<tr>
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<td>Selaginellaceae</td>
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<tr>
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<td>Sinopteridaceae</td>
<td>Cheilanthes</td>
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<td>15.</td>
<td>Thelypteridaceae</td>
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<td></td>
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<td>Pseudocorycosorus</td>
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<td>Pseudophegopteris</td>
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<td>Thelypteris</td>
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</table>
LIST OF THE PTERIDOPHYTES
Fern-allies
1. Family- Equisetaceae
Genus- Equisetum
(i) *Equisetum diffusum* D. Don. (Fig. 2A)

The plant was growing adjacent to water channel in the sandy soil near Sankri. Inspite of being a common species, it was located in a single locality, 6282 ft., N 31º 04.552' E 078º 10.652', 7.11.2012, SKB 253085.

![Figure 2. A, Equisetum diffusum D. Don; B, Selaginella kraussiana (Kuntze) A. Braun; C, Adiantum venustum D. Don; D, Adiantum Phillipense L.; E, Asplenium dal housiae Hook.; F, Asplenium trichomanes L.](image-url)
2. **Family- Selaginellaceae**  
**Genus- Selaginella**  
(i) *Selaginella kraussiana* (Kuntze) A. Braun ([Fig. 2B])  
The plant was collected from the place on the way to Kedarkantha, 8094 ft., N 31° 03.612’ E 078° 11.342’, 5.11.2012, SKB 253042. The plant was terrestrial as well as lithophytic.

**Ferns**  
3. **Family- Adiantaceae**  
**Genus- Adiantum**  
(i) *Adiantum Phillipense* L. ([Fig. 2D])  
The plant was terrestrial. Netwar, 3 kms away on the way to Sankri, 4512 ft., N 31° 04’08.96” E 078° 06’20.35”, 8.11.2012, SKB 253707.

(ii) *Adiantum venustum* D. Don ([Fig. 2C])  
The plant was terrestrial and found to grow on moist places. On the way to Taluka from Sankri, 13.5.2011, SN 253001. En route to Oslo from Taluka, 14.5.2011, SN 253016. On the way to Kedarkantha, 6547 ft., N 31° 04.331’ E 078° 11.413’, 5.11.2012, SKB 253027; 4 km before Jakhol on the way from Shankri to Jakhol, 6435 ft., N 31° 06.603’ E 078° 14.777, 6.11.2012, SKB 253073. Between Oslo and Gangar, 2456 m, N 31° 06’38.82” E 078° 19’28.64”, 4.4.2013, VS 253104; 2388 m, N 31° 06’21.56” E 078° 18’50.00”, 4.4.2013, VS 253107; 2456 m, N 31° 06’38.82” E 078° 19’28.64”, 4.4.2013, SKB & VS 253104. On the way to Oslo from Taluka, 2068 m, N 31° 04’49.48” E 078° 15’08.29”, 1.4.2013, SKB 253096.

4. **Family- Aspleniaceae**  
**Genus- Asplenium**  
(i) *Asplenium dalhousiae* Hook. ([Fig. 2E])  
The plant was terrestrial. 4 km before Jakhol on the way from Sankri to Jakhol, 6435 ft., N 31° 06.603’ E 078° 14.777, 6.11.2012 SKB 253072. Taluka 1 km towards Oslo, 2022 m, N 31° 04’51.6” E 078° 15’11.9”, 4.4.2013, VS 253109.

(ii) *Asplenium tenuicaule* Hayta  
Lithophytic and epiphytic covered with moss near the water stream. On the way to Oslo from Taluka, 14.5.2011, SN 253013; on the way from Taluka to Oslo, 2083 m, N 31° 04’49.97” E 078° 15’10.26”, 9.10.2013, SKB 253097; between Oslo and Gangar, 2712 m, N 31° 06’41.9” E 078° 19’44.2”, 4.4.2013, VS 253101. Taluka 1 km towards Oslo, 2022 m, N 31° 04’51.6” E 078° 15’11.9”, 5.4.2013, VS 253110. Dhaulia, 5182 ft., N 31° 07’ 52.5” E 078° 05’04.29”, 9.10.2013, VS 253705.

(iii) *Asplenium trichomanes* L. ([Fig. 2F])  
The plant was lithophytic. On the way to Oslo from Taluka, 14.5.2011, SN 253014. Sankri local, 6282 ft., N 31° 04.552’ E 078° 10.652’, 7.11.2012, SKB 253088. Taluka, 1 km towards Oslo, 2022 m, N 31° 04’51.6” E 078° 15’11.9”, 5.4.2013, VS 253111.

5. **Family- Athyriaceae**  
**Genus- Athyrium**  
(i) *Athyrium flabellulatum* (C.B. Clarke) Tardieu  
The plant was terrestrial. On the way to Taluka from Sankri, 14.5.2011, SN 253023

(ii) *Athyrium foliolosum* T. Moore ex R. Sim  
The plant was terrestrial and growing in moist shady slopes in the forest, 6547 ft., E 78° 11.413’ N 31° 04.331’, 5.11.2012, SKB 253029.

(iii) *Athyrium nigripes* (Blume) T. Moore.  

(iv) *Athyrium schimperi* Moug. ex Fée ([Fig. 3A])  
The plant was terrestrial. On the way to Kedarkantha, from Sankri, 7430 ft., E 078° 11.342’ N 31° 03.95’, 5.11.2012, SKB 253709.
Genus- Diplazium
(i) Diplazium polypodiodes Blume (Fig. 3D)

The plant was terrestrial and found to grow on humus-rich mountain slopes with high moisture at various elevations, usually at edge of forests or in clearings, not in deep shade. On the way to Kedarkantha from Sankri, 7430 ft., N 31º 04.331' E 078º 11.413', 5.11.2012, SKB 253031; 8094 ft., N 31º 03.612' E 078º 11.342', 5.11.2012, SKB 253051. 2 km before Jakhol from Sankri, 7060 ft., N 31º 06.733' E 078º 14.029', 6.11.2012, SKB 253070. Sankri local, 6479 ft., N 31º 04.618' E 078º 11.007', 7.11.2012, SKB 253074.

Figure 3. A, Athyrium schimperi Moug. ex Fée; B, Cheilanthes farinosa (Forssk.) Kaulf; C, Coniogramma procera (Wall.) Fée.; D, Diplazium polypodiodes Blume; E, Dryopteris caroli-hopei Fraser-Jenkin; F, Dryopteris wallichiana Wall.

6. Family- Blechnaceae
Genus- Woodwardia
(i) Woodwardia unigemmata (Makino) Nakai (Fig. 5F)

The plant was terrestrial. 2 km before Jakhol from Sankri, 7060 ft., N 31º 06.733' E 078º 14.029', 6.11.2012, SKB 253069.
7. **Family- Coniogrammaceae**  
**Genus- Coniogramma**  
(i) *Coniogramma procerai* (Wall.) Fée. (Fig. 3C)  
The plant was terrestrial and growing in humus rich soil at higher altitude. On the way to Kedarkantha from Sankri, 6547 ft., E 078° 11.342' N 31° 03.95', 5.11.2012, SKB 253032.

8. **Family- Cryptogrammaceae**  
**Genus- Onychium**  
(i) *Onychium contiguum* Wall ex Hope (Fig. 5E)  
(ii) *Onychium japonicum* var. *lucidum* (D. Don) Christ.  
The plant was terrestrial. Located at Sankri, 6282 ft., N 31° 04.552'E 078° 10.652', 7.11.2012, SKB 253089.

9. **Family- Dryopteridaceae**  
**Genus- Cyrtomium**  
(i) *Cyrtomium caryotideum* (Wall ex Hook et Grev.) C. Presl  
The plant was terrestrial and growing in moist and shaded forest slopes. On the way to Osla from Taluka, 14.5.2011, SN 253009, 14.5.2011, SN 253020.  
**Genus- Dryopteris**  
(i) *Dryopteris caroli-hopeli* Fraser-Jenkin (Fig. 3E)  
The plant was found to grow from the crevices of rocks of a wall. Sankri local, 6479 ft., N 31° 04.618' E 078° 11.007', 7.11.2012, SKB 253081.  
(ii) *Dryopteris cochleata* (Buch. Ham ex D.Don) C.Chr  
(iii) *Dryopteris conjugata* Ching  
The plant was terrestrial and growing in moist slopes of the forest. On the way to Kedarkantha from Sankri, 8094 ft., N 31° 03.612'E 078° 11.342', 5.11.2012, SKB 253046.  
(iv) *Dryopteris juxtaposita* Christ  
The plant was terrestrial herb. On the way to Taluka from Sankri, SN 253010; on the way to Kedarkantha, from Sankri, 8094 ft., N 31° 03.612'E 078° 11.342', 5.11.2012, SKB 253047.  
(v) *Dryopteris lepidopoda* Hayata  
The plant was terrestrial and growing in moist slopes of the forest. On the way to Kedarkantha, from Sankri, 8094 ft., N 31° 03.612'E 078° 11.342', 5.11.2012, SKB 253038.  
(vi) *Dryopteris neoarosthornii* Ching  
The plant was terrestrial and growing in moist and shaded forest slopes. On the way to Kedarkantha from Sankri, 6547 ft., N 31° 04.331'E 078° 11.413', 5.11.2012, SKB 253026.  
(vii) *Dryopteris nigropalaceae* (Fraser- Jenk.) Fraser- Jenk.  
(viii) *Dryopteris sparsa* (Ham. ex D.Don) Kuntze
   The plant was terrestrial and growing in moist and shaded forest slopes en route to Osla from Taluka, SN
(ix) *Dryopteris subimpressa* Loyal

The plant was terrestrial. On the way to Kedarkantha, from Sankri, 8094 ft., N 31° 03.612' E 078° 11.342', 5.11.2012, *SKB* 253053.

(x) *Dryopteris wallichiana* Wall (Fig. 3F)

The plant was terrestrial, evergreen with shuttlecock-like rosettes of lance-shaped fronds. On the way to Kedarkantha, from Sankri, 7430 ft., E 078° 11.342' N 31° 03.95', 5.11.2012, *SKB* 253033.

**Figure 4.** A, *Drynaria propinqua* (Wall) J. Smith; B, *Hypodematium crenatum* (Forssk.) Kuhn; C, *Lepisorus nudus* (Hook.) Ching; D, *Polypodiodes amoena* (Wall. ex Mett.) Ching; E, *Polystichum squarrosum* D. Don; F, *Pseudophegopteris pyrrhorachis* (Kunze) Ching.

**Genus- Hypodematium**

(i) *Hypodematium crenatum* (Forssk.) Kuhn (Fig. 4B)

The plant is lithophytic and found to grow in the rock crevices in the exposed areas of forest. Sankri local, 6479 ft., N 31° 04.618' E 078° 11.007', 7.11.2012, *SKB* 253077.
Genus- *Polystichum*

(i) *Polystichum discretum* (D.Don.) J. Smith

The plant was terrestrial. Near Juda tal, on the way to Kedarkantha, 9429 ft., N 31° 03.116' E 078° 11.016', 5.11.2012, *SKB* 253054.

(ii) *Polystichum mucranifolium* (Blume)

The plant was terrestrial. En route to Osla from Taluka, 13.5.2011, *SN* 253008.

(iii) *Polystichum obliquum* (Don) Moore

The plant was lithophyte and was growing in ravines swamp and gorges. En route to Osla from Taluka, 14.5.2011, *SN* 253021.

(iv) *Polystichum piceopaleatum* Tagawa

The plant was terrestrial. En route to Kedarkantha from Sankri, 15.5.2011, *SN* 253024. On the way to Kedarkantha, 3 km from Sankri, 6547 ft., N 31° 04.331' E 078° 11.413', 5.11.2012, *SKB* 253028. Between Osla and Gangar, 2712 m, N 31° 06'41.9'' E 078° 9'44.2'', 1.4.2013, *VS* 253100.

(v) *Polystichum shensiense* Christ

The plant was terrestrial and growing in alpine forest. On the way to Kedarkantha, from Sankri, 8094 ft., N 31° 03.612' E 078° 11.342', 5.11.2012, *SKB* 253040.

(vi) *Polystichum stimulate* (Kunze ex Mettenius) Beddome

The species was terrestrial and growing in moist and shaded forest slopes en route to Taluka from Sankri, *SN* 253007. On the way to Osla from Taluka, 2108 m, N 31° 04'50.58'' E 078° 15'13.10'', 1.4.2013, *SKB* 253098. On the way from Osla to Gangar, 2468 m, N 31° 06'39.83'' E 078° 19'38.01'', 4.4.2013, *SKB* 253102, 4.4.2013, *SKB* 253103.

(vii) *Polystichum squarrosum* D.Don (Fig. 4E)


(viii) *Polystichum yunnanense* Christ


10. Family- Osmundaceae

Genus- *Osmunda*

(i) *Osmunda claytonia* L.

The plant was terrestrial and growing in humus rich soil at higher altitude. En route to Osla from Taluka, 14.5.2011, *SN* 253018, 253022.

11. Family- Polypodiaceae

Genus- *Arthromeris*

(i) *Arthromeris wallichiana* (Spreng.) Ching

The plant was epiphyte and found to grow on tree trunk. En route to Osla from Taluka, 14.5.2011, *SN* 253015

Genus- *Drynaria*

(i) *Drynaria propinqua* (Wall) J. Smith (Fig. 4A)


Genus- *Lepisorus*

(i) *Lepisorus contortus* Ching


(iii) Pteris excelsa Gaud (Fig. 5C)


(iv) Pteris pseudoquadriaurita Khuller


(v) Pteris wallichiana J. Agardh (Fig. 5D)

The plant was terrestrial, large, evergreen and clumping. The plant was found 4 km before Jakhol from Sankri, 6435 ft., N 31° 06.603' E 078° 14.777' 6.11.2012, SKB 253071.

13. Family- Pteridaceae

Genus- Pteridium

(i) Pteridium aquilinum (L.) Kuhn (Fig. 5A)

14. Family- Sinopteridaceae  
Genus- Cheilanthes  
(i) *Cheilanthes farinosa* (Forssk.) Kaulf. (Fig. 3B)  
The plant was both terrestrial and lithophytic. 1 km from Taluka, towards Osla, 6653 ft., N 31° 04'51.6" E 078° 15'11.9", 5.4.2013, VS 253112.

15. Family- Thelypteridaceae  
Genus- Glaphyropteridopsis  
(i) *Glaphyropteridopsis erubescens* (Wall. ex Hook.) Ching  

Genus- Pseudocyosorus
(i) *Pseudocyosorus canus* (Baker) Holtum & J.W. Grimes

The plant was terrestrial. Sankri local, 6282 ft., N 31° 04.552' E 078° 10.652', 7.11.2012, *SKB* 253087.

**Genus- Pseudophegopteris**

(i) *Pseudophegopteris pyrrhorachis* (Kunze) Ching (Fig. 4F)


**Genus- Thelypteris**

(i) *Thelypteris palustris* Schott

This is a perennial fern and found to grow in open area where the soil is permanently wet and organic at Netwar, 3 kms away on the way to Sankri, 4512 ft., N 31° 04'08.96'' E 078° 06'20.35'', 8.11.2012, *SKB* 253708.

**DISCUSSIONS**

The preliminary observations of the studied areas showed that this Sanctuary is most diversified in terms of taxa although some genera had single representation of species. The species *Dryopteris caroli-hopei* Fraser-Jenkins (Fig. 2E), which is believed to be common fern in Western Himalaya and hence not listed in threatened category by Chandra et al. (2008) was observed in one locality with single individual, indicates the species is at risk. The luxuriantly growth of *Pteris wallichiana* J. Agardh in a specific habitat shows, it prefers to grow in open spaces with sufficient sun light at high altitude. At the same time since the habitat was road side hence, it was more prone to destruction by anthropogenic activities. The plants of *Pteridium aquilinum* (L.) Kuhn were being used by the local people for burning fire after drying it, which was again a threat for the survival of this plant.

The natural calamity due to heavy rain fall and cloud burst which resulted in destruction of roads debarrd us to visit the all areas of the sanctuary. However, the complete studies of the Pteridophytic flora of all the areas of the sanctuary will give the clear picture of the status of different species and hence will fill up the gap left behind.

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**REFERENCES**


