Index Copernicus Value
2011:5.09, 2012:6.42,
2013:15.8, 2014:89.16,
2015:78.30, 2016:91

NAAS Rating
2012:1.3; 2013-16: 2.69
2017-19: 3.98

Received on:
26th June 2019

Revised on:
8th July 2019

Accepted on:
20th July 2019

Published on:
1st August 2019

Volume No.
Online & Print
114 (2019)

Page No.
09 to 16

ADDITIONS TO THE PTERIDOPHYTIC FLORA OF UNESCO WORLD HERITAGE SITE, GREAT HIMALAYAN NATIONAL PARK, KULLU, HIMACHAL PRADESH, WESTERN HIMALAYA

KAPIL KHARKWAL [1], SANTOSH NAUTIYAL[1], RAJNI KANT*[1], KUMAR AMBRISH[1] AND B.K. SINHA[2]

[1]BOTANICAL SURVEY OF INDIA, NRC, 192 KAULAGARH ROAD, DEHRADUN-248195.

[2] BOTANICAL SURVEY OF INDIA, SALT LAKE CITY KOLKATA-700064.

Corresponding author's e-mail: kapilkharkwal76@gmail.com
rajnikantthakur167@gmail.com

ABSTRACT:

The present study was conducted in the UNESCO declared world heritage site, the Great Himalayan National Park (GHNP), Kullu, Himachal Pradesh (India), during the years 2016-2018. The surveys resulted in additions of 14 new species of Pteridophytes belonging to 11genera under 07 families. The information related to the distributional status, habitat and an altitudinal ranges are also provided.

KEY WORDS: *Pteridophytes, New additions, GHNP, UNESCO, Western Himalaya.*

INTRODUCTION:

The Himalayan region, one among the 34 global biodiversity hotspots, is the richest source of biological diversity and is very well known for its unique topography, valleys, hills, climate, altitudinal ranges, diverse habitats, network of rivers and streams (Sharma, 2013). These unique features of the Himalaya support diverse plant species, communities, and ecosystem (Singh, 2006). The present study area viz., Great Himalayan National Park, (GHNP) is a part of Western Himalaya, which is located in Kullu district of Himachal Pradesh,

India (fig.1). This National Park was established in the year 1984 and was declared as UNESCO world heritage site in 2011. The area, came into limelight after the initial notification of Great Himalayan National Park (GHNP) in 1984, situated between 31˚ 38'28" N to 31˚ 51'58" N latitude and 77˚ 20'11"E to 77˚ 45'52" E longitude, covering an area of 1,171 km^2 area (Singh and Rawat, 2000) and has an altitudinal range between 1,350-6,000m. The park is bounded by Rupi Bhaba Wildlife Sanctuary (WLS) in the East, Pin Valley National Park in the North East and Kunawar Wildlife Sanctuary (WLS) in the North West. The south Western fringe of the park is surrounded by heavy human habitation, cultivation and orchids. It is one of the two National Parks in the world to support a population of endangered Western Tragopan *(Tragopan melanocephalus)* and a large number of rare as well as threatened plant species many of which possess medicinal values (Gaston and Garson, 1993). It has only about 17% geographical area under forest vegetation (Negi, 1996). This is due to preponderance of alpine areas beyond tree line such as meadows, rocky and snow bound areas. According to Champion and Seth (1968), the major categories of the vegetation in the area include: Banj Oak forest, Moist -deodar forest, Kharsu Oak forest, Western Himalayan upper Oak-fir Forest, Montane Bamboo Brakes, Himalayan Temperate Parkland, Himalayan Temperate Pasture, Western Himalaya Subalpine Fir Forest, Subalpine Pasture, Birch-rhododendron Scrub forest, Deciduous alpine Scrub and alpine Pasture. The dominant tree species in the National Park are *Abies pindrow, pinus wallichiana, Cedrus deodara, Quercus leucotrichophora, Q. floribunda, Q. semecarpifolia, Betula alnoides, B.utilis* and *Acer caesium* etc. (Singh and Rawat, 2000). The Himalayan region of India, Western Himalaya and Himachal Pradesh was previously explored by Bir, 1959, 1987; Khullar, 1988, 1994, 1995, 2000; Jenkins, 1992, 2017; Dhir, 1980; Dixit, 1984; Singh and Rawat, 2000; Chandra, 2000; Sharma and Samant, 2016 and Singh *et al.,* 2017 etc. Singh and Rawat (2000) reported, a total of 27 species of Pteridophytic flora belonging to 16 genera under 13 families from the area of Great Himalayan National Park, Kullu, Himachal Pradesh. However, recent collection yielded 14 new species of Pteridophytes belonging to 11 genera under 07 families as new additions to the flora of Great Himalayan National Park, Kullu, Himachal Pradesh, India under National Mission on Himalayan studies (NMHS,MG) project of Botanical Survey of India, NRC, Dehradun and are enumerated below.

METHODOLOGY:

Specimens were identified with the help of existing literature (Khullar, 1988, 1994, 1995, 2000 & Singh and Rawat, 2000) and confirmed by matching them with authentic specimens housed at Botanical Survey of India (BSD) herbarium, Dehradun.

RESULT AND DISCUSSION:

Enumeration of Taxa

1. **Selaginellaceae** Willk., Anleit. Stud. Bot. 2: 163. 1854.

   Selaginella jacquemontii Spring, Bull. Acad. Roy. Sci. Bruxelles 10: 226. 1843.

   Ecology: Uncommon, found growing on wall as stone base in deep forest at an elevation 2,100m.

   Distribution: INDIA (Jammu & Kashmir, Uttarakhand, Himachal Pradesh: Kullu district); AFGANISTAN, PAKISTAN.

   Specimen examined: Himachal Pradesh, Kullu, GHNP (Sainj Valley), Shakti on way, 14.09.2017, *Rajni Kant, Kapil and Shalini*, 129222(BSD).

2. **Equisetaceae** Michx. ex DC., Essai Propr. Méd. Pl. 49. 1804.

   Equisetum diffusum D. Don, Prodr. Fl. Nepal. 19. 1825.

   Ecology: Uncommon, found on moist and little bit swampy places at an elevation 3,200m.

   Distribution: INDIA (Arunachal Pradesh, Bihar, Chhattisgarh, Jammu & Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Uttarakhand, West Bengal, Himachal Pradesh: Kullu district); BHUTAN, CHINA, JAPAN, MYANMAR, NEPAL, PAKISTAN, TIBET, VIETNAM.

   Specimen examined: Himachal Pradesh, Kullu, GHNP (Sainj valley), Majhoni, 20.09.2017, *Rajni Kant, Kapil and Shalini*, 129378(BSD).

3. **Polypodiaceae** J. Presl & C. Presl, Delic. Prag. 159. 1822.

   Polypodiodes microrhizoma (C.B. Clarke ex Baker) Ching, Acta Phytotax. Sin.16(4): 27.1978.

   Ecology: Uncommon, growing as epiphyte on tree branches at an altitude 2,500m.

   Distribution: INDIA [North West: (Uttarakhand, Himachal Pradesh: Kullu district) & Eastern Himalaya]; BUTAN, CHINA, MYANMAR, NEPAL, SOUTH WEST CHINA, TAIWAN, THAILAND, TIBET.

   Specimen examined: Himachal Pradesh, Kullu, GHNP (Sainj valley), Shakti, 15.09.2017, *Rajni Kant, Shalini and Kapil*, 129241(BSD).

4. **Pteridaceae** E.D.M. Kirchn., Schul-Bot.109. 1831.

   (A.) ***Gymnopteris vestita*** (Wall.) Underw., Bull. Torrey Bot. Club 29. 627. 1902. 1902

   Ecology: Infrequent on shady, moist humous rich wall as well as on big boulders exposed to intense sun light at an elevation 2,100m.

Distribution: INDIA (Uttarakhand, Himachal Pradesh: Kullu district); BHUTAN, CHINA, NEPAL, PAKISTAN, TAIWAN.

Specimen examined: Himachal Pradesh, Kullu, GHNP (Sainj valley), Shakti, 11.09.2017, *Rajni Kant, Kapil and Shalini*, 129513 (BSD).

(B.) ***Pteris excelsa*** Gaudich., Voy. Uranie 388. 1829

Ecology: Uncommon, terrestrial, in moist- humid localities at an altitude 2,000m.

Distribution: INDIA (Kashmir to Eastern Himalaya through Uttarakhand, Himachal Pradesh: Kullu district, South India); BHUTAN, CHINA, JAPAN, JAVA MALAYA, MYANMAR, NEPAL, PAKISTAN, PHILIPPINES, POLYNESIA, TAIWAN.

Specimen examined: Himachal Pradesh, Kullu, GHNP (Tirthan valley), Rolla area, 29.11.2016, *Kumar Ambrish, Rajni Kant and Kapil*, 128948(BDS).

5. Aspleniaceae Newman, Hist. Brit. Ferns 6. 1840.

(A.) ***Asplenium dalhousiae*** Hook., Icon. Pl. 2: pl. 105. 1837.

Ecology: Not common, growing on stones at an altitude 2,100m.

Distribution: INDIA (Kashmir, Haryana, Sikkim, Darjeeling, Arunachal Pradesh, Manipur, Uttarakhand, Himachal Pradesh: Kullu district); AFGANISTAN, AGRICA, CHINA, JAPAN, MEXICO, NEPAL, PAKISTAN, UNITED STATES OF AMERICA.

Specimen examined: Himachal Pradesh, Kullu, GHNP (Sainj valley), Shakti, 11.09.2017, *Rajni Kant, Kapil and Shalini*, 129514(BSD).

(B.) ***Asplenium laciniatum*** D.Don, Prodr. Fl. Nepal.8.1825.

Ecology: Uncommon, seen as shady and moist places amongst boulders at an elevation 2,550m.

Distribution: INDIA (Kashmir, Sikkim, Meghalaya, South India, Uttarakhand, Himachal Pradesh: Kullu district); BHUTAN, CHINA, NEPAL, PAKISTAN, AFRICA, SRILANKA, TIBET.

Specimen examined: Himachal Pradesh, Kullu, GHNP (SainjValley), Maroor Area, 16.09.2017, *Rajni Kant, Kapil and Shalini*, 129258 (BSD).

(C.) **Asplenium trichomanes** L., Sp. Pl. 2: 1080. 1753.

Ecology: Uncommon, oftenly seen on stone walls prefers xeric conditions, forms bushy paths at 1,771m.

Distribution: INDIA (Kashmir, Rajasthan, Sikkim, Assam, Meghalaya, Arunanchal Pradesh, Manipur, South India, Andaman Island, Uttarakhand, Himachal Pradesh: Kullu district); AFGANISTAN, AUSTRALIA, BHUTAN, CANADA, CHINA, EUROPE, JAPAN, NEPAL, NEW GUNIEA, NEW ZEALAND, NORTH AND CENTRAL SOUTHERN AMERICA, PAKISTAN, PHILIPPINES, SOUTH AFRICA, SRILANKA, TAIWAN, TASMANIA, TIBET, VIETNAM, WEST INDIES.

Specimen examined: Himachal Pradesh, Kullu, GHNP (Sainj Valley), Sainj Area, 01.12.2016, *Kumar Ambrish, Rajni Kant and Kapil*,129027(BSD).

6. Athyriaceae Alston, Taxon 5: 25. 1956.

(A.) ***Athyrium strigillosum*** (E.J. Lowe) Salomon, Nomencl. Gefässkrypt. 112. 1883.

Ecology: Uncommon, on moist place, species reported to occur at elevation ± 2500m.

Distribution: INDIA (Kashmir, Sikkim, Arunachal Pradesh, Uttarakhand, Himachal Pradesh: Kullu district); BHUTAN, CHINA, NEPAL, PAKISTAN, TIBET.

Specimen examined: Himachal Pradesh, Kullu, GHNP (Sainj Valley), Maroor Area, 21.09.2017, *Rajni Kant, Kapil and Shalini*, 129441(BSD).

(B.) ***Diplazium esculentum*** (Retz.) Sw., J. Bot. Schrader 1801(2): 312. 1803.

Ecology: Abundant, dwells in low hills, on shady, moist places at an elevation 1850m.

Distribution: INDIA (Throughout North-West Himalaya, Kashmir, Darjeeling, Meghalaya, Assam, Manipur, Arunachal Pradesh, Nagaland, Tripura, Uttarakhand, Himachal Pradesh: Kullu district); CHINA, INDONESIA, MALAYA, MALAYSIA, MYANMAR, NEPAL, NEW GUNIEA, PAKISTAN, PHILIPPINES, POLYNESIA, SAMOA, SRILANKA, TAIWAN.

Specimen examined: Himachal Pradesh, Kullu, GHNP, (Sainj valley), Sainj, 02.12.2016, *Shalini, Kapil and Rajni Kant*, 129070 (BSD).

7. Dryopteridaceae Herter, Revista Sudamer. Bot. 9(1): 15. 1949.

(A.) ***Cyrtomium macrophyllum*** (Makino) Tagawa, Acta Phytotax. Geobot. 3(2): 62–63. 1934.

Ecology: Rare, terrestrial on shady, moist forest floor near streamlets at an elevation 1800m.

Distribution: INDIA (Kashmir, Sikkim, Darjeeling, Arunanchal Pradesh, Khasi Hills Assam, Nagaland, South India, Uttarakhand, Himachal Pradesh: Kullu district); BHUTAN, CHINA, JAPAN, NEPAL, PAKISTAN, TAIWAN, TIBET.

Specimen examined: Himachal Pradesh, Kullu, GHNP (Sainj valley), Shakti, 21.09.2017, *Rajni Kant, Kapil and Shalini*,129479(BSD).

(B.) ***Dryopteris wallichiana*** (Spreng.) Hyl., Bot. Not. 1953(3): 352. 1953.

Ecology: Fairly common growing as a terrestrial on shady, moist places at an elevation above 2600m.

Distribution: INDIA (Kashmir, Sikkim, Uttarakhand, Himachal Pradesh: Kullu district); NEPAL, SOUTH-WEST CHINA.

Specimen examined: Himachal Pradesh, Kullu, GHNP, Chius Area, 18.09.2017, *Rajni Kant, Kapil and Shalini*, 129313(BSD).

(C.) ***Polystichum nepalense*** (Spreng.) C. Chr., Index Filic. 10: 84, 585. 1906.

Ecology: Uncommon, epilithic over old deteriorating walls, on shady banks against water-streams at 2205m.

Distribution: INDIA (Sikkim, Uttarakhand, Himachal Pradesh: Kullu district); AFGANISTAN, BHUTAN, CHINA, FORMOSA, JAPAN, MYANMAR, NEPAL, PHILIPPINES, SRILANKA, TIBET.

Specimen examined: Himachal Pradesh, Kullu, GHNP (Sainj valley), Shakti, 11.09.2017, *Rajni Kant, Kapil and Shalini*, 129507(BSD).

(D.) ***Polystichum stimulans*** (Kunze ex Mett.) Bedd., Ferns Brit. India pl. 31. 1865.

Ecology: Uncommon, on moist-shady wall crevices at an elevation 2520m.

Distribution: INDIA (Sikkim, Darjeeling, Meghalaya, Mizoram, Arunachal Pradesh, Manipur, Nagaland, South India, Uttarakhand, Himachal Pradesh: Kullu district); BHUTAN, CHINA, NEPAL, PAKISTAN, TIBET.

Specimen examined: Himachal Pradesh, Kullu, GHNP (Tirthan valley), Shankha, 07.06.2018, *Rajni Kant and Kapil*,131263(BSD).

Abbreviations: GHNP = Great Himalayan National Park, UNESCO = United Nations Educational, Scientific and Cultural Organization, BSD= Botanical Survey of India herbarium, Dehradun

ACKNOWLEDGEMENT:

The authors are grateful to the Director, Botanical Survey of India, Kolkata, MOEF & CC, New Delhi for providing financial support, necessary facilities and to the staff of forest Department of Great Himalayan National Park, Kullu, Himachal Pradesh Uttarakhand for their kind co-operation during floristic exploration.

REFERENCES:

Bir, S.S. (1959). Cytotaxonomic observation on some Aspleniaceae from Kullu Valley. *J. Indian Bot. Soc.* **38**: 528-539.

Bir, S.S. (1987). Pteridology in India. *Indian Fern J.* **4**: 95-101. (In Indian)

Chandra, S. (2000). *The Ferns of India (Enumeration Synonyms & Distribution).* International Book Distribution, Dehra Dun.

Dhir, K.K. (1980). Ferns of North Western Himalayas. *Bibliotheca Pteridologica*. **1**:138

Dixit, R.D (1984). *A Census of India Pteridophytes.* Botanical Survey of India. 177p.

Fraser- Jenkins C.R. (1992). The ferns and allies of the West Himalaya. *Pakistan Systematics*. **5**(1- 2): 85-120.

Fraser-Jenkins, C.R. Gandhi, K.N. and Kholia B.S. (2017). *An Annotated check list of India.* Bishen Singh Mahendra Pal Singh, Dehradun.

Gaston, A.J. and Garson, P. J. (1993). A Re- Appraisal on the Great Himalayan National Park, Report. *Report to HPDFFC. International Trust for Nature Consevation,* WWF-India.

Khullar, S.P. (1988). The fern of West Himalaya: an enumeration. *Journal of Himalaya Research and Development* **7**:59-67.

Khullar, S.P. (1994). *An Illustrated Fern Flora of West Himalaya, Vol I.* International Book distributors, Dehra Dun (India).

Khullar, S.P. (1995). List of the Fern of Himachal Pradesh, North Western Himalay. *Indian fern J.* **12**(1-2): 177-187.

Khullar, S.P. (2000). *An Illustrated Fern Flora of West Himalaya, Vol II.* International Book distributors, Dehra Dun (India).

Negi, A.S. (1996). Assessment of issues related to soil erosion landslides and to provide technical support to park management. *WII Report,* Dehra Dun.

Sharma, P. (2013). Ecological assessment of floristic diversity and possible impacts of hydropower projects in Kullu district of Himachal Pradesh, North Western Himalaya. Thesis sub-mitted to Kumaun University, Nainital.411p.

Sharma, P. and Samant, S. (2016). Diversity of Pteridophytes in the Surroundings and Dam Submergence Areas of Hydroelectric Projects in Kullu District of Himachal Pradesh, Indian Himalaya. *Forestry Ideas* **22**(52):127-136.

Singh, S., Kharkwal, K., Thakur, R. Sinha, B.K. and Ambrish, K. (2017). Ethnobotanical aspects of Pteridophytes of Great Himalayan National Park, Kullu, Himachal Pradesh. *Phytotaxonomy* **17**: 43-49.

Singh, J.S. (2006). Sustainable development of Indian Himalayan Region: Linking ecological and economic concerns. *Current Science* **90**(6): 784-788.

Singh, S.K. and Rawat, G.S. (2000). *Flora of Great Himalayan National Park- Himachal Pradesh.* Bishen Singh Mahender Pal Singh Dehra Dun.

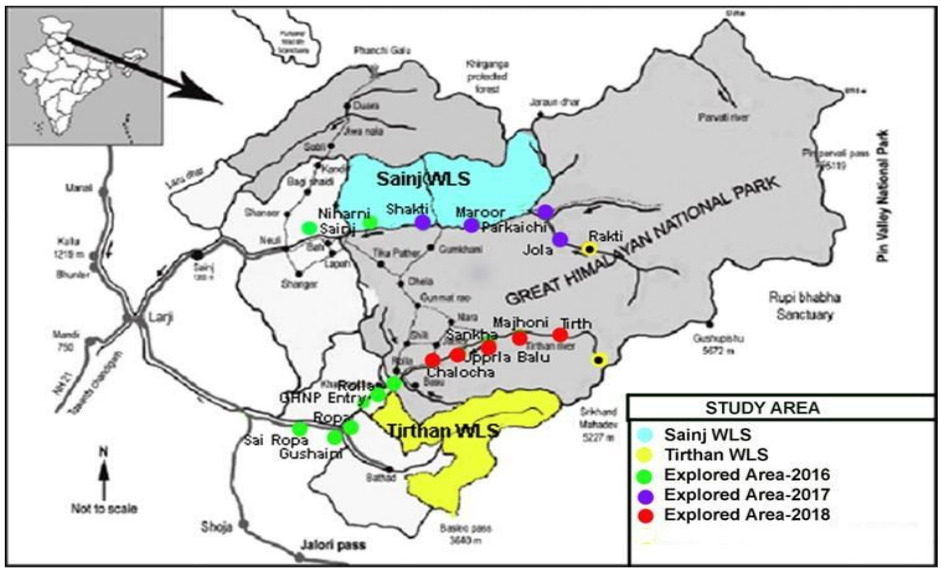

Fig.1 Great Himalayan National Park, Kullu, Himachal Pradesh