PLATINUM OPEN ACCESS

The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under Creative Commons Attribution 4.0 International License unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

Journal of Threatened Taxa

Building evidence for conservation globally

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

COMMUNICATION

PLANT AND FUNGI DIVERSITY OF DEVI PINDIYAN VALLEY IN TRIKUTA HILLS OF NORTHWESTERN HIMALAYA, INDIA

Sajan Thakur, Harish Chander Dutt, Bikarma Singh, Yash Pal Sharma, Nawang Tashi, Rajender Singh Charak, Geeta Sharma, Om Prakash Vidyarthi, Tasir Iqbal, Bishander Singh & Kewal Kumar

26 November 2019 | Vol. 11 | No. 14 | Pages: 14827–14844
DOI: 10.11609/jott.4792.11.14.14827-14844

For Focus, Scope, Aims, Policies, and Guidelines visit https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-0
For Article Submission Guidelines, visit https://threatenedtaxa.org/index.php/JoTT/about/submissions#onlineSubmissions
For Policies against Scientific Misconduct, visit https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-2
For reprints, contact <ravi@threatenedtaxa.org>

The opinions expressed by the authors do not reflect the views of the Journal of Threatened Taxa, Wildlife Information Liaison Development Society, Zoo Outreach Organization, or any of the partners. The journal, the publisher, the host, and the partners are not responsible for the accuracy of the political boundaries shown in the maps by the authors.

Partner

Publisher & Host
PLANT AND FUNGI DIVERSITY OF DEVI PINDIYAN VALLEY IN TRIKUTA HILLS OF NORTHWESTERN HIMALAYA, INDIA

Sajan Thakur 1,2, Harish Chander Dutt 3,4, Bikarma Singh 5, Yash Pal Sharma 6,7, Nawang Tashi 6,7, Rajender Singh Charak 6,7, Geeta Sharma 8, Om Prakash Vidyarthi 6,7, Tasir Iqbal 6,8, Bishander Singh 9 & Kewal Kumar 10

1,2,5,7,9 Department of Botany, 3 Department of Geography, University of Jammu, Jammu, Jammu & Kashmir 180006, India.
3 Plant Sciences (Biodiversity and Applied Botany Division), CSIR-Indian Institute of Integrative Medicine, Canal Road, Jammu, Jammu & Kashmir 180001, India.
4 State Forest Research Institute, Jammu, Jammu & Kashmir 180007, India.
5 Department of Botany, Veer Kunwar Singh University, Arrah, Bihar 802301, India.
6 Department of Botany, Government Degree College for Women, Udhampur, Jammu & Kashmir 182101, India.
7 csir007thakur@gmail.com, 2 hcdutt@rediffmail.com, 4 dbikarma@iiim.ac.in (corresponding author),
8 yashbdnm3@yahoo.co.in, 5 nawang7786@gmail.com, 6 rajsinghju@gmail.com, 7 geetaji@yahoo.com,
9 opsfrjik@gmail.com, 10 tasier83@gmail.com, 11 bishander85@gmail.com, 12 kewalkumar0@gmail.com

Abstract: The Devi Pindiyan Valley, an abode of Goddess Vaishno Devi, in Trikuta Hills (western Himalaya) is a unique hill-top land ecosystem with a diverse regional mixed subtropical and temperate flora. Because of its suitable geographic location, specific and unique habitat conditions, this mountainous belt of Shivalik Himalaya has a large number of endemic and threatened plant species. This study presents information on the plant diversity of Devi Pindiyan Valley of Trikuta Hills. Several line-transect (100m N-S and 100 E-W) surveys were conducted in which nested quadrats of 10m × 10m were laid for trees, within which interspersed two 5m × 5m sub-quadrats for shrubs and five 1m × 1m sub-quadrants for herbs at different places for determination of floristic composition. In the diverse habitats of this valley, we recorded 213 vascular plant species belonging to 164 genera under 71 families. This study area also harbors rich diversity of fungi, where the most visible 7 species of macrofungi belongs to 7 genera and 4 families were documented. Out of the documented species, 35 species have been categorized as threatened based on the latest IUCN Red list criteria, while 178 species are included in the catalogue of world life. Engelhardtia spicata Lechen ex Blume var. integra (Kurtz) Manning ex Steenis has been categorized as Least Concerned (LC) by IUCN Red List site. The species diversity indicates the high conservation value of this area and documenting such an ecologically rich ecosystem becomes a prerequisite for developing and formulating conservation-cum-management strategies. Therefore, we recommend there is need for ecological research in terms of biodiversity conservation on Devi Pindiyan Valley and similar ecosystems.

Keywords: Conservation status, Devi Pindiyan Valley, floristic composition, Shivalik Himalaya.
INTRODUCTION

Himalayan eco-terrains are globally recognized as a hub and repository of unique biological diversity in Asia, and their distribution differs from tropical to alpine climate (Nayar & Shastri 1987; Singh 2019). The species composition of the Himalayan hills and mountains varies from place to place and these variations depend mainly on different climatic factors coupled with differences in latitude, longitude, and altitude (Singh 2015). The Indian Himalaya are home to more than 8,000 species of vascular plants, of which 4,000 species are endemic and 1,748 are known for their medicinal properties (Samant et al. 1998; Singh 2019a). The western Himalayan geographic region extends from Jammu & Kashmir to the Kumaon belt of Uttarakhand State. The Shivalik region of Jammu division is known for unique and endemic species whose occurrence is due to favorable climatic conditions required for the growth and dissemination of plant species (Singh 2019b). Review of literature reveals that Jammu & Kashmir is home to about 4,439 species of plants (Singh et al. 1999), and out of these, 948 species are published to have medicinal and aromatic value (Gairola et al. 2014). It is evident from the published work that a lot of research has been carried out in this region by different plant scientists to study biodiversity, ethnobotany, ecology, and data up-gradation on environmental parameters (Sharma & Kachroo 1983; Kapur & Sarin 1990; Swami & Gupta 1998; Kirn 2000; Kumar & Hamal 2009; Kumar et al. 2009, 2015; Kumar & Sharma 2011; Bhellum & Magotra 2012; Bhatia et al. 2013, 2014; Dar et al. 2014; Dutt et al. 2015; Kour et al. 2017; Pandita & Dutt 2017; Singh et al. 2016, 2019).

Trikuta Hills in the Himalaya are known for the holy pilgrimage of the shrine of Shri Mata Vaishno Devi and more than 1.5 lakh people visit this place of worship every year from different parts of the globe. This shrine mountain ecosystem has several steep slopes, deep gorges and valleys, rich in different types of vegetation. Ecologically, these hills can be characterized as sub-tropical to temperate mixed vegetation, rich in Pinus, Quercus, Engelhardtia, and Cedrus as dominant tree species. The elevation of this mountain ranges from 750 to 2,706m. Many sacred rivers and small streams originate from these hills, and the higher reaches of these hills are occasionally covered with snow during winter months. There are several unexplored regions due to sacred beliefs and tough terrain in the hills. In this study, we present the floral and fungal diversity of Devi Pindiyan Valley with an aim to conserve species in this valley.

MATERIALS AND METHODS

Study Area

Devi Pindiyan Valley of Trikuta Hill is situated 36km from Jammu Town and 13km from Katra City (Reasi District) in Panthal forest area. It lies between latitudes of 32.892 to 33.010N and longitudes of 74.986 to 74.995E and the elevation range of 860–1,360m (Figure 1). It covers approximately an area of 17.3 km². The study area is part of district Reasi of Jammu & Kashmir. This mountainous belt falls in the Palaearctic Realm and the forest terrains are rugged and the hills are characterized by moderate to steep slopes. The vegetation components are characterized by typical subtropical and temperate forests. The forest components as a whole are regarded as a sacred grove and named Devi Pindiyan Shakti Pith. The upper ridges of Trikuta Hill experiences winter snowfall which is responsible for the moderate temperature in summer and cool weather in winter. December–January are the coldest months of the year when minimum temperatures reach minus 4°C. The mean temperature in January is about 8°C, and in May, the temperature rises between 35°C and 40°C. The annual rainfall ranges between 3,200mm and 3,472mm, distributed over 60–90 rain days. A number of seasonal streams that provide water to the local community for domestic purposes originate from the forest reserve. River Jhajjar is one of the important sacred perennial water system originating from Trikuta Hill which runs through the valley. There are only four villages where an indigenous Dogri speaking community of Duggar resides. Due to the remote location, typical physiography and climate, the local people derive much of their livelihood from agriculture, horticulture and floriculture. They mostly depend on forest resources for food, shelter and medicine. Since the region is known as a sacred place, some of them cultivate marigolds for sale in the market which adds to their earnings.

Field Survey, Data Collection and Identification

Four field exploration tours were undertaken for survey, collection and mapping of plant samples from six study sites in Devi Pindiyan Valley from March 2017 till September 2018 with the help of experts from the J&K Forest Department, CSIR-IIIM Jammu, and the University of Jammu (Image 1). Several line-transect (100m N-S and 100m E-W) surveys were conducted at different places for determination of floristic composition. Nested quadrats of 10 × 10m were laid for floristic studies, within which were interspersed two 5 × 5m sub-quadrats for shrubs and five 1 × 1m sub-quadrats for herbs in different
Plant and fungal diversity of Devi Pindiyan Valley

Thakur et al.

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 November 2019 | 11(14): 14827–14844

Growing seasons. GPS coordinates were recorded by using Garmin Oregon 650 GPS navigation device (Table 1). Data on habit, phenological characters and associated species of plants were collected along with digital photographs. Macro-fungi present in the area were also systematically collected, photographed and preserved. Laboratory studies were conducted in the Department of Botany, University of Jammu and RRLH Janaki Ammal Herbarium at CSIR-Indian Institute of Integrative Medicine, Jammu (CSIR-IIIM). Conventional herbarium techniques proposed by Jain & Rao (1977) and Rao & Sharma (1990) were followed. The accurate identification and authentication of plants was based on the collected herbarium vouchers and photographs, which were used as unique evidence and reference material for regional distribution. Proper identification and naming of macro-fungi species was done through individual expertise and online databases such as Index

**Table 1.** Characterization of collecting sites from Devi Pindiyan Valley of Trikuta Hill, Shivalik Himalaya.

| Survey sites (Date of collection) | Geographical coordinates | Habitat characterized                  |
|----------------------------------|--------------------------|----------------------------------------|
| Site 1 (14 March 2017)           | 32.982° N 74.986° E     | 860 Tropical forests                  |
| Site 2 (19 August 2017)          | 32.987° N 74.987° E     | 1020 Mixed tropical and subtropical forests |
| Site 3 (19 August 2017)          | 32.994° N 74.990° E     | 1149 Mixed tropical and subtropical forests |
| Site 4 (28 April 2018)           | 32.999° N 74.989° E     | 1135 Mixed tropical and subtropical forests |
| Site 5 (28 April 2018)           | 33.004° N 74.993° E     | 1089 Mixed tropical and subtropical forests |
| Site 6 (14 September 2018)       | 33.010° N 74.995° E     | 1360 Mixed subtropical and temperate forests |

**Figure 1.** Devi Pindiyan Valley and main sampling plots (details information of each plot is given in Table 1).
fungorum (www.indexfungorum.org) and Mycobank (www.mycobank.org).

The species were enumerated and photographed through non-invasive methods. The vouchers of the collected plants were identified by comparing them physically with existing preserved specimens at the Herbarium of the University of Jammu (HBJU) and Janaki Ammal Herbarium (RRLH) Jammu. Later, all taxa were authenticated by using taxonomic keys and published floras (Sharma & Kachroo 1983; Kapur & Sarin 1990; Swami & Gupta 1998). The prepared herbarium sheets were deposited at the Herbarium of University of Jammu (HBJU).

Systematization and Presentation

All plant species of Devi Pindiyan were systematically arranged. Families were arranged as per Bentham and Hooker’s System of Classification (Bentham & Hooker 1876). Habit of each plant species were categorized as trees, shrubs, herbs and lianas. The correct ICN names of each plant and macro-fungi species were carried out using web-based databases (www.theplantlist.org, www.indexfungorum.org and www.mycobank.org). The threat status of each species was determined using the online database of IUCN Red List (www.iucnredlist.org) and presented as Critically Endangered, Endangered, Vulnerable, Least Concern, Data Deficient and if
similar information was not available, then they were designated as NA.

RESULTS

Forest Characterization

The intermediate climate between the subtropical and the temperate vegetation along with the topography of the Devi Pindiyan Valley is responsible for its unusual mixed type of vegetation. The forest belts possess different types of very unique plant associations such as mixed deciduous broad-leaved forests, lower pine association coupled with secondary scrub parameters. This valley is dominated by species such as *Sapium sebiferum*, *Grewia optiva* and *Toona ciliata* in mixed broad-leaved areas. *Pinus roxburghii*, *Phoenix dactylifera*, *Trema politoria*, and *Debregeasia longifolia* at the upper hills mixed with pine vegetation. The secondary scrubby layers are dominated by *Woodfordia fruticosa*, *Justicia adhatoda*, *Euphorbia royleana* and *Ehretia acuminata*.

Floristic Composition and Analysis

A total of 213 plant species belonging to 165 genera and 71 vascular plant families were collected from the Devi Pindiyan and associated hills of Trikuta Mountain (Appendix 1). Out of a total of 213 plant species, 204 were angiosperms (166 dicots and 38 monocots), one was gymnosperm and the remaining eight were pteridophytes (Table 2). The highly represented families were Poaceae (19 species), Lamiaceae (14 species), Fabaceae (13 species), Asteraceae & Moraceae (12 species each), Solanaceae (9 species), Euphorbiaceae (8 species), Rosaceae (7 species), Ranunculaceae (6 species) & Malvaceae, Pinaceae and Pteridaceae (5 species each). Highly represented genera in the valley were *Ficus* (10 species), *Euphorbia* & *Solanum* (5 species each), *Rubus* (4 species), and *Acacia* & *Datura* (3 species each). A total of 95 plant species were herbaceous in habit, 48 were shrubby bushes, 54 were trees and 16 were climbers. Some snapshots of species diversity are given in Images 2 and 3.

Besides vascular plant diversity, this region also exhibits macrofungal diversity, of which some are used as food or medicine by the local inhabitants of the study area. While investigating, seven macro-fungi were documented from the study area that include *Schizophyllum commune* (Curtis) P. Karst. (Schizophyllaceae), *Calvatia gigantea* (Batsch) Lloyd, and *Bovista minor* Morgan (all Agaricaceae members). The first two macro-fungi (*Schizophyllum commune* and *Schizophyllum commune*) are used as medicine by the local people, whereas the remaining were recorded as being used as wild edible macro-fungi (Image 4).

Economically Valued Plants

Out of a total of 213 plant species collected from the area, 76.05% (162 spp.) are reported in literature as high valued medicinal plants (Samant et al. 1998; Bhatia et al. 2013, 2014; Gairola et al. 2014; Dutt et al. 2015). Some abundantly growing medicinal plants of Devi Pindiyan Valley and its associated mountain ranges include *Achyranthes bidentata*, *Acamia modesta*, *Artemosia nilagirica*, *Berberis lycium*, *Bergenia pacumbis*, *Cissampelos pareira*, *Colebrookea oppositifolia*, *Colchicum luteum*, *Cryptolepis dubia*, *Datura innoxia*, *Holarrhena pubescens*, *Micromeria biflora*, *Mentha spicata*, *Melia azedarach*, *Melia chinensis*, *Schizophragma spinosum*, *Viola conchescens*, and *Zanthoxylum armatum*.

While gathering oral information from local people, 26 species were recorded as edible and consumed as wild leafy vegetables, wild fruits or seeds. Most abundantly growing plants under this category are *Colocasia esculenta*, *Debregeasia longifolia*, *Ficus spicata*, *Mentha spicata*, *Morus alba*, *Murraya koenigii*, *Rubus ellipticus*, *Rubus niveus*, *Rumex hastatus*, *Zanthoxylum armatum* and *Ziziphus jujuba*. The study area is composed of nearly 55 timber yielding plants, with *Engelhardtia spicata*, *Ficus semicordata*, *Ficus racemosa*, *Mallotus philippensis*, *Kigelia africana*, *Melia azedarach*, and *Pinus roxburghii* being the most dominant tree species. We also recorded 10 plants from the area as a source of dye such as *Impatiens balsamina*, *Impatiens bicolour*, *Geranium nepalensis*, *Acacia catechu*, and *Pistacia chinensis* (Figure 2).
Image 2. Plant diversity found in Devi Pindiyan Valley and adjoining areas: A—Engelhardtia spicata Lechen ex Blume var. integra (Kurz) Manning ex Steenis | B—Woodwardia radicans (L.) Sm. | C—Euphorbia royleana Boiss. | D—Thysanolaena latifolia (Roxb. ex Hornem.) Honda | E—Adiantum recurvatum (D.Don) Fraser-Jenk. | F—Pteris vittata L. | G—Toona sinensis (A.Juss.) M.Roem. | H—Vitex altissima L.f. | I—Rubus ellipticus Sm. | J—Senna occidentalis (L.) Link | K—Bauhinia variegata L. | L—Dendrocalamus strictus (Roxb.) Nees. © S. Thakur, B. Singh & O.P. Vidyarthi.
Native and Non-Native Status

Of the total 213 investigated species, 124 species representing 58.22% are native to the Palaearctic Realm and remaining 89 species (41.78%) are non-native to India and adjoining areas (Appendix 1). They are either introduced, alien (invasive) or recorded from other regions as native plants. They are European, African, Australian, or tropical American origin plants escaped to have distribution in the study area (India) as invasive or were introduced sometime in history. A total of 32 species (15.02%) are native to India or are exclusively endemic to the Himalayan regions. Common endemic species to Himalaya include Mimosa himalayana, Valeriana jatamansi, Neolitsea umbrosa, Engelharddia spicata, Colchicum luteum, Isachne himalaica, Colebrookea oppositifolia, Ficus semicordata, Delphinium denudatum, Grewia optiva, Acacia modesta, Begonia picta, Heracleum candicans, Selinum vaginatum, and Euphorbia royleana. About 0.93% species have nativity in Indo-Malayan regions. There are several species which are of Chinese origin and have abundant growth in the study area includes Ficus sarmentosa, Hedychium spicatum, Pteris vittata, and Pistacia chinensis.

Threats and Conservation Perspectives

Human disturbance coupled with habitat fragmentation have been identified as a major cause of biodiversity loss in many hotspots. Destruction of forests has resulted in the degradation of the environment and habitat of native species of the state. The rich genetic diversity has been depleted and many plant species are facing the threat of extinction in their natural habitats. Expansion of developmental activities (road/dam/city construction), logging, mining and similar associated activities are major threats to plant and animal species. The conservation status of all collected and authenticated species were worked out following IUCN Red List website (www.iucnredlist.org), and out of a total of 213 species, 34 species have been categorized under one or other threat concern. Total 32 species were listed as Least Concern (LC) species, 1 species each were categorized under Vulnerable (V) category and Data Deficient (DD) and remaining 178 species were not assessed as per IUCN classification (Figure 3).

DISCUSSION

The endemic species with limited geographical ranges are susceptible to extinction as they are extremely vulnerable to environmental changes, while widely distributed species can cope with the changing environment and anthropogenic disturbances (Rao et al. 2003). In this study, we reviewed for the first time, and presented the plant diversity of unexplored Devi Pindiyan Valley of Trikuta Hills in Shivalik Himalaya. In the diverse habitats of this valley, we recorded 213 vascular plants of 164 genera under 71 families, and seven macro-fungal genera belonging to four families, indicating that the flora of the surveyed region shows high diversity. In fact, while surveying and exploring the interior belts, we often found a large number of plant species from a certain small area, which were very different in habitat condition from their surroundings. In addition to these, we were able to mark wide variations in ecological conditions found within the explored area along with variations in altitudes. According to the Botanical Survey of India, Jammu & Kashmir in the western Himalaya is one such region which has been floristically under-explored (Dar et al. 2012), and the present finding helps to fill the data gap. Few research projects were previously conducted in the area, and one of them was of Kapur (1982),
Image 3. Plant diversity found in Debi Pindiyan Valley and adjoining areas: A—Toona ciliata M.Roem. | B—Mimosa himalayana Gamble | C—Neolamarckia cadamba (Roxb.) Bosser | D—Cotinus coggyria Scop. | E—Rhamnus triquetra (Wall.) Brandis | F—Sauromatum venosum (Alton) Kunth | G—Cissampelos pareira L. | H—Leucas lanata Benth. | I—Boehmeria macrophylla Hornem. | J—Impatiens balsamina L. | K—Impatiens bicolor Royle | L—Viola canescens Wall. | M—Pinus roxburghii Sarg. | N—Olea paniculata R.Br. | O—Thalictrum foliolosum | P—Saccharum spontaneum L. | Q—Zanthoxylum armatum DC. © S. Thakur, B. Singh & O.P. Vidyarthi.
Image 4. Macro-fungal diversity found in Devi Pindiyan Valley and adjoining areas: A—Ganoderma lucidum (Curtis) P.Karst. | B—Schizophyllum commune Fr. | C—Termitomyces heimil Natrajan | D—Macropleota procera Scop. | E—Agaricus arvensis Schaeff. | F—Calvatia gigantea (Batsch) Lloyd | G—Bovista minor Morgan. © Y.P. Sharma.
who studied the phytocology and forest associations, but very little data on ecology was presented. Lesser known species outside their natural habitat are facing threats of existence seeing in vulnerable category and may slowly move towards the verge of extinction due to unabated anthropogenic activities such as deforestation and illicit extraction of valuable medicinal plants. Hence, such species need immediate conservation measures and research on ecological restoration. Owing to our extensive study efforts in the Devi Pindiyan, this documented research will provide a good notion of the plant diversity and reasons for conservation of this sacred place for the future.

REFERENCES

Bentham, G. & J.D. Hooker (1876). Genera Plantarum. Published by L. Reeve & Co., London, 1040pp.

Bhatia, H., Y.P. Sharma, R.K. Manhas & K. Kumar (2013). Ethnobotanical plants used by the villagers of district Udhumpur, J&K, India. Journal of Ethnopharmacology 151: 1005–1018.

Bhatia, H., Y.P. Sharma, R.K. Manhas & K. Kumar (2014). Traditional phytothermies for the treatment of menstrual disorders in district Udhumpur, J&K, India. Journal of Ethnopharmacology 160: 202–210. https://doi.org/10.1016/j.eph.2014.11.041

Bhelliom, B.L. & R. Magotra (2012). A catalogue of flowering plants of Doda, Kishtwar and Ramban Districts (Kashmir Himalayas). Bishen Singh Mahendra Pal Singh, Dehradun, India, 286pp.

Dar, G.H., A.A. Khuroo, C.S. Reddy & A.H. Malik (2012). Impediment to taxonomy and its impact on biodiversity science: an Indian perspective. Proceedings of the National Academy of Sciences, India, Section B. Biological Sciences 82: 235–240.

Dar, G.H., A.H. Malik & A.A. Khuroo (2014). A contribution to the flora of Rajouri and Poonch Districts in the PirPanjal Himalaya (Jammu & Kashmir), India. Check List 10: 317–328.

Dutt, H.C., N. Bhatag & S. Pandita (2015). Oral traditional knowledge on medicinal plants in jeopardy among Gaddi shepherds in hills of Northwestern Himalaya, J&K, India. Journal of Ethnopharmacology 168: 337–348.

Gairola, S., J. Sharma & Y.S. Bedi (2014). A cross-cultural analysis of Jammu, Kashmir and Ladakh (India) medicinal plant use. Journal of Ethnopharmacology 155:925–986.

Jain, S.K. & R.R. Rao (1977). A Handbook of Field and Herbarium Methods. Today and Tomorrow Printers and Publishers, New Delhi, India, 157pp.

Kapur, S.K. (1982). Phytocoenological studies in Trikuta Hills with special reference to the distribution pattern of economic plant products. PhD Thesis, Regional Research Laboratory, Jammu (unpublished).

Kapur, S.K. & V.K. Sarin (1990). Flora of Trikuta Hills. Bishen Singh Mahendra Pal Singh, Dehradun, India, 267pp.

Kim, H.S. (2000). Pteridophytic flora of Poonch District of Jammu and Kashmir State, north-west Himalayas. Indian Fern Journal 17: 92–105.

Kour, S., R. Yangdol, S. Kumar & Y.P. Sharma (2017). Reports on family Psathyrellaceae from Jammu and Kashmir, India. Indian Journal of Forestry 40:303–311.

Kumar, K., Y.P. Sharma, R.K. Manhas & H. Bhatia (2015). Ethnobotanical plants of Shankaracharya Hill, Srinagar, J&K, India. Journal of Ethnopharmacology 170: 255–274.

Kumar, M., Y. Paul & V.K. Anand (2009). An Ethnobotanical study of medicinal plants used by the locals in Kishtwar, Jammu and Kashmir, India. Ethnobotanical Leaflets 13: 3240–3256.

Kumar, S. & I.A. Hamal (2009). Wild edibles of Kishtwar high altitude national park in Northwest Himalaya, Jammu and Kashmir (India). Ethnobotanical Leaflets 13: 195–202.

Kumar, S. & Y.P. Sharma (2011). Diversity of wild mushroom from Jammu and Kashmir, India, pp. 568–579. Proceedings of the 7th International Conference on Mushroom biology and Mushroom Products (ICMBMP).

Nayar, M.P. & A.R.K. Shastry (1987-1990). Red Data Book of Indian Plants. 3 Vols. Botanical Survey of India, Calcutta, India.

Pandita, S. & H.C. Dutt (2017). Herbaceous species in structuring the ecotope between forest-grassland in lesser stratum of North-West (NW) Himalaya. NeBIO 8: 287–293.

Rao, C.K., B.L. Geetha & G. Suresh (2003). Red list of Threatened Vascular Plant Species in India. Published by ENVIS, Botanical Survey of India, MoEF, Howrah, India, 144pp.

Rao, R.R. & B.D. Sharma (1990). A Manual for Herbarium Collections. Botanical Survey of India, Calcutta, India, 20pp.

Reddy, C.S., G. Bagayanarayana, K.N. Reddy & V.S. Reddy (2008). Invasive Allen Flora of India. Published by National Biological Information Infrastructure, US Geological Survey, USA, 130pp.

Samant, S.S., U. Dhar & L.M.S. Palni (1998). Medicinal Plants of Indian Himalaya: Diversity Distribution Potential Values. G.B. Pant Institute of Himalayan Environment and Development: Almora, India, 161pp.

Sharma, B.M. & P. Kachroo (1983). Flora of Jammu and Plants of Neighbourhood (Vol. I-II). Bishen Singh Mahendra Pal Singh, Dehradun, India, 407pp.

Singh, B. (2015). Himalayan Orchids- Distribution and Taxonomy. Write and Print Publications, New Delhi, India, 224pp.

Singh, B. (2019a). Plants for Human Survival and Medicine. New India Publishing Agency, New Delhi, India, 592pp.

Singh, B. (2019b). Plants of Commercial Values. New India Publishing Agency, New Delhi, India, 450pp.

Singh, B., B. Singh, S.K. Borthakur & S.J. Phukan (2018). Contribution to biodiversity hotspot: assessment of forest types, floristic composition and economic wealth of Nokrek Biosphere Reserve in northeast India. Indian Forester 144: 734–741.

Singh B., S. Singh, B. Singh, S. Kitchlu & B. Babu (2019). Assessing ethnic traditional knowledge, biology and chemistry of Lepidium didymum L., lesser-known wild plants of western Himalaya. Proceedings of the National Academy of Sciences, India Section B. Biological Sciences 89(3): 1087–1094. https://doi.org/10.1007/s40011-018-1027-4

Singh B., P. Sultan, Q.P. Hassan, S. Gairola & Y.S. Bedi (2016) Ethnobotany, traditional knowledge, and diversity of wild edible plants and fungi: a case study in the Bandipora district of Kashmir Himalaya, India. Journal of Herbs Spices and Medicinal Plants 22(3): 247–278.

Singh, D.K., B.P. Uniyal & R. Mathu (1999). Jammu and Kashmir, pp. 905–974. In: Mudgal, V. & P.K. Hajar (eds.). Floristic Diversity and Conservation Strategies in India, Vol. 2. Botanical Survey of India, Ministry of Environment and Forests, Dehradun, India.

Swami, A. & B.K. Gupta (1998). Flora of Udhumpur. Bishen Singh Mahendra Pal Singh, Dehradun, India, 455pp.
Appendix 1. List of plants in Devi Pindiyan Valley of Trikuta Hills, Shivalik Himalaya.

| Botanical name | Phenology period | Habit | IUCN status | Nativity status | Voucher no. |
|----------------|------------------|-------|-------------|----------------|-------------|
| **DICOTS**     |                  |       |             |                |             |
| Ranunculaceae  |                  |       |             |                |             |
| 1. Clematis barbellata Edgew. | June–August | Climber | NA | Native to Palaearctic realm and in Himalaya | HBJU125 |
| 2. Clematis gouriana Roxb. ex DC. | September–December | Climber | NA | Native to Palaearctic realm | HBJU126 |
| 3. Delphinium denudatum Wall. ex Hook.f. & Thomson | May–September | Herb | NA | Native to Himalaya | HBJU151 |
| 4. Ranunculus distans Royle | June–August | Herb | NA | Native to Himalaya | HBJU206 |
| 5. Ranunculus muricatus L. | March–July | Herb | NA | Non-native to India, and native of Europe | HBJU276 |
| 6. Thalictrum foliolosum DC. | August–December | Herb | NA | Native to Himalaya | HBJU226 |
| Menispermaceae  |                  |       |             |                |             |
| 7. Cissampelos pareira L. | March–October | Climber | NA | Native to India | HBJU124 |
| 8. Cocculus laurifolius DC. | March–August | Climber | NA | Native to Himalaya | HBJU127 |
| Berberidaceae   |                  |       |             |                |             |
| 9. Berberis lycium Royle | April–June | Shrub | NA | Native to Palaearctic realm | HBJU112 |
| Papaveraceae    |                  |       |             |                |             |
| 10. Fumaria indica Pugsley | March–July | Herb | NA | Native to Palaearctic realm | HBJU178 |
| Violaceae       |                  |       |             |                |             |
| 11. Viola odorata L. | April–September | Herb | NA | Non-native, introduced from Europe | HBJU290 |
| 12. Viola canescens Wall. | March–July | Herb | NA | Native to Himalaya | HBJU288 |
| Malvaceae       |                  |       |             |                |             |
| 13. Bombax ceiba L. | November–March | Tree | NA | Non-native to India and introduced | HBJU115 |
| 14. Grewia asiatica L. | March–September | Tree | NA | Non-native to India | HBJU159 |
| 15. Grewia optica (Buch.-Ham. ex Roxb.) J.R.Drumm. ex Burret | April–September | Tree | NA | Native to Himalaya | HBJU184 |
| 16. Pterospermum acerifolium (L.) Wild. | December–July | Tree | NA | Native to Palaearctic realm (Southeastern Asia) | HBJU203 |
| 17. Sida rhombifolia L. | September–January | Shrub | NA | Non-native to India, and native to New World (America & Oceania) | HBJU263 |
| Linaceae        |                  |       |             |                |             |
| 18. Reinwardtia indica Dumort. | April–January | Shrub | NA | Native to Himalaya | HBJU246 |
| Geraniaceae     |                  |       |             |                |             |
| 19. Geranium nepalense Sweet | April–October | Herb | NA | Native to Himalaya | HBJU156 |
| 20. Geranium mascatense Boiss. | February–May | Herb | NA | Native to Palaearctic realm (Himalaya) | HBJU277 |
| Balsaminaceae   |                  |       |             |                |             |
| 21. Impatiens balsamina L. | July–October | Herb | NA | Non-native to India, and native to tropical America | HBJU190 |
| 22. Impatiens bicolour Royle | May–October | Herb | NA | Non-native to India | HBJU191 |
| Oxalidaceae     |                  |       |             |                |             |
| 23. Oxalis corniculata L. | February–October | Herb | NA | Non-native to India, and native of Europe | HBJU228 |
| Rutaceae        |                  |       |             |                |             |
| 24. Aegle marmelos (L.) Corrêa | October–January | Tree | NA | Non-native to India and introduced | HBJU107 |
| 25. Murraya koenigii (L.) Spreng. | March–August | Tree | NA | Native to Palaearctic realm | HBJU187 |
| 26. Zanthoxylum armatum DC. | April–October | Shrub | NA | Native to Palaearctic realm (Southeastern Asia) | HBJU239 |
| Botanical name                      | Phenology period | Habit | IUCN status | Nativity status                                      | Voucher no. |
|-----------------------------------|------------------|-------|-------------|------------------------------------------------------|-------------|
| **Meliaceae**                     |                  |       |             |                                                     |             |
| 27. Melia azedarach L.             | March–October    | Tree  | LC          | Non-native to India, and native of Bangladesh        | HBJU180     |
| 28. Toona ciliata M.Roem.          | January–August   | Tree  | LC          | Non-native to India                                   | HBJU229     |
| 29. Toona sinensis (Auss.) M.Roem. | May–January      | Tree  | NA          | Native to Palaearctic realm (Southeastern Asia)      | HBJU281     |
| **Rhamnaceae**                    |                  |       |             |                                                     |             |
| 30. Rhamnus triqueta (Wall.) Brandis | July–September  | Tree  | NA          | Native to Palaearctic realm                          | HBJU247     |
| 31. Ziziphus jujuba Mill.         | May–October      | Tree  | LC          | Native to Palaearctic realm (Southeastern Asia)      | HBJU294     |
| 32. Ziziphus oenopolia (L.) Mill. | August–December | Shrub | NA          | Native to Palaearctic realm                          | HBJU295     |
| **Sapindaceae**                   |                  |       |             |                                                     |             |
| 33. Cardioperumum halicacabum L.   | June–October     | Climber | NA          | Non-native to India and invasive                      | HBJU149     |
| 34. Dodonaea viscosa (L.) Jacq.    | January–August   | Shrub | NA          | Non-native to India                                   | HBJU160     |
| **Anacardiaceae**                 |                  |       |             |                                                     |             |
| 35. Cotinus coggygria Scop.        | February–November| Shrub | LC          | Non-native to India, and native of Southern Europe   | HBJU140     |
| 36. Lannea coromandelica (Houtt.)  | March–September  | Tree  | NA          | Native to Palaearctic realm (Southeastern Asia)      | HBJU202     |
| 37. Mongifera indica L.           | March–September  | Tree  | DD          | Native of Indo-Malaya region, planted                | HBJU212     |
| 38. Pistacia chinensis Bunge       | March–November   | Tree  | NA          | Native to Palaearctic realm (Western China)          | HBJU233     |
| **Fabaceae**                      |                  |       |             |                                                     |             |
| 39. Acacia catechu (L.f.) Willd.   | April–September  | Tree  | NA          | Native to Palaearctic realm                          | HBJU101     |
| 40. Acacia modesta Wall.           | May–October      | Tree  | NA          | Native to Himalaya                                   | HBJU102     |
| 41. Acacia nilotica (L.) Delile    | March–August     | Tree  | LC          | Non-native to India and native of Tropical America   | HBJU103     |
| 42. Bauhinia vahlii Wight & Arn.   | April–August     | Climber | NA          | Native to Palaearctic realm (Southeastern Asia)      | HBJU110     |
| 43. Bauhinia variegata L.          | February–July    | Tree  | LC          | Native to Palaearctic realm (Southeastern Asia)      | HBJU111     |
| 44. Cassia fistula L.              | April–July       | Tree  | NA          | Native to Palaearctic realm                          | HBJU119     |
| 45. Indigofera cassoides DC.       | January–June     | Shrub | NA          | Native to Palaearctic realm                          | HBJU163     |
| 46. Indigofera heterantha Wall. ex Brandis | May–October | Shrub | NA          | Native to Palaearctic realm                          | HBJU193     |
| 47. Lespedeza gerardiana Wall. Ex Maxim. | September–December | Shrub | NA          | Native to Palaearctic realm                          | HBJU175     |
| 48. Mimosa himalayana Gamble       | June–December    | Shrub | NA          | Endemic to Himalaya                                 | HBJU183     |
| 49. Pueraria tuberosa (Willd.) DC.  | March–August     | Climber | NA          | Native to Palaearctic realm (India)                  | HBJU204     |
| 50. Senna occidentalis (L.) Link   | October–March    | Shrub | NA          | Non-native to India, and native to tropical South America | HBJU217     |
| 51. Senna tora (L.) Roxb.          | November–February| Shrub | NA          | Non-native to India, and native to tropical South America | HBJU218     |
| **Rosaceae**                      |                  |       |             |                                                     |             |
| 52. Cotoneaster nummularius Fisch. & C.A.Mey. | May–October | Shrub | NA          | Native to Palaearctic realm (Southeastern Asia, Himalaya) | HBJU132     |
| 53. Prunus cerasoides Buch.-Ham. ex D.Don | October–March | Tree  | LC          | Native to Palaearctic realm (Southeastern Asia)      | HBJU199     |
| 54. Rubus ellipticus Sm.           | March–May        | Shrub | NA          | Native to Palaearctic realm (Southeastern Asia, India) | HBJU210     |
| 55. Rubus niveus Thurb.             | May–September    | Shrub | NA          | Native to Palaearctic realm                          | HBJU250     |
| 56. Rubus paniculatus Sm.          | June–October     | Shrub | NA          | Native to Palaearctic realm                          | HBJU251     |
| 57. Rubus rosifolius Sm.           | March–July       | Shrub | NA          | Native to Himalaya                                  | HBJU211     |
| 58. Spiraea bella Sims.            | May–September    | Shrub | NA          | Native to Himalaya                                  | HBJU224     |
| Botanical name | Phenology period | Habit   | IUCN status | Nativity status | Voucher no. |
|---------------|------------------|---------|-------------|----------------|-------------|
| Saxifragaceae |                  |         |             |                |             |
| 59. Bergenia pacumbis (Buch.-Ham. ex D.Don) C.Y.Wu & J.T.Pan | June–August | Herb     | NA          | Native to Palaearctic realm (Himalaya) | HBJU146     |
| Myrtaceae     |                  |         |             |                |             |
| 60. Psidium guajava L. | May–September | Tree    | NA          | Non-native, introduced from Europe       | HBJU200     |
| Lythraceae    |                  |         |             |                |             |
| 61. Woodfordia fruticosa (L.) Kurz | January–May | Shrub    | LC          | Native to Asia (Himalaya)               | HBJU292     |
| Onagraceae    |                  |         |             |                |             |
| 62. Oenothera rosea L’Hér. ex Aiton | May–December | Herb     | NA          | Native to Palaearctic realm             | HBJU225     |
| Begoniaceae   |                  |         |             |                |             |
| 63. Begonia picta Sm. | July–September | Herb    | NA          | Native to Himalaya                        | HBJU278     |
| Apiaceae      |                  |         |             |                |             |
| 64. Heracleum conicans Wall. ex DC. | May–September | Herb    | NA          | Native to Himalaya                        | HBJU244     |
| 65. Ligusticum elatum (Edgew.) C.B.Clarke | July–September | Herb    | NA          | Native to Himalaya                        | HBJU209     |
| 66. Selinum vaginatum C.B.Clarke | June–October | Herb    | NA          | Native to Himalaya                        | HBJU260     |
| Araliaceae    |                  |         |             |                |             |
| 67. Hedera helix L. | September–May | Climber  | NA          | Non-native to India, and native of Europe | HBJU185     |
| Caprifoliaceae|                  |         |             |                |             |
| 68. Valeriana jatamansi Jones | April–September | Herb    | NA          | Endemic to Himalaya                       | HBJU232     |
| Adoxaceae     |                  |         |             |                |             |
| 69. Viburnum nervosum D.Don | April–October | Shrub    | NA          | Native to Palaearctic realm (Southeastern Asia) | HBJU286     |
| Rubiaceae     |                  |         |             |                |             |
| 70. Catunaregam spinosiss (Thumb.) Tirveng. | March–June | Tree     | NA          | Native to Palaearctic realm               | HBJU120     |
| 71. Neolamarckia cadamba (Roxb.) Bosser | June–November | Tree     | NA          | Non-native to India                        | HBJU312     |
| 72. Spermadictyon suaveolens Roxb. | September–March | Shrub    | NA          | Non-native to India, Native of Tropical America | HBJU223     |
| 73. Wendlandia heynei (Schult.) Santapau & Merchant | March–August | Tree     | NA          | Native to Palaearctic realm               | HBJU236     |
| Asteraceae    |                  |         |             |                |             |
| 74. Ageratum conyzoides (L.) L. | January–December | Herb    | NA          | Non-native, invasive to India and native from tropical America | HBJU105     |
| 75. Artemisia nilagirica (C.B.Clarke) Pamp. | July–October | Herb    | NA          | Native to Palaearctic realm               | HBJU131     |
| 76. Bidens bitemota (Lour.) Merr. & Sherff | January–December | Herb    | NA          | Non-native, invasive to India and native to tropical America | HBJU113     |
| 77. Cirsium arvense (L.) Scop. | June–October | Herb    | NA          | Non-native, invasive to India             | HBJU123     |
| 78. Erigeron bonariensis L. | May–October | Herb    | NA          | Non-native, invasive to India             | HBJU144     |
| 79. Inula cuspidata (Wall. ex DC.) C.B. Clarke | June–August | Shrub    | NA          | Native to Himalaya                        | HBJU164     |
| 80. Launaea procumbens (Roxb.) Ramayya & Rajagopal | June–October | Herb    | NA          | Native to Palaearctic realm (Southeastern Asia) | HBJU172     |
| 81. Parthenium hysterophorus L | April–August | Herb    | NA          | Non-native and invasive to India, and native of Tropical America | HBJU253     |
| 82. Silybum marianum (L.) Gaertn. | February–September | Herb    | NA          | Non-native, Mediterranean and Africa      | HBJU264     |
| 83. Sonchus arvensis L. | July–September | Herb    | NA          | Non-native to India, and native of Europe | HBJU272     |
| 84. Sonchus oleraceus (L.) L. | May–December | Herb    | NA          | Non-native to Palaearctic realm           | HBJU273     |
| 85. Taraxacum campylodes G.E. Haglund | September–March | Herb    | NA          | Non-native, introduced from Mediterranean and Africa | HBJU268     |
| Oleaceae      |                  |         |             |                |             |
| 86. Jasminum grandiflorum L. | August–January | Shrub    | NA          | Native to Palaearctic realm (Southeastern Asia) | HBJU168     |
| Botanical name                              | Phenology period | Habit  | IUCN status | Nativity status                                      | Voucher no. |
|--------------------------------------------|------------------|--------|-------------|------------------------------------------------------|-------------|
| 87. Ligustrum nepalense Wall.              | April–July       | Tree   | NA          | Native to Palaearctic realm                          | HBU177      |
| 88. Olea paniculata R.Br.                  | April–November   | Tree   | NA          | Native to Palaearctic realm (Himalaya)               | HBU313      |
| Apocynaceae                                |                  |        |             |                                                     |             |
| 89. Carissa spinarum L.                    | April–June       | Shrub  | NA          | Non-native to India, probably native of South Africa | HBU118      |
| 90. Cryptolepis dubia (Burm.f.) M.R.Almeida| March–November   | Climber| NA          | Native to Palaearctic realm                          | HBU133      |
| 91. Holarrhena pubescens Wall. ex G.Don    | April–December   | Tree   | LC          | Non-native to India, and native of Africa            | HBU188      |
| Boraginaceae                               |                  |        |             |                                                     |             |
| 92. Cynoglossum wallichii G.Don            | May–August       | Herb   | NA          | Native to Palaearctic realm                          | HBU135      |
| 93. Cynoglossum zeylanicum (Vahl ex Hornem.) Thumb. ex Leh. | April–October | Herb | NA | Native to Palaearctic realm                          | HBU136      |
| 94. Ehretia acuminata R.Br.                | March–May        | Tree   | NA          | Native to Palaearctic realm                          | HBU157      |
| Convolvulaceae                             |                  |        |             |                                                     |             |
| 95. Ipomoea purpurea (L.) Roth             | June–September   | Climber| NA          | Non-native and invasive to India                      | HBU165      |
| 96. Ipomoea calophylla Fenzl               | August–November  | Climber| NA          | Non-native to India                                  | HBU279      |
| Solanaceae                                 |                  |        |             |                                                     |             |
| 97. Datura inoxia Mill.                    | May–October      | Shrub  | NA          | Non-native to India, and native to tropical America  | HBU280      |
| 98. Datura metel L.                        | March–December   | Shrub  | NA          | Non-native to India, and native to tropical America  | HBU283      |
| 99. Datura stramonium L.                   | June–November    | Shrub  | NA          | Non-native, introduced from Europe                    | HBU148      |
| 100. Physalis minima L.                    | August–October   | Herb   | LC          | Native to Palaearctic realm                          | HBU195      |
| 101. Solanum americanum Mill.              | June–January     | Herb   | NA          | Non-native to India, and native of tropical America  | HBU220      |
| 102. Solanum hazenii Britton               | January–December | Shrub  | NA          | Native to Palaearctic realm                          | HBU221      |
| 103. Solanum torvum Sw.                    | April–July       | Shrub  | NA          | Native to Palaearctic realm                          | HBU222      |
| 104. Solanum villosum Mill.                | July–November    | Herb   | NA          | Non-native to India                                  | HBU284      |
| 105. Solanum virginianum L.                | May–November     | Herb   | NA          | Non-native to India                                  | HBU271      |
| Scrophulariaceae                           |                  |        |             |                                                     |             |
| 106. Buddleja crispa Benth.                | February–August  | Shrub  | NA          | Native to Palaearctic realm                          | HBU116      |
| 107. Verbascum thapsus L.                  | June–October     | Herb   | NA          | Non-native to India, native of Europe                | HBU274      |
| Bignoniaceae                               |                  |        |             |                                                     |             |
| 108. Jacaranda mimosifolia D.Don            | May–August       | Tree   | Vu          | Non-native, introduced from America                  | HBU167      |
| 109. Kigelia africana (Lam.) Benth.         | April–October    | Tree   | LC          | Non-native, introduced from Europe                   | HBU170      |
| Acanthaceae                                |                  |        |             |                                                     |             |
| 110. Dicliptera bupleuroides Nees          | May–July         | Herb   | NA          | Native to Palaearctic realm                          | HBU139      |
| 111. Justicia adhatoda L.                  | June–September   | Shrub  | NA          | Native to Palaearctic realm (Southeastern Asia)      | HBU169      |
| 112. Lepidobathis incurve Buch.-Ham. ex D.Don | October–May   | Herb | NA          | Native to Palaearctic realm                          | HBU173      |
| Verbenaceae                                |                  |        |             |                                                     |             |
| 113. Lantana camara L.                     | January–October  | Shrub  | NA          | Non-native and invasive to India, and native of tropical America | HBU171     |
| Lamiaceae                                  |                  |        |             |                                                     |             |
| 114. Ajuga macroperma Wall. ex Benth.       | January–November | Herb | NA          | Native to Palaearctic realm (Himalaya)               | HBU106      |
| 115. Colebrookea oppositifolia Sm.          | January–March    | Shrub  | NA          | Native to Palaearctic realm (Himalaya)               | HBU128      |
| Botanical name                             | Phenology period | Habit     | IUCN status | Nativity status                                      | Voucher no. |
|-------------------------------------------|------------------|-----------|-------------|-------------------------------------------------------|-------------|
| Elsholtzia fruticosa (D.Don) Rehder       | August–October   | Shrub     | NA          | Native to Palaearctic realm (Southeastern Asia)        | HBJU158     |
| Jasdon rugosus (Wall. ex Benth.) Codd     | July–October     | Shrub     | NA          | Native to Palaearctic realm                           | HBJU166     |
| Leucas Ianota Benth.                      | August–September | Herb      | NA          | Non-native to India                                    | HBJU176     |
| Mentha longifolia (L.) L.                 | May–November     | Herb      | LC          | Non-native to India, native to Europe                 | HBJU181     |
| Mentha spicata L.                         | July–November    | Herb      | LC          | Non-native to India, native to Europe                 | HBJU285     |
| Microcera biflora (Buch.-Ham. ex D.Don)   | January–December | Herb      | NA          | Native to Himalaya                                    | HBJU182     |
| Nepeta graciliflora Benth.                | June–August      | Herb      | NA          | Native to Palaearctic realm                           | HBJU245     |
| Ocimum americanum L.                      | January–December | Shrub     | NA          | Native to India, and native of tropical America       | HBJU287     |
| Origanum vulgare L.                       | July–December    | Herb      | NA          | Non-native to India, and native of Europe             | HBJU252     |
| Scutellaria scandens D.Don                | April–August     | Herb      | NA          | Native to Palaearctic realm                           | HBJU215     |
| Thymus vulgaris L.                        | August–November  | Herb      | LC          | Non-native to India, native to southern Europe        | HBJU227     |
| Vitex altissima L.f.                      | June–November    | Shrub     | NA          | Native to Palaearctic realm                           | HBJU235     |
| **Plantaginaeae**                         |                  |           |             |                                                       |             |
| Plantago major L.                         | June–September   | Herb      | LC          | Non-native, introduced from Mediterranean and Africa   | HBJU289     |
| Plantago lanceolata L.                    | May–August       | Herb      | Vu          | Native to Palaearctic realm                           | HBJU198     |
| **Nyctaginaceae**                         |                  |           |             |                                                       |             |
| Mirabilis jalapa L.                       | June–November    | Shrub     | NA          | Non-native to India, and introduced                   | HBJU242     |
| **Amaranthaceae**                         |                  |           |             |                                                       |             |
| Achyrantes bidentata Blume                | July–October     | Herb      | NA          | Non-native to India, and native to tropical Africa    | HBJU109     |
| Chenopodium album L.                      | May–November     | Herb      | NA          | Non-native, Introduced species from Mediterranean and Africa | HBJU122   |
| **Polygonaceae**                          |                  |           |             |                                                       |             |
| Rumex hastatus D.Don                      | April–June       | Herb      | NA          | Native to Himalaya                                    | HBJU261     |
| **Lauraceae**                             |                  |           |             |                                                       |             |
| Neolitsea umbrosa (Nees) Gamble           | March–May        | Tree      | NA          | Endemic to Himalaya                                   | HBJU267     |
| **Proteaceae**                            |                  |           |             |                                                       |             |
| Grevillea robusta A.Cunn. ex R.Br.        | March–August     | Tree      | NA          | Non-native to India, and native of South Wales        | HBJU241     |
| **Euphorbiaceae**                         |                  |           |             |                                                       |             |
| Euphorbia helioscopia L.                  | January–July     | Herb      | NA          | Non-native to India                                   | HBJU161     |
| Euphorbia hirta L.                        | June–December    | Herb      | NA          | Non-native to India, and native to tropical America   | HBJU162     |
| Euphorbia neriifolia L.                   | June–September   | Shrub     | NA          | Non-native to India                                   | HBJU179     |
| Euphorbia prostrata Aiton                 | April–October    | Herb      | NA          | Non-native to India                                   | HBJU192     |
| Euphorbia royleana Boiss.                 | May–July         | Shrub     | NA          | Native to Himalaya                                    | HBJU194     |
| Mallotus philippensis (Lam.) Müll. Arg.   | March–August     | Tree      | NA          | Native to Palaearctic realm                           | HBJU258     |
| Ricinus communis L.                       | June–December    | Shrub     | NA          | Non-native to India                                   | HBJU248     |
| Sapium sebiferum (L.) Roxb.               | May–October      | Tree      | NA          | Native to Himalaya                                    | HBJU256     |
| **Phyllanthaceae**                        |                  |           |             |                                                       |             |
| Glossacion heyneanum (Wight & Arn.) Wight | June–November    | Tree      | NA          | Native to Palaearctic realm                           | HBJU240     |
| Leptopus cordifolius Deene                | May–August       | Shrub     | NA          | Non-native to India                                   | HBJU254     |
| Botanical name                      | Phenology period       | Habit  | IUCN status | Nativity status                                           | Voucher no. |
|------------------------------------|------------------------|--------|-------------|----------------------------------------------------------|-------------|
| **Urticaceae**                     |                        |        |             |                                                          |             |
| 146. *Boehmeria macrophylla* Hornem. | June–January          | Shrub  | NA          | Native to Palaearctic realm                              | HBJU114     |
| 147. *Debregeasia longifolia* (Burm.f.) Wedd. | August–February       | Shrub  | NA          | Native to Himalaya                                       | HBJU137     |
| 148. *Debregeasia saeneb* (Forssk.) Hepper & J.R.I.Wood | March–July           | Shrub  | NA          | Non-native to India, and native of South America         | HBJU150     |
| 149. *Urtica dioica* L.            | June–September        | Herb   | LC          | Non-native to India                                      | HBJU231     |
| **Cannabaceae**                    |                        |        |             |                                                          |             |
| 150. *Trema politoria* (Planch.) Blume | May–October          | Tree   | NA          | Native to Palaearctic realm                              | HBJU282     |
| **Moraceae**                       |                        |        |             |                                                          |             |
| 151. *Ficus arnottiana* (Miq.) Miq. | March–November        | Tree   | NA          | Native to Palaearctic realm                              | HBJU196     |
| 152. *Ficus auriculata* Lour.       | March–August          | Tree   | NA          | Native to Palaearctic realm                              | HBJU197     |
| 153. *Ficus benghalensis* L.        | April–October         | Tree   | NA          | Native to Palaearctic realm (India)                      | HBJU201     |
| 154. *Ficus higida* L.f.            | June–October          | Tree   | NA          | Native to Palaearctic realm (Southeastern Asia)          | HBJU207     |
| 155. *Ficus palmata* Forssk.        | June–November         | Tree   | NA          | Native to Himalaya                                       | HBJU208     |
| 156. *Ficus pumila* L.              | May–November          | Tree   | NA          | Native to Palaearctic realm                              | HBJU213     |
| 157. *Ficus racemosa* L.            | June–November         | Tree   | NA          | Native to Palaearctic realm                              | HBJU214     |
| 158. *Ficus religiosa* L.           | May–August            | Tree   | NA          | Native to Palaearctic realm                              | HBJU216     |
| 159. *Ficus sermentosa* Buch.-Ham. ex Sm. | May–September     | Shrub  | NA          | Native to Palaearctic realm (China)                      | HBJU174     |
| 160. *Ficus semicordata* Buch.-Ham. ex Sm. | May–November     | Tree   | NA          | Native to Palaearctic realm (Himalaya)                   | HBJU234     |
| 161. *Morus alba* L.                | April–August          | Tree   | NA          | Non-native to India                                      | HBJU219     |
| 162. *Morus macroura* Miq.          | March–May             | Tree   | NA          | Native to Palaearctic realm (Himalaya)                   | HBJU266     |
| **Ulmaceae**                       |                        |        |             |                                                          |             |
| 163. *Holoptelea integrifolia* (Roxb.) Planch. | May–October          | Tree   | NA          | Native to Palaearctic realm                              | HBJU189     |
| **Juglandaceae**                   |                        |        |             |                                                          |             |
| 164. *Engelhardtia spicata* Lechen ex Blume var. integra* (Kurz) Manning ex Steenis | January–December   | Tree   | LC          | Endemic to Himalaya                                      | HBJU143     |
| **Fagaceae**                       |                        |        |             |                                                          |             |
| 165. *Quercus oblongata* D.Don      | March–October         | Tree   | NA          | Native to Himalaya                                       | HBJU243     |
| **Salicaceae**                     |                        |        |             |                                                          |             |
| 166. *Flacourtia indica* (Burm.f.) Merr. | January–July         | Tree   | NA          | Native to Palaearctic realm                              | HBJU237     |
| **GYMNOSPERMS**                    |                        |        |             |                                                          |             |
| **Pinaceae**                       |                        |        |             |                                                          |             |
| 167. *Pinus roxburghii* Sarg.       | October–November      | Tree   | LC          | Native to Himalaya                                       | HBJU270     |
| **MONOCOTS**                       |                        |        |             |                                                          |             |
| **Cannaceae**                      |                        |        |             |                                                          |             |
| 168. *Canna indica* L.             | September–October     | Herb   | NA          | Non-native to India                                      | HBJU147     |
| 169. *Hedychium spicatum* Sm.       | June–November         | Herb   | NA          | Native to Palaearctic realm (China)                      | HBJU186     |
| **Dioscoreaceae**                  |                        |        |             |                                                          |             |
| 170. *Dioscorea bilobae* (Phil.) Caddick & Wilkin | August–November     | Climber | NA          | Native to Palaearctic realm (Southeast India)            | HBJU154     |
| 171. *Dioscorea bulbifera* L.       | July–November         | Climber | NA          | Native to Himalaya                                       | HBJU141     |
| **Smilaceae**                      |                        |        |             |                                                          |             |
| 172. *Smilax aspera* L.             | June–November         | Climber | NA          | Native to Palaearctic realm                              | HBJU262     |
| Botanical name | Phenology period | Habit | IUCN status | Nativity status | Voucher no. |
|---------------|-----------------|-------|-------------|----------------|-------------|
| **Asparagaceae** | | | | | |
| 173. Agave americana L. | April–October | Shrub | NA | Non-native, introduced from Mexico | HBJU104 |
| 174. Asparagus adscendens Roxb. | October–December | Climber | NA | Native to Palaearctic realm | HBJU142 |
| 175. Asparagus racemosus Willd. | October–January | Climber | NA | Native to Palaearctic realm (Himalaya) | HBJU108 |
| **Colchicaceae** | | | | | |
| 176. Colchicum luteum Baker | February–May | Herb | NA | Endemic to Himalaya | HBJU152 |
| **Commelinaceae** | | | | | |
| 177. Commelina benghalensis L. | May–October | Herb | LC | Native to Palaearctic realm (Southeastern Asia) | HBJU130 |
| 178. Floscopa scandens Lour. | March–May | Herb | LC | Native to Palaearctic realm | HBJU155 |
| **Arecaceae** | | | | | |
| 179. Phoenix dactylifera L. | June–September | Tree | NA | Non-native to India, native of northern Africa | HBJU230 |
| **Araceae** | | | | | |
| 180. Colocasia esculenta (L.) Schott | February–September | Herb | LC | Native to Palaearctic realm | HBJU138 |
| 181. Sagittaria graminea Michx. | June–November | Herb | LC | Native to Palaearctic realm | HBJU255 |
| **Alismataceae** | | | | | |
| 182. Sagittaria graminea Michx. | June–November | Herb | LC | Native to Palaearctic realm | HBJU255 |
| **Cyperaceae** | | | | | |
| 183. Cyperus setigerus (L.) Kuntze | April–December | Herb | LC | Non-native to India, native of southeastern Australia | HBJU310 |
| 184. Fimbristylis quinquangularis (Vahl) Kunth | August–October | Herb | LC | Non-native to India | HBJU312 |
| 185. Fimbristylis schoenoides (Retz.) Vahl | January–December | Herb | LC | Non-native to India, native of Australia | HBJU311 |
| 186. Cyperus sanguinolentus Vahl [=Pycreus sanguinolentus (Vahl) Nees] | July–December | Herb | NA | Non-native to India, and native to tropical Africa | HBJU205 |
| **Poaceae** | | | | | |
| 187. Arundinella pumila (Hochst. ex A.Rich.) Steud. | May–July | Herb | NA | Non-native to India, and native to western Africa | HBJU300 |
| 188. Brachiaria ramosa (L.) Stapf | May–October | Herb | LC | Non-native to India | HBJU305 |
| 189. Capillipedium assimile (Steud.) A.Camus | August–December | Herb | NA | Non-native to India | HBJU307 |
| 190. Chrysopogon fulus (Spreng.) Chiov. | June–October | Herb | NA | Non-native to India, and native to central Africa | HBJU303 |
| 191. Cydonia japonica (L.) Pers. | January–December | Herb | NA | Non-native to India, and invasive to South Africa | HBJU134 |
| 192. Dactylis glomerata (L.) Willd. | May–October | Herb | NA | Non-native to India, and native to South Africa | HBJU309 |
| 193. Dendrocalamus strictus (Roxb.) Nees | November–June | Tree | NA | Native to Palaearctic realm (Southeastern Asia) | HBJU153 |
| 194. Eragrostis curvula (Desf.) Trin. ex Steud. | May–September | Herb | NA | Native to Palaearctic realm | HBJU298 |
| 195. Imperata cylindrica (L.) Raeusch. | April–August | Herb | NA | Non-native to India, and native to tropical America | HBJU306 |
| 196. Isachne himalaica Hook.f. | June–December | Herb | NA | Endemic to Himalaya | HBJU301 |
| 197. Oplismenus burmannii (Retz.) P.Beauv. | July–October | Herb | NA | Native to Palaearctic realm | HBJU249 |
| 198. Oplismenus composites (L.) P.Beauv. | September–November | Herb | NA | Non-native to India, and native of North America | HBJU304 |
| 199. Paspalum scrobiculatum L. | May–December | Herb | LC | Non-native to India | HBJU302 |
| 200. Paspalum vaginatum Sw. | June–September | Herb | LC | Non-native to India, and native of western Australia | HBJU296 |
| 201. Paspalum setaceum (L.) P.Beauv. | July–September | Herb | LC | Non-native to India | HBJU297 |
| 202. Pogonatherum crinitum (Thunb.) Kunth | May–September | Herb | NA | Non-native to India | HBJU308 |
| Botanical name                  | Phenology period | Habit | IUCN status | Nativity status                          | Voucher no. |
|-------------------------------|------------------|-------|-------------|-----------------------------------------|-------------|
| 203. Saccharum spontaneum L.   | July–September   | Herb  | LC          | Native to Palaearctic realm (India)     | HBJU291     |
| 204. Thysanolaena latifolia (Roxb. ex Hornem.) Honda | March–June | Herb  | NA          | Non-native to India and American origin | HBJU269     |
| 205. Brachiaria setigera (Retz.) C.E.Hubb. (=Urochloa setigera(Retz.) Stapf) | July–September | Herb  | NA          | Non-native to India                      | HBJU299     |

**PTERIDOPHYTES**

| Selaginellaceae |
|----------------|
| 206. Selaginella sp. | November–January | Herb  | NA          | - | HBJU259 |

| Adiantaceae |
|-------------|
| 207. Adiantum lunulatum Burm.f. | January–April | Herb  | NA | Native to Palaearctic realm (India) | HBJU117 |
| 208. Adiantum recurvatum (D.Don) Fraser-Jenk. | December–April | Herb  | NA | Native to Himalaya | HBJU121 |

| Pteridaceae |
|-------------|
| 209. Cheilanthes argentea (S.G.Gmel.) Kunze | August–October | Herb  | NA | Native to Palaearctic realm | HBJU129 |
| 210. Pteris linearis Poir. | March–June | Herb  | NA | Non-native to India, and native of Europe | HBJU238 |
| 211. Pteris vittata L. | January–April | Herb  | LC | Native to Palaearctic realm (China) | HBJU275 |

| Blechnaceae |
|-------------|
| 212. Woodwardia radicans (L.) Sm. | July–September | Herb  | NA | Non-native to India and native of Europe | HBJU293 |

| Aspleniaceae |
|--------------|
| 213. Asplenium dalhousiae Hook. | August–November | Herb  | NA | Native to Palaearctic realm | HBJU145 |

Note: NA—IUCN status not assessed | LC—Least Concern | Vu—Vulnerable | DD—Data Deficient | Native status worked out from Reddy et al. (2008).
