

FLORISTIC STUDIES IN NORTH-WESTERN INDIA—PRESENT
STATUS AND FUTURE STRATEGY

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North-western India comprising of the States of Jammu & Kashmir, Punjab, H. P., Haryana, Western U.P. including its 8 hill districts and Union territory of Delhi with altitude ranging from a few hundred metres to more than 7000 m (the limit of any vegetation), presents a varied topography, climate, soil and vegetation. This region is extremely rich and varied in its flora. The numerous valleys and mountains up to the snow line have always been a challenge to the mountaineers and happy hunting grounds of botanists and naturalists from many parts of the world, for the last 150 years.

The geology of the Himalayas has been discussed in detail by Wadia. The forest types of region under review have been studied from time to time separately for different areas. Seth and Champion (1968) has summed up 7 main different vegetation types viz., the tropical thorn, the tropical dry deciduous, the tropical moist deciduous (sal), the sub-tropical pine, the moist temperate, the dry temperate and the alpine type of forests. The observations of members of some of the mountaineering expeditions have also added materially to our knowledge of the vegetation. In the extremely arid region i.e. Ladakh, which lies to the North of the Great Himalayan range, cold and dry conditions

prevail. The terrain neither permits the development of any forest nor it shows the usual zonation of vegetation. There are practically no trees. The prevailing character of the vegetation is the conspicuous cushion-habit of the shrubby plants which are adapted to withstand the cold dry winds. Kashyap (1925) has observed *Caragana versicolor* (= *C. pygmaea*) as the prominent plant of this group. *Acantholimon lycopodioides* and *Thylacospermum caespitosum* are the other shrubs, which form hemispherical mounds. In the Indus valley, *Capparis spinosa* is a typical member along with species of *Artemesia*, *Echinops* and several members of *Chenopodiaceae*, *Boraginaceae* and *Cruciferae*. Watt (1881) published account on the vegetation of Chamba state and Lahul. Sher Singh (1929) has discussed the effect of climate on the Conifer forests of Kashmir valley. Osmaston (1922) has detailed the forest communities of Garhwal Himalaya and Gorrie (1929) the forests of upper Bushahr Division. Fawcett (1930) has studied the forests of Kulu forest division while Mohan (1956) has described *Pinus roxburghii* forests of Kangra and Hoshiarpur forest divisions. Mohan *et al.* (1955-57) have described the Himalayan Conifer forests of Bushahr Himalaya and Puri (1952) correlated the conifers of the Kulu Himalaya with its geology. Joshi

(1952) studied the aquatic vegetation of Lahul, and Raizada and Sahni (1955) described the vegetation of Kumaon in reference to Panch chuli area. Rau (1975) has discussed in detail the West Himalayan vegetation and its phyto-geography.

Floristic studies (a) Past History : Burkill (1965) has discussed in considerable detail the past history of floristic studies in India and the index in his work is a virtual Roll call of Honour of pioneer plant explorers. The earliest attempt to probe into the wealth of plants of these valleys goes back to the last decade of 18th century when Thomas Hardwicke in 1796 on a political mission to Srinagar-Garhwal collected plants in Alaknanda valley. Buchanan in 1813 collected plants along Jamuna to Agra and Govan in 1817 in Sabathu and Gerard brothers in 1818 from Shipke via Spiti. With the establishment of a Botanic Garden in Saharanpur with Govan as in-charge in 1820, the plant collection work in the area accelerated. N. Wallich in 1829 collected plants from Hardwar, Saharanpur and Dehra Dun and the countess of Dalhousie collected more than 600 species from Simla in the same year. Almost at the same period Maxwell made collections from Kunawar. Victor Jacquemont of National Museum, France collected plants from Kashmir state and his collections were studied and published by J. Cambassade and J. Decaisne. Moorcroft collected plants in the Ladakh region, Niti valley and Mansarovar (source of Sutlej) and Griffith in 1830 along Dehra Dun and Saharanpur. Baron Von Huegal and Godray Thomas Vigne in 1835 and Vigne again in 1836-38 collected plants from Deosai plains and Astore valley of Kashmir. Royle collected in Kashmir between 1835-39 and his rich collections were published in 1839-40. Falconer in 1837 collected plants from Kishan Ganga valley and upper Indus valley near Skardo

and Winterbottom in 1846 from Astore and Skardo to Gilgit. Schlagintweit in 1855-57, J. L. Stewart in 1868 and Henderson and Hume in 1873, also made collections from Kashmir. Edward Madden collected from Shattul, Burum Pindras passes and Pindari glacier in 1846, T. Thomson from Nubra and Shyok valleys and in Zaskar and Karakoram areas. Edgeworth in 1847 collected in Mandi and Kangra and Parish in Kulu and Kangra. Aitchison (1868) was the first to give an account of the flora of Lahul valley. The other collectors during the period were G. W. Trail, Inglis, Vicary, Mrs. Walker, Hoffmeister, R. S. Simson, J. W. Grant who collected around Simla and their collections are distributed in the Herbaria of Liverpool, Edinburgh, Vienna and Calcutta. Brandis, Gamble and Watt also collected from Simla in the later half of the 19th century.

The Sector between the Sutlej and Kali valleys bordering Nepal which includes the river systems of Tons, Yamuna, Bhagirathi, Alaknanda and Kali and includes the major peaks viz., Kamet, Nanda Devi, Nilkanth, Trisul, Panch chuli etc. and the famed shrines of Gangotri, Jumnotri, Kedarnath, Badrinath and Hemkund has received considerable attention of plant hunters. Strachey and Winterbottom have made considerable collections in this area in 1846-49 and published the same in 1882 (Revised by Duthie in 1906).

Collett, who was an ardent collector, made collections and prepared material for the Flora of Simla, which was published after his death as "*Flora Simlensis*" in 1902. Sir George King published a list of plants of Garhwal, Jaunsar-Bawar and Dehra Dun in 1883 and Watson a similar list for Kumaon in 1874. Duthie (1892-93) made collections in Kashmir and published the same in 1894. Coventry published in 3 series illustrated work of about 150 species between 1923-30.

Blatter in 2 volumes published *Beautiful Flowers of Kashmiri* in 1827-29 and Duthie "The Flora of Upper Gangetic Plain" in 1903-1922. With the closure of the Botanic Garden, Saharanpur in 1908, the plant exploration activities were slowed down.

The second spurt in the exploration programme in the area began with the forest officers like Parker, Bamber etc., taking particular interest and appreciably enlarging the collections and publishing forest floras. Bamber published "*Plants of the Punjab*" in 1916, Parker (1918) published *Forest Flora of Punjab*, Osmaston (1927) *Forest Flora of Kumaon* covering more than 800 species. Kanjilal U. N. (1911) published *Forest Flora of Siwaliks*, P. C. Kanjilal (1933) *Forest Flora of Pilibhit, Oudh, Gorakhpur and Bundelkhand* and Joshi *et al* (1936) published *Flora of Lahore district*.

The efforts of Dr. N. L. Bor, Dr. R. R. Stewart and Prof. M. B. Raizada need special mention. Bor published the grasses of Upper Gangetic Plain. Stewart carried out extensive explorations in Kashmir valley and Ladakh, and published his results in 1917, 1945, 1961, 1967 and 1972. Raizada has been active for more than 50 years and published numerous papers on plants and vegetation of the area and in 1976 "*Supplement to Duthie's Flora of Upper Gangetic Plain*" It may be of interest to record that the highest altitude known for a flowering plant in western Himalaya is 6300 m on Mt. Kamet, where a specimen of *Christolea himalayensis* was gathered by Gurdial Singh.

On the basis of material available in foreign herbaria, collected in the past by above stated workers and a host of other collectors, a number of monographs on different genera have been published. Of these recent generic monographs viz. *Epilobium* (Raven, 1962), *Saxifraga* (Smith, 1958-60), *Bergenia* (Yeo, 1966) are worth mentioning.

The establishment of Regional Research Laboratory at Jammu, and survey conducted in west Himalaya especially Jammu and Kashmir and Himachal Pradesh by its various workers, has helped in bringing vast collections and enhancing our knowledge on plants of these states. The contributions of Kapoor *et al* (1951) on economic plants of Jammu and Kashmir, Kapoor (1968) on flora of Doda district, and Sarin (1967) are interesting and worthy of record.

Alongwith the collections of flowering plants, the plant material of other groups of lower plants were also collected. In this respect, contributions of Brotherus (1898, 1928), Dixon (1910, 1926, 1929), Dixon and Badhwar (1938) on mosses, Kashyap (1932) on Liverworts of West Himalaya and the Punjab plains, Clarke (1879), Stewart (1942 & 1945), and Mehra (1939) on ferns of the region are worth mentioning.

Floristic studies : (b) Present status : The organised effort at a planned exploration programme, however, was started with the implementation of the scheme for re-organisation of the Botanical Survey of India towards the close of the year 1954. The survey assumed greater responsibility in making available to a much wide circle of botanists and students and other researchers, material information on flora and vegetation of our country based on upto date and authentic data through intensive explorations of the hitherto unexplored and underexplored areas.

The Northern Circle of the Botanical Survey of India was started on 1st August, 1956 and unlike other Circles, this Circle had not inherited any old collections. The explorations were conducted in a planned, phased programme in remote valleys from which no data or little information on plants were available and this has resulted in collections of nearly 62000 specimens containing 4500

species which now form the herbarium of Northern Circle, BSI (BSD).

Among the recent collections, contributions of M. A. Rau (1956-74), T. A. Rao (1956-60), N. C. Nair (1960-65) and U. C. Bhattacharyya (1960-73) stand prominent. M. A. Rau collected in Garhwal Himalaya in 1957-73 and published his finding in (1961-1963 and 1964), surveyed Lahul, Kulu, Kangra Sirmour of Himachal Pradesh between 1957-60 and published plants of Lahul in 1960. In addition, he collected in Banda, Bahraich, Gonda, Mirzapur, Pithoragarh, Kashmir valley and Hissar. Because of his vast experience and knowledge of the plants and vegetation of the western Himalaya, he published two valuable books "Illustrations of West Himalayan Flowering Plants" in 1963 and "High altitude Flowering Plants of West Himalaya" in 1975. T. A. Rao collected in Kashmir valley in 1956-57 and published his results in 1959-61. He also collected in Milam and Pindari Glaciers and in eastern Kumaon region and published the same in 1959, 1960 and 1964. N. C. Nair collected mostly in Himachal Pradesh specially in Bushahr Himalaya between 1962-1965, Chamba 1964 and published the *Flora of Bushahr Himalaya* (1977). He also collected in Punjab and Haryana plains and published numerous papers and the *Flora of the Punjab plains* (1978). Bhattacharyya collected in Garhwal between 1962-69, Pithoragarh and Almora in 1961-63, Mirzapur in 1960-61, Lahul-Spiti in 1961-72, and Ladakh in 1970-73. The other collectors for this herbarium are K. P. Janardhanan (1970-74) who mostly collected in Kinnaur District, C. L. Malhotra (1960-73) made collections from Hamirpur and Pilibhit, Singh (1960-65) from Bulandshahr, P. C. Pant (1960-70) from Kumaon, V. J. Nair (1961-68) from Punjab plains and Hissar Distt. of Haryana and O. P. Misra collected in Hoshiarpur between 1970-73,

Amongst the present workers, C. M. Arora (1965-onwards) has been exploring Pithoragarh for orchids and other plants and B. D. Naithani (1960 onwards) has been collecting in Garhwal-Chamoli Distt., B. M. Wadhwa (1974 onwards) has collected plants from Almora, Chamba, Ladakh and valley of flowers (Garhwal) while J. N. Vohra (1974 onwards) has collected from Sirmour, Almora and Hoshiarpur, M. V. Viswanathan (1974 onwards) from Tehri and Ladakh and A. S. Rao has collected from Pauri-Garhwal and Dachigam Sanctuary in Kashmir.

These explorations have resulted in 12 new species including 2 varieties, viz. *Alectra parasitica* A. Rich var. *chitrakutensis* M. A. Rau, *Veronica biloba* var. *minima* N. C. Nair (Scrophulariaceae), *Tetrastigma indicum* M. Maulik (Vitaceae), *Argyrolobium album* U. C. Bhattacharyya (Papilionaceae), *Peucedanum dehradunensis* C. R. Babu (Apiaceae), *Gentiana spitiensis* N. C. Nair (Gentianaceae), *Neesiella intermedia* C. R. Sreemadhavan (Acanthaceae); *Sesamum mulayanum* N. C. Nair (Pedaliaceae), *Euphorbia sharmae* U. C. Bhattacharyya (Euphorbiaceae), *Listera mucronata* Panigrahi et J. J. Wood, *Bulbophyllum raui* C. M. Arora (Orchidaceae) and *Saxifraga poluniniana* H. Sm. var. *mucronata* Bhattacharyya et Vishwanathan.

In addition \pm 100 new records and many interesting and rare plants have been discovered. In these, some species of Orchidaceae mostly from the Gori river valley of Kumaon and N. Garhwal viz., *Didicaea cunninghamii* King and Prantling, *Cypripedium elegans* Reichb. f., *Listera longicaulis* King and Prantling, *Bulbophyllum triste* Reichb. f., *B. densiflorum* Rolfe, *Cirrhopetalum cornutum* Lindl., *Oberonia myriantha* Lindl., *Pleione grandiflorum* Rolfe, *Corallorhiza trifida* Chatel, and *Epipogium tuberosum* Duthie, stand prominent. *Circaeaster agrestis* Maxim, an extremely interesting botanical curiosity

was collected from new localities. *Rhododendron nivale* Hook. f. and *Hydrobryum griffithii* (Wall.) Tulasne and *Falconeria himalaica* are the other few recent rare additions to the herbarium.

The workers of Kashmir University, under the guidance of Prof. P. Kachroo, are also actively engaged in plant exploration of some areas. In addition to bringing out accounts of a few families and genera, Kachroo *et al.*, has published the Forest Flora of Srinagar in 1976.

In addition, the moss material from West Himalaya, i.e. Tehri to Chakrata and Kashmir valley was collected by Wadhwa and Vohra between 1960-63, and published by later in 1969. Together they published a few new records between (1963-1966) and also mosses collected during Nilkanth and Chaukhamba expedition of 1959. Mehra *et al.* (1965) and Bir (1963) have added to our knowledge on ferns of Dalhousie and Simla.

In spite of the fact that the vegetation types and their floristic composition in the Himalaya are fairly known, there are numerous gaps in our knowledge of the flora of this extremely rich region and many remote valleys have yet to be explored. There is considerable need for intensive study for better understanding of the ecological, phyto-geographical and evolutionary processes. The very many wild plants with fine foliage and beautiful flowers of potential interest to garden lovers and Horticulturists, await introduction in our garden. Then, there are the several drug yielding plants, some of them on the average of extinction that need special attention.

On the basis of the analysis of our holdings in the BSD Herbarium, the district floras of Chamoli (with ± 1300 species), Pithoragarh (with more or less 1400 species) and Hoshiarpur (with nearly 650 species) are being pre-

pared. To project the plant wealth of Himachal Pradesh, a very rich area, the State flora analysis (with ± 2000 species) has also been taken up, on the basis of holdings in BSD, DD and CAL Herbaria.

Currently plant explorations are being undertaken in Garhwal, Ladakh, Dachigam Sanctuary, some hitherto unvisited areas of Himachal Pradesh, and Hoshiarpur district of Punjab. Plans have been drawn up for intensive explorations in Kashmir and Ladakh, Tehri-Garhwal and Almora districts (U.P.) which are likely to be taken for writing up the State Flora Analysis and District Floras in future, so that the plant resources of these areas could be utilised to the advantage of the people and the country. Such botanical studies of limited areas, in great detail, would not only furnish all the floristic data, but also train up a cadre of young botanists who can contribute confidently to the preparation of the Flora of India.

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