

CONCEPT AND DEVELOPMENT OF HERBARIUM WITH SPECIAL REFERENCE TO INDIA

S. K. MURTI AND D. K. SINGH

Botanical Survey of India, Dehra Dun

ABSTRACT

The present paper briefly outlines an account of the concept and development of herbarium with emphasis on the Indian situation. Well established herbaria, being repositories of dry plant specimens, gathered from far and wide are centres for assimilation and dissemination of basic knowledge about plants, and greatly aid in taxonomic researches of both fundamental and applied nature.

While discussing an account of development of some of these major herbaria, the authors briefly outline the history, development and salient statistics of a few major Indian Herbaria such as Central National Herbarium at Howrah (CAL), Forest Research Institute Herbarium at Dehra Dun (DD), the Blatter Herbarium at Bombay (BLAT) and other regional herbaria of Botanical Survey of India.

INTRODUCTION

Since the dawn of civilization man has been dependent on the plants for all his basic needs like food, clothing and shelter. The thought of sharing his knowledge and experience about the utility of plants with his fellow beings must have struck to his mind, which might have prompted him to preserve these plants for future references. Perhaps this must have been the beginning of the development of the herbarium practices.

Herbarium is simply a dried and pressed collection of plants arranged in an accepted sequence of classification (Lawrence, 1951; Shetler, 1969). It can be a very useful teaching-aid or an absorbing hobby (Cronquist, 1966). Herbarium also refers to an institution, e.g. Central National Herbarium. The word "Herbarium" was originally applied, not to a collection of plants but to a book dealing with medicinal herbs. Tournefort (1656-1708) used the term as an equivalent to "*Hortus Siccus*" which was later on adopted by Linnaeus (Stern, 1957).

The present concept and development of Herbarium is due to efforts of Botanists for more than four centuries. The concept of herbarium has been changing continuously, which in turn, has shaped the gradual development of herbarium and herbarium practices.

The concept of preserving plant specimens in dried form, as is practiced in modern herbaria, is *ca* 450 years old. Although, one cannot say with certainty as to who discovered this method of preserving plants, the oldest preserved herbarium specimen is kept in Rome, collected by a naturalist Gharardo Cibo, a pupil of Luca Ghini in the year 1532. Subsequently, Luca Ghini recommended this method of plant preservation and this paved the way for the establishment of the first Herbarium of the world in 1545 in the University of Padova, Italy. However, the Naturkudemuseum Kassel, Germany (KASSEL), established in the year 1569, is the oldest recognised herbarium in the world. Numerous herbaria have since been established throughout the world.

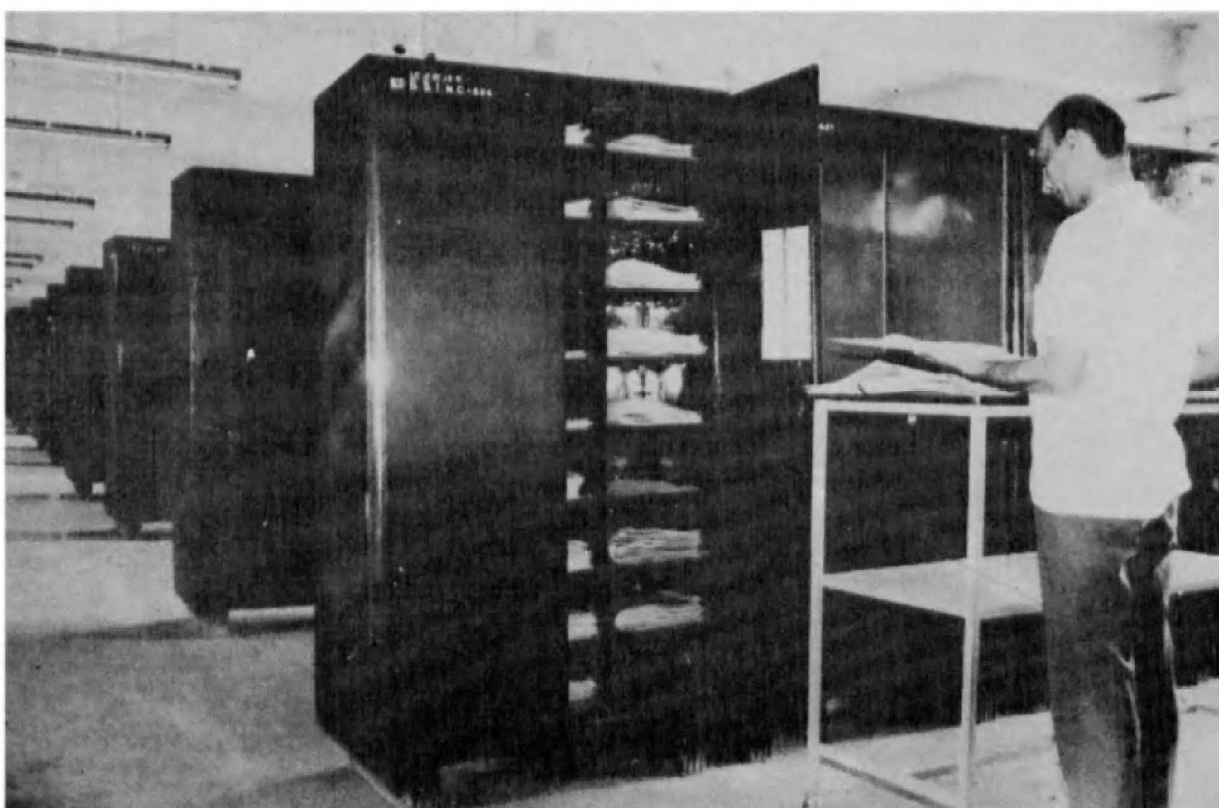


Fig. 1 A general inside view of BSD Herbarium at Dehra Dun.



Fig. 2. Mycological section of BSD Herbarium at Dehra Dun.

CONCEPT OF PLANT COLLECTION AND DRY PRESERVATION

The beginning of the herbarium as dried collection, affixed to a paper, is attributed to Luca Ghini (1490–1556), who perhaps made the first herbarium specimen. He made many plant collecting journeys in Italy. He, subsequently, followed this method of plant preservation and this led to the establishment of the first herbarium in 1545 in Italy alongwith the establishment of the first botanic garden in the same year. John Falconer, an Englishman also learnt either directly or indirectly from Ghini the technique of making the herbarium specimen (Arber, 1938).

The Greeks were conspicuous in the use of plants for healing. Dioscorides's "*Materia Medica*" gives an account of the medicinal uses of about 100 plants. He followed Theophrastus in this regard. As the Renaissance developed in Italy, they went about teaching botany, and developed the first ever botanical gardens. They also developed "Books" of mounted dried plants, which they called "*Horti Sicci*" or "Dry Gardens" the forerunners of the present day herbarium.

In the initial days the specimens were mounted on sheets of paper which were bound in the form of a book. Although this practice was fairly common during the time of Linnaeus, occasionally there were deviations also from the convention of the day in mounting on single sheet and arranging them according to groups, as is the practice today. In spite of the efforts of Linnaeus and his immediate successors, the binding of the herbarium sheets into volumes continued up to as late as 1830 when Asa Gray sold her many bound volumes of grass and sedge herbarium specimens (Dewolf, 1968).

By the year 1970, several herbaria are known to have existed in several parts of the world e.g. Hugo de Vries-Laboratorium, Amsterdam, Netherlands (1700); Rijksherbarium, Laiden University, Netherland (1829); Botanical Museum, Lund, Sweden (1770), Swedish

Museum of Natural History, Stockholm, Sweden (1739); University of Uppsala, Sweden (1785); University of Cambridge, England (1761); British Museum (Natural History) (1753); Linnean Society of London (1730); Museum National d'Histoire Naturelle, Paris (1635) etc.

The simple, yet almost revolutionary technique of preserving plants by drying them under moderate pressure between sheets of paper and then mounting them on stiff paper or cards marked the beginning of the modern herbarium (Mortan, 1981). Gradually the techniques, in pressing and mounting of the specimens improved with experience. Further, the use of realistic illustrations of plants drawn from living specimens contributed significantly in the progress of botanical studies. The present procedure of pressing and drying specimens for storage has been amazingly successful, and has stood the test of time. Plants so preserved provide a concrete basis for past, present and future.

Botanists of those days had even realized the need for depositing their collections in other established herbaria, to offset any threat of destruction in the event of war or through accident. Thus some of the very old collections are seen even today in the European herbaria, although detailed history of the collectors are not accurately maintained.

The present concept of herbarium collections along with detailed field data is also due to experiences of botanists for over four centuries. Early botanists recorded only scanty data or no data at all alongwith the collections. Many times it was difficult to trace the original collections. Similarly the present size of the herbarium sheets ($29 \times 41 \text{ cm} \pm 1 \text{ cm}$) is also due to efforts and experience of several scientists. In early days the size of sheets varied with the size of plants. The standard size of the sheets in all herbaria helps in exchange and incorporation in standard pigeon holes of herbarium cupboards.

The modern herbarium is a great filing system for information about plants, both primary in the form of actual specimens and secondary in



Fig. 3. *Kobresia trinervis* (Nees) Boeck. var. *foliolosa* (C. B. Clarke) Kukenth. collected by J. F. Duthie on 29th June 1883 and housed in DD Herbarium at Dehra Dun.

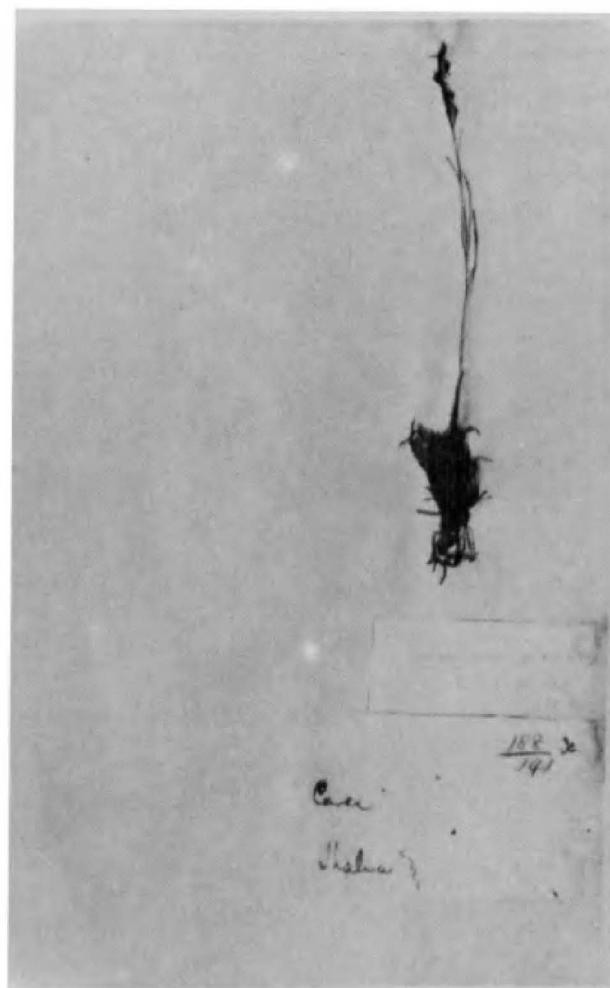


Fig. 4. *Kobresia trinervis* (Nees) Boeck. var. *foliolosa* (C. B. Clarke) Kukenth. collected by C. B. Clarke in Nov. 1884 and housed in DD Herbarium at Dehra Dun.

the form of published information, drawings, recorded field notes, etc. It, thus functions as a centre for assimilation and dissemination of all basic information about plants, such as its proper identity, distribution, frequency and uses, if any. Besides, frequency of collection and its representation in the herbarium gives an insight into the changing patterns, both quantitative as well qualitative, in the flora of a particular region (see also Chauhan & Singh, 1992; Rao, 1977).

Apart from that, the herbarium specimen of different plant groups, especially bryophytes and lichens, with capacity to absorb, accumulate and retain considerably high level of toxic heavy metal pollutants such as lead, cadmium, zinc, mercury chromium, nickel, etc., also serve as 'Environmental Specimen Banks' (Pakarinen, 1977). A comparative study, using such specimens and current samples may indicate trends in environmental pollution, over a period of time, in different regions of the world (Chopra & Kumra, 1991; Pakarinen, 1977; Singh, 1993).

INDIAN SCENE

The history of the development of herbaria in India is directly associated with the history of botanical explorations. Therefore, it is necessary to glance through the early botanical explorations in the Indian sub-continent.

Garcia Da Orta came to Goa in the year 1534 and remained there till his death. He had a garden in Goa where he grew plants and wrote a book entitled "*Coloquica dos simplas drogas he cousas medicinais da India compostos palle Doutor Garcia da Orta*" in 1565. It was just the time the development of Herbarium concept was in its initial stages. There is apparently no record of the collections of Garcia Da Orta, indicating that the herbarium concept and technique had not yet reached the Indian sub-continent. After Garcia Da Orta there appears to be not much botanical activity till almost the mid 17th century, though during early part of 17th century the Dutch people had developed considerable interest in Indian plants. Later Heinrich van Rheedea (1637-1692),

who was made Governor of the Dutch possessions in Malabar in 1667, published a monumental 12 volume work entitled "*Hortus Malabaricus*" between 1678 and 1703. During this period the concept of the Herbarium-making had developed fairly well.

While Rheedea was studying the plants of the Malabar coast, some British collectors were also collecting plants on the Madras coast. James Petivar and Charles Du Bois (1656-1740) were prominent among them. Similarly Samuel Brown, who appears to have gone to Madras around 1688, prepared a packet of dried plants, a "*Hortus-Siccus*" and sent it to London. Perhaps this was the organised beginning of collection for herbarium purpose in India. Edward Burckley (about 1651-1714) also sent packages of dried plants to London. Boiss ultimately accumulated "*Hortus Siccus*" of 74 volumes. Leonard Plukenet (1641-1707) who was a contemporary of James Pativer and Charles Du Boiss, began to publish in 1697 small copper plate illustrations of plants under the title *Phytographia*. After the death of Plukenet, Sir Hans Sloane bought the whole lot and added it to the accumulation that he bequeathed to the British Museum.

ESTABLISHMENT OF THE ROYAL BOTANIC GARDEN (PRESENTLY INDIAN BOTANIC GARDEN) AND DEVELOPMENT OF CALCUTTA HERBARIUM

Keeping in view the great demand for teak wood, Robert Kyd (1746-1793) suggested for its trial cultivation at Calcutta and in 1786 the Royal Botanic Garden (the present Indian Botanic Garden), came into existence. Establishment of this Garden actually formed a sort of nucleus for all future botanical studies and herbarium collections from practically all over the Indian sub-continent. William Roxburgh succeeded Kyd in 1793. His contributions to Indian Botany are well known.

After the departure of Roxburgh in the year 1813, William Carey became incharge of Calcutta Botanic Garden for a short period until Francis Buchanan joined in 1814. On his return James Hara, Thomas Cassy and Nathaniel Wallich took

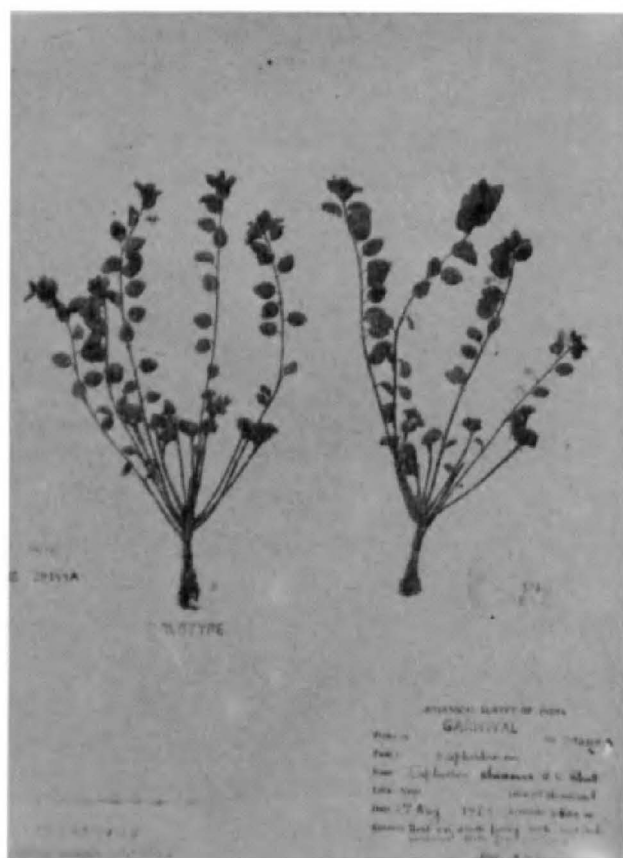


Fig. 5. Holotype of *Euphorbia sharmae* U. C. Bhattach. in BSD Herbarium at Dehra Dun.

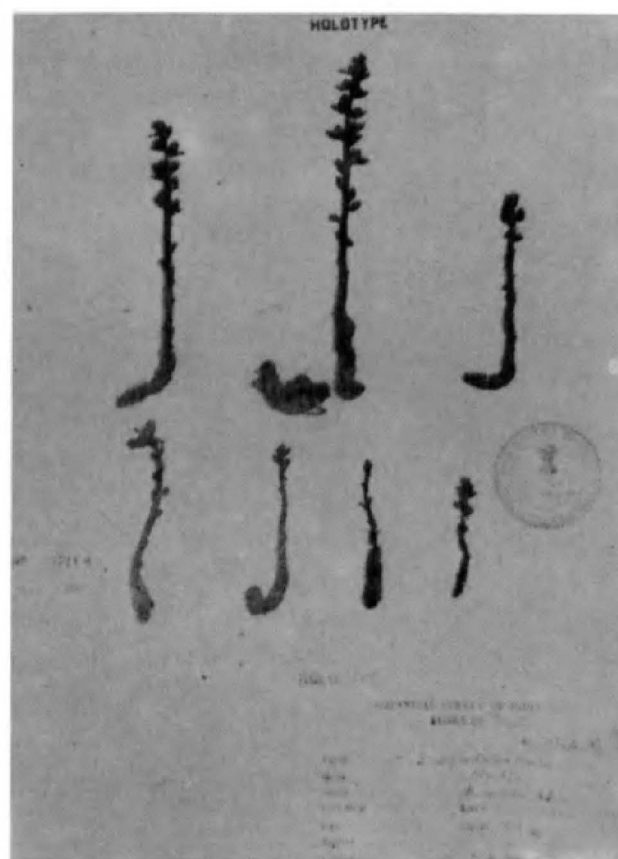


Fig. 6. Holotype of *Aleutra parasitica* A. Rich. var. *chitrakutensis* M. A. Rau in BSD Herbarium, Dehra Dun.

over as the superintendents of the garden for varying periods. Finally Nathaniel Wallich joined Calcutta Botanic Garden in 1817. He made, and received from his colleagues, enormous collections of plants from Nepal, Kumaon, Gilgit and Deccan in India, Ava, Irrawady Delta, Mandalay, Myomya in Burma, Penang, Parak, Singapore etc. and developed the so called "Catalogue" of dry herbarium specimens. The duplicate set of his collections and the 'Catalogue' is preserved in Central National Herbarium.

Wallich took away all his collection to London in 1820. Nearly 7683 species together with many of the specimens of Roxburgh, Buchanan and others were taken. His main set comprised more than 20,000 specimens and was incorporated in herbarium of the East India Company, which came to the Linnaean Herbarium (LINN) in 1832 but were finally transferred to Kew Herbarium (K) in 1913.

During the second spell of his Superintendentship from 1832 onwards, Wallich felt difficulties in the identification of his fresh collections in the absence of a well identified set of the earlier collections of Roxburgh, Buchanan etc. He proceeded then vigorously to build up a herbarium in the basement of Roxburgh's house in the Calcutta Garden. This was the starting point of the development of the Central National Herbarium at Calcutta. Griffith is accredited with having reorganised a Working Herbarium.

Thomas Thomson had been collecting plants from North Western India, Kashmir etc., during 1839 and onwards. He joined J. D. Hooker at Darjeeling in 1848 and collected plants from Sikkim, Khasi & Jaintia Hills, Sylhet etc. He also received from Kew Herbarium, duplicate collections of Falconer, J. D. Hooker, Robert Wight, Wallich etc. He reorganised and consolidated a 'Public Herbarium' housed in 93 cabinets up to his time.

The 'Company Garden' or Calcutta Garden was renamed as 'Royal Botanic Garden' when it was taken over by British Crown in 1861 and Wilhelm Sulpiz Kurz (1833-1878) joined

Anderson in 1862 as the first Curator of the Herbarium. A further large consignment of duplicates of J. D. Hooker's Indian plants were received from Kew in 1867 for incorporation into the Calcutta Herbarium.

C. B. Clarke (1832-1936), another noted botanist added collections from Khasi Hills, Sikkim, Nilgiris, Kangra, Chamba, Kashmir and Karakoram etc. Sir George King took over from Clarke in 1872 and enormously augmented the collections in the herbarium through his own collections and also through his paid collectors. He shifted the herbarium and the library from Roxburgh House to a new building in 1883. In the year 1890 Sir George King was appointed as the Ex-officio Director of the Botanical Survey of India.

From 1890 to 1957 G. King with D. Prain (1890 to 1897), D. Prain with A. T. Gage (1897 to 1906), A. T. Gage with W. W. Smith (1906 to 1912), A. T. Gage with C. C. Calder (1912 to 1923), C. C. Calder with P. M. Debbarman, V. Narayanswamy and K. P. Biswas (1923 to 1939), J. M. Cowan (1937), K. P. Biswas (1937-1955) and D. Chatterjee (1955-59) functioned successively as Curators and have enormously enriched the Herbarium.

With the reorganisation of the Botanical Survey of India by E. K. Janaki Ammal in the year 1955, a new era of botanical collections ushered in

DEVELOPMENT OF REGIONAL AND UNIVERSITY HERBARIA

From 1839 onwards Thomas Thomson (1854-1861) had been collecting plants from north-western India, Kashmir etc. He joined J. D. Hooker at Darjeeling in 1848, and together they collected plants from Sikkim, Khasi & Jaintia Hills, Sylhet, Chittagong etc. They left for U. K. in February 1851 with all their collections about 1,50,000 specimens. This, alongwith all early collections from Indian sub-continent deposited in the Kew Herbarium, formed the basis for J. D. Hooker's monumental work on 'Flora of British

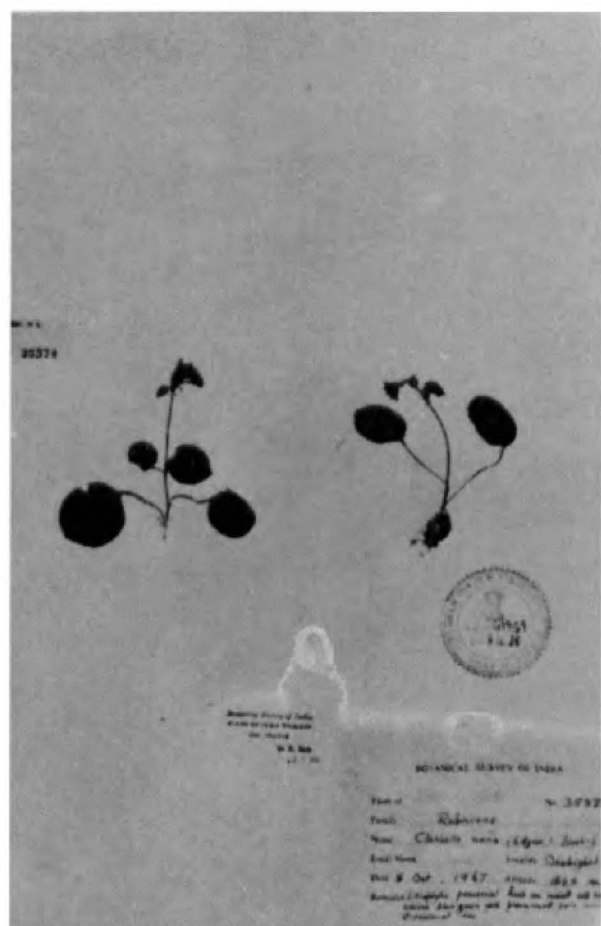


Fig. 7. *Clarkella nana* (Edgew.) Hk. f. collected after 60 years since last collected by Gollan in 1896.

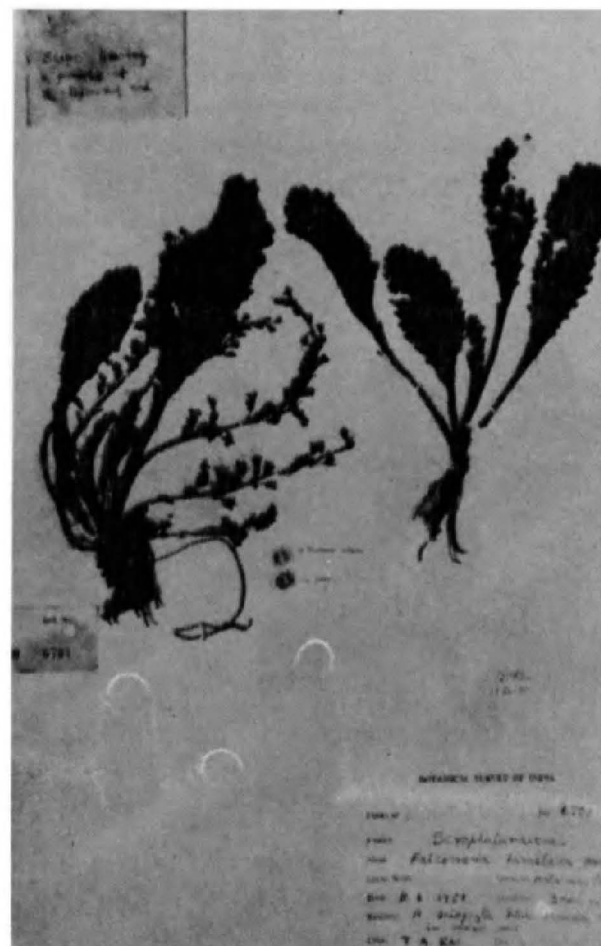


Fig. 8. *Falconeria himalaica* Hk. f. collected after 60 years since last collected by Strachey & Winterbottom in 1894.

India' published in 7 volumes between 1872-97. This enthused a large number of workers to initiate plant collections for the ultimate preparation of regional floras. These include Prains' (1903) Bengal Plants; Gamble's (1915-1936); Flora of Madras Presidency; Cooke's (1901-1908); Flora of Bombay Presidency; Haines' (1921-25) Botany of Bihar & Orissa; Duthie's (1903-22) Flora of Upper Gangetic Plains; U. N. Kanjilal's (1934-40) Flora of Assam; P. C. Kanjilal's (1933) Forest Flora of Pilibhit, Oudh, Gorakhpur & Bundelkhand Forest Division; and Forest Flora of Chakrata, Dehra Dun, and Saharanpur Forest Division; Osmaston's (1927) Forest Flora of Kumaon; Parker's (1918) Forest Flora for Punjab with Hazara and Delhi; Parkinson's (1923) Forest Flora of Andaman Islands etc. In the process a number of regional herbaria, viz. Madras Herbarium, Blatter Herbarium, Dehra Dun Herbarium, Assam Herbarium, Herbarium of the Western zone of the old Botanical Survey of India, etc., were established. At present *ca* 47 herbaria, some of them holding only specialised collections, belonging to Government/ private Institution and State Universities exist in different parts of our country (Holmgren *et al.*, 1990).

The re-organisation of Botanical Survey of India in 1955 forms a land mark in the history of taxonomic studies and plant collections in India.

Initially four Regional Herbaria viz., Northern Circle at Dehra Dun, Southern Circle at Coimbatore, Eastern Circle at Shillong and Western Circle at Pune were set up with the Headquarters at Calcutta. Subsequently five more regional Circles viz., Central Circle at Allahabad, Arid Zone Circle at Jodhpur, Arunachal Pradesh Circle at New Itanagar, Sikkim Himalayan Circle at Gangtok and Andaman & Nicobar Circle at Port Blair were added, each with its own herbarium. Thus, nine Government owned regional herbaria came into being. While some of them were built upon certain earstwhile old herbaria, in some other cases the latter were marged with the former.

After re-organisation of the Botanical Survey of India an urgent need was felt for fresh explorations and survey of plant resources of our country, particularly for the reason of altered geographical situations. This, coupled with the need to revise existing floras prompted various institutions, including Universities to initiate local collections and develop their own herbarium. This led to the establishment of several small herbaria in universities and colleges and also in some research institutions. Some floras have also come out from these university herbaria. Some important herbaria associated with colleges, universities and research institutions are listed in Table 1.

Table 1 : Some important university herbaria in India
(after Holmgren, *et al.* 1990)

Name with abbreviation	Acronym	Date of start	Number of Specimens (approx.)
1	2	3	4
1. Centre for Taxonomic Studies, St. Joseph's College, Bangalore.	JCB	1964	50,000
2. Department of Boatany, Punjab University, Chandigarh.	PAN	1947	28,620
3. Department of Botany, Rajasthan University, Jaipur.	RUBL	1963	20,033

Table 1 Cond.

Name with abbreviation	Acronym	Date of start	Number of Specimens (approx.)
1	2	3	4
4. Department of Botany, Calcutta University, Calcutta.	CUH	1921	25,000
5. Rapinat Herbarium, St. Joseph's College, Tiruchirapalli.	RHT	1967	86,077
6. Department of Botany, Presidency College, Madras.	PCM	1901	1,00,000
7. Department of Botany, Delhi University, New Delhi.	DUH	1947	19,000
8. Department of Botany, Punjabi University, Patiala.	PUN	1967	40,000
9. Department of Botany, Kashmir University, Srinagar.	KASH	1972	55,300
10. Department of Botany, North Eastern Hill University, Shillong.		1975	14,000
11. Department of Botany, University of Garhwal, Srinagar.	GUH	1978	8,000
12. Botany Department, St. Xavier's College, Bombay.	BLAT	1906	2,00,000
13. Botany Department, University of Lucknow, Lucknow.	LWU	1925	35,000
14. Botany Department, Banaras Hindu University, Varanasi.	BAN	1918	25,000

IMPORTANT HERBARIA OF THE WORLD AND INDIA

Herbaria range from small personal collections to large collections of universities and Government Institutions. According to a recent census there are over two thousand six hundred recognised herbaria world over, together harbouring between 250-273 million species (Holmgren, *et al.*, 1990; Shetler, 1969). Of this *ca* 78 million are in European herbaria and *ca* 36 million in American herbaria. Fifteen countries, *viz.*, U.S.A. (22.1%), France (7.4%), U.S.S.R. (6.6%), U.K. (5.7%), Sweden (4.5%), Federal Republic of Germany (4%), Switzerland (3.9%), China (3.7%), Italy (3.3%), Czechoslovakia (2.8%), Austria (2.7%), Japan (2.6%), Canada (2.5%), Australia (1.9%), and the Netherlands

(1.7%), currently hold *ca* 75% of the total specimens of the world (Holmgren *et al.* 1990). By mid 20th century, the number of herbaria throughout the world had become so numerous that it was thought desirable to publish a consolidated list of all world herbaria. This important task was accomplished by the International Association for Plant Taxonomy (I.A.P.T.) in the form of *Index Herbariorum*, under Regnum Vegetable series. It is an extremely useful publication for locating different herbaria of the world, their size and type of collections, important contributors, name of the Curator, etc. This compilation is also helpful for loan and exchange of specimens etc., at international level. Some important world and Indian herbaria are listed in Table 2 and 3.

Table 2 : Important herbaria of the world
(after Holmgren, *et al.* 1990)

Name	No. of sheets (approx.)	Year of founding	Acronym
1	2	3	4
1. Royal Botanic Garden, Kew, U. K.	6,000,000	1841	K
2. V. L. Komorov Botanical Institute, Leningrad, USSR.	5,770,000	1823	LE
3. Museum National d'Histoires Naturalle Laboratoire de Phanerogamma, Paris, France.	8,877,300	1635	P, PC
4. Rijksherbarium, Leiden, Netherlands.	3,000,000	1829	L
5. Conservatoire et Jardin Botaniques, Geneve, Switzerland.	5,000,000	1824	G
6. U. S. National Herbarium Washington, USA	4,368,000	1848	US, USNC
7. Swedish Museum Natural History, Stockholm, Sweden.	5,600,000	1739	S
8. New York Botanical Garden, New York, USA.	5,300,000	1891	NY
9. The Natural History Museum, London, U.K.	5,200,000	1753	BM
10. Botanical Museum, Uppsala University, Sweden.	2,500,000	1785	UPS
11. Botanical Museum, Lund, Sweden.	2,400,000	1770	LD
12. Natural History Museum, Chicago, USA.	2,415,000	1893	F
13. Royal Botanic Garden, Edinburgh, U.K.	2,000,000	1839	E
14. Gray Herbarium, Harward University, Cambridge, USA.	4,607,000	1864	GH
15. Arnold Arboretum, Massachussetts, USA.	1,230,000	1872	A

SALIENT FEATURES OF SOME INDIAN HERBARIA

1. *Central National Herbarium, Howrah, W. B. (Cal)* :

The Central National Herbarium, situated in the Indian Botanic Garden, Sibpore, Howrah (W. B.), being the repository of not only the Indian but a sizable samples of the world flora, provides an essential aid in the pursuit of taxonomic researches in India, both fundamental and applied. The classificatory sequential arrangements of hundreds of genera and thousands of species, a huge assemblage of the 'Types' of many of the Indian taxa and preservation of duplicate set of the famous Wallichian sheets, amongst many other classical collections made during the 19th century, impart a prestigious position to this Herbarium. The historical collections include those of Roxburg, Wallich, Griffith, Wight, J. D. Hooker, T. Thomson, Royle, C. B. Clarke, G. King, Prain, Kurz, W. W. Smith, etc. The Central National Herbarium (C.N.H) has a chequered past, extending over the last two hundred years (see Burkill, 1965; Ghosh, 1948; Mukherjee, 1959; Panigrahi, 1977). Recently the herbarium has celebrated its bicentenary.

Since the reorganisation of the Botanical Survey of India in 1956 more than 2,50,000 plant specimens were added to this herbarium, by the scientists of Botanical Survey of India, from different parts of the country. And at present it houses *ca* 1,500,000 specimens of Angiosperms, Gymnosperms and Pteridophytes. Apart from that it also houses *ca* 3000 specimens of lichens, *ca* 7000 specimens of bryophytes and *ca* 15,000 species of fungi. Besides, there are *ca* 10,000 type specimens and *ca* 20,000 photo negatives of type specimens. Based on studies in the herbarium, *ca* 200 taxa, including 7 genera have been described as new to science. Besides, over 10 books and 600 scientific papers are to the credit of C. N. H. About 20 research scholars have also been trained here in plant taxonomy and other allied aspects.

2. *Herbarium, Industrial Section, Indian Museum (BSIS)* :

Situated in Calcutta, this herbarium was established in 1887 but subsequently was merged

with Botanical Survey of India in 1911. There are at present *ca* 50,000 herbarium specimens and 15,000 museum specimens. The herbarium has helped publication of seven books and more than 115 scientific papers so far.

3. *The Madras Herbarium (MH)* :

The Madras Herbarium, now known as the herbarium of the Botanical Survey of India, Southern Circle, Combatore has to its credit about 150 years of fine service.

Initiated around the year 1853 as 'Madras Museum Herbarium' by Hugu Clegharn with his own collections alongwith those of Dr. Drew and Sir W. Elliot, was subsequently merged with 'Madras Herbarium' established by M. A. Lawson in 1874. While R. H. Beddome not only contributed to Madras Museum Herbarium but also donated his private herbarium comprising *ca* 6000 specimens, A. G. Bourne made substantial contributions to the latter. It was during Bourne's tenure as Superintendent of Madras Museum during 1897-98 that both these herbaria were merged under the name 'Madras Herbarium'

The herbarium was transferred to the Government Botanist in 1898-99 when C. A. Barber took up the appointment alongwith that of Director, Botanical Survey of South India. Subsequently in 1905 the herbarium was transferred to Coimbatore. Untill 1908 the herbarium had nearly 40,000 specimens. Dr. Barber added over 20,000 specimens to this. From 1912 to 1923 K. Rangachariar was incharge of the herbarium, who also considerably augmented herbarium holdings.

With the setting up of the Southern Circle of Botanical Survey of India at Coimbatore in 1955, the herbarium, containing 95,106 specimens, and representing the flora of the old Madras Presidency (including Mysore, Coorg, Cochin and Travancore) and specimens from north India, Burma, Sri Lanka, Malaya, Europe, Africa, Australia, U.S.A., etc., was transferred to this Circle. More than 88,480 specimens from Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, part of

Table 3 : Important Indian Herbaria

(after Holmgren, *et al.* 1990)

Name	No. of sheets (approx.)	Year of founding	Acronym
1	2	3	4
1. Central National Herbarium, Howrah, W.B.	1,300,000	1793	CAL
2. Forest Research Institute & Colleges, Herbarium, Dehra Dun	3,30,000	1890	DD
3. Botanical Survey of India, Southern Circle, Coimbatore, Tamil Nadu.	2,29,210	1853	MH
4. Blatter Herbarium, Bombay, Maharashtra.	2,00,000	1906	BLAT
5. Andaman & Nicobar Circle, Botanical Survey of India, Port Blair.	26,000	1972	PBL
6. Arid Zone Circle, Botanical Survey of India, Jodhpur.	15,292	1972	BSJO
7. Sikkim Himalayan Circle, Botanical Survey of India,, Gangtok.	8,000	1979	BSHC
8. Botanical Survey of India, Eastern Circle, Shillong, Meghalaya.	2,25,000	1956	ASSAM
9. Botanical Survey of India, Western Circle, Pune, Maharashtra.	1,45,464	1880	BSI
10. Botanical Survey of India, Northern Circle, Dehra Dun, U.P.	84,575	1956	BSD
11. Botanical Survey of India, Industrial Section, Indian Museum, Calcutta, W.B.	52,675	1897	BSIS
12. Botanical Survey of India, Central Circle, Allahabad, U.P.	50,000	1962	BSA
13. National Botanic Garden, Lucknow, U.P.	1,20,000	1948	LWG
14. Marine Alga Herbarium, Central Salt and Marine Chemicals Research Institute, Bhavnagar, Gujarat.	3,000	1961	BHAV
15. Central Drug Research Institute, Lucknow.	40,000	1951	CDRI
16. Herbarium, Division of Mycology and Plant Pathology, I.A.R.I., New Delhi.	41,000	1905	HCIO
17. National Herbarium of Cultivated Plants. N.B.P.G.R., I.A.R.I., New Delhi.	6,000	1983	IARI
18. Mycology and Plant Pathology Herbarium, Maharashtra Association for the cultivation of Science Research Institute, Law College Road, Pune.	27,000	1968	AMH
19. Institute of Genetics and Tree Breeding, Coimbatore.	36,382	1962	FRC

Madhya Pradesh and the Andaman were added to this herbarium by the scientists of the department. There are about 800 'Type' and many authentic specimens. At present nearly 2,33,000 specimens are housed in this herbarium. Seventeen Research scholars have been trained and Ten books and more than 500 scientific papers have been published.

4. *The Blatter Herbarium (BLAT)* :

The herbarium is situated in St. Xavier's College at Bombay. The precise date of foundation of this herbarium is uncertain. According to Santapau (1954) it was founded some time between 1906-1907 after Blatter received a consignment of specimens from C.E.C. Fischer from the Coimbatore Herbarium. In the beginning the herbarium was known as St. Xavier's College Natural History Museum but was later renamed as 'Blatter Herbarium' in 1941 when Fr. H. Santapau took charge of the herbarium.

After Blatter's demise in 1934, McCann was assistant Curator and then Curator of the Natural History section of the Museum. Soon after independence he migrated to New Zealand along with ca 20,000 specimens, given to him by Blatter. Later he returned these specimens to the Blatter herbarium in 1972. The herbarium houses more than 100,000 specimens representing the collections, besides others, of L. J. Sedgwick, R. D. Acland, J.C. Lisboa, M. L. Banerjee, B. G. Mundkar, H. Santapau, etc.

5. *The Dehra Dun Herbarium (DD)* :

It is the herbarium of the Forest Research Institute & College, Dehra Dun (now Indian Council of Forestry Research and Education) and is composed of the Forest School Herbarium, started by J. S. Gamble in 1890. The erstwhile Saharanpur herbarium was merged with it in 1908. The oldest specimens collected by George Govan dates back to about 1816.

Dr. George Govan was appointed the first Superintendent of the Saharanpur Botanic Garden

in 1816. He collected plants mainly in the adjacent Sirmoor State, now in Himachal Pradesh. Dr. J. F. Royle succeeded Dr. George Govan in 1823. He collected in the adjacent Himalayas. Dr. Hugh Falconer succeeded Royle in 1831 and sent his collectors to Kashmir and Ladakh. Dr. William Jameson succeeded Dr. Falconer in 1842. After Jameson's retirement in 1876, the post of Superintendent went outside the medical service and J. F. Duthie was appointed as his successor. During Duthie's time Gamble was vigorously building up the Forest School Herbarium at Dehra Dun.

Immense amount of labour was put in, mainly by Duthie and Gamble, for bringing together a good representation of the Flora of North-Western region of the Indian sub-continent. A good collection of trees and shrubs by U. N. Kanjilal and his associates and several private herbaria made by forest officers, viz. Smythies, Gustav Mann and J. C. McDonell were presented to the school. A number of Australian specimens were also received, on exchange basis.

The Dehra Dun herbarium now contains more than 300,000 specimens which include collections of J. E. T. Aitchison, N. L. Bor, D. Brandis, J. F. Duthie, J. S. Gamble, G. Govan, Gustav Mann, H. H. Haines, W. Jameson, U. N. Kanjilal, P. C. Kanjilal, A. E. Lowrie, H. F. Mooney, A. E. Osmaston, R. N. Parker, C. E. Parkinson, Stocks, Keshavanand, M. B. Raizada, J. F. Royle, K. C. Sahni, R. R. Stewart and many others from not only N. W. Himalayan region but other parts of the country as well. The collections include ca 1200 'Type' materials.

6. *Herbarium of Botanical Survey of India at Pune (BSI)* :

Western Circle of Botanical Survey of India came into being on 12th December, 1955 at Pune with the transfer of the herbarium of the Western Zone of the old Botanical Survey of India under the then Government of Bombay. This old herbarium was started in 1880 by the Government of Bombay under Theodore Cooke of the Science

College. G. M. Woodrow succeeded Cooke in 1896. There were about 5000 sheets by 1899. However, the entire collection was destroyed by fire in May 1902. However, it was re-established with the duplicate set generously presented by T. Cooke. This formed the nucleus of the Poona Herbarium. Gammie succeeded Woodrow and made large collections not only within the state but from as far as Kashmir to Assam in the Himalayas. W. A. Talbot's collections of North Kanara were purchased and added to the herbarium in 1910. Lastly the Maharaja of Kuchh presented the collections of Jaykrishna Indrajit Thakkar from Gujarat in 1929.

Besides Cooke and Woodrow a number of other workers also contributed to this herbarium. Notable among them are Kanitkar (1891), Ranade (1909), Bhide (1898), Patwardhan (1908), Paranjpe (1909), Shavda (1909), Burns (1916), Narayana (1922), and Godbole (1929). Ryan's (1908) collections, mostly from Sind, were also added. At present more than 1,50,000 specimens are housed in this herbarium, which include about 465 'Types'. About 8 books and 350 scientific papers have been published from this centre so far and *ca* 50 new taxa have been described.

7. *The Herbarium of the National Botanical Research Institute, Lucknow (LWG)* :

Established relatively recently with the efforts of late Prof. K. N. Kaul, with his collections mainly from Delhi, Mussoorie and Kashmir, the herbarium at the National Botanical Research Institute, Lucknow, presently houses *ca* 1,20,000 specimens, which include, besides Gymnosperms and Angiosperms, Fungi, Lichens, Bryophytes, Pteridophytes as well as some carpological collections. Specimens of grasses and other herbaceous elements were transferred from Government Agriculture College, Kanpur. Norman Gill's collection from Kumaon were also acquired. Besides, D. D. Awasthi, R. C. Bharadwaj, K. P. Biswas, B. K. Nayar, H. O. Saxena, J. G. Srivastava, H. Yadav, etc., have also made important contributions towards the development of this herbarium.

8. *The Rapinat Herbarium (RHT)* :

The credit of having this prestigious herbarium goes to St. Joseph's College, Tiruchirapalli. The herbarium, organized in 1967, is named after Alfred Rapinat (1892-1959) whose collections formed the nucleus of the herbarium. At present there are more than 86,000 specimens in the herbarium. Fr. K. M. Mathew, as incharge of the herbarium, has significantly contributed towards the development of this herbarium.

9. *The Herbarium of Central Circle, Botanical Survey of India, Allahabad (BSA)* :

The herbarium was established in 1962 with the establishment of this Circle. There are more than 45,000 specimens, which have accumulated through the sustained efforts of the scientists of the department. Seven books and *ca* 250 scientific papers have been published, and *ca* 25 new taxa have been described. Five research scholars have been trained so far at this centre.

10. *The Herbarium of Northern Circle, Botanical Survey of India, Dehra Dun (BSD)* :

This herbarium came into being with the setting up of this Circle in 1956. And at present it houses more than 90,500 specimens, which include 65 'Type' specimens, collected by the scientists of the department, from North-western U. P., Delhi, Jammu & Kashmir, Himachal Pradesh, Punjab, etc. Besides, *ca* 1,500 specimens of fungi, belonging mostly to Aphyllphorales and few bryophytes are also available for study and reference. Twelve books and more than 250 scientific papers have so far been published, and *ca* 75 new taxa have been described. Ten research scholars have also been trained at this centre.

Apart from that, the herbarium also houses a sizeable number of Japanese and Russian specimens acquired on exchange basis.

11. *The Herbarium of Andaman & Nicobar Circle, Botanical Survey of India, Port Blair (PBL)* :

With the establishment of this Circle in 1972,

this herbarium was also started. There are more than 26,000 specimens, collected by the scientists of the department from Andaman & Nicobar Islands. These include 30 'Type' specimens of the newly described taxa. About 100 scientific papers have been published and 2 research scholars have been trained at this centre so far.

12. *The Herbarium of Eastern Circle, Botanical Survey of India, Shillong (ASSAM) :*

Established in 1956 with the transfer of ca 40,000 specimens, comprising the erstwhile 'Assam Forest Herbarium' it has since been enriched and increased manifolds through the concerted efforts of the scientists of the Department. At present it harbours ca 2,25,000 specimens of Angiosperms, Gymnosperms and Pteridophytes which include some historical collections of Gustav Mann, P.C. Kanjilal, U. N. Kanjilal, N. L. Bor etc. Apart from that, with 13,000 specimens of lichens and 11,000 specimens of bryophytes (mostly liverworts) the ASSAM herbarium has the distinction of having the largest collection of these groups in India.

The herbarium also has ca 460 'Type' specimens. Over 90 new taxa, including 3 genera, have been described from this centre, 8 books and ca 275 research papers have been published. Besides, 12 research scholars have also received training here.

13. *The herbarium of Sikkim Himalayan Circle, Botanical Survey of India, Gangtok (BSHC) :*

The herbarium was established in the year 1979. There are about 10,000 specimens, representing collections from Sikkim State. More than 25 scientific papers have been published and one research scholar has been trained.

14. *The herbarium of Arunachal Pradesh Circle, Botanical Survey of India, New Itanagar :*

The herbarium was established in the year 1979 and its acronym is yet to be assigned. The herbarium holding at present represents more than 8000 specimens. So far ca 15 research papers have been published from this Circle.

15. *The Herbarium of Arid Zone Circle, Botanical Survey of India, Jodhpur (BSJO) :*

The herbarium is established in the year 1972. It contains more than 17000 herbarium specimens, which include 20 'Type' specimens. Three books and ca 100 scientific papers have been published, and ten new taxa have been described.

CONCLUDING REMARKS

The establishment of herbaria, a prerequisite for any taxonomic or floristic study, has gained considerable momentum during last four and a half century or so. The procedure of pressing, drying, mounting, and storage have all been amazingly successful, and are due to the efforts and long experience of numerous scientists, naturalists and plant enthusiasts. Efforts of Indian botanists towards establishment of herbaria and botanical studies are in no way lagging behind, compared to other regions of the world. India is perhaps the second country to have established a quite large number of herbaria at Government level. Botanical Survey of India, being the nodal organisation, entrusted with the survey, documentation and conservation of plant resources of the country, is the custodian of several herbaria located in different phytogeographical regions of India. The Survey is also instrumental in enthusing a large number of university as well as private herbaria. And today there are over 4 million specimens housed in about 47 listed herbaria (Holmgren *et al.*, 1990) across the country. Besides, every institution even remotely related with plant science has its own herbarium for which no exact data is available at present.

The concept and role of herbarium is also changing. Other than general herbarium now there are many specialised herbaria also, set up to cater to the needs and orientation of research of various institutions.

Although plant taxonomy is in its low phase today, the scope and challenges of the future are enormous. One of the greatest challenges is how

to conserve the plant resources of the world. We need to learn more about plants that are basic to our survival. There is also a need not only to store these vast collections and information on them, but also to develop capabilities to retrieve this information quickly. Many herbaria now are supported by a very well maintained documentation system with associated library and have such facilities as microfiches of old classical and out of print literatures, as also of classical old collections such as Linnaean Herbarium, Willdenov's collections, etc., to facilitate easy accessibility for all. Several of these herbaria are also supported by computerised data base to make them more user-friendly. Same facilities need to be extended to every herbarium and efforts should be made to link them with a common terminal. Such reorganisation needs cooperation and considered planning at the highest level.

The usefulness of herbarium as 'Environmental Specimen Bank' is yet to be fully ascertained and exploited. If successful, it would open new vistas of research in environmental monitoring and management. The Herbarium taxonomists should, therefore, accept the challenges of the future with an open mind and resolve to deal with these problems in the larger interest of mankind.

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