The Role of Herbaria in the Assessment of Plant Biodiversity

L.B. Chaudhary
Plant Diversity, Systematics and Hebarium Division,
CSIR-National Botanical Research Institute, Lucknow-226001
Email: chaudharylb@nbri.res.in

Biodiversity refers variety and variability among all living beings such as plants, animals, fungi and microbes present on the Earth in different ecosystems. It also mentions the number and abundance of different species living within a particular region or on the entire Earth. When we talk about plant biodiversity, there are more than 4 lakhs species have been estimated throughout the world in flowering plants alone. Authentic identification of species is pre-requisite for correct assessment of diversity at all three levels, i. e. species, gene and ecosystem. This job cannot be done only in the field without proper characterisation and identification of plant species. The work of assessment of diversity either at regional or global level becomes easier when sufficient natural history collections are available in different herbaria. Therefore, people started collecting and maintaining the plant specimens since 16^{th} century in different herbaria to know the exact number of plant species occurring on the planet Earth.

Herbarium is a store house of preserved plant materials that may be in dried form mounted on a hard sheet of paper or may also be stored in boxes or kept in alcohol or other preservatives along with all essential associated data for long period with vouchers. Herbaria are precarious primary databank for taxonomy, biodiversity, ecology and evolutionary research.The plants collected from far and wide are kept in pigeon holes of steel and wooden cupboards in the herbarium according to some accepted system of classification after doing their proper processing and identification. Herbarium acts as reference centrefor plant identification and authentication. It provides a record and reference about flora of a specific region. In addition, herbarium also serves as a ready reference tool for assessing the conservation status of plant species, especially of rare and threatened ones. The Red List plants can also be assessed by using herbarium data. Due to habitatchange and many other factors, many species are either on the verge of extinction or shifting towards other habitats. Here again herbarium plays a major role to maintain the biodiversity data which will be useful for climate change and evolutionary studies.Further, specimens are also used for palynology, phytogeography, anatomy, phenology and molecular systematic studies which are directly or indirectly used in identification, authentication and assessment of plant diversity.

Till date, there are 3095 recognised herbaria in the world in 178 countries, containing about 38,75,13,053herbarium specimens. The taxonomic studies conducted by different organisations on these specimens have yielded so far about 3,08,312 vascular plants in the world in which angiosperms are 2,95,383, which are quite low than estimated numbers. It reflects that many areas throughout the world are either unexplored or under explored and also the specimens available in different herbaria are not fully examined and identified till date. The plant biodiversity is well known and studied in temperate regions, because the number plant species is comparatively quite low. But in tropical regions the condition is very different, where the plant diversity is not onlyvery rich and varied, rather they are lessknown and yet to be identifiedas every year about 4000 new species are being described from this region. It is a great challenge to accurately identify the enormous plant biodiversity existing in tropical countries.Therefore,the comparison and matching of unknown plants with identified plants available in the herbarium is one of the authentic ways of identification.

India is among 17 megadiverse countries in the world with four biodiversity hotspots (Himalaya, North-East region, Western Ghats and Andaman and Nicobar Islands), out of 35 hotspots recognised throughout the world. It holds about 7–8% of the plant species of the world chiefly due to its various ecological and climatic factors found in 12 different biogeographic zones (i. e. Trans Himalaya, N. W. Himalaya, Eastern Himalaya, North-East region, Gangetic Plain, Desert region, Semiarid zone, Deccan Peninsula, Western Ghats, Coastal region, Andaman and Nicobar Islands and Lakshadweep Islands). It harbours about 19,000 plant species only in angiosperms including 6200 endemic species.According to *Index Herbariorum* data there are 88recognised herbaria in India, containing only about 54 lakhs natural history collections, while many other countries where plant biodiversity is comparatively less have quite more herbaria with huge collections (Table 1). The countries where herbaria and plant collections are more, they do not only have better understanding of their plant diversity, rather they also play major roles in formulating biodiversity rules and regulations at international levels. Therefore, the biodiversity rich countries like India must properly maintained the available natural history collections and information associated with them. The attention should also be paid towards increasing and making quality collections and herbarium specimens to generate primary data for their uses in future.Since the utility of herbarium specimens has increased now many folds, the collections of plant specimens should also be accompanied with as much as field data and related various information.Now the preparation of World Flora Online (WFO) is in progress and several plant data bases such as *The Plant List* (TPL),

International Plant Names Index (IPNI), *Tropicos* etc. have been developed nationally and internationally, thus it becomes important to develop linkages among different herbaria for meeting the common goal. In view of this, more herbaria should be establishedin various locations, especially in plant biodiversity rich countries of the world tohouse local collections

Table 1: Some ccountries with highest number of herbaria

Country	Number of Herbaria	Holding of specimens	Number of vascular plants
U. S. A.	659	7,65,30,922	17,000
China	355	2,00,85,018	33,000
Brazil	168	81,49,176	56,000
Russia	116	1,59,37,399	12,500
U. K.	107	2,23,06,427	1407
India	88	53,63,459	20,620
Canada	87	49,10,833	4,100
Italy	78	1,15,54,153	6,711
France	76	2,59,62,993	4,630
Germany	70	2,21,59,950	3,319
Japan	69	1,23,34,980	5,565

forreal assessment of the regional plant diversity in order to maintain, sustainably utilise and conserve plant resources, which is required more than previously in the currentbiodiversityand environmental crisis. Further, there is also a need to record more field and botanical data during plant collection, so that they can be utilised for various purposes.

Key words: Biodiversity, Assessment, Herbarium, Plant collecting.