BULL. BOT. SURV. INDIA
Vol. 19, Nos. 1-4: pp. 250-255, 1977

ROLE OF HERBARIA AND MUSEUMS IN THE PREPARATION OF ECONOMIC MONOGRAPHS

K. KASHYAPA

Publication and Information Directorate, CSIR, New Delhi

The museum speaks of a language that is specific, of the real thing, that of the object, and, therefore, exerts great influence on both the learned and the laymen who normally form their impressions from texts, two-dimensional pictorial images, reproductions and other verbal and non-verbal aids. Museums play a great educational role in their specific fields and are invaluable sources of information, in both cultural and economic fields.

There are different types of museums, the most important amongst which are the Art Museums and the Science Museums. Other museums include Historical Museums; Shrines, Treasury houses, and other places of display of curios; and open-air museums created within the bounds of gardens or parks. Botanical gardens, with their herbaria, are good examples of open air museums. For preparing scientific monographs, therefore, the science museums and the botanical gardens with their herbaria are of greater relevance.

The museums of natural science, of exact or applied science, and technical museums are classified as science museums. The museums of natural science that were created first were the *Museum National d' Histoire Naturelle* of Paris, at the end of the 18th Century, and the *British Museum (Natural History)* of London. Museums of the applied sciences, and technical museums, of which the most celebrated example is the Deutsches (German) Museum of Munich, are more recent. Developing countries are anxious to establish their museums for the sake of popular education and India has succeeded in establishing such museums at Calcutta and Bangalore.

Since my experience is almost wholly confined to the writing of economic monographs on botanical subjects, particularly for the Wealth of India, an Encyclopaedia of the Indian raw materials and industrial products, this account is limited to the role of the botanic gardens and their herbaria in solving our problems.

BOTANICAL GARDENS IN INDIA

Except in the earlier Buddhistic period, when pharmaceutical gardens seem to have been established, there is no clear evidence of the existence of herbaria or gardens of scientific or botanical interest, though there were numerous gardens and beauty spots laidout for the great kings and Sultans who had an eye for splendour. The British established a few botanic gardens in the 18th and 19th centuries with the main purpose of exploiting the natural resources of the country. The more important botanical gardens are mentioned below :

1. *Indian Botanic Garden, Calcutta* : It is one of the oldest and the largest botanical

gardens in Asia and has been a centre of botanical and horticultural research for over two centuries. At present the garden occupies an area of 273 acres; about *15,000* plants representing approximately 2500 species are found in this garden. There are several ferneries, arboreta, and nurseries, and orchid, palm and succulent houses. The herbarium in the Indian Botanic Garden is one of the largest herbaria in the east. The library contains approximately 25,000 volumes and is very well equipped for research in Systematic Botany.

2. *Lal Bagh Botanic Garden, Bangalore*: It was started in about 1760 by Hyder Ali as an orchard and is said to have been named Lal Bagh because of the cultivation of roses on a large scale. The garden is a treasure-house of plants introduced from all over the world, having particularly beautiful collections of palms, Araucarias, bamboos and orchids. A number of economic plants yielding fatty oils, essential oils, fibres, dyes & tans, gums & resins, fodders, etc. are cultivated. Almost all the exotic fruits, such as apples, sapota, litchi, bread fruit and avocado are grown.

3. *Lloyd Botanic Garden, Darjeeling*: It is known after William Lloyd who donated about 40 acres of land for the purpose. The garden has excellent rockeries, nurseries, and hothouses, and has arrangement for the distribution of seeds of the Himalayan plants. It has a good collection of exotic species from China and Japan, and representative plants from the Nilgiris, the north-western Himalayas, and Burma. A small herbarium is also attached to the garden.

4. *Government Horticultural Garden, Saharanpur* : It was in the year 1779 that Zabita Khan appropriated the revenues of seven villages for the maintenance of this garden. This was ultimately converted into a botanic garden during the time of the Marquis of Hastings. The garden is important because this is the place of introduction of many plants from America. Some of these plants were potato, tobacco, pine apple, guava, chillies, papaya, sapota, logwood and Mahogany.

5. *National Botanical Research Institute, Lucknow* : The idea of establishing a botanic garden at Lucknow originated in 1929 due to an interest in the cultivation of the drug *Santonin*, which is obtained from *Artemisia maritima*. In 1946, there was a proposal for converting Sikander Bagh into a botanic garden. In 1953, it was taken over by the CSIR. The object of establishing the National Botanic Garden was to conduct research in economic botany. The main functions include: collection, introduction and propagation of economic and ornamental plants; botanical, horticultural and phytochemical studies on economic plants; maintenance of botanical gardens; setting up of herbaria and supply and exchange of plants and plant materials.

The botanic garden occupies an area of 27 hectares, with an arboretum, of herbarium, a library, research laboratories, and a field research station at Banthra. The garden has a rosarium, conservatory, cactus house, palm house and a fern house besides a huge collection of indigenous and exotic living plants. The herbarium contains more than 88,000 plant specimens.

HERBARIA

1. *The Central National Herbarium, Calcutta* : A complete collection of Indian plants is housed in this herbarium; specimens from Europe, Africa and America are also well represented. The number of specimens exceeds 2 million. Sir Arthur Hill, (Erstwhile Director of the Royal Botanic Garden, Kew) once said, "This herbarium is the Mecca for

the study of Indian botany by botanists not only in India but also from the overseas."

2. *Herbarium of the FRI, Dehra Dun*: It has the second largest collection with about 3 lakh specimens.

3. *Madras Herbarium, Coimbatore* : This was attached to the Agricultural College and Research Institute, Coimbatore and contains over one lakh specimens. It has now been amalgamated with the Southern Circle Herbarium of the Botanical Survey of India.

4. *The Eastern Circle Herbarium, Botanical Survey of India, Shillong* : It contains about one lakh specimens, and includes the earlier collections of the Assam Forest Herbarium.

Other herbaria include the Blatter Herbarium, Bombay (1 lakh specimens); the Western Circle Herbarium, Botanical Survey of India, Poona (60,000 specimens); National Botanic Garden Herbarium (88,000 specimens); and Northern Circle Herbarium, Botanical Survey of India, (60,000 specimens).

All these herbaria deal mainly with vascular plants and there is no institution where indentification of Algae, Fungi, Lichens, and Mosses can be satisfactorily carried out. Quite often, even for higher plants, the problems have to be referred to the Royal Botanic Garden, Kew when critical determination of the specimens is required.

PROBLEMS

During the scrutiny of literature for writing a monograph, certain technical and non-technical problems crop up. For finding an answer to them the help rendered by herbaria is substantial. A few such problems are listed below :

Inadequacy and inaccuracy of information : It has been observed that a number of analytical results may have to be annulled because of the doubtful identity of material analyzed, confusion in the regional names, and inadequacy or inaccuracy of information. There are many languages in the country and the confusion arises when a number of different plants are known by the same vernacular names, resulting in samples which though emanating from different sources, represent the same commercial product. As for example, samples of *Gaozaban*, a well-known drug in Unani system of medicine used for digestive troubles and as a cooling agent, procured from the market have been found to consist of the leaves and twigs of *Coccinia glaucasayi*, *Trichodesma indicum* R. Br. *Anisomeles malabarica* R. Br., *A. indica* Kuntze, *Onosoma bracteatum* Wall. and *Macrotomia benthamii* DC. Because of this confusion an analysis of a sample of *Goazaban* obtained from the drug dealers is in fact an analysis of a mixture of plant material, signifying nothing. In such circumstances, the herbaria can provide for comparison the authentic material obtained from the correctly identified botanical sources.

Another familiar example is that of *Ratanjot* roots, which yield a red dye. This dye has been of interest as a colouring material for vegetable *ghee*. The roots of at least fifteen species, viz. *Anchusa tinctoria* Linn. syn. *Alkanna tinctoria* Tauch., *Anemone obtusifolia* D. Don, *Arnebia benthamii* Johnston, *A. euchroma* Johnston, *A. hispidissima* DC., *Clausena pentaphylla* DC., *Geranium nepalense* Sweet, *Jatropha curcus* Linn., *Lochnera rosea* Reichb., *Maharanga emodi* DC., *Onosma hispidum* Wall., *O. hookeri* C.B. Clarke, *Potentilla nepalensis* Hook., and *Viola pilosa* Blume. though some of these are without any dye, are known by the name of *Ratanjot* and the Food Adulteration Rules are silent about the correct identity of the plant. The herbarium material has been of great help in finding the correct

identity of the genuine *Ratanjot* yielding plant, *Arnebia benthamii* from Afghanistan.

The fruits of *Capparis moonii* Wight are said to be used for the treatment of tuberculosis. The water oozing out of the hydathodes in this plant gives the appearance of tears. Based on this observation the plant was given the name *Rudanti* while the actual *Rudanti* of ancient Ayurvedic works, as identified by the study of herbarium material, is *Cressa cretica* L.

Confusion in botanical nomenclature : In some of the earlier floras, a number of Indian plants have been considered identical with those occurring in European and other countries; with the result that the economic uses attributed to the plant occurring in foreign countries have also been attributed to the Indian plant. But later investigations have shown that the plants are different; the economic uses attributed to one, therefore cannot hold good for the other. In a number of Indian books on medicinal plants, the Indian plant *Fumaria indica* Pugsley is incorrectly mentioned as the botanical name of the Unani drug *Shahtera* or *Pitpapra*, for stomach derangements, liver complaints, and skin troubles. Studies of herbarium specimens have shown that *P. indica* has been confused with three foreign species—*F. officinalis* Linn., a predominantly European species; *F. parviflora* Lamk., a European plant stopping short of the present day India at Baluchistan; and *F. vaillantii* Loisel., also a European species extending to Altai mountains of Central Asia and to Kashmir. It is the herb *F. officinalis*, and possibly also *F. parviflora*, which constitutes the genuine *Pitpapra* or *Shahtera*.

Another example of great confusion regarding the correct identity and nomenclature of plants is furnished by *Mung* (Green Gram) and *Urad* (Black Gram). The confusion arose because Linnaeus gave the name *Phaseolus mungo* not to *Mung*, but to *Tikari*, a pulse with black seeds much allied to *Urad*, thus not conserving the vernacular name of the *Mung* plant; he gave the name *P. radiatus* to a plant, evidently of *Mung*, illustrated by Dillenius. Roxburgh later tried to set the matters right by reversing the names, *i.e.* he gave the name *P. mungo* to *Mung* and *P. radiatus* to *Urad*. In Baker's account in the Flora of British India, Roxburgh's treatment is followed : *P. mungo* of Baker is *Mung* and is the same as Roxburgh's *P. mungo* and not *P. mungo* of Linnaeus. This instead of eliminating the confusion made it still worse. It was confounded further when George Watt in his *Dictionary of Economic Products of India* (1889-1896) followed Roxburgh's nomenclature, while later, in his *Commercial Products of India* (1908), he followed the original nomenclature by Linnaeus. It may, however, be mentioned that there is a view that *Mung* and *Urad* are scarcely more than the botanical variants of the same single species, but this view has not found much favour due to its commercial impracticability. According to the new circumscription of the genus *Phaseolus*, most of the Asiatic species have been placed under the genus *Vigna* and the nomenclature of *Mung* and *Urad* sorted out as follows : *Mung—Vigna radiata* (L.) Wilczek syn. *Phaseolus radiatus* L. non. Roxb. and auct; *P. aureus* Roxb; *P. mungo* auct. non L. *Urad—Vigna mungo* (L.) Hepper syn. *P. radiatus* Roxb. non L.; *P. mungo* L. non Roxb.

During the course of compiling information on the oil of *Khas* obtained from the roots of *Vetiveria zizanioides* Nash, it has been observed that two different types of volatile oils are obtained from the roots : a high levorotatory oil from the roots of wild plants occurring in North India, and a dextrorotatory oil from the roots of cultivated plants from South India. Both these oils differ not only in the aroma, but also in their physical

and chemical characteristics. That these differences were not caused by different environments obtained in the two regions were shown by the fact that in transplant experiments these differences were maintained to a large extent. Further chemotaxonomic investigations based on authentic herbarium specimens may ultimately reveal that the north Indian and South Indian *Khas* plants, though related, are distinct species.

While reviewing the literature on the species of *Ruta* L., some doubts cropped up regarding the correct identity and nomenclature of the plant reported from India. In the Flora of British India (Vol. I, 485) *R. angustifolia* Pers. and *R. chalepensis* Wall. are recorded as synonyms of *R. graveolens* L. var. *augustifolia* Hook. f. According to recent European works, however, the three species mentioned above, namely *R. graveolens* L., R. *chalepensis* L. and *R. augustifolia* Pers. are considered distinct. *R. graveolens* is distinguished from the other two in having the petals whith more or less wavy or denticulate margins, while both *R. chalepensis* and *R. augustifolia* have petals with ciliated margrns. Study of the specimens obtained from Bombay, Banaras, Bangalore, Coimbatore and some other parts of India have shown that the plant cultivated is *R. chalepensis,* and not *R. graveolens,* though the former is used for the same purposes as the latter. While it is not improbable that *R. chalepensis* possesses all virtues attributed to the exotic *R. graveolens,* yet, it appears that neither chemical analysis of the Indian plant has been made under its correct specific name, nor the medicinal efficacy of the Indian material properly ascertained.

Misrepresentation of information : Unnecessary confusion has been caused because of misquoting of the earlier information. particularly with respect to the individual opinions which though cautiously expressed with an element of doubt, have been mentioned in some medicinal literature as if these opinions were fully established facts. Moreover, the information in many of the Indian books on economic botany and medicine, such as Rama Rao's Flowering Plants of India, Dastur's Useful Plants of India and Pakistan, and also Medicinal Plants of India and Pakistan, Bal's Useful Plants of Mayurbhanj in Orissa, Chopra's Glossary of Medicinal Plants, is repetitive, rather than providing confirmatory evidence of the earlier records through actual observations. A glaring instance of an inadvertent but persistent error was found in the case of a perennial herb *Glycyrrhiza glabra* L., the source of the well known *Mullathi* or *Atimaduram.* The plant is found in the Mediterranean and Central Asian countries. In several Indian books it is erroneously mentioned that the plant is distributed from Chenab *eastwards,* while the correct statement would be, from Chenab *westwards.* Actually, the plant is not found in a wild state in India.

Based on insignificant and unauthenticated information, the roots of *Polygala chinensis* L. were made official in the Indian Pharmacopoeia, 1955 as a suitable substitute for the roots of American *P. senega* L., constituting the drug *senega,* used as an expectorent. Later, it was revealed by 'investigations that the material sold as Indian senega was spurious and from plants not even belonging to the genus *Polygala.* Indian senega and its preparations were, therefore, deleted from the subsequent editions of Indian Pharmacopoeia.

In the absence of the illustrated catalogues giving the important external and internal characters of the drugs, spices, food and fodders, herbaria and other museums are the main authentic sources for clearing the doubts,

solving the tricky problems, and rectifying the long persisting errors that one may come across when compiling economic monographs on materials of vegetable origin.

Herbaria as guides to new economic resources : There are about 800,000 species of plants on this planet and; of these, to my knowledge, there are not more than 10,000 species which can be categorised as economic plants. Of these, only three major cereals and about 10 other widely cultivated species are the sources of food grains constituting the staple diet of millions in India and elsewhere. Similarly there are only a handful of the nature's bounty of herbs that have been put to medicinal use. A treasure of untapped information on protein rich foods of vegetable origin and the herbal medicines lies in the ethnobotanical information in the field notes attached to the herbarium specimens. It is therefore, not really surprising that the herbaria are repositories to the clues of the usefulness of little known plants. Further investigation may reveal herbs with a broad spectrum of biodynamic chemicals, such as alkaloids, glycosides, essential oils, fatty oils, tannins, mucilages, saponins, resins, gums, and other substances. The main constitutents in the prescription of the day are the plant-derived drugs or their synthetic duplicates.