

## Are herbaria redundant?

R. R. Rao

In the current era of biotechnology and molecular biology the classical subjects like the taxonomy and herbarium have witnessed a great debacle. Unless immediate measures are taken to restore the herbaria and associated taxonomic activity, the entire biological community would soon end up in a state of confusion with regard to their own taxa of investigation and may have to knock the doors of scientists outside the country for seeking basic information on identity, nomenclature and even distribution of those taxa which occur at their door steps. While cautioning about such an ensuing serious problem I intend to outline here the paramount role of herbaria in allround development of botanical sciences including modern biology. This should also call for a dialogue between the classical biologists and experimentalists as to whether herbaria are redundant or they need to be maintained with added significance.

### What is a herbarium?

Herbarium is a place where plants collected from far and wide are preserved in pressed and dried condition and are kept in pigeon holes of almirahs according to some accepted system. It is a great filing system for information about plants primarily in the form of actual specimens and secondarily in the form of recorded notes on labels attached on the sheets. In other words, herbarium is a vast reservoir of facts about plants.

### Functions or utility

In order to wash out the wrong notion among a section of modern biologists it is necessary to highlight the diverse functions of a modern herbarium and prove how it acts as a connecting link between various disciplines. The following are a few important functions of a herbarium.

- \* Conservatory of material and data
- \* As a storehouse of collections including the valuable type specimens the herbaria greatly aid in all kinds of taxonomic researches

- \* Aids in teaching and in all biological researches
- \* Serves as a fundamental resource for identification of all plants of the globe
- \* Serves as source for collection of biodiversity information (to capture biodiversity information from herbaria is at least 10 times more cost efficient than to collect new data from field). Most estimates on global biodiversity today is based on herbarium collections only
- \* Aids in biodiversity monitoring; carrying out scrutiny of herbarium collections to obtain quantitative baseline data on the distribution and abundance of keystone species is essential for all monitoring programmes
- \* Aids in assessment of conservation status of a taxon (helps in cataloguing of rare and endangered species for conservation programme)
- \* Serves as a repository of historic collections and at times acts as the only record of past vegetation
- \* Serves as a source for search of new genetic material for improvement of our cultivated stock
- \* Aids in assessment and cataloguing of all species of economic potential; these may include commercial species, medicinal herbs, food plants and so on
- \* Serves as a source of material for investigations on anatomy, morphology, ecology, chemistry, molecular biology, pharmacognosy and for environmental impact assessments
- \* Seeds of herbarium specimens can be used to resurrect species extinct in the wild using modern technologies
- \* Herbarium, like a library, is a service institute; solves all queries about plants from scientists, administrators, lawyers, corporate personnel, industrialists, environmentalists and foresters
- \* Helps in development of computer databases on plants and maintains active links to international net-

work of systematic resources and electronic knowledge base.

Thus, it is clear that herbaria contribute to the development of all biological disciplines. But today herbaria are completely ignored by the so-called modern biologists who have least knowledge of the significance of a herbarium. Although herbarium is a facility of a data bank on plants to be used by all biologists only a handful of surviving taxonomists are putting their efforts to nourish and maintain the fragile heritage of herbaria in the country. This has resulted in erroneous conclusion that herbaria are the establishments solely of taxonomists. Rather, herbaria are national facilities and their maintenance should be a national responsibility.

Some herbaria developed over several decades of efforts of taxonomists are today at the verge of collapse due to wrong impression among the ruling biologists that herbaria are merely a storehouse of collections of dead plants, which cannot contribute to the national development nor can generate funds for research forgetting that herbaria are simply a facility of a databank on plants from which all biologists draw their basic informations directly or indirectly about the plant species on which they carry out all advanced researches.

The significance of voucher specimens, on which varieties of researches are carried out, need not be elaborated here. It is only the herbaria which maintain such voucher specimens for posterity. Time and again the necessity of depositing the voucher specimens in some recognized herbaria has been stressed. But today this aspect is so much ignored that many modern biologists carry out outstanding researches on taxa but without maintaining voucher specimens nor do they feel the necessity. In the absence of voucher specimens vast amount of new data/new discoveries on a particular plant species quite likely may not pertain to the plant species studied. Even if the species is well known it may contain a number of ecotypes, cytotypes, varieties or strains and hence it is absolutely necessary to maintain the voucher specimens in any

herbarium to allow subsequent researchers to evaluate statements made in the literature about the characteristics of a given taxon. The editors of various scientific journals should also ensure that all authors cite the accession number/numbers of their voucher specimens and the herbaria where deposited. While this enhances the value of scientific findings, at the same time it strengthens the justification of the importance of the herbaria.

Thus, herbaria are helpful to both classical and experimental biologists not only for obtaining the basic data on plants but in also serving as a caretaker of the voucher specimens on which tremendous amount of literature accumulates. In view of this, are we unjustified in demanding for allocation of some percentage of funds from all research projects as service charge for development and maintenance of herbaria? It is also certainly unwise to score out the herbaria and taxonomic researches as establishments of no economic gains as the present trend goes.

National herbaria like the Central National Herbarium, Herbarium of the Forest Research Institute, Dehra Dun, and the Herbarium of the National Botanical Research Institute, Lucknow are critically endangered due to lack of sufficient trained manpower, facility and even due recognition by the so-called

experimentalists. With the overgrowth of several modern disciplines the importance of herbaria has faded, resulting in such a damage that would be felt in the immediate coming years. Khoshoo<sup>1</sup> has rightly pointed out that taxonomists are a 'vanishing tribe' among the biologists and are greatly overshadowed by the so-called and more often secondary biotechnologists and environmentalists.

Herbaria require large buildings and staff for curation of vast collections, laboratories for associated researches and funds for continuous explorations for enriching the herbaria, particularly in a developing country like India where the coverage of holdings is incomplete. The knowledge of variation within species is another aspect which is very limited. But the increasing financial squeeze and thoughtless prioritization of research programmes have greatly affected the overall health of the herbaria in the country. Often comments from scientists state that the massive collections in the herbaria be dispensed with and only few sample collections and type specimens be maintained<sup>2</sup>. There is therefore, an urgent need to educate the policy makers, the experimental biologists, and other key persons who matter much for development of herbaria in the country about the 'essentiality' of a herbarium.

A rational economic basis for maintenance and furtherance of herbarium research must consider the fact that botanists with all their concerted efforts have known only 1/10th of what exists in our tropical forests and still less is known of the economic utility of those species which are recorded. Intraspecific biodiversity and population variation of the rich tropical flora are little understood. But certainly maintaining and enriching a herbarium is expensive. A strict monitoring of the quality of the incoming collections and zones from where they come is essential in order to maintain the quality and not the size of the herbarium. More than one herbaria if any, within a city or town (e.g. Dehra Dun, Lucknow) can be considered for merging in view of the increasing cost of maintenance, manpower, space on buildings, etc., rather than 'killing' a herbarium due to wrong policies and apathy towards such classical subjects upon which many future solutions depend.

1. Khoshoo, T. N., *Curr. Sci.*, 1995, 69, 19-17.
2. Clifford, H. T., Rogers, R. W. and Dettmann, M. E., *Nature*, 1990, 346, 602.

*R. R. Rao is in the National Botanical Research Institute, Lucknow 226 001, India.*

## SCIENTIFIC CORRESPONDENCE

### The academy fellowship problem

#### The problem

A science academy elects new fellows every year. In order to improve the overall quality of its fellowship, it decides to impose a new criterion that every new fellow elected shall be better than the median level of the existing population of fellows\*. How fast will the quality of the fellowship improve?

\*This criterion was proposed for the Indian Academy of Sciences by Professor V Radhakrishnan in the mid-seventies.

#### A toy model

The above problem needs to be recast in a quantitative form. It is difficult to quantify 'quality' of a scientist but suppose in a toy model we use a variable  $x$  to measure it on a scale ranging from 0 to 1, with 1 being the mark of perfection. Let us measure the time in years with  $t = 0$  denoting a starting year when this criterion is announced to be implemented in all subsequent years. Let  $f_n(x)$  denote the cumulative quality distribution of fellowship in the year  $t = n$ ,  $n = 0, 1, 2, \dots$ . In the starting year the

total number of fellows was  $N_0$ , say and suppose that by statutes, every year  $N$  fellows must be elected.

Denote by  $M_n$  the median of the distribution  $f_n(x)$ . Thus

$$f_n(M_n) = \frac{1}{2} f_n(1) = \frac{1}{2} (N_0 + nN), \quad (1)$$

and while electing in year  $n$ , care is taken that all new additions shall have the quality parameter  $x > M_{n-1}$ . Improvement in quality will then be indicated by how the median  $M_n$  steadily increases in value year by year.

We still need to specify the quality distribution of the pool of scientists