

**CENTRAL BOTANICAL LABORATORY**

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**Historical**

The Botanical Survey of India has been in existence since 1890. Owing to lack of funds it was held in abeyance in an inactive condition since 1937. In the draft Five Year Plan of 1947 for the development schemes of the Food and Agriculture Department, money was set aside for the reorganisation of the Botanical Survey of India. It included a proposal for taking over the herbarium at Sibpur from the West Bengal Government together with about 3 acres of land for the construction of additions to the Herbarium, so as to make available more adequate accommodation and provide for a laboratory. This proposal was not put into action owing to financial stringency.

In July 1953, the Botanical Survey of India was transferred to the administrative control of the newly formed Ministry of Natural Resources and Scientific Research. An Officer-on-Special Duty was appointed in October 1952 to draw up a comprehensive scheme for the reorganisation of the Botanical Survey of India on a "broad approach to the problems of reorganisation on a regional basis with a headquarters establishment for over-all supervision, guidance and co-ordination".

A report on the reorganisation was submitted to Government by the Officer-on-Special Duty in July 1953, the main features of which are now fairly known. Amongst other things the scheme provided for the "creation of a Central Botanical Laboratory under a Director at a suitable place in India where the living plant will be studied in relation to its botany and utility to the nation". Thus in the proposal of 1953, the laboratory occupied a very important place in the Botanical Survey of India.

The President of India having been pleased to sanction the expansion and reorganisation of the Botanical Survey of India, the Central Botanical Laboratory came into existence on the 13th April, 1954 with Dr. E. K. Janaki Ammal as its first Director. The laboratory started its activities in the Indian Museum, Calcutta, in the same rooms where the Botanical Survey of India in the olden days had done its research work on Cinchona and other plant products. Thus the continuity of research which had snapped as a result of stagnation of the survey, was once again revived in the very same building where Watt worked on the Economic Products of India.

From Calcutta the laboratory was temporarily moved to Lucknow in rooms rented from the Central Drug Research Institute at Chhatter Manzil Palace where it remained for three years (2nd December 1954 to 3rd December 1957). The expansion of the laboratory was not possible during the period of its stay in Lucknow owing to the limited space available and lack of grounds for experimental plants. Plants for genetical studies were grown in pots and left on verandahs and wherever space was available. Search for a permanent home in Allahabad resulted in acquiring the Old Commissioner's office building, 100 year old mansion, with seven acres of land attached to it for experimental work. Though plans for a new building were submitted to Government together with the reorganisation scheme of the Botanical Survey of India, the work has not so far been taken up and the condemned building is serving as a laboratory after repairs.

**Functions of the Central Botanical Laboratory**

The aim of the Central Botanical Laboratory is to conduct research which will cover a wide range of problems relating to the botany of India, and to supply information relating to the living plants of India for utilization and exploitation of the botanical wealth of India for agriculture, horticulture and forestry, trade, industry and medicine. It is also intended to provide information to the common man on all aspects of the plant life of India. These problems will relate to cytological, genetical, ecological, economical and physiological aspects of the flora of India and their relation to the flora of the adjoining countries. The progressive development of a family, genus or species of Indian plants in the different parts of the sub-continent and the part played by animals and man in changing the vegetation of India and the methods of regeneration of deserts and waste lands will also receive attention. Possibilities for the introduction of new economic plants from within the flora of India and from outside and the improvement of Indian medicinal, timber and other minor economic plants will also be considered.

These functions were to form the work of the four departments of (1) Cyto-genetics, (2) Ecology, (3) Economic Botany, and (4) Plant Physiology with a Radio-isotope Laboratory attached to it.

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### Programme of Work

The type of investigations of each of the departments as given in the Report of the Central Botanical Laboratory submitted on 16th March, 1954 to Government, is given below.

#### DEPARTMENT OF CYTO-GENETICS

This department deals with cytological and genetical studies of the population of India. The following are some of the problems which are being investigated by this twin department:

- (1) The cytological study of wild progenitors of economic plants, to evaluate their genetical merits for use in the improvement of their cultivated prototypes.
- (2) A chromosome survey of the Flora of India to ascertain the progressive development of a family, genus or species in different parts of India and the causes underlying speciation of the Indian Flora.
- (3) A comprehensive cyto-systematic survey of the grasses of India in particular, with special reference to their economic value and their possible use as potential ancestors for the synthesis by hybridization and selection of new cereals and fodder plants.
- (4) The creation of new and improved varieties of timber, fruit and drug plants—teak, sandal-wood, ephedra, cinnamon, etc., by doubling of chromosomes, by the use of colchicine and other chemicals.
- (5) Tracing the ancestry of the cultivated plants of India by chromosome analysis of related species and genera.
- (6) Studies in the evolution of the Flora of India by cyto-systematic surveys of genera and species of Indian plants which show affinities with those of neighbouring countries and continents, and
- (7) The genetical basis of endemism in the Indian flora.

#### DEPARTMENT OF ECOLOGY INCLUDING PLANT GEOGRAPHY

In this department, plants composing the Flora of India will be studied as units of a community or association. The following are some of the problems which will receive the attention of this department:

- (1) The ecological association of plants in the different climates and soils of India and the influences and selective value of environment on these plants.
- (2) The geographical distribution of different species and genera of Indian plants in the light of the above.
- (3) The role of plants as indicators of special types of soil and climate.
- (4) The part played by man and animals in changing the vegetation of India and methods of regeneration of

deserts and wastelands to counteract the damage done to the natural vegetation of India.

(5) Examination of suitable plants from different parts of India and areas of similar climate outside of India useful for regeneration of swamps and deserts, and

(6) The alpine Flora of the Himalayas will receive special attention for the study of the effect of altitude on plant life.

#### DEPARTMENT OF ECONOMIC BOTANY

The Botanical Survey of India had in its early days an Economic Botanist whose duty it was to explore, examine and evaluate the wealth of economic and medicinal plants of India. The Dictionary of Economic Plants compiled by Dr. George Watt was the result of the work of the Economic Botanist, and the collection made by this officer still forms a great part of the exhibits of the Industrial Museum. The laboratory work connected with economic plants of India will now form part of the work of the Central Botanical Laboratory. As however, a great deal of work in this field is being conducted by the Agricultural and Forest Departments and the different National Laboratories, the research work done by this department will be chiefly collaborative. The department of Economic Botany of the Central Botanical Laboratory will thus unify the work done by other departments of economic plants and explore possibilities for the introduction into cultivation of new economic plants. The work of this department will also include:

- (1) Notes on new economic uses will be gathered during botanical expeditions and added to the information already existing. New plants will be grown and their uses investigated in collaboration with the Drugs and Chemical Departments.
- (2) A survey of the regions of distribution of the different economic plants of India and the introduction and experimental planting of new economic plants will also be the work of this section.
- (3) The botanical identification of economic plants, fibres, medicinal plants, will be a part of the routine work of this department.
- (4) A collection of anatomical, palaeontological slides for identification will be built up for comparative studies.

#### DEPARTMENT OF PLANT PHYSIOLOGY INCLUDING EXPERIMENTAL MORPHOLOGY

This department will work in close collaboration with the Ecology Department. Subjects for study will be:

- (1) This department will examine both in the laboratory and under field conditions the water and mineral



*Tapioca being popularized in Uttar Pradesh by the Central Botanical Laboratory.*

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*Experimental plants, of DIOSCOREA both wild & cultivated, grown at the Central Botanical Laboratory.*

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requirements of important species of Indian plants and the effect of salinity, drought and other environmental factors on the Flora of India.

(2) The study of the life history of resistant species of plants for land reclamation, sand dune fixation and desert and semi-desert conditions.

(3) The metabolism of parasitic plants of India and the relationship between host and parasite.

(4) Special excretion of roots which control plant growth.

(5) Physiological study of germination of seeds.

(6) Photoperiodism in Indian plants.

As this department develops, the effect of hormones, drugs and X-rays on plant, as well as the analysis of taxonomic relationship of plants by serological, embryological and tissue culture studies and radioisotope work will be taken up.

Of these four departments, the only one that has been actively organised since the laboratory came into being, is the Cyto-genetic Department. The functions of this department at present, are as follows:

(1) to make a cyto-taxonomic survey of the Flora of India with special stress on medicinal and other economic plants and to keep a cyto-taxonomic herbarium for reference by workers in this field, and

(2) to create new and important varieties of timber, fruit and drug plants by inducing mutation and tetraploidy by use of chemicals, X-rays or radio-isotopes, and by hybridization.

Even though an Economic Botanist has not yet been appointed, a nucleus of the Economic Botany Department is being developed under the immediate charge of the Director. The functions of this department are:

(1) to study the wild progenitors of economic plants of India and to evaluate their merits for improvement of their cultivated varieties.

(2) to trace the ancestry of the cultivated plants of India by chromosome analysis.

(3) to study the plants grown or collected by primitive tribes of India and evaluate them in relation to the crops grown in India.

(4) to study the grasses of India with special reference to their economic value and for the synthesis of new cereals and fodder.

(5) to survey the distribution of different economic plants of India in relation to world distribution of the same.

For the first time an attempt is being made to study the plants grown and cultivated by primitive tribes of India as they provide genetic materials for the understanding of the improvement of some of our cultivated plants as well as providing new materials for introduction. With this end in view, a department of Ethnobotany has been started as part of the work of the Economic Botany Department.

### Activities of the Central Botanical Laboratory

#### (1) CREATION OF NEW VARIETIES OF VEGETABLES, FRUITS AND DRUG PLANTS BY INDUCTION OF TETRAPLOIDS

The use of colchicine for inducing tetraploids is well known and though much work has been done on agricultural and horticultural plants, tropical trees and drug plants have not been experimented on. At the Central Botanical Laboratory, seedlings of the following fruits and vegetables were treated.

*Artocarpus integra*

Custard apple

Gauva

Litchi

Mango

*Curcuma*

*Ipomoea bona-nox*

*Nyctanthes arbor-tristis*

*Citrus*

*Rauwolfia*

*Capsicum*

#### (2) SURVEY OF THE WATERLILIES OF INDIA

Owing to their restricted fresh water habitat, waterlilies are indicators of old land connections and their cyto-systematic study throws light on evolutionary problem. Collections of *Nymphaea* made and received from various parts of India are being grown in large earthen pots for study. The cytological data from Peninsular collections of the small blue waterlily *N. stellata* links this species with the blue waterlily of *N. madagascariensis* morphologically and cytologically. Both species are primitive diploids with  $2n=28$  chromosomes.

A large form of the same species *N. coerulea* collected in Shillong seems more related to the Sacred Blue Waterlily of the Nile and seems identical with the forms represented in the Ajanta paintings. The red waterlily of Bengal *N. rubra* is found to be a tetraploid ( $2n=56$ ) and is thus more highly evolved than the blues. The survey continues.

#### (3) SEARCH FOR NEW ECONOMIC PLANTS

In the study of the evolution of cultivated plants, ethnobotanical studies involving the genetic analysis of plants collected or grown by aborigines will indicate the ancestral types from which the cultivated forms are derived. Such studies have been initiated for the first time in the Central Botanical Laboratory on the genus *Dioscorea* (Yam), *Colocasia* and *Curcuma*.

#### STUDY OF DIOSCOREAS OF INDIA

Studies of *Dioscoreas* of India started with collection of 50 varieties (includes both cultivated and wild) in Malabar by the Director after visiting tribal areas of

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Wynaad and Coimbatore. To this collection was added 10 others by Dr. K. M. Sebastine and 13 from Bombay Presidency by Dr. R. P. Patil. This work is now being conducted by Shri R. Sundararaghavan, Technical Assistant, who had added 250 further collections so that the Central Botanical Laboratory can now boast of having the best collections of *Dioscoreas* in India, if not of the world. These are being analysed for cytotoxic study of the genus and preliminary publication of chromosome numbers of more than 100 have already appeared in the Proceedings of the Indian Academy of Sciences. The wild forms in all cases showed lower chromosome number  $2n=40$  while the cultivated forms of the same species had from  $2n=60$ , 80 and 100.

With regard to the wealth of edible tuberous plants, the Indian Flora is very rich. Ginger, Turmeric, Arrowroot, Yams and Taros abound in the Flora of India which are yet untapped for utilization in agriculture. Some of these like, *Kaempferia*, are highly aromatic and could be utilized for the production of perfumes and drugs. The medicinal plants of India though known to Ayurved from ages, have not been properly studied and many more uses of plants remain to be discovered from the tribals. This is receiving attention.

### (4) CYTO-SYSTEMATIC SURVEYS

As a sample study of the Flora of the Gangetic plains, Lucknow and its environs have been examined fully from the cytological and systematic angle and the result of this work will form the basis of a Flora of Lucknow by Dr. R. P. Patil, Botanist.

The Flora of the hills of South India have some resemblances to the Himalayan Flora. A closer study of the Nandi hills of Mysore and the Nilgiris were made for cyto-taxonomic study and the compilation of the Flora of these hills by the Director is nearing completion. It has been found that in some cases the species are identical with those of the Himalayas.

### (5) CYTOLOGICAL STUDIES OF MEDICINAL PLANTS

With a view to understanding the genetic make up of India's rich flora of medicinal plants, a catalogue of their chromosome numbers is being compiled. In this way the work on drug plants which has so far been neglected will be brought in line with the work done on other economic plants of India. Several hundred plants have been examined for chromosome numbers.

### (6) TO MAKE A CHROMOSOME ATLAS OF THE FLORA OF INDIA FROM PUBLISHED MATERIALS

The classification of the Flora of India according to Hutchinson has been started and a chromosome cata-

logue of the Flora of India is being compiled from published materials.

### (7) THE GENETICAL COMPOSITION OF SMALL REGIONS OF INDIA OF DIFFERENT VEGETATIVE TYPES ETC.

The potentiality of mangroves as source of tannins were examined. For the first time the study of chromosomes of mangroves have been taken up by Dr. R. P. Patil, Botanist, Central Botanical Laboratory.

### (8) AN ASSEMBLAGE OF THE USEFUL GRASSES OF INDIA WITH A VIEW TO THEIR IMPROVEMENT

One of the first problems undertaken by the Central Botanical Laboratory was a comparative study of the varieties of *Cymbopogon martinii*, Sofia and Motia. While they are morphologically similar, the essential oils differ in chemical composition. The method of differentiation other than morphological, had to be discovered so as to make adulteration impossible. The Forest Department of Nagpur supplied the seeds of both Sofia and Motia. On being sown, they were found to be only mixed population of the two varieties. After making sculpture study of few plants it was found that Sofia variety had 20 chromosomes and Motia 40. In the field these two varieties can be distinguished apart, early flowering of the diploid as against late flowering of tetraploid Motia. The same number was noticed in our studies of Moong and *Saccharum* population of Lucknow. The difference in the flowering time of the diploids and polyploids is responsible for the absence of hybridization between the varieties. Six other species of *Cymbopogon* are included in these studies.

### (9) WORK ON TUBEROUS PLANTS

Besides Yams, the following diploid tuberous plants of India are being grown and examined for chromosome studies at the Central Botanical Laboratory.

*Colocasia*, Ginger, *Curcuma*, Sweet Potatoes, *Canna edulis*, Arrowroots and Tapioca.

Our study in *Colocasia* and *Curcuma* has shown that the wild species differed from the cultivated plants in their chromosome numbers while the species is generally diploid and tetraploid and the cultivated ones hexaploids.

### (10) STUDIES ON ENDEMIC ORCHIDS OF ASSAM

Study of Assam orchids was started while the Central Botanical Laboratory was at Calcutta and the genus *Dendrobium* was selected for special study. But, however, the plant had not flourished either in Lucknow or Allahabad and therefore our study had to be abandoned after making preliminary study.

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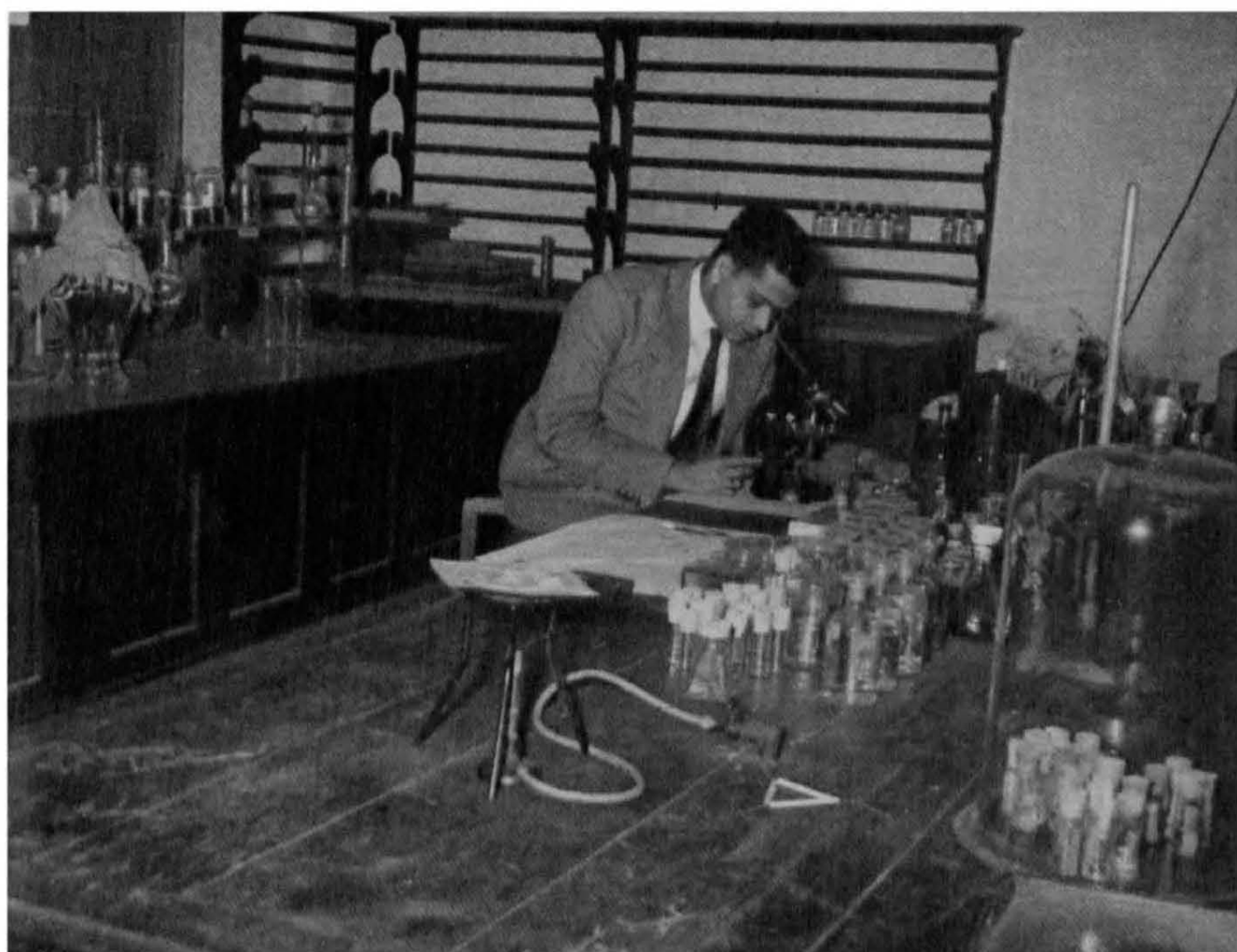
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*LIBRARY*



*The first home of the Central Botanical Laboratory in the Indian Museum.*



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### (11) SURVEY OF LANTANA SPECIES

A study of lantana species collected from various parts of India show interesting parallel evolution of polyploidy in the different coloured varieties. It was found that aggressive types are all tetraploid. The diploid forms of these have been found growing isolated on Nandi hills in Mysore and Ellora hills in Hyderabad and the Nilgiris.

Cyto-morphological evidence of the origin of tetraploidy from these isolated diploids is helping to solve the problem of lantana as a pest in India.

### (12) POLYPLOIDY IN RAUVOLFIA

3 species of Rauvolfia, *R. serpentina*, *R. densiflora* and *R. canescens*, are being extensively grown in the Central Botanical Laboratory for comparative study. Geographical races of *R. serpentina* from different parts of India are grown for the study of genetical variation and for the evolution of mutants by colchicine and X-rays. *R. serpentina* is a diploid with  $2n=22$ , *R. densiflora*  $2n=44$  and *R. canescens*  $2n=66$ .

Attempts to produce interspecific hybrids have so far not been successful.

### (13) WORK ON RADIO-ISOTOPES

A Radio-isotope Laboratory will be attached to the Physiology Department. This has not yet been started for lack of suitable and safe building for handling isotopes. At present the work is being done in collabora-

tion with the Biology Division of the Atomic Energy Establishment at Bombay and the following plants have been treated for mutation:

*R. serpentina*

*R. canescens*

*Dolichos sinensis*

*Zea mays* and 4 varieties of Papaya.

### (14) SURVEY OF THE FLORA OF MONAZITE REGIONS OF KERALA

Field work on the flora of Kerala involving the study of perceptible change in the plants growing on the monazite regions is being undertaken. Two visits have already been made and materials are being grown and analysed. Striking morphological differences have been noticed in the two medicinal plants, namely, *Bacopa monnieri* and *Lippia nodiflora*. This work is being extended to other plants found on the sands.

#### Herbarium

The Herbarium of the Central Botanical Laboratory has been arranged according to phylogenetic relationship based on the recent classification of plants (Hutchinson) and is supported by chromosome numbers wherever available. Thus it will be the first All India Reference Herbarium for Cyto-taxonomic work.

#### Publications

Several papers were published in Scientific Journals by officers of the Central Botanical Laboratory since its inception.