

**TROPICAL BOTANIC GARDEN AND RESEARCH INSTITUTE
TRIVANDRUM**



ANNUAL REPORT 1986

Front cover

Rauwolfia tetraphylla, one of the sources of the alkaloid reserpine.

ANNUAL REPORT

1986

TROPICAL BOTANIC GARDEN AND RESEARCH INSTITUTE
(T B G R I)

PALODE, TRIVANDRUM, KERALA, INDIA

PHONES : 70686, (Trivandrum) 26, 36, 46 (Palode)

Grams : TROPGARDEN

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6.	Director, Tropical Botanic Garden and Research Institute, Trivandrum	...	Member Secretary

PREFACE

The year 1986 marked all round progress in building up infrastructural facilities, garden development and research.

Two events deserve special mention. After prolonged discussions our scientists, engineers and architects had finalised the plan for the Laboratory and Library complex and the contract for the building was awarded in November. Work on the first phase of staff quarters was initiated. Land for this purpose was purchased in February after satisfying what seemed to be unending procedural formalities. Tenders for quarters were called after rushing through preliminary work such as preparation of a master plan, fencing in of boundaries, construction of roads, extension of telephone and electric lines and provision of water facilities. All these details were worked out in less than eight months and construction work began in October.

The Visiting Scientists' Guest House was completed and the Library and the taxonomists' laboratories were shifted to the new site in July. A new Orchidarium and a Community Pot Centre are nearing completion. The 4 Km long fencing around the garden was completed. Phase II of the irrigation system became operational. At the end of the year, work on the main arterial road, and the arboretum and medicinal garden road was on various stages of progress.

The medicinal plant garden has been renovated, more species added and a small exhibition section with 250 samples of officinal parts was built up. The seed bank exchanged material with the several international centres listed on pages 12 and 13. A computer was purchased for the library. The rose garden was given a fish-bone design and shifted to a site near the entrance. Our biotechnology division perfected techniques for propagation of two endangered species. The work on Palode Flora was published. The herbarium was expanded. In the Arboretum, the first phase of plantings was completed as scheduled. And our scientists also published several papers in leading journals.

Ambassadors, ministers and distinguished scientists visited the garden during the year but what surprised us was the steady flow of research workers and post-graduate students from many universities and colleges who spent profitable hours in our laboratory, library, herbarium and among the living collections. We also welcomed groups of enthusiastic students of the Science Clubs of various high schools.

One of the most important visitors of this year was Mr. Hans Fliegner from the Royal Botanic Gardens, Kew. This was his second visit and during the most rewarding month he spent with us, Mr. Fliegner reviewed the several projects initiated by him in 1984 and drew up syllabus for the course in basic horticultural training scheduled to be conducted during early next year.

We mourn the death of Vyeskara N. S. Mooss, the renowned scholar and Ayurvedic Physician, who was our consultant from the beginning of this Institute and the sudden passing away of Sri. K. Sankaranarayanan, an officer of unswerving loyalty and integrity.

The Institute has to cross many hurdles to reach the status of a real centre of excellence but at this moment we have plenty to thank for and hope for the future.

Professor A. N. Namboodiri Director, TBG & RI

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PLANT BIOTECHNOLOGY

Conservation of endangered plant species

Biotechnology offers means to conserve important, elite and rare plant species which are threatened with population depletion and genetic erosion. It is forecasted that due to rapid deforestation and consequent microclimatic changes, there will be insufficient habitats to sustain viable populations of plants. Conservation biologists are therefore forced to depend more and more on *ex situ* care and biotechnological methods for protecting those rare and important plants which are otherwise on the verge of extinction. For obvious reasons such as their immobility, their natural potential for seed dormancy and also the diverse breeding systems present in them, plants including the endangered ones form the best systems for biotechnological investigations. Their unusual capacity for cellular totipotency could best be used for rescuing and multiplying the vanishing species through plant tissue culture technology. As there can be no better place than a botanical garden to undertake projects on maintenance and propagation of such species, attempts were made to multiply two of the selected plants, one orchid, (*Vanda coerulea* Griff.) and another medicinal plant (*Kaempferia galanga*) both of which are listed out as endangered in the IUCN publication on Rare and Threatened species of India.

Experiments conducted with one year old seedlings showed that both excised leaf bases and bases of intact leaves were capable of producing protocorm-like bodies (PLB) within three months of culture in a suitable nutrient medium. Among the various nutrient formulations tested, the commercial fertilisers, Gaviota 63 and Gaviota 67 supplemented with coconut water, peptone and banana pulp promoted maximum PLB differentiation. As many as 60 plantlets could be obtained from a single leaf base within a period of six months. Regeneration response was completely lacking in tips and mid-portions of the leaves. Leaf base-derived plantlets were separated and transferred to fresh nutrient medium for further development into mature plantlets that could be transferred to community pots. The plantlets were robust and hardy

with well developed roots, showing a survival frequency of more than 98% after transplantation into the pots. The possible effect of the relative age of the leaf on PLB differentiation, growth characteristics of the seedlings in the nursery and occurrence of 'sports' among the regenerants is now being ascertained.

A few experiments were carried out to determine the nutrient requirements of seedlings raised from green-pod culture. Six months old seedlings recorded maximum growth on Knudson C medium supplemented with coconut water 30%, casein hydrolysate 500 mg/l, peptone 500 mg/l, MS vitamins and folic acid 0.1 mg/l. One year old seedlings, however required further supplementation of the medium with 0.2 mg/l NAA for optimal growth and development.

In *Kaempferia*, axillary buds of the underground rhizome and the bases of the scaly leaves covering such buds formed the best sources of tissue for rapid multiplication of plants. Highly consistent, multiple shoot formation (3-8 shoots/bud) without any visible callus occurred on MS medium supplemented with IAA 2.5 mg/l and BA 1.0 mg/l. Though multiple shoot formation was of common occurrence in media containing higher concentrations of cytokinins (kinetin and 6-benzyladenine) the roots formed were few and unhealthy. Significant increase in fresh weight was observed with the buds cultured in liquid media though the number of shoots remained more or less the same in both solid and liquid nutrient media. A tendency to shooting was observed in liquid media even when a combination of 2,4 - D 2.0 mg/l and BA 0.5mg/l which promoted callusing on agar media was used. Individual cytokinins did not evoke positive shooting response; however, cytokinins were obligatory for shoot regeneration in callus cultures. The regenerated shoots with well developed roots were transferred to pots and maintained in the culture room for a period of at least one week before being transferred to the nursery area. The percent survival of the plantlets after transplantation was nearly 100. The plantlets produced additional shoots and roots within a period of 2 weeks. Most of these roots proved to be aromatic and tuberous as they swelled up in size after a period of six weeks.

Micropropagation of ornamentals, ferns and other plants

Orchids

As part of our attempts to develop the best orchid tissue culture media with raw materials available locally, the effect of Borassus endosperm pulp (BEP) on protocorm differentiation and growth of two different orchids, *Dendrobium* Ng Eng Cheow and *Cymbidium aloifolium* was investigated. Presence of 15% BEP in the medium significantly enhanced the growth of the seedlings compared to the standard medium supplemented with tender coconut water. Combinations of BEP and low concentrations of auxins (IAA or NAA 0.5 mg/l) caused maximum growth as evidenced from fresh weight determinations and expression of morphological characters. Different concentrations of 2,4-D and 2-isopentenyladenine and combinations of NAA and cytokinins were found to be inhibitory to the growth and differentiation of the protocorms. Borassus haustorial homogenate (BHH) was found to be especially useful for multiple shoot induction from protocorms at concentrations of 1 to 2.5% (wt/volume). High concentrations of BHH seemed to be inhibitory to growth.

Suitable nutrient media were standardised for the culture of hybrid embryos obtained from successful crosses. Hybrids of atleast 4 different crosses have already been multiplied using these media. The crosses were:

♀	♂
Dendrobium Tay Swee Kang	X Dend. Ng Eng Cheow
Dendrobium Toshiko	X Dend. chrysanthum
Vanda tessellata	X Vandopsis Twinkle
Renantanda Henry Truman	X Vanda coerulea

Ferns

Spores of different ferns received from the Royal Botanic Gardens, Kew were cultured and sporophytes raised in five of them have been successfully transferred to community pots.

Trees

Seeds of three rare tree species from Kew were germinated on basal MS medium. Five seedlings of St. Helena Redwood and

one of *Hovea lanceolata* were subsequently transferred to pots for further growth in the nursery.

Calamus

The rattans are on the wane from the forests of the Western Ghats where they form an important raw material for the cottage industry. Initial studies with the culture of immature embryos of this important palm have yielded some positive results. Whereas a combination of 2, 4-D (2.0 mg/l) and BA (0.5 mg/l) promoted shoot development, coconut water (20%) alone induced haustorium development in liquid cultures of *Calamus hookerianus* Becc. Embryos of *Calamus thwaitesii* Becc. produced shoots with relative ease on MS medium supplemented with NAA 0.8 mg/l and Kinetin, 2.0 mg/l. Induction of calli from the tender leaf bases did not yield desired results.

Withania

A highly consistent regeneration system was established from the nodal meristems of *Withania somnifera*. It is proposed to use the axenic shoot cultures for establishing protoplast regeneration and transferring traits such as nopaline synthesis and kanamycin resistance using the *Agrobacterium* strains available with us.

The important prerequisite in a protoplast regeneration and somatic hybridization scheme is the isolation of viable protoplasts. The method of protoplast isolation was therefore refined with low concentrations of macerozyme (0.25%) and cellulase (1.0%) to permit large scale isolation of protoplasts from diverse taxa and sources of tissue including protocorms and pollinia. Mesophyll of *Anoectochilus elatus* yielded maximum number of protoplasts (3.1×10^6 protoplasts/g fresh wt). The yield of such protoplasts from the cultured seedlings of *Vanda coerulea* and *Cattleya* Wine Festival was significantly higher than that of the potted mature plants.

Seedling-derived protoplasts of *Phalaenopsis* Fire Water Ponce and *Dendrobium* Ng Eng Cheow cultured in MSH medium supplemented with appropriate concentrations of NAA, BA and 2, 4-D increased in size within two weeks. 3-8% protoplasts, particularly the less or non-pigmented ones, 'budded' after 6 weeks

of culture. Apparent protoplast divisions were not followed by cell wall synthesis. The budded protoplasts perished in prolonged culture. The results suggest that the less pigmented protoplasts apparently derived from the tender leaf bases and vascular parenchyma are more desirable for culture experiments than those of the green mesophyll tissues. Successful application of the methods in orchid breeding depends on further refinement of the nutrient media and protoplast culture technique to get increased plating efficiency and protoplast regeneration.

Biochemical changes during orchid differentiation

Preliminary studies on the development of protocorms from tender leaf bases of *Cymbidium* suggested a biphasic nature of the process. The initial phase is characterised by the uptake of nutrients and the later phase by degradation of starch and protein synthesis. Based on these results, attempts were made during the latter part of the year to analyse the proteins that are synthesised during the development by gel electrophoresis. Techniques were therefore standardised to separate the proteins of crude extracts prepared from the leaf tissues under denaturing and non-denaturing conditions. Enzymatic analysis of the extracts with reference to amylase was also made. The experiments now in the penultimate stage would soon be completed elucidating the dynamic nature of the unique differentiation process.

Production of haploids through anther culture in Cassava

Multicellular bodies and calli were routinely established from cultured anthers of Cassava M-4 variety. They were found to develop from exine-free uni-nucleate pollen. Cytological observations further provided evidence for the haploid nature of at least 30% of the calli where the chromosome number of the cells varied from 17 to 20. Some of the calli were 'chimeric' as cells of varied ploidy levels were present in the same callus.

The calli were transferred to differentiation media in an effort to induce shoot regeneration. They usually turned brown and eventually necrosed in most of the media supplemented with different permutative combinations of phytohormones. Incorporation of substances such as charcoal, ascorbic acid and PVP in the

medium was not effective in preventing browning. Green patches of cells were infrequently observed in the less-affected calli, some of which produced roots on prolonged culture in the same nutrient medium. However, till date, these patches have not responded to our attempts to induce a shoot initiation.

PLANT TAXONOMY

The work on the flora of the garden site briefly mentioned in the previous report came into fruition in June 1986 with the publication of 'Flora of Tropical Botanic Garden, Palode'. The work includes the essential nomenclatural details and botanical descriptions of 317 wild species belonging to 82 angiosperm families and is based upon a study of 520 representative herbarium specimens prepared from more than 1500 specimens collected from the 121 hectare natural forest and cleared areas of the garden site. Diagnostic, bracketed keys are provided for families, genera and species.

Copies of the flora were sent to leading taxonomists in India and abroad and also for reviews to taxonomic journals. The book is priced at Rs 50/- per copy.

Ecological studies with Professor Andrew Grellet

Ecological studies on the forests of Palode, Ponnudi, Kallar and Bonacaud in Trivandrum District were carried out under the guidance of Professor Andrew M. Grellet, Department of Biology, Queens College of the City University of New York. Data on phytogeographic distribution, plant succession, growth and biomass production of more than 2000 trees were gathered from these forests and are now being analysed for preparing a final report.

Herbarium

The herbarium is enriched with additional 2536 mounted sheets and 7788 duplicates during the year. 2200 specimens (including duplicates) have been processed, poisoned and kept for mounting. 125 spirit collections were made for display purposes. Voucher specimens of 'Flora of Tropical Botanic Garden', Flora of the Carnatic and Professor K. Narayana Iyer's collection have been processed; they were poisoned, mounted,

fumigated, labelled, accessed and arranged according to the modified Bentham and Hooker's classification as followed at the Royal Botanic Gardens, Kew and BSI Calcutta.

The updated position of the collection is as follows:

Total mounted Herbarium sheets	:	7,200
Duplicates	:	15,497
Processed (but not mounted) specimens	:	2,200
Spirit collection	:	125
Calamus collection (including duplicates)	:	300
Accessioned specimen	:	1,500

Introduction of unified labelling system

After extensive discussions with Mr Hans Fliegner of the Royal Botanic Garden, Kew and after studying the various systems of labelling in international botanic gardens it was decided to adopt a unified system of labelling with the following broad categories:

1. *Display labels*: One of the widely used types in the garden are designed to contain all the basic details of the species. These are of two types:

- a) Nailing type (15 × 10 cm. aluminium) is intended for arborescent plants with trunks having more than 10 cm in diameter
- b) Pegging type (12.5 × 7.5 cm. aluminium) for potted plants and planted arborescent species with trunks having less than 10 cm in diameter.

The first type is to be nailed on to the tree trunk while the second one is pegged in the soil or in pot.

2. *Identification labels*. These are mainly intended for visitors with a scientific background.

- a) Inserting type (9 × 3.5 cm.)
- b) Foil type (9 × 2.5 cm.)

3. *Educational labels*. (basically of 25 × 15 cm, but the size can vary). These are to be used in the scientific

display of a group of plants having a common cause or interest and will contain more details than are provided in other labels.

The labels are to be wooden or aluminium material and letters will be painted or engraved on them.

Project proposals submitted

The following research proposals were prepared in consultation with the Director and other scientists and submitted for approval by the Research Advisory Committee. It is proposed to start the work from next year.

1. Taxonomic studies on Indian orchids
2. Taxonomic studies on Insectivorous plants of India
3. Collection and conservation of Bamboos in Tropical Botanic Garden and Research Institute, Palode
4. Forest Exploration of Pathanamthitta District with special reference to the collection and introduction of arborescent species in to the Garden and Flora of the District
5. Study and introduction to garden of wild flowers of Kerala

Miscellaneous

Bibliographic work on Indian flora with special reference to species of the Western Ghats is in progress. This will form the basis of our future work on the Flora of Kerala

Identification and labelling of wild plants in our collection were done as and when they flowered during the year. This includes 27 species of medicinal plants belonging to 22 genera and 19 families and 23 species of orchids belonging to 15 genera.

The herbarium specimens of Maharashtra State brought from Sardar Patel University, Vallabh Vidyannagar in the year 1985 were indexed and the list prepared. Renovation and stitching of about 60 specimens were also completed.

One species each of *Philodendron*, *Maranta* and *Anthurium* required by the Joint Director, Central Plantation Crops Research Institute, Kayamkulam were collected, species identified and handed over to him.

GARDEN DEVELOPMENT

Plant Introduction

Plants of various groups were introduced into the garden by the combined efforts of personnel attached to Plant Taxonomy, Herbarium and units of the Garden Development. One of the best introductions was a gift of five rare cycad species from the Royal Botanic Garden at Kew. They are *Ceratozamia kuesteriana*, *Cycas rumphii*, *Dioon edule* var. *angustifolia*, *Dioon spinulosum* and *Encephalartos barteri*.

With the addition of 18 species this year, the *Ficus* collection has gone up to 56 species. Of these, 7 species were brought by Mr Hans J. Fleigner from Kew on his second visit to the garden in October 1986. Mr Fleigner also brought seeds of St. Helena red wood, St. Helena ebony and St. Helena rebony of which St. Helena rebony is established at the garden site. Other important trees introduced are *Antiaris toxicaria* (Maravuri - the tree from which bark cloth is taken) *Ghuta travancorica*, an endemic of Travancore and *Adansonia digitata* (Baobab tree).

Greater emphasis was given to introduce plants especially tree species from various botanic gardens of the world based on their list of seeds for exchange. Largely due to the efforts of Ambassador Manfredo Maciotti of EEC, contact with ten botanic gardens in Europe was established. Seeds of 162 varieties of Solanaceae and Cucurbitaceae were introduced from the Central Institute for Genetics, Gatersleben, GDR for growth trials.

Fifty new species of medicinal plants were added to the Herbal Garden. The strength of germplasm of medicinal plants is now raised to 650 species. A few of the important herbs introduced are *Dioscorea floribunda*, *Mentha piperita*, *Vanilla planifolia*, *Heracleum candolleianum*, *Solanum khasianum*, *Equisetum arvense* and *Helminthostachys zeylanica*.

Seedlings of 80 species including *Victoria amazonica*, *Victoria cruziana* and *Cycas rumphii* were introduced from the Indian Botanic Garden, BSI, Calcutta.

Seeds of 10 species of palms (*Arenga pinnata*, *A. triandra*, *Bentinckia nicobarica*, *Chrysalidocarpus lutesee*, *Elaeis guianensis*, *Hyphaene thebaica*, *Licula grandis*, *L. peltata*, *L. spinosa*, and *Rhaphidoblaste augusta*) were also brought for introduction into the garden. Capsules of *Coelogyne stricta*, *Coelogyne sp.*, *Cymbidium devonianum* *C. eburneum*, a *Cymbidium* hybrid, *Dendrobium hookerianum*, *D. ochreatum*, *Paphiopedilum spicerianum*, *P. venustum*, *Pleione maculata* and *Thunia marshalliana* were brought from Shillong for *in vitro* culture. Three collection trips to the forests of the Western Ghats were made as a result of which ten species of *Calamus* were introduced into the garden.

Arboretum

About 150 seedling of 60 species were added to the tree collection. These seedlings were collected from forest areas of the state, from private nurseries and also from the seeds received from other botanic gardens. 140 species were planted at the arboretum this year raising the number of species established in the Arboretum to 240. Also, saplings of another 120 species are maintained for planting during the monsoon season of 1987. Work on an approach road along the periphery of the arboretum was started in December 1986. The completion of this road would make the arboretum easily accessible to interested visitors and students.

Ornamentals

Ornamentals both foliaceous and flowering plants were mostly bought from nurseries all over the country. Out of 122 taxa of ornamental value added during the year, the foliage plants included 25 spp./cv of *Codiaeum variegatum*, 13 spp./cv of *Sansevieria*, 8 spp./cv of *Asparagus*, 16 spp./cv of *Dracaena*, *Acalypha*, *Calathea* etc. and the flowering ones included 52 spp./cv of *Hibiscus*, 11 spp./var of *Ixora*, 5 spp./cv of *Allamanda*, 25 of *Gerbera*, *Dahila*, *Gladiolus* etc. At present, ornamental plants section is represented by 746 taxa of ornamentals which include orchids and roses as well.

The section was particularly benefited by the visit of Mr Fliegner. Discussions were held and a layout of the orna-

mental garden was prepared. Accordingly, roses and *Hibiscus* varieties hitherto confined to the nursery and propagation shed, were planted in an area in front of the Guest House. Landscaping of this area was also partially completed during the period.

Medicinal Plants

The medicinal plant garden has been improved in its form and shape covering about 3 acres of land mostly consisting of slopes. The garden is bounded by the main road of the garden on one side and the Chittar river in South West direction on the other. With the completion of a road extending from the ornamental plants' nursery to the medicinal plant garden along the side of the river, the garden has become more accessible to the visitors. A plot for growing aromatic plants was developed and work on the construction of a hut surrounded by aromatic herbs is in progress. This hut may be later used by the visitors to the garden as a resting place. A newly laid lawn characterized by the abundant growth of *Centella asiatica* and a small pond with profusely growing *Nelumbium speciosum* in the centre of the lawn are added attractions of the garden.

A quick aerial view of the herbal garden more or less in its full form may be had at the place where the approach path connecting the iron bridge gate meets the main road inside the garden. It is proposed to raise a viewing platform in this area.

Specimens of about 650 species were added to the existing collection of medicinal herbarium raising its strength to 850 species. This includes, 500 specimens representing 500 species from Professor K. Narayana Iyer's collection donated by his daughter Professor N. Lakshmi of Government Ayurveda College, Trivandrum. In order to develop a museum with officinal parts used in herbal medicines, 200 samples were gathered largely through the efforts of Professor V.P.K. Nambiar. These precious samples are well displayed in a manner which on sight gives the curious visitor a deep insight into the raw materials precisely used in the preparation of some of the best medicines in Ayurveda.

Seeds of medicinal plants were collected periodically from the garden for purposes of seed exchange and germplasm storage.

In addition, planting materials of some 30 species were supplied to the social forestry wing of Kerala Forest Department.

The endangered and highly valuable *Coscinium fenestratum* was selected for propagation through conventional means. The initial results mentioned elsewhere in the report are encouraging. It is planned to run a series of experiments under different external conditions to maximise regeneration of plants from stem cuttings.

Germplasm Centre and Seed Bank

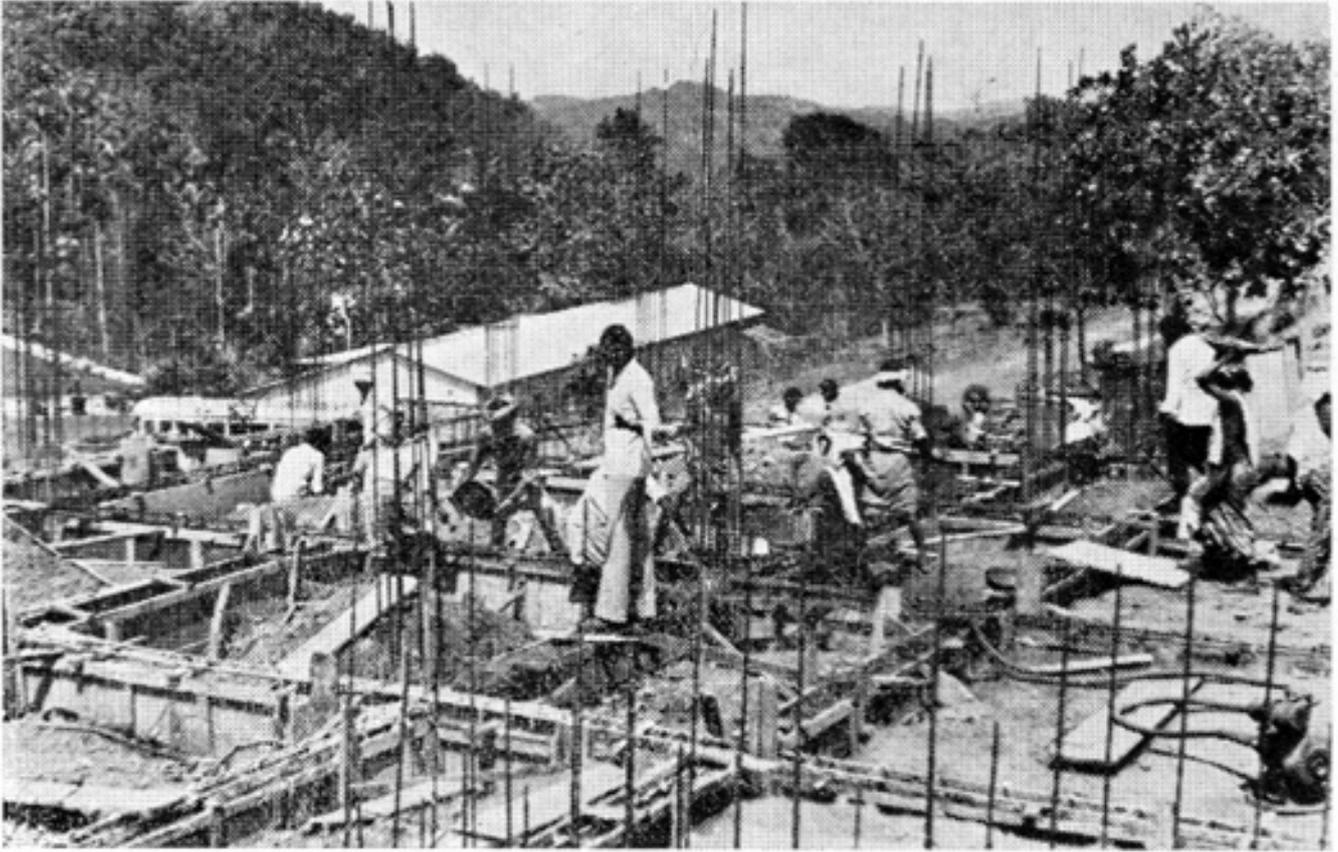
Actual functioning of the Seed bank started during the report year by assembling some of the essential requirements and by exchanging plant germplasm. On the basis of the guidelines and informations received from Kew, IRRI, IBPGR and ICRISAT, the particulars of the requirements for establishing a seed bank for handling active collections in our climatic conditions were formulated. Accordingly, a chest type deep freezer with a temperature range of 5°C to -20°C was imported for storing very important plant seeds, fern spores etc. Stackable plastic crates for storing seeds and covers for sending seeds etc. were also made available.

Over 50 requests for our plant seeds were received from Botanic Gardens/Universities around the world as a result of our Index Seminum published in 1985. The first 25 requests were processed. The necessary seed material was collected, dried and about 300 seeds samples were sent to the botanic garden/universities. Requests from the following centres have already been served while the remaining are being processed.

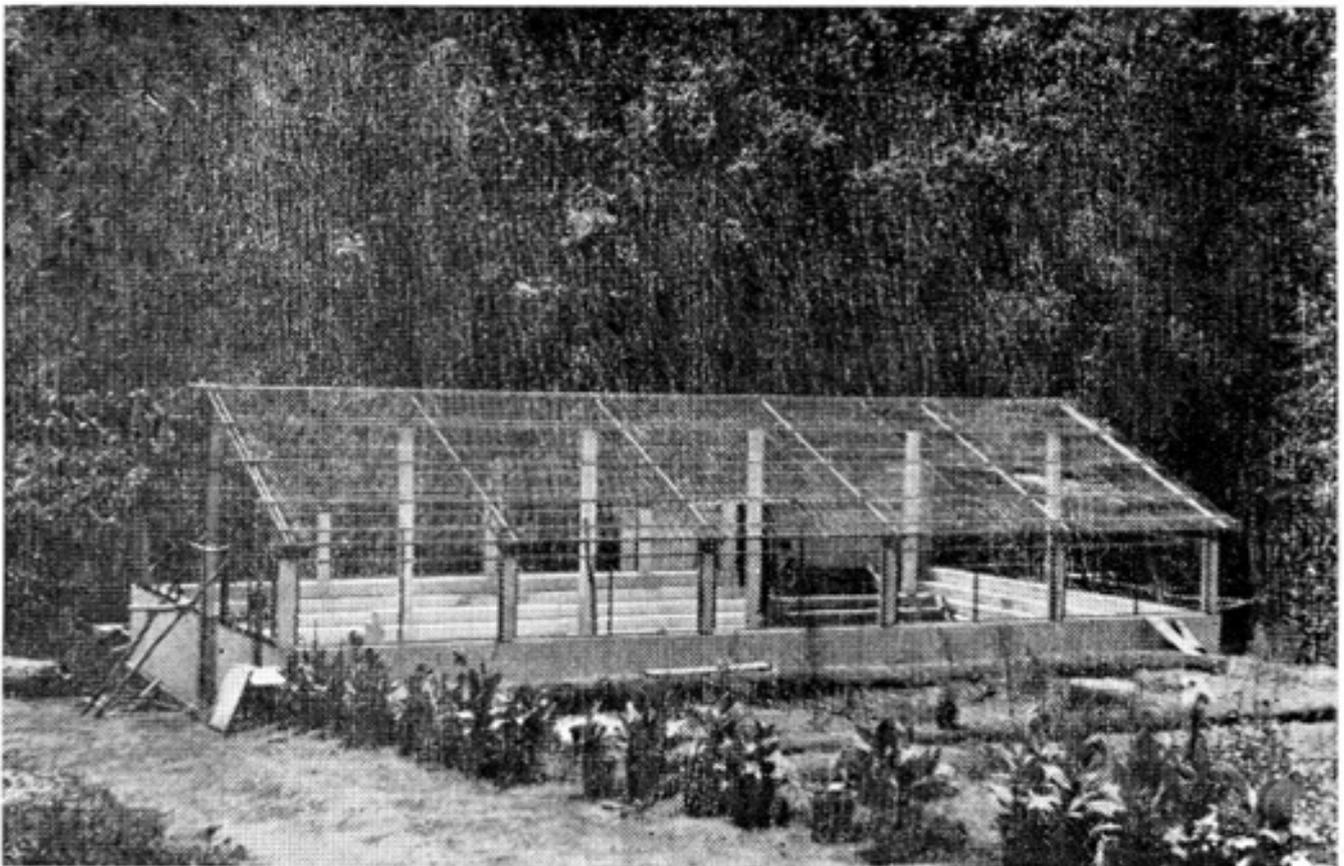
1. Botanischer Garten, Munchen, F. R. Germany
2. National Botanical Research Institute, Lucknow
3. Royal Botanic Gardens, Kew, England
4. Hortus Botanicus, Amsterdam, The Netherlands
5. Estacao Agronomica Nacional, Portugal
6. Botanischer Garten, Halle, GDR
7. Hortus Botanicus, Guangzhou, China
8. Nippon Shinyaku Institute, Kyoto, Japan
9. Dept. of Botany & Forestry, University of Toronto, Canada
10. University of Helsinki Botanic Gardens, Finland
11. Jardin Botanique, Copenhagen, Denmark



Dr Manmohan Singh, Vice Chairman, Planning Commission planted a sapling at the conclusion of his visit to the Garden on August 23, 1986.



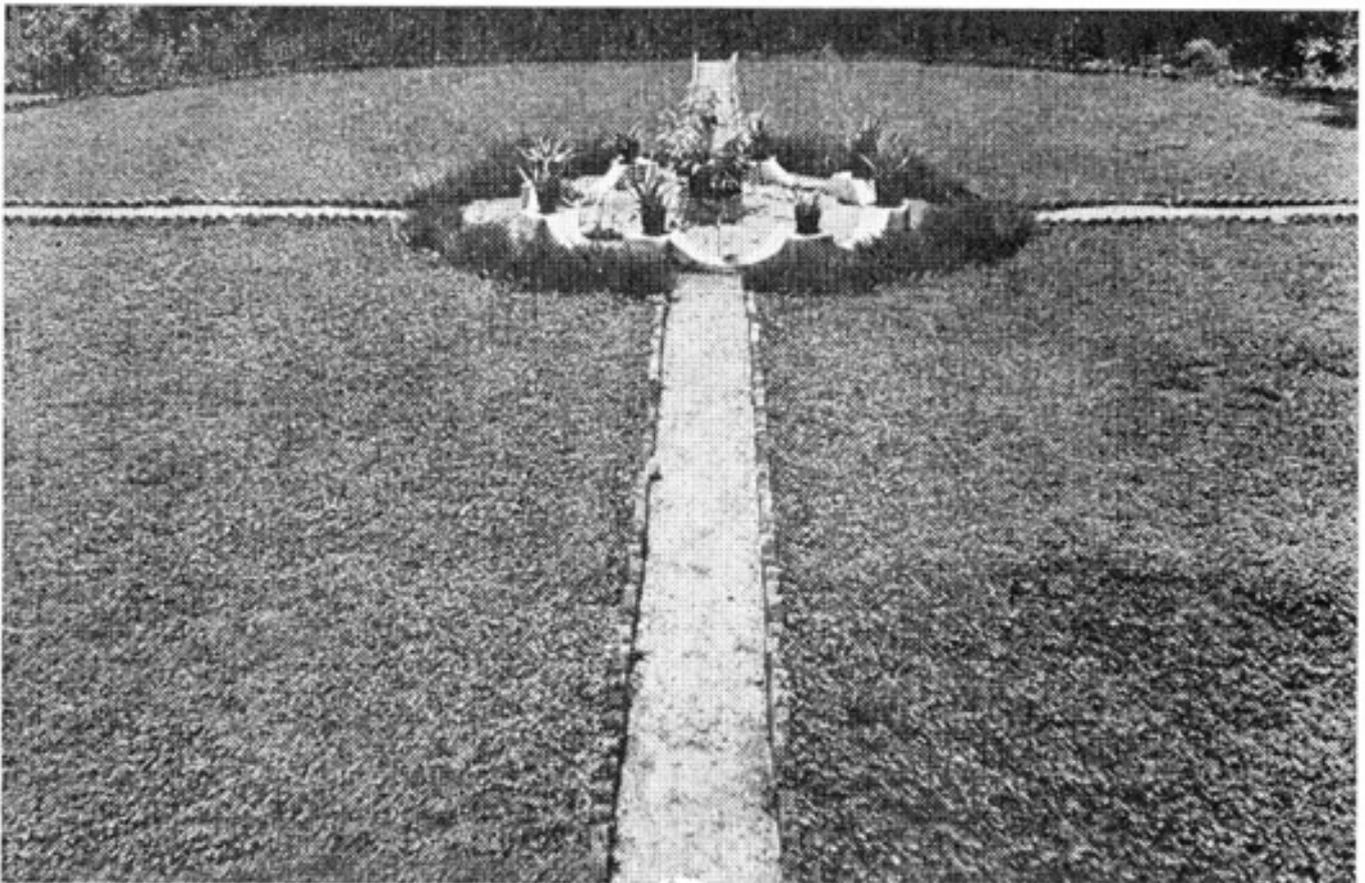
Construction work on the main Laboratory-Library Complex began towards the end of December 1986.



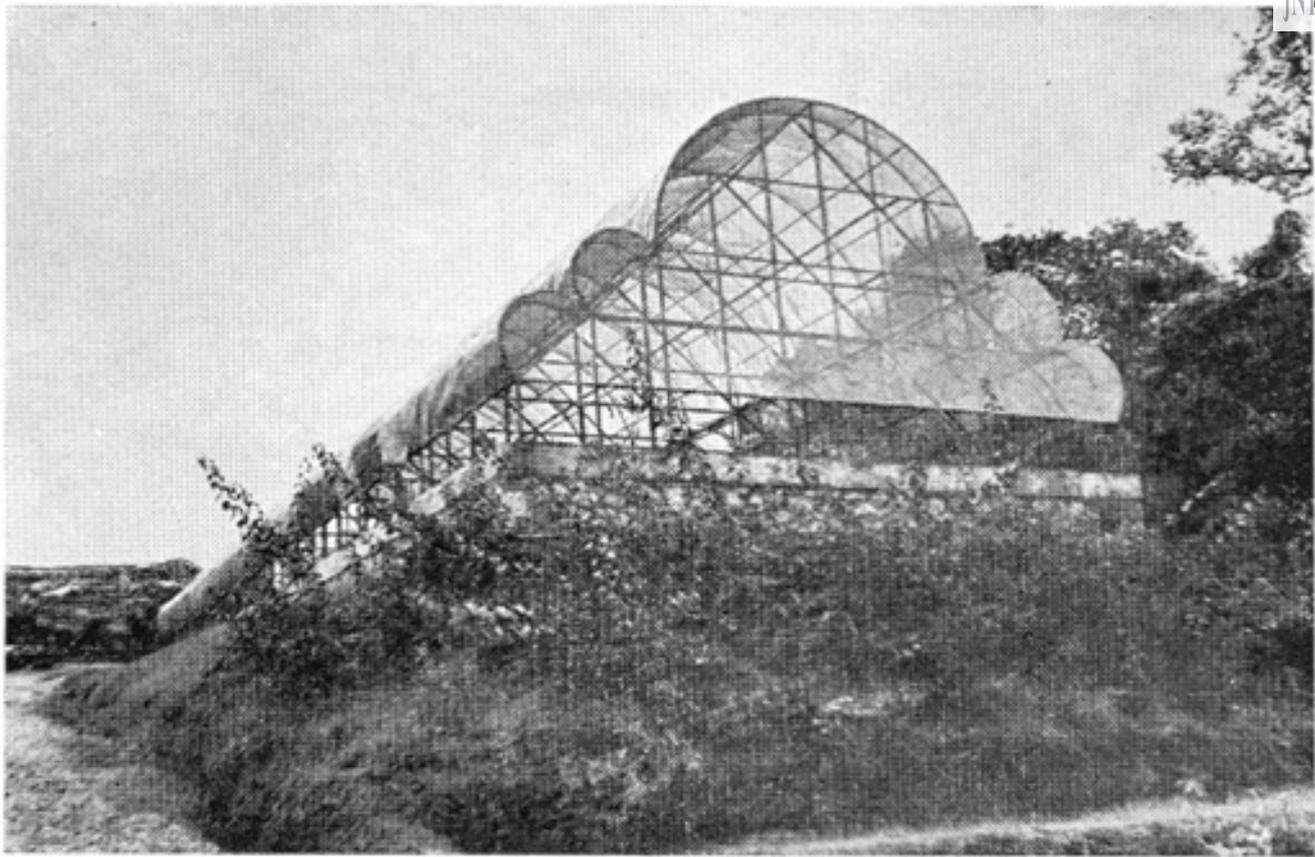
The Community-pot Centre would be commissioned by the end of the year.



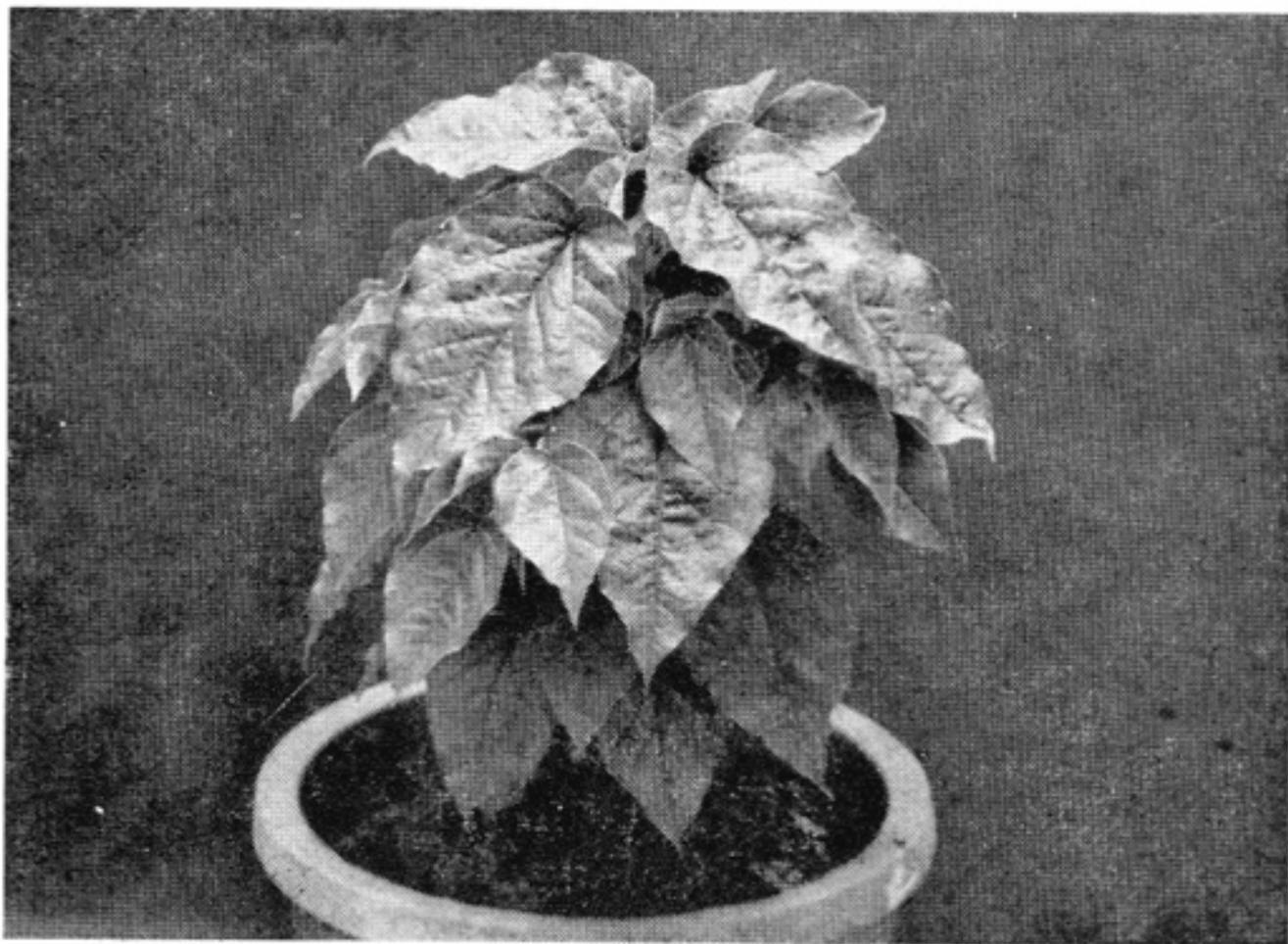
Steep slopes dominate the Garden Site. Here, a difficult terrain is being landscaped for plantings.



Grassless lawn. *Centella asiatica*, a medicinal plant was substituted for grass in this lawn.



The New Orchidarium.



St Helena Rebony : An exotic curiosity.

12. Pacific Tropical Botanic Garden, Hawaii, U. S. A.
13. Botanic Gardens, Singapore
14. J. L. Hudson, Seedsman, California, U. S. A.
15. Institute of Ecology and Botany, Vacratot, Hungary
16. Palmengarten, Frankfurt, F. R. Germany
17. Orto Botanico Dell Universita, Padova, Italy
18. Laboratory de Anallsa de Sementes, Brasil
19. Fovarosi, Budapest, Hungary
20. Central Institute for Genetics, Gatersleben, G. D. R.
21. Museum National D' Historie Naturelle, Paris, France
22. Jardin Botanique, Bordeaux, France
23. Botanic Gardens, Glasgow, Scotland
24. University of Edinburg, Scotland, U. K.
25. Royal Botanic Gardens, Wakehurst Place, U. K.

Fresh seeds of *Hevea braziliensis* and *Hopea parviflora* were specially supplied to Royal Botanic Gardens at Kew and Wakehurst place, U. K., for growing plants and for storage experiments, respectively.

The unit received seeds/spores of 230 species from the following 10 botanic gardens/universities abroad. On germination these plants will be added to the plant wealth of the garden.

1. Royal Botanic Gardens, Kew, U. K.
2. Hortus Botanicus, Guangzhou, China
3. Nippon Shinyaku Institute, Kyoto, Japan
4. Botanischer Garten, Halle, G. D. R.
5. Botanic Gardens, Glasgow, Scotland
6. Montreal Botanic Gardens, Canada
7. Botanischer Garten, Wien, Austria
8. Morton Arboretum, Illinois, U. S. A.
9. Botanical Garden of the University of Amsterdam, The Netherlands
10. Mr Peter, R. A. Dolphin, Hants, U. K.

THE LIBRARY

This was a year of hectic activity. Decision to buy a micro-computer and an automatic plain paper copier for the Institute was taken in the beginning of the year. The Assistant Librarian held discussions with computer experts available in Trivandrum to decide the type and capacity of the system required and other details. Ultimately the system offered by Keltron, KELTRON PC 400 with printer was selected. The copier was also purchased. In July 1986, the library was shifted to the Visiting Scientists' Guest House building at Palode. Thereafter, Public Relations and sale of publications were also entrusted to the Library Division.

Books and Periodicals

During the year 1986, 602 volumes were added to the collection raising the total to 3166. Almost all the books were classified and catalogued.

A thorough scrutiny of the journals currently subscribed to was made and order for the year 1987 was placed with few deletions and additions in the existing list. Consequently, the number of journals in 1987 would rise to 85 in the place of 77 at present without considerable increase in the subscription cost. More than 25 newsletters and journals are also received free of cost.

Other Documents

Microfiche of the Herbarium collections of Lindley, Linnaeus and Wallich which would immensely help the taxonomists in the identification of specimens were procured from Inter Documentation Company, Switzerland. A portable microfiche reader was obtained from the company as a free gift.

Services

With the installation of an automatic photocopying machine, the reprographic work could be done more effectively. Rules were framed for the proper use of the machine. Steps to prepare a database of the plants accessioned in the garden and an inventory of the holdings of the library are on the anvil.

In spite of the distance from the city, many students, research scholars and teachers from the colleges and the University of Kerala made use of the Library.

Training Programmes

As a part of the programme to train scientists in computer use, a series of seminars were arranged in January. Sri A. K. Poojary, Head of the Computer Centre, University of Kerala and Sri K. Kalyanaraman, Department of Statistics, University of Kerala were the principal speakers.

The Assistant Librarian participated in a two week training programme, 'Personal Computers and Basic Programming' conducted by CMC Limited, Madras in November 1986.

Publications

First issue of the Newsletter TROPGARDEN NEWS was released in January 1986. Sales of the publication *Flora of Tropical Botanic Garden, Palode* has also been taken up.

METEOROLOGY STATION

The meteorology station established last year was immensely useful in monitoring weather at the garden site. For the first time, complete data on precipitation, evaporation, maximum temperature and relative humidity were available for the entire year. Data were collected at two times (0830 hrs and 1730 hrs) daily and mean values were calculated on a monthly basis.

<i>Month</i>	<i>Precipitation</i>	<i>Evaporation (mm)</i>	<i>Maximum Temperature °C</i>	<i>Relative humidity %</i>
1	2	3	4	5
January	14.2	130.7	32.9	71.8
February	70.0	152.0	34.1	72.3
March	23.8	177.8	34.4	73.7

1	2	3	4	6
April	171.9	140.7	34.9	78.3
May	146.2	130.5	33.0	78.5
June	191.3	97.5	30.5	81.2
July	142.0	98.4	30.1	82.3
August	335.7	113.7	29.9	80.7
September	173.3	108.1	30.6	78.2
October	221.5	95.1	31.2	84.2
November	224.4	138.0	30.9	80.8
December	12.7	160.9	33.1	73.5

PARTICIPATION IN SEMINARS, WORKSHOPS AND TRAINING PROGRAMMES

1. Shri S. Mukunthakumar, Assistant Herbarium Keeper received training on various aspects of modern Herbarium keeping at the Central National Herbarium, Botanical Survey of India, Howrah during the months of February and March 1986.
2. The staff of the Medicinal Plant Section (Shri P. J. Mathew and Shri A. E. Shanavaskhan) participated in the following events:
 - a) 'Karshaka Mela' organised by CPCRI Regional Station at Palode on 16th February 1986 and exhibited medicinal plants that could be commercially cultivated in Kerala.
 - b) Seminar on 'Role of indigenous drugs in the treatment of viral hepatitis' organised by the Department of Microbiology, University of Madras on 28th and 29th of August, 1986 at Madras.

- c) Seminar on 'Medicinal plants' conducted by Prakrithi Chikitsa Sahakarana Sanatorium Ltd. at Trichur on 23rd November 1986. Presented a paper on 'Conservation of Medicinal Plants'.
3. Shri C. Sathish Kumar, Junior Scientific Assistant participated in a workshop on Conservation Biology held at Bangalore under the auspices of the Centre for Ecological Sciences, Indian Institute of Science, Bangalore during 10-22 November 1986. Presented a paper entitled 'Diversity and Conservation of Orchids in Kerala'.
4. Shri K. P. Vijayakumar, Assistant Librarian, attended a two week training programme on computer at Madras in November 1986.

LIST OF PUBLICATIONS

1. Nayar, T.S., K.C. Koshy, C. Sathishkumar, N. Mohanan and S. Mukuntakumar. Flora of Tropical Botanic Garden, Palode. TBGRI Publication 1986. p. 144
2. Chanda S. V., A. K. Joshi, P. N. Krishnan, P. P. Vaishnav and Y. D. Singh 1986. Distribution of indoleacetic acid oxidase, peroxidase and esterase activities in relation to elongation growth in pearl millet internode. J. Plant Physiol. 122: 373-383
3. Chanda, S. V., A. K. Joshi, P. N. Krishnan and Y. D. Singh 1986. Distribution of glycosidases and acid invertase activities in relation to elongation growth in pearl millet internode. J. Exp. Bot. 37: 1406-1415
4. Joshi, A. K., S. V. Chanda, P. N. Krishnan, P. P. Vaishnav and Y. D. Singh 1986. Chlorophyll content and Hill reaction and PEPcase activity in relation to hybrid vigour in pearl millet during early seedling growth. J. Agro. Crop Sci. 157: 1-12
5. Joshi, A. K., S. V. Chanda, P. N. Krishnan, P. P. Vaishnav and Y.D. Singh, 1986. Seedling peroxidase and LAA-oxidase activities in relation to hybrid vigour in pearl millet (*Pennisetum americanum* L. Leeke) J. Agro. Crop. Sci. 157: 156-168
6. Koshy, K. C. and G. L. Shah 1986. On the occurrence of *Aspidopterys nutans* Juss (Malpighiaceae) in Peninsular India J. Econ. Tax. Bot 7: 553-555

7. Madhusoodanan, P. V. and C. Sathish Kumar, 1986. *Schizaea digitata* (L.) Sw. in South India. Ind. J. Bot. 9: 144-146
8. Manilal, K. S. and C. Sathish Kumar, 1986. Researches on Indian Orchids — A Review.
In S P Vij. (ed), Biology, conservation and culture of Orchids. pp 1-16. East West Press, New Delhi.
9. Manilal, K. S. and C. Sathish Kumar, 1986.
Thrixspermum pulchellum (Thw.) Schltr. (Orchidaceae) A new record for India. Ind. J. Bot. 9: 11-13
10. Nayar, T. S. 1986. *Smithia aghar karii* Hernadri — A new synonym for *Smithia hlgemina* Dalz. Indian Forester 112: 353-356
11. Nayar, T. S. 1986. Keralatile Sasyasambatu. Yojana, 14: 4-9

Seminars

The TROPGARDEN FORUM organised the following seminars

9- 1-1986	Sri A. K. Poojari	Computer and its organization
10- 1-1986	Sri A. K. Poojari	File organization
10- 1-1986	Sri Kalyanaraman	Computer Programming
13-10-1986	Mr Hans Fliegner (Royal Botanic Garden, Kew)	Botanic Gardens of the World
15-11-1986	Prof. Dr C. D. K. Cook (University of Zurich)	Pollination Biology of some selected genera of Hydrocharitaceae

CIVIL WORKS

The take off period in construction was 1985 and a review of the achievements was given in last year's annual report. This note gives a short account of the progress made this year in the background of the civic works that existed at the beginning of this year.

It may be pointed out that meaningful civic works at the site began only with the construction of a culvert in the approach road to the garden. The culvert, completed in October 1984, assured access of heavy vehicles to the garden. From then on the momentum for construction work picked up and in about 14 months (by the end of 1985) we were able to erect 3 kms of barbed wire fencing along the periphery of the garden, to complete the Bio-technological laboratory, to commission an orchidarium, to lay 1 kilometre of the main road, to establish a meteorological station and to complete phase I of the irrigation system.

The fencing of additional 1 km of the border was completed by March this year which contributed immensely to the security of the site. Construction of the Visiting Scientists' Guest House was completed by the middle of this year and it was commissioned in July 1986. It temporarily houses our Library and accommodates the laboratories of the taxonomists. Some of the rooms are earmarked for administrative staff who are scheduled to move into the garden early next year.

A significant achievement during this year was the purchase of 4.5 acres of land for constructing the staff quarters. The plot was purchased after the official land evaluation by the Collector's office and after going through the myriad procedural formalities. The purchase deed was eventually signed on February 3, 1986, and immediately afterwards work on the contour map of the site was undertaken. Steps were also taken to put barbed wire fencing around the site and to construct the roads in the campus. A master plan for the Staff Quarters campus was drawn up by our architect. A borewell was dug and a pump installed. The telephone connection to the quarters site was obtained and the contract for the first phase of the construction involving 14 quarters, a bachelor's hostel and a community hall was awarded in September 1986. The foundation stone of the first unit was laid in October and work on all units is showing steady progress.

Phase II of the irrigation project was taken up early this year. This involved laying pipelines across the garden site, constructing

2 water tanks of 20,000 lit. capacity on the arboretum side of the garden and erection of pipeline to reach all areas of arboretum. Extension to the existing pump house was completed and steps were taken to instal a second pumpset for fail-safe supply of water to the site.

In addition to the large orchidarium a mini orchidarium for medicinal plants was constructed. A green house to keep endangered species was completed. Water tanks for planting aquatic medicinal plants and *Victoria regia* were also constructed.

A major work undertaken this year was the levelling of the front yard and slope of the Guest House. The steepness of the slope and other peculiarities of the topography defied any form of aesthetic landscaping and we got advice from several experts including Mr S. D. Vaidya, formerly the landscape architect of BARC and the State Landscape Architect. Ultimately, it was the ingenuity of our engineers that helped to create a beautiful design. Work on landscaping involving the use of three thousand cubic metres of soil for levelling and turfing the entire area was completed in two months.

Several projects were taken up to stop soil erosion. One of the most effective approaches was the construction of a series of steps along the western margin of the slope in front of the Guest House and diverting storm water down through the steps. This system was also found to be useful to prevent soil erosion near the steep terraces of and near the medicinal plant garden.

During the year the long planned jeep road from the nursery shed through the periphery of the medicinal plant garden along the river side was completed. A ride through this road will enable the visitor to have an overall view of the medicinal plant collections.

A number of minor works done in and around the biotechnological laboratory included construction of septic tanks, masonry drains, dispersion trenches for the disposal of waste water, the construction of enclosures in the air conditioned room etc.

Metalling of the Guest House road was completed this year. Work on the approach road and the main arterial road that began

last year was continued and completed. Construction of another road that connects all important points in the major forest patches and arboretum was taken up in December.

A canteen building aesthetically constructed from indigenous material was completed and it was formally opened by the First Secretary of the British High Commission, Dr Blake, in early 1986. Preliminary work on the foot paths and trails of arboretum is over. Construction of fern house and orchid community pot centre has reached the final stages. Estimates for a new orchidarium, glass house, and the iron bridge road are being processed.

A wide path connecting the Guest House Road to the canteen and from there to the main road leading to the nursery area was constructed. The major portion of the rose garden was shifted to the guest house slopes. The whole area was turfed and several foot paths in the rose garden were laid.

Landscaping on the sides of the Guest House is progressing.

Another important event of the year was the finalisation of the plans for the laboratory and library complex. Merging with the landscape at three levels and spreading over an area of 27000 square feet, the building is designed to house laboratories, herbaria, library, administrative office, conference halls and in addition has ample space for plant displays. Plan and estimates of the building were ready in September, tenders were called for in October and the contract was awarded in November. By year end, the building site was levelled, a road was constructed to the site and the foundation was laid.

DISTINGUISHED VISITORS

We are fortunate to receive a number of distinguished visitors who have shown keen interest in our garden development activities and research projects. Several of these guests continued to keep contact with us and helped the Institution in establishing liaison with international organisations and scientists as well as in obtaining material for research and garden development.

Ambassador Manfredo Maciotti visited the garden and the sustained interest he has taken in the garden helped us to establish

relations with directors of ten European gardens. The Ambassador is also helping us by sending literature on publications in taxonomy, especially those emanating from Europe.

Dr Dogmar Jickinska and Dr Koncalova, Scientists from the Czechoslovak Academy of Sciences visited the garden and had discussions with the Director and the Scientists on various ongoing research programmes.

The Karnataka Minister of Horticulture, Mr B. Somasekharan, with the Director of Horticulture and other high officials visited the garden and studied the functioning of the biotechnology laboratory and the lay out and organisation of the medicinal plant garden. The Minister was so impressed by the working of this Institute that he requested for the blue print of the laboratories and details of the set up of the various divisions with a view to start an Institute on these lines in Karnataka. All the materials he requested were forwarded through the officers of the Karnataka Government who visited the garden.

Mr John Hanson, Minister of Cultural Affairs, British High Commission during his visit to our Garden had wide ranging consultations with the Chairman and the Director on collaborative projects with the British Council. The problems associated with running a course in basic horticulture with the help of an expert from Kew Gardens were also discussed.

The visit of the Minister of Cultural Affairs was followed by the arrival of a number of U. K. experts this year who contributed significantly to the projects undertaken by this Institution. Dr Chris Birkenshaw of the Cambridge Botanic Garden was with us to discuss conservation programmes. His visit to the garden focussed interest on the various collaborative programmes on conservation we are having with the International Union of Conservation of Nature and Natural Resources and the Threatened Plant Committee.

Seed exchange programmes were the main subject of interest during the visit of Dr Paul Tompsett who was with us in February this year. Arrangements for supply of *Hopea* seeds to Wakehurst Place, England, where Dr Tompsett works, were finalised during his visit.

Dr B. F. Blake, First Secretary, British High Commission visited the garden twice and finalised arrangements for the visit of eminent biotechnologists to our laboratory, organisation of the horticulture course, expansion of the library with O. D.A. assistance and the possible assistance from British Council in the maintenance of expensive equipments supplied from British sources.

The garden hosted the Afghan Planning Commission led by Dr Asmail. The members of the Commission spent a hectic evening in the garden and greatly appreciated the rapid progress we have made in two years. They were enquiring of the possibility of getting experts from here to advise on the organisation of Institutions of a similar nature in Afghanistan.

Dr Raymond J. Mathias, Plant Breeding Institute, Cambridge was our honoured guest in July. Dr Mathias had several round of discussions with the biotechnologists of TBGRI on the ongoing programmes. His seminar on genetic engineering was so informative that the story was carried by wire services and appeared in many newspapers throughout India.

In September, Dr Man Mohan Singh, Vice-Chairman, Planning Commission visited us. The distinguished visitor met scientists from all divisions and had discussions with senior scientists on prospective schemes and visited all divisions of the garden. Dr Singh wrote in the Visitor's diary that the garden is an exciting and creative effort.

Another visitor, Claire Sanders, from the Observer group of Newspapers, London, became so enamoured of the Garden that she decided to write a story of the garden which she hopes to do in consultation with the horticultural experts of the Kew Garden who visited us earlier.

The well known landscape architect and horticulturist, Mr Hans Fliegner from Kew Gardens, was with us throughout October, 1986. He reviewed the several projects which were initiated during his first visit in November 1984 and was surprised by the rapid progress we made during this short period. Mr Fliegner also held meetings with scientists and gave a seminar. He was also able to draw up a detailed syllabus for the course in basic training in horticulture to be organised in the first half of next year.

Professor Christopher Cook, Director of the Botanical Garden and Botanical Institute, Zurich visited our Institution in November. Our taxonomists had the benefit of working with Dr Cooke during plant collection trips. Professor Cook gave very valuable advice on some of the projects taken up by our taxonomists and gave a seminar.

H. E. Van Der Willigen, Netherlands' Ambassador to India and his wife graced the garden in December. Both visitors who are keen plant lovers, inspected the orchid collection in great detail and discussed the culture of orchids with the scientists.

A list of important visitors and their affiliations is given below:

Dr Mammen Koshy	Joint Director, National Zoological Park, New Delhi
Mr Chris Birkinshaw	Cambridge Botanic Garden, Cambridge, England
Dr Paul Tompsett	Royal Botanic Gardens, Kew
Dr Asmail	Planning Commission, Government of Afghanistan
Mr Azizi	
Mr Ayubi	
Mr Azizyzb	
Dr S. P. Ghosh	Director, Central Tuber Crops Research Institute, Trivandrum
Dr R. D. Iyer	Central Plantation Crops Research Insti- tute, Kasaragod
Dr Shymala Bhaskaran	Texas A & M University College Station, Texas, USA
Dr Govindan Bhaskaran	
Dr B. F. Blake	First Secretary, British Council, Madras
Alan Maley	
Dr M. H. Mari Gowda	Retired Director of Horticulture (Karna- taka), Bangalore
Dr Jaffar Nizam	Ex-Vice-Chancellor, Kakatiya University, Hydrabad
Dr T. R. Govindachari	Formerly Director of Research, CIBA, Madras
Prof. M. S. Chennaveeriah	Dean, Faculty of Science, Karnataka University

Mr S. Varadachary	Secretary, Planning and Economic Affairs Department, Government of Kerala
Dr R. J. Mathias	Plant Breeding Institute, Cambridge, England
Mr S. Narayanaswamy	Additional Chief Secretary, Government of Kerala
Dr Man Mohan Singh	Deputy Chairman, Planning Commission of India, New Delhi
Miss Claire Sanders	77 Pymmes Green Road, New South Gate, London, England
Dr M. R. Sivaraman	Finance & Planning Secretary, Government of Madhya Pradesh
Dr P. S. Rao	Plant Biotechnology Division, BARC, Bombay
Brig. A. S. Iyer	Adviser, State Land Use Board, Government of Kerala
Prof. C. D. K. Cook	Director of the Institute for Systematic Botany and Botanic Gardens of the University of Zurich, Switzerland
Dr T. N. Khoshoo	Distinguished Scientist, CSIR, New Delhi
H. E. A. van der Willigen	Netherlands Ambassador, New Delhi
Mr R. Narayanan	Finance Secretary, Government of Kerala

Support from Public Accounts Committee

We were happy to note that the Public Accounts Committee has taken a very encouraging attitude towards the development of this Institute. The Director has appeared before the Committee and explained the objectives and working of the Institute. In the report published in May 1986, the Committee appreciated the exposition and incorporated the entire data presented by the Director in his briefing. In its recommendations, the Committee wrote:

'The Committee wish to point out that the idea behind establishing the Tropical Botanic Garden and Research Institute is to develop the flora of Kerala and to do advanced research work in plant development. The Committee feel

that the Government of Kerala was not giving enough encouragement and backing for the Institute. The Committee recommend that the State Government should reconsider their policies regarding financial assistance to such projects and give the maximum assistance possible. The Government should also see that wide publicity is given to the various findings of the Research Centre'.

Eulogising the working of an Institute by the PAC is apparently a rare event and these recommendations immediately attracted wide attention. The Hindu, the Indian Express, and the Malayala Manorama separately reported on the PAC report while the Press Trust of India's story was carried by newspapers all over the country.

Publicity and Extension

Several newspapers and magazines have written articles about our Institution. "The Hindu" ran a five column article entitled "Institute for Rare Plants and Research" in October 1985 and later its Sunday edition also carried an article on the unique features of our garden. "The Malayala Manorama" published an article under the heading "Incomparable Garden" with several illustrations in colour. Perhaps the most well written piece on garden was the lavishly illustrated article that appeared in the "Frontline" in May 1986. "The Times of India" published a news story about the significance of somatic hybridization and related projects carried out in our laboratory.

When our scientists detected the appearance of the objectionable weed *Parthenium* in Trivandrum, this was brought to the attention of the media and wide coverage was given by newspapers about the need for eradicating the weed. This was done and Trivandrum at the moment is free from this obnoxious weed.

The visit of Dr Raymond Mathias was reported in the media and the seminar he gave on the recent developments in genetic engineering was reported by the wire services and carried by several newspapers.

The Director gave three talks on the AIR on different aspects of the work of the Institute. Both All India Radio and Door-

darshan had been cooperative with us in giving publicity to the research and development of the Centre.

The Garden as a Centre for Educational Tours

Almost in no time the garden—especially its living collections, the library, the laboratory and the herbarium—began to attract research workers and students from all over the State. Groups of post-graduate students from many colleges within and outside Kerala have already visited the garden and for some of the groups of students we have taken classes in tissue culture and recent developments in Genetic Engineering. The library is being regularly used by post-graduates and research students of several colleges and Universities of Kerala. We also welcome selected students from the Science Clubs of several High Schools. These visits, sometimes two or three a week, do take a lot of the working time of our Scientists and it is felt that a better system should be evolved to handle the steadily increasing number of scholars and visitors who would like to use our facilities.

Staff Training in Horticulture and Garden Development

It was obvious from the beginning that the young scientists involved in garden development work had not any substantial training in horticultural methods including landscaping, terracing and planting. The Royal Botanic Garden, Kew agreed to provide a training officer to instruct the staff on a wide range of basic horticultural methodology.

In spite of best efforts it was difficult to find a suitable expert to teach the course. This was because, as Mr Fliegner pointed out, "well qualified people held posts which they could not leave for a long time and financial reward was not particularly attractive for specialists".

Mr Fliegner who visited Trivandrum in 1984 helped us in drawing up a master plan and also identified our requirements. With his initiative and with the support of the Royal Botanic Garden staff, and co-operation of the British Council, an ex-student of Kew was identified for running a course in Trivandrum.

The British Council agreed to support this scheme and the expert started arrangements to leave U. K. but because of a bereavement her travel arrangements had to be cancelled. Another attempt to reactivate the proposal had also to be abandoned in September 1985.

Mr Fliegner visited the garden again in October 1986. After detailed discussions with the Director and staff it was decided to select 5 of the existing staff and to recruit five new candidates for training.

It was also decided that a three month horticultural course should be conducted which would include the following subjects. Nursery practice, ornamental horticulture, arboriculture, turf culture, habitat conservation, special care of conservation material, planning and organising work schedules, storage of seeds, irrigation systems, garden layouts, designs, indoor displays and collecting plant material in the wild and establishment techniques. This is only a rough outline of the subjects thought to be included in the course but the training officer would take the final decision on topics and their scope.

Even while Mr Fliegner was here in October 1986, the British Council confirmed that Mr Roy Bee, former Director of the Park Systems in Manchester, a renowned horticultural consultant, writer and broadcaster has agreed to teach this course. This is very encouraging news and it may be pointed out that the nomination of Mr Bee was due to the combined efforts of the Curator of Kew Garden, the Supervisor of Studies, Royal Botanic Garden, Kew, Mr Hans Fliegner and the British Council.

On the return to Kew, Mr Fliegner met Mr Roy Bee and discussed the course contents and other details.

The course is expected to commence in early 1987.

Training Facilities offered

Our biotechnology laboratory is only in the process of being organised but we had pressing requests from various organisations to train their staff in tissue culture and also to provide facilities to complete projects that need biotechnological laboratory procedures. In spite of the limitations in space and facilities we have tried our

best to accede to these requests. Recently, a student from the Agricultural University had completed her thesis work in our laboratory and we had a student from I.I.T. Kharagpur working on the micropropagation of *Withania somnifera* for his M. Phil thesis.

Staff changes, Promotions

Dr P. Mohankumar, Senior Scientific Assistant left the Institute on 28-2-1986. Dr G. Gopalan, joined the Institute as Scientist B on 6-8-1986. Dr S. Seeni, Scientist C, was promoted as Scientist E from 14-8-1986. Shri R. Muralcedharan Nair, Assistant Audit Officer, Accountant General's Office joined the Institute as Section Officer on 3-3-1986 on deputation basis.

Staff of the Institute

Director

Professor A. N. Namboodiri

Deputy Director

Dr G. Bhadrans Nair

Research and Development

Plant Taxonomy Division

Dr T. S. Nayar	Sr. Scientific Assistant
Dr K. C. Koshy	Jr. Scientific Assistant
Sri C. Sathish Kumar	Jr. Scientific Assistant
Sri N. Mohanan	Jr. Scientific Assistant

Herbarium Section

Sri S. Mukuntha Kumar	Assistant Herbarium Keeper
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Plant Biotechnology Division

Dr S. Seeni	Scientist
Dr G. Gopalan	Scientist
Dr P. N. Krishnan	Scientist
Smt. P. G. Latha	Scientist
Smt. C. G. Sudha	Technical Assistant
Sri P. K. Suresh Kumar	Technical Assistant

Medicinal Plant Division

Dr T. K. Abraham	Scientist
Dr P. Mohan Kumar	Sr. Scientific Assistant (upto 2/86)
Sri P. J. Mathew	Sr. Scientific Assistant
Sri A. E. Shanavaskhan	Field Assistant (on leave from 10-11-1986)

Germplasm and Living Plant Collection

Sri Jacob Thomas	Sr. Scientific Assistant
Sri Bejoy Mathew	Field Assistant

Library

Sri K. P. Vijayakumar	Assistant Librarian
Smt. V. Sujatha	Jr. Library Assistant

Artist

Sri K. P. Pradeep Kumar	
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Administrative Division

Sri K. K. Kuttappakurup	Accounts Officer
Sri R. Muraleedharan Nair	Section Officer
Sri K. G. Ajithkumar	P. A. to the Director
Smt. S. Radhalekshmy Ammal	P. A. to the Accounts Officer
Sri Suresh Chandran	Assistant Gr. I
Smt. C. Syamala	Accountant
Smt. V. Jayasree	Assistant Gr. II
Smt. A. Santha	Typist Gr. II
Smt. G. Subhadra	Typist Gr. II
Smt. C. Gracy	Stenographer Gr. II

Drivers

Sri M. Ramaswamy	Driver Gr. I
Sri V. Rajendran Nair	Driver Gr. I
Sri D. Mohanachandrakumar	Driver Gr. II
Sri A. Salim	Driver Gr. II
Sri R. Gopinathan Nair	Driver Gr. II
Sri N. Raveendran	Driver Gr. II

Helpers

Sri R. Bhargavan	Helper Gr. I
Sri S. Chandran Chettiar	Helper Gr. II
Sri C. Sathyan	Helper Gr. II
Sri B. Vijayakumar	Helper Gr. II
Sri T. Mohanakumar	Helper Gr. II

Engineers

Sri K. I. Idiculla	Consulting Engineer
Sri K. C. Eapen	Consulting Engineer
Sri P. P. Markose	Site Engineer

Purchase Section

Sri C. M. George	Purchase Officer
Smt. R. Sarala Devi	Assistant Gr. I
Smt. N. Rajalekshmy Ammal	Typist Gr. II

Field Section

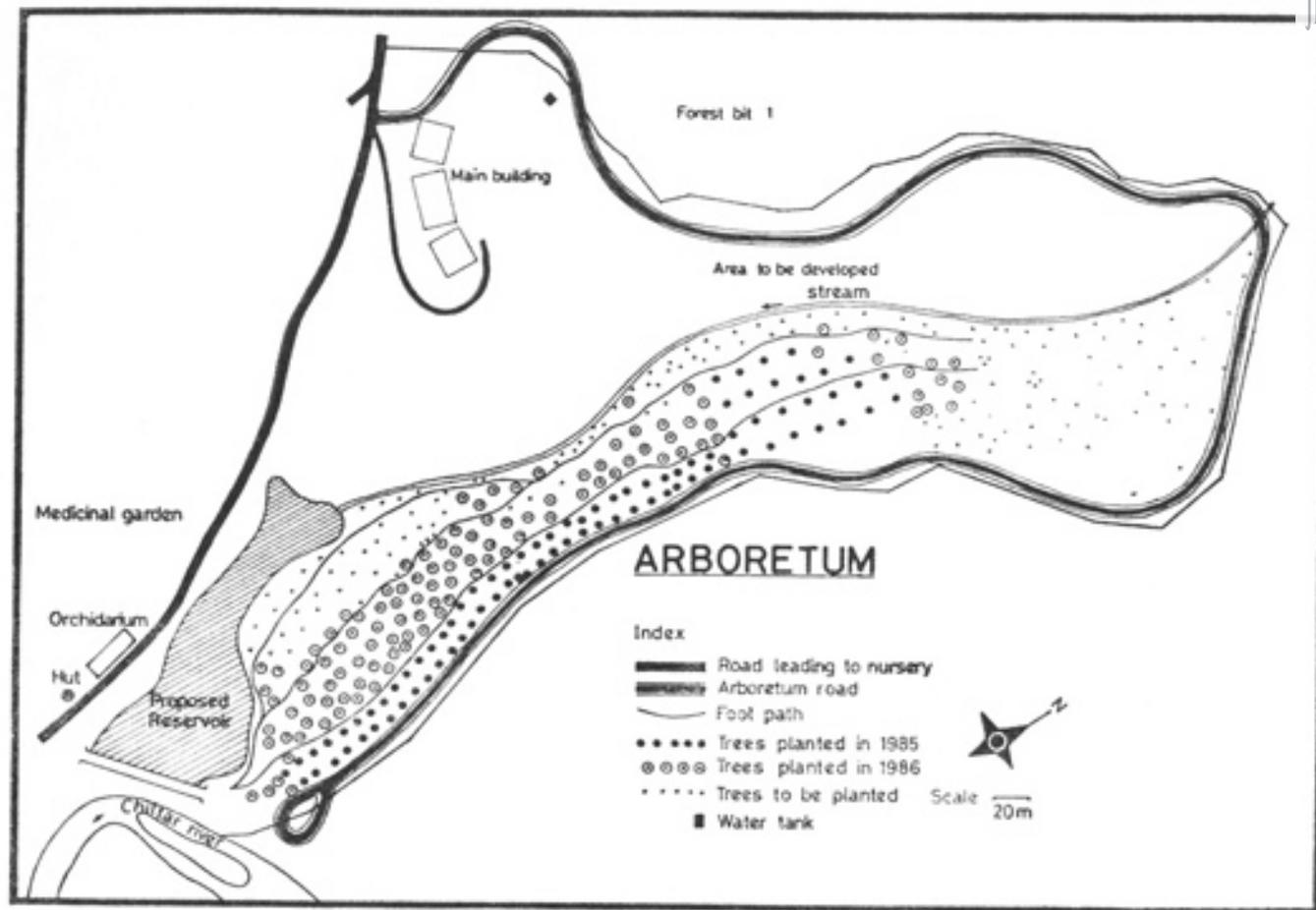
Sri Cheriyan P. Koshy	Garden Works Manager
Sri G. K. Udayadas	Garden Maistry
Sri P. Mony	Garden Maistry
Sri T. Bhaskaran	Garden Maistry
Sri K. Selvaraj	Garden Maistry
Sri J. Micheyal	Gardener

Security Wing

Sri T. M. Abdul Salam	Security Officer
Sri P. R. Chandrasekharan Nair	Security Guard
Sri P. Jain	Security Guard
Sri K. Ramachandran Nair	Security Guard
Sri A. Johnson	Security Guard
Sri K. Mohanan	Security Guard
Sri K. G. Vijayakumar	Security Guard
Sri S. Bhuvanendran Nair	Security Guard
Sri S. Chandran	Security Guard
Sri G. Somasekharan Nair	Security Guard
Sri C. Stanly	Security Guard

Other Staff

Sri Lazer Joseph	Night watchman
Sri M. Bhuvanachandran	Night watchman
Smt. R. Valsala Devi	Part time Sweeper





Introduced plants on cut terraces merge with the sylvan setting of the Garden.