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STATE OF SINGAPORE

ANNUAL REPORT OF THE BOTANIC GARDENS DEPARTMENT FOR 1959

PRINTED BY LEE KIM HENG, ACTING GOVERNMENT PRINTER, SINGAPORE.

1960

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BY

H. M. BURKILL

*Director, Botanic Gardens
Singapore*

PRINTED BY LEE KIM HENG, ACTING GOVERNMENT PRINTER, SINGAPORE.

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ADMINISTRATION

I. GENERAL

FROM THE BEGINNING of the year till 31st May the Department was under the former Chief Secretary's Ministry. From 3rd June onwards it came under the newly-formed Ministry of National Development.

II. CENTENARY OF THE GARDENS

2. The most notable event of the year was the centenary of the founding of the Gardens. An agri-horticultural association, with official assistance, took possession of most of the land which is now the Gardens near the end of 1859. Its purpose was to provide a pleasure garden for its members and to introduce and acclimatise plants of possible economic value and to foster the growing agricultural and horticultural interests of the young settlement of Singapore. Financial difficulties beset the Society, and from its inception it was never without direct or indirect Government assistance. Eventually in 1874 Government accepted the entire liability for running the Gardens as a public department. From this time its function broadened; a horticultural officer with taxonomic experience was appointed Superintendent and the Department was charged with a duty of studying the flora of the Malay Peninsula. The priority of botanical research over horticulture was further emphasised in 1888 when a trained botanist became its first Director, the title of Superintendent being dropped.

3. In 1882 a Department of Forests was created in the Straits Settlements under the direction of the officers of the Botanic Gardens. In 1896 the Director of Gardens advised on the establishment of a Forest Department in Selangor and recommended the formation of a Forest Department in the Federated Malay States (Perak, Selangor, Negri Sembilan and Pahang). After further investigation by an officer of the Indian Forest Service a unified Straits Settlements-Federated Malay States forest service was created as a self-contained department in 1901.

4. Similar growth took place in the agricultural field and a Department of Agriculture in the Federated Malay States was set up in 1905. Up to this time the Gardens had been the only source of information on economic crops. From 1891 to 1900 the Gardens published *The Agricultural Bulletin of the Malay Peninsula*, and from 1901 to 1912 *The Agricultural Bulletin of the Straits and Federated Malay States*. Though the title of these periodicals suggested material of agricultural significance, their contents were in fact varied and covered agriculture, forestry, horticulture and many related sciences.

5. From 1913 onwards the Gardens has published its research work in *The Gardens' Bulletin* and in a number of separate books. With the strengthening of the work on agriculture and forestry in Malaya by the formation of specialised departments, the Botanic Gardens concentrated on taxonomic botany and ecology, which are basic problems to land utilisation and economic exploitation of natural plant resources, and on horticulture.

6. The occasion of the centenary was marked by the issue of a special number of the *Gardens' Bulletin*, Vol. 17, pt. 2.

III. STAFF

7. Mr. G. H. Addison, Curator, ceased duty on 1st March and retired on 12th June under the terms of Government's Malayanisation policy. Mr. Addison had served the Department for over 22 years. Mr. J. L. Pestana, Laboratory Assistant (Special Grade), retired on 31st July after 31½ years' service. The post of Assistant Director, vacant since January 1958, was advertised but no appointment was made. However it is possible to report some slight improvement on the very difficult staff position recorded in the previous two years' reports. It was decided to regrade the post of Assistant Director as Botanist and Miss Chang Kiaw Lan, a Botany Honours graduate of the University of Malaya, was appointed on 7th July. One officer was away on overseas training throughout the year but three others completed their training during the year and resumed duty. These absences threw extra responsibilities on the staff members remaining on duty at Singapore. The services of Dr. Furtado, a Botanic Gardens pensioner, were retained as a training replacement officer in the post of Botanist.

8. Mr. Sinclair was on overseas leave from 1st April to 13th October and the Director on short overseas leave from 16th December for the rest of the year.

9. The decision to regrade the post of Assistant Director was taken after failure to fill the appointment. At the same time it was decided to designate the post of Keeper of the Herbarium as "Botanist (Keeper of the Herbarium)." The posts of Assistant Director, Keeper of the Herbarium and Botanist are all on the same salary scale in the Botanical Research Division of the Department and grading them all as Botanist will simplify the allocation of duties and obviate certain establishment procedures in filling the posts.

IV. TRAINING

10. Under Government's policy of training personnel the following officers were on courses of study overseas:

- (i) Mr. Chew Wee Lek, Botanist, continued to study for a post graduate degree at Cambridge University under Mr. E. J. H. Corner, who was at one time Assistant Director of this Department.
- (ii) Mr. Lam Hin Cheng, Horticultural Assistant, successfully completed a two-year course of study at the Royal Botanic Gardens, Kew, for the Kew Diploma. He returned to duty at Singapore on 10th October.
- (iii) Mr. Bajuri bin Sappan, Laboratory Assistant, successfully completed an eleven-month course of instruction in plant breeding and propagation at various institutions in England and returned to duty at Singapore on 3rd January.
- (iv) Mr. Tan Kim Ho, Librarian, went to Australia on 20th February on a fellowship awarded by the Australian Government under the Colombo Aid Plan to study Library Management. He studied at various libraries under arrangements made by the Commonwealth Scientific and Industrial Research Organisation, and returned to duty at Singapore on 26th November.

V. LABOUR

11. The labour force averaged 70 men, women and juveniles in the Botanic Gardens, 4 in the herbarium, 55 in the Istana Negara (Government House) Domain and 8 in the Nature Reserves.

VI. BUILDINGS AND ROADS

12. Gardens resources undertook the following works:
- (i) The water tank in the Plant House was completed early in the year.
 - (ii) The manure shed on Lawn U was enclosed with very fine mesh wire netting as a precaution against flies.
 - (iii) A new nursery on Lawn Z below the Curator's (Assistant Director's) bungalow was enclosed with a wire netting fence.
 - (iv) A number of seats was constructed using surplus perforated steel plate from the old Kallang Airport. These were placed on Lawns F and E.
 - (v) The fernery at the Potting Yard, which had become very dilapidated, was pulled down and reconstruction was begun.
 - (vi) Repairs to many drains were carried out, some on roadsides requiring complete regrading and relaying of their brick sides.
 - (vii) Construction of a slatted roof house in the Orchid Nursery (Lawn T) for the orchid species.
 - (viii) Erection of a 40 ft. metal tower was begun. This is intended to carry meteorological instruments, which will then be free of shading from trees. The tower will also carry a small water tank to give a head of water for a mist propagation unit which will be constructed nearby.
13. In April very extensive cracking appeared in the lower walls of the herbarium built in 1901, and in the buttresses built to carry the weight of the upper floor which was added in 1930. The P.W.D. has carried out an inspection and will undertake any repairs considered necessary.

14. The condition of the roads remained good and no repairing was necessary.

VII. VISITORS

15. Many official visitors called at the office including:

Nai Kasin Suvatabandhu, Department of Agriculture, Thailand.
 Professor P. R. Richards, University College of North Wales, Bangor.
 Lord Faringdon, Buscot Park, Berkshire, England.
 Prof. D. P. Watson, Michigan State University, U.S.A.
 Prof. J. H. Davis, University of Florida, U.S.A.
 Mr. and Mrs. R. D. Pope, Proprietors of Cypress Gardens, Florida, U.S.A.
 Mr. L. Mattsson, Director U.N.E.S.C.O. Science Co-operation Office, Djakarta.
 Dr. P. O. Wiehe, Director, Sugar Research Institute, Mauritius.
 Dr. W. S. Stewart, Director, Los Angeles State and County Arboretum, California, U.S.A.
 Prof. M. E. Poore, Department of Botany, University of Malaya, Kuala Lumpur.
 Prof. G. M. Davis, Department of Agriculture, University of Malaya, Kuala Lumpur.
 Dr. Kamemoto, Head, Department of Horticulture, University of Hawaii.
 Dr. R. A. Hamilton, Professor of Agriculture, University of Hawaii.
 Dr. Kusnoto Setyodiwiryo, Director, Kebun Raya, Bogor, Indonesia.
 Dr. W. H. Hodge, Department of Education and Research, Longwood Gardens, Pennsylvania, U.S.A.
 Dr. K. A. Chowdhury, Department of Botany, Aligarh University, India.
 Mr. and Mrs. Rod McLellan, Orchid Nursery Proprietors, San Francisco, U.S.A.
 Mr. R. O. Williams, Asst. Director of Agriculture (Research), Sarawak.
 Mr. Tatsuro Matsuda, Faculty of Sciences, Tohoku University, Japan.

These visits afforded occasion for useful and interesting discussions.

16. Many visiting research workers were afforded facilities for studying in the herbarium and gardens:

- Dr. Paul Surani, Entomologist, South Pacific Commission, Noumea. Coconut weevil.
- Mr. A. Santiago, Botanist, Department of Agriculture, Kuala Lumpur. *Citrus*.
- Mr. R. W. Paine, Entomologist, Department of Agriculture, Fiji. Banana Scabmoth (*Nacoleia*) project.
- Mr. M. B. Spurling, Horticultural Research Officer, Department of Agriculture, South Australia. *Citrus* breeding.
- Dr. A. J. G. H. Kostermans, Professor of Botany, University of Bandung, and Inspector of Forests, Forest Research Institute, Bogor. *Lauraceæ* and forest trees.
- Prof. E. C. Abbe, Department of Botany, University of Minnesota, U.S.A. *Fagaceæ*.
- Prof. F. Fagerlind, Department of Botany, University of Lund, Sweden. *Selaginella*.

17. The facilities of the Department were made freely available to members of the staff and to sponsored students of the University of Malaya.

18. The Gardens attracted an even greater number of casual visitors coming on their own or in organised parties. Travel agencies seem to be making greater use of the Gardens to bring tourists and many busloads are brought to the gates to be walked through the Gardens. On occasions when prior notice had been given special traffic arrangements were made for taxis to bring in elderly visitors.

VIII. CONCERTS

19. Twenty-one band performances were given in the Gardens, two by the band of the 1 Loyal Regiment and the rest by the band of the Singapore Police Force. Their respective band masters, the Commanding Officer of the 1 Loyal Regiment, the G.O.C., Singapore Base District and the Commissioner of Police, Singapore, are thanked for their courtesy in permitting their bands to play.

20. Five variety shows (the Aneka Ragam Ra'ayat) were staged in the Botanic Gardens under arrangements made by the Ministry of Culture. The first one held on 2nd August was declared open by Mr. Lee Kuan Yew, Prime Minister, before a crowd estimated to be 20,000 persons. Another was held after dark and the section of the Gardens around the Lake was floodlit.

IX. PUBLICATIONS

21. Part 2 of *Gardens' Bulletin* 17 was issued on 5th December as a special number to mark the occasion of the Gardens' centenary. Contributions were received by invitation from guest writers whose work, or the work of the institutions they represented, had a bearing on the work of the Botanic Gardens. Thus 17 authors presented articles of topical significance, which were not only retrospective but prospective and indicative of the rôle of Botanic Gardens in modern society. A further nine papers on subjects of original research were also presented.

22. During the year papers by members of the Department were published:

BURKILL, H. M.: The Botanic Gardens and Conservation in Malaya *Gard. Bull. Sing.* 17 (2) 1959. The Botanic Gardens, Singapore, 1859-1959 *Nature* 184, 1602-1604, 1959. A survey of Nature Conservation on Singapore Island *Proc. 9th Pac. Sci. Cong.*, 7, 1959. Large Scale Variety Trials of *Hevea Brasiliensis* Muell.-Arg. on Malayan Estates, 1934-53. *J. Rubb. Res. Inst. Malaya* 16, 1959.

FURTADO, C. X.: Singapore's Contribution to the Study of Palms, *Gard. Bull. Sing.* 17 (2) 1959. A New Aroid from Sarawak *ibid*, 1959. Some New or Noteworthy Species of Malaysia, *ibid*, 1959.

23. Five new parts of the series "Malayan Garden Plants" were published: No. 7, Ten Flowering Shrubs (second decade); No. 8, Ten Flowering Climbers; No. 9, Ten Flowering Bulbs; No. 10, Ten Hedge Plants; and No. 11, Ten Succulents. Departmental publications produced a revenue of \$6,702.33, including those sold through the Government Publications Bureau.

X. LIBRARY

24. The accommodation of the library remains unchanged, the books being stored in two separate rooms, neither of which was designed for this function, and both badly needed for their intended purpose. One is an office room, the other is an extension of the herbarium in which the spirit collection of plants should be stored. The spirit collection remains in the herbarium and is an embarrassing fire hazard. The lack of proper library accommodation is most unsatisfactory and it impedes the normal functioning of the library and holds up other work.

25. Library accessions amounted to 295 volumes, of which 258 were periodicals received on reciprocal exchange. This large intake of material adds to the difficulty of improper and inadequate accommodation.

26. A large amount of binding was carried out during the year. Two hundred and twenty-one volumes were bound, three quarters by the Prisons Department, the rest by the Government Printer.

XI. AGRICULTURAL PESTS SUPERVISORY COMMITTEE

27. Mr. Burkill, Director, was a member of the Committee.

XII. IMPERIAL WAR GRAVES COMMISSION CEMETERY KRANJI

28. The Botanic Gardens continued to supervise the horticultural work of the Cemetery under instructions from the Imperial War Graves Commission Regional Headquarters in New Delhi. The Chief Horticultural Officer and two Regional Horticultural Officers of the Commission visited Singapore in January and discussions were held with them regarding maintenance of the Cemetery. Funds for personnel and materials for this work were provided by the Commission in whose reports fuller detail may be found.

29. The highlight of the year was the visit on 22nd February of H.R.H. The Duke of Edinburgh. The Director had the honour of conducting His Royal Highness and His Excellency, Sir William Goode, then Governor of Singapore, round the Cemetery.

30. The number of visitors to the Cemetery during the year is estimated at about 14,500.

XIII. NATURE RESERVES

31. The Board of Trustees consisted of:

Nominated by the Governor-in-Council (Yang di-Pertuan Negara as from 3rd June, 1959)	1. Mr. E. Galistan	Retired 26-6-59.
Nominated by the Minister ...	2. Mr. Morgan Khoo Kay Ann.	
	3. Mr. Tan Hoon Siang.	
	4. Prof. H. B. Gilliland.	
Nominated by the City Council	5. Mr. Chan Chee Seng ...	Retired 5-6-59.
	Mr. Tan Jake Hooi ...	From 1-10-59.
Nominated by the Rural Board	6. Mr. R. S. Boswell ...	Retired 4-7-59.
	Mr. Chan Chiaw Thor ...	From 1-10-59.
Chairman ex-officio ...	7. Director of Botanic Gardens.	

32. No major matter arose during the year and normal maintenance and development was possible. The foot-paths at Bukit Timah and the perimeter path at the Kranji Reserve were upkept. Additional notice boards drawing the attention of the public to the existence of the Reserves were put up at Labrador, Ulu Pandan and Bukit Timah. A further 50 notice boards were supplied to the Water Department for placing around the Water Catchment Area.

33. The P.W.D. request for an exchange of 1.8 acres of rocky land for a similar piece adjoining in order to improve their facilities for extracting rock at their quarry at the north end of Bukit Timah was approved, and the two pieces of land were realienated.

34. A temporary boathouse was put up at the Ulu Pandan Reserve where the Board's boat could be kept and locked against theft.

35. The main matter of import in the Water Catchment Area was an application by the military authorities for an increase in range facilities for small arms firing. The Chief Engineer of the British Army and the Director made two aerial surveys of the Water Catchment Area and the off-lying islands and covered on foot areas of the Water Catchment Area which appeared to be possible locations. Eventually the siting of ranges with the extent of target space required was agreed upon without enlarging the danger area of the existing ranges and without involving the destruction of certain areas of swamp forest vegetation unique on Singapore Island. The military proposal with the concurrence of the Water Department and the Nature Reserves Board were put up for Government approval at the end of the year.

36. The Nature Reserves Board held two meetings during the year.

XIV. METEOROLOGICAL

37. Observations were continued at the meteorological stations at the office and in the orchid enclosure. Records are tabulated in the Appendices II and III. In all recorded respects the year was near average.

38. In recording the hours of sunshine a critical defect was observed in shade cast by trees in the early morning and late evening. Comparison with sunshine data recorded by the Meteorological Department at the station at Paya Lebar Airport indicated that our records were short by about 1½ hours daily. Because of this, sunshine data is not given in this report and previously published figures should be viewed with caution.

39. To avoid such shading a tower is being erected so that instruments will be placed beyond extraneous interference. It will also be used for obtaining other data which may have a bearing on plant physiology.

BOTANICAL RESEARCH

XV. COLLECTING AND NEW RECORDS

40. Many single day collecting trips were made into the Nature Reserves and countryside on Singapore Island and into the forests and countryside of South Johore. These yielded much useful and valuable material, but the bulk of the collecting work was done on the following expeditions:

J. Sinclair	West Java	21/2-3/3	96 nos.
J. Sinclair	Ceylon (while proceeding to Europe on leave)	5-6/4	36 nos.
Mohd. Shah bin Haji Md. Nur and Kadim bin Tassim	Kerilla Estate, Temangan, Kelantan	28/2-9/3	132 nos.
Kadim bin Tassim and Mahmud bin Awang ...	Sungei Mai Estate, Pahang ...	26/3-1/4	113 nos.
H. M. Burkill, Kadim bin Tassim and Md. Noor bin Jumaat	Kuala Sedili New Road, Johore ...	21-29/6	194 nos.
H. M. Burkill, Kadim bin Tassim and Md. Noor bin Jumaat	Endau Development Project, Johore	13-24/7	205 nos.
Mrs. B. E. Allen and Kadim bin Tassim ...	Ipoh District, Perak	9-17/8	75 nos.
H. M. Burkill, Md. Shah bin Hj. Md. Nur and Md. Noor bin Jumaat ...	Fraser's Hill, Pahang/Selangor boundary	24-30/8	298 nos.
H. M. Burkill, Md. Shah bin Hj. Md. Nur and Md. Noor bin Jumaat ...	Kuala Sedili New Road, Johore ...	21-28/9	118 nos.
A. G. Alphonso	Crocker Range, N. Borneo Bau, Sarawak	14/11-3/12	87 nos.
Miss Chang Kiaw Lan ...	Kuala Sedili New Road, Johore ...	22-27/9	50 nos.
E. C. Abbe, L. Abbe and Kadim bin Tassim ...	Malaya (all States except Kelantan and Trengganu)	2-12/11	100 nos.
J. Carrick, I. Enoch and Kadim bin Tassim ...	Bako National Park, Sarawak ...	18/4-11/5	600 nos.
H. M. Burkill, Hassan bin Rani. Kadim bin Tassim	Chemara Research Station, Layang-layang, Johore	23/1-2/2	129 nos.

41. Mr. Sinclair's expedition to West Java took him to a game reserve on Pulau Handeuleum Sisi and P. Peutjang where the indigenous vegetation and representatives of large wild game still exist under protection. The islands are mostly coral beaches which have risen just above sea level and one can see much of the coral, now a greenish hue due to algae and age, amongst the tree roots. Lagoon formation typical of atoll islands is absent. On P. Peutjang the following tall trees were common: *Tetrameles nudiflora*, 120 ft.; *Ficus pubinervis* and *F. calophylla*, 100 ft.; *Pterygota horsfieldii* 40-100 ft., *Lagerstroemia speciosa*, 70 ft. Smaller trees were *Radermachera gigantea*, *Pterospermum javanicum*, *Ardisia lanceolata*, with *Sophora tomentosa* and *Messerschmidia argentea* frequent on the foreshore.

42. In Ceylon, while travelling to Britain on leave, Mr. Sinclair ascended to the summit of Pidurutalagala, 8,290 ft. From about 4,000 ft. to the top the vegetation is dwarf scrub and at the top *Osbeckia buxifolia*, a melastomaceous shrub with attractive red flowers, *Helichrysum buddleoides*, an everlasting with yellow blooms, *Disporum leschenaultianum*, a white flowered lily-like plant and *Ranunculus wallichianus* were seen. Just over half way up the mountain is a sphagnum bog with *Lycopodium carolinianum* and a rare everlasting *Anaphalis thwaitzii*. *Symplocos cordifolia* was seen slightly lower down. A visit was also paid to Hakgala Botanic Gardens some eight miles away.

43. The expeditions to Kerilla Estate, Sungei Mai Estate, Chemara Research Station, and the Endau Development Project were undertaken in continuation of the work recorded in previous annual reports of sampling the vanishing vegetation. In these four widely spaced areas (north, east, centre and south of the Malay Peninsula) forest in the process of being felled for cultivation gave a convenient opportunity of collecting from the fallen forest canopy. The work at Kerilla Estate yielded at least three new records for Kelantan.

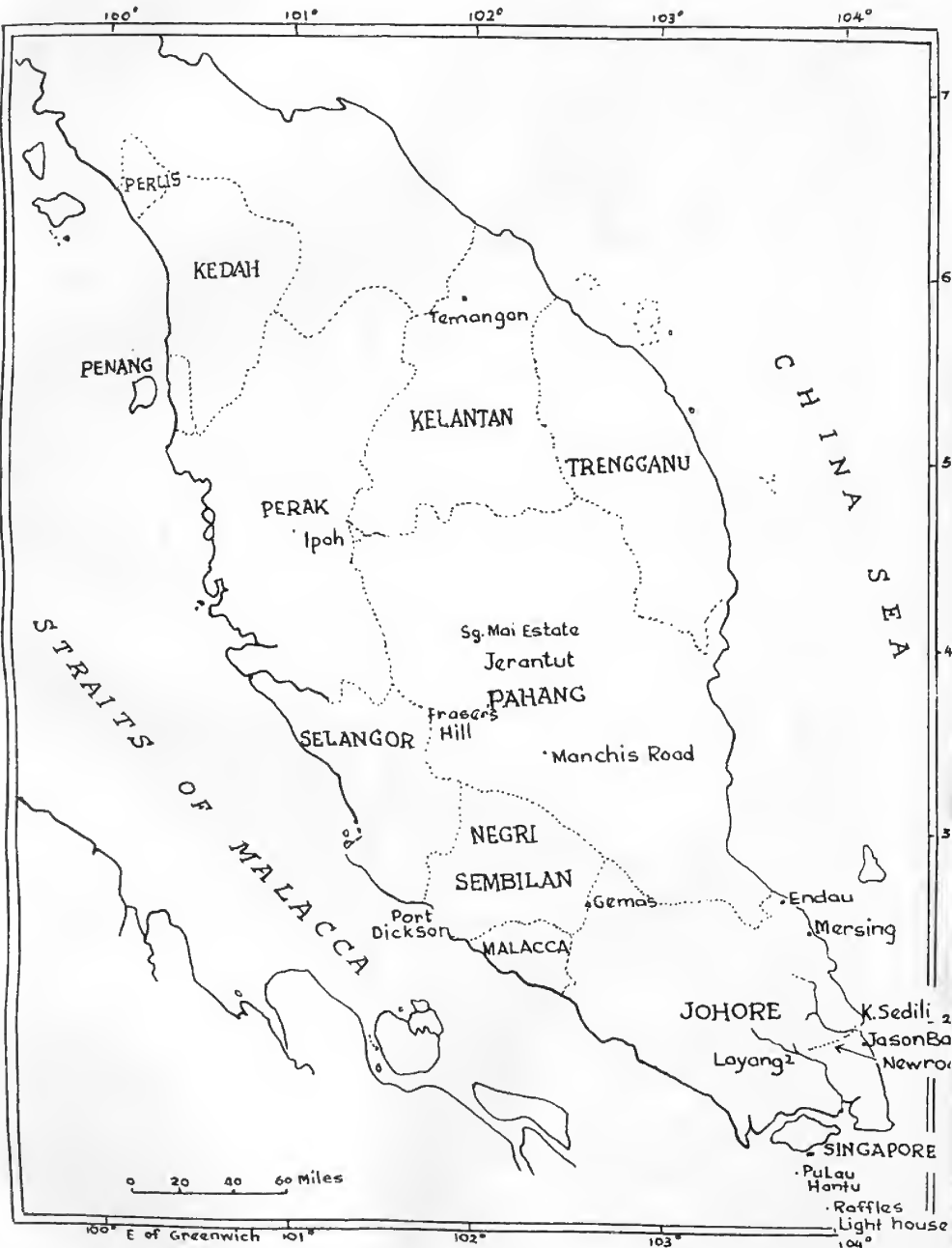
44. Similarly the visits to the Kuala Sedili New Road afforded an unusual chance of collecting in fresh water swamp forest, not the easiest kind of terrain in which to work. The road trace, cut through some five miles of swamp progressed at the rate of a chain or two per day, hampered by the lack of anything more substantial than sand to build up the roadway above water level and by every rainstorm that turned it into a morass. Tree specimens, epiphytes and parasites were taken as bulldozers knocked the trees down. The road construction work was zealously watched for some three months by tiger, elephants and wild pig who left their pug marks each night in the freshly laid sand, and by day by gentle cooing *wah-wahs* and raucously protesting *enggang* (hornbills). Innumerable birds, lizards and small mammals could be seen which normally one never or seldom comes across. A portion of the area merits serious consideration for protection as a nature reserve.

45. Further north near to Mersing the coastal area has examples of raised beaches identified by the shells of living marine molluscs and one might expect the extensive sand lying under a foot of peat all along this road trace to have been of similar recent marine origin, but no sea-shells were observed. One must assume then that this area is a river alluvium.

46. Miss Chang's visit to the Kuala Sedili road trace proved profitable in the collection of forty different species of lignicolous *Polyporaceae* and *Agaricaceae*. The abundance of dead timber of trees knocked down in the road construction and the dampness of the habitat supplied suitable conditions for fungal growth.

47. The work at Layang-layang revealed two plants of interest. The land is on Rengam Series soils and carried good primary forest of which 800 acres was being felled for planting oil palm. The Botany Department of the University of Malaya had marked out quadrats for ecological analysis in the course of which it was found that in parts of the forest the dominant tree was *Kostermansia malayana* Soegeng, a close relative of the durian and a hitherto undescribed genus and species. Two seedlings have now been established at the Botanic Gardens. The other plant of interest was a twining *Gleichenia*. This genus is almost entirely sprawling and scandent. This record of a twining habit is the first for Malaya and has only once been recorded elsewhere in the

MAP SHOWING MALAYAN PLACE
NAMES MENTIONED IN THIS REPORT.



region—by Nakai in the Rhio Archipelago. The plant is *A. truncata* (Willd.) Spr. and twining appears to be an unusual habit-form.

48. The expedition in the Ipoh district was made under the guidance of Mrs. B. E. Allen, a resident of Ipoh, who is an acknowledged authority on Malayan Pteridophyta. Opportunity was taken to collect on Gunong Bujong Malacca and Gunong Tempurong, limestone hills where the vegetation is all being burnt off preparatory to mining operations. Collections were also made at Bukit Batu Suloh and in the mining area of the Kinta Valley.

49. The collections made at Fraser's Hill, while Mr. Burkill was on casual leave, yielded two probably new orchid species. Further material will be sought at the next opportunity to send living plants to the Royal Botanic Gardens Kew where cultivation is more likely to be successful than in the humid heat of Singapore.

50. Mr. Alphonso visited the Crocker Range in North Borneo in search of material to introduce alive to cultivation in Singapore. A number of aroids was successfully brought back. Collections were made near Tenom, Tambunan and Patau, on the Keningau Plateau and on the Bainio and Biak Rivers, also at Bau in Sarawak. The weather was extremely wet making the field work very arduous. Nevertheless no botanist can always be a "fair weather" field worker and as the flora becomes better known collections in the wet season are possibly more likely to produce novelties than other times.

51. Mr. Burkill continued his collections of marine algae at Raffles Light, Singapore, and the nearby islands, and made smaller collections at Malacca and Port Dickson. An inspection of the northern portion of Jason Bay, by Kuala Sedili revealed only one single algal specimen, *Hydroclathrus clathratus*, but no mud-dwelling species for which the muddy coastal strand would seem suitable. Unusually large specimens of *Valonia ventricosa* J. Ag., up to 3 inches across were found on the coral reef of Pulau Hantu.

52. Beside the phanerogamic collection at Fraser's Hill, Mr. Burkill collected 34 numbers of lichen and 20 of mosses. The lichens together with others from Singapore and Kuala Sedili area were sent to experts in London and Holland for naming.

53. On most of these trips in Malaya samples of water from streams, ponds and swamps were taken for sending to Dr. Prowse at the Fish Culture Research Station, Malacca, for his work on phyto-plankton. Samples of water were sent from the Botanic Gardens Lake; Fraser's Hill; Kinta Valley, Perak; 94th mile Manchis Road, Pahang; Muar River near Gemas; Kota Tinggi; Kuala Sedili swamp, and central Johore.

54. This opportunity is taken to acknowledge the help given by the following persons in the above field work:

Mr. Dilmy, Director, Herbarium Bogoriense and Dr. Kostermans of Bogor.
The Master Attendant, Singapore.

Mr. D. St. G. Stewart, Manager, Kerilla Estate, Kelantan.
The Manager, Sg. Mai Estate, Pahang.

Inche Ismail bin Haji Ariffin, District Officer, Mersing, and Mr. W. F. Toft, Manager, Endau Development Project, Kg. Hubang, Johore.

Mr. Inder Singh, District Engineer, P.W.D., Kota Tinggi, Johore.

Mr. J. Comber, Asst. Manager, Sapong Estate, North Borneo.

Mr. J. Seal of the Civil Aviation Department, Sarawak and Honorary Curator of the Kuching Herbarium.

Mr. J. A. R. Anderson, Forest Department, Sarawak.

Mr. E. A. Rosenquist of Chemara Research Station, Layang-layang, Johore, and Prof. H. B. Gilliland of the University of Malaya Singapore.

55. The series "Singapore Field Numbers" for recording plant specimens has been falling into disuse for a number of years owing to collectors using their own series. While the number of field workers contributing to the herbarium was relatively small, their use of the *S.F.N.* series was easy to control, but now the number is greatly increased and extends well beyond the Gardens' staff, its application is difficult. From the beginning of the year the use of the *S.F.N.* series was discontinued, but its principle was modified to the opening of a herbarium accession register in which all material entering the herbarium for retention is registered under its originator's field number.

XVI. EXCHANGE AND ACQUISITION

56. The number of specimens received in exchange from other institutions was 2,130. The Herbarium Bogoriense was again the highest contributor; most of the specimens were collected by Dr. A. Kostermans. It is notable that the amount of material collected by him exceeds that obtained by any other present-day collector in South-east Asia. As he collects in quantity his duplicates are widely distributed to the very great benefit of collaborators of *Flora Malesiana* and other students of South-east Asian botany. A summary of institutions contributing to the Singapore herbarium is given in Appendix IV.

57. Distribution of specimens from the Singapore Herbarium amounted to 3,786, details of which are given in Appendix IV.

XVII. TAXONOMY

58. Mr. Sinclair continued his work throughout the year on Malaysian *Myristicaceae* (Nutmeg Family) in collaboration with the Flora Malesiana Foundation, chiefly on the genus *Knema*. Even though he was officially on leave in Europe, 1st April to 13th October, he visited and worked at a number of European herbaria—Edinburgh, Kew, British Museum, Cambridge, Leiden, Utrecht, Brussels and Paris—on a small Government grant. While travelling to Europe he visited Peradeniya in Ceylon, and on his return from Europe he spent a week at Calcutta.

59. Collections from the Smithsonian Institution, Washington, U.S.A. were sent to Leiden for him to work on there as that institution will not send specimens on loan to Singapore. Likewise Peradeniya and the British Museum were unable to lend material. Kew, Paris and Utrecht place restrictions on their material, while at Paris there is a great deal of unmounted and undetermined material which workers must search over for themselves. It was thus essential for Mr. Sinclair to visit these institutions as otherwise he would not have been able to see types, historical collections and much of their general material. Without such essential basic study it is impossible to make any accurate and comprehensive revision.

60. This work had to be done rapidly owing to limitation of time, but much useful knowledge was gained whereby several name changes, reductions and corrections will have to be effected. No satisfactory or complete research of this kind can be done in Singapore entirely or even at Kew or Leiden alone. Certainly Singapore holds the key collection of the local flora, but regional aspects of plant dispersal and evolution, oblivious of and far beyond political boundaries have to be understood in the preparation of a local flora. The Malaysian region presents a well-defined phytogeographical unit and for this reason the Department's collaboration in the Flora Malesiana project is the most important undertaking as it serves to place the Malayan flora in its proper regional context.

61. Mr. Chew Wee Lek continued his study of the *Moraceae* while at Cambridge reading for a higher degree. Dr. Furtado sorted out and renamed where necessary the following genera: *Ardisia*, *Maesa*, *Embelia* and *Barringtonia*. A number of new species were described for the first time in the *Gardens' Bulletin* 17 (2), December 1959, as a result of this work. Dr. Furtado also was chiefly responsible for editing the posthumous publication of five new dipterocarp species from Borneo in the same issue.

62. Miss Chang Kiaw Lan took charge of the mycological collection which had not been added to nor studied since Mr. Corner retired in 1946. Collections were sorted out on the taxonomic system of Clements and Shear (*The Genera of Fungi*, 2nd edition, 1931). Many new collections were made during the year but identification presents difficulties owing to shortage of mycological literature in the Gardens' Library. Mastering the latest methods of identification based on microscopic analysis and colour reactions with stains is a research in itself and it is hoped this officer may go overseas for training in these developments. The number of mycologists in Singapore and Malaya has been seriously depleted in recent years by retirements and it is an urgent necessity to maintain an adequate expertise on this subject as, *inter alia*, plant protection and plant pathology depends in a large measure on a knowledge of fungi.

63. It is a pleasure to record co-operation with persons outside the Gardens' staff who are studying the taxonomy of local plants. Mr. Tan Ah King of Midland Estate, Kulai, Johore, has been studying palms in the field and has collected specimens for the Singapore herbarium. Palms, particularly rotans, are of considerable economic importance and because of the straggly length of their stems, often intertwined with a half dozen or so tree canopies, and because of their acute thorniness, they are a very difficult group to study.

64. Dr. Anne Johnson of the Botany Department of the University of Malaya has been working on the *Sphagna* of Malaysia and her monograph describing twelve species, three of them new, and one new variety was published in the *Gardens' Bulletin* 17 (2).

65. Dr. E. C. Abbe, Professor of Botany of the University of Minnesota and Mrs. L. Abbe of Department of Biology, Macalister College, St. Paul, Minnesota spent three weeks in Singapore in October and made use of the herbarium facilities prior to setting out on a 6-month expedition in the Federation of Malaya, Thailand, Vietnam and Cambodia to study *Fagaceae* (Oak family) in the field.

66. The Druids who developed a culture in central and western Europe before the Roman invasions of Gaul, Iberia and Britain took their name from the oak, vast forests of which covered Europe at that time. (*Druidh*, Gaelic, Men of Oak). In more recent times the value of oak timber in northern Europe and temperate North America has had a great economic importance and popular glamour. Even the vestige of druidic rites persists in the Christian usage of mistletoe at Christmas. It is little wonder therefore that many people, botanists of temperate countries included, think of the oaks as essentially typical of northern temperate regions. In fact, however, the family is more tropical than temperate and has probably had its origin in South-east Asia, where the order is particularly well represented. It is to be hoped that when the results of the Abbess' field work is published a very important chapter will be added to our knowledge of the regional flora on a group of plants of which so far too little is known.

67. Two visiting research workers were at different times given facilities for taxonomic and field study of the order *Rutaceae* of which *Citrus* is the most important family. These workers were Mr. M. B. Spurling of the Department of Agriculture, Adelaide, South Australia and Mr. A. Santiago of the Department of Agriculture, Federation of Malaya.

68. Collaboration such as the above is always welcome. The field for research is immense and the facilities of the Department will always be fully at the service of research workers, especially trained botanists from the main herbaria and Universities of Europe and America. It is on such institutions where classical collections and type specimens are stored that a knowledge of tropical botany is to a large extent dependent.

69. Much material was received from other institutions for naming, in particular from the Department of Chemistry, Kuala Lumpur, in connexion with the phytochemical survey of the Malayan flora, and from the Forestry Departments of the Federation of Malaya and the Borneo territories.

70. Routine mounting, repairing of damaged sheets and poisoning proceeded normally.

71. The herbarium has now reached saturation. With cracking of the walls, recorded above, additional weight cannot now be added to the upper floor and the space available there for more cabinets is thus not usable. Consideration must therefore now be given to further building.

XVIII. LOANS OF HERBARIUM MATERIAL

72. Specimens sent on loan totalled 2,517 sheets. The majority went to Leiden for *Flora Malesiana* workers. The principal families were *Bombacineae*, *Celastraceae*, *Euphorbiaceae* (*Trigostemon*), *Menispermaceae*, *Staphyleaceae* and certain genera of *Roseaceae*, *Lauraceae*, *Sterculiaceae*, *Leguminosae*, *Guttiferae* and *Tiliaceae* for Dr. Kostermans at Bogor. Distribution is given in Appendix IV.

73. Specimens received on loan for study at Singapore totalled 2,651 sheets which were 2,606 sheets of *Myristicaceae* for Mr. Sinclair from Bogor and Kepong and 45 sheets of *Myrsinaceae* for Dr. Furtado from Kuching.

XIX. PLANT UTILISATION

74. The Director in the course of his work on marine algae collected samples in bulk of certain common species and sent them to the Tropical Products Research Institute in London for chemical analysis. Two species submitted warranted further consideration.

HORTICULTURE

XX. GARDENS MAINTENANCE

75. The Gardens were well maintained. Lawns were kept mown and tidy. A large number of beds was prepared and twenty-two existing beds were reconditioned and manured. Seventy-six shrubs and trees were planted. Eight hundred and forty-one plant labels were made or renewed.

76. The water in the Lake was drained to permit clearing out of debris. At the same time the pandans on the island there were cut back. Attempts to re-establish the water lilies have not been successful. These plants succumbed when the lake was drained and remained empty for some weeks in 1956 to



Lawrence Niven, the first Superintendent of the Botanic Gardens, Singapore, 1860-1875. He laid out the Gardens and his landscaping has remained almost unaltered to this day.

3 Jan. 79

Present: Cecil Clement Smith

Minutes of the 30th Dec. 78 read and considered.

It is arranged that the rate of salary to be offered to the India gardener is \$80 a month and a free house & passage out—2nd class to be paid by Committee. An agreement to serve five years to be entered into and it is to be laid down that he should have an increment after three (3) years of \$10 a month up to \$120 a month. The gardener should be of good physique and not over 30 years.

[Initialled] C.C.S. [Cecil Clement Smith.]
C.S. [Colonial Secretary.]

Photo-copy of the minutes of the Gardens' committee meeting giving authority for recruitment which resulted in the appointment of Nathaniel Cantley in 1880. Under Cantley's administration the Singapore herbarium was established and the Gardens developed from a pleasure garden to a botanical, horticultural and forestry institution

[Copy]
3 Jan. 79

Present: All the members.
Minutes of His Exc. (?) the Governor of the 30 Dec. 78 read and considered.
It is arranged that all disbursements are made through the Treasury.
An advance of Fifty Dollars is to be given to the Supt. for petty expenditure.
It appearing that great necessity merits for an India gardener [sic.] it is ordered an application be made to the authorities at Kew to select and send out a suitable person. The rate of salary to be offered is 80 a month and a free house. A married man preferred. Passage out—2nd class to be paid by Committee. An agreement to serve five years to be entered into and it is to be laid down that he should have an increment after three (3) years of \$10 a month up to \$120 a month. The gardener should be of good physique and not over 30 years.

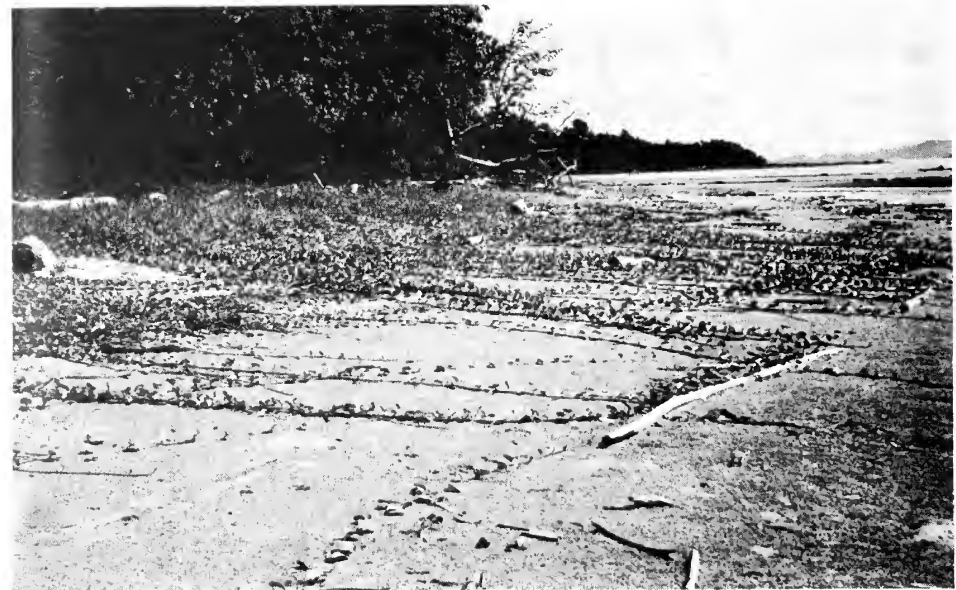
[Initialled] C.C.S. [Cecil Clement Smith.]
C.S. [Colonial Secretary.]

SOME SAND BINDING PLANTS OF THE FORESHORE

from a short section of the South China Sea Coast near Mersing



H. M. Burkill



H. M. Burkill

Ipomoea pes-caprae (L.) Sweet.

From the top of the beach sending out surface runners, 30-40 ft. long, to below high tide level.

(Upper) *Ischaemum muticum* Linn., forming a carpet from high tide level to the top of the beach. Note surface runners. Other grasses invade at the upper limit

(Lower) *Cyperus stoloniferus* Retz. The lowest of the beach plants, growing below high tide level. Root runners are subsurface at about 6 inches depth

Note: black lumps in foreground are clay pebbles



H. M. Burkill

Vitex ovata Thunb.

At the crest of the beach and inundated only at high water spring tides.

H. M. Burkill

FRESHWATER SWAMP FOREST

Kuala Sedili new road

October 1959



H. M. Burkill



H. M. Burkill

permit repairs to the retaining wall. They were one of the most decorative attractions for early morning visitors to the Gardens and continuous efforts will be made to get them growing again. It is thought that the turtles (*Trionyx cartilagineus*) are responsible for eating their roots. *Salvinia auriculata* Aubl., which was introduced some years ago, has recently spread rapidly on the Lake, taking as it were, the place vacated by the water lilies. Regular collection and destruction is carried out lest it become a pest. Like that great pest of waterways in many countries, *Eichornia crassipes*, which is grown in nearly every pond in Singapore and Malaya for fish and pig feed, and is yet not a problem in the Peninsula, *Salvinia* may possibly be benign or even useful in fish farming.

XXI. PESTS AND DISEASES

77. The long-tailed macaque monkeys (*Macaca irus*) remain the worse pests and much damage is attributable to them. About thirty were shot thanks to the services of an assistant from Raffles Museum. Four others were caught alive in trap cages for the Department of Zoology of the University of Malaya.

78. Misguided people occasionally release monkeys from captivity in the Gardens. Most conspicuously are those with collars or wire attachments. Release in the Gardens not only contravenes the Gardens' by-laws, but exposes the wretched monkey to certain cruelty at the hands and teeth of its own kind for trespassers in each troop's preserve suffer a prolonged chastisement inevitably ending in some permanent disability, if not death.

79. No less than thirty plants were mauled by monkeys and six tree saplings were killed. Cannas received regular uprooting. These depredations have to be combatted by enclosing the more valuable permanent plantings in wire netting gages till the plants are big enough to withstand being swung on and pulled about. Forty plants have been so enclosed.

80. There has been a marked check in the incidence of the Rhinoceros Beetle (*Oryctes rhinoceros*) and there has been less damage done to palms. Constant watch is kept on compost heaps and the grubs are collected and destroyed. More serious is the damage done by the Red Stripe Weevil (*Rhynchophorus ferruginea*) as control is much more difficult. Regular patrols were kept on the palms involving climbing to the crown, sometimes 60 ft. high, to spray and dust powder into the leaf brackets. Infected trees unfortunately show the symptoms of attack when it is too late to save the tree. Specimens of the following died during the year: *Coelococcus carolinensis*, *Stevensonia grandifolia*, *Adonidia muellerii*, *Acrocomia fuciformis*, *Sabal princeps*, *Acanthorhizia aculeata*, *Hyophorbe amaricaulis*, *Oreodoxa regia* and *Phoenix madagascariensis*.

81. There has been no serious fungal disease. *Helminthosporium oryzae* is present on the Manila grass (*Zoysia* sp.) in the plant house quadrangle, but its activity has not been enough to be as unsightly as in previous years. *Phytophthora palmivora* and *Pectobacterium caratovororum* were diagnosed on a number of orchid seedlings and fully grown plants. Regular spraying against commoner pests and diseases was carried out.

XXII. ISTANA NEGARA DOMAIN

82. The grounds were kept in a tidy condition, but difficulty was experienced with some of the mowers which were constantly breaking down.

83. The Gardens in front of the Istana Negara and the lower garden and the gardens attached to the other houses in the Domain were all upkept. That

at Sri Temasek (the former Chief Secretary's House) received additional attention as the change in use of the house to the State Guest House called for extra potted plants and decoration for special occasions.

84. The visit of H.R.H. The Duke of Edinburgh in February, and the reception held to which some 4,000 guests were invited necessitated a greatly increased number of pot plants. Twenty groups of floral decorations were put up at Clifford Pier and the Victoria Memorial Hall was decorated from Domain resources. At one time a lorry load of plants was leapfrogging the royal party from one function to the next but one ahead. Later in the year decoration was supplied for the Constitutional Exposition, the opening of the first Legislative Assembly, and the "Government in Action" Exhibition. The Domain nursery to meet these calls maintained a stock of some 2,000 foliage and flowering pot plants, 50 beds of orchids and over 30 beds of other flowering plants.

85. The hedge around the lower part of the potting yard was removed and replaced by a wire fence. Beds of *Hymenocallis* were planted alongside the fence to supply cut flowers.

86. To supply adequate potting soil and humus, soil was burnt regularly, and cattle manure and spent hops were obtained. As in previous years a few loads of elephant manure were also obtained for the especial purpose of acting as a starter for composting. The *fons et origo* of this manure is by way of being a professional circus hand and odd jobbing elephant now living in semi-retirement on the outskirts of the City. Had we not made its acquaintance some years ago we would never have known what remarkably versatile talent it possesses. It is furthermore to be congratulated on its tremendous productivity.

87. The Domain was open to the public on Christmas Day.

88. The horticultural staff of the Domain competed in the 1959 Singapore Flower Show and won three prizes in the pot plant sections.

89. Periodic visits were made to Changi Cottage to give advice on the maintenance of the garden.

XXIII. ORCHIDS

90. The expansion of the orchid collection continued and more of the plant introduction nursery was removed from the enclosure to Lawn Y to make room for the additional orchid plants. A slatted roofed house was completed for the species and the whole collection was moved to it from the Bear Pits on Lawn T. Four of the seedling houses in the nursery were surrounded with aluminium shade screening. This helps to break direct sunlight of the early morning and late afternoon and to maintain slightly moister conditions by reducing air movement and drying out, yet not so damp as to induce rotting.

91. During the year sixty-four successful crosses were made, of which thirty-five yielded fertile pods. The work of crossing had to be suspended for about half the year owing to loss of staff by retirement. Seed from fertile pods raised by the Gardens together with seed from eleven other pods donated by local residents and seed received from New Guinea, Australia and Florida were sown in the laboratory in flasks on agar with Vacins' prescription plus diluted coconut water. The Gardens are grateful to Messrs. Braga, Lewis,

George C. C. Chan, and Mrs. P. L. Tan of Singapore, Dr. Yeoh Bok Choon of Johore Bahru, Mr. J. S. Womersley of Lae, New Guinea, Mr. E. de Saram, Florida, U.S.A., and Mr. F. Tiernay of Australia for donations of seed.

92. An average figure for the number of flasks in use in the laboratory during the year was more than 1,000. The seedlings from 477 flasks were potted out into community pots in the nursery.

93. Manuring followed the policy of using both foliar and root manures. Plants in thumb pots were manured weekly. Older plants were manured monthly. Weekly spraying with insecticides and fungicides was carried out. Bedded plants were manured weekly and sprayed twice weekly.

94. Many plants were received as gifts or on exchange and the Gardens are indebted to the following: Dr. Womersley of Lae, New Guinea; Mr. E. de Saram, Florida, U.S.A., Longwood Gardens, Pennsylvania, U.S.A.; Mr. E. D. Menninger, Florida, U.S.A.; Mr. Ong Kee Chong and Mr. Donough of Kuching, Sarawak; Mr. P. Smithers, London, England; Mr. P. Kuok, Johore Bahru and Mr. Voon, Messrs. Kian Kee Garden, Mr. T. J. Hale and Mr. Chia Kay Heng of Singapore.

95. The orchid species collection was enlarged by sixty-one collections mostly from Johore with a few from Malacca, British North Borneo and Sarawak.

96. The following crosses which had flowered before were named and registered during the year:

1260 *Vanda Yukum B.* (*V. dearei* × *V. Gilbert Triboulet*) Cross made and registered by Mr. Braga of Singapore.

1400 *Vandanthe Noalproth* (*V. Norbert Alphonso* × *V. Rothschildiana*).

1425 *Vanda Muthiya* (*V. luzonica* × *V. Kapoho*).

97. First flowerings during 1959 were:

2432 *Dendrobium Sonia Tan* (*D. Gracia Lewis* × *D. Lady Constance*).

2303 *Vandanthe Lee Chin Chin* (*V. Ruby* × *Vandanthe Ellen Noa*).

1715 *Vanda Dolores Anne* (*V. Ruby* × *V. tessellata*).

1479 *Aranda Wong Mook Kwi* (*A. Ishbel* × *V. Diana*).

1785 *Vanda Mong Lan* (*V. Gilbert Triboulet* × *V. tessellata*).

1883 *Dendrobium Memoria Mohamed Nur* (*D. Ursula* × *D. Alice Spalding*). This cross is named in memory of Haji Mohamed Nur B.E.M. who served the Botanic Gardens for 46 years.

1930 *D. Lim Tar Fang* × *D. Rosalind Lee*.

1744 *A. hookeriana* var. *luteola* × *Vandopsis lissochiloides*.

1534 *V. Ruby Prince* × *Vandanthe Rothschildiana*.

1218 *A. Maggie Oei* × *A. hookeriana*.

1672 *Brassia maculata* × *On. lanceanum*.

2095 *V. tricolor* v. *Charlotte Jones* × *V. the Onomea*.

2436 *D. d'Albertissii* × *D. bromfieldii*.

1055 *V. Audrey* × *V. Prolific*.

1819 *V. Ruby Prince* × *V. Kapoho*.

2268 *V. Ruby Prince* × *V. Caroline J. Robinson*.

1823 *V. Kapoho* × *V.opsis lissochiloides*.

2173 *D. trilamellatum* × *D. Schueleri*.

2440 *D. leporinum* × *D. Leeanum*.

2449 *D. Pompadour* var. *Phra Taba* × *D. Mary Neal*.

Those listed first with cultivar names were registered.

XXIV. SUCCULENTS

98. With the retirement of the Curator in charge of this collection, no expansion was undertaken. The collection was kept under care and maintenance and propagation of species was done whenever possible. The use of broken coral as a top dressing was extended to the major portion of the collection.

EXTENSION WORK

XXV. TRAINEES

99. Seven men were accepted for training and worked for varying periods during the year. They came from Shell Coy., Seria—2; Agricultural Department, Brunei—1; Trafalgar Home—2; and Labour Department—2.

XXVI. SUPPLY OF PLANTING MATERIAL

100. A total of 17,580 plants, cuttings, lots of bulbs and packets of seeds were sold to the public during the year. This compares favourably with last year's sales. Revenue to a value of \$22,201.71 cents was obtained, of which \$18,676 came from orchid sales and the balance from other plants.

101. The Gardens continued to supply planting material free of charge to Singapore Government Departments, charitable institutions, the University of Malaya and the Services. 3,403 plants were supplied to 36 Government-aided schools; 4,007 went to Government Departments, hospitals, police stations, the Airport and service stations, and 763 plants to Nanyang University and charitable organisations.

102. The Gardens supplied potted plants to official departments, military, welfare and cultural organisations for decoration at special occasions; 2,930 pots were so loaned.

XXVII. EXHIBITIONS AND SHOWS

103. The Gardens participated in several shows during the year and won awards.

104. Over 150 prime plants of orchids, *Saintpaulia ionantha*, cacti and succulents, and Begonia species were sent to Kuala Lumpur for display at the Malayan Agri-horticultural Association Exhibition. This was the best horticultural exhibit at the show and created a great attraction. The material taken for sale was all sold out before the Exhibition was officially opened! Revenue was \$1,182.50.

105. Mr. Burkill and Mr. Alphonso were both judges in the competitive sections of the M.A.H.A. Exhibition.

106. The Singapore Gardening Society staged its annual show at the Happy World Stadium during 3rd-5th April. The Botanic Gardens put up a large (400 sq. ft.) landscape of foliage flowering and orchid plants set around a pond as a central motif.

107. The Malayan Orchid Society held its third post-war show at the Happy World Stadium on 9th-11th September. The Botanic Gardens put up the largest single exhibit of 150 of its choicest orchid plants. The Gardens won a Challenge Cup awarded to the originator of the best Malayan hybrid in the show. The plant was a variety of *Arandanthe Grandeur* and was given

the varietal name of Ena Goode as a mark of esteem of the wife of Singapore's first Yang di-Pertuan Negara. The parentage of this plant is:

V. dearei × *E. sanderiana*

↓
V. Ellen Noa × *A. flos-aeris*

↓
A. Grandeur, var. *Ena Goode*

108. The Gardens exhibited at the Malayan Orchid Society monthly shows and won the following awards:

Award of Merit

Spathoglottis Premier var. *Chantek*.

Dendrobium Murray Henderson var. *Tanglin Beauty*.

Arandanthe Grandeur var. *Ena Goode*.

109. In July the Gardens participated at the Malacca State Agricultural Show. A few select plants were taken together with a large quantity of cut flowers. The Gardens are indebted to Mr. and Mrs. M. E. L. Robey of Malacca for the loan of vases and arranging of the blooms of exhibition. A quantity of orchid cuttings and seedlings were sold at the show and netted \$930 revenue.

110. The Penang Gardening Society Show was also held in July and the Gardens sent a consignment of orchid blooms.

111. Orchid blooms were sent to the following exhibitions overseas and our thanks are offered to Messrs. B.O.A.C., QANTAS and A.I.I. who flew them there:

Pakistan Flower Show, Karachi.

The Daily Telegraph Flower Show Festival, England.

Royal Horticultural Society Chelsea Flower Show, England.

Sissinghurst Flower Show, England.

The Olympic Orchid Festival, Melbourne, Australia.

The Victoria Orchid Club Show, Australia.

XXVIII. SINGAPORE GARDENING SOCIETY

112. Mr. H. M. Burkill was President for the years 1958/59 and 1959/60. Mr. A. G. Alphonso was committee member for 1958/59 and was elected vice-President for the 1959/60 year. Mr. A. G. Alphonso was honorary show manager for the 1959 Flower Show and Mr. Wong was assistant manager. The following members of the staff were judges at the Show: Messrs. H. M. Burkill, A. G. Alphonso, Lee Sai Kwong, Wong Siew Hang, G. H. Addison, J. L. Pestana and M. Ramiah. A number of the Society's meetings were held at the Botanic Gardens when demonstrations and talks on different aspects of gardening were given by members of the Botanic Gardens staff.

XXIX. MALAYAN ORCHID SOCIETY

113. Mr. A. G. Alphonso, Mr. G. H. Addison and Mr. J. L. Pestana served on the committee. Mr. Alphonso was Hon. Show Manager and Secretary for the Society's Annual Show. Mr. Wong Siew Hang was Assistant Show Manager. Several of the Society's monthly meetings were held at the Botanic Gardens. Mr. Addison was editor of the *Malayan Orchid Review* for part of the year and contributed articles and numerous photographs and descriptions of new orchid hybrids.

XXX. MALAYAN NATURE SOCIETY

114. Mr. Burkill served on the main committee of the Society and on the committee of the Singapore branch. Two field trips were arranged in the Singapore Nature Reserves.

XXXI. MALAYAN AGRI-HORTICULTURAL ASSOCIATION

115. Mr. Burkill served on the committee of the Society till May.

XXXII. FILM PRODUCTION

116. Some ten films were made in whole or in part in the Gardens during the year by various film studios when the Gardens became resplendent with glamorous stars and all the panoply of high pressure production.

117. A British Broadcasting Corporation television team also visited the Gardens and arranged an interview with the Deputy Prime Minister in a Gardens setting. A free-lance maker of films for T.V. screening also took shots in the Gardens.

XXXIII. ADVISORY

118. Assistance was rendered to the P.W.D., schools and other Government organisations in devising planting schemes for compounds and roadsides. Many requests from private individuals and unofficial bodies were dealt with. Requests were varied but the most frequent referred to planting of shade trees or the removal of trees grown too large or thought to have become dangerous. Except for the business centre of the City, the residential areas are remarkably well planted up and it is undoubtedly this extensive use of trees that adds not only to the beauty of Singapore but sensibly affects the climate. Gone is most of the forest, and only by the use of trees can the heat of the sun be tempered. Every encouragement is given to plant trees.

119. The herbarium staff continued to deal with enquiries relating to the identity, purity and uses of plants of economic use. Medicinal use of plants is a major source of interest not only for officinal purposes but also for research. Sometimes even the pedlars of non-officinal quack nostrums come to seek the opinion of western science.

STAFF OF BOTANIC GARDENS, 1959

DIVISIONS I—III

<i>Appointment</i>	<i>Holder</i>	<i>Notes</i>
Director ..	H. M. Burkill, M.A. (Cantab.), F.L.S. ..	On overseas leave from 16/12
Assistant Director ..	<i>Vacant</i> ..	—
Keeper of Herbarium	J. Sinclair, B.sc. (Edin.) ..	On overseas leave 1/4-13/10
Botanists ..	1. Chew Wee Lek, B.sc. (Malaya) ..	On fellowship at Cambridge University with effect from 18/9/57
	C. X. Furtado, D.sc. Bom- bay) ..	Re-engaged pensioner as training replacement <i>vice</i> Mr. Chew Wee Lek
	2. Chang Kiaw Lan, B.sc. (Malaya), (Miss) ..	Appointed 7/7. Appointment held against vacancy of Assistant Director
Curators ..	1. G. H. Addison ..	On leave prior to retirement with effect from 1/3. Retired 12/6
	<i>Vacant</i> ..	From 1/3
	2. A. G. Alphonso	
Librarian ..	Tan Kim Ho, B.sc. (Malaya)	On Colombo Aid Scheme Training Award in Australia 20/2-26/11
Executive Officer ..	F. A. Pereira ..	1/1-15/3
	Mohamed bin Osman ..	16/3-30/4
	R. S. Mani ..	1/5 onwards
Laboratory Assistant (Special Grade) ..	J. L. Pestana ..	Retired 31/7
	<i>Vacant</i> ..	From 1/8
Horticultural Assistant	Lam Hin Cheng ..	On Scholarship at Royal Botanic Gardens, Kew, 24/9/57-9/10/59. Acting Curator from 10/10/59.
Herbarium and Mu- seum Assistant ..	Mohamed Shah bin Haji Mohamed Nur	

METEOROLOGICAL REPORT

APPENDIX II

BOTANIC GARDENS, SINGAPORE 1959

Reading daily at 9.30 a.m. local time at Gardens' Office

1959	Total Rainfall	Highest fall in 24 hrs.	No. of days rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.
	ins. *	ins.	°F	°F	°F	°F	°F	°F	°F	%
January	10.78 (11.39)	2.04	19	85.0	89.5	74.0	71.5	76.7	75.6	83.9
February	3.88 (7.30)	0.85	11	89.2	91.8	74.8	72.5	81.6	73.4	80.3
March	11.72 (8.48)	2.21	18	88.5	93.0	77.0	71.5	80.2	76.2	84.1
April	8.65 (8.12)	2.68	13	88.6	92.8	75.3	73.0	81.6	78.0	85.0
May	4.14 (7.41)	1.47	12	90.5	94.0	76.4	73.5	83.0	78.5	82.4
June	11.25 (6.65)	3.17	18	88.1	93.0	76.3	71.2	81.7	78.0	81.3
July	4.59 (6.17)	1.89	12	88.5	93.5	74.8	73.5	82.1	78.1	82.7
August	3.64 (7.36)	0.88	14	86.1	91.0	75.6	72.5	80.6	76.7	83.6
September	6.30 (7.70)	2.15	13	87.3	90.0	75.7	72.0	82.3	76.8	78.5
October	5.28 (8.03)	1.14	15	89.0	91.0	75.2	71.5	82.4	78.0	83.3
November	13.76 (10.62)	3.46	21	87.5	90.5	74.4	72.0	80.6	77.4	85.6
December	12.95 (9.93)	1.78	24	86.6	91.0	74.1	71.5	79.7	73.4	84.7
Total/Mean ..	96.94 (99.16)	—	190	87.9	91.8	75.2	72.2	81.0	76.7	82.6

* Mean for the period 1914-1959 (46 years).

APPENDIX III

METEOROLOGICAL RECORD

BOTANIC GARDENS, SINGAPORE 1959

Reading Daily at 8.00 a.m. Local Time at Orchid Enclosure from 1-1-59

1959	Total Rainfall	Highest fall in 24 hours	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.	Mean Min. Grass Temp.	Mean Earth Temp. 4"	Mean Earth Temp 1'	Mean Earth Temp. 4'	Mean Solar Rad. Thermometer
	ins.	ins.		°F	°F	°F	°F	°F	°F	%	°F	°F	°F	°F	°F
January ..	8.73	2.00	18	85.0	89.0	73.1	70.5	75.0	74.1	95.9	72.2	79.4	83.7	82.9	— *
February ..	3.68	0.72	11	88.5	91.5	73.7	71.8	75.6	75.0	97.4	72.5	80.8	83.4	83.8	— *
March ..	11.62	1.40	19	87.6	93.5	73.2	70.0	75.7	74.9	96.1	70.8	80.5	83.3	83.0	154.3
April ..	9.32	2.76	15	84.4	91.2	74.3	72.5	76.8	76.1	96.7	71.1	80.8	83.3	83.6	143.0
May ..	3.96	1.38	11	88.1	91.5	75.2	73.5	77.8	77.1	96.7	72.5	82.0	84.3	84.7	143.9
June ..	10.67	3.37	19	86.6	92.0	75.0	71.0	77.2	76.8	96.8	72.2	81.9	83.2	84.0	134.0
July ..	4.71	1.81	13	87.4	90.0	75.2	70.5	79.6	76.9	95.7	73.2	82.0	83.2	84.1	140.5
August ..	3.35	0.89	10	85.4	89.0	74.2	71.8	76.8	75.9	95.7	72.8	81.4	82.8	83.6	137.2
September ..	5.57	1.80	13	84.4	91.0	74.1	71.0	77.1	76.2	96.3	72.9	81.8	83.0	83.7	142.2
October ..	4.93	1.25	16	87.3	90.0	74.3	71.0	77.5	75.9	95.5	73.1	82.5	84.2	84.6	142.5
November ..	14.26	3.38	18	85.9	88.5	73.3	71.0	76.3	75.3	95.8	72.4	80.9	82.0	83.1	140.2
December ..	13.03	1.92	22	88.7	89.5	73.1	70.0	75.3	74.7	97.5	72.7	79.3	81.1	82.0	136.3
Total/Mean ..	98.83	..	185	86.6	90.6	73.9	71.2	76.7	75.7	97.7	72.4	81.2	83.2	83.6	141.4

*Not recorded.

SUMMARY OF DISTRIBUTION OF EXCHANGES AND LOANS

Institution	EXCHANGE		LOANS	
	NO. OF SPECIMENS		NO. OF SPECIMENS	
	Out	In	Out	In
Arnold Arboretum	399	..	..	..
Bailey Hortorium	16	..	..	..
Bangkok	52	..	1	..
Berlin	75	..	..	..
Bogor	182	1,190	905	2,439
British Museum	96	..	..	..
Calcutta	14	..	..	..
Cambridge	22	69	125	..
Dehra Dun	30	..	..	..
Edinburgh	519	..	..	..
Goteborg	4	..	..	..
Groningen	48	..	..	..
Kepong	36	..	..	167
Kew	741	..	37	..
Kuala Lumpur (D. of Chem.) .. .. .	..	176	..	..
Kuching	43	..	..	45
Lae	96	78	..	..
Leiden	634	121	1,294	..
Manila	440	350	..	..
Manokwari .. .. .	..	7	..	..
Mauritius (Sugar Ind. R. I.) .. .. .	..	21	..	..
Munich	94	..	..	..
New York	102	..	155	..
Paris	76	..	..	..
Sandakan	67	118	..	..
Total	3,786	2,130	2,517	2,651

APPENDIX V

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM PLANTS AND SEEDS WERE RECEIVED ON EXCHANGE IN 1959

Australia	...	...	Botanic Gardens, Canberra.
France	...	...	Centre de Recherches Agronomiques de Province Villa Thurat (A.M.).
Japan	...	...	Osaka University.
Malaya	...	...	Singapore—E. V. Lin & Co., Singapore Gardening Society; Mrs. Gracia Lewis; Mr. A. G. Banfield; Mr. A. Voon; Malayan Trading Co. Ltd.; Mrs. J. MacDougal; Kian Kee Gardens; Mrs. Siegruhn; Mrs. E. M. Airriess; University of Malaya; Mrs. Bond. Perak—Mr. Woo Chee Meng, Teluk Anson. Selangor—Department of Chemistry; Mrs. D. J. Maslin, Kuala Lumpur. Johore—Mr. Philip Kuok; Istana Gardens of Johore Bahru; Mr. Tan Ah King, Kulai. Malacca—Mr. M. E. L. Robey. Penang—Botanic Gardens.
New Guinea	...	...	Forest Department, Division of Botany, Lae.
North Borneo	...	...	Department of Agriculture; Department of Forests.
Sarawak	...	...	Bako National Park; Agricultural Department; Mrs. Donough, Kuching.
United Kingdom	...	...	Eden (Battle) Ltd., Sussex.
United States of America	...	...	Mr. E. de Saram, California; Dr. R. Fosberg, Washington (plants ex Bali); Cypress Gardens Florida; Mr. Menninger, California, Gates Cactus Inc., California; California Jungle Gardens; Mr. R. H. Gast, California; Department of Education and Research, Longwood Gardens, Pennsylvania; Makiki Nursery, Hawaii.

INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS AND SEEDS
WERE SENT ON EXCHANGE IN 1959

Australia	...	...	Botanic Gardens of Brisbane and Adelaide.
Bermuda	...	...	Department of Agriculture.
Brazil	...	...	Botanic Gardens, Rio de Janeiro.
Ceylon	...	...	Department of Agriculture.
Czechoslovakia	...	...	Botanic Gardens of Prague; University of Brno; Charles University; Institute of Yang Natural Philosopherin Praqueq, Vysocany; Kaul Zartos and Davidik Vactor, Krasna Flora; Horni Borg, 77 Okres Velke Mexirrii.
Denmark	...	...	Botanic Gardens of Copenhagen University.
Egypt	...	...	Middle Egypt Botanic Station.
Fiji	...	...	Department of Forests.
Finland	...	...	Botanic Gardens of the Universities of Turku and Helsinki.
Ghana	...	...	University College.
Holland	...	...	Botanic Gardens of Amsterdam and Delft.
Hongkong	...	...	Gardens Division of Urban Services Department.
Hungary	...	...	Hortus Agrobotanicus, Szentes; Botanic Gardens of Budapest University; Botanic Gardens of the University of Szeged; Botanikai Kutata Intezete, Vacraldt.
India	...	...	Director of Horticulture, New Delhi; Forest Research Institute, Dehra Dun; Indian Agriculture Research Institute, New Delhi; Government Fruit Research Station, Saharanpur; Botanic Gardens, Calcutta; Central Arecanut Research Station.
Italy	...	...	University of Catania; Botanic Gardens, Milan.
Japan	...	...	Izu Pharmaceutical Gardens, Shizuoka; Osaka Botanic Gardens; Satake Engineering Co. Ltd., Tokyo; Onomichi Botanic Gardens, Hiroshima; Tanaka Seed and Nursery Ltd., Osaka; Kyushu Regional Agriculture Experimental Station.
Kenya	...	...	Nairobi City Parks Department.
Malta	...	...	Argotti Botanic Gardens.
Malaya	...	...	Department of Agriculture, Kuala Lumpur; State Forest Officer, Pahang, Kuantan; Nam Kee Nursery, Singapore.
Mexico	...	...	Sen. C. Prieto, Mexico City; D. F. San Angel Inn, Col. Thacopal Mexico City.
New Guinea	...	...	Forest Department, Lae; Department of Agriculture, Stock and Fisheries, Port Moresby; Education Department Port Moresby; Arawa Plantation, Rabaul.
New Zealand	...	...	D.S.I.R., Division of Botany, Christchurch.
Nigeria	...	...	Nigerian College of Technology, Zaria.
Poland	...	...	Botanic Gardens, University of Wroclaw.
Portugal	...	...	Instituto de Botanico, Porto.
Samoa	...	...	Director of Agriculture.

Sarawak ...	...	Conservator of Forests, Kuching.
Spain ...	...	Instituto Botanico, Barcelona.
Sweden ...	...	Hortus Bergianus, Stockholm.
Switzerland	...	St. Gallen Botanic Gardens.
Thailand ...	...	Department of Agriculture, Bangkok.
Trinidad ...	...	Imperial College of Tropical Agriculture.
United Kingdom	...	Mr. V. F. Howell, Surrey; Botanic Gardens, Glasgow; Royal Botanic Garden, Edinburgh; Mr. E. Hodgkin, Bucks.; University College of North Wales.
United States of America		University of Tennessee; School of Medicine, Boston University; California Jungle Gardens; Cypress Gardens, Florida; Mr. R. L. Brovalli, California; Mr. R. B. Kurtz, New York; University of California; Makiki Nursery, Hawaii.
Union of Soviet Socialist Republic ...	...	University of Latvia; Batum Botanic Gardens, Georgia; Biological Institute, Kannas; Excavator nijtupik, Tashkent; Hortus Pomologicus Latvia; University of Moscow.
Yugoslavia ...	...	Institute for Research in Plant Production, Zagreb; Botanic Gardens, Zagreb.



STATE OF SINGAPORE

ANNUAL REPORT OF
THE BOTANIC GARDENS
DEPARTMENT FOR 1960

Price: \$1



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ANNUAL REPORT OF THE BOTANIC GARDENS DEPARTMENT FOR 1960

BY

H. M. BURKILL
*Director, Botanic Gardens
Singapore*

PRINTED BY LEE KIM HENG, GOVERNMENT PRINTER, SINGAPORE.

1961

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ADMINISTRATION

I. STAFF

THERE WAS NO CHANGE in establishment during the year. The improvement of the staff position recorded in last year's report was maintained. One Curator's post was vacant for the first 8 months of the year, but by the end of 1960 all Division I and II posts were substantively filled. The important subordinate post of Horticultural Assistant in Division III, vacated by promotion of the holder, remained vacant for the last four months of the year. The services of Dr. C. X. Furtado were retained till August as a replacement officer for staff away on training. The Director, away on overseas leave from mid-December 1959 returned to duty on 9th February. During his absence Mr. Alphonso acted as Director.

2. In the 1957 Report a new venture in staff employment was recorded, the appointment of a totally blind telephone operator, the first blind person so employed in Singapore. Another successful venture can now be reported. A few years ago a cured patient of Trafalgar Home was taken onto the Gardens' establishment. Only the man concerned, the Director of the Botanic Gardens, the hospital almoner and the confidential branch of the Establishment Office knew the medical details of this appointment. For obvious reasons, till the man had established his niche amongst his new colleagues, the matter has remained a secret. Now after several years of working here, there cannot be any valid objection by those with whom he works to a continuation of this harmony, even though they may now learn his history. May this be an example to help in breaking down age-old ignorant social prejudice which besets persons cured of leprosy when they leave the confinement of their isolation after successful treatment.

II. TRAINING

3. Dr. Chew Wee Lek, Botanist, awarded a Government Fellowship to study for a Ph.D. degree at Cambridge University, returned to duty on 18th August after successful completion of his course of study.

4. From 28th October to 8th December, Dr Chew Wee Lek attended an U.N.E.S.C.O. Field Training Course held in West Java. The course, which was fully financed by U.N.E.S.C.O., and run by the staff of the Bogor herbarium, was intended to teach young botany graduates how to work in the forest under primitive conditions.

III. LABOUR

5. The labour force was on average 71 labourers and gardeners in the Botanic Gardens, 54 in the Istana Negara Domain, 8 men in the Nature Reserves, and 2 men and 2 women in the herbarium.

IV. BUILDING AND ROADS

6. Gardens resources undertook the following work:

- (i) A new wooden bridge on the path around the Lake was put up over the overflow spillway. The path itself was also raised and resurfaced on the south and south-western sides of the Lake. The path edges were curbed to prevent erosion.

- (ii) Two plant houses were built, one for orchid seedlings, and the other for foliage plants.
7. The Public Works Department did:
- (i) Repairs to the fabric of the herbarium.
 - (ii) Redecoration of all the office buildings.
 - (iii) Repairs and repainting of the band stand.
 - (iv) Repainting of the orchid nursery fencing.
 - (v) Patching of the roads.
 - (vi) Repairs and redecoration to the Curator's quarters at 30 Cluny Road.
8. Contract sources installed a fire detector system in the herbarium and adjoining buildings.

V. VISITORS

9. Many official visitors called at the office including:
- Mr. J. M. Addis, U.K. Ambassador to Laos.
 - Professor M. E. D. Poore, Department of Botany, University of Malaya in Kuala Lumpur.
 - Mr. E. J. H. Berwick, Director of Agriculture, North Borneo.
 - Dr. R. Cleland and Mr. H. Coolidge, National Academy of Sciences, U.S.A.
 - Haji Abdul Malik, Governor of the State of Malacca.
 - Dr. Salim Ali, Bombay Natural History Society.
 - Mr. P. Weissich, Director, Foster Botanical Gardens, Hawaii.
 - Rear Admiral R. E. Portlock, Chief of Staff, Far East Station, Royal Navy.
 - Prof. Finn Sandberg, Royal Pharmaceutical Institute, Sweden.
 - Dr. D. D. Keck, National Sciences Foundation, U.S.A.
 - Lord Perth, Minister of State, London, and Lady Perth.
 - Mr. R. F. Wolf, Natural Rubber Bureau, U.S.A.
 - Professor V. J. Chapman, Auckland University College, New Zealand.
10. Visiting research workers who made use of the Gardens facilities were:
- Mr. P. S. Ashton, Forest Department, Brunei. (Forest trees).
 - Dr. W. Meijer, Forest Department, North Borneo. (Forest trees).
 - Mr. D. J. Cloward, United Fruit Coy, Boston, U.S.A. (Bananas).
 - Mr. P. Allen, United Fruit Coy, Lancetilla Experiment Station, Honduras. (Bananas).
 - Prof. H. St. John, University of Saigon. (Pandanus).
11. Useful discussions were had with all the above visitors and visiting research workers. The latter by using the herbarium facilities added to the value of the material available to them by making notes, determinations, corrections and amendments as well as working on their own material brought for comparison.

VI. CONCERTS

12. There were 19 band performances by the Singapore Police Band during the year, which, as always, drew large crowds. Thanks are offered to the Commandant of the Singapore Police Force and to his band-masters. Two variety shows (the Aneka Ragam Raya'at) were put by courtesy of the Ministry of Culture.

VII. PUBLICATIONS

13. Printing of Supplement I by G. H. Addison to *Malayan Orchid Hybrids* was well advanced by the end of the year. Material for a second supplement is now available. *Gardens' Bulletin* 17 (3) was published in December. Staff members published the following papers:

BURKILL, H. M.: A Biologist amongst the Rubber Barons, *Family Forum* Christmas 1960 [A periodical of the British Services in Singapore].

FURTADO, C. X.: Superfluous Names and later Homonyms, *Taxon* 9 (5), 1960, 147-150. The Philological Origin of Areca and Catechu, *Principes* 4 (1) 1960, 26-31.

14. *Gardens' Bulletin*, Volume 6, was reprinted. This volume containing papers on local medicinal lore had been out of print for some time. With the marked revival of interest in recent years in phyto-chemistry, reprinting was undertaken to meet worldwide requests.

15. Botanic Gardens publications brought in \$9,848 revenue.

VIII. LIBRARY

16. The accommodation of the library remains unchanged. The books being stored in two separate rooms, neither of which was designed for this function and both badly needed for their intended purpose. One is an office room, the other is an extension of the herbarium in which the spirit collection of plants should be stored. This collection remains in the herbarium and is an embarrassing fire hazard. The lack of proper library accommodation is most unsatisfactory and it impedes the normal functioning of the library and holds up other work.

17. Library accession amounted to 243 volumes. This large intake of material adds to the difficulty of improper and inadequate accommodation. The accession register contained the titles of 8,047 volumes at the end of the year.

IX. AGRICULTURAL PESTS SUPERVISORY COMMITTEE

18. Mr. Burkill, Director, was a member of the committee.

X. COMMONWEALTH WAR GRAVES COMMISSION CEMETERY KRANJI

19. The Imperial War Graves Commission changed its name during the year to the Commonwealth War Graves Commission. The Director, Botanic Gardens, remained the Commission's representative in Singapore. The Botanic Gardens continued to supervise the horticultural and administrative work in maintaining the Cemetery under instructions from the Commission's Eastern Region Headquarters in New Delhi, India. Further information may be found in the Commission's own reports.

XI. NATURE RESERVES

20. The Board of Trustees consisted of:

Nominated by Yang di-Pertuan Negara	...	...	1. Mr. O. K. Abraham	...	w.e.f. 27-1-60.
			2. Mr. Morgan Khoo Kay Ann	...	
The Minister for National De- velopment	...	...	3. Mr. Tan Hoon Siang	...	
			4. Prof. H. B. Gilliland	...	
The City Council	...	...	5. Mr. Tan Jake Hooi	...	up to 30-9-60.
			Mr. Khong Kit Soon	...	w.e.f. 1-10-60.
The Rural Board	...	...	6. Mr. Chan Chiaw Thor	...	up to 30-9-60.
			Mr. R. Ramalingam	...	w.e.f. 1-10-60.
Chairman, ex-officio	...	...	7. Director of Botanic Gardens.		

21. Normal maintenance was continued during the year. The Board held one meeting. Formal Government approval was given to the Army for the construction of additional small arms ranges within the danger area of the existing ranges in the Water Catchment Area.

22. Considerably increased numbers of people are availing themselves of the amenities for recreation in the Reserves and litter at certain points is becoming a nuisance. Organised parties of school children are the main offenders and collaboration of the schools' authorities is being solicited to try to instill a sense of civil consciousness on this matter.

XII. METEOROLOGICAL

23. Observations were continued at the two sites in the Botanic Gardens. A summary of recorded information is given in Appendices II and III. The year was noteworthy for being the driest since 1941, and the second driest since 1914 when reliable recordings were first begun in the Gardens. The year's rainfall was 21 inches below average for the period 1914-60, but rain was recorded on more days than during the past few years. The November-December-January monsoon period of 1959-60 was appreciably wetter than normal and the rains extended into February to stop abruptly in March. February was the wettest month for the year with 10.04 inches of rain and March the driest with 2.24 inches. The monsoon at the end of the year failed to break in November. This month was the third driest in the year with 3.41 inches while on average it has 10.47 inches. December's rainfall was also under average. The short-fall in rain appears to have had little effect on the other phenomena recorded, but the relative dryness of the year has made its impression on tree flowering which has been as a result very much more abundant.

BOTANICAL RESEARCH

XIII. COLLECTING AND NEW RECORDS

24. Many single day collecting trips were made into the Nature Reserves and countryside on Singapore Island which yielded valuable material, but the bulk of the collecting work was done on the following expeditions:

J. Sinclair	...	Johore: Kota Tinggi-Mersing Road, 5¼ m.s. and 12¼ m.s.	13/1	5 nos.
J. Sinclair	...	Johore: Kota Tinggi-Mersing Road, 4¼ m.s.	26/2	5 nos.
J. Sinclair	...	Mawai-Kuala Sedili New Road	4/3	10 nos.

J. Sinclair	...	Mawai-Kuala Sedili New Road	...	...	30/9	9 nos.
J. Sinclair and Kadim bin Tassim	...	Sarawak and Brunei	...	...	31/7 - 7/9	374 nos.
A. G. Alphonso and Samsuri bin Ahmad		Kedah: Langkawi group P. Dayang Bunting, P. Umban, P. Bumbon Kechil, P. Singa Besar, and P. Langkawi	...	...	29/11- 9/12	73 nos. for herbarium 28 alive for cultivation
H. M. Burkill	...	Malacca: Tj. Kling, Tj. Bidarak	...	...	15-17/4	23 nos.
		Johore: K. Sedili New Road	...	...	25/4	19 nos.
		Johore: Bt. Takadai, Mersing, and Sri Pantai	...	...	3- 5/5	29 nos.
H. M. Burkill and Md. Shah	...	Johore: Kota Tinggi-Mersing Road, Kg. Selantai, P. Batu Gajah	...	...	7-10/8	48 nos. 3 nos.
		Pahang: Tokong Burong	...	...
H. M. Burkill, Md. Shah and Md. Noor	...	Pahang: Fraser's Hill	...	...	14-22/8	136 nos.
H. M. Burkill	...	Singapore: Raffles Light	...	...	March-December periodic visits for Sargassum alginic acid assay	26 nos.
Chang Kiaw Lan	...	Penang: Waterfall Gardens and Penang Hill	...	...	23-30/1	15 nos.
Chang Kiaw Lan	...	Penang: Balik Pulau, Waterfall Gardens, Penang Hill, Batu Ferringi	...	...	11-24/5	50 nos.
Chang Kiaw Lan	...	Kedah: Kedah Peak, P. Langkawi, P. Dayang Bunting, Gunong Mas F.R., Telui F.R. near Kg. Weng	...	...	1-17/10	342 nos.
Chang Kiaw Lan	...	Perlis: Kaki Bukit and limestone hill between Kangar and K. Perlis	...	...
Chang Kiaw Lan	...	Johore: Kota Tinggi-Mersing Road	...	...	13/1	10 nos.
Chang Kiaw Lan	...	Johore: Kota Tinggi-Mersing Road	...	...	20/2	14 nos.
Chang Kiaw Lan	...	Mawai-K. Sedili Road	...	...	18/2	5 nos.

25. The salient features of this field work are noted below. Two of Mr. Sinclair's Johore excursions were to the Forest Reserves at the $3\frac{3}{4}$, $5\frac{1}{4}$ and $12\frac{3}{4}$ miles Kota Tinggi-Mersing Road in the beginning of the year. Here, *Horsfieldia tomentosa* was obtained as a first record for Johore while good fruiting material of *Knema mandaharan* was also collected. The only other Johore record for the latter is that of Mr. Corner's from the Sungei Sedili. Two trips were made to the Mawai-Kuala Sedili new road, where there is an extensive area of fresh water swamp forest on each side of the road. This extends back to the Sungei Sedili Besar. During the first visit, Dr. W. Meijer, Forest Botanist, Sandakan, North Borneo, then on a visit to Singapore and

Malaya, accompanied Mr. Sinclair, and was shown the area where he made a small collection, also noting some dipterocarp timber trees in the locality. On the second visit, Mr. J. A. R. Anderson, Chief Research Officer, Forest Department, Sarawak, was able to be present. He is an expert on swamp forest vegetation and was anxious to compare this type of swamp forest with similar regions in which he has worked in Sarawak. Unfortunately just before his visit a vast area of this most interesting type of primitive virgin forest had been felled and all the trees including even the larger timber species with all their epiphytic flora of orchids and festoons of climbers completely burned on the spot. At one point on the north side of the road good flowering and fruiting material of *Genianthus maingayi* (Asclepiadaceae) was obtained. This rarity has been collected only once in Malaya and there is a single rather scrappy and ancient specimen in the Singapore herbarium. On the opposite side of the road is ruined country recently burned and entirely denuded of the last vestige of plant life. It is very important that some of this area should be preserved as a nature reserve since there is no swamp forest now left between Singapore and this place, a distance of 130 miles from the Gardens or University and back. It is also important for students of botany and zoology that this area be preserved so that it can be compared with the similar areas in Borneo, especially if we wish to have a complete phytogeographic picture of the rarer swamp forest species and their distribution. Some of the species will no doubt turn up in Borneo and *vice versa*, but we shall never know that precise facts if the land is stripped before scientists get a chance to make a proper enumeration. Many smaller animals, including snakes and insects must have perished in the blaze. Recently a mouse deer was seen in the area by the Singapore botanists. The larger animals, elephants, tigers and wild pigs are also here, but they will be forced to retreat into an ever-narrowing belt, until they are finally cornered and run to bay. Not even a roadside fringe of shade trees has been left in the burnt areas.

26. The trip to Sarawak and Brunei by Mr. J. Sinclair was one of outstanding success. The main object was to study the Myristicaceae in the field; to obtain as much missing information as possible on bark and field characters, ecology and distribution; to look for rare species, especially those which were imperfectly known as regards flowers or fruits and finally to use this information in revising and writing up the family for *Flora Malesiana*. At the same time other plants were not neglected. A good selection of Annonaceae, Dipterocarpaceae, Sapotaceae and other plants in flower and fruit was obtained amounting to 374 field numbers. The majority of these has now been named and distributed to other herbaria.

27. Mr. Sinclair arrived in Kuching by air on 31st July while Che Kadim bin Tassim, plant collector from Singapore Botanic Gardens arrived by the m.v. *Raja Brooke* with collecting equipment on 1st August. An excellent and judicious programme of itinerary had been previously arranged by Messrs. B. E. Smythies and J. A. R. Anderson of the Forest Department, Kuching, and everything went according to plan. The Botanic Gardens is most grateful to these two officers and to the Sarawak Government for their help. Sarawak is a most interesting place as many kinds of habitat exist in a small area and can readily be visited. The actual places where collecting was done had been well chosen and were fully representative of the major plant communities. These included primary forest on flat and hilly terrain, mountain forest with a distinct flora on Mt. Matang, fresh water swamp forest, beach forest, riverine flora on the Batang Kayan, the granite rocks at Lundu and the "kerangas" padang vegetation at Bako National Park.

28. The first visit, 2nd August, was to the Semengoh Forest Reserve or "Arboretum" where many of the trees have been labelled and are protected. Here Mr. Anderson makes frequent visits, always on the look out for trees in flower and fruit. A tree-house has been erected here where one can observe temperature, humidity and other meteorological data at various heights in the forest throughout the year. The forest was notable in that it contained a good many members of the Sapotaceae not seen in Malaya. Here also the Myristicaceae were fairly abundant and *Knema rufa*, a rare species collected by Beccari once only and in flower, was discovered by Mr. Sinclair on the first day of the trip. This was indeed fortunate for *K. rufa* was one of the special plants required for the monograph and it was seen in fruit for the first time. It was again obtained at Gunong Gaharu in fruit and at the Andulau F.R. in Brunei in male flower. Two more visits were paid to this forest reserve, namely on 3rd and 11th August, where it was relatively easy to collect material since one could choose from the numbered list any special tree that was wanted from which an expert tree climber provided by the Forest Department could collect specimens. From 4th-9th August the party went to Gunong Gaharu and Sungei Sabal Tapang, some 80 miles inland, near the Indonesian border. Mr. Smythies came also and Mr. Anderson arrived on the 6th. Accommodation was found for the party in a house belonging to a Chinese who was extracting "belian" logs, *Eusideroxylon zwageri* from the forest. The only persons to collect in this area previously were Nahar, a forest guard from Kuching, and Asah, the Forest Department's tree climber, who both made a preliminary visit to prepare for the advent of the Singapore party. They searched for Myristicaceae and these were shown to the Singapore members on arrival. Rare and little collected plants, obtained from Gunong Gaharu were *Macaranga setosa*, *Mammea anastomosa*, *Paramapania radians*, *Aporosa*, a new genus according to Airy-shaw, *Knema rufa*, *K. ashtonii*, *Gonystylus borneensis* and *Aetoxylon sympetalum*. *Upuna borneensis*, a very tall endemic Dipterocarp reaching to 180-200 feet, was plentiful.

29. A day was spent at the Bako National Park of which Mr. Anderson is warden. On the top of the ridge above the rest house is the stunted "kerangas" or padang vegetation. "Kerangas" is an Iban word meaning ground on which paddy will not grow. The substratum consists of podsolic sand, sandstone rocks and peat. A few plants are now mentioned which occur here and are representative of such a community:— *Cotylelobium flavum*, *Whiteodendron moultonianum*, *Tristania obovata*, *Calophyllum nodosum*, a peculiar species from 6 inches to 1 foot high, looking very much like a *Vaccinium*, *Alyxia pilosa*, *Vaccinium borneensis*, *Burmannia aisticha*, *Dacrydium beccarii* var. *subelatum*, *Schoenus calostachys*, *Tetraria borneensis* and a new species of *Casuarina* formerly confused with *sumatrana*. In a stream at the foot of the hill *Dipteris lobbiana* was obtained while *Spilanthes urens*, a Composite with white flowers and the margins of the inflorescence bracts purple, was obtained creeping on the sand near the rest house. Here it was rare but was again found in some quantity at Muara Beach in Brunei. The latter record is the first for this species in Brunei. The plant has been found before at Sibü and in North Borneo but the Bako record is the first for the 1st Division of Sarawak.

30. The visit to Matang on 13th August was a rush and the actual summit was not reached. Good fruiting material of the rare *Knema pectinata*, also once collected here by Beccari in flower, was obtained at 2,000 ft. Near it were male and female trees of *K. cinerea* var. *cordata* in flower. The character of the flora began to change above this point when some crags were reached. Here there were some unique and interesting plants such as

Argostemma borraginea, *Steensia borneensis*, *Stilphonothrix ornata* and ferns such as *Diplazium porphyrorachis*, *Tectaria grandidentata*, *T. angulata* and *Thelypteris beccariana*.

31. The visit to Lundu and Gunong Gading lasted from 15th–19th August. This mountain and the Gunong Puey Range have some peculiar plants and are composed of granite while most of the rocks in the 1st Division are of sandstone. The granite ranges have not been inundated in recent geological times like the sandstone coastal areas and this may account for some of the peculiar plants found at Gading and Puey. A few rarities or endemics may be briefly mentioned here. G. Gading (1) base of mountain to waterfall—*Hallieracantha caudata*, *Piptospatha insignis* (the type locality), *Heterogonium stenoseminoides*, *Streblosa urticina* and a new variety of *Knema latericia* which also occurs higher up in the mid-zone, (2) above the waterfall—*Goniothalamus rufus*, *Popowia odoardii*, *Aglaia unifoliata* (3) summit—*Loxocarpus longipetiolatus*, *Vaccinium borneense* var. *poianum*, *Ctenopteris repandulum* and *Lindsaya parallelogramma*.

32. A 3-hour trip by speed boat in the same area was made up the Batang Kayan to Gunong Meroyong, Sampadi Forest Reserve. Here there was a kerangas ridge where the following were obtained:— *Dipterocarpus rigidus*, *Elaeocarpus chrysophyllus*, *Ginalloa linearis* (a parasitic mistletoe), *Nepenthes albomarginata* and a new species of *Horsfieldia*, *Hosea lobbii*, an attractive *Clerodendron*—like a climber with orange-pink flowers and inflorescence bracts—was conspicuous and common in many places along the banks of the Kayan River.

33. On 25th August Mr. Sinclair and Che Kadim left Kuching by air and arrived at Brunei Town. They were met by the State Forest Officer, Inche Mohd. Yakin bin Long, and directed to Seria where headquarters were set up and a programme was planned. Thanks are especially due to the State Forest Officer and the Brunei Government who provided free transport to all the collecting sites as well as several assistants and a tree climber. The Keeper is deeply indebted to the Forest Department for providing a special motor launch for a trip from 29th–31st August up the Sungei Belait to Bukit Puan and back. The Singapore party is also indebted to the late Haji Abang Suhaili, District Forest Officer, Kuala Belait, and his men who accompanied them on all the excursions and arranged the details of each trip.

34. On 24th August a short visit was paid to Anduki Forest Reserve, Seria. Here the forest was composed of almost a pure stand of “Kapur paya”, *Dryobalanops rappa*, a tall timber tree with a mast-like trunk 100 feet or more in height. On the morning of 25th August a visit was paid to the forest at Sungei Lumut and in the afternoon to Andulau F. R. (North). In the former place the monotypic Ericaceous genus *Costera ovalifolia*, a crown epiphyte on *Myristica lowiana* was collected. In a swampy peaty area a pitcher plant *Nepenthes bicalcarata* and a tall dipterocarp, “Kukup”, *Shorea pachyphylla* were taken. In the latter place an interesting palm with stilt roots, *Eugeissona minor*, “tunjang pipit”, was collected. This tree is well-known locally for the excellent walking sticks which are made from the stilt roots, the handle being fashioned from the rhizome or stem-like portion where the stilt roots are attached.

35. On 26th August another trip was made to Andulau F.R., but at its western sector. Here some interesting Myristicaceae were obtained, some of which are new. A huge *Nephelium* species, a kind of wild “pulasan” 120 ft. high and probably new, was discovered. The fruits were found to be very

palatable. A peat-swamp forest at Badas with *Shorea albida*, "seringawan" as the dominant was visited on 28th August and again on 3rd September. Here felling of "seringawan" was in progress. The tree has large buttresses and from these arise enormous gnarled and tangled surface-roots which make walking very difficult. The interstices between the roots are crammed with saplings and ground flora and this covering hides the treacherous holes into which one's foot can easily slip. Several of the peat-swamp species enumerated by Anderson in his work on these forest were located here. A few are *Stemonurus scorpioides*, *Goniothalamus malayanus*, *Polyalthia hypoleuca*, *Lecananthus erubescens*, *Knema kunstleri*, *Ficus deltooides* var. *motleyana* and *Combretocarpus rotundatus*.

36. As mentioned previously, the party proceeded to Bukit Puan on 29th August by launch and stayed there at a saw-mill. Collections were made from Bukit Puan, Bukit Labi and the river banks of the Sungei Belait above Bukit Puan. The main timber trees at Bukit Labi is *Agathis alba* subspecies *borneensis*, "tulang" (Malay), "bulu" (Iban), but it is not found in any great quantity. The Forest Department has started a nursery for young seedlings of this tree and it is hoped that they will reach maturity one day. The terrain in this area consists of sandy ridges and a new species of *Cyathocalyx* was taken here. There were also some plants which so far have not been identified. A new *Hopea* species *H. fluvialis* Ashton, common on the river banks, was gathered in fruit.

37. On 1st September, the party crossed the Belait and Baram rivers and visited Miri in the 4th Division of Sarawak, returning to Seria in the evening. A most puzzling shrub, locally called "balek angin" was common by the sandy roadsides at the 31st mile Miri-Kuala Baram Road, Sarawak. It was seen again on kerangas west of Muara Beach but both times without flowers or fruit. It was later identified at Singapore as *Alphitonia moluccana* (Rhamnaceae).

38. On Sunday, 3rd September, the party left Seria and arrived at the rest house in Brunei Town in preparation for the return to Singapore. A visit was paid to Berakas on 5th September to look for *Knema galeata*, a species hitherto found only in male flower. A few very old fruits were obtained but some time later the State Forest Officer sent excellent fruiting material of this species to the Gardens.

39. Finally one more plant must be mentioned which will at once strike anyone at all interested in vegetation visiting Brunei. It can be seen from the town rest house scrambling over the trees on the hillside in white patches, but is commoner at the 23rd mile by the Tutong-Brunei roadside. The plant on closer inspection will be seen to have purple flowers and is *Jacquemontia tomentella* var. *micrantha* (Convolvulaceae).

40. Mr. Burkill's collecting at Fraser's Hill was done while on casual leave. The major part of the specimens resulted from a strenuous slog to Pine Tree Hill, now safely accessible since the end of the emergency and the clearing of the forest of terrorists. The party had the company, fortunately at a respectful distance, of a 'seladang' cow and calf (*Bos gaurus hubbacki*), both going and returning. A number of new or rare records for the Fraser's Hill area were recorded including: a *Sonerila* sp. not matched in Singapore, *Dischidia gaudichaudii*, *Coelogyne stenochila*, *Campnosperma minor*, and *Pyramidantha prismatica*. *Liparis purpureo-viridis*; an attractive ground orchid known only from Fraser's Hill and Gunong Tahan was seen in flower in great abundance. The fern *Matonia pectinata* collected at the

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summit of Pine Tree Hill, and later on the Jeriau Road and seen elsewhere, is apparently spreading and becoming more common in the Fraser's Hill area.

41. Most of the other collecting done by Mr. Burkill was of marine algae. A course of monthly visits was paid to Raffles Light off Singapore Island to sample the year-long cycle of growth of *Sargassum* spp. for testing the alginic acid content. The weed is entirely broken off in February leaving only the hold-fast and basal 2-3 inches from which the new growth emerges. The young stems contain little alginic acid, but the percentage increases to about 25 per cent later in the year and stays at this figure. Unfortunately this is not a high enough concentration to suggest that local sargassum weed could at present be exploited commercially in the face of the more productive weed of temperate waters, but it may become so with the greatly increasing usage of alginic acid in industry. Alginic acid assays were done by the Tropical Products Institute in London to whom thanks are due for their help.

42. An interesting visit was paid to P. Tokong Burong while at Mersing to see the vegetation of these rocky islets inhabited by a dense colony of seabirds, *Sterna s. sumatrana*, the black naped tern. The soil is sparse and is almost entirely made up of grit and faecal droppings of the birds. The only vegetation found was a plentiful tussock cover of *Chrysopogon collinus* on the cliffs and upper slopes of the rocks between which the birds nest and hatch single eggs, and occasional clumps of *Cyperus polystachyos* at the base of the cliffs in the splash zone of the waves. Standing water, very rich in faecal nitrogen, was coloured a vivid green by *Chlamydomonas*. The water also contained a xanthophyceae.

43. Mr. Alphonso's visit to the Langkawi group of islands was made possible by the kind cooperation of the Commanding Officer of the Singapore Guard Regiment who invited the Gardens to lend a botanical flavour to a party of troops undergoing jungle exercises. Major R. Brewer, in command of the party, was extremely helpful and cooperative in detailing soldiers for assistance whom we hope learnt, as a suitable *quid pro quo*, something of the vegetation, and that the forest was not just "jungle" to be hated and avoided but a living entity in which man can be and work. The main object of the collecting was to obtain living plants of ferns and orchids for the Botanic Gardens nurseries.

44. The Department is indebted to Mr. Cheang Kok Choy, Superintendent of the Penang Botanic Gardens, who gave Miss Chang considerable assistance on her expeditions to Langkawi and to Kedah Peak. Help was also given by Mr. Abdul Kareem Hussain of Balik Pulau, Penang, and various *ketuas*; also the lumbering contractor working on the new road to Sik who loaned jeep transport, and the sawmill manager at Kulim who loaned labourers and transport.

45. Miss Chang's main collections have been of fungi, mostly of the group *Basidiomycetes*. In this group most *Boletes* and some agarics have been found to be mycorrhizal. Information into the specificity of host trees should yield invaluable useful information to forest botanists and silviculturists engaged on problems of afforestation. In Singapore a feeble fructification season occurred in April. There was a more pronounced season in January which would normally have occurred in the preceding November had the monsoon rains not been delayed. The January season was also

peculiar for containing much fewer species of *Boletes* and agarics than usual. *Cantharellus cibarius*, abundant in 1959, was wholly absent. Fructifications of *Hydnum repandum* were found in great abundance.

46. A number of instances of mushroom poisoning were brought to the attention of the Gardens by the Medical and Chemical Departments for identification of the fungus concerned. Two instances involved *Lepiota* spp. In both cases the fructifications were gathered from the foot of banana clumps. One was identified as the poisonous *L. morgani* and is thought to be mycorrhizal on bananas. The other could not be identified with certainty. If indeed *L. morgani* grows in association with bananas, the public should be warned to be careful of fructifications gathered from near banana plants. There are at least five species of *Lepiota*. Extracts of two growing on dung were made by an University physiology research worker who injected the extracts into rabbits. One extract caused no distress, the other produced diarrhoea. The genus *Lepiota* clearly has more than one poisonous species.

47. The Department also received fungus specimens from Jungle Warfare Training School in Johore. These were identified as *Lentinus* sp. (Sayer caju) and *Schizophyllum* sp. both of which are edible. While this is satisfactory to know, the J.W.T. School, conducting survival courses for forest-benighted servicemen, has indeed an overwhelming and unenviable task to put across such information and the like to those on whose memory of it depends perhaps their survival.

XIV. EXCHANGE AND ACQUISITION.

48. Specimens were again distributed to the usual botanical institutions outside Singapore. 3,901 duplicates were sent out as against 3,786 in 1959. Specimens received in exchange or as gifts numbered 3,829. This year the greatest number came from Mr. P. S. Ashton, Forest Department, Brunei, with contributions from the Forest Department, Kuching, and Dr. Kostermans at Bogor were next in order. Details of despatches and receipts are given in Appendix IV. Our thanks are offered to all who sent material. Accession of material through domestic sources amounted to 1,400 numbers.

XV. TAXONOMY.

49. Mr. Sinclair continued throughout the year his work on Malaysian *Myristicaceae* (Nutmeg family) in collaboration with the Flora Malesiana Foundation. His monograph on the genus *Knema*, prepared before his visit to Sarawak and Brunei, had to be considerably amended in the light of his findings there in the field. The revised text now far more complete was finished by the end of the year.

50. Work was begun on naming the abundant collections of P. S. Ashton from Brunei. This and material from other sources has severely taxed the capacity of the staff to keep pace and burdens the available space within the herbarium building, now curtailed by delapidations. The provision of further herbarium space has become an urgent necessity.

51. Dr. Chew Wee Lek on his return from overseas training began to rewrite his doctoral thesis on *Poikilospermum* (Urticaceae) and *Taxotrophis* (Moraceae) in a form suitable for publication. Concurrently he has begun work on the genera *Fleurya* and *Laportea* with the aim of undertaking a revision of the family Urticaceae.

52. Miss Chang has been able to make some progress with her initial work on the higher fungi, but sections are hampered by a very restricted library vote precluding the purchase of appropriate literature, and by the lack of a suitable microscope. The artist made 64 illustrations in colour as a beginning to an *icones fungorum*.

53. Dr. Furtado before he ceased to work on the Gardens' establishment completed the arrangement of the palm section of the herbarium and distributed all the duplicate material. He carried out routine determinations of incoming material sent for naming and of material brought in by students and teachers.

54. On a voluntary basis after ceasing to be on the establishment, Dr. Furtado sorted out material of Mangiferae, Guttiferae (*Calophyllum*), Rutaceae and parts of Fagaceae which had been accumulating over the past few years. He paid special attention to unnamed material from Sarawak, Brunei and North Borneo.

55. Dr. E. C. Abbe, Professor of Botany of the University of Minnesota, and Mrs. L. Abbe of the Department of Biology, MacAlister College, St. Paul, Minnesota (see para. 65 of the Report for 1959) spent about two weeks in Singapore on return from their expedition to Malaya, Thailand, Cambodia and Vietnam collecting and studying Fagaceae (Oak family). A duplicate set of the Abbes' collections will be deposited in the Singapore herbarium.

56. The facilities of the herbarium were made available to Messrs. Cloward and Allen of the United Fruit Company of the U.S.A. to study the collections of Musaceae (bananas). Mr. Allen's subsequent field collections of living material which have been duplicated to the Gardens have added valuably to our banana collection. Professor Harold St. John of Saigon University also made use of the herbarium to study Pandanaceae (pandanus).

57. Routine mounting, repairing of damaged sheets and poisoning proceeded but a very much reduced rate owing to the retirement of one of the two mounters. A replacement was found eventually. With the promotion of one of the two herbarium boys to the post of plant collector, it was decided to fill the vacancy with a third specimen mounter. Not only is there much material to mount but old sheets need repairing, particularly the very old sheets where the paper has become brittle with age.

XVI. LOANS OF HERBARIUM MATERIAL

58. Specimens sent on loan for study at other institutions numbered 2,595 sheets. The majority went to Leiden for workers engaged on the preparation of the *Flora Malesiana*. Other major borrowers were in India, Sweden, Vietnam. The principal plant families concerned were: Bombacaceae, Juglandaceae, Malvaceae (*Hibiscus*), Santalaceae, Niadaceae, Marsiliaceae, Haloragaceae, Simaroubaceae, and Coniferae (*Dacrydium*, *Podocarpus*).

59. Specimens received on loan for study in Singapore numbered 1,835 sheets. The main consignments were 832 sheets of Myristicaceae for Mr. Sinclair and 993 sheets of Urticaceae for Dr. Chew Wee Lek.

HORTICULTURE

XVII. GARDENS MAINTENANCE

60. The density of trees in the Gardens has reached such a concentration that further planting of important species and new introductions can only be done at the price of removing old trees whose performance is known and which are now established in commercial nurseries and in private gardens, no matter how beautiful they may be. Over a dozen unimportant trees or trees which are replicated in the Gardens were culled to make room for new plantings. Some 200 newly introduced plants established in pots await planting out. Notable losses of old trees were:

Cedrela glaziovii (Lawn C), an extremely handsome tree of about 80 ft. height, suffering from termite attack and die-back of the branches. Breaking branches damaged and endangered the herbarium roof.

Ficus benjamina (Lawn B), culled to improve the husbandry of other newer plants growing nearby.

Araucaria cunninghamii, storm damage (Lawn B).

Fagraea fragrans, storm damage. (Lawn F).

Elaeocarpus ganitrus, a gnarled specimen some 50 ft. high and a bole of 20 ft. girth which was completely hollow, culled to permit new planting on Lawn T. This lawn and adjacent Lawn Z in February 1942 during the Japanese attack on Singapore were subject to concentrated artillery bombardment. Many shells burst in the tree crowns. It seems likely that this *Elaeocarpus* and many other trees on these lawns which have died or are now slowly dying of die-back and fungal attack in the crown and the top of the trunk suffered damage during this bombardment 19 years ago which permitted fungal invasion. Similar damage has been reported amongst forest trees in the Federation through military and aerial action during the emergency.

61. Shrubs and trees pruned were *Trachylobium verrucosum*, *Caesalpinia pulcherrima*, *Erythrina glauca*, *Amherstia nobilis*, *Calamus scipionum*, 22 bougainvilleas and a *Bauhinia bidentata*. *Cyrtosperma lasioides* running rampant at the upper end of the lake was cut back; much of it will have to be eradicated as its roots are blocking the flow of water through the Dell Rockery into the Lake.

62. As a result of cutting out and losses by natural causes, it was possible to find space to put out 63 trees and shrubs, most of which were newly introduced plants. These changes necessitated amending the lawn plans which was done.

63. The canna beds along the side of Main Gate Road were dug out, manured and replanted. Other herbaceous beds were also manured with cattle dung and/or artificials. Sixty bushes of bougainvillea were trenched with cattle dung and compost. Four hundred and forty-two plant labels were made or repaired. The bank along the Lake and bordering the Main Gate Road was turfed.

64. A part of the orchid nursery was divided off for the purpose of displaying orchid plants to the public. This will permit a greater number of plants to be on show at any one time than was possible when the plants were put out in the plant house of Lawn L. Now about 130 plants, changed weekly, are on display at any one time.

XVIII. PESTS AND DISEASES

65. The long-tailed macaque monkeys (*Macaca irus*) remain the worst pest. Only four were shot during the year and none caught in traps. Shooting is of little avail as a single shot will scatter all the monkeys to the tree-top to

safety where they pour vituperation on the helpless Gardens' staff. The office shot gun was found to have bent barrels, and to this defect is attributed a major share of ineffective action. A number of plants particularly on Lawn A, E, F, H and L have been badly damaged by monkeys. Young palm seedlings on Lawn W have had to be caged in wire netting.

66. The reduction in incidence of rhinoceros beetle (*Oryctes rhinoceros*) reported in the 1959 Report has been maintained, but constant watch on compost heaps is necessary. Perhaps the nicotine content of small quantities of impounded and confiscated tobacco received through the Customs and Excise Department which has been mixed into compost heaps may help to reduce suitable nursery areas for larvae.

67. The red stripe weevil (*Rhyncophorus ferruginea*) remains a problem. Nine palms were killed by this insect during the year: *Verschaffeltia splendida*; *Licuala grandis*; *Phoenix dactylifera*; 3 *Oreodoxa oleracea*; 2 *Sabal mexicana* and *Borassus machadonis*. Control of this beetle presents greater difficulties than of the rhinoceros beetle. It is usually the taller palms that are attacked and the crown does not show any symptom till after the fatal damage has been done.

68. An attack of banana stem borers (Coleoptera) was discovered in a planting of banana varieties of Lawn T. The Commonwealth Institute of Entomology, London, determined the major damage as done by *Odoiporus longicollis*, and the minor pest as *Polytus mellerborgi*, recorded from the Philippines and Fiji, but only once previously from Malaya. The outbreak was successfully controlled by dusting the banana pseudostems with Agrocide 3.

69. An unidentified animal in the Lake continues to graze down the *Nymphaea preventing* re-establishment of the very decorative cover these plants gave to the Lake a few years back. Colonies of *Nymphaea* have been growing behind wire netting protection and whatever it is that likes to eat *Nymphaea* roots is clearly too large to pass through the 2 inch mesh of the netting. The turtles (*Trionyx cartilagineus*) in the Lake are suspect, but this hypothesis is unfortunately in conflict with zoological opinion which has it that these animals are wholly carnivorous.

70. *Dioscorea sansibarensis*, which was introduced to the Gardens some 45 years ago for the then Director's work on the genus *Dioscorea*, has persisted as a rampant, smothering weed around the perimeter of the Gardens but has never apparently spread further afield. In the past four years there has been very appreciable increase in its abundance, and steps have had to be taken to eradicate it. This feature of vigorous colonisation of a locality without spreading from it is an interesting aspect of plant invasion ecology. It has a close parallel in the animal world in Malaya in the Ceylon Crows at Klang and more recently in the Singapore harbour area. In marked contrast is the spread of other introduced plants and animals such as *Cordia cylindristachya*, which will soon be a common waste-land shrub throughout most of Malaya, and the Giant African snail, *Achatina fulica*, long since spread from Singapore and Penang over the whole country in the lowlands of Malaya.

XIX. HORTICULTURAL EXCHANGE

71. Seed and plant exchange with other botanical organisations abroad was again an important aspect of the work of the Horticultural Division. Two persons were engaged full time on seed and plant collection in fulfilment of requests. Owing to the difficulty of storing seed in Singapore's humid climate

Dendrobium Noor Aishah
Cross No. BGS. 2134



H.M. Burkill



H.M. Burkill

See paras. 79 and 89 in this Report

Sargassum sea-weed beds at Raffles Light, Singapore



H.M. Barkill



See para. 41 in this Report

H.M. Barkill

Dipteris conjugata Reinw.



H.M. Burkill

At Summit of Pine Tree Hill, Fraser's Hill, on the Pahang/Selangor boundary
Altitude 4.780 ft.



H.M. Burkill

In the Labrador Nature Reserve, Singapore at sea level

215
33

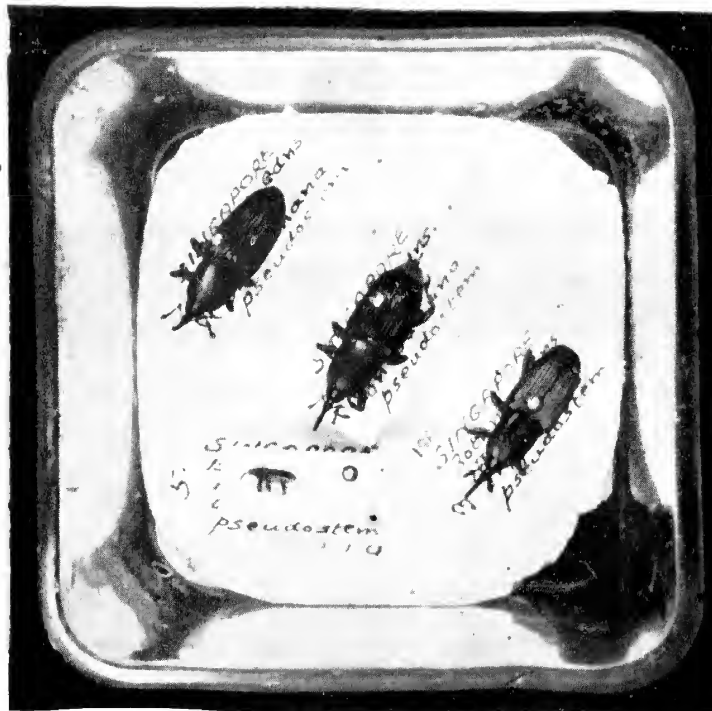
Damage caused by Banana Stem Borers, Botanic Gardens, Singapore
Odoiporus longicollis OL and *Polytus mellerborgi* Boh.

See para. 68 in this Report



Damaged pseudostem

H.M. Burkill



(a) The largest three—*O. longicollis* OL
(b) The smallest one—*P. mellerborgi* Boh.

H.M. Burkill

stocks of seed are not retained for supply on demand. Discharge of requests in most cases have therefore to await the next seed harvest. Seeds and plants were sent to 180 addresses in 47 different countries. The Botanic Gardens received material from 67 addresses in 21 countries and seed exchange lists from 258 addresses in 51 countries—an "united nations" in the cause of botanical science. Addresses concerned in this exchange of material are given in Appendices V and VI.

XX. ISTANA NEGARA DOMAIN

72. The grounds were upkept in a good condition. A number of trees was struck by lightning and two (*Eugenia grandis*, 1, *Fagraea fragrans*, 1) were killed and had to be removed. Some 30 flowering trees were planted including *Cassia spectabilis*, *Millettia atropurpurea*, *Peltophorum pterocarpum*, *Spathodea campanulata*, *Terminalia catappa*, *Cinnamomum iners* and *Delonix regia*. Several clumps of yellow stemmed bamboo were planted on the edge of the golf course. As usual the trees, greens and fairways of the course were well maintained. An epidemic spread of *Elephantopus scaber* appeared in the fairways. This plant is wind dispersed. The flowering stems are usually 6–8 inches long but under impact of frequent mowing they flowered on inflorescences only 1–2 inches high which in general escaped cutting by mowers. The usual selective weed-killers for broad leaved plants proved unable to kill the plant and hand forking and lifting of the tough taproot had to be adopted. At various places in the Domain over 30 chains of hedging were planted, a half of it *Baphia nitida*, the balance being *Acalypha siamensis* and *Cordia cylindristachya*.

73. It is sad to record that our friend, the bountiful elephant, referred to in para. 86 of last year's report was sent early in the year to the Federation of Malaya. For composting it has been necessary to rely on the less efficient product of the domestic cow.

74. The Istana grounds were opened to the public on New Year's Day (1/1/60), Chinese New Year's Day (28/2/60), Hari Raya Puasa (28/3/60) and on Deepavali (19/10/60).

XXI. ORCHIDS

75. The collection of species and hybrids continues to expand rapidly. Eighty-two numbers of species were collected by Gardens' staff while on field work at Cameron Highlands, Fraser's Hill, in Kedah, on Pulau Langkawi and elsewhere. A number was received from outside sources particularly from North Borneo, New Guinea and Brunei. Of the species received, 18 flowered in the nursery and were identified. The collection was also expanded by exchange: 230 plants, cuttings and seedlings were given, 240 were received. Individuals and organisation concerned are listed in Appendices V and VI.

76. Fifty-two hybrid pods were harvested from our own nursery, 12 were received from Singapore growers, four from the Federation of Malaya and three from Sarawak. Of these 71 pods, 50 proved to be fertile and were successfully germinated. Seedlings from 407 flasks reached potting out stage and were moved from flasks in the laboratory to pots in the nursery. The flask culture medium used, as previously, was based on Vacin's prescription; however the coconut water added was diluted to 10 per cent strength instead of 25 per cent. Extensive teratological growth in the flasks of many of the families has been ascribed to the presence of an excess of growth regulators

in the coconut water. Greater use was made of added banana pulp. Excellent results came from the use of both banana pulp and the more dilute coconut water. Over 1,200 flasks were in use.

77. An additional seedling house was built making, now five houses in all. These accommodated about 11,500 seedlings at the end of the year. Some 1,881 seedlings graduated to be grown in the open. Thirty-nine new beds were prepared and planted for large scale multiplication of selected varieties of arachnis-type hybrids.

78. A large proportion of the seedlings will be sold unflowered from the seedling house to the nursery trade and to the public through the Gardens' plant sales office. Also considerable quantities of off-shoots and cuttings of mature selected hybrids will be sold. It is this ready supply of proven and new but promising material upon which Singapore's young and growing orchid nursery trade vitally rests. But the limitations of space are becoming a critical handicap. In the past six years the collection of orchids has expanded from a space little bigger than a tennis court till now it occupies 3 acres—and that after disposal by sale of enormous numbers of seedlings for which neither house or nursery room can be found. Without the provision of further space for seedling houses and nursery area, this work cannot continue at the present tempo which has won a considerable reputation for Singapore.

79. The following hybrid families which flowered for the first time in 1959 were registered:

BGS—

- 1672 *Brassidium* Tan Lean Bee (*Brassia maculata* × *Oncidium lanceanum*).
1823 *Opsisanda* George Addison (*Vanda Kapoho* × *Vandopsis lissochiloides*).
This cross is named after Mr. G. H. Addison, Curator, Botanic Gardens, Singapore, 1938-59, who had charge of the Gardens' work on orchid hybridising for several years.
2440 *Dendrobium* Heng Mui Keng (*D. leporinum* × *D. Leeanum*).

Flowering for the first time were siblings of the following families:

BGS—

- 2353 *Dendrobium* Tan Teo Kim (*D. Ursula* × *D. Tan Chye Siam*).
2134 *Dendrobium* Noor Aishah (*D. capra* × *D. Champagne*). This cross is named after the wife of Singapore's Head of State.
2013 } *Vanda* Ruby Prince × *Vandanthe Ellen Noa* (Proposed name V'the
2302 } *Kupu-kupu*).
2196 *Arachnis Hookeriana* var. *luteola* × *Vandanthe Tatzeri* (proposed name *Arandanthe Bintang*).
2194 *Vanda dearei* × *Vandanthe Tatzeri* (Proposed name *Anna Jackson*).
2327 *Dendrobium* Medusa × *D. Ursula*.
2325 *Dendrobium* Louisae × *D. Constance*.
2651 *Dendrobium* Pompadour 'Phra Tabá' × *D. Rose Marie*.
2059 *Dendrobium* Mt. Waialeale × *D. Champagne*.
2050 *Dendrobium* Clara Cooper × *D. Constance*.
2516 *Dendrobium* Gouldii × *D. mirbellianum*.
2437 *Dendrobium undulatum* var. *broomfieldii* × *D. sp. indet.* (N. Guinea).
2261 *Dendrobium* Medusa × *D. Constance*.
2696 *Dendrobium* Louisae (dark form) × *D. Lady Constance*.
2502 *Dendrobium* Indonesia × *D. Champagne*.
2348 *Dendrobium* Dang Toi × *D. morganster*.

BGS—contd.

- 2007 *Dendrobium* Joanne Sawers × *D. Pauline*.
3040 *Dendrobium mirbellianum* × *D. bigibum*.
2255 *Vanda limbata* × *V. lamellata*.
1953 *Vanda trisum* × *Phalaenopsis serpentilingua*.
1841 *Vanda* Kapoho × *V. insignis*.
1268 *Vanda dearei* × *V. luzonica*.
1806 *Arachnis* Maggie Oei × *Vanda insignis*.
1849 *Arachnis hookeriana* var. *luteola* × *Vandanthe* Ellen Noa.

80. Seven mature plants were supplied for a state gift to H.M. The Yang di-Pertuan Agong of the Federation of Malaya, and five as a state gift to the Sultan of Brunei.

XXII. SUCCULENTS

81. The collection was added to by donations of seeds from other institutions. Many species grow freely. These were multiplied for sale. There is an appreciable public interest in these plants.

EXTENSION WORK

XXIII. SUPPLY OF PLANTING MATERIAL

82. A total of 16,455 plants, cuttings, lots of bulbs and packets of seeds were sold to the public during the year. Revenue to \$21,612.90 was obtained, of which \$17,676 came from the sale of orchid material and the balance by sale of other plants.

83. The Gardens continued to supply planting material free of charge to Singapore government departments, charitable institutions, government-aided schools and other official or quasi-official organisations. Distribution was:

	<i>Plants</i>
Police Stations and Magistrates' Courts ...	185
Schools and Universities ...	3,055
Hospitals ...	184
Other Government departments ...	415
Military ...	645
Charitable organisations ...	231
Total ...	4,715

84. The Gardens also continued to loan potted plants to official and quasi-official departments and to welfare and cultural organisations for decoration at special occasions; 4,257 pots were so loaned. Social Welfare Department alone borrowed 1,365 pots.

XXIV. EXHIBITIONS AND SHOWS

85. The Gardens participated in several shows during the year and won awards. The most notable event was the sweeping success of the Malayan Orchid Society exhibit at the Third World Orchid Congress staged at the Royal Horticultural Society Chelsea Show in London in May. The Botanic Gardens were the major contributor of blooms in this cooperative effort by members of the Malayan Orchid Society. The Society's exhibit won the

highest award, the R.H.S. Gold Medal, and as a result the Fourth World Orchid Congress has been attracted to hold its meeting in Singapore in 1963. Vandanthé Wendy Scott 'Blue Bird', a cultivar of a cross made in these Gardens and grown by Mr. Boey Chun Heng, was given an Award of Merit.

86. The Botanic Gardens participated at the Malayan Agrihorticultural Association Exhibition in Kuala Lumpur, 29–31 July, and staged a non-competitive exhibit which was the outstanding attraction of the horticultural section. A large quantity of plants was taken for sale and \$2,222.50 was obtained as revenue. Mr. H. M. Burkill and Mr. A. G. Alphonso were both judges in the horticultural competitive sections of the exhibition.

87. The Gardens staged the centre piece for the Annual Flower Show under the auspices of the Singapore Gardening Society held at the Happy World Stadium 1–3 April. This was a landscape of near 800 square feet of a garden around a miniature waterfall. Mr. Burkill was Chairman of the Show Committee and Mr. Alphonso was the Show Manager. Many members of the Gardens were judges for the competitive sections.

88. The Annual Show of the Malayan Orchid Society was held 30th September to 2nd October also in the Happy World Stadium. His Excellency the Yang di-Pertuan Negara opened the show. The following are extracts of his opening speech:

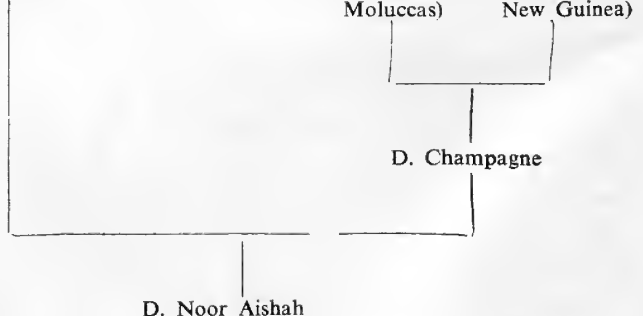
"The year 1960 will go down in history as a very auspicious year for the Malayan Orchid Society. In winning the coveted gold medal at the world-famous Chelsea Show . . . the Malayan Orchid Society has won world acclaim for her orchids . . . I am glad to say that more than 90 per cent of the blooms were hybrids raised in Malaya . . . The Botanic Gardens have pioneered the work in this branch of horticulture . . . and it is gratifying to know that apart from the Botanic Gardens there are no less than 40 people in Singapore alone, who are doing their own crossing and breeding . . . During the last four years the Malayan Orchid Society, the Singapore Gardening Society and particularly the Botanic Gardens have been sending orchid blooms for exhibition overseas . . . it is the overseas exhibitions that will publicise and popularise the many new hybrids which are continually being produced in Malaya . . . with encouragement and guidance from the Malayan Orchid Society and its sister Society, the Singapore Gardening Society, and the technical advice and assistance from the Botanic Gardens, I have no doubt that an orchid industry can be established . . ."

89. The Gardens put up a non-competitive group of some 200 orchid plants landscaped in a rock garden around a "summerhouse" and miniature pool. The Challenge Cup for the best local hybrid flowering for the first time was won by a plant of *Dendrobium* Noor Aishah raised from a cross made in the Gardens. The pedigree of this hybrid is:

Species parents
(Country
of origin)

D. capra
(Java)

D. mirbellianum × *D. undulatum*
(New Guinea, Moluccas) (Queensland, New Guinea)



90. The Penang Gardening Society held its annual show in Georgetown 25-27 November. The Malayan Orchid Society and the Botanic Gardens put up a joint non-competitive exhibit of cut blooms which replicated in a small way the exhibit staged at Chelsea for the World Orchid Congress in the preceding May. The Governor of Penang was so taken with the exhibit that he instructed the President of the Penang Gardening Society to send congratulatory letters to both the Malayan Orchid Society and the Botanic Gardens. Mr. A. G. Alphonso assisted in judging competitive sections of the show.

91. The Gardens also sent flowers to the Florida Federation of Garden Clubs Flower Show, the Jesselton Flower Show, the Glasgow Flower Show, the Royal Commonwealth Society's Flower Show at Sydney, the Selangor Orchid Society's Show and the Federation of Malaya Orchid Society's Show.

XXV. SINGAPORE GARDENING SOCIETY

92. Mr. H. M. Burkill and Mr. A. G. Alphonso were respectively President and vice-President for the year 1960/61. Regular monthly meetings were held, six of which were in the Botanic Gardens, and two by courtesy of the Yang di-Pertuan Negara in the Istana Negara Domain. The Botanic Gardens staff also arranged eight meetings for members' gardeners at which practical demonstrations were given.

XXVI. MALAYAN ORCHID SOCIETY

93. Mr. A. G. Alphonso served on the committee for the year 1960/61. The Gardens continued to contribute descriptions of new hybrid families for publication in the *Malayan Orchid Review*. The Gardens collaborated with Dr. Yeoh Bok Choon in the preparation of *A List of Malayan Orchid Hybrids, 1893-1960*. A number of Gardens' hybrids were displayed at monthly meetings.

94. The Botanic Gardens staff learnt with great regret of the death of Mr. John Laycock on 3rd December at the age of 73 years. Mr. Laycock was a friend of long standing of the Botanic Gardens and it was his enthusiasm for collecting orchid species from the various countries he was able to visit which was one of the basic starting points for the hybridisation of orchids in Singapore over 30 years ago. His collaboration with Dr. Holttum, then Director of the Gardens is today producing remarkable returns, and will, we are certain, continue to do so. Mr. Laycock was one of the founding fathers of the Malayan Orchid Society.

XXVII. MALAYAN NATURE SOCIETY

95. Mr. H. M. Burkill served on the main committee of the Society and on the Committee of the Singapore branch. Many field outings were held, some of them into the Nature Reserves.

XXVIII. FILM PRODUCTION

96. Two studios were at various times engaged on shooting scenes for film stories. Particularly as the actors are usually in exotic attire, this is a source of much interest and attraction to visitors, especially those from overseas.

XXIX. ADVISORY

97. Many visits were paid by the horticultural staff to advise on planting schemes in school and hospital compounds, cultural centres, the grounds of the new National Library and other official sites. Many requests from the public and from unofficial bodies were similarly dealt with. The tree planting programme for shade and aesthetic improvement in school grounds became a major undertaking as scores of schools put in their requests for assistance. Some schools put up their own plans, sometimes with obvious humour such as one requiring a "sugar" palm outside the school tuckshop.

98. The botanical staff continued to deal with enquiries relating to identity and uses of economic plants. Many concerned the identity of samples of seaweeds, commercial value and the availability of certain sorts. As the world is looking more to the sea as a source of raw materials, this interest in algae will certainly increase.

STAFF OF BOTANIC GARDENS 1960

DIVISIONS I-II AND TECHNICAL POSTS OF DIVISION III

<i>Appointment</i>	<i>Holder</i>	<i>Notes</i>
Director ..	H. M. Burkill, M.A. (Cantab.), F.L.S.	Resumed duty after overseas leave 9/2.
Botanists ..	1. J. Sinclair, B.sc. (Edin.) ..	Keeper of Herbarium.
	2. Chew Wee Lek, B.sc. (Malaya) ph.D. (Cantab.)	Resumed duty after overseas training 18/8. Assistant to Director.
	C.X. Furtado, D.sc. (Bombay)	Re-engaged pensioner as training replacement <i>vice</i> Dr. Chew Wee Lek up to 17/8.
	3. Miss Chang Kiaw Lan, B.sc. (Malaya)	
Curators ..	1. A. G. Alphonso	
	2. <i>Vacant</i>	Up to 8/9.
	Lam Hin Cheng ..	W.e.f. 9/9.
Librarian ..	Tan Kim Ho, B.sc. (Malaya)	
Executive Officer ..	R. S. Mani ..	
Laboratory Assistant (Special Grade) ..	<i>Vacant</i>	Up to 27/6.
	Bajuri bin Sappan ..	W.e.f. 28/6.
Horticultural Assist- ant	Lam Hin Cheng ..	* .. Up to 8/9. Promoted Curator w.e.f. 9/9.
	<i>Vacant</i>	From 9/9.
Herbarium and Mu- seum Assistant ..	Mohamed Shah bin Haji Mohamed Nur	
Artist	Juraimi bin Samsuri	

METEOROLOGICAL REPORT

APPENDIX II

BOTANIC GARDENS, SINGAPORE

Reading daily at 9.30 a.m. local time at Gardens' Office

1960			Total Rainfall	Highest fall in 24 hrs.	No. of days of recorded rain	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.
			ins. *	ins.	°F	°F	°F	°F	°F	°F	°F	%
January	..	..	7.36 (11.30)	3.18	17	86.1	90.0	73.8	71.0	79.3	75.8	84.3
February	..	..	10.04 (7.35)	1.83	18	86.6	90.5	73.5	71.5	79.4	75.9	84.4
March	..	..	2.24 (8.35)	0.91	13	89.6	93.0	74.7	72.0	82.1	75.0	79.1
April	..	..	9.02 (8.14)	2.20	17	88.9	93.5	75.5	72.8	82.2	78.2	83.3
May	..	..	5.30 (7.58)	1.71	16	90.5	94.5	76.3	73.5	83.0	77.8	82.9
June	..	..	8.03 (6.68)	4.28	17	88.2	92.0	73.3	72.5	81.8	78.3	85.2
July	..	..	8.29 (6.22)	4.33	14	87.3	91.5	75.6	72.5	81.0	78.2	87.6
August	..	..	3.23 (7.27)	1.07	11	88.7	93.0	76.9	73.5	82.2	78.8	85.3
September	..	..	4.90 (7.64)	1.10	19	87.9	90.5	75.5	73.0	81.7	78.0	84.3
October	..	..	5.53 (7.98)	1.79	14	88.7	91.8	75.4	72.8	82.5	78.1	81.6
November	..	..	3.41 (10.47)	0.54	23	86.3	91.0	74.7	73.2	80.0	76.9	86.8
December	..	..	9.69 (9.93)	2.69	20	86.1	90.5	74.2	71.0	79.9	76.3	85.2
Total/Mean	..	..	77.04 (98.71)	..	199	87.9	91.8	75.0	72.4	81.3	77.3	84.2

* Mean for the period 1914-1960 (47 years).

METEOROLOGICAL RECORD

BOTANIC GARDENS, SINGAPORE, 1960

Reading Daily at 8.00 a.m. Local Time at Orchid Enclosure from 1-1-60

1960	Total Rainfall	Highest fall in 24 hours	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.	Mean Min. Grass Temp.	Mean Earth Temp. 4'	Mean Earth Temp. 1'	Mean Earth Temp. 4'	Mean Solar Radiation
	ins.	ins.		°F	°F	°F	°F	°F	°F	%	°F	°F	°F	°F	°F
January ..	8.25	3.42	17	85.4	89.0	73.2	70.8	74.7	74.1	97.0	72.8	79.1	80.5	81.5	136.6
February ..	9.75	1.68	18	85.4	89.0	72.8	70.8	74.9	74.2	96.8	72.3	79.3	80.9	81.6	137.9
March ..	2.94	0.83	13	87.8	91.0	73.4	71.0	75.7	75.1	97.0	73.6	81.7	82.5	83.2	144.0
April ..	8.62	2.50	16	86.8	90.0	74.4	72.5	76.8	76.1	96.8	74.5	82.0	83.5	83.8	139.9
May ..	3.91	1.48	16	88.0	91.5	74.5	71.5	77.5	77.3	96.6	74.5	81.3	83.8	84.2	141.8
June ..	8.31	4.20	17	86.3	91.0	74.8	72.0	77.9	77.0	96.2	74.3	80.8	82.9	83.5	137.5
July ..	8.11	4.07	14	86.0	89.0	73.9	72.0	76.8	75.1	96.9	74.3	80.2	82.1	83.1	137.7
August ..	3.20	1.10	11	87.7	90.2	75.0	72.2	78.0	76.9	95.4	74.7	82.7	84.1	84.0	142.3
September ..	5.51	1.35	19	86.4	89.5	73.9	72.5	76.7	75.6	94.9	74.0	82.4	84.0	84.3	141.9
October ..	5.75	1.64	14	87.2	90.0	74.0	72.0	74.7	76.0	94.0	74.0	82.0	84.0	84.3	138.7
November ..	3.20	0.60	23	86.1	89.0	73.7	72.0	76.7	75.4	94.2	74.0	80.1	82.2	83.2	133.8
December ..	9.10	2.61	20	85.6	89.5	73.2	71.0	75.8	74.7	96.2	73.1	79.2	80.8	82.5	133.5
Total ..	76.65	..	198	..	..	..	..	..	..	..	..	..	..	..	..
Mean ..	..	..	..	86.6	89.9	73.9	71.7	76.4	75.6	96.0	73.8	80.9	82.6	83.3	138.8

SUMMARY OF DISTRIBUTION OF GIFTS, EXCHANGES AND
LOANS OF HERBARIUM SHEETS

Institution	NUMBER OF SPECIMENS			
	GIFTS AND EXCHANGE		LOANS	
	Out	In	Out	In
Mrs. B. E. Allen (Ipoh) .. .. .	..	20	..	..
Amsterdam .. .. .	..	..	10	..
Arnold Arboretum	514	..	..	..
Bailey Hortorium	121	..	..	..
Bangkok	50	..	..	6
Berlin	134	..	..	34
Bogor	247	505	..	265
Brisbane	70	..	..	..
British Ambassador to Laos .. .. .	..	10	..	..
British Museum	40	..	36	200
Brunei .. .. .	..	1,350	..	..
Brussels .. .. .	..	100	21	..
Calcutta	9	..	..	..
Cambridge	23	..	..	55
Canberra .. .. .	..	..	..	297
Copenhagen .. .. .	..	23	..	10
Dehra Dun	9	..	..	..
Edinburgh	400	289	..	127
Florence	69	..	..	41
Geneva	3	..	..	33
Indian Department of Agriculture, West Bengal .. .. .	..	..	480	..
Kepong, F.R.I.	48	..	..	..
Kew	795	..	2	3
Kuching	341	592	..	74
Kuala Lumpur—Department of Agriculture Lae .. .. .	..	..	34	..
Leiden	88	326	..	..
Malacca, Tropical Fish Culture Research Institute	683	162	1,587	623
Manila	3	..	..	..
Manila	124	291	..	..
Munich	25	..	..	44
New York	80	..	..	..
Paris	16	31	..	1
Saigon University .. .. .	..	..	100	..
Sandakan	7	130	..	..
Stockholm .. .. .	..	..	281	..
Sydney	2	..	..	..
Tokyo University .. .. .	..	..	..	3
University of Malaya .. .. .	..	..	44	..
Washington .. .. .	..	..	..	19
Total	3,901	3,829	2,595	1,835

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM PLANTS AND SEEDS WERE RECEIVED IN 1960

- Australia Nindethana Nursery, N.S.W.
- Argentina Instituto de Botanico, Ministerio de Agriculture. Buenos Aires.
- Bermuda Botanical Gardens, Paget East.
- Brunei Dr. K. F. D. Sweetman, Seria.
- Federation of Malaya Kedah: Mr. Lee Ewe Boon, Alor Star.
 Penang: Botanic Gardens.
 Perak: Mr. E. L. Spykerman, Ipoh.
 Selangor:
 Kepong: Forest Research Institute.
 Kuala Lumpur:
 Che Yacob b. Abdul Latiff
 Lake Gardens and Parks
 Mr. A. A. Allen
 Mr. Chew Sze Foong
 Rubber Research Institute of Malaya
 Mr. Verghese, Department of Agriculture
 Mrs. Fernando.
 Petaling Jaya: Mrs. H. Jones.
 Johore: Istana Gardens, Johore Bahru Nam Heng Estate, Kota Tinggi.
- Finland Dr. Rieno Alava, Turku.
- France Botanic Gardens of the University of Besancon.
- Hong Kong Garden Division, Urban Services Department.
- India Rubber Research Institute of India, Kottayam.
- Indonesia Mr. Yap Sian Too, Bandung; Kebun Raya Indonesia, Bogor, Herbarium Bogoriense.
- Japan Osaka City University Botanic Gardens, Osaka.
- Mauritius Sugar Industry, Research Institute, Reduit.
- New Zealand Leslie D. Foote, New Plymouth.
- New Guinea Dept. of Forests, Lae; Mr. G. C. Elworthy, Port Moresby.
- North Borneo Agricultural Officer, Tawau; Forest Dept., Sandakan.
- Singapore Mr. Chia Kay Heng; Mrs. Max Lewis; Mr. Tan Chye Siam; Mr. Wilgie Heng; Kian Kee Garden; Capt. Taylor; Dr. Furtado; M/s. E. V. Lin; Mr. A. Zehnder; Mr. Choo Yeok Koon; Dr. Au Kee Hock; Mr. George C. C. Chan; Che Hassan Rani; Mr. Yap Cheng Beng; Mr. Alfred Lye; H.E. Yang di-Pertuan Negara; Mrs. Jarvis; Mrs. Richard Terence Down; University of Malaya; Mrs. Heaslett; Mr. Ng Chong Ling; Mr. Wong Kak Sing.
- South Africa Mrs. F. Van Eeden, Natal.
- Sarawak Mr. Ong Kee Chong, Kuching; Mr. C. K. San, Kuching; Mr. Wee Ghim Swee, Kuching.
- Thailand Mr. Rapee Sagarik, Bangkok.
- U.S.A. State and County Arboretum, Arcadia, California; California Jungle Gardens, Los Angeles; Edwin A. Menninger, Florida; Foster Botanic Gardens, Honolulu, Hawaii.
- U.K. Royal Botanic Garden, Edinburgh, Dept. of Botany, University of Hull; Botanic Gardens, Glasgow; Royal Botanic Gardens, Kew; Dr. R. E. Holttum, Kew.

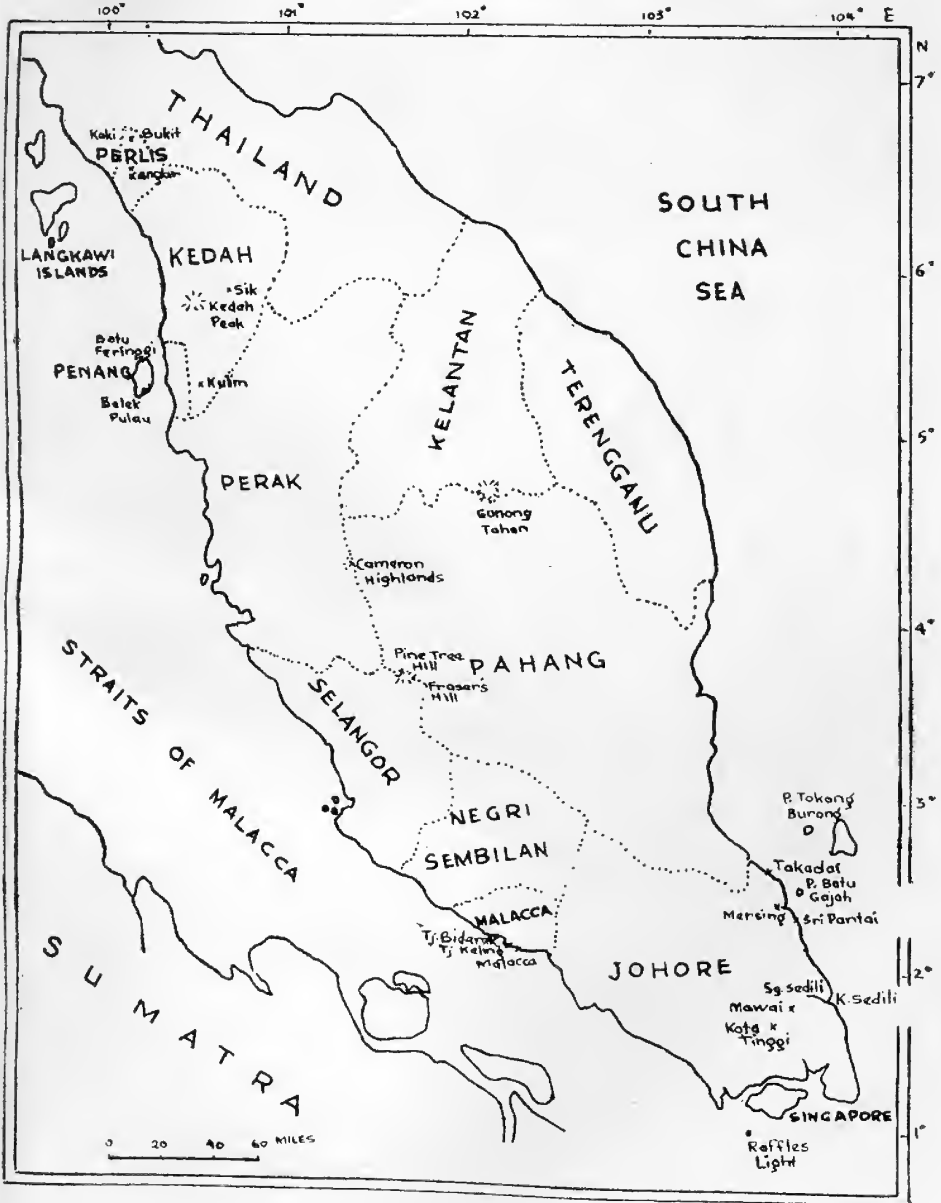
INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS AND SEEDS
WERE SENT IN 1960

Argentina	...	Instituto de Botanica Agricola, Buenos Aires.
Australia	...	Botanic Gardens of Adelaide, Brisbane and Melbourne.
Austria	...	Botanic Gardens of the Universities of Vienna and Graz.
Algeria	...	Institut Scientifique Cherifien, Rabat; Jardin d'Essai, Hamma.
Bermuda	...	Department of Agriculture, Paget East.
Brunei	...	Dr. K. F. D. Sweetman, Seria.
Belgium	...	Jardin Botanique de Louvain; Plantentium, Antwerp.
Brazil	...	Instituto Agronomico do estado de Sao Paulo, Campinas.
Canada	...	Plant Research Institution, Department of Agriculture, Ottawa; Montreal Botanical Garden.
Cook Island	...	Department of Agriculture.
Czechoslovakia	...	Botanic Gardens of Karloveska University, Bratislava; Botanic Gardens of University of Brno; Botanic Gardens, Kosice; Botanic Gardens of Charles University, Prague; Institute for Natural Sciences, Prague; Vyzkumny Ustád Krmivarskya, Mr. Davidik Vaclav, Krasna Flora; Mr. Kotoucek, Horni Borg.
Denmark	...	Botanic Garden of the University of Copenhagen.
France	...	Ministere de l'Agriculture, Pathologie vegetale, Cap D'Antibes; Jardin Botanique de la ville de Nancy; Jardin Botanique Toulouse; Jardin Botanique de Caen; Jardin Botanique, Besancon; Director, Jardin Botanique, ville de Lyon; Universite de Toulouse; Institute de Botanique, Strasbourg; Hortus Botanicus, Insulaecivitatis, Lilla-Nord; Director Botanique "Laleona" Station, Beaulieu; Museum National, Paris 5c; Monsieur A. Pitol, Professor de Botanique, Caen, Calvado.
Fiji	...	Conservator of Forests, Suva.
Finland	...	The Curator, Botanic Gardens, Turku; Dr. Reino Alava, Turku.
Federation of Malaya	...	Istana Gardens, Johore; State Forest Officer, Kuantan; Botanic Gardens, Penang; Mr. A. A. Allen, Kuala Lumpur; Mr. Verghese, Department of Agriculture, Kuala Lumpur; Mr. E. L. Spykerman, Veterinary Department, Ipoh; Montfort Boys Home and Training Centre, Batu Tiga, Selangor; Rubber Research Institute, Kuala Lumpur; Forest Research Institute, Kepong; Mr. P. Kuok, Johore Bahru.
Ghana	...	Botany Department, University College, Lagos.
Germany	...	Botanic Gardens of:—Dresden: University of Frankfurt-am-Main: Tubingen: Bonn: Halle: Darmstadt: Munster: Jena: Hamburg: Kassel: Essen: Wurzburg: Oberholz bei Leipzig: Dortmund: Berlin: Greifswald: Rostok University: Erlangen University: Cologne University: Technical High School Karlsruhe: Potsdam: Freiburg: Landes University, Westfalia.
Holland	...	Botanic Gardens of:—Amsterdam; Delft; Leiden; Landbouogeschool, Wageningen.
Hungary	...	Botanical University, Szeged; Botanic Gardens of Pecs, Vacratots and University of Budapest; Agrobotanic Garden, Godollo.

Hongkong ...	...	The Superintendent of Gardens, Urban Service Department.
Indonesia ...	...	Mr. Yap Sian Too, Bandung.
India ...	...	Indian Agriculture Research Institution, New Delhi; National Botanic Gardens, Lucknow; Dr. Mrs. S. Chitale, Nagpur.
Italy ...	...	Institute and Botanic Gardens of the Universities of Modena, Pisa, Catania, and Naples.
Japan ...	...	Izu Pharmaceu ¹ Garden, 155, Shimohamo, Minamia-Shizuoba-ken; Eiti Midosikawa, Tijosei-Gun, Kiba-ken; Toshihito Satake, Saijomachi, Kamugun, Hiroshima-ken; Mr. Yukio Miyazaki, Minami-izumachi, Kamo-gun, Shizuoka-Prefecture; Shigeki Onchiyama, National Kyushu Regional, Agric. Experimental Station, Kagoshima Prefecture; Botanic Gardens of Osaka, Kisaiki; Kitakawachi, Osaka; V. Segawa, Kosobe Flori-cultural Station, Kyoto University, Kosobe, Takatsuki, Osaka; Mr. R. Hatta, Takeda Herbal Gardens, Kyoto.
Jamaica ...	...	Jamaica Agriculture Society, Kingston.
Kenya ...	...	Parks Superintendent, Nairobi; The Grahame Bell Co. Ltd., Nairobi; Forestry Research Organisation, Kikuyu.
Mariana Islands	...	Director of Agriculture, Guam.
North Borneo	...	Jesselton Town Board.
New Caledonia	...	South Pacific Commission, Noumea.
New Guinea	...	Division of Botany, Lae; Mr. G. C. Elworthy, Port Moresby, Papua; Mr. Blood.
New Zealand	...	Botanic Gardens, Christchurch; Mr. Gay Jamieson, Napier.
Philippine Island	...	Mrs. R. P. Gardener, c/o Philippine Rubber Project & Co., Zamboanga.
Poland ...	...	Hortus Botanicus, Universitatis, Warszawa, Hortus Botanicus, Poznan; Hortus Director, Zaklad Uniwersytetu, Milszajakoperinku, Toxun; Hortus Plantarum, Academiae Medical, Warszawa-Polska.
Portugal ...	...	Institute Botanico Coimbra; Instituto Botanico, Lisboa; Estacao Agronomica Nacional, Sacavem.
Sarawak ..	...	Mr. John Seal, Kuching; Mr. Ong Kee Chong, Kuching.
Singapore ..	...	Mrs. Lewis; Mr. Tan Chye Siam; Kian Kee Gardens; Mr. Chia Kay Heng; Mr. Wilgie Heng; Coronation Nursery; The Japanese Consul-General; The Manager, Southseas Commodities Ltd.; Mr. L. B. Stewart; Mrs. Jarvis.
South Africa	...	University of Pretoria; Botanic Gardens of S. A., Worcester, E. H. Stein, Daleside Estate Nurseries, Transvaal.
South Rhodesia	...	J. H. Blackwood, Murply, Carpenham, Melsetter, South Rhodesia.
Spain ...	...	Instituto Botanico, Barcelona.
Sweden ...	...	Universitetets Botanicka, Lund.
Switzerland	...	Botanicher Garten, St. Gallen; Botanic Garden, Bern.
Tunisia ...	...	Director, Service Botanique, Ariana.
U.K. ..	...	Royal Botanic Garden, Edinburgh; University Botanic Gardens, Cambridge; University of London; Royal Botanic Gardens, Kew; Botanic Gardens, Glasgow; Sandhurst Nurseries, Camberley; Department of Botany, St. Andrews University; Mr. Peter Smithers, M. P., London, S.W.1; Major V. F. Howell, Cobham; The University, Leeds; M. R. Henderson, Aberdeen.

- U.S.A. E. A. Menninger, Florida; Rev. D. Pearce, North Carolina; Mr. Ross H. Gast, California; The Botanic Gardens, University of California; Fairchild Tropical Gardens, Florida; California Jungle Gardens; Dept. of Education, Longwood Gardens, Pennsylvania; Department of Horticulture, University of Hawaii, Honolulu; Foster Botanical Gardens, Honolulu.
- U.S.S.R. Jardin Botanique de l'Universite Mockba, Moscow; Hortus Botanicus Universitatu Latviensis, Latvia; Hortus Botanicus Fominianus, Kiev; Hortus Botanicus Murmansk; Hortus Botanicus Principalis, Academiae Scientiarum, Moscow; Academiae Scientiarum, Ashkhabad; Botanic Gardens, Tomsk; Horti Botanic, Ukraine; Botanic Gardens, Erevan, Armeniae; Prof. A. A. Pristupa, Rostov on Don, Botanical Cabinet of Pedagogici Institute; Teodor Bahams, Smilahu iela, 16, Felgava, Latvia.
- Yugoslavia ... Hortus Botanicus, Zagreb.

MAP SHOWING LOCATION OF MALAYAN PLACE NAMES MENTIONED IN THIS REPORT



10/21



STATE OF SINGAPORE

ANNUAL REPORT OF THE
BOTANIC GARDENS DEPARTMENT
FOR 1961

Price: \$1

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STATE OF SINGAPORE

ANNUAL REPORT OF THE
BOTANIC GARDENS DEPARTMENT
FOR 1961

BY
H. M. BURKILL
*Director, Botanic Gardens
Singapore*

PRINTED BY THE GOVERNMENT PRINTING OFFICE, SINGAPORE

1963

13/25

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ADMINISTRATION

I. STAFF

THERE WAS NO CHANGE in establishment during the year and with the filling of the post of Horticultural Assistant in May, senior, research and technical personnel was again at full strength.

II. TRAINING

2. From 11th October to 7th November Mr. Alphonso, attended a course on genetics sponsored by U.N.E.S.C.O. at the National Institute of Genetics in Japan. Miss Chang Kiaw Lan was given an Asia Foundation Award tenable in the United States of America but due to delay in settling the terms on which she could proceed on overseas study, the award could not be taken up.

III. LABOUR

3. An average number of 70 labourers was employed in the Botanic Gardens, 54 in the Istana Negara Domain, 6 men in the Nature Reserves and two men and two women in the Herbarium.

4. During the 26-day strike of Government daily-rated employees in November, 56 labourers in the Botanic Gardens did not report for duty; all other labourers including the entire labour force at the Istana Negara Domain remained on duty.

IV. BUILDINGS AND ROADS

5. The Public Works Department renovated and extended the public w.c. on Lawn D. Roads remained in a good state. The fabric of the herbarium building, however, showed more cracking (see Reports for 1959, paragraph 13, and 1960, paragraph 7), and there was evidence of straining of timbers in the roof. Though the main foundation of the building seems to be solid there is obviously movement which first became apparent in April 1959 and has been continuous since. The state of the building and its valuable contents inevitably give rise to some anxiety.

6. By Gardens' resources a fireproof cement and brick store for petrol and other inflammable articles was constructed near the potting yard: the ruins of an ancient latrine below the Director's quarters on Lawn Z were removed: the Gardens' fence, which is a constant target for sportive youngsters who prefer to make holes through it instead of walking to the nearest gate, was frequently repaired: the sealed-up gate at Liane Road was repaired and opened and a new gate, Holland Gate, was made at the Holland Road end of Tyersall Avenue.

V. VISITORS

7. Many official visitors called at the office including:

Mr. J. S. Womersley, Forest Department, Lae, New Guinea.

Mr. J. A. Bourne, Horticultural Adviser to Air Ministry, London.

Miss Regina Schoental, Medical Research Council Laboratories, Carshalton, England.

Sir Roland Robinson, Chairman, General Council, Commonwealth Parliamentary Association, House of Commons, London, and a keen horticulturist.

Sir Frank Engledow, Emeritus Professor of Agriculture, Cambridge University, England.

Dr. P. C. Spensley, Assistant Director, Tropical Products Institute, London.
 Mr. M. D. French Mullen, Director of Agriculture, Mauritius.
 E. J. H. Corner, Reader in Botany, Cambridge University.
 Dr. A. V. Castillo, Director, Rubber Program, Mexico.
 Dr. G. Markovitch, U. N. Technical Adviser.
 Dr. Salim Ali, Bombay University.
 Dr. G. P. Askew, Soil Scientist, Wye College, England.
 Dr. K. N. Kaul, Director, National Botanic Gardens, Lucknow, India.
 Mr. A. Dilmy, Director, Herbarium Bogoriense, Indonesia.
 Mr. Sadikin Sumintawikarta, Director, Kebun Raya, Indonesia.
 Prince Chalermbol of Thailand.
 Princess Chumbhot of Nagor Svarga, Thailand.
 Mom Chao S. Sonalkul, Bangkok, Thailand.
 Nai Tem Smitinand, Royal Forest Department, Thailand.
 Mr. J. Wyatt-Smith, Forest Research Institute, Kepong, Malaya.
 Dr. J. W. Evans, Director, Australian Museum, Sydney.
 Mr. D. Rhind, Department of Technical Co-operation, London.
 Dr. A. A. Kirpichnikov, U.N.E.S.C.O., Jakarta.

and many others. These visits afforded occasion for useful and interesting discussions.

8. Many visiting research workers use the facilities of the herbarium, library and Gardens:

Mr. D. H. Nicolson, Cornell University, U.S.A. (Araceae).
 Prof. J. E. Canright, Indiana University, U.S.A. (Annonaceae).
 Mr. K. M. Kochumen, Forest Research Institute, Kepong. (Herbarium practice).
 Mr. Ho Sai Yuen, Forest Research Institute, Kepong. (Art work).
 Dr. Harold St. John, Bishop Museum, Honolulu. (Pandanus).
 Professor E. C. Abbe, University of Minnesota, and Mrs. L. Abbe, Macalister College, St. Pauls, U.S.A. (Fagaceae and Myricaceae).
 Mr. R. B. Kaul, University of Minnesota, U.S.A. (Hydrocharitaceae).
 Dr. J.A.R. Anderson, Forest Department Kuching. (Ecology of swamp forests).
 Mr. J. Womersley, Forest Department Lae, New Guinea. (Bananas).
 Dr. Mamoru Ohashi and Mr. Makoto Togashi, Tokyo Kyoiku University, Japan. (Phytochemistry).
 Mr. P. H. Allen, United Fruit Coy, Honduras. (Bananas).

9. The facilities of the Department were made freely available to members of the staff and to sponsored students of the Universities of Singapore and Malaya.

10. The usual very large number of casual visitors came to the Gardens during the year.

VI. CONCERTS

11. The Singapore Police Force band gave eleven concerts during the year by courtesy of the Commissioner of Police. The Ministry of Culture staged one Aneka Ragam Ra'ayat variety show.

VII. PUBLICATIONS

12. Parts 2 and 3 of *The Gardens' Bulletin, Singapore*, Volume 18 were published. Papers for the whole of volume 19 were to hand at the end of the year with little hope of early publication owing to the low priority in the Printing Office accorded to papers of scientific research.

13. During the year papers were published by members of the Department.

BURKILL, H. M.: Protection of Wild Life on Singapore Island, *Malayan Nature Journal*, Special Issue July 1961: An Elephant Affair, *Malayan Nature Journal* 15 (3/4) December, 1961.

SINCLAIR, J.: A new species of *Goniiothalamus* from peat swamp forest in Borneo, *Gardens' Bulletin, Singapore*, 18 (3) December, 1961; *Florae Malesianae Precursores—XXXI. The Genus Knema (Myristicaceae) in Malaysia and outside Malaysia, Gardens' Bulletin, Singapore* 18 (3) December, 1961.

Anonymous contributions were also made to the *Malayan Orchid Review*.

VIII. LIBRARY

14. The Library has remained in very cramped accommodation, partly in the spirit collection room of the herbarium, and partly in the horticultural officers' office.

15. Accessions amounted to 254 volumes of which 231 were journal volumes. There is a very considerable back log of binding; only 53 volumes were bound free at the Printing Office and the small vote for the library precluded any binding being done outside.

16. Revenue from the sale of publications prepared by the Department amounted to \$11,475. It is suggested that the revenue from this source for 4-5 years should be set aside for the construction of a proper library building.

IX. AGRICULTURAL PESTS SUPERVISORY COMMITTEE

17. Mr. Burkill, Director, was a member of the Committee.

X. UNIVERSITY OF MALAYA

18. The Director represented the Botanic Gardens on the University Court.

XI. COMMONWEALTH WAR GRAVES COMMISSION CEMETERY, KRANJI

19. The Director, Botanic Gardens, remained the Commission's representative in Singapore. The Botanic Gardens continued to supervise the horticultural and administrative work in maintaining the Cemetery under instructions from the Commission's Eastern Region Headquarters in India. Further information may be found in the Commission's own reports.

XII. NATURE RESERVES

20. The Board of Trustees consisted of:

Nominated by Yang di-Pertuan Negara	1.	Mr. O. K. Abraham.	
	2.	Mr. Ong Theng Hong.	
The Minister for National Development	3.	Mr. Tan Hoon Siang.	
	4.	Mr. Tan Jake Hooi.	
The City Council	...	5.	Mr. Khong Kit Soon.
The Rural Board	...	6.	Mr. R. Ramalingam.
Chairman <i>ex-officio</i>	...	7.	Director of Botanic Gardens.

21. Normal maintenance of the Reserves was continued during the year. Many people are visiting these areas, especially Bukit Timah. Unfortunately continuous petty damage is done to map holders, path name boards and other facilities by hooligans. It has not been possible to catch the offenders red-handed.

XIII. METEOROLOGICAL

22. Observations were continued at the recording points in the Gardens near the office and in the orchid enclosure. A new station was opened up in July on the summit of Bukit Timah. Records are tabulated in Appendices II, III and IV.

23. The most marked feature of the year was the relatively small rainfall, being 30 per cent below normal. It was the driest year since 1914 when reliable recording was begun in the Gardens. In 1960 the rainfall was 20 per cent below normal and two consecutive comparatively dry years raised serious problems of municipal water supply. The Gardens are however not entirely dependent on mains water and two springs, one on Lawn W and the other on Tyersall Palace land which feeds the Gardens Lake never went completely dry. Except for March and November, rainfall in all months was below average, and in some of them markedly so. The monsoon rains of November 1960/January 1961 failed entirely to materialise, and the monsoon which broke normally in November 1961 did not continue into December, nor into 1962. Other recorded phenomena do not appear to have varied much from normal.

24. The dry weather, as recorded in the 1960 Annual Report (paragraph 23), has continued to produce unusually abundant flowering. Singapore has thereby enjoyed a sample of horticultural delights commonplace in areas where dry seasons are usual. An unprecedented flowering of *Irembusu* trees (*Fagraea fragrans*) took place in the early part of the year. This covered much of the Federation of Malaya too.

BOTANICAL RESEARCH

XIV. COLLECTING AND NEW RECORDS

25. A most important expedition took place in June to September on the south and east slopes of Kinabalu in North Borneo. Organised and largely financed by the Royal Society of London, the personnel of the Expedition consisted of:

Mr. E. J. H. Corner, Botany School, Cambridge University (Botanist and Leader).

Mr. Adam Stainton, London (Botanist).

Dr. Chew Wee Lek, Botanic Gardens Singapore (Botanist).

Dr. G. P. Askew, University of London (Soil Scientist).

Prof. J. L. Harrison, Nanyang University, Singapore (Vertebrate Zoologist).

Mr. Chin Phui Kong, Agricultural Department, North Borneo (Fisheries Officer).

Mr. B. E. Smythies, Forest Department, Sarawak (Ornithologist).

*Che Md. Shah bin Haji Md. Nur, Botanic Gardens, Singapore (Plant Collector).

*Che Kadim bin Tassim, Botanic Gardens, Singapore (Plant Collector).

Mr. Ben Ensol, University of Malaya (Hunter).

Mr. Gaun, Sarawak Museum (Hunter).

Messrs. E. J. H. Berwick, Director of Agriculture, E. Carson, Conservator of Forests, and W. Meijer, Forest Botanist, of the North Borneo Forest Service also paid short visits to the expedition. Though the field of work lay in North Borneo, the Botanic Gardens, Singapore, provided a considerable quantity of equipment and a stronger contingent than other organisations more closely concerned with the aims and objects of the expedition—namely to survey the eastern shoulder of Kinabalu in the assistance of the North Borneo Government's proposal to create there a national park. This effort on the part of the Gardens was not by any means selfless. Such botanical surveys further the research of the Department on regional botany and the first set of duplicates after being worked over by experts will come to be deposited

in the Singapore Herbarium. The expedition concerned itself mainly with the eastern shoulder of Kinabalu above Ulu Langanani. From the Ranau Hot Springs the North Borneo Forest Department had opened up a trail leading to five camps: Camp I (Base) at 3,400 feet altitude; Camp II at 6,500 ft.; Camp III at 8,000 ft.; Camp IV at 9,500 ft. and Camp V 10,500 ft. At base camp an Uni-pot aluminium hut was built which served as an office, laboratory and store and soon it acquired the name of "Burlington House", the address of the Royal Society in Piccadilly, London. Plant collections by Dr. Chew Wee Lek were made from Camps I, II and III, while Messrs. Corner and Stainton worked from Camps IV and V. The expedition made no attempt and had in fact no intention of reaching the summit (13,455 ft.) and probably from the eastern shoulder it would have proved to be inaccessible. This shoulder is one of the unexplored parts of the mountain. Virgin forest extends down to about 2,500 ft. From that elevation to about 4,000 ft. the vegetation is montane dipterocarp rain forest. From 4,000 ft. to 6,000 ft. oaks appear and above that the trees become smaller, knarled and merge into Moss Forest with dwarfed trees covered with water-saturated mosses and lichens. Ericaceous plants (rhododendrons and vacciniums) become common above 8,000 ft., and also species of *Nepenthes*, especially *N. lowii*.

26. At the end of July the expedition withdrew from the east shoulder and made its way by contour at about 4,000 ft. across the Sg. Mahmood Valley to Kundasang. Along this trail a species of *Rafflesia* was common.

27. All plant collections made have been sent to the Royal Botanic Gardens, Kew for sorting into families and for distribution to specialists. The Singapore Botanic Gardens will receive Palmae, Araceae, Myristicaceae, Urticaceae and the genus *Ardisia* to work up.

28. A very large number of single day collecting trips were made on Singapore Island and in South Johore, especially by the Keeper whose other work precluded prolonged absence, and by the Mycologist. These trips yielded valuable material but because of their number are not listed. Other expeditions were:

H. M. Burkill	...	Raffles Light and neighbouring islands and reefs	...	28-29/ 1	7 nos.
		Raffles Light and neighbouring islands and reefs	...	3- 5/ 3	7 nos.
		Raffles Light and neighbouring islands and reefs	...	5/ 8	2 nos.
		Raffles Light and neighbouring islands and reefs	...	30/12-	
				2/ 1/62	29 nos
		Bukit Kroh Forest Reserve and P. Undan, Malacca	...	1- 3/ 4	28 nos.
		Tanjong Kling, Pulau Nangka, Malacca	...	28/4-1/5	30 nos.
		Kuantan and central Pahang Road	...	7-11 /6	33 nos.
		Tanjong Gul, Singapore	...	20/8	33 nos.
		Pulau Besar, Malacca	...	29/8	17 nos.
		Fraser's Hill	...	2- 7/10	40 nos.
		Cameron Highlands	...	8-14/10	62 nos.
		P. Hantu, Singapore	...	19/11	11 nos.
		Cameron Highlands	...	1- 2/4	7 nos.
Chew Wee Lek	...				
Chew Wee Lek with U. of Malaya Expedition	...	Tasek Bera and Temerloh, Pahang	...	22/10-	
				1/11	42 nos.
A. G. Alphonso	...	Kedah Peak, Penang Hill, Batu Caves	...	5-16/ 9	21 nos.
					(also 146 living plants for cultivation)

12149

29. The Director continued collection of marine algae around Raffles Light and extended collections to islands lying off Malacca and at Kuantan. His collections of October at Fraser's Hill and Cameron Highlands were made while on convalescent medical leave. The Cameron Highlands vegetation is but poorly known and the aspect of the area is changing so rapidly that colonies of potentially valuable, rare and scientifically interesting plants may well be snuffed out under the steam roller of 'development' before they have been discovered, let alone studied. Even the Director's small collection of 62 numbers contained new Malayan records and others of plants represented by only one or two sheets in the Singapore herbarium: for example, an *Osbeckia* sp. unmatched in the Singapore herbarium and in the Malaysian collections at Leiden possibly a new species or perhaps an Indian species representing an outlier from the Himalayan flora; *Medinilla penduliflora*, very decorative and collected only twice before; *Lasianthus salicifolius* known from only one previous collection made by Ridley in 1908 on the Telom ridge; *Clidemia hirta*, a South American immigrant spreading over both lowlands and hill stations in Malaya, now collected for the first time at Cameron Highlands; *Pycnostachys stuhlmannii*, an East African plant now running wild. The Director also collected a number of water samples containing phytoplankton for the Director, Fish Culture Research Institute, Malacca.

30. In the single day trips, most attention was paid to the fresh water swamp forest around Mawai, the Gunong Panti and Gunong Pulau Forest Reserves. These areas, each some 40 miles distant from Singapore, are the nearest considerable blocks of forest remaining. Gardens staff took visiting botanists passing through Singapore there and to the Singapore Nature Reserves. Among the noteworthy plants obtained from Johore during these trips, the following may be mentioned: *Crataeva religiosa*, a pretty flowering shrub sometimes seen in cultivation; *Stemonurus malaccensis*; *Dipteris lobbiana*, a rare fern from the Kota Tinggi area, now in great danger of extinction by depredations of picnickers; *Schoutenia accescens*, a tree from Gunong Pulau certainly worth cultivating for its beautiful papery yellow flowers; *Poikilospermum scortechinii*, a rare climber with white flowers; *Phalaenopsis fuscata*, an orchid not seen everyday; *Aquilaria beccariana*, a Bornean element in the drier parts of the swamp forest; *Phaeomaria venusta*, a member of the ginger family with rose-like flowers; *Lepisorus longifolius*, a fern; *Smilax sinclairii*, a common but overlooked plant named after the Keeper of the Singapore herbarium; *Vaccinium leptanthum* and *Maesa macrothyrsa*, the latter relatively rare.

31. Accorded by the Keeper the best find of the year however was a totally different plant. None of those listed above is really new to Malaya nor even to the State of Johore itself. One would scarcely imagine that even now in Singapore, after 140 years of botanical exploration, novelties apart from introduced plants would turn up. This nevertheless is the case for the Director, seeking marine algae in the mangrove mud, and brackish waters of the Sg. Kranji, discovered half buried in the mud the first record for the Malay Peninsula of the semi-marine *Halophila beccarii*. It was there in considerable quantity, but on account of its cryptic habit in a dirty habitat which has little attraction for collectors after less lowly plants, it had certainly escaped notice of all. Also on Singapore Island the presence in fair abundance of *Rhizophora stylosa*, a mangrove tree and certainly not one of microscopic dimensions, was discovered. Ridley recorded it in his Flora as probably occurring at Malacca but the Singapore herbarium has no specimen in substantiation and only two collections of a later date from the Langkawi Islands. It was found at Tanjong Gul, Tanjong Teritep, and on

Pulau Pawai and Pulau Senang. Collections were also made at Malacca on Pulau Besar, Pulau Nangka and Pulau Dodol, one of which must have been the collecting locality of the collections cited by Ridley. This tree is obviously commoner than originally thought.

32. The Keeper also found *Iyengaria stellata*, a new marine algal record for the Malay Peninsula at Tanjong Gul. It has subsequently been found at Blakang Mati. *Monogramma trichoidea*, thought to be extinct on Singapore Island was rediscovered. The locality is not being disclosed since the plant is extremely scarce and should never be taken up by the roots. A rare lycopod, which may be *L. dalhousianum*, has also been found, but unfortunately near a main road where it can be seen by the public. Its expectation of life can only be very limited. There used to be several species of *Lycopodium* in the Water Catchment Area growing on trees as epiphytes but they are fast disappearing. They make decorative hanging plants and have probably been picked for this purpose.

33. More cases of mushroom poisoning occurred during the year and it is now certain that the poisonous species is *Lepiota morgani*. In view of this it is interesting to note the possible identity of *Chendawan Kelemumur* (scurfy fungus) in prescription 523 of "The Medical Book of Malayan Medicine" in the *Gardens' Bulletin* VI (3) October 1930, p.p. 417 and 432. When the commentary on this book was prepared *Chendawan Kelemumur* was unidentified. None of the present cases of poisoning by *L. morgani* has proved fatal, nor more serious than a very unpleasant discomfort of vomiting and diarrhoea. This violent emetic and purgitive action may indeed be a saving grace and the character upon which the Malay *bomoh* relied to shift more potent poisons from the intestines when he prescribed this fungus, adding—where the modern physician would put "Fiat haust" without mention of the outcome—confidentially" . . . and let him be relieved."

XV. EXCHANGE AND ACQUISITION

34. Specimens were again distributed to the usual botanical institutions outside Singapore. The number distributed was 2,672, considerably lower than normal owing to the diversion of botanical staff time to the Kinabalu expedition. Specimens received in exchange or as gifts totalled 2,824 which is also a reduction on previous years. The greatest number came from North Borneo, with the Forest Research Institute, Kepong, second, Herbarium Bogoriense third and the Kuching herbarium fourth. Details are given in Appendix V.

XVI. TAXONOMY

35. Mr. Sinclair continued his work on Malaysian Myristicaceae (Nutmeg Family) in collaboration with the Flora Malesiana Foundation. The manuscript revision of the genus *Knema*, prepared in 1960, passed through the printer and appeared as *Florae Malesianae Praecursores—XXXI. The Genus Knema (Myristicaceae) in Malaysia and outside Malaysia*, in the *Gardens' Bulletin*, 18 (3), December 1961.

36. Work was begun on the genus *Myristica*. This is the largest genus of the family with about 70 species and contains the most unsolved problems. Several of the type specimens from New Guinea were destroyed in Berlin during the recent war. Many isotypes have fortunately been located in other herbaria, but some of the destroyed types of which isotypes have not been found elsewhere probably were never duplicated. In some cases a species is known by only one or two gatherings and the material is inadequate for a good description to be made. Nor do these sheets bear detailed field notes on the general appearance of the tree, bark characteristics and other features.

Useful work is being done by botanists of the land utilisation section, C.S.I.R.O., Canberra, and of the Forest Department of New Guinea, but it is desirable that the monographer who is engaged on such work should see for himself the living trees in the forest. It is hoped that arrangements now being made to send Mr. Sinclair to New Guinea in 1962 will be successfully concluded.

37. Dr. Chew's work on the Urticaceae was held up by his participation in the Royal Society Kinabalu Expedition. However the work on the genera *Fleurya* and *Laportea* reached an advanced stage of preparation. As in the case of the *Myristica* types, there is difficulty locating and examining type collections of the genera under review which, if they still exist are laid in European herbaria. This would normally be resolved by the monographer visiting the relevant institutions and it is hoped that in a year or two's time this will be possible. The Botanic Gardens are greatly indebted to Miss P. I. Edwards, Librarian, of the British Museum of Natural History, and to Dr. Ding Hou of Flora Malesiana Foundation, who have supplied photocopies of critical literature not available in Singapore.

38. Miss Chang collected fungi and was particularly occupied with the genus *Lepiota* which, as recorded elsewhere in this report, was the cause of poisoning. Two hundred and thirty seven numbers of fungi were added to the mycological herbarium. Seventy two illustrations were added to the *icones fungorum*.

39. Dr. Furtado, now on retirement and working on a voluntary basis, determined material sent over from the Kuching herbarium, some of it classical collections of Haviland and Hose.

40. Determination of material received from other institutions proceeded satisfactorily, and in spite of the absence of herbarium staff on the Kinabalu Expedition good progress was made with naming Mr. Ashton's large collections from Brunei. This is the first really comprehensive collection of forest trees from Brunei and so fills a gap in our knowledge of the Bornean flora.

41. Routine mounting, repairing of damaged sheets and poisoning were continued without break. Three mounters are now employed and inroads are being made into the backlog of specimens awaiting mounting. Some 3,000 sheets were prepared and laid in.

XVII. LOANS OF HERBARIUM MATERIAL

42. Nine loans were made, all in connection with monographic revisions for *Flora Malesiana*. The Rijksherbarium, Leiden, took 950 sheets of Sapindaceae, Sapotaceae, Ochnaceae, Primulaceae, *Pisonia*, *Pygeum* and *Ormosia*. Canberra took 706 sheets of Saxifragaceae and Monimiaceae. Sheets received on loan were 1,280 Myristicaceae for Mr. Sinclair's work. They came from the University of California, Royal Botanic Gardens, Kew, Kuching Herbarium, Arnold Arboretum and the Rijksherbarium, Leiden.

HORTICULTURE

XVIII. GARDENS MAINTENANCE

The Lake

43. The main horticultural work was carried out in June, July and August when the dry weather and the reduced flow of water into the Lake gave the opportunity for draining it for repairs to the crumbling banks at the upper end, and for the removal of an accumulation of silt. An average of 40 labourers daily were deployed from their usual duties on this work. A coral boulder wall was made around the head of the Lake. Considerable quantities of mud and silt were removed and put in the Dell Rockery. Bridges

over the silt pits were repaired and seats put up at the head of the Lake giving a vista down its length. The silt pits were also cleaned out and repaired.

44. The lowering of the water level in the Lake also facilitated further investigation into the mystery of the complete disappearance of the waterlily population recorded in previous reports (1959, paragraph 76; 1960, paragraph 69). As soon as the water level had receded to a small muddy area at the lower end, sweep netting was undertaken to trap the turtles. The presence of the Malayan Leathery-backed Mud Turtle (*Trionyx cartilagineus*) was known and zoologists protested its carnivorous innocence, an alibi soon to be substantiated by the discovery of a second species of turtle that had no such horticulturally benign character. The other species was found to be *Callagur borneoensis*, an animal of known vegetarian habits. Some half dozen of this species were caught, one or two weighing over 50 lb. and their removal from the Lake subsequently led to such an overwhelming regeneration of *Nelumbium* and *Nymphaea* as to be a little embarrassing. That only half a dozen turtles could keep down the growth of these waterlilies dispersed thickly over about 3 acres of water is quite remarkable.

45. Almost as soon as the mud was exposed by draining the Lake germination of *Nymphaea* began and soon a complete mat of plants was formed. These must have come from a rich stock of seeds lying dormant in the mud for at least five years and which drying or an improved aeration stimulated to germinate. Material long thought lost was soon identifiable, for example, a blue *Nymphaea* which last flowered in 1953 reappeared in exactly the same spot in which it was then planted.

46. While the *Nymphaea* was early to reappear, the *Nelumbium* did not start to grow till water had begun to accumulate again in the Lake. It very soon became rampant and strong measures had to be taken to curb this untidy plant and to prevent it completely smothering the desirable *Nymphaea*. Spraying the leaves with Agroxone, followed 2 weeks later by hand pulling of the unsightly trash and then by patrol rounds to catch the few regenerating survivors gave a very excellent degree of control. The surface-lying leaves of *Nymphaea* with careful handling of the spray escaped damage.

47. Besides the six *Callagur borneoensis* turtles, ten *Trionyx cartilagineus* were also caught. All 16 were distributed to the University of Singapore, the National Museum, the Van Kleef Aquarium or to the Water Department. At the same time nearly 100 specimens of a fish called "Aruan" (*Chanos micropeltes*) were caught and distributed, but many were left. Acknowledgement is made to the Director, Tropical Fish Culture Research Institute, Malacca, for a supply of *Tilapia zillii* fingerlings on whose advice the Lake has been restocked.

Horticultural Work

48. Thirty new beds were dug and borders reconditioned. The canna beds along the Main Gate Road were manured and replanted. The thick undergrowth along the road boundary of Lawn A was cut back and removed, exposing an interesting banyan (*Ficus retusa*) with many thick and long root stems. The following plantings were carried out: *Antherstia nobilis*; Bougainvillea 'Easter Parade'; *Lodoicea seychellarum*; *Solanum wrightii*; *S. wendlandii*; *Cassia spectabilis*; *Adenium coetanium*; *Nymphaea* yellow variety; *Victoria regia*; *Cydista acquinocialis*; *Ipomoea tuberosa*; *Durio zibethinus*; *Ochroma lagopus*; *Jacquemontia violacea*; *Coreopsis coronata*; *C. delphinifolia*; *C. lanceolata*; *Rudbeckia laciniata*; *R. hirta*; *R. fulzida*; *R. laciniata*; *R. hybrida*; *R. maxima*; *R. amplexicaulis*; *Dianthus cassius*; *D. giganteus*;

Hibiscus trionum; *Asclepias curassavica*; *Mutisia oligodon*; *Gaillardia pulchella*; *G. aristata*; *Verbena grandiflora*; *Salvia officinalis*; *S. sclarea*; *Platycodon manesii*; *Gerbera anandria*. Most of these are annuals. Planting of permanent plants such as trees is severely limited by lack of space.

49. In collaboration with the United Fruit Company of Boston, U.S.A., who sent a team of specialists to Malaya to collect genetic material of bananas (*Musa* spp.) for their breeding programme on their estates in Honduras, the Botanic Gardens established a duplicate set of their material. This is now being multiplied for distribution in Singapore and Malaya, but because of the amount of space this stock requires at the expense of other horticultural material in the Gardens' nursery it cannot be maintained after the initial distribution has been done. This situation clearly illustrates the way the useful and economic function of the Botanic Gardens is severely limited by shortage of space.

50. Another introduction of commercial potential was seeds of *Macadamia ternifolia* from Hawaii, but because of lack of space only ten plants were established and probably eight of these will have to be thinned out as the trees grow larger. Some of the seeds acquired were passed on to the Federation Department of Agriculture. This species produces an edible nut which is finding increasing use in confectionery. It was introduced into the Botanic Gardens in the last century but without success. The tree is very variable. Selected clones are cultivated in Hawaii and in tropical Queensland. There is no obvious reason why selected seedlings, which later could be cloned, should not do well in Malaya provided the selection can be done over a large enough population of seedlings.

51. Casualties during the year included: *Chrysalidocarpus decipiens*; *Adomidia muellerii*; *Shorea bracteolata*; *Elaeis guineensis*; *Talauma candollei*; *Melocana bambusoides*; *Actinophloeus angustifolius*; *Aleurites moluccana*; *Araucaria cunninghamii*; *Fagraea fragrans*; *Acacia magnum*; *Theobroma cacao*; *Bassia madhuca*.

52. The six motor mowers gave good service and the lawns were maintained in top condition except during the 26-day strike of Government daily-rated employees when mowing was stopped. An interesting point of natural history was observed during this period. Frequency of mowing is normally weekly. With the cessation of mowing, *Eragrotis amabilis* and *Axonopus compressus* which together make up most of the turf began to flower. Normally there is little or no grass seeding in the Gardens and grass seed eating birds are not often seen, but during this period it was a delight to see small flights of white-headed and black-headed munias working across the lawns.

Composting

53. Our friend, the bountiful elephant, whose productiveness has been commented on in previous reports (1959, paragraph 80; 1960, paragraph 73) regarding the preparation of compost was followed in a rather dramatic manner by the Comptroller of Customs. Notwithstanding the official status of the Comptroller and that the material with which he supplied the Gardens was above suspicion, considerable embarrassment as is recorded below was suffered both on receipt of Comptroller's generosity and all along the line in processing his product, but when it was finally made it certainly had more than a little of the good things in it that plants like.

54. Occasionally the Comptroller had sent small consignments of confiscated tobacco to the Gardens for composting and these had been readily absorbed and lost in the considerable quantity of vegetable debris which all the time is being processed. However, some time early in the year, without much warning, eight tons of tobacco, impounded by the Customs on a false

import declaration and ordered to be confiscated by the Courts, arrived at the Gardens just as the day's work was ending. All available hands were summoned and compost heaps were prepared non-stop for the next three days under the eye of Customs officers and until the officers were satisfied that the tobacco was beyond pilfering. Even then eight tons goes a remarkably long way!

55. Tobacco leaf which has been prepared for smoking is treated with added chemicals which may well be preservative, and it would seem that the normal course of decomposition in the heaps, which were scarcely diluted with other trash, did not occur. Heating went wrong and instead of heaps sterilised by heat they became first-class breeding clamps for flies and there was a localised plague of flies in the Gardens area. Tobacco, as everyone knows, contains nicotine, and nicotine is a powerful insecticide, but it was obvious that in this form it was ineffective. The expectation of effectiveness expressed in the Departmental Report for 1960 (paragraph 66) has not been fulfilled. Further evidence of the absence of insecticidal properties was to be had from attempts to dress lawns infested with small black viciously-biting ants with the tobacco dust. This proved quite useless and left the lawns reeking of the death-like smell of stale tobacco smoke. Nevertheless the compost when eventually completely processed was first class horticultural material.

56. In spite of the difficulties outlined above, which were really teething troubles in handling a novel commodity in virtually a pure state, the Gardens are willing and ready to accept more. In fact acknowledgement is here given to the Malayan Tobacco Company for the regular supplies of sweepings from their factory which being received in more moderate quantity at any one time constitutes a welcome addition to our usual composting mixture.

XIX. PESTS AND DISEASES

57. The trouble caused by Rhinoceros Beetle (*Oryctes rhinoceros*) and Red Stripe Weevil (*Rhynchophorus ferruginea*) recorded fairly regularly in previous reports, has been very much less. Nevertheless constant watch has to be maintained and regular prophylactic dressing of palm crowns with insecticide has been done. However, *Cytostachys lakka* and *Roystonea regia* have been badly attacked by another pathogen the identity of which has not yet been determined. The leaves turn brown and die back to the stem. After that the stem also dies. Investigation into the cause is still being conducted.

58. The long-tailed macaque (*Macaca irus*) remained the most troublesome pest and against which little can feasibly be done. The Gardens were issued with a new shot gun and three monkeys were shot at points where most damage was being done, but the "bandarlog" (to quote Rudyard Kipling in *The Jungle Book*) "... have no remembrance . . . their memories would not hold over from day to day . . .". The effect of such defensive plant protection is but short lived.

59. An interesting effect of the prodigious flowering of the *tembusu* trees (paragraph 25) was an unusually heavy fruit-set which was quickly discovered by the flying foxes (*Pterocarpus edulis*). For the previous few years these animals have come in from outside during the season to feed on the *tembusu* fruit and squabble the night through returning at dawn to roost outside again. This year several hundred of them found it to their convenience to roost in the Gardens' jungle where they stayed for about a month. Then one morning early in September they failed to settle and weaved about over the Gardens in a most restless manner till about 10 a.m. when the whole flight took off together and were gone.

60. During the year the Director of the National Museum, Singapore, found a thriving colony of *Amphidromus inversus* (Muller) on the trees by the potting yard. This is a snail known to occur in the Riau Islands and but dubiously reported from Malaya in a single record of many years ago. This is certainly the first record of it in Singapore. The size of the colony found shows that the snail is established and is able to reproduce itself. There is no indication so far, that the snail is troublesome, but till its habits are better known it will have to be watched. In appearance the shell is not unlike that of the Giant African snail (*Achatina fulica*) but it has a reflexed rim to the opening by which it can at once be distinguished.

XX. HORTICULTURAL EXCHANGE

61. Seed and plant exchange with other botanical organisations in Singapore, Malaya and overseas was again an important aspect of the work of the Horticultural Division. Two persons were engaged full time on seed and plant collection in fulfilment of requests. This work is done on a mutual exchange basis and our output is requited by receipts in response to our own requests. Material was sent to 159 addresses in 43 countries and received from 114 addresses in 39 countries, which are listed in Appendices VI and VII.

XXI. ISTANA NEGARA DOMAIN

62. Supervision of work at the Domain has not been easy owing to the transfer of the Junior Horticultural Assistant and the retirement on medical grounds of the Foreman Gardener. The latter post was filled in July. In May the post of Horticultural Assistant on the Gardens establishment was filled and this officer was placed in charge of the horticultural work of the Domain.

63. The grounds, including the immediate gardens of all the houses in the Domain, have been kept in good condition. The three Dennis motor mowers gave excellent service on the lawns, and so did the motor scythes in the outlying rougher areas. Outdoor receptions, especially in the garden of 'Sri Temasek' raised a problem of ant control, for the lawns there are infested with a small viciously-biting ant. Heavy dosing with an insecticide just before a reception would give very brief control. The outbreak of *Elephantopus scaber* recorded in last year's report (paragraph 72) has been checked. The use of a selective weed killer was found to be not only expensive but not efficient enough. Hand weeding has the plant under control, but as the seeds are wind-distributed and the plant is ubiquitous in Singapore, constant patrolling is necessary. A number of old trees were pruned or removed for safety. New plantings were restricted because of the severe drought. Preparation of compost was again a major item of work and the quantity of vegetable debris from the Domain was inadequate for the amount of compost required. Spent hops from a local brewery were a welcome addition to the compost heaps. The potting yard has maintained a stock of some 2,000 potted plants for use as house decoration, not only in the Istana, but in the other houses within the Domain, and also for use as bedding-out material. Additional orchid beds were planted.

64. The Domain grounds were open to the public on New Year's Day (January 1st), Chinese New Year's Day (February 15th), Hari Raya Puasa (March 18th) and on Labour Day (May 1st).



H. M. Burkill

Plate 1. *Rhizophora stylosa* Griff. on rocky shore line off Pulau Dodol, Malacca.
See para. 31.



J. L. Harrison

Plate 2. Dr. Chew Wee Lek, Botanist, holding a flower of *Rafflesia* sp. aff. *R. schadenbergiana* Goepp., Mt. Kinabalu, Borneo, July 1961. See para. 26.



Plate 3. Preparing compost heaps.

H. M. Burkill



H. M. Burkill

Plate 4. After regeneration of *Nelumbium* and *Nymphaea*.



H. M. Burkill

Plate 5. *Callagur borneoensis* responsible for browsing down the water lily population of the Gardens Lake.



H. M. Burkill

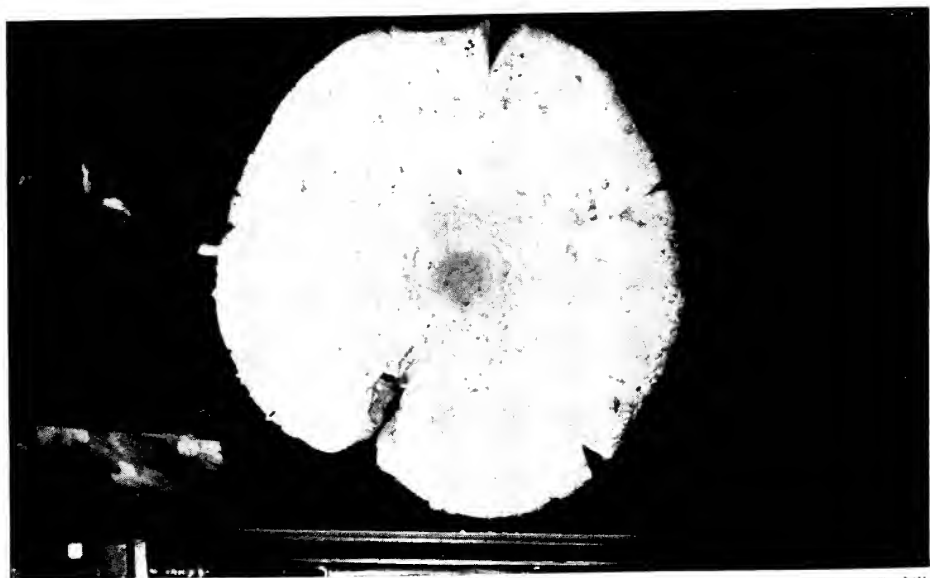
Plate 6. *Micropeltes chanos* "Aruan", also found in the Gardens Lake.

Lepiota morgani to which poisonous properties are attributed. See para. 33.



H. M. Burkill

Plate 7. Note gills free from the main stem, and prominent collar on it, which will become free on ageing.



H. M. Burkill

Plate 8. In surface view. Note scurfy appearance.

Changi Cottage

65. The Curator in charge of the Domain also visited and gave advice on the maintenance of the garden at Changi Cottage.

Singapore House, Kuala Lumpur

66. The Domain nursery was used to prepare planting material for the garden of this house. These amounted to 1,500 pots excluding hedging material. The Curator visited Kuala Lumpur on 6th November, with the Superintendent, City Parks, and the P.W.D. architect to prepare landscape plans.

XXII. ORCHIDS

67. The collection of species and hybrids continues to expand. Seventy-two field numbers were collected by Gardens' staff while on field work at: Gunong Pulai, Johore; Cameron Highlands and Fraser's Hill, Pahang; Pulau Undan and Pulau Nangka, Malacca; Ulu Gombak, Selangor; and Kedah Peak. Others were received from outside sources, in particular from Sarawak, Brunei, North Borneo, New Guinea, Nepal and Costa Rica. *Dendrobium longicorum* received from Nepal obligingly flowered at Singapore six months after receipt. The collection was greatly added to by exchange: 260 plants, cuttings and seedlings were received and 257 given. Individuals and organisations concerned are listed in Appendices VI and VII.

68. Sixty-one hybrid pods were harvested from the Gardens nursery, five were received from Singapore growers, four from the Federation of Malaya, eight from Queensland, Australia, one from Sarawak and seven from the U.S.A. Of these 86 pods, seed from 80 have been successfully germinated. Excellent results have been achieved with the use of banana pulp added to the flasks and growth of seedlings is accelerated. Good results have also been achieved with addition of a sterilised aqueous solution of "Foliar Gaviota" (1 gm. in 500 ccs.) to the flasks containing older seedlings.

69. Over 1,000 flasks were constantly in use during the year. Seedlings from 500 were planted out in "community" pots. Manuring and insecticide and fungicide spraying was conducted on a weekly basis throughout the year. Root and foliar manuring was alternated weekly. Two efficient proprietary fungicides were also alternated weekly. One thousand seedlings from the houses went out into the open or into beds.

70. The problem of space in the orchid nursery becomes more acute. This was commented on in the Gardens' Report for 1960, and its repetition here is no cry of "wolf". The time when saturation in the nursery will be reached is in sight. There is already a shortage of seedling houses and accommodation asked for has not been approved. Seedlings which should be potted on from the flask stage have had to be held back in the flasks. Thus is frustrated the speeding up of growth in the flasks referred to above (paragraph 69) which has been achieved by diligent research. And at the mature stage new Aranda and Arachnis plants which should be grown in beds—and multiplied for sale to the public and industry—have had to be retained, and retarded, in pots. The Botanic Gardens has pioneered orchid research in Malaya and a growing orchid nursery industry has come into being because of this work. Not one of the commercial nurseries, nor even an amalgamation of nurseries has the combination of facilities and knowledge that are at the disposal of the Gardens. Without research this promising industry will stagnate and die. If the Botanic Gardens are to continue to serve the industry its activities have created, more land to accommodate the living collection must be provided.

71. The following, which first flowered in 1960, were registered during 1961:

BGS—

- 2441 *Dendrobium Verninha* (*D. undulatum* var. *broomfieldii* × *D. d'albertissii*).
- 2261 *Dendrobium* Loke Looi Chiew (*D. Medusa* × *D. Constance*).
- 2255 *Vanda Wee Kim Lian* (*V. limbata* × *V. lamellata*).
- 1268 *Vanda Mark Shou Young* (*V. dearei* × *V. luzonica*).
- 2327 *Dendrobium Helen Loke* (*D. Medusa* × *D. Ursula*).
- 2325 *Dendrobium Lin Yoke Ching* (*D. Louisae* × *D. Constance*).

and flowering in 1961, two crosses were also registered:

BGS—

- 2405 *Aeridovanda Chiun Hai Cheok* (*Vanda Kapoho* × *Aerides quinquevulnerum*).
- 1931 *Arachnopsis Khalsom* (*Arachnis hookeriana* var. *luteola* × *Phalaenopsis violacea*).

A further six flowered, and registration names have been proposed:

BGS—

- 2684 *Vandanthe Bellasan* (*Vanda Rubella* × *Euanthe sandariana*).
- 2619 *Dendrobium Ng Keng Soon* (*D. Emma Mathieu* × *D. Constance*).
- 2482 *Vanda Felix Quek* (*V. Josephine van Brero* × *V. Oriole*).
- 2654 *Arachnopsis Napier* (*A. Eric Holttum* × *Phalaenopsis denevei*).
- 2452 *Aranda Majula* (*Arachnis Maggie Oei* × *Vanda insignis*).
- 1809 *Vanda Nellie Corbett* (*V. Ruby* × *V. insignis*).

and flowered without action to register:

BGS—

- 2290 *Dendrobium strebloceras* × *D. Constance*.
- 2687 *Dendrobium Caesar* × *D. trilamellatum*.
- 2503 *Dendrobium Margaret Paxton* × *D. Champagne*.
- 1599 *Arachnis Catherine* × *Phalaenopsis denevei*.
- 1597 *Arachnis hookeriana* var. *luteola* × *Phalaenopsis serpentilingua*.
- 2291 *Vanda Tan Chay Yan* × *Vandanthe Ellen Noa*.
- 2739 *Dendrobium Champagne* × *D. Aries*.
- 1780 *Aranda Lucy Laycock* × *Vanda luzonica*.
- 2521 *Vanda Norbert Alphonso* × *Phalaenopsis denevei*.
- 1921 *Cypripedium glaucophyllum* × *C. philippense*.
- 3093 *Dendrobium affine* × *D. Lady Hamilton*.
- 1891 *Vanda Ruby Prince* × *V. insignis*.

72. During the year Gardens-raised hybrids won the following awards of the Malayan Orchid Society:

BGS—

- 2134/7 *Dendrobium Noor Aishah* 'Singapura', *Award of Merit*.
- 2432/3 *Dendrobium Sonia Tan*, *Preliminary Certificate*.
- 2502/1 *Dendrobium Sri Temasek*, *Preliminary Certificate*.
- 1649/1 *Arachnopsis Helen Khoo* 'Star Beauty', *Award of Merit*.
- 2654/1 *Arachnopsis Napier* 'Brown Beauty', *Award of Merit*.
- 2376/1 *Aranthera Beatrice Ng*, *Preliminary Certificate*.

and at the Malayan Orchid Society Show in September, the Challenge Cup for the best Malayan hybrid flowering for the first time.

BGS 2654 *Arachnopsis Napier* (*Arachnopsis Eric Holttum* × *Phalaenopsis denevei*).

73. The display section of the orchid nursery was kept supplied throughout the year with some 120–130 potted orchid plants in prime bloom. This continued to be a great attraction. A display was also put up for a fortnight during the Air Show at Paya Lebar airport.

XXIII. SUCCULENTS

74. The collection was added to by donation and acquisition of seeds under the seed exchange programme. There is an appreciable public interest in these plants. Proposal to construct a public display house for this kind of plant have unfortunately not been approved.

EXTENSION WORK

XXIV. SUPPLY OF PLANTING MATERIAL

75. A total of 13,391 plants, cuttings, lots of bulbs and packets of seeds were sold to the public. Revenue was \$20,147 of which \$16,672 was derived from the sale of orchid material and the balance from other plants.

76. The Gardens continued to supply planting material free of charge to Singapore Government departments, charitable institutions, government-aided schools and other official or quasi-official organisations. A total of 3,772 plants was made available. The Gardens also continued to loan potted plants to official and quasi-official departments and to welfare and cultural organisations for decoration at special occasions: 3,552 pots were so loaned.

XXV. EXHIBITION AND SHOWS

77. Mr. Alphonso was invited to judge at the Malayan Agrihorticultural Association show at Kuala Lumpur, 31st August to 3rd September. Once again the Botanic Gardens put up a non-competitive exhibit at this show. About 80 orchid plants, 50 cacti and succulents and 50 *Saintpaulia ionantha* were on display. This exhibit was not only a great attraction, but was an excellent demonstration of the horticultural research work of the Gardens which has no parallel in the Federation. The scope of the Gardens' exhibit in future is likely to be restricted because of the new federal plant import rules by which Singapore is treated as a foreign country.

78. The Gardens gave considerable assistance to the Singapore Gardening Society and the Malayan Orchid Society in staging their respective annual shows. Highlights of each show were the large non-competitive landscape groups put up by the Gardens. Exhibits were also put up at the Penang Gardening Society annual show, the Selangor Orchid Society Show, and new hybrids were regularly exhibited at the Malayan Orchid Society's monthly meetings.

79. Besides the local exhibitions Gardens orchid hybrids were shown overseas at: The Pakistan Flower Show, Karachi; Delhi Flower Show, India; Johannesburg Autumn Flower Show, South Africa; Philippine Orchid Society Annual Show, Manila; Transvaal Horticultural Show, South Africa; Chelsea Flower Show, London; City of Glasgow Flower Show, Scotland; and the Sydney Orchid Festival, Australia. Acknowledgement is here made to Messrs. BOAC, QANTAS and Air India who flew certain of the consignments free of charge.

XXVI. SINGAPORE GARDENING SOCIETY

80. Mr. H. M. Burkill and Mr. A. G. Alphonso were respectively President and Vice-President for the year 1961/62. Regular monthly meetings seven of which were in the Gardens were held for members and conducted by Gardens' officers. Demonstrations were also arranged in the Gardens for 'Kebuns' (private gardeners) on topical matters of interest such as burning soil, vegetative propagation, insecticide and fungicide spraying. Several members of the Gardens' staff assisted as judges at the Society's annual show.

XXVII. MALAYAN ORCHID SOCIETY

81. Mr. A. G. Alphonso served on the committee for the year 1961/62. Mr. Bajuri was Hon. Secretary of the Society's Panel of Judges. The Gardens gave strong support to the Society's monthly exhibitions and annual show, and contributed regularly descriptions of new hybrids for publication in the Malayan Orchid Review.

XXVIII. FILM PRODUCTION

82. One studio has from time to time come 'on location' in the Gardens, but the tempo of production of previous years has slackened.

XXIX. ADVISORY

83. Many visits were paid by the horticultural staff to advise on planting schemes in school (80 schools sought advice) and hospital compounds, at Police Stations and at charitable institutions. Advice was given to the Public Works Department in connection with a number of their projects including the Industrial Development Project, Jurong, The Prison Reformation Training Centre, Changi, The National Library, and at 'Temasek', Kuala Lumpur. The Director and Curator both paid visits to Pulau Senang Settlement to offer advice on planting. A quantity of irritant plant juices and irritant plant hairs was prepared for the Police as an experiment in curbing unruly crowds to exchange baton and broken heads for a more sardonic touch. This interesting experiment has however not been carried out.

84. As much advice and more was tendered by telephone and correspondence, not a little of which has gone to the Federation of Malaya. Many requests for advice related to the safety of trees adjacent to buildings.

85. The botanical staff continued to deal with enquiries relating to identity and uses of plants. Much interest was shown in marine algae and in edible mushroom cultivation, fostered, no doubt, by the spate of *Lepiota* poisoning recorded above. The Gardens collaborated with the Health Authorities and the Pharmacology Department of the University of Singapore over this poisoning, and issued a press release describing how to distinguish between safe and unsafe species.

86. The very great amount of enquiries received is a good and satisfying indication of the service the Gardens plays for the public weal. The extent of these enquiries is certainly increasing. Though the primary function of the Gardens is research, the culmination of research is knowledge from out of which enquiries can be correctly answered and advice reliably given.

STAFF OF BOTANIC GARDENS 1961

DIVISIONS I AND II AND TECHNICAL POSTS OF DIVISION III

<i>Appointment</i>	<i>Holder</i>	<i>Notes</i>
Director	H. M. Burkill, M.A. (Cantab.), F.L.S.	
Botanists	1 J. Sinclair, B.sc. (Edin.)	Keeper of Herbarium
	2. Chew Wee-Lek, B.sc. (Malaya), Ph.D. (Cantab.)	Assistant to Director
	3. Miss Chang Kiaw Lan, B.sc. (Malaya)	
Curators	1. A. G. Alphonso	
	2. Lam Hin Cheng	
Librarian	Tan Kim Ho, B.sc. (Malaya)	
Executive Officer	R. S. Mani	
Laboratory Assistant (Special Grade)	Bajuri bin Sappan	
Horticultural Assistant	<i>Vacant</i>	To 17/5
	Ang Gek Choo	W.e.f. 18/5
Herbarium and Museum Assistant	Mohamed Shah bin Haji Mohamed Nur	
Artist	Juraimi bin Samsuri	

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE

Reading daily at 9.30 a.m. local time at Gardens Office

1961	Total Rainfall	Highest fall in 24 hrs.	No. of days rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.
	ins. *	ins.		°F	°F	°F	°F	°F	°F	%
January	6.56 (11.20)	0.83	14	85.3	91.0	73.2	71.0	78.9	75.1	84.0
February	3.96 (7.28)	1.66	15	87.7	92.2	74.2	71.0	80.0	76.0	84.0
March	8.70 (8.36)	1.49	16	89.1	93.0	74.9	72.5	79.3	77.4	82.0
April	7.35 (8.13)	2.55	18	89.4	93.9	75.9	73.2	82.2	78.4	83.4
May	5.21 (7.53)	1.82	13	90.3	94.5	76.6	72.8	82.6	79.6	87.5
June	6.32 (6.70)	2.13	12	90.0	93.6	75.7	72.7	80.2	79.9	84.7
July	4.27 (6.18)	1.38	14	88.7	94.3	76.1	70.8	82.3	78.6	83.2
August	1.46 (7.15)	0.69	5	88.2	91.0	76.2	71.0	82.1	77.3	78.6
September	4.49 (7.58)	1.80	12	89.5	92.6	78.5	71.0	80.0	77.4	77.7
October	5.93 (7.94)	1.04	15	86.3	92.4	74.5	71.5	82.2	77.4	80.7
November	10.67 (10.47)	0.95	23	88.3	91.0	73.8	71.0	82.2	77.6	81.6
December	4.10 (9.81)	0.53	23	86.5	89.0	73.7	72.0	80.3	76.6	85.8
Total/Mean ..	69.02 (98.30)	..	180	88.2 (31.2°C)	89.9 (32.2°C)	75.3 (24.0°C)	71.7 (22.1°C)	81.0 (27.2°C)	77.6 (25.3°C)	82.8

* Mean for the period 1914—1961 (48 years).

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1961

Reading daily at 8.00 a.m. local time at Orchid Enclosure from 1-1-61

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1961	Total Rainfall	Highest fall in 24 hours	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.	Mean Min. Grass Temp.	Mean Earth Temp. 4"	Mean Earth Temp. 1'	Mean Earth Temp. 4'	Mean Solar Rad. Thermometer
	ins.	ins.		°F	°F	°F	°F	°F	°F	%	°F	°F	°F	°F	°F
January ..	6.58	1.46	15	84.6	90.0	72.5	70.3	75.7	74.7	95.0	71.4	77.8	79.8	81.3	134.0
February ..	4.71	1.70	14	86.8	90.0	72.8	69.8	75.2	74.2	96.0	71.3	79.5	81.8	82.4	136.5
March ..	8.27	1.40	15	88.1	91.5	73.6	71.0	76.2	75.3	97.0	72.9	81.6	83.7	83.5	142.2
April ..	6.92	2.60	15	87.1	90.4	75.0	72.2	77.2	76.5	96.6	74.4	81.0	84.4	84.7	144.9
May ..	3.09	1.63	11	88.4	91.4	75.4	73.0	78.3	77.3	95.0	74.9	..	84.2	84.5	135.9
June ..	5.37	2.21	13	86.6	90.0	74.1	70.9	77.5	76.5	94.6	74.3	..	83.0	83.8	123.9
July ..	6.12	1.50	13	86.9	90.8	74.2	70.0	77.2	76.4	95.8	73.2	..	82.9	83.7	..
August ..	1.25	0.60	5	87.1	90.2	73.4	71.1	77.2	76.1	95.0	72.8	..	83.4	83.5	..
September ..	4.09	1.64	12	87.8	90.5	73.1	69.1	76.8	75.8	95.5	72.9	82.2	84.2	84.3	147.3
October ..	3.33	0.98	13	88.0	90.5	73.9	71.0	76.7	75.8	93.5	71.8	81.1	83.6	84.1	139.6
November ..	10.97	1.09	23	86.6	90.7	73.2	71.8	75.8	75.2	95.9	70.5	79.9	82.1	83.2	138.2
December ..	4.02	0.69	22	85.4	89.7	73.1	71.5	75.7	75.0	96.3	71.3	79.8	81.7	82.7	141.6
Total/Mean ..	64.72	..	171	87.8 (31.0°C)	90.5 (32.5°C)	73.7 (22.8°C)	71.0 (21.7°C)	76.6 (24.8°C)	75.7 (24.3°C)	95.5	72.6 (22.6°C)	80.1 (26.7°C)	82.9 (28.3°C)	83.4 (28.6°C)	138.4 (59.1°C)

METEOROLOGICAL REPORT

SUMMIT BUKIT TIMAH, ALTITUDE 581 FEET

Reading daily at 8.00 a.m. local time August to December, 1961, only

1961	Total Rainfall	Highest fall in 24 hrs.	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean Relative Humidity
	ins.	ins.		°F	F	F	°F	F	F	%
August	2.43	1.08	4	85.2	89.3	74.0	65.0	77.2	75.1	90.3
September	8.65	1.78	13	86.2	89.2	74.4	71.5	78.0	75.5	88.4
October	3.03	0.51	12	85.9	89.9	74.5	70.3	77.8	74.8	86.3
November	15.26	2.60	19	74.7	88.2	72.9	69.1	76.9	74.7	88.9
December	8.75	1.87	20	83.1	88.5	72.3	70.1	75.5	74.0	93.7
Total/Mean ..	38.12	..	68	83.0 (28.3°C)	89.0 (31.7°C)	75.6 (24.2°C)	67.2 (19.6°C)	77.1 (25.1°C)	74.8 (23.8°C)	89.5

SUMMARY OF DISTRIBUTION OF HERBARIUM SPECIMENS
ON EXCHANGE AND LOAN

	EXCHANGE		LOAN	
	In	Out	In	Out
Adelaide .. .. .	..	2	..	..
Arnold Arboretum .. .. .	..	233	899	..
Bailey Hortorium .. .. .	..	2	..	..
Bangkok .. .. .	..	52	..	..
Beaudette Foundation .. .. .	..	6	..	..
Berlin .. .. .	..	36	..	..
Bogor	396	140	..	..
Brisbane .. .. .	..	9	..	..
British Colombia, University of	25	..	..	..
British Museum .. .. .	..	103	..	..
California, University of .. .. .	..	9	239	..
Cambridge	30	..	..	..
Canberra, C.S.I.R.O.	86	..	..	706
Copenhagen .. .. .	..	7	..	..
Dehra Dun .. .. .	..	10	..	..
Delhi University .. .. .	..	6	..	..
Duke University .. .. .	..	4	..	..
Edinburgh .. .. .	..	228	..	..
Florence .. .. .	..	22	..	..
Geneva .. .. .	..	10	..	..
Goteborg .. .. .	..	7	..	..
Groningen .. .. .	..	2	..	..
Hawaii, University of .. .. .	..	9	..	..
Kepong	435	13	..	..
Kew .. .. .	..	553	1	..
Kuching	322	182	80	..
Lae	130	300	..	..
Leiden	90	437	61	950
Malacca, Tropical Fish Culture Research Institute .. .. .	..	7	..	..
Malaya, University of .. .. .	..	43	..	..
Manila	160	70	..	..
Michigan University .. .. .	..	14	..	..
Minnesota University .. .. .	..	1	..	..
Montreal .. .. .	..	16	..	..
New York .. .. .	..	36	..	..
Philippines, University of .. .. .	..	13	..	..
Sandakan	861	87
Tokyo	289
Uppsala	2
Wycherley, Dr. P. R.	1
Total	2,824	2,672	1,280	1,656

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INSTITUTIONS AND PRIVATE COLLECTIONS FROM WHOM PLANTS AND SEEDS WERE RECEIVED IN 1961

Algeria	...	...	Ministry of Agriculture and Forests, Algiers.
Argentina	...	...	Instituto de Botanica Agricola, Buenos Aires.
Australia	...	...	Mr. W. B. Muir, Queensland.
Brunei	...	...	Dr. K. F. D Sweetman, Seria.
Bulgaria	...	...	Academy of Sciences, Sofia Botanic Gardens of the University, Sofia.
Canada	...	...	Botanical Garden, Montreal.
Cook Islands	...	...	Count F. M. Knuth, Rarotonga.
Costa Rica	...	...	Dr. A. J. Hansen, Turrialba.
Eire	...	...	National Botanic Gardens, Dublin.
Federation of Malaya	...	...	Mr. Lee Ewe Boon, Alor Star; Mr. F. G. H. Allen, Ipoh; Mrs. H. Jones, Petaling Jaya; Mr. M. E. L. Robey, Malacca; Botanic Gardens, Penang; Mr. C. C. P. Wilkins, Batu Gajah; Mr. Philip Kuok, Johore Bahru; Tuan Haji Ahmad, Anak Bukit; Mr. Leong Hoi Choon, Ipoh; Dato Sir Mahmud bin Mat, Kuantan; Dr. (Miss) Soo Kim Lan, Kuala Lumpur.
France	...	...	Jardin Botanique, Dijon; Jardin Botanique, Lyon; Museum National d'Histoire Naturelle, Paris; Ms. Vilmorin-Andrieux, Verrieres-le-Buisson; Jardin Botanique, Strasbourg; Jardin Botanique, Anders; Station de Botanique et de Pathologie Vegetal, Antibes; Jardin Botanique, Nantes; Jardin Botanique, Marseilles; M. J. Marnier Lapostolle, St. Jean Cap Ferrat; Ministere de l'Agriculture, Antibes; Jardin Botanique, Besancon; Dr. Maurice Boussard, Saint Mihiel.
Germany	...	...	Botanischer Garten der Universitat, Erlangen; Botanischer Garten der Justus-Liebig Universitat, Giessen; Botanischer Garten, Kassel; Botanischer Garten, Munich; Botanischer Garten der Universitat, Munster; Botanischer Garten der Technischen Hochschule, Braunschweig; Botanischer Garten, Hamburg; Botanischer Garten der Technischen Hochschule, Dresden; Botanischer Gartens und Museums, Berlin; Botanischer Garten der Pedagogischen Hochschule, Potsdam; Botanischer Garten der Karl Marx Universitat, Leipzig.
Ghana	...	...	University College, Lagos.
Greece	...	...	Botanic Garden of the University, Athens.
Hungary	...	...	University, Debrecen; University, Budapest; Gyogynoveny Kutato Lutezet, Budapest; Institute of Sylviculture, Budapest.
Italy	...	...	Orto Botanico dell'Universita, Modena; Amministrazione Borromeo, Milan; Istituto Botanico dell'Universita, Florence; Villa Taranto Gardens, Lake Maggiore; Orto Botanico, Udine; Orto Botanico, Genoa.
Japan	...	...	Kyoto Takeda Herbal Gardens.
Kenya	...	...	Parks Department, Nairobi.
Mauritius	...	...	Sugar Industry Research Institute, Reduit.
Nepal	...	...	Dr. G. A. C. Herklots, Kathmandu.
New Guinea	...	...	Department of Forests, Lae.
New Zealand	...	...	Mr. G. N. Sheldon, Christchurch.
North Borneo	...	...	Mrs. Collinette, Jesselton.
Norway	...	...	University, Oslo.
Philippine Islands	...	...	Department of Forests, Manila.

Poland	...	University, Wroclaw; Medical Academy, Poznan; Institut de Pharmacognosie, Varsovie.
Portugal	...	Agricola do Ultramar, Lisbon; University, Coimbra; Instituto de Botanica, Porto.
Roumania	...	Agricultural Institute, Cracow; University, Bucarest; University, Cluj.
Sarawak	...	Mr. J. Seal, Kuching.
Singapore	...	Mrs. M. Lewis; Mr. Leong Chun Wei; Mr. Robert Wee Soon Bee; Mr. Choo Yeok Koon; Mr. James Lee; Mr. Tan Chye Siam; Mr. E. Klass; Mr. George Chan; Mr. D. C. Doo; Mr. Yap Cheng Beng; Mr. Tan Hoon Siang; Mrs. MacDougall.
South Africa	...	Mrs. F. van Eeden, Magoeboskloof; Mrs. C. F. Todd, Johannesburg.
Spain	...	Municipal Parks and Gardens, Barcelona.
Sweden	...	Bergianska Tradgarten, Stockholm.
Trinidad	...	Agricultural Department.
Tunisia	...	Service Botanique et Agronomique, Ariana.
United Kingdom	...	University of St. Andrews; University of Birmingham; Royal Horticultural Society Gardens, Wisley; Eden (Battle) Ltd., Battle; Royal Botanic Garden, Edinburgh; University College, Cardiff; Royal Botanic Gardens, Kew; Royal Society, London.
United States of America	...	California Jungle Gardens, Los Angeles; Boyce Thompson South-western Arboretum, Arizona; Mr. D. H. Nicolson, Cornell University; Garfield Park Conservatory, Chicago; Mr. Ernest de Saram, Florida; United Fruit Coy., Boston; Foster Botanical Gardens, Honolulu; Dr. Degener, Waialua, Hawaii.
Union of Soviet Socialist Republics	...	Academy of Sciences, Georgia; University of Latvia, Riga; Academy of Sciences, Alma-Ata; Academy of Sciences, Ashkhabad; Institute for Experimental Biology, Tallinn.
Yugoslavia	...	University, Zagreb.

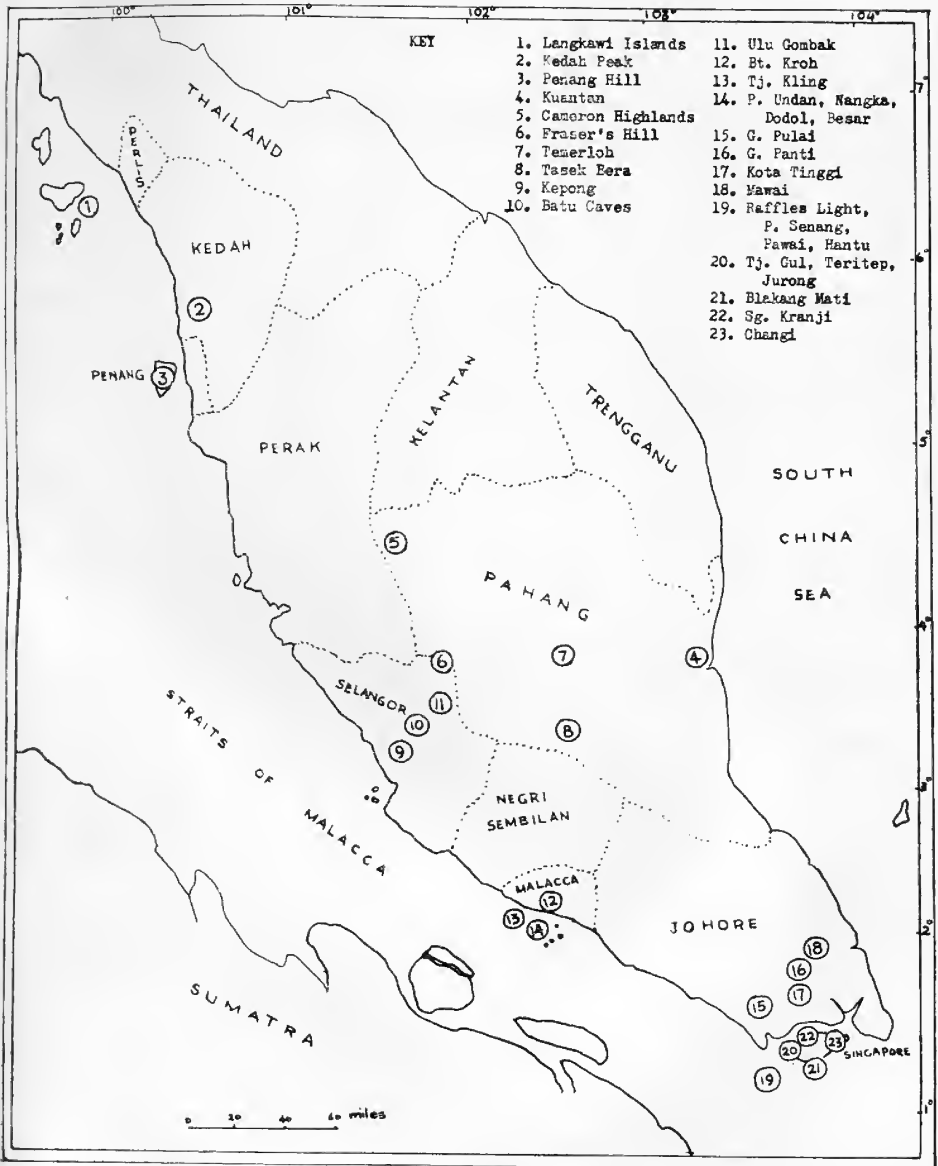
INSTITUTES AND PRIVATE COLLECTORS TO WHOM PLANTS AND SEEDS
HAVE BEEN SENT IN 1961

Algeria	...	...	Institut Scientifique Cherifien, Rabat; Jardin d'Essais du Hamma.
Argentina	...	...	Instituto de Botanica Agricola, Buenos Aires.
Australia	...	...	Botanic Gardens, Brisbane; Botanic Gardens, Melbourne; Botanic Gardens, Adelaide; Parks and Reserves Department, Townsville.
Austria	...	...	Botanischer Garden, Vienna; Botanischer Garten, Graz.
Belgium	...	...	Plantentuin, Antwerp.
Bermuda	...	...	Department of Agriculture, Paget East.
Brunei	...	...	State Agricultural Office; Dr. K. F. D. Sweetman. Seria.
Canada	...	...	Botanical Garden, Montreal.
Cook Islands	...	...	Department of Agriculture, Rarotonga.
Costa Rica	...	...	Dr. A. J. Hansen, Turrialba.
Czechoslovakia	...	...	Botanic Gardens, Brno; Botanic Gardens of Charles University, Prague; Institutus Pedagogici, Kosice; Botanic Garden of the University, Bratislava; Mr. Davidik Vaclav; Institute of Natural Sciences, Prague; Vyzkumny Ustav-Krsnivassky, Troubsko u Byna; Botanic Gardens of the University, Brno; Mr. R. Kotoucek; Botanic Gardens, Liberec; The Research Station, Sumperek-Temenice.
Federation of Malaya	...	...	Forest Research Institute, Kepong; Dunlop Malayan Estates Ltd., Malacca; Montford Boys Home, Batu Tiga; Department of Chemistry, Petaling Jaya; Rubber Research Institute of Malaya, Kuala Lumpur; Department of Botany, University of Malaya, Kuala Lumpur; Botanic Gardens, Penang; Istana Gardens, Johore Bahru; Mr. Philip Kuok, Johore Bahru; Mr. Leong Hoi Choon, Ipoh; Mr. Lee Ewe Boon, o.B.E., Alor Star; Dato Sir Mahmud bin Mat, Kuantan.
Finland	...	...	Botanical Garden, Turku.
France	...	...	Jardin Botanique, Caen; Dr. Maurice Boussard, Saint-Mihiel; Jardin Botanique, Besancon; Museum National d'Histoire Naturelle, Paris; L'Institut de Botanique de la Faculte des Sciences, Strasbourg; Jardin Botanique de l'Universite, Toulouse; Jardin des Plantes de l'Universite, Montpellier; Jardin Botanique, Nancy; Ministry of Agriculture, Cap d'Antibes.
Germany	...	...	Botanischer Garten der Johannes Gutenberg Universitat, Mainz; Botanischer Garten der Westfalschen Landesuniversitat, Munster; Botanic Gardens Berlin; Institute for Forest Botany, Berlin; Botanic Gardens, Potsdam; Botanic Gardens, Darmstadt; Botanic Gardens, Munich; Botanic Gardens of the Technical Highschool, Dresden; Botanic Gardens of the Technical Highschool, Karlsruhe; Botanic Gardens of the University, Erlangen; Botanic Gardens, Essen; Botanic Gardens, Dortmund; Botanic Gardens, Frankfurt; Botanic Gardens of Halle University; Botanic Gardens of the University, Tübingen; Botanic Gardens of the University, Bonn; Pflanzenphysiologisches Institut der Frein Universitat, Berlin; Botanic Gardens, Hamburg; University Botanic Gardens, Rostock; University Botanic Gardens Wurzburg; Botanic Gardens, Oberholz.
Holland	...	...	Rijksuniversiteit, Leiden; Botanic Gardens, Delft; Laboratory for Microbiology, Wageningen.
Hongkong	...	...	Gardens Division, Urban Services Department.

Hungary	...	...	Botanic Gardens of the Academy of Sciences, Vacratot; University of Agricultural Science, Godollo; Botanic Gardens, Pecs; University Botanic Gardens, Budapest; University, Szeged.
India	...	...	Indian Botanic Gardens, Calcutta; National Botanic Gardens, Lucknow; Sandoz (India) Ltd., Rohohet.
Italy	...	...	Botany Department of the University, Catania; Botany Department of the University, Modena; Botanic Gardens, Naples; Botanic Gardens of the University, Pisa.
Japan	...	...	National Kyushu Regional Agricultural Experiment Station, Tansegashima; Kyoto Takeda Herbal Gardens; Botanic Gardens of Osaka City University; Mr. Toshihiko Satake, Hiroshima; Mr. Yukio Mivazaki, Minami-izumachi Kamogun; Mr. Yoschumi Oka, Mutsuzaka.
Kenya	...	...	Parks Department, Nairobi; Messrs. Grahame Bell Ltd., Nairobi.
Malta	...	...	Argotti Botanic Gardens.
Mauritius	...	...	Sugar Industry Research Institute, Reduit.
Mexico	...	...	Ministry of Agriculture.
New Guinea	...	...	Forest Department, Lae.
New Zealand	...	...	Parks and Reserves Department, Christchurch; Mr. G. Jamieson, Napier; College of Technology, Zaria.
Nigeria	...	...	University College, Lagos.
North Borneo	...	...	Forest Department, Sandakan, Town Board, Jesselton.
Portugal	...	...	Instituto Botanico da Universidade, Coimbra; Estacio Agronomica Nacional, Sacavem.
Poland	...	...	Hortus Plantarum Academiae medicae, Warsaw; Botanic Garden of the University, Wraclaw; Botanic Garden of the University, Poznan; Szkoly Glownez Gospwicz Skiego Arboretum; Botanic Gardens of the University, Cracow.
Rhodesia	...	...	Mr. H. J. Blackwood Murphy, Melsetters; Mr. B. C. N. Mountain, Umtali.
Sarawak	...	...	Mr. J. Seal, Kuching.
Singapore	...	...	H. E. Yang di-Pertuan Negara; Mr. A. J. Braga; Mrs. M. Lewis; Mr. Leong Chun Wei; Mr. D. C. Doo; Mr. Choo Yeok Koon; Mr. Yap Cheng Beng; Mr. E. Klass.
South Africa	...	...	Mrs. Ulay van Eden, Tzaneen; Daleside Estate Nurseries, Kliprivier; Mr. P. Bell, Richmond.
Spain	...	...	Instituto Botanico, Barcelona.
Sweden	...	...	Botanic Garden of the University, Uppsala; Bergianska Tradgarden, Stockholm; University Botanic Garden, Lund.
Switzerland	...	...	Botanic Garden, St. Gallen.
Tunis	...	...	Service Botanique, Ariana.
Uganda	...	...	Department of Agriculture, Entebbe.
United Kingdom	...	...	Royal Botanic Garden, Edinburgh; Major V. F. Howell, Cobham; University College of North Wales, Bangor; Col. J. A. MacRae, Kyle of Lochalsh; Department of Botany, St. Andrews University; David Sanders Orchids Ltd., East Grinstead; Botany Department, University College of Southampton; St. Wulfromis Secondary School, Grantham.

- United States of America Department of Plant Pathology, University of California; Botany Department, Cornell University; Botanic Gardens, University of California; The Flowering Tree Man, Stuart, Florida; Mr. E. Lowe, Huntingdon, W. Va; Department of Botany, Los Angeles; Mr. R. D. Pearce, Hendersonville, N. Carolina; Garfield Park Conservatory, Chicago; Foster Botanical Garden, Honolulu.
- Union of Soviet Socialist Republics ... Mr. Theodor Balams, Latvia; Botanic Gardens of the Academy of Sciences, Erevan; Academy of Sciences, Ashkhabad; Botanic Gardens of the Academy of Sciences, Moscow; Botanic Gardens, Kiev; Botanic Gardens of the Ukraine Academy of Sciences; Botanic Gardens of the University, Moscow; Botanic Gardens, Batum; Biological Institute, Kannas; Botanic Gardens, Tomsk; Botanical Section of the Pedological Institute Rostov on Don; University Botanic Gardens, Latvia; Hortus Pomologicus, Dobeles, Latvia.

MAP SHOWING LOCATION OF MALAYAN PLACE NAMES
MENTIONED IN THE REPORT



12/62

12/63



STATE OF SINGAPORE

ANNUAL REPORT OF THE
BOTANIC GARDENS DEPARTMENT
FOR 1962

Price: S1

(Cmd. 17 of 1964)



STATE OF SINGAPORE

ANNUAL REPORT OF THE
BOTANIC GARDENS DEPARTMENT
FOR 1962

BY
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*Director, Botanic Gardens
Singapore*

PRINTED BY THE GOVERNMENT PRINTING OFFICE, SINGAPORE.

1964

12/65

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ADMINISTRATION

I. STAFF

THERE WAS NO change in establishment during the year. The Director went on overseas leave from 5th August to the end of the year, during which time Dr. Chew Wee Lek, Botanist, was Acting Director. The post of financial clerk remained vacant from the beginning of the year to 15th May, when it was filled.

II. TRAINING

2. Miss Chang Kiaw Lan, Botanist, who was awarded a scholarship under the United Kingdom Government Commonwealth Scholarship and Fellowship Scheme left in October for Cambridge University, to study taxonomic mycology.

3. Training facilities were offered by the Singapore Government under the Colombo Plan for three students sponsored by the Department of Agriculture, Sarawak, to undergo training at the Botanic Gardens. Each trainee was put through a 6-month training course in elementary horticulture.

4. Under a scheme of training for disabled persons, three youths were sent by the Labour Department and one from the Singapore Anti-Tuberculosis Association for elementary training at the Botanic Gardens to fit them for work as gardeners. In addition 40 employees of the People's Association were given instruction in simple gardening.

III. LABOUR

5. During the year under review an average of 72 labourers were employed in the Botanic Gardens, 56 in the Istana Negara Domain, nine men in the Nature Reserves and one man and three women in the herbarium.

IV. BUILDINGS AND ROADS

6. Generally, the roads and buildings in the gardens remained in good condition. The herbarium building showed new and widening cracking of the walls. One of the main buttresses was opened up and the steel H-girder was found to be corroded through. Urgent action is necessary to safeguard the uniquely valuable collections housed in this building.

7. Crumbling banks of the lake by the Main Gate Road have been strengthened with *bakau* (*Rhizophora* sp.) poles. This was done by the P.W.D. Gardens resources were utilised to make brick pillars for the plant house on Lawn L. A fence was also erected around the nursery on Lawn Y. The construction of a new orchid species house in the Orchid Nursery was begun.

V. SECURITY

8. On 30th January the Police received information of a safe-breaking raid planned on the Gardens office. Needless to say this office seldom has any money to store, and on this occasion the safe was empty. An ambush laid by the police resulted in a gun battle (no casualty), the arrest of one person *in deticto flagrante*, the finding of two daggers and two revolvers, and the arrest

of three other persons in the subsequent chase and the seizure of a van loaded with oxyacetylene apparatus. The Police and the office watchman, who had perforce to play the part of a vicarious votive, are to be commended for the success of the operation.

VI. VISITORS

9. Among the many prominent visitors who called at the office were: His Excellency, the Yang di-Pertuan Negara, Inche Yusoff bin Ishak on an official tour of inspection;
H.R.H. Prince Norodom Sihanouk, Head of State, Cambodia, and Madame Norodom Sihanouk;
Dr. Phay Seng Whatt, Chairman, Public Service Commission, Singapore;
Professor E. E. Trease, Department of Pharmacy, Nottingham University;
Professor L. J. Audus, Department of Botany, University of London;
Mr. Anthony Johnston, F.A.O., Bangkok;
Dr. C. F. Hickling, Department of Technical Co-operation, London;
Mr. D. J. Eyre, Minister for Defence, New Zealand;
Brigadier R. H. Perry (retiring), and Mr. C. D. Jack (designate), Regional Director, Commonwealth War Graves Commission, New Delhi;
Professor B. J. Grieve, University of Western Australia;
Dr. T. H. Everett, New York Botanical Garden;
Mr. R. Smith, Department of Agriculture, North Borneo;
Dr. J. W. Blencoe, Rubber Research Institute, Kuala Lumpur;

and many others. These visits afforded occasion for useful and interesting discussion.

10. In addition many research workers also visited the office to make use of the facilities of the herbarium, library and gardens. These included:

- Professor Wm. Macnae, Department of Zoology, Witwatersrand University, South Africa — mangrove communities;
Mr. B. L. Burt and Mr. P. Woods, Royal Botanic Garden, Edinburgh — Gesneriaceae;
Dr. Wm. Meijer, Forest Department, Sandakan — forest botany;
Dr. J. A. R. Anderson, Forest Department, Kuching — forest botany;
Dr. P. Guinet, French Institute, Pondicherry — palynology.

The facilities of the Department were also extended to members of the staff and to sponsored students of the Universities of Singapore and Malaya, and to other official organisations.

11. The usual very large number of casual visitors came to the Gardens during the year.

VII. STATE GIFTS

12. On the occasion of the visit to the Botanic Gardens of H.R.H. Prince Norodom Sihanouk of Cambodia and Madame Norodom Sihanouk, ten mature orchid plants were presented to them. This visit was also marked by orchid hybrid family No. BGS. 2705 (*Vanda* Tan Chay Yan x *Renanthera coccinea*) being named *Renantanda* Prince Norodom Sihanouk, one plant of which was included in State gift.

VIII. CONCERTS

13. The Singapore Police Band gave 11 concerts in the Gardens during the year. These were well attended by the public. The Police Commissioner and the Police Bandmaster are thanked for this courtesy.

IX. PUBLICATIONS

14. *Gardens' Bulletin*, Volume XIX, was issued in three parts during the year. Papers were:

- PROWSE: Diatoms of Malayan Freshwaters.
PROWSE: Further Malayan Freshwater Flagellata.
GILLILAND: A Checklist of Malayan Grasses.
FURTADO: The Species of *Brackenridgea* in the Singapore Herbarium.
FURTADO: Name changes in Bornean Araliads.
CORNER: The Classification of Moraceae.
ASHTON: Some new Dipterocarpaceae from Borneo.
WHITMORE: Studies in Systematic Bark Morphology, III.
Bark Taxonomy in Dipterocarpaceae.
JOHNSON: On a small Collection of Bryophytes collected by Professor H. B. Gilliland in Eastern New Guinea.
JOHNSON: A short Note on Some Soil Algae from New Guinea.
JOHNSON: Precursory studies on the epiterranean soil Algae of Singapore and Malaya.
CORNER: Taxonomic Notes on *Ficus*, Asia and Australasia; Addendum II.

Anonymous contributions were made by staff members to the *Malayan Orchid Review*.

X. LIBRARY

15. The Library has remained in very cramped accommodation, partly in the spirit collection room of the herbarium and partly in the horticultural officers' office.

16. Accessions amounted to 19 books, 1 microfilm, 6 photostats, 39 periodical volumes on subscription, and exchange publications from 286 addresses. One hundred and thirty volumes were bound free at the Printing Office. The small vote for the library precluded any binding being done outside.

17. Revenue from the sale of publications prepared by the Department amounted to \$11,895.

XI. AGRICULTURAL PESTS SUPERVISORY COMMITTEE

18. Mr. H. M. Burkill, Director, was a member of the Committee till proceeding on overseas leave.

XII. UNIVERSITY OF SINGAPORE

19. Mr. H. M. Burkill represented the Botanic Gardens on the University Court till he proceeded on overseas leave.

XIII. COMMONWEALTH WAR GRAVES COMMISSION

20. The Director continued to be the Commission's representative in Singapore, and was responsible for the maintenance of the War Graves Cemetery at Kranji under instructions from the Commission's Eastern Region Headquarters at New Delhi. Funds for the maintenance work are provided by the Commission, and further information may be found in the Commission's own reports.

XIV. NATURE RESERVES

21. The Board of Trustees consisted of:

- | | |
|--|------------------------|
| Nominated by the Yang di-Pertuan
Negara | 1. Mr. O. K. Abraham. |
| | 2. Mr. Tan Jake Hooi. |
| Nominated by the Minister for National
Development | 3. Mr. Tan Hoon Siang. |
| | 4. Mr. Liew Tiew Kee. |

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Representative of the City Council	...	5.	Mr. Khong Kit Soon.
Representative of the Rural Board	...	6.	Mr. R. Ramalingam.
Chairman, <i>ex-officio</i>	...	7.	Director of Botanic Gardens.

One board meeting was held.

22. During the year the Pandan Nature Reserve and the Labrador Nature Reserve were appropriated for industrial development and were subsequently deleted. In view of the deletion from the Nature Reserves an equivalent area at Tanjong Gul was asked for.

23. However, in the other reserves normal maintenance was continued. Many people are visiting these areas and greater use is being made of by schools and cultural organisations.

XV. METEOROLOGICAL RECORDS

24. Throughout 1962, relatively drier weather was recorded. The main recording station at the Gardens registered only 89.59 inches of rain against an average for the previous 48 years of 98.30 inches. The new meteorological station at Bukit Timah where recording was begun in July 1961 registered 97.51 inches during the year. It is expected that the records here will show higher rainfall than in the cleared parts of Singapore Island because of the forest cover of the hill and adjoining water catchment areas of the three reservoirs. This is an important aspect in helping to ease Singapore's water problems.

25. Other recorded phenomena remain much in close accord with the records of previous years. Data are summarised in Appendices II, III and IV.

BOTANICAL RESEARCH

XVI. COLLECTING

26. Several major expeditions were made during the year. With the expansion of the Department's orchid research programme, funds were available for exploration specifically for plants for cultivation. It is however convenient to record all the collecting work together, whether for the herbarium or for the Gardens. Some expeditions were of mixed botanical and horticultural personnel, and all, as is the usual practice, were of dual purpose.

27. The most important expedition was undoubtedly that to the limestone areas near Bertam and Gua Musang in Ulu Kelantan. Sponsored by U.N.E.S.C.O. South-East Asia Science Co-operation Office, and jointly organised by the Botany Department of the University of Singapore and the Botanic Gardens, Singapore this expedition, under the leadership of Dr. Hsuan Keng of the University, took place from 24th July to 17th August. Extensive collecting was carried out in the limestone hills along the Sungei Bertam, mainly near Batu Pintu and Batu Bayeh (Bayam) and later at Gua Musang, Batu Boh and Gua Panjang, obtaining some 691 numbers including many new records for the herbarium with up to 6 duplicates for exchange distribution, and over 200 kinds of living plants. As such, the expedition greatly extended the knowledge of the limestone flora. From a botanical aspect this element of the Malaysian flora is relatively poorly known and understood. It was therefore chosen for concerted investigation on the recommendation of U.N.E.S.C.O.'s Humid Tropics Research Committee. The expedition was the first of a series planned to cover Thailand, Malaya, Borneo and Java.

It aimed to provide training courses for young botanists to give them experience of the Malaysian flora outside their own countries, and of living and working in the field, often under rigorous conditions. At U.N.E.S.C.O.'s invitation botanists from the Federation of Malaya, Thailand, Hongkong, Philippines and Indonesia, and four graduate students (two on Federation of Malaya Government scholarships) from the University of Singapore attended. Mr. Lam Hin Cheng, Curator, and two plant collectors of the Botanic Gardens also joined the expedition. Acknowledgement is made to the Protector of Aborigines, the Director of the Geological Survey and the Geologist, Kelantan, of the Federation of Malaya Government for their assistance.

28. In May and June, Dr. Chew Wee Lek, Botanist, and Mr. A. G. Alphonso, Curator, and a plant collector joined an expedition organised by the Forest Department and the Department of Civil Aviation (prospecting for new landing strip sites) of Sarawak. Messrs. B. Burt and P. Woods of the Royal Botanic Garden, Edinburgh, also joined the expedition to study *Gesneriaceae*. This was essentially a joint expedition in that each of the four departments represented worked on their own particular project but by travelling together there was a considerable saving in the cost of transport. Mr. Alphonso collected plants in the vicinity of the Niah hills and the Undup River for cultivation in the Singapore Botanic Gardens. Of particular interest was a *Vanda dearii* with yellow sepals and petals as is usual but with brown markings at the tips. Dr. Chew concentrated on taxonomic and ecological studies on the Niah hills and on Gunong Mulu and Melinau Gorge, a possible site for a national park.

29. Between June and August, Miss Chang Kiaw Lan, taking vacation leave to visit Kotaraja in Aceh, north Sumatra, was granted facilities to spend a month collecting in this botanically little-known area, and on the islands of Weh and Bras off the northern tip of Sumatra and along the west coast.

30. The other overseas collection was made by Mr. Burkill at the game sanctuary at Panganderan on the south coast of Central Java during a visit in the U.N.E.S.O. Nature Conservation Symposium held in Java in February. The sanctuary is a hilly headland almost an island, connected by a narrow spit of sand to the mainland and fringed with coral reefs which afforded excellent collecting of marine algae. Some 46 numbers were collected and brought back to Singapore for study.

31. Two other minor collecting expeditions were made under the arrangements of Mr. R. K. Dentan, an anthropologist from New York University to whom the Botanic Gardens lent the services of a plant collector to assist in ethnobotanical work. Two other members of the Department also joined expeditions organised by the University of Malaya. All these expeditions added useful records to the Malayan flora. Further details are given in Appendix V.

XVII. EXCHANGE AND ACQUISITION

32. Duplicate specimens were again distributed to the usual collaborating botanical institutions outside Singapore. The number distributed was 2,613, mainly to Kew and Leiden. In return the Singapore herbarium received 4,575, of which 38 were gifts. The Forest Department, Sarawak, headed the list of those sending material here with 1,781 numbers, and the Forest Department, North Borneo, came seconded with 965 numbers. These accessions are of great value to the Singapore herbarium in facilitating its taxonomic studies of the Malaysian flora. Details of exchanges are given in Appendix VI.

33. A quantity of prewar collections of Corner, Holttum, Henderson, Md. Nur and Kiah bin Salleh which had not been distributed were sorted out and now ready for distribution. Some 500 collecting numbers were involved, and sets will be sent to collaborating institutions.

XVIII. TAXONOMY

34. Mr. Sinclair continued his research work on Malaysian *Myristicaceae* (Nutmeg family) in collaboration with the Flora Malesiana Foundation. He was engaged mainly on studies of the Genus *Myristica* containing about 73 species. By the end of the year, when he retired under Government's malayanisation policy, the major part of the practical work was already completed, leaving the keys and introduction to be done. Mr. Sinclair will be doing this and the checking of the whole manuscript at Kew while on leave after his return to Britain. However, the last genus, *Horsfieldia*, remains to be worked out, and arrangement should be made for Mr. Sinclair to return to Singapore to complete this work of economic importance.

35. Dr. Chew Wee Lek has been studying the genera *Laportea* and *Fleurya* (Urticaceae). However, progress is rather slow due to the lack of literature in Singapore and the difficulty of tracking down the whereabouts of type materials and obtaining loan of them. The refusal of many institutions to loan out classical material has also hampered the work. Such a situation for an expatriate officer can be overcome while on vacation leave since he has the opportunity to visit the relevant European herbaria. For local officers this can only be resolved by granting him study leave.

36. Dr. Chew has also been engaged in naming the Urticaceae of the Royal Society North Borneo expedition of 1961 and of the recent Danish Expedition to Thailand.

37. Dr. Furtado, although in retirement, has nevertheless continued to work in the herbarium to sort out and bring up to date the names of several genera in the herbarium. He named the palms and the genus *Ardisia* collected on the Royal Society Expedition.

38. Miss Chang continued her collection of Agaricales and prepared her material for her studies at Cambridge.

XIX. LOANS OF HERBARIUM MATERIAL

39. Loans of Herbarium material were made to nine institutions. Most of them were sent to Leiden, Holland, for monographers working on Flora Malesiana. The Department received loans from 13 institutions. Details are given in Appendix VI.

HORTICULTURE

XX. GARDENS MAINTENANCE

40. Normal maintenance of beds and lawns was carried out. Hedges were kept trimmed and the encroaching jungle on Lawn V was cut back. The motor mowers gave a minimum of mechanical trouble and mowing was kept up to the usual weekly round. The tidying up of the lake continued. Control of the *Nelumbium* seems to be almost complete (see Annual Report for 1961, para. 46) and the display of red, pink and white flowering *Nymphaea* was again, as it was before 1955, a reward of the early morning visitor to the Gardens.

41. Nineteen trees died during the year, and seven others were destroyed by storms. The major losses were *Orania regalis*, *Macrozamia hopei*, *Eucalyptus robusta*, *Rhopatoblaste hexandra*, *Phoenix rupicola*, *Mimusops elengi* and *Hydnocarpus anthelmintica*. Thirty-one new plantings were done, the most interesting being *Ervatamia* sp. and *Macadamia ternifolia*. The planting of trees has always been a problem owing to the lack of adequate space. Consequently, this aspect of the Gardens work has been greatly restricted. Without further land to develop as an arboretum this aspect of the Gardens' work must inevitably be greatly restricted.

42. The multiplication nursery on Lawn Y now enclosed in a fence, was expanded by removing unwanted shrubbery which surrounded it. The old quarantine house was refurbished, and a telephone installed, to become the Plant Sales Office. This has greatly facilitated the plant sales service since the nursery and office are now on the same site.

43. Preparation was made to close the Gardens entirely to all vehicular traffic to avoid congestion and dangers to visitors. In this matter the co-operation of the police had been obtained by allowing the vehicles to be parked outside. These arrangements have not been implemented, but are held pending.

XXI. HORTICULTURAL EXCHANGE

44. Exchange of seeds and plants with other botanical organisations in Singapore, Malaya and overseas remained an important aspect of the work of the Horticultural Division. However, only one man was engaged on seed collection throughout the year and the demand is much greater than can be met. Institutions with which exchanges were carried out are listed in Appendices VII and VIII.

XXII. ISTANA NEGARA DOMAIN

45. The grounds, including the immediate gardens of all the houses in the Domain, have been kept in good condition. Mechanical equipment gave good service. The infestation of *Elephantopus scaber* in the turf of the golf course (see Annual Reports 1960 para. 72, and 1961 para. 63) has been held in check. The golf course was also kept in good condition. The work at the potting yard and the vegetable and flower nurseries was maintained at a high state to provide for the households of the Domain. Nearly 2,000 pot plants were cultivated in the potting yard and additional plants were grown for trans-shipment to Kuala Lumpur for the grounds of "Temasek".

46. The grounds were open to the public by kind permission of H.E. the Yang di-Pertuan Negara on New Year's Day (1st January), Chinese New Year's Day (5th February), Hari Raya Puasa (7th March), Labour Day (1st May) and on Deepavali (27th October).

XXIII. SINGAPORE HOUSE, KUALA LUMPUR — "TEMASEK"

47. The Domain nursery was used to prepare planting material for the garden of this house. These amounted to 1,500 pots. Since these were shipped rooted in pots with soil, special permission had to be obtained from the Director of Agriculture, Federation of Malaya. The Curator made two visits to Kuala Lumpur to give advice on the garden works.

XXIV. ORCHIDS

48. The availability of extra funds has enabled plant collecting expeditions to be carried out during the year. The major ones have been referred to in Section XVI, Collecting. These expeditions resulted in 362 orchid species being added to the existing living collection. Other plants

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amounting to 426 species and hybrids were also received from outside sources on exchange from Singapore, Malaya, Sarawak, Brunei, New Guinea, India, Nigeria, Costa Rica, Venezuela, Abyssinia, Kenya and Hawaii; and 115 orchid species and hybrid plants of diverse and worldwide origin were obtained by purchase from nurserymen. Against the plants received on exchange, some 396 were given in reciprocation.

49. Sixty-seven hybrid pods were harvested from the Gardens nursery, seventeen were received from Singapore growers, eleven from the Federation of Malaya, sixteen from New Guinea, six from Sarawak and one from Brunei. Of these 118 pods, seeds from 89 of them have been successfully germinated. About 2,000 flasks are being used for the young seedlings. During the year the contents of 553 flasks were potted out. The flask culture medium used, as previously, is based on Vacin's formula plus 10 per cent coconut water and banana pulp. Trails with "Pepton" in the absence of coconut water and banana pulp gave encouraging results.

50. A total of eight hundred and ninety-five seedlings were potted out from the seedling houses and planted in pots outside, but the lack of planting space will hamper appreciably their further progress.

51. The following crosses were registered during the year:

BGS—

- 2687 *Dendrobium* Wee Cheow Ean (*Den. Caesar* × *Den. trilamellatum*).
- 3093 *Dendrobium* Emily Cheah (*Den. affine* × *Den. Lady Hamilton*).
- 1780 Aranda Eric Mekie (Aranda Lucy Laycock × *Vanda luzonica*).
- 1957 *Arachnopsis* Adrian Cheok (*Arachnis hookeriana* 'luteola' × *Phalaenopsis serpentilingua*).
- 2247 Arandanthe Lily Chong (*Arachnis Ishbel* × Vandanthe Rothschildiana).
- 1859 Aranda Saw Kim San (Aranda Hilda Galistan 'Suntan' × *Vanda sumatrana*).
- 2499 Vandanthe Lee Chin Chin (*Vanda Ruby* × Vandanthe Ellen Noa).
- 3074 *Dendrobium* Barbara Moore (*Den. affine* × *Den. gouldii*).
- 2705 Renantanda Prince Norodom Sihanouk (V. Tan Chay Yan × *Renanthera coccinea*). Named in honour of H.R.H. Prince Norodom Sihanouk who visited the Botanic Gardens on 17th December, 1962.

52. Flowering for the first time were crosses:

BGS—

- 1793 *Arachnis* Maggie Oei × *Vanda lamellata* 'boxallii'.
- 1796 *Arachnis* Ishbel × *Vanda lamellata* 'boxallii'.
- 1821 *Vanda* Flammerolle × *Vanda tessellata*.
- 1865 *Vanda suavis* × Vandanthe Ellen Noa.
- 1944 *Arachnis* Catherine × *Vanda tricolor*.
- 1947 Vandachnis Scarlet Runner × *Vanda Trisum*.
- 1987 *Vanda Trisum* × *Phalaenopsis denevei*.
- 2216 *Vanda* Tan Chay Yan × Vandanthe Ellen Noa.
- 2276 *Vanda* Tan Chay Yan × *Vanda suavis*.
- 2282 *Vanda* Ruby Prince × *Vanda dearei*.
- 2305 *Vanda* Ruby Prince × *Vanda Josephine*.
- 2581 *Vanda* Tan Chay Yan × *Vanda caerulea*.
- 2636 *Vanda* B.P. Mok 'Old Rose' × Vandanthe Bill Sutton.
- 2650 *Arachnis* Maggie Oei × Vandanthe Onomea.
- 2656 *Vanda* Tan Chay Yan × *Phalaenopsis denevei*.
- 2693) *Vanda* Josephine van Brero × *Vanda tessellata*.
- 2723)
- 2741 *Dendrobium aries* × *Dendrobium* Champagne.
- 2742 *Dendrobium* Ursula × *Dendrobium aries*.
- 2816 *Dendrobium* Mustard × *Dendrobium gouldii* 'Saipan'.
- 2819 *Dendrobium* Brown Curls × *Dendrobium* cv. unnamed.
(*D. gouldii* × *D. Merrietta* Chang).
- 2821 *Dendrobium* Champagne × *Dendrobium* Bernice.
- 3317 *Dendrobium* Syaj × *Dendrobium* Lady Hamilton.

53. During the year the following cultivars gained awards of the Malayan Orchid Society:

BGS —

953/2	Aranthera	Anne Black 'Chili Padi' ...	Award of Merit.
1319/6	Arandanthe	Grandeur 'Hitam' ...	Award of Merit.
2134/9	Dendrobium	Noor Aishah 'Subur' ...	Award of Merit.
2223/1	Vandanthe	Candlelight 'Belerang' ...	Award of Merit.
2502/3	Dendrobium	Sri Temasek 'Kuning' ...	Award of Merit.
2654/2	Arachnopsis	Napier cv. unnamed ...	Certificate of Preliminary Cultivation.

54. Many blooms were sent overseas for exhibition, for details of which see para. 59. A demonstration of flask culture and some 60 flowering plants were put on exhibition at the Malaysia Solidarity Exhibition in the Victoria Memorial Hall in February. At the public enclosure of the orchid nursery at the Botanic Gardens more than 100 prime bloom plants which were changed weekly were on display throughout the year.

EXTENSION WORK

XXV. SUPPLY OF PLANTING MATERIAL

55. A total of 15,561 plants, cuttings, lots of bulbs or roots, and packets of seeds were sold to the public bringing in a revenue of \$21,111.05. Of this sum, \$17,349 alone was derived from the sale of orchid material.

56. The Gardens continued to supply free planting material to Government departments, charitable institutions, state-aided schools and other official and quasi-official organisations. Of the 5,277 plants supplied, 2,279 went to the compounds of new schools. Furthermore the Gardens also continued to loan out foliage pot plants for decoration at official or charitable functions; the year's total was 2,717 pots.

XXVI. EXHIBITIONS AND SHOWS

57. The Botanic Gardens participated in the Malayan Agri-horticultural Association's show in Kuala Lumpur between 5th-9th July. An exhibit of orchids, cacti and saintpaulias was displayed which proved to be the centre of attraction. Mr. A. G. Alphonso officiated as a judge in the competitive horticultural sections of the show.

58. The Gardens gave considerable assistance to the Singapore Gardening Society and to the Malayan Orchid Society in staging their respective annual shows at the Happy World Stadium. For the Gardening Society flower show in March, Mr. Alphonso was Show Manager and among the judges were seven members of the Gardens staff. The Gardens put up a 600 square feet landscape containing over 400 plants in flower including orchids, saintpaulias and foliage plants. Mr. Alphonso was also Show Manager for the Malayan Orchid Society's show in November at which a large display was put up by the Gardens.

59. Besides these local exhibitions, the Gardens also participated in:

- The Penang Gardening Society Show, Penang;
- The Jesselton Gardening Society Show, Jesselton;
- Bazaar of the Sarawak Society for the Blind, Sarawak;
- The Indonesian Orchid Society Show, Bandung;
- The Philippine Orchid Society Show, Manila;
- The Siam Society of Plant Culture Exhibition, Bangkok;
- The Pakistan Flower Show, Karachi;
- The Chelsea Show, London;
- City of Glasgow Flower Show, Glasgow;
- The American Orchid Society Show, Oregon, U.S.A.;
- Orchid Society Show of Greater St. Louis, Mississippi, U.S.A.

Acknowledgement is made to Messrs. B.O.A.C./Qantas/A.I.I. for assistance in flying exhibits to some of these exhibitions.

XXVII. SINGAPORE GARDENING SOCIETY

60. Mr. H. M. Burkill and Mr. A. G. Alphonso were respectively President and Vice-President of the Society till June when both retired by rotation. Dr. N. K. Law, a private citizen and medical practitioner in Singapore, became President. Many of the regular monthly meetings of the Society during the year were held, in the Botanic Gardens.

XXVIII. MALAYAN ORCHID SOCIETY

61. Mr. A. G. Alphonso was Honorary Secretary of the Society for 1962. Mr. Bajuri bin Sappan was honorary secretary to the Society's panel of judges. The Gardens gave strong support to the Society's monthly exhibitions and activities. Regular descriptions of new hybrids were prepared for publication in the *Malayan Orchid Review*.

XXIX. MALAYAN NATURE SOCIETY

62. Mr. H. M. Burkill was on the Central Committee for the years 1961/62 and 1962/63. The Singapore Branch of the Society held its meetings, both, in the Botanic Gardens and in the Singapore Nature Reserves.

XXX. ADVISORY

63. Planting schemes for the compounds of new schools increased the outside advisory work of this Department. Some 40 schools sought advice and help. Visits and advice, as well as planting material, were also made to the Reformative Training Centre at Ulu Bedok, the new Customs Station at Pasir Panjang, the District Office at Jalan Teck Whye and St. Andrew's Orthopædic Hospital. Assistance was also extended to the public and commercial organisations who sought specific information on a wide variety of botanical and horticultural matters, and on economic plants.



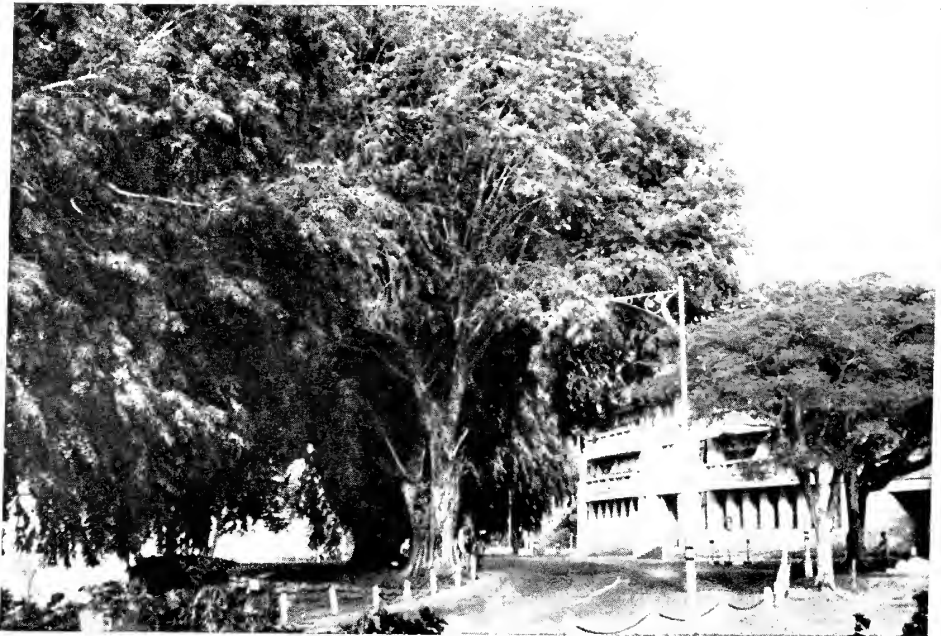
Straits Times Press Ltd.

H.R.H. Prince Norodom Sihanouk signing the Visitors Book.

Looking on left to right: Mr. Tan Kia Gan, Minister for National Development, Mr. Anwar Ibrahim, Prime Minister's Department, Mr. A. G. Alphonso, Curator, Botanic Gardens, Dr. Chew Wee Lek, Acting Director, Botanic Gardens.



Enterolobium saman, Rain Tree
Connaught Drive, Singapore.



Pterocarpus indicus, Angsana
By The Fort, Malacca.

AVENUE TREES



Acacia auriculaeformis, Wattle
Adam Road, Singapore.



Melaleuca leucodendron, Gelam
Jalan Scudai, Johore Bahru.

BGS 2705 — *Renantanda* Prince Norodom Sihanouk
(*Vanda* Tan Chay Yan × *Renanthera coccinea*)

A cross named in honour of the visit of H.R.H. Prince Norodom Sihanouk to the
Botanic Gardens, 17th December, 1962.



Inflorescence: from base to distal tip approximately 60 cms.



Photographs of the first plant of this cross to flower, BGS 2705/1.

STAFF OF BOTANIC GARDENS 1962

DIVISIONS I AND II AND TECHNICAL POSTS OF DIVISION III

<i>Appointment</i>	<i>Holder</i>	<i>Notes</i>
Director	H. M. Burkill, M.A. (Cantab.), F.L.S.	On overseas vacation leave from 5th August to end of year.
Botanists	J. Sinclair, B.Sc. (Edin.)	Keeper of Herbarium.
	Chew Wee Lek, B.Sc. (Malaya), Ph.D. (Cantab.)	Assistant to Director, Act- ing Director, 5th August to end of year.
	Chang Kiew Lan, Miss, B.Sc. (Malaya)	On U.K. Government Scholarship from Octo- ber 1962.
Curators	A. G. Alphonso	—
	Lam Hin Cheng	—
Librarian	Tan Kim Ho, B.Sc. (Malaya)	—
Executive Officer	R. S. Mani	Up to 20/9/62.
	Khor Teik Loon	From 21/9/62 to 30/11/62.
	Ooi Teng Lai	From 1/12/62.
Laboratory Assistant (Spe- cial Grade)	Bajuri bin Sappan	—
Horticultural Assistant	Ang Gek Choo	—
Herbarium and Museum Assistant	Md. Shah bin Haji Md. Nur	—
Artist	Juraimi bin Samsuri	—

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METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1962

Reading daily at 9.30 a.m. local time at Gardens Office from 1-1-62 — 31-12-62

Altitude c.90 feet a.s.l.

1962	Total Rainfall	Highest fall in 24 hrs.	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.
	inches	inches		°F	°F	°F	°F	°F	°F	%
January	10.28 (11.19) [*]	2.57	18	84.9	89.0	73.5	71.4	78.0	75.1	87.0
February	2.13 (7.18)	0.80	8	86.9	90.0	73.2	70.0	79.0	75.0	80.6
March	9.19 (8.38)	2.27	16	88.1	91.0	74.1	71.9	80.3	76.6	84.0
April	6.90 (8.10)	1.74	15	89.8	93.0	74.5	72.2	81.7	77.4	81.6
May	5.35 (7.49)	1.42	12	90.7	93.0	75.9	73.2	83.5	78.8	80.1
June	6.39 (6.67)	1.57	15	88.2	93.5	75.9	72.8	81.9	78.3	83.5
July	5.72 (6.17)	2.09	17	87.8	92.0	75.7	71.0	80.7	73.9	84.2
August	5.52 (7.12)	1.83	19	86.0	91.5	74.8	71.5	80.4	76.9	84.8
September	6.75 (7.56)	2.65	10	87.2	91.2	75.6	71.5	81.2	77.3	82.1
October	5.90 (7.89)	1.47	14	88.9	93.0	75.7	73.2	83.2	78.1	79.3
November	12.16 (10.51)	1.67	19	87.9	93.0	74.6	72.8	80.7	77.0	84.3
December	13.30 (9.89)	3.52	23	86.0	89.8	73.3	70.5	79.6	75.8	83.7
Total	89.59 (98.12)	—	186	..	..	..	..	..	..	..
Mean .. ..	..	..	..	87.7 (30.9°C)	91.7 (33.2°C)	74.7 (23.7°C)	71.8 (22.1°C)	80.8 (27.1°C)	76.4 (24.7°C)	82.9

* Mean rainfall for the period 1914—1962 (49 years).

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1962

Reading daily 8.00 a.m. local time at Orchid Enclosure from 1-1-62 — 31-12-62

Altitude c.80 feet a.s.l

13

1962	Total Rainfall	Highest fall in 24 hours	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.	Mean Min. Grass Temp.	Mean Earth Temp. 4"	Mean Earth Temp. 1'	Mean Earth Temp. 4'	Solar Radiation Thermometer
	ins.	ins.		°F	°F	°F	°F	°F	°F	%	°F	°F	°F	°F	°F
January ..	9.90	2.49	18	83.9	88.0	72.6	68.5	74.7	73.9	96.2	71.1	78.4	80.2	81.5	137.0
February ..	2.18	0.73	8	86.5	89.0	72.4	69.5	74.7	73.7	94.9	70.5	78.0	80.7	81.3	143.7
March ..	8.83	2.10	16	86.8	90.3	73.5	71.3	75.4	74.5	96.9	71.1	80.0	82.2	82.9	148.3
April ..	6.71	1.53	15	88.1	92.0	74.0	71.0	76.7	76.0	96.8	70.8	81.2	83.5	83.5	144.8
May ..	4.82	1.44	12	88.9	91.5	74.3	72.0	77.9	77.2	96.7	71.4	82.0	83.8	84.0	143.6
June ..	6.75	1.64	13	86.5	91.0	74.7	72.3	77.1	76.5	97.2	69.9	80.9	83.2	84.1	131.1
July ..	5.56	1.45	18	86.3	90.0	73.3	71.0	76.7	75.8	96.2	72.4	76.3	82.2	82.6	134.2
August ..	5.47	1.64	19	84.9	89.5	72.6	70.5	76.3	75.6	96.9	72.3	79.1	82.0	82.2	137.8
September ..	6.75	1.62	10	85.9	89.5	74.2	71.0	77.6	76.3	91.4	74.2	73.4	81.7	83.1	141.0
October ..	5.95	1.55	14	87.5	91.0	74.1	72.8	77.7	76.8	96.1	73.6	81.1	83.6	83.5	128.3
November ..	11.52	1.64	18	84.3	91.0	73.5	71.0	76.2	85.4	95.8	72.7	80.2	81.9	82.1	123.9
December ..	12.78	3.47	25	86.0	90.0	72.2	69.0	75.2	74.5	96.6	71.4	78.7	80.8	81.9	103.1
Total ..	87.22	..	186	..	..	..	..	..	..	..	..	..	..	..	..
Mean ..	..	..	..	86.3 (30.2°C)	90.2 (32.3°C)	73.6 (23.1°C)	70.8 (21.6°C)	76.3 (24.6°C)	75.5 (24.2°C)	95.1	71.8 (22.1°C)	79.1 (26.2°C)	81.3 (27.2°C)	82.7 (28.2°C)	134.6 (57.0°C)

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1962

Reading daily 8.00 a.m. local time at "Bukit Timah" from 1-1-62 — 31-12-62

Altitude 581 ft. a.s.l.

14

1962	Total Rainfall	Highest fall in 24 hrs.	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Dry Bulb Temp.	Mean Wet Bulb Temp.	R.H.
	inches	inches		°F	°F	°F	°F	°F	°F	%
January	10.70	3.47	12	80.6	84.9	71.3	69.9	73.3	72.2	94.8
February	2.92	0.72	8	83.2	86.7	71.1	69.0	73.5	72.2	93.8
March	10.27	2.38	13	83.3	86.6	72.8	70.0	75.2	73.8	93.4
April	6.32	1.46	19	86.4	89.5	74.1	71.4	77.1	75.2	95.1
May	5.12	2.18	12	87.5	89.6	75.4	70.0	77.8	75.6	89.8
June	10.30	2.22	11	85.6	88.9	75.6	70.2	77.2	74.8	92.3
July	4.89	1.46	10	85.8	88.9	75.2	70.9	75.6	73.6	87.2
August	8.00	1.46	14	85.1	88.9	74.6	69.9	76.3	73.7	91.6
September	7.89	1.46	8	85.0	87.8	74.3	70.5	75.9	74.2	92.5
October	5.56	1.05	14	85.2	89.0	74.5	70.5	76.6	74.9	89.2
November	10.06	2.18	16	88.6	88.9	73.3	70.5	75.9	74.3	89.7
December	15.48	2.65	19	83.7	87.8	72.8	68.2	74.1	72.8	93.7
Total	97.51	..	156	..	..	..	..	..	..	..
Mean .. ..	..	..	..	85.0 (29.4°C)	88.1 (31.2°C)	73.8 (23.2°C)	70.1 (21.2°C)	75.7 (24.3°C)	73.9 (23.3°C)	91.9

SUMMARY OF MAIN PLANT COLLECTING EXPEDITIONS

Area	Personnel	Dates	Notes
<p><i>Penang, Kedah, Perlis</i></p> <p>Penang Island Gunong Jerai (Kedah Peak) Sik, Kedah Kaki Bukit, Perlis</p> <p>Pulau Dayang Bunting, Langkawi Bukit Telega Tujoh, Langkawi Bukit Choping, Perlis</p>	<p>Bajuri bin Sappan Samsuri bin Ahmad</p> <p>Samsuri bin Ahmad (in assistance to Mr. Burt and Mr. Woods, of Royal Botanic Garden, Eoinburgh).</p>	<p>9th—18th November</p> <p>23rd April to 1st May</p>	<p>Plants for cultivation, 80 nos. Herbarium specimens, 60 nos.</p> <p>Plants for cultivation, 17 nos.</p>
<p><i>Ulu Kelantan</i></p> <p>Sungei Bertam Gua Musang</p>	<p>Lam Hin Cheng Samsuri bin Ahmad Md. Noor bin Jumaat (Under Dr. Hsuan Keng, Leader, of the University of Singapore, and other botanists from Singapore, Malaya, Thailand, Indonesia, Philippines and Hongkong).</p>	<p>25th July to 16th August</p>	<p>U.N.E.S.C.O. limestone expedition and training course. General herbarium collection, 691 nos. Plants for cultivation, 221 nos.</p>
<p><i>Perak</i></p> <p>Near Kampar</p>	<p>Robert K. Dentan (Anthropologist, New York, U.S.A.)</p>	<p>1962/63</p>	<p>Anthropology of the Semai; ethnobotanical collections, 54 nos.</p>

SUMMARY OF MAIN PLANT COLLECTING EXPEDITIONS

Area	Personnel	Dates	Notes
<i>Pahang</i> Fort Dixon, near Kuala Lipis Pulau Tioman Pulau Tupai	Kadim bin Tassim (in assistance to R. K. Dentan) Kadim bin Tassim Md. Noor bin Jumaat (Under Lord Medway, Department of Zoology, University of Malaya).	8th—20th February 6th—28th April	Anthropology of the Semai; ethnobotanical collections, 400 nos. General herbarium collections, 163 nos.
<i>Selangor</i> Kepong Templer Park Klang Gates	J. Sinclair	12th—20th November	Myristicaceae for herbarium, 15 nos.
<i>Malacca</i> Tanjong Kling Pulau Dodol	H. M. Burkill	22nd—23rd April	Marine algae for herbarium, 23 nos.
<i>Johore</i> Gunong Ledang (Mt. Ophir) Gunong Pulai	A. G. Alphonso Samsuri bin Ahmad Sanusi bin Sarih A. G. Alphonso	4th—12th December 24th November	Plants for cultivation, 122 nos. Herbarium specimens, 52 nos. Plants for cultivation, 20 nos. Herbarium specimens, 7 nos.

SUMMARY OF MAIN PLANT COLLECTING EXPEDITIONS

Area	Personnel	Dates	Notes
<i>Singapore</i> Raffles Light	H. M. Burkill Kadim bin Tassim	10 visits	Sampling Sargassum for phytochemical analysis and phenological studies.
<i>Sumatra</i> Pulau Wch Pulau Bras Acheh West Coast Brastagi	Chang Kiaw Lan	Various, between June and August	Fungi, Algæ, Sulphur—spring vegetation and general collections for herbarium
<i>Sarawak</i> Niah Undup River Batu Lintang Niah Gunong Mulu	A. G. Alphonso (Accompanied by J. Seal, Department of Civil Aviation, Sarawak). Chew Wee Lek (Accompanied by J. A. R. Anderson, B. E. Smythies, and D. Parsons, Forest Department, Sarawak, and B. Burt and P. Woods, Royal Botanic Garden, Edinburgh).	30th May to 22nd June 31st May to 2nd July	Plants for cultivation, 135 nos. Herbarium specimens, 54 nos. General collections for herbarium 211 nos.
<i>Java</i> Panganderan	H. M. Burkill	19th—20th February	Marine algæ for herbarium, 46 nos.

SUMMARY OF DISTRIBUTION OF HERBARIUM SPECIMENS ON EXCHANGE
AND LOAN

Herbaria	No. of specimens	EXCHANGE		LOAN	
		Sent	Received	Sent	Received
Allen, Mrs. B.E. (gift)	38	..	..
Arnold Arboretum	..	331	..	..	..
Bangkok	..	30	..	54	1
Bogor	..	183	..	156	..
Brisbane	..	22	..	..	..
British Museum	..	26	79	..	..
Budapest	106
Calcutta	15
California	..	28	..	..	..
Cambridge	..	33	..	..	..
Colombo	..	12	..	..	..
Columbia University	..	13	..	..	..
Copenhagen	9	1	..
Dehra Dun	..	9	..	..	48
Durham University	..	3	..	..	..
Edinburgh	..	71	46	77	1
Hamburg	21
Hawaii	..	22	14	..	6
Hokkaido	..	5	..	..	..
Kepong	..	21	203	..	84
Kew	..	446	142	1	1
Lae	..	281	..	..	..
Leiden	..	796	448	2,039	1,328
Manila	..	76	254	..	..
Mauritius	..	20	..	..	..
Michigan	..	32	..	..	..
Missouri	74	..
Paris	588	..	2
Peradeniya	8	..	..
Sandakan	..	29	965	..	..
Sarawak	..	93	1,781	46	..
Tokyo	5
University of Malaya	..	31	..	1,424	..
Zurich	143
Total	..	2,613	4,575	3,872	1,777

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM PLANTS AND SEEDS WERE RECEIVED ON EXCHANGE

Abyssinia	...	...	Dr. Brehme, Forest Research Institution, Addis Ababa.
Argentine	...	...	Victor A. Milano, Instituto de Botanica Agricola, Buenos Aires.
Australia	...	...	Mr. W. Morris, Warnes Bay, N.S.W.; Director of Horticulture, Department of Agriculture and Stock, Brisbane.
Brunei	...	...	Dr. K. F. D. Sweetman, Seria.
Ceylon	...	...	Royal Botanical Gardens, Peradeniya.
Costa Rica	...	...	Dr. A. J. Hansen, Institute Interamericano, Turrialba.
Federation of Malaya	...	...	Mr. P. G. Herklots, Kuala Lumpur; Professor of Botany, University of Malaya, Kuala Lumpur; Mr. Verghese, Department of Agriculture, Kuala Lumpur; Agronomist-in-charge, Federal Experimental Station, Serdang; Botanic Gardens, Penang; Mrs. H. Jones, Petaling Jaya, Kuala Lumpur; Mr. G. Lee, Klian Pau, Taiping; Mr. A. S. M. Hawkins; Mr. Leong Hoi Choon, Ipoh; Tuan Haji Ahmad, Anak Bukit Garden, Alor Star; Mr. R. J. S. Galphine, Pamol Estate, Kluang.
Germany	...	...	Botanischer Garten der Padagog-Hochschule, Potsdam; Botanischer Garten der Universitat, Wursburg; Georg Vorwerk, Hamburg; Palmengarten, Frankfurt A.M.
Hawaii	...	...	Foster Botanic Gardens, Honolulu.
Holland	...	...	Hortus Botanicus, Leiden.
Hungary	...	...	Institutum et Hortus Botanicus, Debrecen; Hortus Botanicus Academiae, Vacratot.
India	...	...	Mr. G. Gogel, Bombay.
Indonesia	...	...	Kebun Raya Indonesia, Bogor; Botanic Gardens, Bogor, Djawa.
Italy	...	...	Orto Botanico, Udine.
Japan	...	...	Dr. Makato Togashi, Osaka; Kyoto Takeda Herbal Garden, Kyoto.
Kenya	...	...	Mr. J. E. Castelino, Mombasa.
New Guinea	...	...	Mr. J. S. Womersley, Department of Forests, Lae; Mr. J. B. Smit, Sentani.
Nigeria	...	...	Mr. S. H. Wimbush, Forestry Department, Northern Nigeria.
North Borneo	...	...	Mr. K. Ralph, Tuaran; Mr. Y. K. Wong, Jesselton.
Rhodesia	...	...	Mr. John Scott, Bauket, S. Rhodesia.
Sarawak	...	...	Mr. J. E. Seal, Kuching; Mr. Ong Kee Chong, Kuching; Mr. R. E. Donough, Kuching; Mr. Robert Koh Sze Teck, Kuching; Wee Ghim Swee, Kuching.
Singapore	...	...	Coronation Nursery; Mr. K. Arnold; Mrs. Rajaratnam; Mr. How Yee Peng; Mr. H. Paul; Mr. M. Lewis; Singapore Orchid Ltd.; Che S. Yusof; Mr. Choo Yeok Koon; Mr. Chan Kim Yan; Mr. Sum Lai Woh; Mrs. R. T. Down; Prof. & Mrs. Green, University of Singapore.
Sweden	...	...	Hortus Botanicus Bergianus, Stockholm.
United Kingdom	...	...	Royal Botanic Garden, Edinburgh; Mrs. Lutyens-Humfrey, Gloucester.
United States of America	...	...	California Jungle Gardens, Los Angeles, California.
Union of the Soviet Socialist Republic	...	...	Hortus Botanicus Tallinnensis, Estonia.
Venezuela	...	...	Mr. G. C. K. Dunsterville, Caracas.
Yugoslavia	...	...	Hortus Botanicus, Zagreb.

INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS AND SEEDS WERE SENT ON EXCHANGE

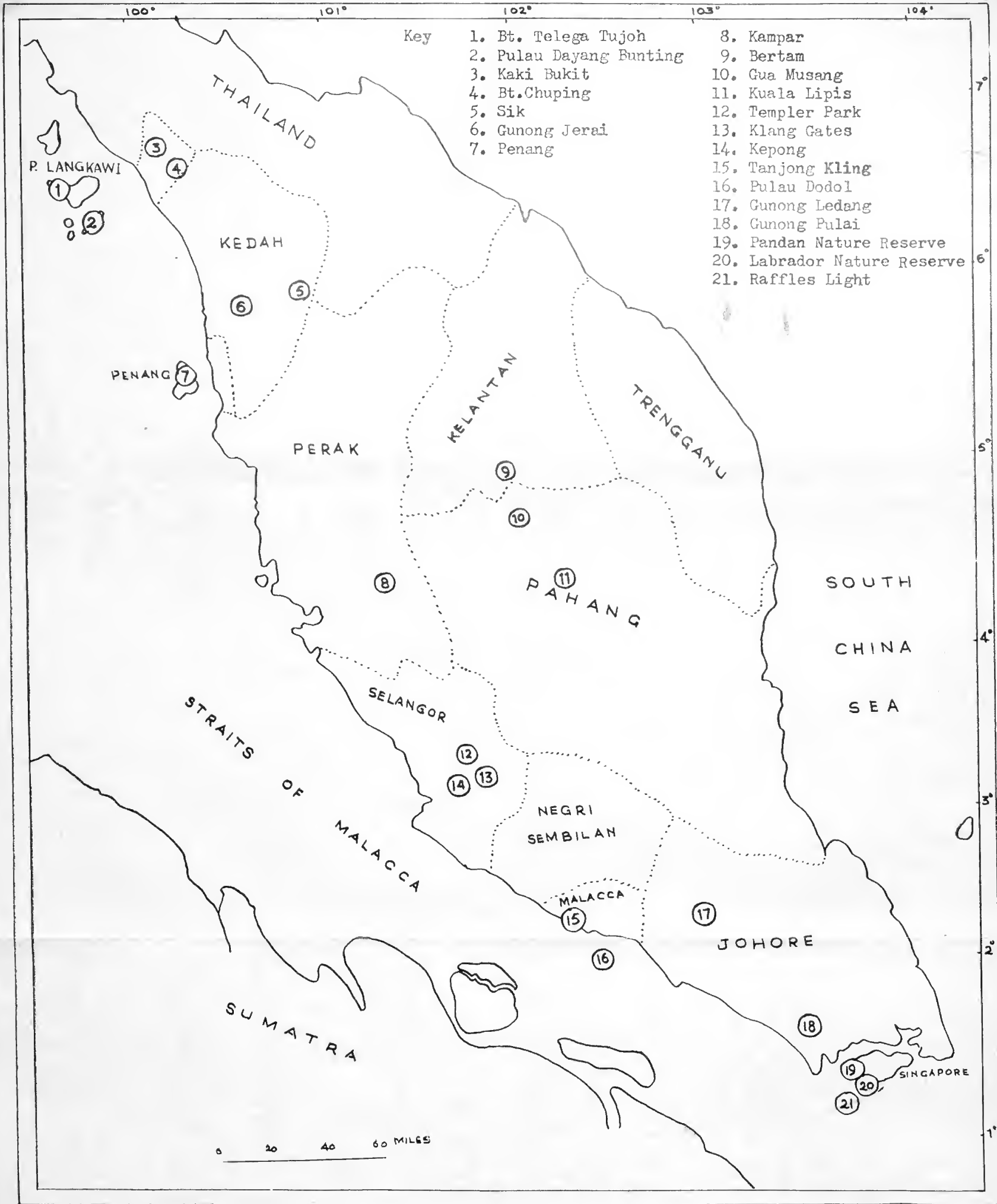
Argentina	...	...	The Instituto de Botanica Agricola Araos 2875, Buenos Aires.
Australia	...	...	W. Morris, Warnes Bay, N.S.W.; Mr. A. E. Wilson, Supt. Parks and Reserves Department, Townhall, North Queensland; Mr. C. Barnard, Division of Plant Industry, C.S.I.R.O.
Borneo	...	...	Conservator of Forests, Sandakan.
Brunei	...	...	Dr. K. F. D. Sweetman, Seria.
Br. Solomon Islands	...	...	The Hon. Chief Justice Briggs, Honiara, British Solomon Islands.
Czechoslovakia	...	...	Botanicka Zahrada, University Karlovy, Benatska, Praha; Director of the Research Station, Sumperk-Temnice; Director, Hortus Botanicus, Institute Pedagogici, Kosice, C.S.R.; Director, Botanic Garden of the University, Karloveska, Bratislava.
Federation of Malaya	...	...	Mr. P. G. Herklots, Ipoh; Mr. H. Jones, Petaling Jaya; Botanic Gardens, Penang; Mr. Leong Hoi Choon, Ipoh.
Finland	...	...	Prof. Aarno Kalela, University of Helsinki.
France	...	...	Director, Jardine Botanique, Ville de Lyon; Ministere de l'Agriculture, Cap D'Antibes.
Germany	...	...	Botanischer Garten der Universitat, Bonn; Botanischer Garten der Techn., Dresden; The Botanischer Institut und Botanischer Garten, Bern; Botanischer Garten, Cologne; Director, Botanischer Garten, Jena; Botanischer Garten der Westfalischen Landes-Universitat, Munster in Westfalen; Director, Botanischer Garten, Darmstadt; Dr. J. Zarnack, Pharmazeutischer Institut der Math-Naturwissenschaften der Humboldt-Universitat, Berlin; Prof. Dr. E. Bunning, Botanischer Gartens der Universitat, Tubingen; Botanischer Garten der Universitat, Rostock; Mr. Georg Vorwerk, Hamberg.
Ghana	...	...	The Botany Department, University College, Legon.
Holland	...	...	Hortus Botanicus, Amsterdam.
Hawaii	...	...	Mr. Paul R. Weissich, Honolulu.
Hungary	...	...	Director, Hortus Botanicus Universitatis, Budapest; Director, MTA, Botanikai Kutato Interzete, Vacratot; Director, Institutum Botanic Universitatis, Szeged; Director, Hortus Botanicus Academiae Scientiarum Hungariae, Vacratot.
India	...	...	Superintendent, Indian Botanic Gardens, Howrah, Calcutta; Mr. G. Gopel, Bombay; Mr. J. J. Chinoy, Ahmadabad.
Indonesia	...	...	Kebun Raya, Bogor.
Italy	...	...	Director, Instituto ed orto Botanico Dell'Universita, Modena; Director, Instituto Botanico Della Universita, Catania
Japan	...	...	Izu Experiment Station of Medicinal Plants, Shizuoka-ken; Mr. R. Hatta, Kyoto.
Kenya	...	...	Mr. H. P. Greensmith, Nairobi; Dr. J. E. Castellino, Mombasa.
Malta	...	...	Director, Argotti-Botanic Gardens, Floriana.
Mexico	...	...	Ing. Jesus Patino Navarette, Mexico.
New Guinea	...	...	Mr. J. S. Womersley, Lae; Plant Introduction Officer, Port Moresby, Lae.

INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS AND SEEDS
WERE SENT ON EXCHANGE — *continued.*

- New Zealand ... Director, Parks & Reserves Department, Christchurch; Mr. Metcalfe, The Botanic Gardens, Christchurch; Mr. Dean J. Eyre, Minister of Defence, Wellington C.I.
- Nepal ... Dr. G. A. C. Herklots, c/o British Embassy, Kathmandu.
- Nigeria ... Mr. J. T. Swarbrick, Ibadan.
- Poland ... The Hortus Botanicus, Poznan.
- Portugal ... The Lisu Herbario do Instituto Botanico, Lisboa.
- Rhodesia ... B. C. N. Mountain, Esq., Southern Rhodesia.
- Sarawak ... Mr. Ong Kee Chong, Kuching; Mr. J. E. Seal, Kuching; Mr. Donough, Kuching; Mr. Robert Koh Sze Teck, Kuching; Dr. Peter Ashton, Kuching.
- Singapore ... Coronation Nursery; Mr. M. Lewis; Mr. Sum Lai Woh.
- South Africa ... Curator, Botanic Gardens, Durban.
- Sweden ... Director, Bergianska Tradgarden, Stockholm.
- Tunisia ... Le Directeur, Service Botanique, Ariana.
- Thailand ... Mr. Tem Smitinand, Royal Forest Department, Bangkok.
- United Kingdom ... G. G. Yearly, F.R.H.S., St. Wulfromis Secondary School, Lincolnshire; Mr. G. T. Prance, Department of Forestry, University of Oxford; Mr. T. C. Whitmore, Botany Department, Southampton; Curator, Royal Botanic Gardens, Kew; The Department of Botany, St. Andrews University; Shepherds Yards, Alcester, Warwickshire.
- United States of America Nat J. De Leon, Miami, Florida; Peter H. Raven, Claremont, California.
- Union of Soviet Socialist Republic ... Director, Hortus Botanicus Batumensis, Batumi, Georgia; Director, Biologijos Institutos, Kaunas; Director Jardin Botanique de L'universite, Mockba, Moscow; Teodor Balams, Hortus Botanicus Academiae Scientiarum Latvensis, Riga, Latvia; The Hortus Botanicus Forminianus, Kiev; Director, Horti Botanici, Ukraine; The Director, Botanic Gardens of the Academy of Sciences, Yerevan, Armenia.
- Venezuela ... Mr. Augusto Braun, Instituto Botanico, Caracas.

12/19

Map Showing Malayan Place Names Mentioned in this Report



Key

- | | |
|-------------------------|-----------------------------|
| 1. Bt. Telega Tujoh | 8. Kampar |
| 2. Pulau Dayang Bunting | 9. Bertam |
| 3. Kaki Bukit | 10. Gua Musang |
| 4. Bt. Chuping | 11. Kuala Lipis |
| 5. Sik | 12. Templer Park |
| 6. Gunong Jerai | 13. Klang Gates |
| 7. Penang | 14. Kepong |
| | 15. Tanjong Kling |
| | 16. Pulau Dodol |
| | 17. Gunong Ledang |
| | 18. Gunong Pulai |
| | 19. Pandan Nature Reserve |
| | 20. Labrador Nature Reserve |
| | 21. Raffles Light |

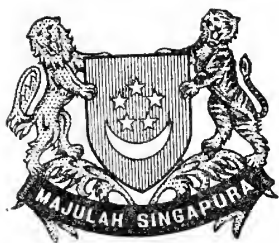
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STATE OF SINGAPORE

COMPLIMENTARY

ANNUAL REPORT OF THE
BOTANIC GARDENS DEPARTMENT
FOR 1963



STATE OF SINGAPORE

ANNUAL REPORT OF THE
BOTANIC GARDENS DEPARTMENT
FOR 1963

BY

H. M. BURKILL

*Director of Botanic Gardens
Singapore*

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ADMINISTRATION

I. FUNCTION

To conduct research into the regional flora and to provide a taxonomic service in support of technological activities concerning Malaysian plant life; to conduct research into tropical horticulture.

II. STAFF

2. There was no change in establishment, and the only major change in personnel was the retirement of Mr. James Sinclair, Botanist, on 18th July, and the appointment of Mr. Hardial Singh to the post on 1st November. In accordance with Government's policy of Malayanisation under the Retirement from the Public Service (Compensation) Ordinance, No. 43 of 1956, Mr. Sinclair's post was Malayanised on 1st January when he proceeded on final leave. He was re-engaged on contract for one year on 19th July as a replacement officer, vice Miss Chang Kiaw Lan, Botanist, who was overseas for the whole year.

3. Mr. A. G. Alphonso, Curator, was seconded as Chief Parks Officer for the whole year in addition to being responsible for his normal duties. This arrangement was far from satisfactory.

4. Mr. A. G. Alphonso was awarded the Public Administration Medal (Bronze) in the National Day honours.

III. LABOUR

5. The labour force was on monthly average 76 men in the Gardens, 54 men in the Istana Negara Domain, nine men in the Nature Reserves, and one man and three women in the herbarium. Health was generally good. Establishment matters, recruitment procedure and correspondence with the trade union representing the labour force took up a considerable proportion of the time of the Curator in charge of labour.

IV. TRAINING

6. Miss Chang Kiaw Lan, Botanist, who was awarded a scholarship by the United Kingdom Government under the Commonwealth Scholarship and Fellowship scheme at Cambridge University commencing in October 1962, continued her studies there on taxonomic mycology throughout the year. The award was in the first instance made for two years and towards the end of 1963 it was extended for a third year.

7. Mr. Munir Ahmad abid Chaudhry of the Department of Botany, University of Sind, West Pakistan, was awarded a Colombo Plan Senior Fellowship granted by the Singapore Government to study taxonomic botany. He arrived in Singapore in December to take up the award.

8. Three subordinate officers of the Department of Agriculture, Sarawak, were given a course in elementary horticulture lasting three months, and five trainees from the Singapore Labour Department and three from the Water Department were given training in gardening. Also one man was accepted from Toc H for training.

V. BUILDINGS AND ROADS

9. The most important event of the year was the condemnation of the herbarium building which had been showing signs of serious dilapidation for some years. In September all the contents and personnel were ordered out owing to its dangerous condition. Working places were found for the displaced staff with some considerable difficulty causing additional congestion in the departmental offices. The herbarium cabinets were housed three quarters in the Botany Museum of the University of Singapore, with nearly a quarter in the National Museum and the balance containing material urgently required for current work, in the remaining buildings of the Gardens office. The generous assistance of the Professor of Botany and the Curator of the Museum are gratefully acknowledged. The demolition began on 18th December with a little spontaneous and unofficial ceremony carried out by two labourers, one man and one woman, who arrived some ten days before the expected date for the commencement of the work. While the man pulled a single window out of its frame and then re-closed the doors of the building, the woman made a small altar and burnt joss at it. This combined operation, it would seem, was intended to warn any spirits that might be living in the building that their world was about to fall about their ears, and to invite them to leave by the open window before they were so inconvenienced, and incensed against those engaged on the job and cause them harm.

10. In consultation with the Director of Public Works and his architects, a design was laid for reconstruction of the building on the same site, and using such salvage from the old building as might be sound, at a cost of \$84,000.

11. All other buildings remained in good repair. The main roads used by cars in the Gardens were in good condition, but other roads which have not been resurfaced nor repaired for very many years were becoming rough, broken and pot-holed.

12. An orchid seedling house and two angle iron structures for hanging pots of dendrobiums and cattleyas and orchid species were constructed from the Gardens' resources. One cactus house in the Orchid Enclosure was dismantled and transferred to the Potting Yard to give way to the increasing demands for space for orchids.

VI. VISITORS

13. On 12th November, Their Majesties the Yang di-Pertuan Agong and the Permaisuri Agong visited the Gardens, and they with their entourage were conducted round the Orchid Enclosure after a drive through the Gardens.

14. On 1st December, Her Royal Highness Princess Margarethe, Crown Princess of Denmark, paid a visit to the Gardens, and she too was conducted round the Orchid Enclosure.

15. The holding of the meeting of the U.N.E.S.C.O. Visiting Committee for Tropical Herbaria and the Fourth World Orchid Conference in Singapore and the U.N.E.S.C.O. Humid Tropics Symposium in Kuching drew a large number of men of science to Singapore, including many of international eminence. Details of the Visiting Committee for Tropical Herbaria are given in para. 38. Amongst other visitors may be mentioned the following:

- J. Müller, Palynologist, Brunei Shell, Seria.
W. D. Raymond, Tropical Products Institute, London.
Taib b. H. Andall, Federal Land Development Authority, Kuala Lumpur.
H. J. Nicholson, Biochemist, Kansa City, U.S.A.
H. W. Simmonds, Entomologist, Fiji.
H. J. Frith, C.S.I.R.O. Wild Life Service, Australia.
H. Elliott McClure, U.S. Army Medical Research Unit, Institute for Medical Research, Kuala Lumpur.
Lucy B. Moore, Botanist, D.C.I.R., New Zealand.
T. C. Katayama, National Institute of Genetics, Japan.
Anthony Johnston, F.A.O., Bangkok, Thailand.
G. W. Gillett, Associate Professor of Botany, University of Hawaii.
M.E.D. Poore, Professor of Botany, University of Malaya.
J. S. Womersley, Chief of Division of Botany, Forest Department, New Guinea.
Anwari Dilmy, Director, Herbarium Bogoriense.
Tran Van Nao, Director of Forestry, Cambodia.
L. M. Qureshi, Head of Division of Forestry, Forest Research Institute, Dehra Dun, India.
A. J. Kostermans, Botanist, Bogor Botanic Gardens.
P. W. Richards, Professor of Botany, University College of North Wales.
E. L. Nuernbergk, Professor, Botanical Institute, University of Hamburg, Germany.
Panich Chawanonda, The Siam Society of Plant Culture.
B.E. Smythies, Conservator of Forests, Sarawak.
G. S. Foster, Professor of Botany, University of California, U.S.A.
Howard J. Teas, Program Director, Metabolic Biology, National Science Foundation, U.S.A.
Maxwell S. Doty, Professor of Botany, University of Hawaii, U.S.A.
Lennart Mattsson, Director, U.N.E.S.C.O. Science Co-operation Office for South-East Asia, Djakarta, Indonesia.
Harold J. Coolidge, International Union for Conservation, Washington, U.S.A.

16. Many research workers also visited the office and made use of the facilities of the herbarium, library and gardens. These were:

- Paul A. Zahl, Biologist, National Geographic Society of America (*Nepenthes*).
K. M. Kochumen, Botanist, Forest Research Institute, Kepong (Forest botany).
Kai Larsen, Professor of Botany, Botanical Institute, Copenhagen (*Zingiberaceae*).
R. E. Holttum, retired Director of Botanic Gardens, Singapore, 1925-49 (Ferns).
Leslie A. Garay, Harvard University, U.S.A. (*Orchidaceae*).
H. E. Moore, Director, Bailey Hortorium, Cornell University, U.S.A. (Palms).
T. D. Pennington, Commonwealth Forestry Institute, Oxford University, England (*Meliaceae*).
J. A. R. Anderson, Forest Department, Sarawak (Forest botany).
L. Johnson, Botanist, Royal Botanic Gardens, Sydney, Australia (*Casuarinaceae*).
Llewellyn H. Colinvaux, Phycologist, Te Vega Indian Ocean Expedition, Yale University, U.S.A. (Marine algae).
W. Meijer, Forest Department, Sandakan (Forest botany).
H. Sleumer, 's Rijksherbarium, Holland (*Ericaceae*).
Benjamin C. Stone, Associate Professor of Botany, College of Guam (Tropical botany).

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17. Facilities of the Department were made freely available to members of the staff and to sponsored students of the Universities of Singapore and Malaya, and to other official organisations. The usual very large number of casual visitors came daily to the Gardens.

VII. STATE GIFTS

18. On the occasion of the state visit of Their Majesties the Yang di-Pertuan Agong and the Permaisuri Agong, a gift of seven mature orchid plants was made. State gifts were also made of mature orchid plants to H.R.H. Princess Rasmi Sobhana of Phnom Penh, Cambodia, six plants, and to H.E. The Governor of Malacca, five plants. Flowers provided as state gifts to overseas Heads of Governments and Government representatives amounted to 360 orchid sprays, while 900 sprays were supplied for state banquets and other government functions.

VIII. CONCERTS

19. The Singapore Police Band gave six concerts in the Gardens, which were very much appreciated by visitors. The Police Commissioner and the Police Bandmaster are thanked for this courtesy.

IX. PUBLICATIONS

20. Three parts of *The Gardens' Bulletin, Singapore*, volume XX were issued during the year. Papers were:

- | | |
|----------------------|--|
| CHEW WEE LEK : | Florae Malesianae Precursores — XXXIV. A Revision of the genus <i>Poikilospermum</i> (Urticaceae). |
| FURTADO, C. X. : | Notes on some Malaysian Melastomaceae. |
| HSUAN KENG : | <i>Phyllocladus inophyllus</i> Hk.f. |
| HSUAN KENG : | Taxonomic position of <i>Phyllocladus</i> and the classification of Conifers. |
| ANDERSON, J. A. R. : | The Flora of the Peat Swamp Forests of Sarawak and Brunei, etc. |
| ASHTON, P. S. : | Taxonomic notes on Bornean Dipterocarpaceae. |
| TURNER, G. J. : | New records of Plant Diseases in Sarawak for the years 1960 and 1961. |

A quantity of other papers is to hand in typescript adequate to make up volume XX (4) and a half of volume XXI.

21. Mr. A. G. Alphonso, Curator, prepared a short pamphlet 'A Guide to Tree Planting' in support of the Prime Minister's tree planting campaign. The Ministry of Culture translated this into Malay, Chinese and Tamil.

X. LIBRARY

22. The Library has remained in very cramped and unsatisfactory accommodation in the spirit collection room of the herbarium and in the horticultural officers' office to the exclusion of the proper use of these rooms. Accessions amounted to 26 books by purchase, three books as gifts, four classical works on microfiche, 40 titles of periodicals on subscription, and the publications of 287 institutions receiving the *Gardens' Bulletin, Singapore* on

exchange. This intake of literature year by year which is so vitally necessary for the conduct of the Department's work adds to the congestion in the restricted accommodation. At the end of the year 8,573 volumes were on the library register, excluding unbound material.

23. Revenue from the sale of publications prepared by the Department amounted to \$9,504.

XI. AGRICULTURE PESTS SUPERVISORY COMMITTEE

24. The Director was a member throughout the year.

XII. UNIVERSITY OF SINGAPORE

25. Mr. H. M. Burkill, Director, represented the Botanic Gardens on the University Court.

XIII. COMMONWEALTH WAR GRAVES COMMISSION

26. The Director continued as the Commission's representative in Singapore, and was responsible for the maintenance of the War Graves Cemetery at Kranji under instructions from the Commission's Eastern Region Headquarters at New Delhi. Funds for the maintenance work are provided by the Commission, and further information may be found in the Commission's own reports.

XIV. NATURE RESERVES

27. The Board of Trustees consisted of:

Nominated by the Yang di-Pertuan Negara	...	1. Mr. O. K. Abraham	Retired 8th January and re-appointed from that date
		2. Mr. Tan Jake Hooi	
Nominated by the Minister for National Development	...	3. Mr. Tan Hoon Siang	
		4. Mr. Liew Tiew Kee	
Representative of the City Council	...	5. Mr. Khong Kit Soon	Retired 1st October
		<i>vacant</i>	From 1st October
Representative of the Rural Board	...	6. Mr. R. Ramalingam	Retired 1st October
		<i>vacant</i>	From 1st October
Chairman, <i>ex-officio</i>	...	7. Director of Botanic Gardens	

28. Routine patrolling and maintenance were carried out in the reserves. Seventeen permits were issued to staff and students of the University of Singapore, Nanyang University and schools, and to responsible individuals to collect specimens of plants and animals in the Reserves.

XV. METEOROLOGICAL RECORDS

29. South-east Asia in general suffered an unusual short-fall of rain. Southern Malaya and Singapore were particularly affected. The average rainfall in the Gardens for the previous 49 years (1914–1962) was 98.12 inches and this was matched in 1963 by only 66.94 inches, or 68.2 per cent. The recording station at Bukit Timah again supported prognostications of a higher rainfall on the forest clad hill; 89.73 inches of rain were recorded there. The number of days on which rain was recorded was at both stations very much less than normal. Data of rainfall and other phenomena are recorded in Appendices II, III and IV.

BOTANICAL RESEARCH

XVI. PLANT COLLECTING

30. Five major collecting expeditions were undertaken and several minor ones. The two most important were made, one by Dr. Chew Wee Lek in collaboration with officers of the Sarawak Forest Department to the limestone areas of Bau and Tiang Bekap near Kuching, and the other by Mr. Lam Hin Cheng, who joined the U.N.E.S.C.O. Expedition to Surat Thani and Saraburi in Thailand. The former expedition was made in June when some 200 numbers including a new undescribed species of *Arthocarpus* were collected for the herbarium. The latter expedition was one of the series conducted by U.N.E.S.C.O. to study the limestone flora of south-east Asia (see Annual Report for 1962, para. 27) while at the same time being a training course for young botanists to give them experience of living and working under primitive and often arduous conditions. Collections were made in the limestone areas near Surat Thani in Peninsular Thailand and near Saraburi north of Bangkok. The main botanical collections have gone to the Royal Thai Forest Department herbarium, Bangkok, for preparation and distribution and a set will be deposited at the Singapore herbarium. Mr. Lam made extensive collections of many groups of plants for despatch direct to the Singapore Botanic Gardens for cultivation. Some 150 numbers were so obtained. The conditions of this expedition were made very uncomfortable by monsoon rains, and in this respect more than fulfilled training expectations. It is a mistake for budding young botanists to imagine that they can be only fair weather field workers, for some species of plants only flower and fruit in the rains and it is then that the botanist must be in the field to observe and collect them. At the conclusion of the U.N.E.S.C.O. expedition, Mr. Lam went to Chiangmai and Doi Su Thep for further collecting and returned with an additional 93 numbers. A schedule of all collecting outside of the main island of Singapore is given at Appendix V.

XVII. EXCHANGE, ACQUISITION AND LOANS

31. Duplicate specimens were again distributed to collaborating institutions outside Singapore, the larger lots going to Kew (1,094 numbers), Leiden (1,184 numbers), Arnold Arboretum (980 numbers), and to Lae (710 numbers). The total quantity distributed was 6,674 duplicates, while 5,347

were received from collaborating institutions, most coming from Sandakan (1,582 numbers), Arnold Arboretum (1,500 numbers), and Kew (1,400 numbers). These exchanges are appreciably larger than for a number of years and represent valuable augmentation and dissemination of new knowledge regarding the Malaysian flora. Details are given in Appendix VI.

32. Loans sent out to specialists on the Flora Malesiana project numbered 2,917 sheets, while officers of the department borrowed 2,055 sheets from other institutions.

XVIII. TAXONOMY

33. Mr. J. Sinclair continued his work on Malaysian Myristicaceae (Nutmeg family) in collaboration with the Flora Malesiana Foundation. While on vacation leave in Europe he spent at his own expense two months working at the Kew herbarium, ten days at Edinburgh, ten days at Geneva and eight days at Florence studying classical collections and other important material. As a result of this work, some corrections and alterations had to be made to his draft text on the genus *Myristica* which he had prepared in Singapore before going to Europe. On his return to Singapore he spent the rest of the year incorporating new material and making necessary amendments to his text, but the demolition of the herbarium seriously hampered the progress of this work.

34. Dr. Chew Wee Lek continued his studies on the genera *Laportea* and *Fleurya* in the family Urticaceae (nettle family). Satisfactory progress has been made since obtaining the loan of type material from Kew and of a quantity of material from the Arnold Arboretum. As this work progressed it became apparent that these two genera had to be studied on a world basis as an acceptable taxonomic revision cannot be prepared on the regional representatives only.

35. Mr. Hardial Singh, who joined the Department towards the end of the year, took up a study of the family Araceae, which if pursued to its fulness is a life time study. Miss Chang Kiaw Lan continued her work on the fungal order Agaricales while studying at Cambridge University. Mr. H. M. Burkill, when administrative demands permitted, continued his collecting of marine algae.

36. Dr. Furtado, though in retirement, has continued to work in the Department making use of the herbarium and library facilities. He has made some interesting literary research into the origin of the word 'Cocos' which will be published in *The Gardens' Bulletin*. He has prepared a similar paper on 'Malayan Ornamental Palms' which has been published in *Principes* 7 (1) 1963.

37. Mr. Munir Ahmad abid Chaudhry (see para. 7) has begun a study of the genus *Petraeovitex*.

XIX. U.N.E.S.C.O. VISITING COMMITTEE FOR TROPICAL HERBARIA

38. This Committee, whose function it is to advise U.N.E.S.C.O. on the state of preservation, upkeep and use made of collections of plant specimens

in tropical institutions, held its third meeting at the Singapore Botanic Gardens during 28th–30th June. The Committee consisted of:

- Dr. Al Smith (Chairman)—Secretary of the Smithsonian Institution, Washington, U.S.A.
- Dr. Ray Fosberg (Secretary)—Pacific Science Project, National Science Foundation, Washington, U.S.A.
- Sir George Taylor (Member)—Director, Royal Botanic Gardens, Kew, England.
- Prof. Dr. H. J. Lam (Member)—Professor emeritus of Botany, Leiden University, and lately Director, 's Rijksherbarium, Leiden.
- Mr. H. M. Burkill (Co-opted *ad hoc* Member)—Director, Botanic Gardens, Singapore.

The four regular members of the Committee travelling to Singapore from diverse starting points and by diverse routes singly visited a total of 25 herbaria en route, and then foregathered in Singapore to see the Singapore herbarium and to prepare a general report on all herbaria visited. The Committee's first meeting in 1961 was in general an exploratory one held at Leiden, Holland, to decide ways and means. Their second in 1962 was held at Sao Paulo in Brazil. So it is a matter of some pride that their third, so early in the life of the Committee, was held in Singapore, and of considerable gratification that the Committee found well of Singapore. In fact in the old world tropics, the Singapore herbarium holds a vital key position in tropical botany, and this is recognised by the Committee in meeting here. The Committee had interesting and useful discussions with Dr. Toh Chin Chye, Deputy Prime Minister of Singapore, and Mr. Tan Kia Gan, Minister for National Development.

HORTICULTURE

XX. GARDENS MAINTENANCE

39. The first ten months of the year witnessed a severe shortage of rainfall, of which there was a little over a half of the normal amount. This followed on a period of six years of subnormal rainfall. Many persons have enquired how the Gardens managed for a supply of water when the Municipal supply to the whole of Singapore was severely rationed. It is worth recording for general information that the Gardens have an internal distribution system for water pumped from the Gardens' Lake. This system was installed many years ago, before there was piped water available in the Tanglin area. Though the level of the lake receded by about 18 inches, the Gardens never had any shortage of water. The source of the Lake water is in Tyersall Estate, and this source did actually go dry towards the end of the drought and the reduced capacity of the Lake would have failed to tide over the situation had the drought continued much longer. Though the Gardens did not therefore go short of water for its pot culture which received hand watering, the prolonged dry weather did make the year a difficult one for normal husbandry. In compensation, however, flowering trees and shrubs such as Flame of the Forest (*Delonix regia*), bougainvilleas, cassias and others maintained prolonged and continuous flowering. Curiously, the New Guinea Creeper (*Mucuna bennettii*), which normally flowers about six times during the year, managed

only one rather poor flowering at its main flowering period, December, after the rains had come. The Sealing Wax Palm (*Cytostachys lakka*) avenue also suffered during the drought. The leaves shrivelled but no causitive pathogen could be found (see Annual Report 1961, para. 58), and in severe cases the whole stem would die. As soon as normal rainfall was experienced, the plants recovered. This plant occurs naturally in damp places.

40. Forty established plants died or were removed, the most important being *Cocothrinax barbadensis*, *Lodoicea seychellarum*, *Brownea arize* and *Sabal blackburniana*. The Gardens have for very many years been trying to establish plants of the Seychelles Double Coconut (*L. seychellarum*) but have been unsuccessful, the plant's succumbing to attack by Red Stripe Weevil. With nuts weighing up to 50 lb. each, this palm would be an extremely interesting novelty to establish. In olden times, it was so venerated in its native home for its anthropomorphic attributes that it became a royal plant, and a capital offence was committed if a commoner cultivated one.

41. Lawn L by Cluny Road gate, which is the first part of the Gardens many visitors see, was cleared of a large *Rhodammia trinerva* tree and a *Pandanus houlettii* clump, and the whole lawn planted up with bougainvilleas including several newly introduced cultivars. The established, older plants were most spectacular during the dry weather. Other new plantings on various lawns included: *Cassia* 'Rainbow Showers', *Gardenia carinata*, *Cassia spectabilis*, *Bresia madagascariensis*, *Polythia clavegra*, *Eugenia papuasicum*, *Enterolobium contortisilicium*, *Cassia* 'Blue', *Eugenia caryophyllata*, *Lafoensia puniceaefolia*, *Mimusops elengi*, *Ervatamia sphaerocarpa*, *Sapium jamaicense*, *Aglaia odorata*, *Fagraea ridleyi* and *Andira surinamensis*.

42. When the rains finally did come in November, an extensive manuring programme was carried out of 280 trees and shrubs on Lawns A, B, C, D, E, J, K and L. Also 46 compost heaps were prepared using 40 lorry loads of cattle manure. Over 800 wooden plant labels, 5,000 aluminium tag labels and 38 signboards were prepared during the year.

43. Monkeys (*Macacus nemestrina*), Rhinoceros beetle (*Oryctes rhinoceros*) and the Red Stripe Weevil (*Rhyncophorus ferrugineus*) remain the worst pests, but the latter two seem to be on the decline.

44. The low water level in the Lake gave the opportunity for further eradication of the lotus (*Nelumbium nelumbo*) which if unchecked would smother all the other water plants. At the same time the *Salvinia auriculata* was collected and removed from the Lake.

45. The heavy rain of December, 14.11 inches, which was 21 per cent of the year's rainfall and 142 per cent of the normal for this month, led to an outbreak of fungal and bacterial diseases in the orchid collection. Some quarter-terete vandas were affected by *Phytophthora palmivora*, and dendrobiums by *Pectobacterium caratovorum*.

XXI. HORTICULTURAL EXCHANGE

46. Seed and plant exchange continued to be an important aspect of the Horticultural Division's activity. Exchanging institutions are listed in Appendices VII and VIII.

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XXII. ISTANA NEGARA DOMAIN

47. The grounds, including the immediate gardens of all the houses in the Domain, were maintained in fair condition though the prolonged dry weather was adverse to good husbandry. The lack of water during the period of rationing (April onwards) created difficulty which could not be resolved by any domestic source of supply as in the Botanic Gardens. All mechanical equipment gave good service. Burnt earth and compost was prepared in large quantities to maintain the number of pot plants required for decoration and for manuring beds. Changes were made to the landscaping and a number of trees were removed either because of age or proximity to buildings while others were planted. The golf course was maintained in good condition. Infestation of *Elephantopus scaber* was kept under control.

48. By kind permission of H.E. the Yang di-Pertuan Negara, the Domain was open to the public on New Year's Day (1st January), Chinese New Year's Day (25th January), Hari Raya Puasa (23rd February) and on Deepavali (15th November).

XXIII. SINGAPORE HOUSE, KUALA LUMPUR 'TEMASEK'

49. The Curator paid three visits to inspect the grounds of this house to make recommendations on its upkeep.

XXIV. ORCHID RESEARCH

50. Collecting expeditions for obtaining living material for cultivation have been referred to in para. 30 and in Appendix V. These resulted in 381 species (1,175 plants) being added to the living collection. Other plants numbering 248 species and hybrids were received on an exchange basis or as gifts from individuals or organisations in Singapore, Malaya, Brunei, Sabah, Thailand, New Guinea, Philippines, Hawaii, Kenya and Japan, against which 175 cuttings, mature plants, and seedlings were given away. Much of the material collected and received was undetermined at the time of accession, and of this 70 species have since flowered under cultivation and have been identified.

51. During the year, 56 pods from the Department's own hybridising programme were harvested; ten pods of known parentage were accepted from Singapore growers, four from the Federation of Malaya, one from Sarawak and 50 from England. Of these 121 pods, 77 gave viable seed. The Department had on an average over 2,000 flasks in constant use culturing seedlings, and the seedlings of 679 flasks were taken out for potting. It must be reported, and this repeats statements in the Department's Annual Reports for 1961 and 1962, that the lack of nursery space is a critical brake on the progress of this work. The seedlings of many flasks have to be retained in their flasks for the want of space for potted plants. The seedlings are thus retarded and there is an unnecessary increase in the number of casualties. This is both bad husbandry and bad economics since it means loss of potential breeding material, loss of revenue in plant sales, loss of material for commercial and private growers and stunted plants. As a result of very careful resiting of beds, benches, etc., in the Orchid Enclosure, it has been possible to put up two large hanging frames (displacing an equivalent area of benches) for the better accommodation

of epiphitic forms — dendrobiums, cattleyas and strap-leaved vandas. One thousand five hundred and thirty three seedlings were potted on and removed from seedling houses to the open, and 30 new and old beds were dug or redug, but this activity all but brings the nursery to saturation point, and further juggling with distribution is impossible. The provision of other land is imperative if this work is to continue.

52. The following hybrid families were named and registered to mark the state visit of Their Majesties, the Yang di-Pertuan Agong and the Permaisuri Agong to the Botanic Gardens on 12th November.

BGS —

- 2700 *Vanda* Agong Putra (*Vanda* Tan Chay Yan x *Vanda tricolor* var. *suavis*).
 2701 *Dendrobium* Permaisuri (*Den.* Gillian x *Den.* Champagne).
 1921 ~~*Dendrobium*~~^{Pagan} Shireen (*Cyp. glaucophyllum* x *Cyp. philippinense*).
 This is named at Their Majesties' request after their grand-daughter.

The following were also registered:

BGS —

- 2012 *Aranda* Hatifah (*Arachnis hookeriana* var. *luteola* x *Vanda luzonica*).
 2528 *Aranda* Chit Ean Chong (*Arachnis* Ishbel x *Vanda* Herziana).
 2650 *Aranda* Wong Poh Hong (*Arachnis* Maggie Oei x *Vanda* Onomea).
 2728 *Renantanda* Jane McNeill (*Vanda* B. P. Mok 'Old Rose' x *Renanthera storiei*).
 2821 *Dendrobium* Padma (*Den.* Champagne x *Den.* Bernice).
 3079 *Dendrobium* Marie Carmen (*Den.* Bernice x *Den.* Pompadour).

Flowering for the first time were:

BGS —

- 1318 *Vanda* Dinger 'Profusion' x *Vanda* Ellen Noa.
 1369 *Vanda* Kapoho x *Vanda* Trisum.
 1557 *Arachnis* Ishbel x *Vanda* Trisum.
 1582 *Vanda* Trisum x *Vanda luzonica*.
 1851 *Vanda sumatrana* x *Vanda* Ellen Noa.
 1960 *Vanda* Kapoho x *Vanda* Flammerolle.
 2020 *Vanda tricolor* x *Renanthera coccinea*.
 2197 *Vanda* Kapoho x *Vanda* Tatzeri.
 2198 *Vanda sumatrana* x *Vanda* Tatzeri.
 2209 *Arachnis hookeriana* var. *luteola* x *Trichoglottis luzonensis*.
 2231 *Vanda* Kapoho x *Arachnis breviscapa*.
 2273 *Vanda* Kapoho x (*Vanda* Burgeffii x *Vanda* Kupperi).
 2476 *Vanda* Tan Chay Yan x *Vanda dearei*.
 2533 *Vanda* Tan Chay Yan x *Vanda limbata*.
 2769 *Vanda limbata* x *Vanda* Rothschildiana.
 2815 *Dendrobium* Constance x *Dendrobium gouldii* var. *saipan*.
 2998 *Dendrobium* Constance x *Dendrobium* Rosalind Lee.
 3116 *Dendrobium* Tan Seah Boey x *Dendrobium* Guadalcanal.
 3162 *Dendrobium* Abigail x *Dendrobium* Waikiki Beauty.

53. Awards were gained by:

BGS—

1723/7 *Dendrobium* Murray Henderson 'Molek', Award of Merit (M.O.S.) on 29th March, 1963.

2705/1 *Renantanda* Prince Norodom Sihanouk 'Merah', Award of Merit (M.O.S.) on 29th March, 1963.

54. Many blooms were sent for exhibition both overseas and locally, for details of which see Sec. XXVI. At the public section of the orchid enclosure about 100 potted plants in prize blooms were on display. These were changed weekly.

EXTENSION WORK

XXV. SUPPLY OF PLANTING MATERIAL

55. A total of 17,278 plants were sold to the public bringing in a revenue of \$17,573.50. Of this 4,000 plants were orchids realising \$13,667. Orchid sales were \$3,682 less than in 1962, and about \$2,500 of this must be attributed to the inability of the Botanic Gardens to sell plants at the Malayan Agri-horticultural Association's show at Kuala Lumpur in September. Sales of other plants were slightly improved on the previous year.

56. The Gardens continued to supply planting material free of charge to Government Departments, charitable institutions, state-aided schools and other official or quasi-official organisation, a total of 3,239 plants being provided. 5,481 foliage pot plants were also loaned out for decoration at various functions; this number was more than twice the 1962 figure (2,717).

XXVI. EXHIBITIONS AND SHOWS

57. The most important exhibition was that associated with the 4th World Orchid Conference held in Singapore in October. It was staged at the Turf Club and was an immense success, which in part must be attributed to the considerable contribution of plants and personnel by the Botanic Gardens. Mr. A. G. Alphonso was Show Manager, and was on the Working Committee with Mr. Burkill and Mr. Bajuri. Many members of the Gardens staff assisted in the organisation, judging and in setting up and dismantling afterwards. The Botanic Gardens and the Penang Waterfall Gardens put up a joint exhibit of Malaysian orchid species and a quantity of the latest hybrids, for which they were awarded a gold medal. Full details of this show will be found in the *Malayan Orchid Review* and in many other horticultural publications.

58. This exhibition was staged before the Conference proper, and when the 'tourist' element of the thousand over registrants had moved on to pastures new, the remainder got down to work in the Victoria Memorial Hall for the papers and business sessions of the Conference. Mr. Burkill had the honour of reading the first paper titled 'The Role of the Singapore Botanic Gardens in the development of Orchid Hybrids in Singapore'. Mr. A. G. Alphonso presented a paper on 'Malayan Scorpion Orchids and their related Hybrids'. Proceedings of the Conference will be published by the organisers, the Malayan Orchid Society, at a later date.

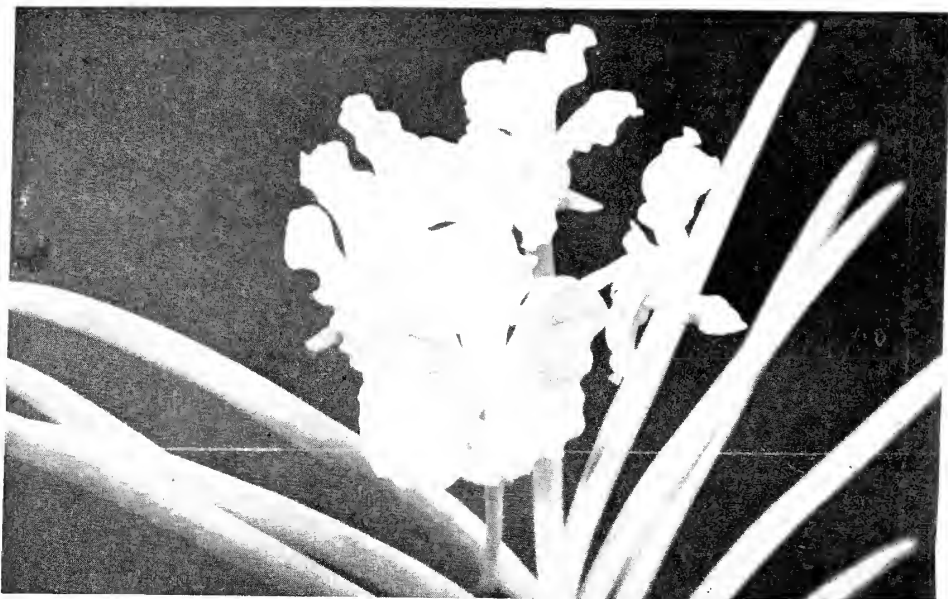
STATE VISIT OF T.M. THE KING AND QUEEN TO THE BOTANIC GARDENS
ON 12TH NOVEMBER, 1963.



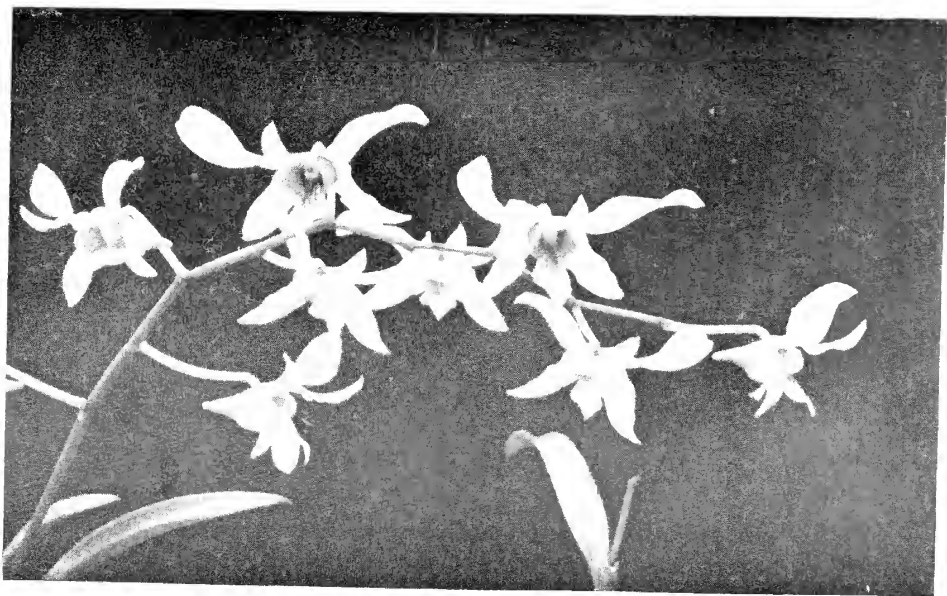
His Majesty inspects the Orchid Culture work.

Left to right: Mr. Yong Nyuk Lin, Minister for Health; H.M. The King; Mr. Lim Kim San, Minister for National Development; H.E. Tun Yusof bin Ishak, Head of State of Singapore.
[Photo by Straits Times Press, Ltd.]

ORCHID FAMILIES NAMED ON THE OCCASION OF THE VISIT OF
THEIR MAJESTIES, THE AGONG AND THE RAJA PERMAISURI
TO THE BOTANIC GARDENS SINGAPORE, 12 NOVEMBER, 1964

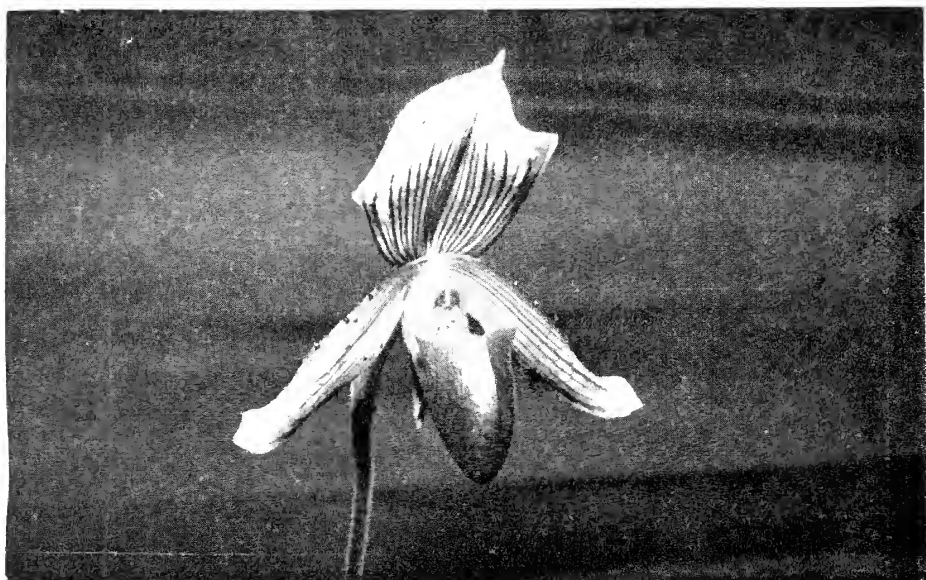


BGS. 2700, *Vanda* Agong Putra (*V. Tan Chay Yan* × *V. tricolor*) named after His Majesty



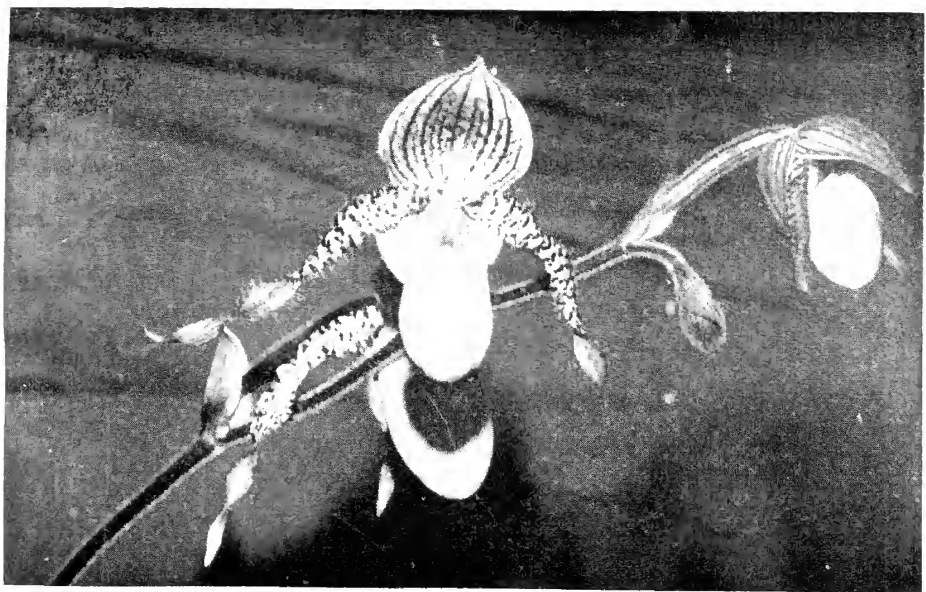
BGS. 2701, *Dendrobium* Permaisuri (*D. Gillian* × *D. Champagne*) named after Her Majesty.

Note:—That the BGS Serial numbers of the above are consecutive is entirely a coincidence. Their respective numbers were given at the time of hybridisation on 15 and 18 April, 1956.



[Photo: H. M. Burkill].

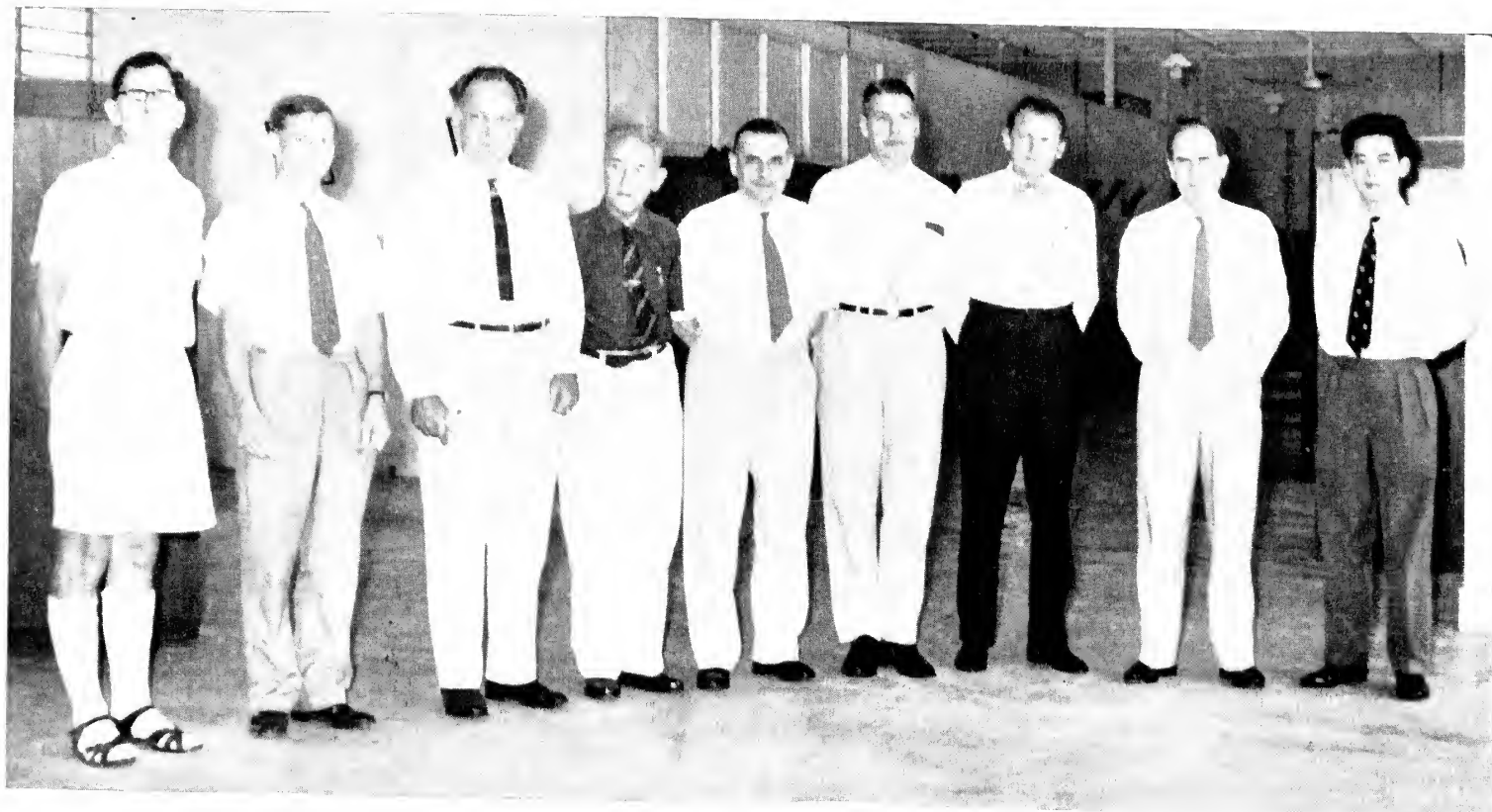
Paphiopedilum barbatum (Lindl.) Pflts., a native Malayan species.



[Photo: H. M. Burkill].

BGS. 1921: *Paphiopedilum* Shireen (*Paph. glaucophyllum* × *Paph. philippinense* named after Their Majesties' grand-daughter.

THIRD MEETING OF THE U.N.E.S.C.O. VISITING COMMITTEE FOR TROPICAL HERBARIA
SINGAPORE 28-30 JUNE, 1963



The Committee and observers.

Photo by Straits Times Press Ltd.

Left to right: T. C. Whitmore, Forest Department, Solomon Islands; M. E. D. Poore, Botany Department, University of Malaya; F. R. Fosberg, U.S. National Research Council, Chairman; H. J. Lam, Rijksherbarium and Leiden University, Secretary; G. Taylor, Royal Botanic Gardens, Kew, Member; A. C. Smith, Smithsonian Institution, Member; L. Mattsson, U.N.E.S.C.O., S.E.A. Office Djakarta; H. M. Burkill, Botanic Gardens, Singapore, adhoc Member; Chew Wee-lek, Botanic Gardens, Singapore.

59. The Botanic Gardens put up a large non-competitive landscape exhibit at the Singapore Gardening Society annual show in April. Mr. Aziz bin Pakiri and Mr. Wong Siew Hang were joint Show Managers and Mr. A. G. Alphonso was Show Secretary. Several members of the staff assisted in judging. The Malayan Agri-horticultural Association Exhibition was staged in Kuala Lumpur in September. Unfortunately, owing to changes in the policy of the organisers which required an outlay in expenditure by the Gardens for which there was no provision, the Botanic Gardens was unable to put up its usual large exhibit. The Gardens participation was limited to a display of 200 stems of cut orchid blooms. Other shows at which the Department participated were:

The Philippine Orchid Society Show, Manila.

Jesselton Gardening Society Flower Show, Sabah.

International Flower Show, Cape Town, South Africa (awarded a silver medal and certificate).

International Horticultural Exhibition, Hamburg, Germany (awarded a bronze medal).

Chelsea Flower Show, England.

Penang Gardening Society Flower Show.

Royal Burgh of Ayr Summer Flower Show, Scotland.

Evening News Flower Show, London.

Exhibition of the Siam Society of Plant Culture Bangkok (awarded a trophy).

Berlin Trade Fair Exhibition, Germany (two consignments).

Orchid Night, Ipoh.

Kuala Lumpur Orchid Show.

Acknowledgement is made to Messrs. BOAC/QANTAS/AII for assistance in flying consignments to some of these events.

XXVII. CULTURAL SOCIETIES

60. The Department gave considerable assistance to both the Singapore Gardening Society and the Malayan Orchid Society. Mr. A. G. Alphonso served on the Committees of both and was Honorary Secretary of the latter Society. Mr. Bajuri bin Sappan served on the Committee of the Orchid Society and was the honorary secretary to the Society's panel of judges. Members of the staff gave demonstrations of horticultural practices at some of the monthly meetings of the Gardening Society.

61. Mr. H. M. Burkill served on the central committee of the Malayan Nature Society for the year 1962/63, and on the Singapore Branch Committee for the years 1962/63 and 1963/64. The Singapore Branch had field meetings in the Botanic Gardens and in the Singapore Nature Reserves.

XXVIII. ADVISORY

62. The year has seen an immense increase in the amount of advice sought from the Gardens. While such a situation is acceptable and, indeed, is desirable, for it is a function of the Gardens to render botanical and horticultural advice, the great increase has thrown no light extra burden on the horticultural staff. The trend of development projects in Singapore is such that this amount of advisory work is likely to continue and possibly increase, at least for several years to come. Additional staff may be necessary for its proper execution. Planting schemes were prepared for the 28 projects listed

below. Each of these necessitated at least two visits to the site followed by drafting the specifications in the office — 56 days work, or two months duty for a curator out of a year. In addition, many visits were paid to official organisations to give advice on such things as pruning or inspection of trees near buildings, planting new trees, etc. Planting schemes were prepared for:

1. Combined Clinic at Still Road.
2. New Clinic at Chong Pang Village (Sembawang).
3. New Police Station at Chong Pang Village (Sembawang).
4. Division III Quarters for Customs Department, Tampenis Road.
5. Camp Temasek 6½ m.s. Holland Road.
6. Sewerage disposal Works — Jurong.
7. Infant and Health Clinic at 7½ m.s. Upper Changi Road.
8. Proposed Secondary Vocational School, Queenstown Neighbourhood IV.
9. 5½ m.s. Dunearn Road Primary and Secondary School.
10. Queenstown Neighbourhood V proposed school.
11. Queenstown Neighbourhood II proposed school.
12. Queenstown Neighbourhood III proposed school.
13. Old Kallang Airport Proposed Secondary Vocational School.
14. Joo Avenue proposed school.
15. Jalan Kembangan proposed primary school.
16. Kim Keat Road proposed primary school.
17. Tanjong Rhu proposed 4 stream primary school.
18. Mountbatten/Wilkinson Road Secondary School.
19. Swiss Cottage/Dunearn Road Primary and Secondary School.
20. Four Storey Secondary Technical School at Ngee Ann Kongsi, Balestier Hill.
21. Dunman/Haig Roads Proposed Secondary School.
22. Secondary Grammar School at 12¼ m.s. Jurong Road.
23. Alexandra Hill proposed primary school.
24. Serangoon Garden Estate Secondary Technical School.
25. Blakang Mati proposed primary school.
26. Bukit Ho Swee East School.
27. Singapore Airport New terminal building and grounds.

63. In July the Prime Minister launched a tree planting campaign with the intention that there should be at least 10,000 trees planted annually by Government. Private sectors of the community were also to be encouraged to plant more trees. The assistance of the Botanic Gardens was solicited and a booklet entitled *A Guide to Tree Planting* was prepared and published in English, Malay, Chinese and Tamil, selling at fifty cents per copy. In the final six months of the year, Government planted over 6,000 saplings, most of which were raised by the Botanic Gardens. Acknowledgement is gratefully made to the Superintendent Waterfall Gardens, Penang, who supplied a quantity of seed and seedlings to the Botanic Gardens to assist in meeting the large demand for planting material.

64. Much casual and specific information was sought by the public and by commercial organisations on a wide variety of botanical and horticultural matters, and on economic plant products.

STAFF OF THE BOTANIC GARDENS 1963

Divisions I, II and technical posts of Division III

Appointment	Holder	Notes
Director ...	H. M. Burkill, M.A. (Cantab.), F.L.S. ...	Resumed duty after vacation leave on 23rd January.
Botanist ...	J. Sinclair, B.Sc. (Edin.) ...	Keeper of Herbarium. Post malayanised w.e.f. 1st January, when he proceeded on final leave prior to retirement w.e.f. 18th July. Re-engaged on contract 19th July.
	Chew Wee Lek, B.Sc. (Malaya), Ph.D. (Cantab.)	Assistant to Director, Acting Director 1st-22nd January.
	Chang Kiaw Lan, Miss B.Sc. (Malaya) ...	On U.K. Government Scholarship from October 1962.
	Hardial Singh, B.Sc. (Sing.)	Appointed w.e.f. 1st November.
Curator ...	A. G. Alphonso ...	—
	Lam Hin Cheng ...	—
Librarian ...	Tan Kim Ho, B.Sc. (Malaya)	
Executive Officer ...	Ooi Teng Lai ...	Up to 10th March.
	D. P. Lazaroo ...	From 11th March.
Laboratory Assistant (Special Grade) ...	Bajuri bin Sappan ...	—
Horticultural Assistant ...	Ang Gek Choo ...	—
Herbarium and Museum Assistant ...	Md. Shah bin Haji Mohd. Nur ...	—
Artist ...	Juraimi bin Samsuri ...	—
Junior Horticultural Assistant ...	Aziz bin Pakiri ...	—
	Wong Siew Hang ...	—

METEOROLOGICAL REPORT

APPENDIX II

BOTANIC GARDENS, SINGAPORE, 1963

Reading daily at 9.30 a.m. local time at Gardens Office from 1-1-63 — 31-12-63

Altitude c.90 feet a.s.l.

1963		Total Rainfall	Highest fall in 24 hrs.	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.
		inches	inches		°F	°F	°F	°F	°F	°F	%
		*									
16	January	5.48 (11.07)	2.38	14	83.4	89.5	72.5	69.0	78.0	74.3	84.0
	February	8.03 (7.20)	3.84	12	84.6	88.5	73.1	69.0	77.6	74.7	87.0
	March	2.11 (8.25)	1.22	8	88.8	91.0	74.3	71.5	81.2	76.1	78.0
	April	3.29 (8.01)	2.12	7	89.8	94.0	73.9	73.0	83.1	77.1	74.0
	May	1.48 (7.33)	0.52	7	80.9	93.5	76.5	72.0	83.7	78.3	78.5
	June	6.44 (6.66)	1.41	17	88.3	93.0	75.1	71.0	82.4	77.9	81.3
	July	8.09 (6.20)	2.02	13	88.9	92.0	75.9	73.0	82.4	77.8	81.2
	August	1.98 (7.01)	0.72	9	85.7	91.5	75.9	72.0	81.7	77.4	81.0
	September	2.34 (7.46)	1.13	5	85.3	92.5	76.4	72.5	82.8	78.0	83.2
	October	3.95 (7.82)	2.55	11	91.6	93.0	75.2	72.0	82.5	77.6	80.0
	November	9.64 (10.59)	3.30	15	88.8	93.5	74.6	72.0	82.5	75.7	79.9
	December	14.11 (9.96)	2.81	24	88.9	90.5	74.1	72.0	83.1	76.4	84.4
	Total	66.94 (97.50)	—	142	..	..	..	..	..	..	..
	Mean .. ..	..	..	..	87.9 (31.06°C)	91.9 (33.28°C)	74.8 (23.78°C)	71.7 (22.06°C)	81.8 (27.67°C)	76.8 (24.89°C)	81.0

* Mean rainfall for the period 1914—1963 (50 years).

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1963

Reading daily at 8.00 a.m. local time at Orchid Enclosure from 1-1-63 — 31-12-63

Altitude c.80 feet a.s.l

1963	Total Rainfall	Highest fall in 24 hours	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.	Mean Min. Grass Temp.	Mean Earth Temp. 4'	Mean Earth Temp. 1'	Mean Earth Temp. 4'	Solar Radiation Thermometer
	ins.	ins.		°F	°F	°F	°F	°F	°F	%	°F	°F	°F	°F	°F
January ..	5.44	2.36	14	86.7	89.5	71.8	69.2	74.6	73.3	94.0	70.6	77.1	80.5	81.6	128.9
February ..	7.95	3.83	12	84.6	89.0	72.1	68.5	74.2	73.2	95.0	70.2	78.2	79.8	81.0	128.6
March ..	2.23	1.30	8	88.6	91.0	73.2	71.2	75.5	74.6	95.0	71.0	80.2	82.1	82.0	139.0
April ..	3.33	2.53	6	90.2	94.5	73.4	72.0	76.7	75.9	96.0	71.1	82.1	84.1	83.9	140.0
May ..	1.37	0.46	7	89.9	93.0	74.8	71.0	77.0	76.6	96.0	73.0	82.1	84.6	84.7	130.3
June ..	5.86	1.42	16	84.8	92.0	74.2	72.0	77.0	76.0	95.3	70.3	79.2	82.5	83.7	128.5
July ..	7.32	2.15	12	88.0	90.0	74.7	72.5	77.2	76.1	94.6	69.9	77.7	82.9	86.8	130.9
August ..	1.84	0.58	8	84.9	90.0	74.6	70.5	77.4	76.2	94.1	73.7	..	83.5	83.8	126.3
September ..	2.37	1.12	8	85.0	91.5	75.2	72.0	78.5	77.3	94.3	74.9	..	84.1	84.3	128.1
October ..	3.37	2.20	11	87.8	92.0	74.6	71.5	77.6	76.5	94.9	73.1	..	83.2	83.5	127.9
November ..	9.42	3.28	14	87.0	92.3	72.5	71.8	76.7	75.5	95.7	73.1	..	82.5	83.5	127.0
December ..	14.50	2.73	24	85.9	90.5	73.2	71.5	75.8	75.0	96.0	71.4	..	81.1	81.8	122.2
Total ..	65.00	..	140	..	..	..	..	..	..	..	..	..	..	..	..
Mean ..	..	..	..	86.9 (30.50°C)	91.3 (32.94°C)	73.7 (23.17°C)	71.1 (21.72°C)	76.5 (24.72°C)	75.5 (24.17°C)	95.1	71.9 (22.17°C)	79.5 (26.50°C)	82.6 (28.11°C)	83.4 (28.56°C)	129.3 (54.06°C)

METEOROLOGICAL REPORT

APPENDIX IV

BOTANIC GARDENS, SINGAPORE, 1963

Reading daily at 8.00 a.m. local time at "Bukit Timah" from 1-1-63 — 31-12-63

Altitude 581 ft. a.s.l.

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1963		Total Rainfall	Highest fall in 24 hrs.	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Dry Bulb Temp.	Mean Wet Bulb Temp.	R.H.
		inches	inches		°F	°F	°F	°F	°F	°F	%
January	.. ..	5.95	2.78	12	81.9	86.7	71.6	68.0	73.5	72.3	94.5
February	.. ..	7.32	4.75	9	82.1	87.8	72.0	68.1	72.7	71.5	93.8
March	.. ..	3.05	2.62	6	85.7	88.8	73.0	69.5	75.0	73.4	92.1
April	.. ..	3.18	1.50	3	86.9	90.5	71.3	70.0	73.7	71.8	90.4
May ..	.. ..	8.52	2.18	11	87.5	90.5	74.9	71.6	77.1	75.2	91.2
June ..	.. ..	8.08	2.78	12	85.6	89.0	73.9	68.0	77.6	75.5	90.1
July ..	.. ..	10.71	2.78	12	85.7	89.9	75.1	70.0	77.2	75.2	90.4
August	.. ..	4.09	1.35	7	85.9	88.0	74.8	68.0	77.7	74.4	90.6
September	.. ..	6.36	1.15	6	86.8	89.5	75.2	72.0	77.5	75.7	92.4
October	.. ..	6.68	2.91	11	85.7	89.9	74.2	71.0	77.7	75.6	90.6
November	.. ..	11.25	2.91	12	86.1	90.0	74.0	70.8	77.5	75.2	88.2
December	.. ..	14.54	2.38	20	83.9	88.0	73.4	70.2	76.2	74.2	91.1
Total	.. ..	89.73	..	121	..	..	..	..	..	..	..
Mean	.. ..	..	..	..	85.3 (29.61°C)	89.0 (31.67°C)	73.6 (23.11°C)	69.8 (21.00°C)	76.1 (24.50°C)	76.0 (24.44°C)	91.3

SUMMARY OF MAIN PLANT COLLECTING

Area	Personnel	Dates	Notes
<p>Perlis, Kedah, Penang, Perak</p> <p><i>Penang</i> Penang Hill, Muka Head</p> <p><i>Perlis</i> Pantai Acheh Kaki Bukit</p> <p><i>Perak</i> Ulu Groh, Taiping</p> <p><i>Penang</i> Maxwell's Hill, Grik</p> <p><i>Kedah</i> Penang Hill P. Langkawi, Sintok, Naka</p>	<p>A. G. Alphonso (in company with Cheang Kok Choy Superintendent, Waterfall Gardens, Penang)</p> <p>A. G. Alphonso and Sanusi bin Sarih</p>	<p>23rd July to 2nd August</p> <p>13th-28th November</p>	<p>54 nos. for herbarium. 161 nos. for cultivation, mainly orchids.</p> <p>33 nos. for herbarium. 168 nos. for cultivation, mainly orchids.</p>
<p>Pahang (Cameron Highlands)</p> <p><i>Pahang</i> Gunong Berembun Bertam Valley</p>	<p>Chew Wee Lek and Mohd. Shah bin Haji Mohd. Nur</p>	<p>30th September to 15th October</p>	<p>250 nos. for herbarium.</p>
<p>Pahang (South), Johore</p> <p><i>Pahang</i> P. Burong</p> <p><i>Johore</i> Tj. Kempit, Sumalayang and Tenggaroh Forest Reserve</p>	<p>H. M. Burkill</p>	<p>27th-30th October</p>	<p>53 nos. for herbarium. 18 nos. forest trees seeds and seedlings for cultivation.</p>

SUMMARY OF MAIN PLANT COLLECTING

Area	Personnel	Dates	Notes
<i>Johore</i> G. Pantí	H. M. Burkill and Sanusi bin Sarih	23rd June	24 nos. for herbarium. 45 nos. for cultivation.
<i>Johore</i> Jason's Bay	H. M. Burkill	30th June	2 nos. for herbarium.
<i>Johore</i> Jason's Bay, Mawai	H. M. Burkill	6th October	8 nos. for herbarium.
<i>Johore</i> Perigi Batu Pahat	H. M. Burkill	26th August	5 nos. for herbarium.
<i>Johore</i> Tenggaroh Forest Reserve	H. M. Burkill	15th December	9 nos. for herbarium. 6 nos. for cultivation.
<i>Johore</i> Sg. Semagot	J. Sinclair	10th October	7 nos. for herbarium.
<i>Johore</i> Kuala Sedili	A. G. Alphonso	19th May	9 nos. for cultivation.
<i>Johore</i> Kota Tinggi	Ang Gek Choo	October	6 nos. for cultivation.

SUMMARY OF MAIN PLANT COLLECTING

Area	Personnel	Dates	Notes
Singapore			
<i>Singapore</i> Raffles Light	Kadim bin Tassim	January February	Sargassum sampling for chemical analysis.
<i>Singapore</i> Raffles Light	H. M. Burkill	11th–14th April 8th–11th June 1st–6th August	Sargassum sampling for chemical analysis. Phenological observations; 15 nos. for herbarium.
Sarawak			
<i>1st Division</i> Bau, Tiang Bekap	Chew Wee Lek (in company with officers of Sarawak Forest Department)	11th–29th June	200 nos. for herbarium, mostly limestone flora.
Thailand			
<i>Peninsular</i> Surathani	Lam Hin Cheng (in company with UNESCO Limestone Expedition under Royal Thai Forest Department)	15th–30th September 1st–8th October	150 nos. for cultivation, mixed groups. A set of herbarium specimens to be received from Royal Thai Forest Department for the Singapore herbarium — see para. 30.
<i>Central</i> Saraburi			
<i>Northern</i> Chengmai, Doi Su Thep	Lam Hin Cheng	9th–18th October	93 nos. for cultivation, mixed groups.

SUMMARY OF DISTRIBUTION OF HERBARIUM SPECIMENS
EXCHANGE AND LOAN

Institutions	No. of specimens	Duplicates exchanged		Specimens loaned	
		Sent out	Received	Sent out	Received
Allen, Mrs. B. E. G. (gift) ...		—	15	—	—
Arnold Arboretum ...		980	1,500	—	153
Bangkok Forest Department ...		105	—	—	—
Berlin ...		35	—	29	—
Bogor ...		616	—	—	—
Brisbane ...		65	—	—	—
British Museum ...		40	74	—	—
Cambridge ...		98	—	—	—
Canberra ...		—	152	—	—
Copenhagen ...		36	—	1	—
Craiova ...		—	100	—	—
Edinburgh ...		100	—	4	—
Florence ...		18	—	—	—
Geneva ...		135	—	1	—
Illinois ...		—	—	3	—
Kepong ...		19	74	—	49
Kew ...		1,094	1,400	30	3
Kuala Lumpur University of Malaya ...		36	126	1,486	—
Lae ...		710	—	—	—
Leiden ...		1,184	188	308	1,756
Manila ...		330	136	—	—
Melbourne ...		26	—	—	—
Michigan ...		—	—	11	—
Munich ...		52	—	—	—
Minnesota ...		39	—	—	—
New York ...		82	—	—	—
Paris ...		6	—	—	1
Pondicherry ...		—	—	—	9
Sandakan ...		246	1,582	—	—
Sarawak ...		622	—	—	—
Utrecht ...		—	—	1,044	83
Washington ...		—	—	—	1
Total ...		6,674	5,347	2,917	2,055

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM PLANTS
AND SEEDS WERE RECEIVED IN 1963

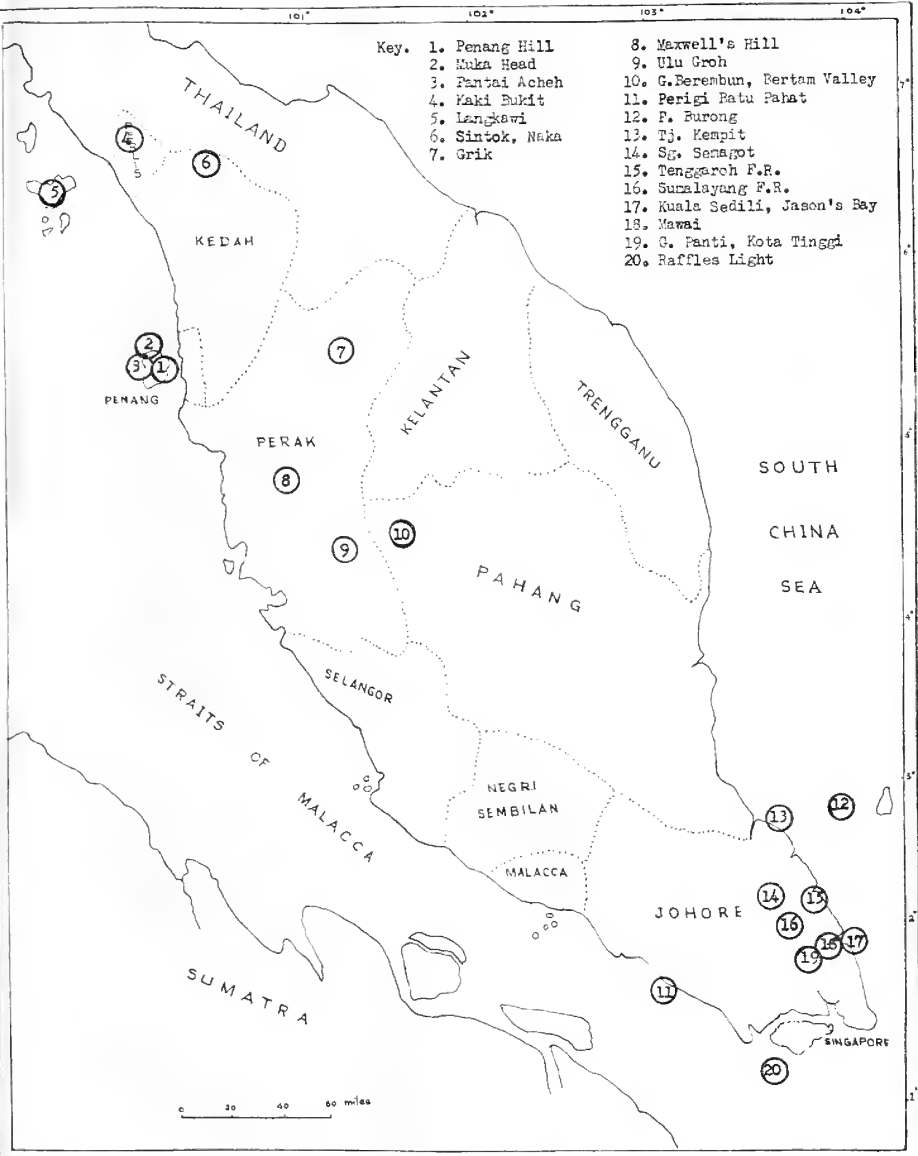
Belgium	...	Plantentium der Rijksuniversiteit, Gent; Jardin Experimental Jean Massart, Brussels; Dienst Voor Parken en Plantsoenen, Antwerp.
Brunei	...	Mr. A. J. Keij, Seria.
Bulgaria	...	Jardin Botanique de l'Universite, Sofia.
Canada	...	Botanical Gardens, Montreal.
Denmark	...	Universitetets Botaniske Hav, Copenhagen.
Federation of Malaya	...	Mr. Eric Spykerman, Ipoh; Botanic Gardens, Penang; Mr. Chua Eng Chye, Kuala Lumpur; Mr. H. Jones, Rompin; Mrs. Betty Allen, Cameron Highlands; Mr. Lee Ewe Boon, Kedah; Mr. J. A. Hislop, Kuala Lumpur.
Finland	...	Hortus Botanicus Universitatis Helsingiensis, Helsingfors.
France	...	Jardin Botanique, Lyon; Jardin Botanique, Strasbourg; Station de Botanique et de Pathologie Vegetale, Antibes; Jardin Botanique, Nancy; Jardin Botanique, Institute de Sciences Naturelles, Besancon.
Germany	...	Botanischer Garten der Stadt Koln, Cologne; Botanischer Garten der Universitat, Tubingen; Botanischer Garten Universitat, Mainz; Botanischer Garten der Karl-Marx Universitat, Leipzig; Botanischer Garten der Justus-Leibig-Universitat, Giessen; Botanischer Garten der Martin-Luther-Universitat, Halle (Saale); Botanischer Garten der Universitat Halle, Halle (Saale); Botanischer Garten der Friedrich-Schilles-Universitat, Jena; Botanischer Garten der Technischen Hochschule, Karlsruhe; Botanischer Garten and Museum, Berlin.
Hungary	...	Hortus Botanicus Universitatis, Szeged.
Indonesia	...	Kebun Raya, Bogor; Dr. A. Kostermans, Bogor.
Italy	...	Villa Taranto Gardens, Lago Maggiore; Giardino Botanico E. Coloniale, Palermo; Istituto Botanico "Hanbury", Genova; Istituto Orto Botanico Della Universita, Cagliari.
Japan	...	Onomichi Botanical Garden, Hiroshima.
Kenya	...	Parks Department, Nairobi; Dr. J. E. Castelino, Mombasa.
Netherlands	...	Zoo and Botanical Gardens, Rotterdam; Hortus Botanicus Universitatis, Nijmegen.
New Guinea	...	Department of Forests, Lae; Mr. V. A. Chadim, Goroka.
Nigeria	...	Botanic Gardens, University of Ibadan.
North Borneo	...	Mr. Robert Young, Tawau.
Philippines	...	Miss Josephine Weeks, Rizal.
Singapore	...	Mr. S. H. Tan; Mr. Chua Kim Guan; Mrs. T. L. Green; Mrs. J. MacDougal; Mrs. Betty Allen; Mr. Lee Toh Ming, Mr. W. G. Thurston, Mr. Sheridan-Lea, H.E. Yang di-Pertuan Negara, Mr. A. J. Braga, Mr. Koh Keng Hoe.
South Africa	...	National Botanic Gardens, Kirstenbosch; University of Pretoria.
Spain	...	Municipal Parks and Gardens, Barcelona.
Thailand	...	Royal Thai Forest Department, Mr. Rapee Sagarik, Bangkok.
United Kingdom	...	Royal Botanic Gardens, Kew; Royal Botanic Garden, Edinburgh; Botanic Gardens, Glasgow; University of St. Andrews, Scotland.
United States of America	...	California Jungle Gardens, Los Angeles, Waikiki Nursery, Honolulu; Foster Botanical Garden, Honolulu; Fairchild Tropical Garden, Miami; Mr. Jack Ching, Hawaii.
Union of Soviet Socialist Republics	...	Hortus Botanicus Academiae Scientiarum, Riga; Hortus Botanicus Academiae Scientiarum, Ashkhabad; Hortus Botanicus Academiae, Erevan-Kanaker; Botanical Garden of Peter Stutchka, Riga.

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INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS
AND SEEDS WERE SENT IN 1963

Australia ...	...	Mr. A. S. Aidmore, Victoria.
Bahamas ...	...	Mr. Colin M. Cambell, Spanish Wells.
Czechoslovakia ...	...	Agricultural Research Station, Sumperk-Temenice; Insitutum Natural Sciencum, Prague.
Federation of Malaya ...	...	Botanic Gardens, Penang; Mr. Lee Ewe Boon, Alor Star, Kedah; Dunlop Malayan Estates Ltd., Malacca; College of Agriculture, Serdang.
Hongkong ...	...	Urban Council & Urban Service Department.
Indonesia ...	...	Dr. A. Kostermans, Bogor.
India ...	...	Dr. Salim Ali, Bombay; Osmania University, Hyderabad; Indian Agricultural Research Institution, New Delhi.
Japan ...	...	Mr. Masaoki Soga, Sakai City, Osaka.
North Borneo ...	...	Cocoa Research Station, Tawau.
New Guinea ...	...	Forest Department, Lae.
Philippines ...	...	Miss Josephine Weeks, Rizal.
Singapore ...	...	Mrs. MacDougal; Mr. W. G. Thurston; Mrs. Max Lewis; Mr. V. C. Bath; Mr. Koh Keng Hoe; H.E. Yang di-Pertuan Negara; Dr. Griffithes, General Hospital.
Sarawak ...	...	Department of Agriculture, Kuching.
Thailand ...	...	Mr. C. Narong, Bangkok; Mr. Rapee Sagarik, Bangkok.
United Kingdom ...	...	Mr. Geoffrey L. Hey, Bedfordshire; University College of Wales.
United States of America		California Jungle Gardens, Los Angeles; Mr. S. Harmacek, New York; Mr. R. Reasar, San Bernardino, California; The University of Arizona, Tucson; Department of Botany and Plant Pathology, Michigan State University, Mr. Robert M. Scully, Miami, Florida.
West Germany ...	...	Geologisches Institut der Universitat Koln, Cologne.

APPENDIX IX



- | | | |
|------|-----------------|--------------------------------|
| Key. | 1. Penang Hill | 8. Maxwell's Hill |
| | 2. Muka Head | 9. Ulu Groh |
| | 3. Pantai Acheh | 10. G. Berembun, Bertan Valley |
| | 4. Kaki Bukit | 11. Perigi Patu Pahat |
| | 5. Langkawi | 12. P. Burong |
| | 6. Sintok, Naka | 13. Tj. Kempit |
| | 7. Grik | 14. Sg. Samapot |
| | | 15. Tenggaroh F.R. |
| | | 16. Sumalayang F.R. |
| | | 17. Kuala Sedili, Jason's Bay |
| | | 18. Mawai |
| | | 19. G. Panti, Kota Tinggi |
| | | 20. Raffles Light |



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COMPLIMENTARY



STATE OF SINGAPORE

ANNUAL REPORT
OF THE
BOTANIC GARDENS
DEPARTMENT
FOR THE YEAR
1964

(Cmd. 18 of 1966)

12/102



STATE OF SINGAPORE

ANNUAL REPORT
OF THE
BOTANIC GARDENS
DEPARTMENT

FOR THE YEAR

1964

12/164

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ADMINISTRATION

I. FUNCTION

To conduct research into the regional flora and to provide a taxonomic service in support of technological activities concerning Malaysian plant life; to conduct research into tropical horticulture.

II. STAFF

2. There has been no change in establishment.

III. LABOUR

3. The Gardens labour force was raised to 80 during the year, an increase of 4 over the previous year. Two deaths have unfortunately to be recorded, one while on duty tree felling, the other in a road accident. In both instances it was possible to take on to strength the next of kin in order to minimise hardship to the families. The current labour force was made up of the following grades: Overseer II, 1; Head Mandore, 4; Mandore, 6; Gardener (Nurseryman), 16; Labourer, 41; Mechanic II, 1; Tree Climber, 1; Mason II, 1; Carpenter II, 1; Sign-writer II, 2; Driver, Motorcycle Operator, 6.

4. The Istana Negara Domain labour force had 59 on strength at the end of the year. The Nature Reserves had nine men, and the herbarium, one man and three women. Health was generally good. Administrative matters continue to take up a disproportionate amount of the horticultural officers' time. None of the whole labour force was involved in incidents during the civil disturbances of July and September, though a certain amount of work time was lost due to a number of labourers living in troubled areas. One retiring member of the labour force was given state decoration for long and faithful service: Che Sumiah binte Pijah, Specimen Mounter, in the Herbarium, Long Service Medal, after 39 years service.

IV. WATCHMEN

5. A complement of 18 was employed, an increase of five over the strength previously. Nine were employed on monthly terms, and nine on daily rates. These men gave good and conscientious service during the year, maintaining continuous patrolling of the Gardens during opening hours, and guard duty at night.

V. STUDY AWARDS

6. Miss Chang Kiaw Lan, Botanist, who was awarded a scholarship by the United Kingdom Government under the Commonwealth Scholarship and Fellowship Scheme at Cambridge University commencing in October 1962, continued her studies there on taxonomic mycology throughout the year.

7. Dr. Chew Wee-Lek was awarded a travel grant by the Royal Society and Nuffield Foundation of London which enabled him, while taking casual leave, to visit many European herbaria to study collections of Urticaceae and literature not available in Singapore. The Department gratefully acknowledges this valuable assistance.

VI. TRAINEES

8. Departmental facilities were, as usual, made available to trainees from other overseas and local organisations. Three persons from overseas were at the Gardens for varying periods under Singapore Government sponsored Colombo Plan Fellowships. Mr. Munir abid Chaudhury, of the Department of Botany, University of Sind, West Pakistan, who arrived in 1963 on a senior fellowship, continued his studies throughout the year. Two other trainees came from Thailand on junior fellowships to study horticulture. They were Mrs. Sompian Kasamsap and Mr. Sanan Khumlert, both of Kasetsart University, Bangkok. The former stayed six weeks and the latter three months.

9. Mr. C. Velupillay, Field Assistant, Botanical Division, Rubber Research Institute of Malaya, was given a three months course in general horticultural methods. Nine trainees were accepted from the Labour Department under the Retraining and Rehabilitation schemes for disabled persons for a course of instruction in elementary gardening. There is a great dearth of gardeners for employment by householders, and many labourers posing as gardeners are simply grass slashers. This Department would welcome, and could readily accept, many more trainees.

VII. WORKS AND BUILDINGS

10. The demolition of the old herbarium building, the commencement of which was recorded in the Report for 1963 (para. 9), was completed, and reconstruction was carried out on the same site. The whole operation was completed by June, and the building was handed over to the Department on 1st July. Acknowledgement is made to the Director of Public Works and his architects and staff, and to the contractor, for the smoothness and expedition with which the job was completed.

11. An official opening ceremony was conducted on 24th October when Mr. Chan Chee Seng, Parliamentary Secretary to the Minister for Social Affairs declared the building open. Instead of a formal unlocking of the main door, or a formal cutting of a tape across it, Mr. Chan was invited to cut a branch of *Kopsia singaporensis* var., a plant of which was placed in a pot at the doorway. A commemorative herbarium label was kindly prepared by the Government Printer and has been used to mark the specimen taken from this branch for laying in the Singapore herbarium, and to go with the 100 duplicates sent out on a world-wide distribution to other herbaria.

12. A chain-link fence 800 feet long was put up enclosing the potting yard. This area, in which the gardening equipment is kept, had for years been a seriously embarrassing security risk. A second piece of chain-link fencing, 1,900 feet long, was put up on the Gardens perimeter along Tyersall Avenue from the drive entrance to the Director's quarters to the junction of Tyersall

Avenue with Napier Road. Provision was made for a lorry gate at about the centre of this strength, and for two pedestrian gates. This fence is the first part of a programme to enclose the entire Gardens.

13. Plans were laid by the Public Works Department, in consultation with the Botanic Gardens Department, for the construction of a new tea kiosk to replace the old one. A site was selected near the Main Gate Road and the Lake on Lawn H.

14. The upkeep of plant houses has always presented difficulties. Houses requiring major repairs need to have the plant collections removed. Repairs by the P.W.D. to two Begonia houses were begun and owing to the time this work took, several casualties amongst the displaced plants have been suffered. Gardens resources were used for minor repairs, and also to erect a 40ft. x 40ft. orchid seedling house.

15. The wooden gate at the main entrance was replaced by a pair of large ironwork gates across the main roadway with a pair of smaller pedestrian gates, one on each side. These gates give a greatly improved appearance to the Gardens main entrance. [Historical note. The original Main Gate to the Gardens when the Gardens were first laid out in 1859-62 is that near the present office and is now called the Office Gate. The present Main Gate was constructed during Phase 2 of the Gardens development in 1864, and it is the pillars of this that now support the iron gates referred to above.]

16. The Public Works Department rendered assistance in repairing dilapidations to the roadside drains of the Office Ring Road and the Main Gate Road, and to a storm water drain in the potting yard. Twenty concrete benches were supplied and placed at various points in the Gardens, and a 40ft. flagpole was put up on the bandstall hill. Plans were made and the initial work begun for the placing of a small fountain in the ornamental pond at the main Plant House.

VIII. BOTANIC GARDENS ORDINANCE AND BY-LAWS

17. Provisions of the Ordinance and administration of the by-laws (Botanic Gardens Rules) worked satisfactorily. No major transgressions of the by-laws occurred except in the case of motor traffic within the Gardens, drivers of which committed over 150 traffic offences. These were referred to the Traffic Police for prosecution. The admission of private vehicles presents a number of unsatisfactory aspects which can only be resolved by the exclusion of all vehicular traffic from the Gardens.

IX. VISITORS

18. The Botanic Gardens was honoured by a visit by H.R.H. The Regent of Perlis and his Consort on 16th November. Besides the many official guests who attended the opening of the Herbarium on 24th October, the Minister for Social Affairs paid a formal visit on 30th January. An official party of Ipoh Municipal Councillors was received on 28th June, and Sir Solomon Hochoy, Governor-General of Trinidad and Tobago, and Lady Hochoy on 30th June.

19. Several groups of scientists in transit through Singapore paid calls at the Gardens office: the Royal Society team en route for Kinabalu (see also para, 37) in January; a group of Japanese scientists with interests in pharmaceutical sciences on study tour; a number of Russian scientists taking part in the U.S.S.R. contribution to the U.N.E.S.C.O. Indian Ocean Research project, and many others in one and twos, a selection of whom are listed below. In the course of one's work there builds up a volume of correspondence with other scientists, and this is an essential aspect, but the opportunity for personal contact such visits give is of immensely greater value for discussion and interchange of ideas which formal correspondence lacks.

Dr. Hugo Boyko	Sec. General World Academy of Art and Science, U.N.E.S.C.O., Consultant.
Mr. S. J. Blake	Queensland Herbarium, Brisbane.
Dr. W. L. Stern	Smithsonian Institution, U.S.A.
Dr. Gunnar Degelius	University of Gothenburg, Sweden.
Dr. Ernest Abbe	University of Minnesota, U.S.A.
Mr. N. S. Bisset	C.N.R.S. Institute de Chemie des Substances naturelles, France.
Mr. J. Tachibana	Osaka City University, Japan.
Prof. P. F. Philipp	Professor of Agricultural Economy, University of Hawaii, U.S.A.
Dr. C. A. Schroeder	University of California, U.S.A.
Mr. K. J. White	Forest Department, New Guinea.
Mr. D. Rhind	Adviser on Agriculture to the Minister for Overseas Development, London.
Dr. T. A. Whitmore	Forest Department, British Solomon Islands Protectorate.
Dr. W. M. Meijer	Forest Department, Sabah.
Dr. S. Krishnamurthi	Director of Agriculture, Madras.

20. Many research workers also visited the office and made use of the facilities of the library and Gardens. The herbarium reconstruction unfortunately greatly restricted study of the plant collections, but with adequate prior notification of a visitor's requirements, it was possible to make a limited quantity available.

21. Facilities of the Gardens and library were as usual made freely available to members of the staff and sponsored students of the Universities of Singapore and Malaya and to other official organisations, local and overseas. The usual very large numbers of casual visitors came daily to the Gardens.

X. STATE GIFTS

22. Three mature orchid plants were given to Lady Thelma Hochoy, wife of the Governor of Trinidad and Tobago; 250 orchid sprays were supplied for official gifts to Heads of Governments and Government representatives of overseas territories and in Malaysia; 800 orchid sprays were provided for state banquets and government functions.

XI. CONCERTS

23. The Singapore Police Force band gave eight Sunday afternoon performances during the year. These were much appreciated and the Commissioner of Police and the Director of Music of the Royal Malaysian Police (Singapore) are thanked for their interest in arranging these concerts.

XII. LIBRARY

24. The library has remained in very cramped and unsatisfactory accommodation intended for other purposes. This has curtailed certain aspects of the Gardens proper functioning. Plans for a new library building have received provisional approval from the Ministry.

25. Accessions for the year amounted to 13 books, three maps and one microfilm by purchase; 21 books as gifts or complimentary copies, 38 volumes of periodicals by subscription, and the periodicals and publications of 322 addresses by exchange. This intake adds to the growing congestion in the very restricted and unsuitably designed accommodation. The library register showed 8,815 bound volumes at the end of the year. Owing to lack of funds, binding is very much in arrears.

XIII. PUBLICATIONS

26. Stocks of *Flora of Malaya*, vol. 1, *Orchids*, 2nd edition, and vol. 2, *Ferns*, 1st edition, became exhausted during the year, and arrangements were made for printing revised editions by incorporating amendments and new information supplied by the author, Dr. R. E. Holttum. The text of a third volume, *Grasses*, by Professor H. B. Gilliland of the Botany Department of the University of Singapore, has been accepted for publication.

27. One part of the *Gardens' Bulletin, Singapore*, vol. XX (4) was brought out with the following papers:

RAO, A. N., and HARDIAL SINGH: Stamens and carpels within the ovary of *Durio zibethinus* Murr.

FURTADO, C. X.: The origin of the word 'Cocos'.

GILLILAND, H. B.: Further notes on the grasses of the Malay Peninsula, I.

JOHNSON, A.: An account of the Malesian Leucobryaceae ('Lumut Puteh').

ALLEN, B. M.: Descriptions of the Malayan species of *Laportea*.

TURNER, G. J.: New records of plant diseases in Sarawak for the year 1962.

FURTADO, C. X.: *Pothos aurea* Hort. Linden.

ALLEN, B. M.: Malayan Fern Notes, III. *Arthropteris* in Malaya.

28. Officers of the Department also had the following papers published elsewhere:

BURKILL, H. M.: The role of the Singapore Botanic Gardens in the development of orchid hybrids: *Proc. 4 World Orchid Conf. Sing.* Straits Times Press, Singapore 1964.

ALPHONSO, A. G.: Malayan scorpion orchids and their related hybrids: *Proc. 4 World Orchid Conf. Sing.*, Straits Times Press, Singapore, 1964.

29. Mr. Alphonso and Mr. Bajuri jointly or individually prepared ten orchid hybrid descriptions for publication in the *Malayan Orchid Review*.

30. Revenue from the sale of publications prepared by the Department and published by the Government amounted to \$5,026.

XIV. AGRICULTURAL PESTS SUPERVISORY COMMITTEE

31. The Director was a member throughout the year.

XV. UNIVERSITY OF SINGAPORE COURT

32. The Director represented the Botanic Gardens on the University Court as Government's nominee.

XVI. COMMONWEALTH WAR GRAVES COMMISSION

33. The Director continued to be the Commission's representative in Singapore, and was responsible for the maintenance of the War Graves Cemetery at Kranji under instructions from the Commission's Eastern Region Headquarters at New Delhi. Funds for the maintenance work of the Kranji Cemetery are provided by the Commission. Further information may be found in the Commission's own reports.

XVII. NATURE RESERVES

34. The Board consisted of:

Nominated by the Yang di-Pertuan Negara	1. Mr. Tan Hoon Siang up to 16-9-64
	2. Mr. Liew Tiew Kee
Nominated by the Minister for National Development	3. Mr. O. K. Abraham
	4. Mr. Tan Jake Hooi
Representative of the City Council	5. Vacant
Representative of the Rural Board	6. Vacant
Chairman, <i>ex-officio</i>	7. Director of Botanic Gardens.

35. To facilitate improvements to Lornie Road undertaken under the State Development Plan, approximately three acres of the Water Catchment Nature Reserves were surrendered. Routine patrolling and maintenance were carried out. Vandalism to the shelters and maps on Bukit Timah is a constant nuisance. Of the ten map holders put up for the information and guidance of visitors, all except two had to be repaired during the year. Seventeen permits were issued to staff and students of the University of Singapore, Nanyang University, and schools, and to responsible individuals to collect specimens of plants and insects in the Reserves. Pilfering of timber from the MacRitchie Reservoir area of the Water Catchment Nature Reserve became a major problem, and police assistance had to be solicited. A number of arrests were eventually made which helped to curb these depredations.

XVIII. METEOROLOGICAL RECORDS

36. As previously recorded (A.R. 1963, para. 29), 1963 was an unusually dry year with a recorded rainfall of only 66.92 inches against a 49-year average of 98.12 inches. The rainfall of 1964 was almost exactly double that of 1963 with 122.23 inches recorded at the Orchid Enclosure and 125.10 inches at the office site. The quantity recorded at the summit of Bukit Timah was 123.79 inches. In the Gardens, February, April, October and December

were particularly wet months with falls of 13-15 inches. The heaviest precipitation in any one day was 5.7 inches, and this occurred in June, a relatively dry month. This particular storm barely reached the Bukit Timah recording station about 8 miles distant, where only 2.18 inches fell. Even the two recording points in the Botanic Gardens, some $\frac{1}{4}$ mile apart showed a difference of $\frac{1}{2}$ inch. This is mentioned to indicate how very local some rainstorms are. Recording of rainfall was begun at the beginning of the year at the Kranji Cemetery on the north side of Singapore Island, so that our records now cover the Island in a median line north-centre-south. Data of rainfall and other phenomena are recorded in Appendices II, III, IV and V.

BOTANICAL RESEARCH

XIX. PLANT COLLECTING

37. The most important botanical field work of the year was undertaken during the Royal Society's Second Kinabalu Expedition which was on the mountain for almost five months, January to May. As in the First Kinabalu Expedition, 1961, the major contribution of man-power in the field came from the Singapore Botanic Gardens with three officers who stayed the full period of the expedition. Biologists from Malaya, Sarawak and Sabah were attached for varying shorter periods. The senior and technical personnel were:

- E. J. H. Corner, Cambridge University: Leader
- G. P. Askew, Newcastle University: Soil Scientist.
- J. Smart, Cambridge University: Entomologist.
- Chew Wee-Lek, Singapore Botanic Gardens: Botanist.
- Mohamed Shah bin Haji Mohamed Nur, Singapore Botanic Gardens.
- Samsuri bin Ahmad, Singapore Botanic Gardens.
- M. E. D. Poore, University of Malaya: Plant Ecologist.
- Ho Coy Choke, University of Malaya: Plant Ecologist.
- Lord Medway, University of Malaya: Zoologist.
- David Lampong, University of Malaya.
- Alex Jamin, Department of Agriculture, Sabah.
- George Mikil, Forest Department, Sabah.
- Michael Chua, Department of Agriculture, Sarawak.
- Stephen Kueh, Department of Agriculture, Sarawak.
- Richard Lau, Department of Agriculture, Sarawak.

38. The main objective of the expedition was to fill in the gaps left by the earlier expedition, in making an intensive study of the natural history of the Pinosuk Plateau on the southern slopes of Mt. Kinabalu between 4,000 and 8,000 ft. altitude, the vegetation of which is dominated by montane Oaks. Base camp was established at the confluence of the East and West Anak Mesilau rivers at about 5,000 ft. altitude. Three other camps were

set up during the course of the expedition; on the Bembangan river, about two hours march east of base at the same altitude: on the East Mesilau river at about 6,000 ft., and at the headwaters of the Mentaki river at about 9,000 ft. More than 3,000 numbers of botanical specimens were collected; numerous soil pits were dug and sampled; many bird and small mammal skins were collected and a large number of birds ringed; twenty ecological plots were sampled, and insects, especially the family *Simuliidae* were collected.

39. An important collecting expedition was made in August by Mr. Hardial Singh, Botanist, in the Sungei Yu and Sungei Jeleteh area of Pahang while attached to a Malayan Geological Survey party. The assistance of the Director of the Malayan Geological Survey and of the State Surveyor are gratefully acknowledged.

40. Mr. Hardial Singh and Mr. Munir abid Chaudhury made two collecting trips, one to Ulu Kerling in Selangor and to Sg. Patani, Kedah, and the other to Sungei Lembing and Lepar Forest Reserve, Pahang, and to the Bukit Bauk Forest Reserve, Trengganu. These expeditions were primarily to look for Verbenaceae being studied by Mr. Munir, and to collect Araceae.

41. The Director made two collecting trips to Pulau Tinggi off the east coast of Johore to extend his marine algal collections, and another to Pulau Undan off Malacca. The Southern Islands off the south side of Singapore Island and particularly Raffles Light which have previously been the main collecting points for this algal field work have become inaccessible owing to Indonesian 'confrontation', and were not visited during the year. While on casual leave he collected on Gunong Jerai, Kedah and at Penang and Port Dickson.

42. It is convenient to record here the collecting expeditions of Mr. Alphonso, Curator, for living plants, chiefly orchids, for cultivation. Two major trips were made into Thailand: one to Chiangmai in the north and to Nakorn Nayok, northeast of Bangkok, and the other to the Western side of peninsular Thailand south of the Isthmus of Kra. Two other trips were made to Pahang. All four were extremely successful, yielding in all 1,266 plants in 237 numbers. These trips are summarised in Appendix VI, as well as other collecting expeditions for herbarium material.

XX. EXCHANGE AND ACQUISITION

43. Because of the necessity of all the herbarium material going into storage during the reconstruction of the herbarium, and because three members of the botanical staff were away on the Royal Society Expedition for five months [a fourth member was away the whole year on national defence duties], distribution of duplicate material virtually ceased though material has continued to come in. The relatively little material that was sent out was entirely of marine algae which, for the Director's convenience of working, had been kept to hand out of the general storage. Though the reconstructed building was ready for use at the beginning of July, normal working was not resumed till after the end of the year. The move back into the reconstructed building was slowed down by the necessity of passing every specimen through the fumigation chamber and of cleaning and thoroughly disinfecting every cupboard and item of furniture going back into the new building.

XXI. LOANS OF HERBARIUM MATERIAL

44. In anticipation of all collections being more or less inaccessible during the storage period, major collaborators were approached regarding their forthcoming loan requirements, and as a result an unusually large quantity of specimens was shipped to Leiden for Flora Malesiana workers, and also large consignments were made to The University of Malaya and the Commonwealth Forestry Institute at Oxford University. Material received on loan was mainly of Myristicaceae for Mr. Sinclair and of Urticaceae for Dr. Chew.

XXII. TAXONOMY

45. Mr. J. Sinclair continued his work on malesian Myristicaceae (Nutmeg family) and the greater part of the year was spent on preparing a second draft of the revision of the genus *Myristica*. Progress was seriously interrupted by not having the herbarium to work in. New collections from North Borneo, Sarawak, New Guinea and the Solomon Islands provided useful additional data.

46. Dr. Chew Wee-Lek, on return from the Royal Society Kinabalu Expedition took leave for 2½ months and assisted by a Royal Society and Nuffield Foundation grant was enabled to make a study of the herbaria of the British Museum, London, Kew, Cambridge, Leiden, Utrecht, Geneva and Paris. These facilities will enable him to prepare a world monograph on some of the genera of the Urticaceae. Without this assistance his project could never be attempted solely on the amenities of literature and collections available in Singapore.

47. Mr. Hardial Singh collected Araceae and made preparations for anatomical study. Miss Chang continued her studies of the fungal order Agaricales while on a U.K. Government award held at Cambridge University, and Mr. Burkill, when administrative demands permitted, followed his study of marine algae.

48. Mr. Munir abid Chaudhury, on a Singapore Government Colombo Plan Senior Fellowship to study botanical taxonomy, undertook a revision of the genus *Petraeovitex* (Verbenaceae), and prepared a paper for publication in *The Gardens' Bulletin, Singapore*. He then began a revision of the closely related genera *Congea* and *Symphorema*.

49. Dr. Furtado, though in retirement, has continued to work in the Department, and has given valuable assistance on nomenclatural procedures and in the preparation of latin diagnoses. While at the University of Singapore, in collaboration with the Botanic Gardens, and mainly dependent on the facilities of the Gardens' herbarium and library, the late Professor H. B. Gilliland completed a flora of *Grasses of Malaya* which has been accepted for publication as Volume 3 of the revised *Flora of Malaya*. Also at the University Dr. Hsuan Keng has continued his revision of Labiatae and Dr. Anne Johnson has prepared a revision of the moss family Leucobryaceae, which has been published in *The Gardens' Bulletin, Singapore*. Both these works have been based mainly on material in the Singapore herbarium or sent on loan from other institutions through the herbarium.

HORTICULTURE

XXIII. GARDENS MAINTENANCE

50. The whole of the Gardens was well maintained throughout the year, but there is a shortage of man-power necessitating the postponement of not immediately essential works. This shortage is the result of a 'creeping' devolution of works previously carried out by the P.W.D. to departments with the result that the general gang of the Gardens labour force tends to become diverted from their primary duties of horticulture. Steps are in train to try to obtain a larger establishment of labourers. The lawns were kept regularly mown on a weekly cycle by a team of 2 Dennis 24" cut mowers, 1 Ransome 24" cut mower and 3 24" cut Hayter Rotor Scythes. New hedge planting was carried out round the orchid enclosure: 60 feet with *Acalypha siamensis* and 100 feet with *Bougainvillea sandieriana*. The latter was chosen specially for its thorny nature. During the year 666 wooden plant labels for lawn plantings were renewed, some 10,000 metal tag labels prepared and 35 signboards repaired and a further eight made.

51. Special attention has been given to the Bandstand hill to try to give it more colour and horticultural interest. Two border beds have been planted with some 20 different acanthaceous species including *Jacobinia*, *Asystasia*, *Ruellia*, *Acanthus*, *Barleria*, *Beloperone*, *Eranthemum* and *Pseudoeranthemum*. Another border has been planted with small and medium sized shrubs: *Stenolobium alatum*, *Brunfelsia nitida*, *Phaleria blumei*, *Hibiscus costatus*, *Erythroxylon coca*, *Dianella ensifolia*, *Petraea volubilis*, *Vitex regandu*, *Allamanda violacea*, *Malpighia urens*, *Duranta plumeri* and var. *alba*, a variegated *Duranta* cv., *Murraya koenigii*, *Stachytaphita indica*, *Honckenya ficifolis*, *Phyllanthus pulcher*, *Stenolobium stans*. A novelty has been to concentrate those plants with red berries at one end.

52. All the pot and bed culture calls for large quantities of compost. A considerable amount of cattle manure is obtained for composting and no less than 20 large compost heaps are maturing at any one time.

53. Monkeys (*Macacus irus*) continued to be the main and most destructive pest in the Gardens. The population of Rhinoceros beetle (*Oryctes rhinoceros*) and Red Stripe Weevil (*Rhyncophorus ferrugineus*) has certainly declined. This may be due to the continuous prophylactic treatment of all the accessible palm crowns in the Gardens with insecticide, the strict control of plant debris, and perhaps also to the now almost completely built-up nature of the land on the Gardens boundaries from which coconut palms and dead stumps and trunks have been removed. The Rhinoceros beetle is not known normally to travel any very great distance and a quarter mile belt around the Gardens of relatively little unattended land is likely to be a great blessing.

54. The denizens of the Lake have in the past few years had quite a hectic time with turtle hunts to catch the culprits responsible for destroying all the nymphaeas, drought, and drainage of the lake for walling. But on the whole the population of fish remains prolific. There was however a disease, or at least the actual cause was presumed to be a disease, which attacked the

aruan (*Micropeltes chanos*) for about one month in the middle of the year, and some 50 or more of these vast fish (see photograph in Annual Report for 1961, Plate 6) which would indeed be an angler's delight were fishing permitted, died. At first sight of their floating corpses, one immediately suspected tuba poisoning, but the *Tilapia* and carp were unaffected. Nor was there any possibility of weedkiller or insecticide poisoning since the stream feeding the lakes comes from enclosed, unoccupied waste grassland.

XXIV. HORTICULTURAL EXCHANGE

55. Seed and plant exchange continued to be an important aspect of the Horticultural Division's activity. One seed collector was kept fully occupied. Exchange institutions are listed in Appendices VII and IX.

XXV. ISTANA NEGARA DOMAIN

56. The grounds, including the immediate gardens of the houses in the Domain, were maintained in good condition. All mechanical equipment gave satisfactory service. Because of the needs for decoration at receptions and official functions, special attention has been given to maintaining a plentiful supply of potted plants. Large quantities of burnt soil have to be prepared, and also of compost using cattle manure, horse manure and spent hops. The golf greens, tees and fairway swere keep in good playing condition.

57. By kind permission of H.E. The Yang di-Pertuan Negara the Domain was open to the public on Chinese New Year (13th February), Hari Raya Puasa (15th February), Labour Day (1st May) and on Deepavali (3rd November).

XXVI. ORCHID RESEARCH

58. Collecting expeditions for obtaining living material for cultivation have been referred to in para. 42 and in Appendix VI. These resulted in 237 numbers consisting of 1,266 plants being added to the living collection; 340 plants of species and hybrids were received on exchange and 154 as gifts, 206 mature plants, cuttings and seedlings were given on exchange. Individuals and institutions concerned are listed in Appendices VIII and IX.

59. During the year 74 hybrids pods were harvested from the Gardens' plants; 15 were received from Singapore growers, five from Malaya and 30 from England. Of these 124 pods, 78 were successfully germinated. More than 2,000 flasks have been regularly in use during the year on this stage of orchid culture.

60. The same unsatisfactory state of congestion in the orchid nursery, due to the lack of provision of adequate space, which has been recorded in the previous three annual reports, continues to hamper seriously the Botanic Gardens' efforts to produce new material for amateur growers and the nursery industry.

61. To mark the visit of H.E. The Governor of Trinidad and Tobago and Lady Hochoy on 30th June, Cross No. BGS. 2812, *Den. Ursula* x *Den. taurinum* was named and registered as *Den. Lady Hochoy*.

62. Eleven *grices* were registered:

- BGS. 787 *Den. Brown Curls* (*Den. Curlylocks* x *Den. Constance*) Originated by the Botanic Gardens.
- BGS.1525 *Vanda Muthiya* (*V. luzonica* x *V. Kapoho*) Originated by the Botanic Gardens.
- BGS.1534 *Vanda Heah Joo Seang* (*V. Ruby Prince* x *V. Rothschildiana*) Originated by the Botanic Gardens.
- BGS.2198 *Vanda Ruth Tan* (*V. sumatrana* x *V. Tatzteri*) Originated by the Botanic Gardens.
- BGS.2375 *Holtumara Loh Chin* (*Aranda Lilac* x *Renanthera storiei*) Originated by the Botanic Gardens.
- BGS.2636 *Vanda Sinada Kuma* (*V. B.P. Mok 'Old Rose'* x *V. Bill Sutton*) Originated by the Botanic Gardens.
- BGS.2656 *Vandaenopsis Mary Seal* (*V. Tan Chay Yan* x *Phalaenopsis denevei*) Originated by the Botanic Gardens.
- BGS.2693 *Vanda Wong Pow Nee* (*V. J. van Brero* x *V. tessellata*) Originated by the Botanic Gardens.
- BGS.3011 *Dendrobium Scraggy* (*D. Ang Swee Kim* x *D. gouldii* (blue form)) Originated by the Botanic Gardens.
- BGS.3161 *Dendrobium Wee Cheow Beng* (*D. Louisae 'Elegance'* x *D. Waikiki Beauty*) Originated by the Botanic Gardens.
- BGS.3235 *Dendrobium Peggy Shaw* (*D. Lava* x *D. Lim Chong Min*) Originated by Mr. A. J. Braga, and raised by the Botanic Gardens.

63. A Malaysian Orchid Society Award of Merit was given to BGS.2376: *Aranthera Beatrice* Ng, and plants of this cross also won the John Laycock Challenge Cup, the Vivian Bath Challenge Cup and the George Chan Challenge Cup at the M.O.S. annual show in November.

64. Many blooms were sent abroad for exhibition: details are given in para. 69. In the public section of the orchid enclosure about 100 potted plants in prime bloom were kept out on display, the plants being changed weekly.

EXTENSION WORK

XXVII. SUPPLY OF PLANTING MATERIAL

65. The sale of planting material of plants other than orchids totalled \$4,726.50, an increase of \$820 more than in 1963. The quantity of material involved was 11,682 seedlings, cuttings, etc. Orchid sales were almost identical with the figure for 1963 at 4,300 plants, \$13,307 (1963 figures 4,000 plants, \$13,667). Total plant sales was \$18,033.50, against \$17,573.50 in 1963.

66. The Gardens continued to supply planting material free of charge to Government departments, charitable institutions, state-aided schools and other official and quasi-official organisations. To these 12,082 plants were provided. The loan of potted plants for decoration at official or charitable functions amounted to 3,097 pots.

67. The Gardens also supplied material to schools and to the Ministry of Education for classwork and for examinations. Towards the end of the year particularly extensive requests for Cambridge School Certificate examinations were met. While most of the required material could be collected locally and without ostentatious disclosure of the purpose for which collection was being made, the Gardens were stumped at the requisition for 5,000 fresh

flowers of any large-flowered legume. Grateful acknowledgement is made to the Managing Director of Dunlop Malayan Estates Ltd., Malacca, and to the Manager of his Gomali Estate, Gemas, who helped us to supply the requisite material in the form of *Centrosema pubescens*, a standard creeping cover plant of rubber estates.

XXVIII. EXHIBITION AND SHOWS

68. The usual two major shows, the Malaysian Orchid Society annual show and the Singapore Gardening Society annual show, were staged at the Singapore Turf Club, and the Botanic Gardens contributed extensively in exhibition material and in personnel. Mr. Alphonso was Show Manager for the S.G.S. show, and Mr. Lam Hin Cheng was Show Secretary, and for the M.O.S. show Mr. Alphonso was Show Chairman and Mr. Tan Kim Ho was Show Secretary. Many other members of the staff served as judges at both shows, and on each occasion the Botanic Gardens put up a large non-competitive exhibit. Though the Botanic Gardens does not compete at S.G.S. show, the Istana Negara Domain has regularly entered in the open professional classes, and in 1964 it won the Show Championship Cup with the highest aggregate of points scored, and also it won a number of other challenge cups for various classes of pot plants.

69. It was again, as in 1963, impossible to stage a normal exhibit at the Malayan Agri-horticultural Exhibition in Kuala Lumpur, but a token exhibit of cut blooms was sent. Judging by the number of letters received and statements made by visitors to the Gardens, the absence of a proper exhibit by the Botanic Gardens is sadly missed. It is hoped that in 1965 the Gardens may be present again. To a number of other exhibitions which are listed below, there were sent cut orchid blooms. In some instances Messrs. B.O.A.C., QANTAS or Air India carried the consignment and arranged clearance for which we wish to make grateful acknowledgement.

Delhi Horticultural Society Show, India. (Replica cup awarded).

Philippine Orchid Society Show, Manila, P.I.

Jesselton Gardening Society Annual Flower Show, Sabah.

Kedah State Agri-horticultural Show, Alor Star.

Chelsea Flower Show, London.

Blind Bazaar, Jesselton, Sabah.

Viennese International Horticultural Exhibition, Austria — Two consignments. (Bronze medal awarded).

Sarawak Society for the Blind, Kuching.

Siam Society of Plant Culture Exhibition, Bangkok.

Queensland Orchid Society Show, Australia.

New York World Fair, for Pavilion of Malaysia, New York — four consignments.

Orchid Night, Alor Star, Kedah.

Royal Commonwealth Society for the Blind, London.

Sarawak Orchid Society Show, Kuching.

Selangor Orchid Society Show, Kuala Lumpur.

Penang Gardening Society Flower Show.

New Guinea Horticultural Society Show, Port Moresby.

XXIX. CULTURAL SOCIETIES

70. The Department gave considerable assistance to the Singapore Gardening Society and the Malaysian Orchid Society. Mr. A. G. Alphonso was vice-President of both, while Mr. Lam Hin Cheng served on the committee of the former and Mr. Tan Kim Ho and Mr. Ang Gek Choo of the latter. Several meetings of the S.G.S. were held in the Botanic Gardens, and Gardens staff prepared a number of contributions for publications in the *Malayan Orchid Review*. Mr. Burkill was a committee member of the Singapore Branch of the Malayan Nature Society.

XXX. ADVISORY WORK

71. There was a slight decline in requests for horticultural advice, though what was required still takes up a disproportionate amount of one curator's time. Planting plans were prepared for:

- (1) Primary School at Jurong New Town, Singapore.
- (2) Primary Schools (North and South) at Queenstown Neighbourhood III.
- (3) Secondary Academic School at Queenstown Neighbourhood III.
- (4) Secondary Vocational School at Queenstown Neighbourhood III.
- (5) Secondary Academic School at Jubilee Road, Singapore.
- (6) Secondary Vocational School at 6½ m.s. Upper Serangoon Road.
- (7) Secondary Vocational School at Lichfield Road.
- (8) Secondary Academic School at Upper Thomson Road.

72. With publicity given over the radio and the press concerning the herbarium reconstruction, there was a marked increase in public interest, and many people came just to see that there really was such a building, and that there really were these immensely valuable plant collections, that they had heard about. Many more traders came too with inquiries on commercial plant projects.

73. Government's tree planting campaign continued, and the Gardens supplied tree saplings for this whenever requested.

STAFF OF THE BOTANIC GARDENS, 1964

Divisions I, II and technical posts of Division III

(Date of first appointment to the Botanic Gardens Service is shown in brackets)

Appointment	Holder	Notes
Director	H. M. Burkill, M.A. (Cantab.) F.L.S. (12-11-54)	
Botanist	Chew Wee-Lek, B.Sc. (Malaya) Ph.D. (Cantab.) 1-10-56	
	Chang Kiaw Lan, Miss, B.Sc. (Malaya) (7-7-59)	On U.K. Government Scholarship in Eng- land from October 1962.
	Hardial Singh, B.Sc. (Sing.) (1-11-63)	
	J. Sinclair, B.Sc. (Edin.) (25-3-48)	Re-engaged pensioner on contract as a training replacement officer <i>vice</i> Miss Chang Kiaw Lan.
Curator	A. G. Alphonso (1-1-40) Lam Hin Cheng (1-7-57)	
Librarian	Tan Kim Ho, B.Sc. (Malaya) (1-4-58)	
Executive Officer	D. P. Lazaroo (11-3-63)	
Laboratory Assistant (Special Grade)	Bajuri bin Sappan (14-9-37)	
Horticultural Assistant	Ang Gek Choo (18-5-61)	
Herbarium and Museum Assistant	Md. Shah bin Haji Mohd. Nur (3-2-55)	
Artist	Juraimi bin Samsuri (1-9-45)	
Junior Horticultural Assistant	Aziz bin Pakiri (26-5-33) Wong Siew Hang (11-2-35)	

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1964

Reading daily at 9.30 a.m. local time at Botanic Gardens Office

Altitude: 100 ft. a.s.l.

1964	Total Rainfall	Highest fall in 24 hrs.	No. of days rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Dry Bulb Temp.	Mean Wet Bulb Temp.	Mean R.H.
	inches	inches		°F	°F	°F	°F	°F	°F	%
January	9.81 (11.05) *	1.94	16	87.1	91.0	74.1				
February	15.85 (7.37)	3.62	23	82.4	90.0	74.2	71.5	80.1	76.9	86.2
March	9.58 (8.28)	3.50	19	88.6	92.0	74.8	72.0	79.9	77.3	88.9
April	13.52 (8.11)	2.35	19	89.3	92.5	75.4	73.0	80.8	77.1	84.4
May	7.62 (7.37)	1.32	16	90.0	94.5	76.8	73.5	82.5	78.6	83.5
June	9.72 (6.72)	5.70	12	88.9	93.3	75.5	74.5	82.4	79.2	87.3
July	9.75 (6.27)	1.70	22	87.2	91.5	74.5	72.2	81.8	77.8	82.5
August	3.12 (6.94)	1.15	9	89.8	94.5	75.8	69.5	79.7	76.9	88.3
September	7.14 (7.45)	1.46	14	88.7	93.0	75.4	72.0	82.3	77.9	81.7
October	15.17 (7.96)	4.03	22	84.8	93.0	73.7	73.5	81.1	77.5	84.9
November	8.53 (10.45)	1.61	14	88.0	92.5	74.1	70.5	81.4	77.8	85.1
December	15.29 (10.07)	4.61	23	83.7	88.5	72.8	71.5 69.0	81.5 78.3	77.1 75.2	83.1 86.1
Total	125.10 (98.04)	5.70	209	..	..	..	..	..	..	..
Mean .. ..	..	..	..	87.4 (30.8°C)	92.2 (33.4°C)	74.8 (23.8°C)	71.9 (22.2°C)	81.0 (27.2°C)	77.4 (25.2°C)	85.2 ..

* Mean rainfall for the period 1914-64, 51 years.

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1964

Reading daily at 8.00 a.m. local time at "Orchid Enclosure" from 1-1-64 to 31-12-64

Altitude: 100 ft. a.s.l.

1964	Total Rainfall	Highest fall in 24 hours	No. of days Rainfall	Mean Maximum Temperature	Highest Maximum Temperature	Mean Minimum Temperature	Lowest Minimum Temperature	Mean Temperature Dry Bulb	Mean Temperature Wet Bulb	Mean R.H.	Mean Minimum Grass Temperature	Mean Earth Temperature 4'	Mean Earth Temperature 1'	Mean Earth Temperature 4'	Mean Solar Radiation Thermometer	Mean Daily Hours of Sunshine
	ins.	ins.		°F	°F	°F	°F	°F	°F	%	°F	°F	°F	°F	°F	
January ..	8.98	1.90	15	87.0	90.5	76.5	71.0	75.6	75.0	97.3	70.5	78.3	80.9	82.2	124.1	5.33
February ..	15.77	4.20	23	85.9	90.5	73.6	71.5	75.3	74.7	97.4	71.4	79.4	81.3	82.6	124.4	4.90
March ..	9.45	3.90	19	87.7	91.5	74.0	72.0	75.8	75.3	97.2	72.3	80.5	81.7	82.2	129.7	5.60
April ..	13.32	3.30	20	88.1	91.0	74.5	69.0	77.2	76.6	97.3	74.2	81.1	82.9	83.4	131.4	5.24
May ..	7.15	1.25	16	88.2	92.5	76.1	73.5	78.3	77.5	96.4	75.2	82.3	83.9	83.4	135.4	5.80
June ..	9.48	5.20	13	86.9	91.8	74.7	72.0	77.0	76.8	96.2	74.2	80.8	83.9	83.4	127.0	5.57
July ..	9.98	1.52	20	85.0	89.5	73.1	69.0	76.2	75.5	96.2	72.8	79.8	82.2	83.0	119.0	5.47
August	2.94	1.14	10	87.4	90.5	74.1	72.0	77.3	76.1	94.7	73.1	81.0	83.4	83.1	132.2	6.94
September ..	7.44	1.54	14	87.7	91.0	74.1	72.0	77.0	75.9	92.1	72.7	80.6	83.1	83.6	122.0	4.61
October ..	14.31	4.18	21	85.7	89.0	72.8	70.0	76.8	75.6	94.5	71.8	79.4	82.2	83.1	123.0	4.74
November ..	8.00	1.51	16	86.6	90.0	72.3	69.0	76.5	75.4	95.0	71.9	79.0	81.0	82.7	..	4.67
December ..	15.41	4.63	22	83.6	88.5	71.1	68.0	74.2	73.3	95.8	69.6	77.7	79.7	86.0	..	3.40
Total ..	122.33	..	209	..	..	..	..	..	..	..	..	..	..	..	..	..
Mean ..	..	..	..	86.6 (30.3°C)	90.5 (31.4°C)	73.9 (23.3°C)	70.7 (21.5°C)	76.4 (24.7°C)	75.6 (24.2°C)	94.8	72.5 (22.5°C)	80.0 (26.7°C)	82.2 (27.9°C)	83.2 (28.4°C)	126.8* (52.7°C)	5.19

* 10 month average.

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1964

Reading daily at 8.00 a.m. local time at Bukit Timah from 1-1-64 to 31-12-64

Altitude: 580 ft. a.s.l.

1964		Total Rainfall	Highest fall in 24 hrs.	No. of days rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	R.H.
		inches	inches		°F	°F	°F	°F	°F	°F	%
January	.. ..	8.37	1.53	14	84.5	87.6	73.0	70.6	75.7	73.8	91.1
February	.. ..	16.81	3.44	19	83.1	87.5	73.1	70.6	75.3	73.6	92.0
March	.. ..	9.12	3.44	14	85.9	88.9	73.6	72.0	76.7	74.9	91.9
April	.. ..	9.37	2.38	18	86.4	89.0	74.4	72.0	77.8	75.8	90.7
May	.. ..	5.37	1.15	11	86.2	89.0	75.4	72.0	77.9	76.1	91.8
June	.. ..	7.59	2.18	11	85.1	87.8	74.7	71.5	77.4	75.4	90.4
July	.. ..	14.24	3.20	15	84.1	87.7	74.0	70.0	76.9	74.9	91.1
August	.. ..	5.71	2.18	7	86.5	89.0	75.8	71.0	78.6	76.4	90.6
September	.. ..	9.33	1.50	11	85.0	88.0	74.4	71.0	77.6	75.5	90.3
October	.. ..	15.27	3.44	19	84.6	89.0	73.4	68.5	77.1	75.1	91.0
November	.. ..	6.67	2.18	12	85.3	89.0	73.2	69.2	76.4	74.5	91.1
December	.. ..	15.94	3.90	18	83.5	88.0	72.8	67.9	75.6	73.2	93.0
Total	.. ..	123.88	3.90	169	..	..	..	..	..	..	..
Mean	.. ..	..	..	..	85.0 (29.4°C)	88.3 (30.7°C)	72.9 (22.4°C)	70.6 (21.4°C)	76.9 (24.9°C)	74.9 (23.8°C)	91.2

METEOROLOGICAL REPORT

KRANJI CEMETERY

Recorded daily at 8.00 a.m.

Altitude: 120 ft. a.s.l.

1964	Total rainfall	Highest fall in 24 hours	No. of days with rain
January	7.72	2.42	12
February	17.25	3.75	16
March	10.82	1.75	10
April	12.20	2.95	13
May	4.70	2.15	6
June	3.20	0.95	5
July	13.00	1.20	15
August	3.25	1.95	2
September	8.80	1.80	10
October	10.70	2.70	13
November	6.00	1.35	5
December	13.70	4.45	12
Total ..	111.34	..	119

SUMMARY OF MAIN PLANT COLLECTING, 1964

Personnel	Date	Area	Collections
Chew Wee-Lak, Mohamed Shah bin Hj. Md. Nur, Samsuri bin Ahmad (with Royal Society Expedition)	January to May	Pinosuk Plateau, Kinabalu, North Borneo	Oak montane forest, 4,000—9,000 ft. over 3,000 nos.
Hardial Singh Munir abid Chaudhury	18th to 23rd March	Sg. Patani, Kedah. Kerling, Selangor	Araceae, Verbenaceae: 10 nos.
20 Hardial Singh (with D. Anderson, Supt. Lyon Arboretum, Hawaii)	24th June	Kuala Sedili	Barringtonia: 6 nos.
Hardial Singh Munir abid Chaudhury	31st May to 5th June	Sg. Lembing, Pahang Lepar For. Res., Pahang Bt. Bauk For. Res., Trengganu	Araceae, Verbenaceae: 12 nos.
Hardial Singh (with Malayan Geological Survey Party)	11th to 12th August	Sg. Yu, Pahang Sg. Jeleteh, Pahang	General collections, Araceae: 86 nos. 21 nos. for cultivation
H. M. Burkill	14th to 20th January 21st to 22nd January	Gunong Jerai, Kedah Penang Port Dickson, N. Sembilan	Montane flora: 79 nos. Marine algae: 22 nos. Marine algae: 18 nos.
H. M. Burkill	16th May	Tg. Kling, Malacca	Marine algae 13: nos.

SUMMARY OF MAIN PLANT COLLECTING, 1964

Personnel	Date	Area	Collections
H. M. Burkill	11th to 14th June	Mersing, Johore Pulau Tinggi, Johore	Marine algae: 65 nos.
H. M. Burkill	7th to 9th August	Pulau Undan, Malacca	Marine algae: 54 nos.
H. M. Burkill	28th August to 2nd September	Pulau Tinggi, Johore Pulau Lima, Johore	Marine algae: 13 nos.
A. G. Alphonso	26th to 29th February 20th to 24th February	Hod, Chiangmai, North Thailand Nakorn Nayok, Central Thailand	Orchids: 42 nos. (for cultivation) Orchids: 14 nos. (for cultivation)
A. G. Alphonso Sanusi bin Sarih	10th to 14th June	Bt. Iban, Pahang Lanjut, Pahang	Orchids and Hoya: 40 nos. (for cultivation)
A. G. Alphonso Cheang Kok Choy, Supt. of Penang Gardens	September	Songkla, Tanto, Natavee Patalung, Trung Ratapoon, peninsular Thailand	Orchids, ferns, gingers: 59 nos. (for cultivation)
A. G. Alphonso Cheang Kok Choy, Supt. of Penang Gardens Sanusi bin Sarih	3rd to 8th December	Temerloh, Pahang Maran, Pahang	Orchids, ferns, palms: 72 nos. (for cultivation).

In addition there have been many collecting forays in Singapore Island too numerous to list.

SUMMARY OF DISTRIBUTION OF HERBARIUM MATERIAL
ON EXCHANGE AND LOAN

IAPT Code	Institution	Exchange		Loan	
		In	Out	In	Out
AA	Arnold Arboretum, U.S.A.	—	—	92	—
AD	University of Adelaide, Australia	—	7	—	—
B	Botanical Museum, Berlin, Germany	—	—	12	—
BKF	Forest Department, Bangkok, Thailand	48	—	—	—
BM	British Museum, U.K.	39	49	6	—
BRI	Brisbane Herbarium, Australia	—	—	8	—
C	Copenhagen Herbarium, Denmark	493	—	259	—
CAL	Calcutta Herbarium, India	—	—	28	—
CGE	School of Botany, Cambridge, U.K.	—	—	7	64
E	Edinburgh Herbarium, U.K.	156	—	96	—
FHO	Department of Forestry, Oxford University, U.K.	—	—	—	292
GRO	University of Groningen, Holland	—	13	—	—
K	Kew Herbarium, U.K.	—	—	13	—
KEP	Forest Research Institute, Kepong, Malaya	57	—	13	—
KLU	University of Malaya, Kuala Lumpur	43	—	—	632
L	Rijksherbarium, Leiden, Holland	569	54	758	3,481
LAE	Forest Department, Lae, New Guinea	487	—	215	—
LD	Botanical Museum, Lund, Sweden	—	—	17	—
MAU	Mauritius Herbarium, Reduit	17	15	—	—
MEL	National Herbarium, Melbourne, Australia	71	—	—	—
MICH	University of Michigan, U.S.A.	—	35	—	—
MO	Missouri Botanic Gardens, U.S.A.	—	—	201	—
NSW	National Herbarium, N.S.W., Sydney, Australia	18	—	—	—
PNH	National Herbarium, Manila, Philippines	40	—	8	—
PRC	Botanical Institute, Charles University, Prague, Czechoslovakia	100	—	—	—
PUH	University of Philippines, Quezon City	50	32	—	—
S	Naturhistoriska Rijksmuseum, Stockholm	—	—	215	8
SAN	Forest Department, Sandakan, N. Borneo	1,308	—	84	—
SAR	Forest Department, Kuching, Sarawak	1,608	—	—	—
U	Botanical Museum, Utrecht, Holland	—	—	34	—
UBC	University of British Columbia, Canada	—	17	—	—
UC	Botanical Department, University of Cali- fornia, U.S.A.	—	124	180	—
UPS	University of Uppsala, Sweden	—	—	57	—
US	Smithsonian Institution, U.S.A.	175	—	—	—
Z	Botanic Gardens, Zurich, Switzerland	—	—	66	—
—	College of Guam, Agama	105	—	—	—
—	Colombo University, Ceylon	—	21	—	—
—	University of Hawaii, Honolulu	—	31	—	—
—	University of Singapore	16	—	—	—
—	Dr. Colinvaux, Yale University, U.S.A.	—	1	—	—
	Total	5,400	399	2,369	4,477

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM PLANTS
AND SEEDS WERE RECEIVED IN 1964

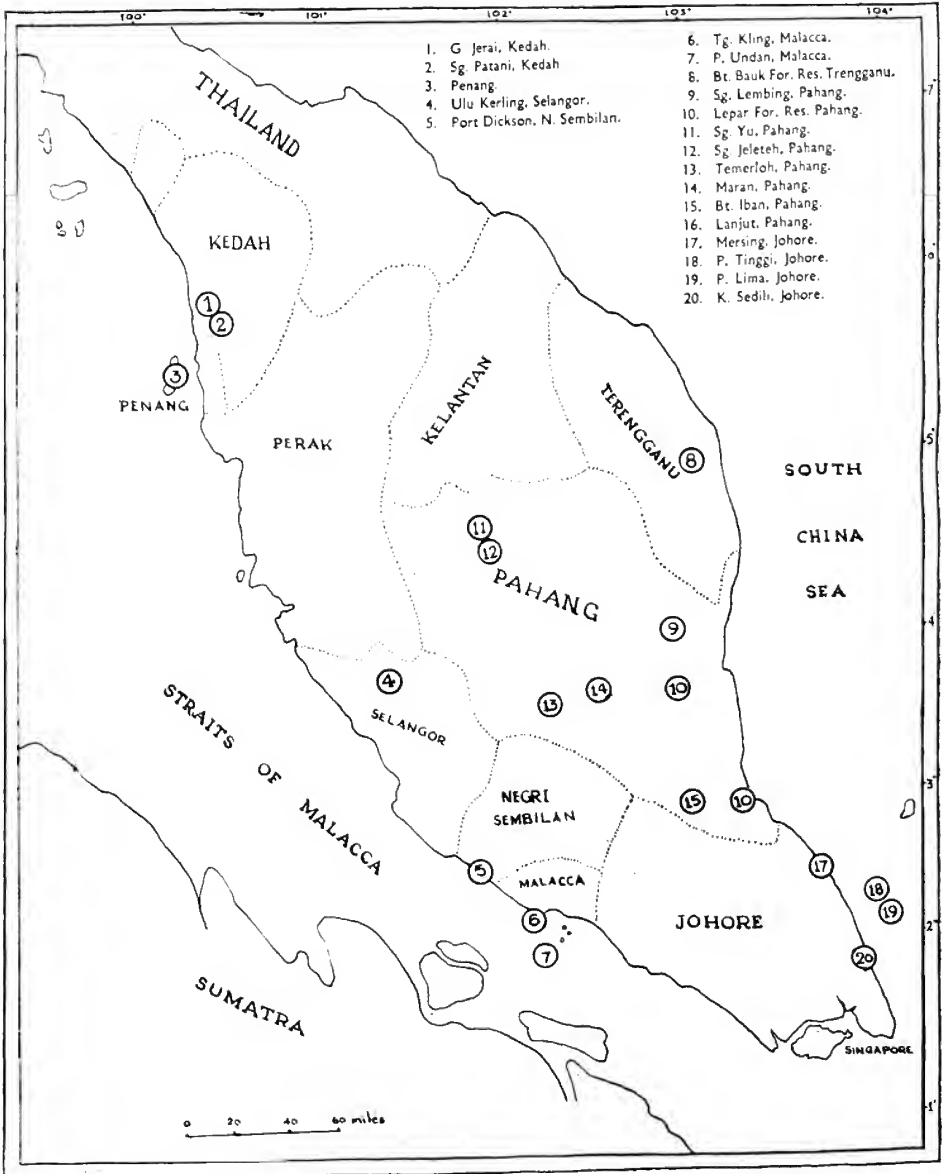
ARGENTINE	Instituto de Botanica Agricola, Buenos Aires.
AUSTRALIA	Botanic Gardens, Adelaide.
AUSTRIA	Hortus Botanicus Universitatis Vindobonensis, Wien III. Botanischer Garten der Universitat, Graz.
BELGIUM	Jardin Experimental Jean Massart, Universite Libre, Auderghem. Jardin Botanique de l'Etat, Bruxelles.
BRAZIL	Mr. Ramon Duran, Rio de Janeiro.
BULGARIA	Hortus Botanicus Academiae Bulgariae, Sofia. Jardin Botanique de l'Universite, rue Moskowaka 49, Sofia.
CANADA	Montreal Botanical Garden, Montreal. The Botanical Garden, University of British Columbia, Vancouver.
CHINA	Hortus Yunnanensis, Institutum Botanicum Kunming- ensis, Yunnan. Hortus Botanicus Pekingensis, Institutum Botanici Academiae Sinica, Peking. Hortus Botanicus Ausfro-Sinensis, Canton.
CZECHOSLOVAKIA	Academia Scientiarum Cechoslovaca, Arboretum Mlynany, Slepčany.
FED. OF MALAYA	Botanic Gardens, Penang; Mr. J. Hislop, Kuala Lumpur; Mr. Lee Ewe Boon, O.B.E., Alor Star; Che Ibrahim Baba, Horticultural Station, Petaling Jaya; Mr. E. L. Spykerman, Ipoh.
FIJI	Mr. H. W. Simmonds, Suva.
FINLAND	Botanical Gardens, Department of Botany, Turku.
FRANCE	Jardin Botanique, Lyon. Jardin Botanique, Dijon. Jardin Botanique, Nancy.
GERMANY	Botanischer Garten der Universitat, Freiburg. Institute fur Spezielle Botanik und Arboretum, Humboldt Universitat, Berlin. Botanischer Garten der Stadt, Köln-Riehl. Botanischer Garten und Museum, Berlin. Botanischer Garten, Hamburg, Botanischer Garten der Karl Marx Universitat, Leipzig. Botanischer Garten der Friedrich-Schiller Universitat, Jena.
GREECE	Botanical Garden of the University of Athens.
HOLLAND	Institute of Horticultural Plant Breeding, Wageningen. Hortus Botanicus der Universitat, Nijmegen.
HUNGARY	Hortus Botanicus Universitatis Sc. Hungaricae, Buda- pest. Institutum Plantarum Medicinalium, Budapest.
IRELAND	National Botanic Gardens, Glasnevin, Dublin.
ITALY	Villa Taranto Gardens, Lake Maggore.
JAPAN	Kyoto Takeda Herbal Garden, Kyoto. The Botanical Garden of Osaka City University, Osaka. Dr. Makoto Togashi, Takeda Chemical Industries, Higashiyodoga, Osaka. Seiichi Sakakibara Esq., Sankooen Gardens Co., Suginanmi-ku, Tokyo. Kasukabe Experiment Station of Medicinal Plants, Kasukabe-shi, Saitami- ken.
KENYA	Parks Department, Nairobi.

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NEW GUINEA	Division of Botany, Forest Department, Lae; Mr. F. G. Driver.
NIGERIA	Botanical Garden, University of Ibadan.
NORWAY	Hortus Botanicus Universitatis, Oslo.
PHILIPPINE ISLANDS	Mrs. P. K. Manuel.
POLAND	Ogrod Botaniczny Uniwersytetu Warszawskiego, Warsaw. Hortus Botanicus Universitatis Jagellonicae, Krakow.
PORTUGAL	Instituto de Botanica, Porto.
SABAH	J. Comber, Esq., Sapong Estate.
SARAWAK	Dr. J. A. R. Anderson, Conservator of Forests. Prof. E. Abbe, Kuching; Mr. John Seal, Kuching; Mrs. Y. T. Chan.
SINGAPORE	Inche Yusof bin Ishak, Yang di-Pertuan Negara; Mr. Chan Chee Seng, Parliamentary Secretary to Minister for Social Affairs; Mrs. Heaslett; Mr. R. Scott; Mrs. Holloway; Mrs. J. E. Eales; Mrs. Lim Tay Boh; University of Singapore; L. G. N. M. Ravesloot, Consul General of the Netherlands; Seng Heng Orchid Nursery; Sun Kee Nursery; Mrs. Gracia Lewis; Mrs. A. L. Jenkin; Mrs. Sheridan-Lea; Mr. T. J. Hale.
SPAIN	Municipal Parks and Gardens, Barcelona.
SWEDEN	Hortus Botanicus, Bergianus, Stockholm. Botanic Gardens of the University, Upsala.
U.K.	University Botanic Gardens, St. Andrews. The Botanic Garden, Cambridge. Botanic Gardens, Kew.
U.S.A.	New York State College of Agriculture; Cornell University; California Jungle Gardens, Los Angeles; Fairchild Tropical Garden, Florida; Foster Botanical Garden, Honolulu; Longwood Gardens, Kennett Square, Pa., Mr. David Barry Jr. Hawaii; University of California; Mrs. E. D. Menninger, California.
U.S.S.R.	Hortus Botanicus, Universitatis Vilnensis Nomini V. Kapsukas; Hortus Botanicus, Fominanus Universitatis, Kiowiensis; Botanical Garden of Peter Slutchka, Latvia; Hortus Botanicus Tallinnensis Academiae Scientiarum Estoniae, Tallinn.
YUGOSLAVIA	Hortus Botanicus, Zagreb.

INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS
AND SEEDS HAVE BEEN SENT IN 1964

AUSTRALIA	C.O. Downell, Esq., Dolcon Nursery, Chatswood, N.S.W.
BRAZIL	Sr. Ramon Duran, Rua Senhor dos Passos 12, Rio de Janeiro.
FED. OF MALAYA	Superintendent Parks and Gardens, Municipality of Ipoh; Dunlop Malayan Ltd., Malacca; Tropical Fish Culture Research Institute, Malacca; United Plantation Ltd., Jenderata Estate, Telok Anson; Waterfall Gardens, Penang, Mr. E. L. Spykerman, Ipoh; Mr. Philip Kuok, Johore Bahru.
FIJI	Mr. H. W. Simmonds, Suva.
FRANCE	M. J. Manier Lapostolle, Jardin Botanique, Les Cedres, St. Jean Cap, Ferrat, Paris. Museum National d'Histoire Naturelle Culture, Paris.
HONG KONG	Gardens Division, Urban Services Department.
INDIA	Dr. T. K. Bose, The Royal Agricultural and Horticultural Society of India, Alipore, Calcutta. The Director, Ministry of Education (Department of Science), Indian Botanic Gardens, Calcutta. Prof. V. Puri, Department of Botany, Meerut College, Meerut.
JAPAN	T. Tsujii D. Sc., Botanic Gardens, Hokkaido University, Sappora. Dr. Hiroyuki Murata, Onomichi Botanic Gardens, Onomichi-she, Hiroshima-ken. Mr. Toyoshima, c/o Botanic Gardens, Osaka City University, Osaka. Dr. Norio Kondo, The Institute of Breeding Research of Tokyo, Agricultural University, Setagaya, Tokyo. Dr. Tashihiko Satake, Saijo Machi, Kamogun, Hiroshima-ken. Mr. Y. Okamoto, c/o Osaka Municipal University, Technical Department Botanic Gardens, Kisaichi Katanochi, Kitagawachi-Gun, Osaka Prefecture. National Kyushu Regional Agricultural Experiment Station, Tansegashima.
KENYA COLONY	City Parks Department, Nairobi.
MEXICO	Carlos Pricto, Belderas 68, Mexico City.
NEW GUINEA	Forest Department, Lae; Mr. F. G. Driver.
NEW ZEALAND	Department of Scientific and Industrial Research.
NIGERIA	Botanic Gardens, University of Ibadan.
PHILIPPINE ISLANDS	Mrs. P. K. Manual.
SARAWAK	Mr. John Seal, Kuching.
SINGAPORE	Inche Yusof bin Ishak, Yang di-Pertuan Negara; Seng Heng Orchid Nursery; Mr. W. G. Thurston; Sun Kee Nursery; Mrs. Gracia Lewis.
SOLOMON ISLANDS (BRITISH)	Department of Agriculture, Honiara.
THAILAND	Dr. Bunchurt Khatican, Kasetsart University, Bangkok; Mr. Rapee Sagarik, Bangkok.
U.K.	Miss Chang Kiaw Lan, Cambridge, England. The Director, Royal Botanic Gardens, Kew, Surrey. Mr. D. Boulter, The Hartly Botanical Laboratories, England. University of London, Botanical Supply Unit, Elm Lodge, Englefield Green, Surrey.
U.S.A.	Mrs. E. D. Menninger, California; Mr. David Barry Jr., Honolulu.



Map showing Location of Malayan Place Names mentioned in this Report.

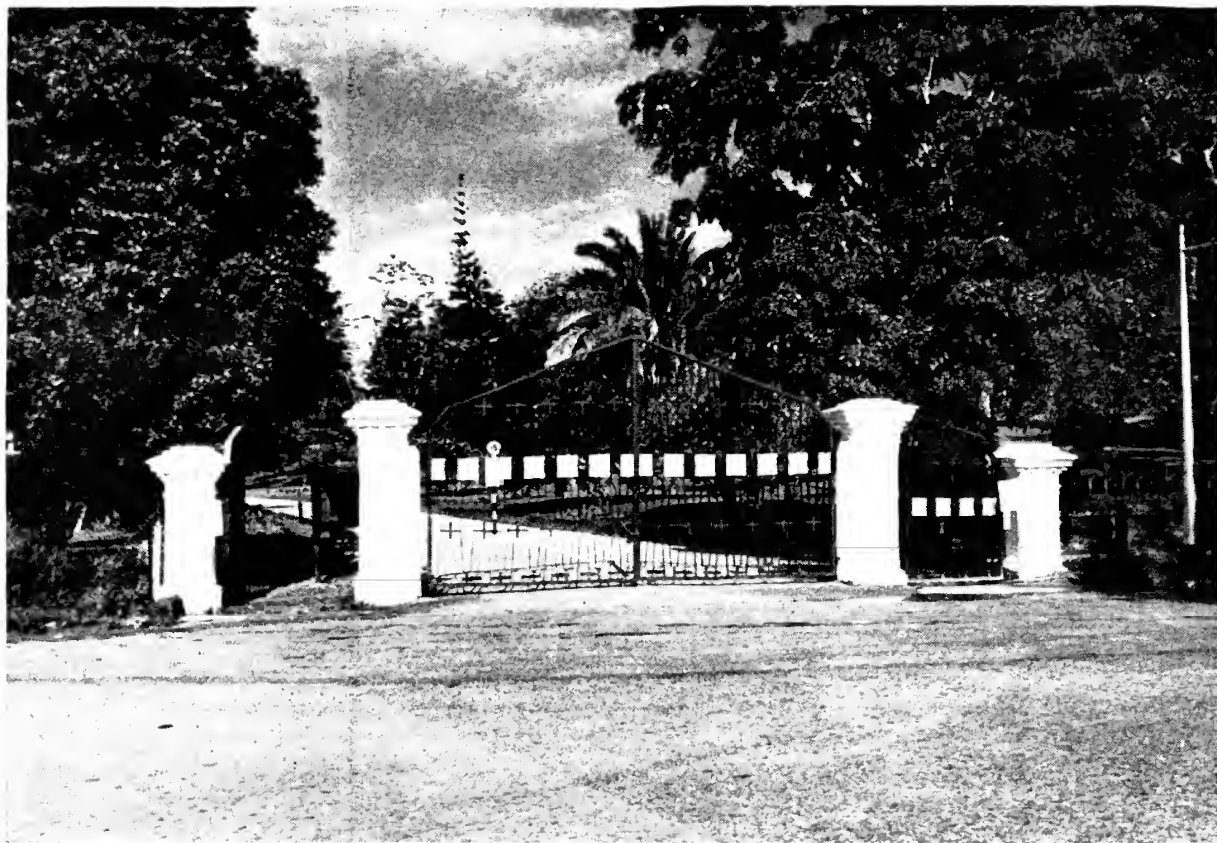


Plate 1. New Gates erected January 1964: one pair road gates and two side pedestrian gates

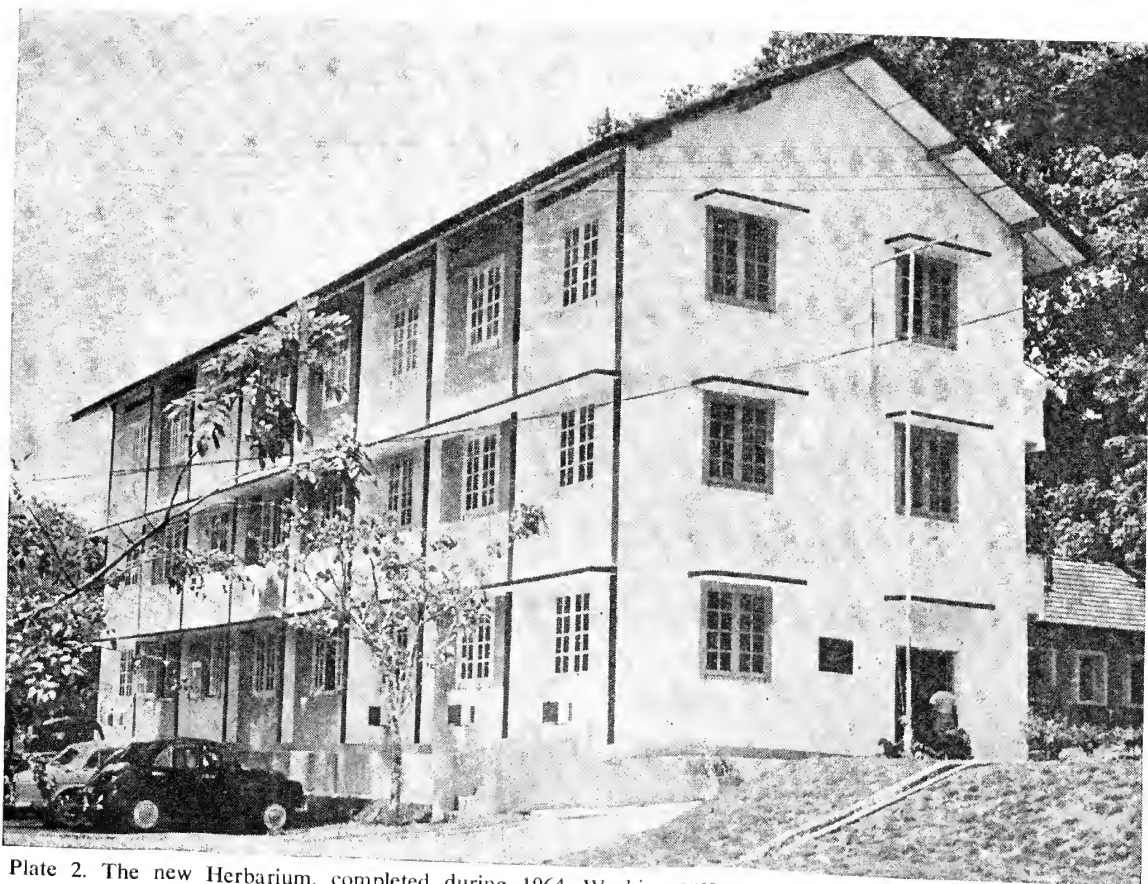


Plate 2. The new Herbarium, completed during 1964. Working area on ground floor; collections on the two upper floors.

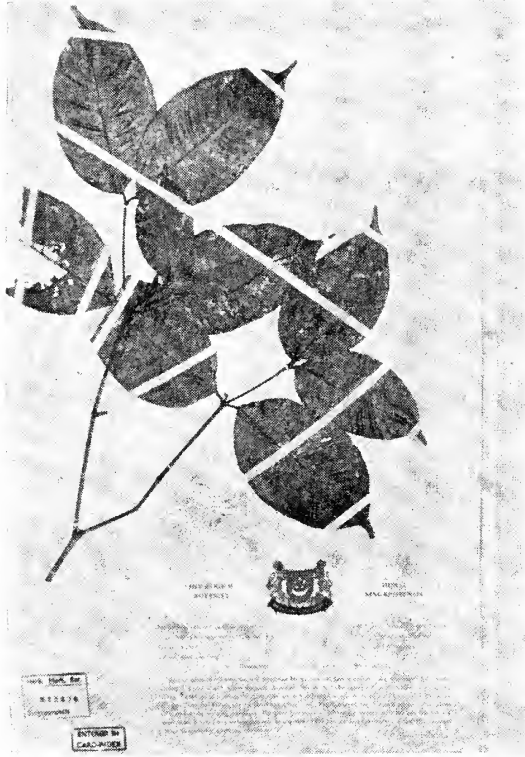


Plate 3. Commemorative specimen of *Kopsia singaporensis* Ridley var., made on the occasion of the opening of the new herbarium for laying in, duplicates of which are being distributed to collaborating herbaria throughout the world.

Plate 4. Commemorative plaque on the wall of the new building in the four official languages of the State of Singapore: left, top to bottom, Malay, English, Tamil; right, Chinese.

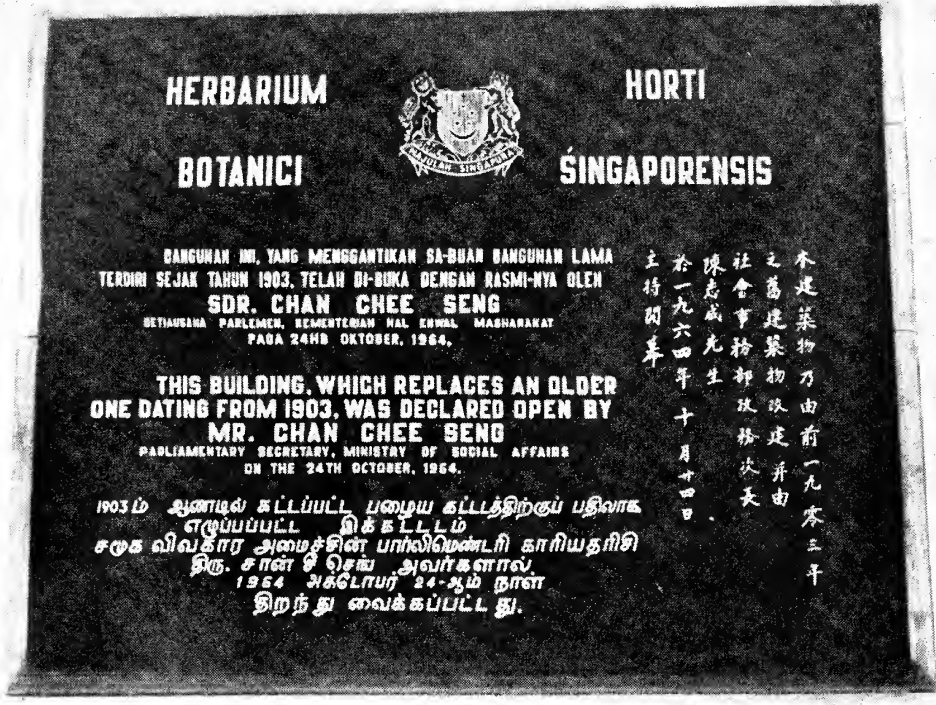




Plate 5. A recent introduction — *Maniltoa gemmifera* K. Schumm. A young seedling with striking pure white flushes of young leaves.

Printed by the Government Printing Office, Singapore
To be purchased from the Government Publications Bureau
Fullerton Building (Ground Floor), Singapore

Price: \$1.50

(Cmd. 17 of 1967)



1965

ANNUAL REPORT

BOTANIC
GARDENS

12/123



REPUBLIC OF SINGAPORE

ANNUAL REPORT
OF
THE BOTANIC GARDENS
1965

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ADMINISTRATION

I. FUNCTION

To conduct research into the regional flora and to provide a taxonomic service in support of technological activities concerning Malaysian plant life: to conduct research into tropical horticulture.

II. STAFF

2. There has been no change in establishment. The Director was away on 144 days overseas leave, February to July during which time Dr. Chew Wee-Lek, Botanist, was Acting Director. The post of Laboratory Assistant (Lower Division), vacant since 1st June, 1964, was at last filled on 20th September, 1965 by promotion within the Botanic Gardens service. Such a prolonged vacancy on the staff is a nuisance, and the recruitment procedure required is unnecessarily ponderous.

III. LABOUR

3. The Gardens labour force started the year at a strength of 81 on Category A, and 8 on Category B terms, and at the end of the year was 86 and 5 respectively in each category. Health was good, and the year passed without any notable incident. Istana Negara Domain labour force averaged 59 employees throughout the year, with no change in strength from the previous year. (But see also paras. 12 and 13.) Labourers employed in the Nature Reserves numbered 9 (7 at Bukit Timah, 2 at Kranji) as in previous year.

IV. WATCHMEN

4. The strength of watchmen remained at 18 throughout the year. Nine were employed on monthly terms, and nine on daily terms. One watchman was suspended from duty pending an inquiry into his cutting of firewood in the Gardens. All other watchmen gave good and conscientious service. (See also Botanic Gardens Ordinance, paras. 10 and 11.)

V. STUDY AWARDS TO STAFF

5. Miss Chang Kiaw Lan, Botanist, who was awarded a scholarship by the United Kingdom Government under the Commonwealth Scholarship and Fellowship Scheme at Cambridge University commencing in October 1962, continued her studies till 21st September, 1965 when she returned to duty. She completed her course with credit and she gained the Doctor of Philosophy degree of the University. This Department acknowledges with gratitude the assistance afforded by the British Government and the Cambridge University authorities, Professor Harry Godwin, Professor of Botany, and Mr. E. J. H. Corner, Reader in Botany (now Professor of Tropical Botany of Cambridge University) who was her Director of Studies.

VI. TECHNICAL ASSISTANCE SCHEMES

6. As usual, departmental facilities were made available to trainees from overseas and from other local organisations.

(1) *Colombo Plan Technical Co-operation Scheme*

Under this scheme the Department offered in 1965:

Two Senior Fellowships in Taxonomy;

Two Senior Fellowships in Ecology;

Six Junior Fellowships in Horticulture.

Mr. Munir Ahmad abid Chaudhury of the Department of Botany, University of Sind, West Pakistan, completed with much credit a two-year study under a Senior Fellowship in Taxonomy and returned to Pakistan on 1st December, 1965. Mr. Mohamed Ismail came on 29th January, 1965 from Dacca, East Pakistan, on a Senior Fellowship in Ecology and left on 15th June, 1965. Mr. Montien Srisuko of the Royal Thai Forest Department arrived on 9th November, 1965 to take up a Senior Fellowship in Taxonomy. See para. 16 for details of the work undertaken by the above trainees.

(2) *Rehabilitation and Retraining Scheme*

Seven trainees were accepted from the Social Welfare Department for putting through a six-month course in general gardening. Most of these trainees are cured tuberculosis cases. Three completed their training and one of these who was found to be a really competent "green finger" was absorbed into the Gardens Service. Three others continued their course, while one trainee's course was terminated after two weeks trial.

(3) *Other schemes*

Two employees of the Water Department of the Public Utilities Board were given a three-month course in general gardening. Two agricultural subordinates were sent by the Brunei Government and were put through a three-month course in horticulture, 1st October to 31st December.

VII. WORKS AND BUILDINGS

7. The Gardens perimeter fencing, begun in 1964 (see Annual Report 1964, para. 12), was completed by the Public Works Department. The heavily wooded stretches of Gardens boundary along lengths of the Cluny Road and Tyersall Avenue frontages presented difficulties of alignment of the fence without destruction of trees. The boundary edges, because of light and space were especially thick with trees, so that the fence on these stretches has been set back up to five yards. The two hundred yards length between the Main Gate and the Office Gate, which has a brick wall, now badly leaning, and a wrought iron top apron is the only portion of the perimeter still needing attention, and this is due for renovation in 1966.

8. The Public Works Department completed the walling of the Lake, and constructed a new tea kiosk on Lawn H. The kiosk will be brought into use early in 1966. The P.W.D. also patched the surface of Office Ring Road and completely resurfaced about 300 yards of roadway in Lawn T. New piping was supplied to the Gardens internal supply system. The Public Works Department also put up a steel frame for climbing plants at the eastern end of the main plant house on Lawn L, and installed an electric fountain in the lily pond in the central quadrangle of this area.

9. By Gardens' resources, a new chain-link fence was put up round the pump house by the Lake, and another 500 ft. in length between Lawns T and X. A large orchid house 50 ft. x 58 ft., was erected in the last remaining vacant corner of the orchid nursery.

VIII. BOTANIC GARDENS ORDINANCE AND BYLAWS

10. Provisions of the ordinance and administration of the bylaws (Botanic Gardens Rules, 1958) worked satisfactorily. No major transgressions of the bylaws occurred, except in the case of motor traffic within the Gardens. Drivers committed 597 reported offences. The Traffic Police, however, ran into technical difficulties with the Police Traffic Regulations which made prosecution not impossible, but procedurally cumbersome so that prosecutions ceased by mid-year. Traffic in the Gardens has got quite out-of-hand. Indeed, it is not only out-of-hand, but also out of place. The Gardens should be where people may come to enjoy the quietness and beauty without the nuisances of fumes and noise and the dangers of the city traffic. Few of the world's major botanic gardens admit traffic on the completely unrestricted scale as is permitted here. The Gardens watchmen have progressively become traffic wardens instead of watchmen. Accidents occur. People, children and adult, have been hit. Cars are driven into the roadside drains and cause damage thereby and in their retrieval. Cars are parked on the grass. Cars are parked against white centre lines causing obstruction. Drivers ignore No Entry signs. This situation cannot be allowed to continue, and discussions with the Police were well advanced by the end of the year towards the total exclusion of all vehicular traffic from the Gardens. An enormous benefit in amenity value will follow since quite 80 per cent of the Gardens visitors enter on foot.

11. A number of petty malingerers were apprehended by watchmen and brought to the office where they were reprimanded without further action. Mostly they were children trying to catch fish in the Lake or to take cuttings or seeds. "Peeping Toms" are a minor pest, and are regularly moved on. One watchman was commended by the Police for his help in catching a group of hooligans who were robbing young children of their Chinese New Year "ang pow" money.

IX. ISTANA NEGARA DOMAIN

12. Changes in administration occurred during the year. From 1st January all staff employed in the Domain became personal servants of the Head of State, and all expenditure on personal emoluments, annually recurrent and special were consolidated under one head. This resulted in the removal of votes for the horticultural upkeep of the Domain from the Botanic Gardens control to that of the Istana Negara Office, though in fact the Director of Botanic Gardens was nominated Approving Officer. This process was carried further to its logical conclusion when, at the end of the year, the Director of Botanic Gardens ceased to have any further administrative or executive responsibility within the Domain. A Superintendent, Mr. Lim Yong Peng, was appointed towards the end of the year who took over the running of the horticultural work with effect from 1st January, 1966.

13. Supervision of the Domain during the history of its existence has been in and out of the hands of the Director of Gardens, and it is topical at this juncture to record the past responsibilities. The Grounds were created some time in the 1850's or earlier. The oldest of the houses in the Domain is that now called Sri Temasek, built originally for the Colonial Secretary. Government House, now the Istana, was built about 1868, and became the official residence of the Governor. The upkeep of the Grounds was supervised first, presumably (there is no record in the Botanic Gardens archives), by the Colonial Engineer, and then, when Government House came into use, by the Aide-de-Camp to the Governor, with the following changes:

up to 1881 under the Aide-de-Camp.

1882-1886 under the Superintendent of the Botanic Gardens.

1887-1894 under the Aide-de-Camp.

1895-1903 under the Director of Botanic Gardens.

1904-October 1911 under the Aide-de-Camp.

November 1911-December 1965 under the Director of Botanic Gardens, but on 1st January 1914 a Committee of Management was formed composed of the A.D.C. to the Governor and the Director of Botanic Gardens. There is no record of how long-lived was the formal life of this Committee, but in fact the Director maintained administrative and executive control throughout till December 1965, acting latterly in consultation with, and receiving instructions from the Governor and later the Head of State, through the A.D.C.

January 1966 — under the Personal Secretary to the President.

X. VISITORS

14. The Botanic Gardens were honoured by a visit by H.R.H. the Sultan of Trengganu, Timbalan Agong of the Federation of Malaysia, and H.R.H. the Sultanah of Trengganu on 23rd March. Inche Othman Wok, Minister for Social Affairs, and Mr. E. W. Barker, Minister for Law, also visited the Gardens in March. Mr. Ong Kee Hui, President, Kuching Municipal Council, paid two visits, on 12th February and 1st November. His Excellency, Mr. Hiroshi Kuroki, Governor of Miyazaki Prefecture, Japan, paid a visit on 15th October, and a party of Japanese Parliamentarians representing the Special Committee for Overseas Economic Co-operation of the Liberal Democratic Party in Japan came to the Gardens on 7th October.

15. Many eminent men of science and leaders of business concerned with biological products called during the year including:

Sir George Taylor: Director, Royal Botanic Gardens, Kew.

Professor Harry Godwin: Professor of Botany, Cambridge University.

Mr. John Corner: Professor of Tropical Botany, Cambridge University.

Dr. Duncan Poore: Commonwealth Forestry Institute Oxford University, lately Professor of Botany, University of Malaya.

Professor John S. Turner: Professor of Botany, University of Melbourne, Australia.

Professor Maxwell Doty: Professor of Botany, University of Hawaii.

Dr. J. W. Fairbairn: Pharmacognosist, University of London.

Mr. N. R. Pellicani: Vice-President, Marine Colloids, Inc., Maine, U.S.A.

Professor P. Maheshwari: Professor of Botany, University of Delhi, India.

Dr. Shigayasu Akai: Professor of Plant Pathology, Kyoto University, Japan.

Dr. Ross G. Robbins: Forest Ecologist, Australian National University, Canberra.

Mr. Dusit Banijsatana: Director-General, Royal Forest Department, Thailand.

Mr. Lennart Mattsson: Director, U.N.E.S.C.O. Southeast Asia Regional Centre for Science and Technology.

16. With the herbarium reconstructed and in full use, working facilities were again available for visiting biologists. The following made use of them:

Dr. P. S. Ashton: Forest Botanist, Kuching. (Forest Botany)

Dr. Garrett Evans: Department of Botany, University of Malaya. (Ecology)

Professor Volkmar Vareshi: Department of Ecology, University of Caracas, Venezuela. (Ecology — life forms)

Mr. John O. Ellefson: Department of Anthropology, University of California, U.S.A. (Habits of gibbons and Kera monkeys)

Mrs. Judith Ellefson: Department of Anthropology, University of California, U.S.A. (means of communication between *Macacus irus*)

Professor J. S. Canright: Arizona State University, U.S.A. (Anonaceae)

Mr. Ronald W. Paine: Entomologist, U.N./South Pacific Commission Rhinoceros Beetle Project Western Samoa. (Coconut beetles)

Dr. T. C. Whitmore: Botanist, Forest Research Institute, Kepong. (Forest Botany)

Mr. Montien Srisuko: Royal Department of Forests, Bangkok. (Taxonomy of *Lagerstroemia* on a Colombo Plan Fellowship)

Mr. Munir Ahmad abid Chaudhury: Department of Botany, University of Sind, West Pakistan. (Taxonomy of Verbenaceae on a Colombo Plan Fellowship)

Mr. Mohamed Ismail: University of Dacca, East Pakistan. (Ecology of mangrove on a Colombo Plan Fellowship)

Dr. J. A. R. Anderson: Forest Botanist, Forest Department, Kuching. (Forest Botany)

Mr. John Palmer: Botanist, Dunlop Research Centre, Batang Malaka, Negri Sembilan. (Palms)

Mr. John Carrick: Botanist, Department of Chemistry, University of Malaya. (Phytochemical Survey)

17. Facilities of the Gardens, herbarium and library were as usual made freely available to members of the staff and sponsored students of the Universities of Singapore and Malaya, and to other official organisations local and overseas. The usual very large numbers of casual visitors came daily to the Gardens.

XI. CONCERTS

18. The Police Band performed once a month on a Sunday evening from January to November. December's concert had to be cancelled because of rain. The Commissioner of Police, the Police Bandmaster and the Bandsmen are sincerely thanked for the concerts given.

XII. LIBRARY

19. The library has remained in very cramped and unsatisfactory accommodation. This has curtailed or completely frustrated certain aspects of the Gardens proper functioning. This is the tenth annual report in succession in which the totally improper provision for library accommodation has been recorded. This deplorable situation becomes worse each year as new literature is acquired, and for long it has been very difficult, even impossible to locate the whereabouts of certain specific items of literature. Books deteriorate under such congestion of storage, and the collection of literature that is without equal in Asia for its research value is in danger of losing in utility. A library building is entered in Development Estimates 1966/67, but this is a need foreseen in 1952 for execution in 1957, and is very long overdue. It is not yet known whether this item of development will eventually gain sanction and be constructed.

20. The library accession register showed 8,875 bound volumes in the collection. Binding is very much in arrears owing to lack of funds. The price of books and periodicals continues to rise each year and it is proving very difficult to purchase the requisite literature necessary for our work. Exchange agreements exist with 290 addresses for our *Gardens' Bulletin, Singapore*.

XIII. PUBLICATIONS

21. *Flora of Malaya*, vol. 1, *Orchids*, 3rd Edition was published incorporating amendments by the author. It is unfortunately not possible to record any progress with volume 2, *Ferns*, and volume 3, *Grasses*, referred to in the Report for 1964.

22. The parts of *Gardens' Bulletin*, volume 21 were brought out with the following papers:

Part 1. Corner, E. J. H.: Checklist of *Ficus* in Asia and Australasia.

Part 2. Allen, B. M.: Malayan Fern Notes.

Chew, W-L.: *Laportea* and allied Genera (Urticaceae).

Gilliland, H. B.: Further notes on the Grasses of the Malay Peninsula, II.

Keng, Hsuan: Report on an abnormal ovulate strobilus of *Gnetum gnemon*, L.

Munir, Ahmad abid: A revision of *Petraeovitex* (Verbenaceae).

23. Mr. A. G. Alphonso, Curator, published a paper on 'Cymbidium roseum' in the *Malayan Orchid Review*, 8 (2), December 1965, and Mr. Alphonso and Mr. Bajuri regularly supplied new hybrid descriptions for publication in this periodical.

24. The revenue from the sale of publications prepared by the Department and published by Government amounted to \$9,408.

25. It is with much satisfaction that it is possible to record action towards reprinting *A Dictionary of the Economic Products of the Malay Peninsula* by the late I. H. Burkill, Director of Botanic Gardens, Straits Settlements, 1912-25. This work became unobtainable in 1948 except at an

exorbitant price for secondhand copies, and anyone seeking a copy inevitably made inquiry to this Department. Recommendation initiated by the Botanic Gardens to reprint, after prolonged deliberation, found acceptance by the Federation of Malaysia Government, and this 'classic' for any tropical plant products technologist will again soon be available.

XIV. AGRICULTURAL PESTS SUPERVISORY COMMITTEE

26. The Director was a member throughout the year.

XV. UNIVERSITY OF SINGAPORE COURT

27. Mr. H. M. Burkill, Director, represented the Botanic Gardens on the University Court as Government's nominee. Dr. Chew Wee-Lek, Botanist (Keeper of the Herbarium) was appointed to the Court as the Court's own electee.

XVI. COMMONWEALTH WAR GRAVES COMMISSION

28. The Director continued to be the Commission's representative in Singapore, and was responsible for the maintenance of the war graves cemetery at Kranji under instructions from the Commission's Eastern Region Headquarters at New Delhi. Mr. Lam Hin Cheng, Curator, was in executive charge. Funds for the maintenance of the Kranji Cemetery are provided by the Commission. Other information may be found in the Commission's own reports.

XVII. NATURE RESERVES

29. There were changes in the appointing authority of Trustees of the Board consequent on the absorption of the City Council and Rural Board into the general government machinery, and changes within government of ministerial portfolios. During the year the Board was constituted as follows:

Appointed by the President (up to 22nd December, 1965 by the Yang di-Pertuan Negara)

1. Mr. Tan Jake Hooi.
2. *vacant*.

Appointed by the Minister for Culture and Social Affairs

3. Mr. Poh Soo Jin, with effect from 14th September, 1965.
4. Mr. Kiat Jun Ngui, with effect from 29th September, 1965.
5. Dr. T. P. Paran, with effect from 16th February, 1965.
6. Professor J. L. Harrison, with effect from 16th February, 1965.

30. There was no change to Nature Reserves boundaries during the year. Vandalism continues in the Bukit Timah reserve. South View Hut was burnt down late in the year. Map holders have been so frequently broken, that no further repairs are being effected. It is virtually impossible to catch the offenders *in dilecto flagrante*. Police co-operation is generously given but the odds are too slender.

XVIII. METEOROLOGICAL RECORDS

31. The swing of much above average and much below average rainfall continues. Unusually dry 1963 (67 inches) was followed by unusually wet 1964 (122 inches) and a relatively dry 1965 (78 inches). The Bukit Timah recording station again registered more rainfall than at the Gardens (83 inches against 78 inches). January, the wettest month over the previous 51 years with an average rainfall of 11.05 inches, was easily the driest month of the year with under one inch of rain recorded at the Gardens office and similarly low records at the other recording points. For details see Appendices II to V.

XIX. CONFERENCES

32. Dr. Chew Wee-Lek attended the opening of the new Lae Herbarium by Sir George Taylor, Director of the Royal Botanic Gardens, Kew, and thereafter the symposium organised by U.N.E.S.C.O. on Herbarium Methods, in Lae, New Guinea from 9th to 18th April, 1965. On his return journey, he stopped briefly at Brisbane to visit the Queensland Herbarium, and at Sydney the New South Wales Herbarium.

33. Dr. Chew also attended the U.N.E.S.C.O.-sponsored Symposium on Conservation of Nature and Natural Resources held in Bangkok 27th November to 9th December, at which he presented a paper on "Need for Conservation of Habitats".

BOTANICAL RESEARCH

XX. PLANT COLLECTING

34. Field work in major collecting expeditions was very much limited by the necessity of retaining all hands at headquarters in order to attack the arrears of curatorial work arising through the years of difficult working conditions in the old herbarium, and the relief of these by herbarium reconstruction carried out in 1964. (Annual Report 1964, para. 10.) Only one expedition of over a week was undertaken by the herbarium staff when the Herbarium Assistant and a collector joined forces with two members of the Horticultural Division for a joint botanical-horticultural foray into a number of localities in Perak. Three expeditions of lesser duration were also undertaken — two by the Director, to the coastal area Negri Sembilan and northern Malacca between Cape Rachado (Tanjong Tuan) and Tanjong Bidarah in February, and to the Bako National Park Sarawak in September, and one by Mr. Hardial Singh, Botanist, in another joint botanical-horticultural expedition to Penang Hill and to Maxwell's Hill, Perak, in early March. Details of these are given in the Appendix VI. Many single day trips were made into the Singapore Nature Reserves, elsewhere on Singapore Island and into South Johore.

35. It is convenient to record here the collecting work of the Horticultural Division to obtain living plants for cultivation in the Gardens. Besides the expeditions of early March and December recorded above, the Horticultural Division staff undertook two other major expeditions to Trengganu and Kelantan, and to Perlis, Penang, Perak and Pahang. Details of these are also recorded in Appendix VI.

XXI. EXCHANGE AND ACQUISITION

36. With the reconstructed herbarium in full use, the arrears of duplicate despatch were tackled, and a larger number of duplicates were distributed than in previous years. Against this a larger number of duplicates than usual was also received. The principal collections received were those of Dr. T. C. Whitmore lately of the Forest Department, Honiara, Solomon Islands, numbering 4,000 specimens. The Singapore Herbarium has a growing and important quantity of material from eastern Malesia, and the Solomons collections are a valuable addition. The Forest Department, Sarawak, has continued to be a major supplier with 1,669 specimens. Remarkably 'confrontation' notwithstanding, Bogor has also contributed valuably to the Herbarium with 966 numbers. Details of receipts and despatches are given in Appendix VII. The mounters prepared 8,754 specimens, and 5,782 were indexed and laid in the herbarium.

XXII. LOANS OF HERBARIUM MATERIAL

37. Activity in this section has also increased with the herbarium being in full use. Though additional material was sent out on loan early in 1964 in view of the temporary close-down of facilities, requests for loans continued to come in and an increased quantity of material was sent out: 5,899 specimens to 13 institutions. The greatest part of this material went to *Flora Malesiana* monographers.

38. A very large amount of material was received on loan for the study of staff members and for Colombo Plan Fellows studying here. The main part of the loans was Urticaceae for Dr. Chew and Verbenaceae for Mr. Munir Ahmad.

XXIII. TAXONOMY

39. Dr. Chew Wee-Lek, Keeper of the Herbarium, has continued his work on a world-wide revision of the Urticaceae, facilitated by the very generous response of other herbaria in the loan of their material for his study. Mr. Hardial Singh, Botanist completed a study of sclereids in the leaves of 28 species of Araceae, and a similar study of sclereids in the leaves of the 31 species of Malesian *Fagraea* has revealed interesting support for current taxonomic concepts based on morphology. Mr. Hardial Singh has commenced a taxonomic study of the aroid genus *Anadendron*. Dr. Chang Kiaw Lan, whose doctoral dissertation was on the taxonomy of the fungal genus *Lentinus*, has continued her studies of this genus and closely allied ones since her

return from Cambridge. This work has a vital bearing on edible mushrooms and the possibility of establishing mushroom culture in Singapore and Malaya. At present there is a large import of 'Shiitake' (*Lentinus adodes*) from Japan, and this species is known to occur naturally at Cameron Highlands. The Director continued his study of marine algae, and has extended his collecting to Trentepohliaceae with a view to study at a later date.

40. Two past members of the staff, Dr. Furtado and Mr. Sinclair have continued to work in the Herbarium in a voluntary capacity. Mr. Sinclair has followed his revision of *Myristica*, the text of which now lies with the Government Printer for issue in the *Gardens' Bulletin*, with a start on the genus *Horsfieldia*. Dr. Furtado has carried out many surveys of sections of the herbarium holding checking for faulty determinations. He has taken under his direction the Colombo Plan Fellows on taxonomy awards. His authoritative knowledge of the rules of nomenclature and a literary fluency in Latin and many European languages are a great asset for this, and the Department is much indebted to him for his help and interest.

41. Mr. Munir Ahmad, of the University of Sind, in Singapore since December 1963 on a Singapore Government Colombo Plan Fellowship, completed his work on the four genera of Verbenaceae. Revisions of *Congea*, *Symphorema* and *Sphenodesme* were finished during the year. These will be published in *The Gardens' Bulletin*.

HORTICULTURE

XXIV. GARDENS MAINTENANCE

42. The Gardens were well maintained throughout the year, and the duties of the nurserymen and specialist workers were satisfactorily carried out. The work of the 'general gang' was hampered, as reported in last year's report, by having to undertake works previously outside its province. The labour force was increased by two, but this is inadequate to cope with present requirements.

43. Specialist collections were maintained and were added to, especially the fern collection which was expanded by plants obtained by officers on field work. Several new bougainvillea varieties were added to the collection, and the bougainvilleas on Lawn L were supplied with iron frames, the wood frames being discarded. The bank between the main office and Office Ring Road which since the death of the *Gardenia carinata* tree some six years ago has given difficulty in making attractive, was laid down to a turf of *Zoysia japonica*. Previous attempts to establish bushes of varieties of *Mussaenda philippica* on this slope were unsuccessful. Hedges, an essential feature of any form of gardening, have in the past five years been emphasised, and during 1965 additional examples were planted near the office, using *Bougainvillea sandariana*, *Malpighia coccigera*, *Ehretia microphylla* and *Bixa orellana*.

44. Lightning caused a number of tree casualties during the year. The whole crown of a 120 ft. high *Anisoptera magistocarpa* was blown off, the main trunk being shattered at about 80 ft. high from the ground by one direct strike on 16th August, 1965. A large tembusu (*Fagraea fragrans*) on Lawn J was also struck and the trunk split — see Plate I. All the leaves had dropped from it in three days, but another tembusu on Lawn T, by the Director's house, which was similarly struck in 1963, lingered with curious results. Bifurcate from about 15 feet height with two main trunks, the one trunk that was struck had a narrow strip of bark seared off along its length. There was no apparent ill effect for over 12 months, then the twigs of the damaged trunk began to show die back while the twigs of the undamaged trunk remained healthy. This continued till 30 months after being struck the damaged trunk had less than a quarter of the density of canopy that was on the other trunk. As branches were then becoming dead, the tree was removed.

45. With the lowering of the water in the Lake to permit the walling to be done, there was an interesting reappearance of *Nelumbium* — a repetition of the outbreak of 1961 after the water had similarly been lowered. (See Annual Report, 1961, paras. 44-46.) There is no doubt that seed of this species retains a high degree of viability for a long time.

46. Pests generally remained as the usual few: monkeys (*Macacus irus*), Rhinoceros beetle (*Orcytes rhinoceros*) and the Red Stripe Weevil (*Rhynchophorus ferrugineus*), but continuous prophylactic treatment is limiting the depredations of the insects. Several cases of monkey bite were recorded and one vicious male was shot. It must be recorded that this monkey had been somebody's pet for it had a wire round its neck, and had illegally been let loose in the Gardens. Animals released in this manner are not accepted by the residential troops, and if they are not mauled and driven off, they lead an outcast's existence constantly attacked and harassed by the others with whom it would wish to associate. Release of pets in the Gardens, besides violating the Gardens Rules, is plainly an act of cruelty.

XXV. HORTICULTURAL EXCHANGE

47. Seed and plant exchanges continued to be an important aspect of the Horticultural Division's activity. One seed collector was kept fully occupied. Exchanging institutions are listed in Appendices VIII and IX.

XXVI. ISTANA DOMAIN

48. The grounds were maintained in a satisfactory condition throughout the year. A number of small changes was made to the golf course, and the eradication campaign against *Elephantopus scaber* which was begun in 1960 on the golf course (see Annual Reports: 1960 para. 72; 1961 para. 63; 1962 para. 45) was extended to the out-lying parts of the Domain. Assistance of Works Brigade is gratefully acknowledged in undertaking this.

49. Pot plants, cut flowers and fresh vegetables were regularly made available for use at functions in the Domain, and pot plant decoration was supplied for the opening of Parliament. The high standard of horticulture achieved by the Istana staff is substantiated by the award of first prize at the Singapore Gardening Society 1965 Show to a large landscape group put up by the Istana of which large flowered zinnias and chrysanthemums were the centrepiece.

50. By kind permission of the President, the grounds of the Istana were opened to the public on New Year's Day (1st January), Chinese New Year's Day (2nd February), Hari Raya Puasa (3rd February), Labour Day (1st May) and Deepavali (23rd October).

XXVII. ORCHID RESEARCH

51. During the year 104 hybrid pods were harvested; 18 pods of known parentage were accepted from Singapore growers, 4 from the Federation of Malaya and 37 from England. Of these 163 pods, 113 gave viable seeds. There were more than 2,300 flasks in constant use culturing seedlings, and seedlings of 702 flasks were taken out for potting. The flask culture medium used, as previously, is based on Dr. Vacin's formula plus 10 per cent young coconut water, banana pulp and peptone. 1,685 maturing seedlings were removed from the seedling houses to be grown in the open and repotted into bigger pots, and 30 new and old beds were dug or redug for planting and replanting.

52. As usual more than 100 flowering orchid plants were put out on display for the public, and changed once every week.

53. The following hybrid families were named and registered to mark the state visit of Their Highnesses the Sultan and Sultanah of Trengganu to the Botanic Gardens on 23rd March:

BGS. 2675 — *Vanda Intan Trengganu* (*Vanda* Norbert Alphonso x *Vanda Sanderiana*).

BGS. 3002 — *Dendrobium Ismail Trengganu* (*Den.* Tumphal x *Den. schulleri*).

The following were also registered:

BGS. 1796 — *Aranda Wee Huck Lay* (*Arachnis* Ishbel x *Vanda lamellata*).

BGS. 2268 — *Vanda Oh Teow Tee* (*Vanda* Ruby Prince x *Vanda* Caroline J. Robinson).

BGS. 2807 — *Dendrobium Ang Bee Neo* (*Den.* Gillian x *Den taurinum*).

BGS. 3004 — *Dendrobium Lee Ewe Boon* (*Den.* Ellen Harris x *Den. schulleri*).

BGS. 3116 — *Dendrobium Lim Swee Lim* (*Den.* Tan Teo Kim x *Den. Guadalcanal*).

BGS. 3222 — *Vanda Delminda* (*Vanda* Ruby Prince x *Vanda* Eisenhower).

BGS. 3371 — *Dendrobium Tess Kleinman* (*Den.* Neo Hawaii x *Den. Hawaiian Beauty*).

BGS. 3630 — *Sappanara Ahmad Zahab* (*Arachnopsis* Eric Holttum x *Renanthera storiei*).

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54. During the year an Award of Merit (M.O.S.) was given to a hybrid No. BGS. 1921 — *Cypridium Shireen* 'Molek'. This plant also won three Special Awards, John Laycock Challenge Cup, Vivian Bath Cup and George Chan Challenge Cup at the Malaysian Orchid Society Show held on 24th September, 1965. Penang Gardening Society Challenge Cup for the best species was given to *Habenaria suzannae*, grown by the Botanic Gardens.

EXTENSION WORK

XXVIII. SUPPLY OF PLANTING MATERIAL

55. The sale of planting material of plants other than orchids totalled \$4,139.80. The amount of material involved was 14,510 seedlings, cuttings, etc. Orchid planting material sales came to \$15,726, 6,056 plants being disposed of. Total sales were \$19,865.80, an increase of \$1,832.30 over the sales in 1964.

56. The Gardens continued to supply planting material free of charge to Government Departments, charitable institutions, state-aided schools and other official and quasi-official organisations. To these 6,260 plants were provided, nearly one half being to schools. The Gardens supplied materials for class work and examinations to schools and the Ministry of Education. The loan of potted plants for decoration at official or charitable functions amounted to 4,213 pots, an appreciable increase over the loans of 1964.

XXIX. ADVISORY WORK

57. Tree planting schemes were prepared for the Public Works Department for the following new schools:

- (1) Primary School, Pulau Merlimau.
- (2) Kim Seng Road Technical School.
- (3) Jalan Turi Secondary Vocational School.
- (4) Jalan Kaki Bukit Secondary Academic School.
- (5) Upper Aljunied Road Secondary Technical School.
- (6) Still Road Secondary Academic School.
- (7) Alkaff Gardens Secondary Academic School.
- (8) Alexandra-Delta Roads Secondary Academic School.
- (9) Jubilee-West Coast Roads, 8¼ m.s. Primary School.
- (10) Yio Chu Kang Road Primary School.
- (11) Lim Chu Kang Road, 19 m.s., School.
- (12) Prince Charles Crescent School.
- (13) Jalan Teck Whye School.
- (14) Jalan Lama, 10¼ m.s. Jurong Road School.
- (15) Resettlement Area 5-A Primary School.
- (16) Farrer Road Primary School.
- (17) Haig-Dunman Roads extension to existing school.



Plate I. Lightning damage to a tree of Tembusu (*Fagraea fragrans*). See para. 44.



Plate II. *Dendrobium Ismail Trengganu* (*D. Tumphal* x *D. Schulleri*), BGS 3002. A free flowering hybrid raised by the Botanic Gardens, and named and registered to mark the visit of H. H. The Sultan of Trengganu to the Botanic Gardens on 23rd March 1965. See para. 53.

58. During the past five years the Department has advised 164 schools on planting schemes, supplied materials for planting and advice. In a distressing number of instances, headmasters have come back for further material because what had been planted had been allowed to die. The number of schools with compounds and playing fields will continue to increase, and it is evident that the Ministry of Education will have to organise a body of its own to give guidance to schools on the development and upkeep of compounds and playing fields, and perhaps venture into the providing of vocational and technical training in simple horticulture. The current practice of coming to the Botanic Gardens for advice and the recurrent requests for replacement planting material is becoming too great for the Gardens resources. While the Department will continue to do what it can, appreciably better service to schools could be given by a horticultural section of the Ministry of Education which could look to the Gardens for assistance and with which the Gardens would only deal.

59. Planting schemes and/or horticultural advice were also given to:

- (1) Singapore Conference Hall — Trade Union House, Shenton Way.
- (2) Superintendent of Prisons for the Medium Security Prison, Moon Crescent, Changi.
- (3) Work Brigade Youth Leadership Training Centre, Buona Vista Road.
- (4) Kim Chuan Sewerage Treatment Station.
- (5) Land Office re Y.W.C.A. Hostel, Fort Canning.
- (6) Nee Soon Community Centre.
- (7) General Hospital.
- (8) Director of Posts re compounds of new posts offices.
- (9) P.W.D. Roads Division on the establishment of a nursery to raise tree seedlings.
- (10) Public Health Training Centre at College Road.
- (11) Superintendent, Mount Vernon Crematoria.
- (12) Thomson Road General Hospital, new School for Nurses.
- (13) Kallang Community Centre.
- (14) Woodlands Old People's Home.
- (15) Red Cross Home, Tanah Rata.
- (16) Fort Canning Home for Girls.
- (17) Faculty of Medicine, Department of Pathology, Outram Road.
- (18) Ministry of Defence re military recreation club.

60. At the request of the Kuching Municipality the Director paid a four-day visit in September to Kuching to report on the feasibility of turning the old reservoir reserve into a park. With the spread of Kuching, this land is now near the centre of the urban area, and its use for this purpose would constitute a very desirable additional open space for the town's population. Recommendations for the use of the land in this manner, a general plan of a tentative lay out and for the carrying out of a number of necessary works were put up for the Municipal Council's consideration.

XXX. EXHIBITIONS AND SHOWS

61. The Botanic Gardens contributed extensively in exhibition material and in assistance by staff members to the Singapore Gardening Society and to the Malaysian Orchid Society at their respective annual shows. Large non-competitive exhibits were staged. Mr. Alphonso was Show Manager and Mr. Lam Hin Cheng was Show Secretary for the former show, and Mr. Tan Kim Ho was Show Secretary for the latter. Many members of the Gardens staff were on the panel of judges of both shows.

62. After a lapse of two years, it was again possible for the Botanic Gardens to participate at the Malayan Agri-Horticultural Exhibition held in Kuala Lumpur between 29th July and 2nd August. Some 200 orchid plants were displayed in a landscape arrangement. Mr. Alphonso officiated as one of the judges at the exhibition.

63. Cut flowers were sent to the following exhibitions:

Indian Agri-Horticultural Society Show, New Delhi.

Seventh Australian Scout Jamboree, Melbourne (for the Malayan Scout Contingent).

The Gardening Club, Ipoh.

Exhibition of the Siam Society of Plant Culture, Bangkok.

Commonwealth Arts Festival Show London, two consignments.

The Victorian Orchid Club, Melbourne, Australia.

XXXI. CULTURAL SOCIETIES

64. The Department gave considerable assistance to both the Singapore Gardening Society and the Malaysian Orchid Society. Mr. A. G. Alphonso was President of both societies, and Mr. Lam Hin Cheng was a vice-President of the former. Mr. Ang Gek Choo, Mr. Bajuri bin Sappan and Mr. Tan Kim Ho were officials of the Malaysian Orchid Society. Mr. Burkill was a committee member of the Singapore Branch of the Malayan Nature Society.

STAFF OF THE BOTANIC GARDENS, 1965

Divisions I, II and technical Posts of Division III

(Date of first appointment to the Botanic Gardens Service is shown in brackets)

Appointment	Holder	Notes
Director	H. M. Burkill, M.A. (Cantab.) F.L.S. (12-11-54)	On overseas leave 20-2-65 to 11-7-65.
Botanist	Chew Wee-Lek, B.Sc. (Malaya) Ph.D. (Cantab.) (1-10-56)	Acting Director 20-2 to 11-7-65.
	Chang Kiaw Lan (Miss) B.Sc. (Malaya), Ph.D. (Cantab.) (7-7-59)	On U.K. Government Scholarship in England up to 16-9-65. Resumed duty 21-9-65.
	Hardial Singh, B.Sc. (Sing.) (1-11-63)	
	J. Sinclair, B.Sc. (Edin.) (25-3-48)	Re-engaged pensioner on contract as training replace- ment officer <i>vice</i> Miss Chang Kiaw Lan up to 18-7-65.
Curator	A. G. Alphonso (1-1-40) Lam Hin Cheng (1-7-57)	
Librarian	Tan Kim Ho, B.Sc. (Malaya) (1-4-58)	
Executive Officer	D. P. Lazaroo (11-3-63)	
Laboratory Assistant (Special Grade)	Bajuri bin Sappan (14-9-37)	
Horticultural Assistant	Ang Gek Choo (18-5-61)	
Herbarium and Museum Assistant	Md. Shah bin Haji Md. Nur (3-2-55)	
Artist	Juraimi bin Samsuri (1-9-45)	
Junior Horticultural Assistant	Aziz bin Pakiri (25-5-33) Wong Siew Hang (11-2-35)	

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1964

Reading daily at 9.30 a.m. local time at Botanic Gardens Office
from 1.1.65 to 31.12.65

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1965		Total Rainfall	Highest fall in 24 hrs.	No. of days rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.
		inches	inches		°F	°F	°F	°F	°F	°F	%
January	.. ..	0.64 (10.86) *	0.46	3	86.1	91.5	72.1	69.0	79.7	73.8	77.3
February	.. ..	7.34 (7.37)	3.24	12	84.7	93.0	73.8	71.0	80.5	76.3	82.0
March	.. ..	5.96 (8.38)	1.40	12	89.9	93.5	74.6	72.0	81.2	77.0	82.3
April	.. ..	8.26 (8.12)	2.59	13	89.1	94.0	75.1	72.0	83.0	78.5	81.4
May	.. ..	15.12 (7.52)	2.75	16	90.4	95.5	76.0	72.5	82.1	79.0	87.5
June	.. ..	7.61 (6.76)	3.80	13	89.5	94.0	75.5	71.0	81.7	78.3	85.6
July	.. ..	2.41 (6.20)	1.50	6	89.6	94.0	76.0	72.0	82.4	77.9	80.9
August	.. ..	4.59 (6.90)	0.84	18	88.5	96.5	75.3	72.5	81.5	77.4	84.1
September	.. ..	3.23 (7.37)	0.83	14	88.8	93.5	74.2	72.0	82.2	77.8	81.6
October	.. ..	10.63 (8.01)	2.37	18	88.4	96.5	74.9	71.5	82.2	78.7	85.2
November	.. ..	6.41 (10.37)	1.30	17	88.8	92.5	74.8	73.0	82.8	78.2	81.0
December	.. ..	6.19 (9.99)	2.05	16	83.6	91.5	74.6	72.9	80.9	73.7	83.5
Total	.. ..	78.39 (97.66)	3.80	158	..	..	..	..	..	..	..
Mean	.. ..	..	..	..	88.1 (31.2°C)	93.8 (34.9°C)	74.7 (23.7°C)	71.6 (22.0°C)	81.7 (27.6°C)	77.2 (25.1°C)	82.7

*Mean rainfall for the period 1914-65, 52 years.

METEOROLOGICAL REPORT
BOTANIC GARDENS, SINGAPORE, 1965

Reading daily at 8.00 a.m. local time at "Orchid Enclosure" from 1-1-65 to 31-12-65

1965	Total Rainfall	Highest fall in 24 hours	No. of days Rainfall	Mean Maximum Temperature	Highest Maximum Temperature	Mean Minimum Temperature	Lowest Minimum Temperature	Mean Temperature Dry Bulb	Mean Temperature Wet Bulb	Mean R.H.	Mean Minimum Grass Temperature	Mean Earth Temperature 4"	Mean Earth Temperature 1'	Mean Earth Temperature 4'	Mean Daily Hours of Sunshine
	ins.	ins.		°F	°F	°F	°F	°F	°F	%	°F	°F	°F	°F	
January ..	0.64	0.46	6	85.8	90.0	69.8	68.0	72.8	71.4	93.1	67.7	77.6	79.1	80.6	5.74
February ..	7.49	3.16	11	87.7	90.5	72.5	71.5	75.4	74.5	96.1	71.2	79.3	81.5	81.9	6.48
March ..	5.75	1.22	14	89.0	91.0	72.8	71.0	75.7	74.8	95.8	72.5	81.2	83.2	83.2	5.32
April ..	8.29	2.66	14	88.9	93.0	72.3	71.0	77.0	76.3	96.4	73.6	81.5	83.5	83.7	5.83
May ..	15.02	2.74	17	87.9	92.5	74.5	72.5	77.2	76.4	95.1	74.1	81.5	82.8	83.1	5.36
June ..	6.84	3.52	15	88.9	91.5	73.6	70.5	77.3	76.4	96.2	72.8	81.6	83.4	83.8	5.71
July ..	2.14	1.33	7	89.0	94.0	72.9	70.0	77.1	76.1	94.9	72.8	81.6	83.5	83.9	6.84
August ..	4.17	0.68	17	88.5	90.5	71.9	70.0	76.4	75.5	96.5	72.2	81.0	83.0	83.8	5.76
September ..	3.53	1.00	12	87.9	92.0	72.1	69.5	76.9	76.0	95.9	72.1	81.1	83.1	83.4	6.07
October ..	10.86	2.40	18	88.6	94.0	72.9	70.0	77.0	76.1	95.9	73.2	81.8	83.6	84.0	4.87
November ..	4.83	1.35	17	88.7	91.5	72.9	71.5	76.7	75.8	95.6	72.7	80.6	82.6	83.3	5.49
December ..	7.31	2.35	16	87.9	91.5	73.2	71.5	76.0	75.2	96.1	72.8	80.5	82.3	82.9	4.23
Total ..	76.87	3.52	164	..	..	..	..	..	..	..	..	..	..	..	..
Mean ..	..	..	..	88.2 (31.2°C)	91.8 (33.2°C)	72.6 (22.6°C)	70.6 (21.4°C)	76.3 (24.6°C)	75.4 (24.1°C)	95.6	72.3 (22.4°C)	80.8 (27.1°C)	82.6 (28.1°C)	82.9 (28.3°C)	5.64

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1965

Reading daily at 8.00 a.m. local time at Bukit Timah from 1-1-65 to 31-12-65

1965		Total Rainfall	Highest fall in 24 hrs.	No. of days rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	R.H.
		inches	inches		°F	°F	°F	°F	°F	°F	%
January	..	1.65	1.15	3	83.6	86.7	72.0	68.0	74.1	72.0	89.4
February	..	7.76	3.44	9	84.6	89.0	72.9	69.0	76.1	74.5	88.3
March	..	4.47	1.65	13	85.7	90.5	73.5	68.0	76.4	74.5	91.0
April	..	3.48	1.80	8	86.5	90.0	71.8	70.5	78.1	75.9	89.9
May	..	12.02	3.44	14	85.6	87.6	73.9	68.5	77.9	76.0	91.5
June	..	6.24	2.18	13	84.5	87.7	72.9	68.0	76.5	74.4	90.5
July	..	1.17	0.55	6	85.8	87.7	74.1	68.0	77.6	75.2	86.2
August	..	5.86	1.46	16	85.0	88.0	73.6	70.0	77.1	75.1	90.5
September	..	4.56	1.46	9	86.6	89.0	74.2	68.8	77.0	74.7	89.4
October	..	11.00	2.60	12	86.4	89.2	73.9	69.3	78.3	75.5	87.2
November	..	12.44	2.22	14	86.5	89.8	74.1	69.9	78.5	75.9	88.1
December	..	12.24	3.47	12	85.4	88.0	73.4	71.0	77.4	75.1	89.9
Total	..	82.89	3.44	129	..	..	..	..	..	..	..
Mean	..	..	..	..	85.5 (29.7°C)	88.6 (31.4°C)	73.4 (23.0°C)	69.1 (20.6°C)	77.1 (25.1°C)	74.9 (23.8°C)	89.3

METEOROLOGICAL REPORT

KRANJI WAR GRAVES CEMETERY

Recorded daily at 8.00 a.m.

1.1.65 to 31.12.65

Month	Total rainfall ins.	No. of days with rain	Highest fall in 24 hours ins.
January	2.15	3	1.00
February	7.95	4	3.60
March	7.60	8	2.15
April	8.80	11	1.25
May	6.32	10	2.10
June	4.00	6	1.20
July	2.60	3	1.60
August	6.05	8	1.20
September	4.96	12	1.60
October	12.16	15	1.72
November	11.55	14	3.10
December	5.63	11	1.35
Total ..	79.77	105	3.60

SUMMARY OF MAIN PLANT COLLECTING — 1965

Personnel	Date	Locality	Collections
H. M. Burkill	15 — 18 February	Cape Rachado, North Malacca Coast	85 nos. marine algae for herbarium.
Hardial Singh Ang Gek Choo	28th February — 6th March	Penang Hill Maxwell's Hill, Perak.	181 nos. general collection for herbarium 85 nos. orchids and general miscellanea for cultivation.
A. G. Alphonso Cheang Kok Choy (Supt. Penang Gardens) Sanusi bin Sarih	3 — 14th May	Trengganu, Kemaman, Pulau Perhentian, Kuala Trengganu Kelantan, Batu Melintang, Kuala Krai	12 nos. for herbarium 96 nos. for cultivation* 38 nos. for cultivation*
H. M. Burkill	17th — 21st September	Kuching and Bako National Park, Sarawak.	29 nos. marine algae and Tren- tepholia for herbarium.
A. G. Alphonso Cheang Kok Choy Sanusi bin Sarih	5th — 16th October	Kangar, Perlis Penang Hill	43 nos. for cultivation* 4 nos. for herbarium 20 nos. for cultivation*
		Teluk Anson, Bidor, Tapah, Perak.	23 nos. for cultivation*
		42-44 mile, Cameron Highlands Road, Pahang.	12 nos. for herbarium 100 nos. for cultivation*
Bajuri bin Sappan Md. Shah bin Hj. Md. Nur Sidek bin Kiah Sanusi bin Sarih	1st — 11th December	Perak, Maxwell's Hill, Gunong Hijau, Padang Rengas, Bukit Kamunting, Batu Hampar	143 nos. for herbarium 52 nos. for cultivation (orchids, ferns).

* This material is duplicated between the Singapore Botanic Gardens and the Penang Gardens.

SUMMARY OF DISTRIBUTION OF HERBARIUM MATERIAL
ON EXCHANGE AND LOAN

IAPT Code	Institution	EXCHANGE		LOAN	
		In	Out	In	Out
A	Arnold Arboretum, U.S.A.	325	947	556	106
AMD	Botanic Gardens, Amsterdam, Holland ..	—	—	9	—
R	Botanic Gardens, Berlin, Germany ..	—	226	45	—
BISH	Bishop Museum, Hawaii, U.S.A. ..	—	97	—	38
BKF	Forest Department, Bangkok, Thailand ..	12	—	21	—
BM	British Museum, Great Britain ..	—	117	128	1,109
BO	Bogor Herbarium, Indonesia ..	966	—	2,582	—
BR	Botanic Gardens, Brussels, Belgium ..	—	—	481	—
BRI	Botanic Gardens, Brisbane, Australia ..	—	141	4	—
C	Botanical Museum and Herbarium, Copenhagen, Denmark	53	735	91	—
CAL	Indian Botanic Gardens, Calcutta, India ..	—	—	99	—
CGE	Botany School, Cambridge University, England	—	—	—	91
DD	Forest Research Institute, Dehra Dun, India	—	—	44	—
E	Royal Botanic Garden, Edinburgh, Great Britain	—	9	83	15
F	Chicago Natural History Museum, U.S.A.	—	—	243	—
FI	University of Florence, Italy	—	—	174	—
G	Botanic Gardens, Geneva, Switzerland ..	—	74	—	1,361
GRO	University of Groningen, Holland ..	—	—	—	5
K	Royal Botanic Gardens, Kew, Great Britain	455	439	63	31
KEP	Forest Research Institute, Kepong, Malaysia	72	5	8	—
KLU	University of Malaya, Kuala Lumpur, Malaysia	39	—	—	221
KYO	Kyoto University, Japan	200	—	—	—
L	's Rijksherbarium, Leiden, Holland ..	—	633	320	2,844
LAE	Forest Department, Lae, New Guinea ..	293	1,619	56	—
LISC	Centro de Botanica da Junta de Investiga- coes de Ultramar, Lisbon, Portugal ..	—	—	48	—
	<i>Carried forward</i> ..	2,413	5,042	5,055	5,821

SUMMARY OF DISTRIBUTION OF HERBARIUM MATERIAL
ON EXCHANGE AND LOAN

IAPT Code	Institution	EXCHANGE		LOAN	
		In	Out	In	Out
	<i>Brought forward</i> ..	2,413	5,042	5,055	5,821
LISJC	Jardine Museo Agricola do Ultramar, Lisbon, Portugal ..	—	—	11	—
LISU	University of Lisbon, Portugal ..	—	1	5	—
M	Botanische Staatssammlung, Munich, Germany	—	57	—	—
MA	Instituto Botanico, Madrid, Spain ..	—	—	4	—
MAU	Mauritius Herbarium	—	38	—	—
MEL	National Herbarium of Victoria, Melbourne, Australia	—	—	172	—
MICH	University of Michigan, U.S.A. ..	—	51	149	—
MO	Missouri Botanical Garden, U.S.A. ..	—	—	18	14
MTJB	Botanic Gardens, Montreal, Canada ..	—	14	—	—
NBG (SAM)	National Botanic Gardens, Kirstenbosch, South Africa	—	—	29	—
NSW	National Herbarium of New South Wales, Sydney, Australia	—	—	56	—
NY	New York Botanical Garden, U.S.A. ..	—	2	472	—
P	National Museum of Natural History, Paris, France	8	15	—	—
POM	Pomona College, California, U.S.A. ..	—	—	22	—
PRC	Botanical Institute of Charles University, Prague, Czechoslovakia	—	1	49	16
PUH	University of the Philippines	—	52	—	—
RSA	Rancho Santa Ana Botanic Gardens, Cali- fornia, U.S.A.	21	—	4	—
SAN	Sabah Forest Department, Sandakan, Malaysia	5	9	17	—
SAR	Sarawak Forest Department, Kuching, Malaysia	1,669	140	—	—
SIU	Southern Illinois University, U.S.A. ..	—	—	—	48
UBC	University of British Columbia, Canada	—	24	—	—
UC	University of California, U.S.A. ..	—	16	22	—
US	Smithsonian Institution, U.S.A. ..	—	52	456	—
WRSL	Wrocklaw University, Wrocklaw, Poland ..	—	—	33	—
Z	University of Zurich, Switzerland ..	—	—	63	—
	Mrs. B. M. Allen	2	—	—	—
	Department of Fisheries, Ceylon ..	—	38	—	—
	University of Hawaii, U.S.A. ..	—	42	—	—
	University of Hokkaido, Japan ..	—	6	—	—
	Forest Department, Solomon Islands ..	4,000	—	—	—
	Total ..	8,118	5,600	6,637	5,899

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM PLANTS
AND SEEDS WERE RECEIVED IN 1965

ALGERIA	Station de Recherches du Jardin D'essais du Hamma, Alger.
AUSTRALIA	King's Park and Botanic Garden, Perth; Parks and Reserves Department, Townsville; Parks and Gardens Department, Canberra; Mr. Gerard M. Blinco, Osborne.
AUSTRIA	Botanischer Garten, Wien; Botanischer Garten, Graz.
BELGIUM	Dienst Voor Parken en Plantsoenen, Antwerpen; Jardin Experimental Jean Massart, Auderghem-Bruxelles; Plantentuin der Rijksuniversiteit, Gent; Mr. Walter van den Bergh, Antwerp.
BR. SOLOMON ISLANDS	Dr. T. C. Whitmore, Forest Department.
BRAZIL	Mr. Ramon Duran, Rio de Janeiro.
BULGARIA	Jardin Botanique de l'Universite, Sofia.
CANADA	Dominion Arboretum and Botanical Garden, Ottawa.
CZECHOSLOVAKIA	Hortus Botanicus Universitatis Palackianse, Olomouc.
FIJI	Mr. H. W. Simmonds, Suva.
FINLAND	Botanical Garden, University of Turku.
FRANCE	Jardin Botanique, Besancon; Jardin Botanique, Alpes-Maritimes; Jardin des Plantes, Montpellier; Jardin Botanique, Strasbourg; Jardin Botanique l'Ecole de Medicine et de Pharmacie, Angers.
GERMANY	Botanischer Garten der Justus-Liebig-Universitat, Giessen; Botanischer Garten der Universitat, Tubingen; Botanischer Garten der Technischen Hochschule, Karlsruhe; Botanischer Garten der Universitat Erlangen-Nurnberg, Erlangen; Botanischer Garten, Bremen; Botanischer Garten der Stadt Koln, Koln-Riehl; Botanischer Garten der Universitat Freiburg; Freiburg im Breisgau; Botanischer Garten, Hamburg; Botanischer Garten der Martin-Luther Universitat, Halle (Saale); Botanischer Garten der Technischen Hochschule, Dresden; Botanischer Garten der Universitat, Rostock; Botanischer Garten der Stadt Kassel. Institut fur Spezielle Botanik und Arboretum der Humboldt- Universitat zu Berlin, Berlin; Botanischer Garten, Aachen; Institut fur Agrobiologie der Ernst-Moritz-Armdt-Universitat, Greifswald.
HONG KONG	Dr. T. C. Lee, Kowloon.
HUNGARY	Hortus Botanicus Universitatis Sc. Hungaricae, Budapest VIII; Hortus Botanicus, Vacratot; Statio Experimentaria Examinations Institut Scientific Sylviculture, Rackeve; Novenytani Intezet, Debrecen 10.
INDIA	Botanical Survey of India, Shillong.
ISRAEL	Post Rupin Institute of Agriculture.
ITALY	Giardino Botanico Hanbury, La Mortola; Istituto-orto Botanico Universita di Milano, Milano; Institute ed orto Botanico dell Universita Degli Studi, Ferrara; Istituto ed orto Botanico dell Universita, Torino; Amministrazione Borromeo, Milano; Istituto ed orto Botanico dell Universita, Pisa.

IVORY COAST	Institut D'enseignement et de Recherches Tropicales, Adiopodoume.
JAPAN	Botanic Gardens, Hokkaido University, Sapporo; Kyoto Takeda Herbal Garden, Kyoto; Mr. Kazumasa Kojima, Nagoya.
MALAYSIA	Forest Research Institute, Kepong; Professor Duncan Poore, University of Malaya, K.L.; Botanic Gardens, Penang; Che Hassan, Kebun Istana, Johore Bahru; Mr. Aw Kheng Huat, Pahang; Mrs. H. Jones, Selangor; Mr. Stanley Khong, Perak.
NEW GUINEA	Division of Botany, Department of Forests, Lae.
NIGERIA	Dr. William W. Sanford.
NORWAY	Botanic Gardens, University of Oslo.
PHILIPPINES	Mrs. Patria K. Manuel.
POLAND	Florets Experimentalis Centrale d'Agriculture, Rogow/Koluszek; Ogród Botaniczny U. Wrocławskiego, Wrocław; Instytut Przemysłu Zielarskiego, Poznań; Ogród Botaniczny U. Warszawskiego, Warszawa; Institut de Pharmacognosis de L'Academie de Medecine, Lodz.
PORTUGAL	Instituto Botanico da Universidade, Coimbra; Instituto de Botanica "Dr. Goncalo Sampaio", Porto.
ROUMANIA	Gradina Botanica A Universitatii "Babes-Bolyai", Cluj.
SIERRA LEONE	University of Seirra Leone, Freetown.
SINGAPORE	Dr. Avadhani; Capt. C. S. Brockway; Mrs. J. A. Lewis; Miss N. Pillai; Mr. John Ede; Mr. Teng Kok Teo; Dr. Hsuan Keng; Mr. Tan Hoon Siang; Mrs. T. L. Green; Union Poultry Farm; Mr. J. Hislop; Mr. Head; Mr. T. J. R. Hale; Koh Keng Hoe Orchid Nursery; Singapore Orchids Ltd.; Mrs. Sheridan-Lea; Mrs. Max Lewis; Mr. Gerald de Cruz; Mrs. J. MacDougal; Mr. G. J. Holmberg; Mr. W. G. Thurston.
SOUTH AFRICA	University of Pretoria.
SPAIN	Servicio Municipal de Parques y Jardines, Avenida Marques de Comillas, Barcelona.
SWEDEN	The Botanical Garden, Lund.
SWITZERLAND	Jardin Botanique, St. Gallen.
TAIWAN	Taiwan Forestry Research Institute, Hengchun Tropical Botanic Garden, Hengchun.
U.K.	Botanical Supply Unit, University of London; Botanic Gardens, Glasgow; Royal Botanic Gardens, Kew; Botanic Gardens, University of St. Andrews; Mr. J. M. Chandler, Birmingham; Royal Horticultural Society Garden, Wisley; Department of Agricultural Botany, University of Reading; Botanic Garden, University of Birmingham.
U.S.A.	Mr. David Barry Jr., Honolulu; Los Angeles State and County Arboretum, Arcadia; Rancho Santa Ana Botanical Garden, Claremont; Regional Park Agency, Oregon; Mr. Michael Starmack, Milpitas; Botanical Garden, University of California, Los Angeles; Longwood Gardens, Pennsylvania; California Jungle Gardens, Los Angeles; University of California, Davis; Honolulu Botanic Gardens, Hawaii.
U.S.S.R.	Hortus Botanicus Tallinnensis, Estoniae, Tallin.
VIETNAM	Hortus Botanicus Saigonensis, Saigon; Jardin Zoo-Botanique, Saigon.

INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS
AND SEEDS WERE SENT IN 1965

ARGENTINA	Instituto de Botanica Agricola, Buenos Aires.
AUSTRALIA	Mr. A. S. Aidmore, Victoria; Mr. Ernest Todd, New South Wales; Parks and Reserves Department, Townsville.
BELGIUM	Mr. Walter van den Bergh, Antwerp.
CANADA	Faculty of Agriculture, Laval University, Quebec.
CONGO	Dr. Dr. J. Fariel.
CZECHOSLOVAKIA	Botanicka Zahrada University Karlovy, Praha 2; Institutum Natural Sciencium, Praha 9; Pedagogicky Institut, Botanicka Zahrada, Kosice; Hortus Botanicus, Botanicka Zahrada, Pruhonice; Vyzkumna Stanice, Zemedelska, Sumperk Temenice; Ing. Frantisek-Pospisil, Lednice Na Morave.
FINLAND	University of Helsinki.
FRANCE	Jardin Botanique, Besancon.
GERMANY	Botanischer Garten der Universitat, Tubingen; Botanischer Garten, Darmstadt; Institut fur Biochin der Pflanzen, Berlin; Palmengarten, Frankfurt Main.
GHANA	Kwan Nkrumah University of Technology, Kumasi.
HOLLAND	Dr. E. Hennispman, Rijksherbarium, Leiden.
HONG KONG	Urban Council and Urban Services Department; Dr. T. C. Lee, Kowloon.
HUNGARY	Hortus Experimentalis, Institute Horticultural Zzentes; Hortus Agrobotanicus Universitatis of Scientiarum Agrarium, Godollo.
INDIA	Indian Agricultural Research Institution, New Delhi; Botanical Survey of India, Shillong.
ISRAEL	Department of Agriculture, Ministry of Agriculture.
ITALY	Orto Botanico dell'Universita, Napoli; Mr. Franco Cuneo, Naples.
JAPAN	Isu Plant Experiment Station, Shizuoka-Prefecture; Mr. Kazumasa Kojima, Nagoya.
MALAYSIA	Mr. E. S. Trevor, Negri Sembilan; Mr. N. V. Lange, Perak; Che Mohd. Yakin bin Long, Pahang; Mr. J. Morris, Sahab; Botany Department, University of Malaya, Kuala Lumpur; Mr. Aw Kheng Huat, Pahang; Botanic Gardens, Penang; Mr. Lee Ewe Bon, Kedah.
NEW GUINEA	Department of Forests, Lae.
NIGERIA	Botanic Gardens, University of Ibadan; Dr. William W. Sanford.
POLAND	Hortus Plantarum Academiae Midaeae, Warsaw.
SINGAPORE	Koh Keng Hoe Orchid Nursery; Mrs. Sheridan-Lae; Mrs. Max Lewis; Singapore Orchids Ltd.; Mrs. J. MacDougal; Mr. Lee Heng; Mr. G. J. Holmberg.
TAHITI	Mdm. Maury Gema, Papeete.
TAIWAN	Taiwan Forestry Research Institute, Hengchun Tropical Botanic Garden, Hengchun.
TANZANIA	Kivukoni College, Dar-es-Salaam.
THAILAND	Mr. R. A. Woodward, Bangkok.
TUNISIA	Director, Service Botanique, Ariana.

UNITED KINGDOM

Mr. L. A. Livermore, Lancaster; Mr. J. M. Chandler, Birmingham; Department of Botany, University of St. Andrews, Scotland; The Royal Horticultural Society, London; Major V. F. Howell, Surrey; Botanic Gardens, Glasgow.

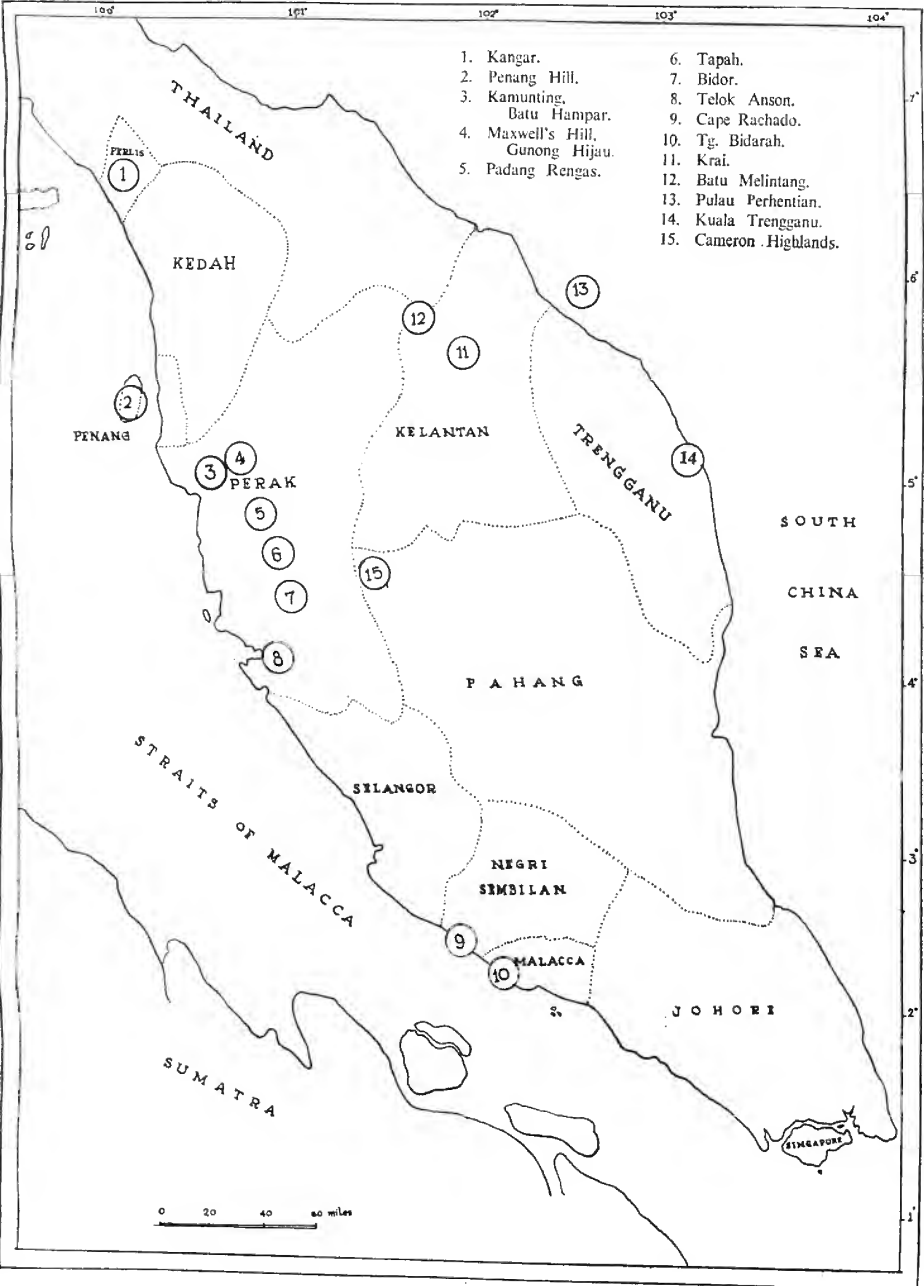
U.S.A.

The University of Arizona, Tucson; Fairchild Tropical Garden, Miami; California Jungle Gardens, Los Angeles; Department of Botany, University of Indiana; Purdue University, Indiana; Bailey Hortorium, Ithaca; Mr. Forest Elliott, Oregon; Mr. Michael Starmack, Milpitas; University of Texas, Austin; Los Angeles State and County Arboretum, Arcadia.

U.S.S.R.

Hortus Botanicus Principalis Academiae Scientiarum, Mosqua; Hortus Botanicus Academiae Scientiarum, Latvia; Hortus Botanicus Forminianus, Kiev; Botanic Gardens of the Ukraine.

MAP INDICATING LOCATION OF MALAYAN PLACE-NAMES MENTIONED IN THIS REPORT



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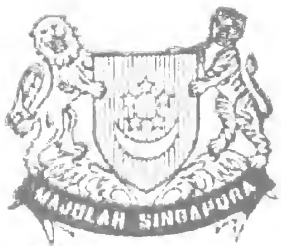
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**Botanic
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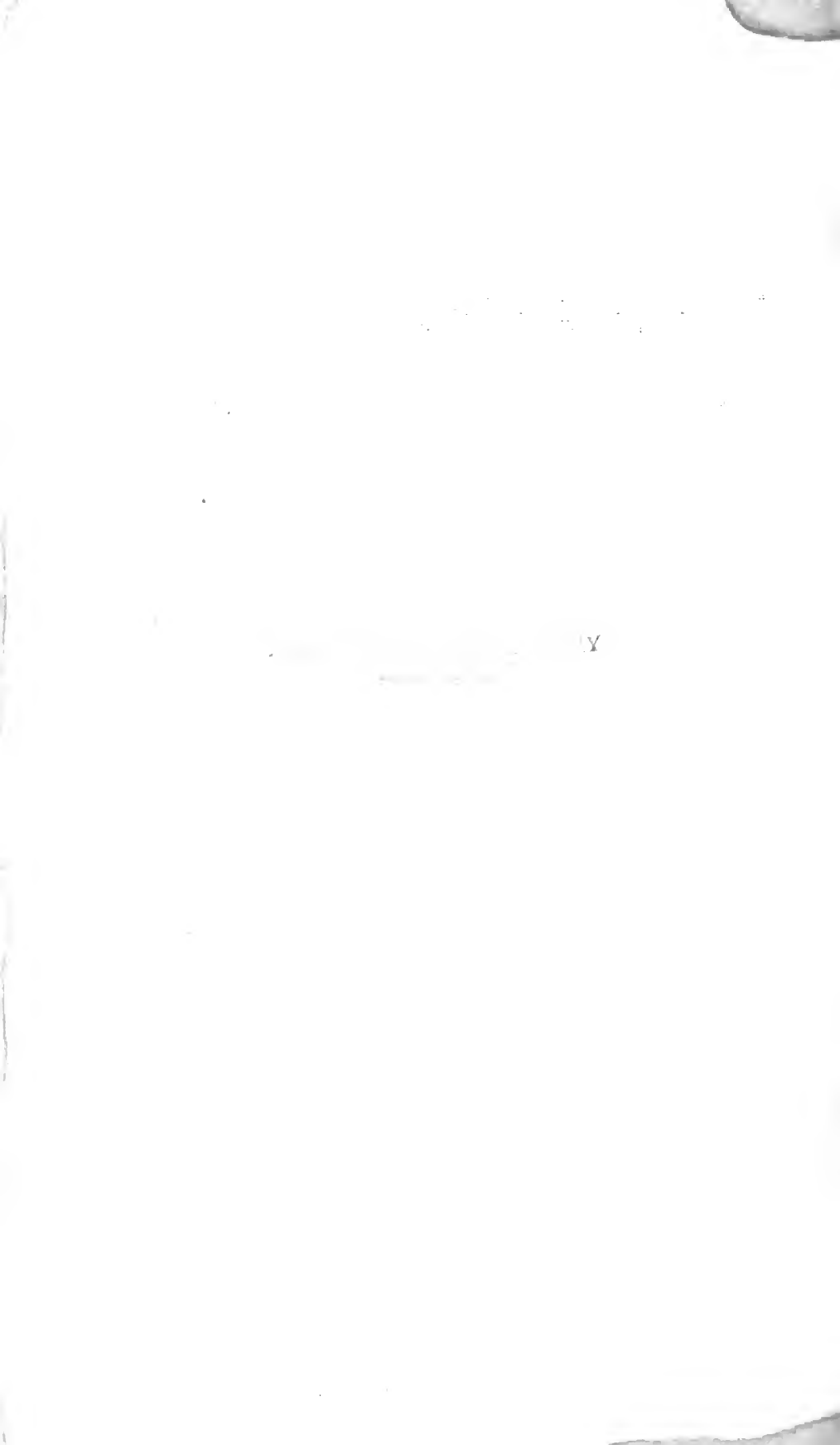
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Botanic Gardens

ANNUAL REPORT FOR 1966 AND 1967



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(1966 Report)

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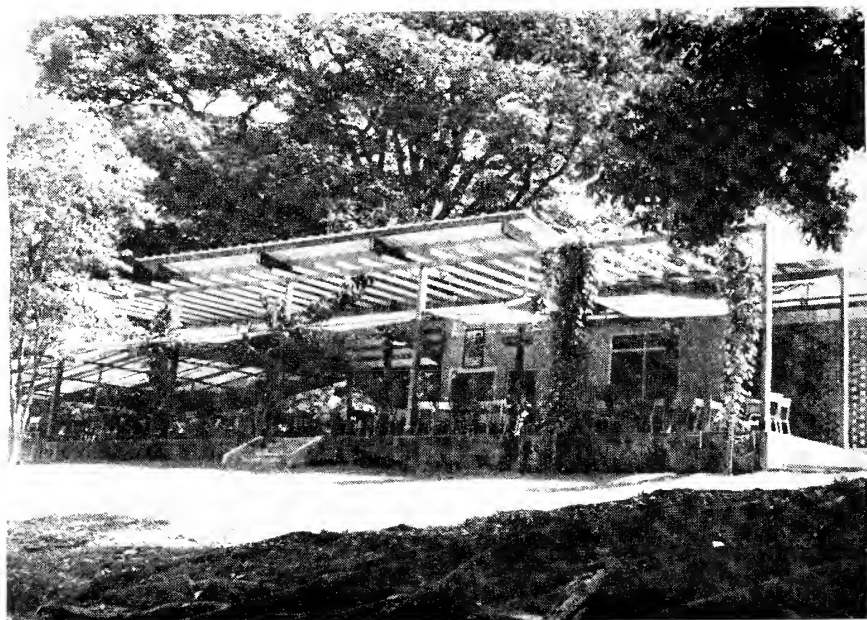


Plate I. New Tea Kiosk, Botanic Gardens

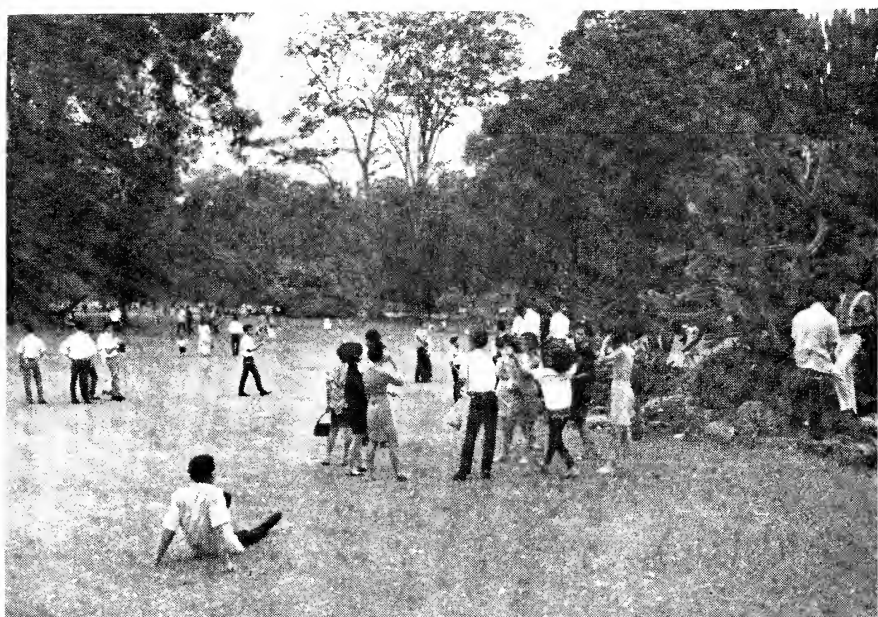


Plate II. Holiday Crowds, Botanic Gardens, Chinese New Year



Plate III. Tree Planting Campaign, Botanic Gardens' Demonstration at Singapore Flower Show

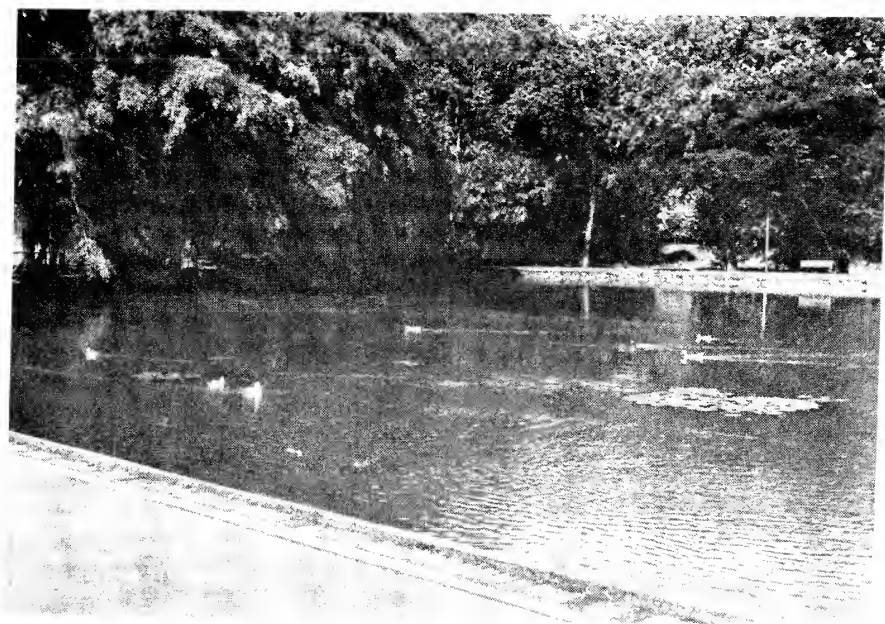


Plate IV. Ducks in Botanic Gardens Lake

ADMINISTRATION

I. FUNCTION

To conduct research into the regional flora and to provide a taxonomic service in support of technological activities concerning Malaysian plant life: to conduct research into tropical horticulture.

II. STAFF

2. Three additional posts were made to the establishment, and were duly filled; one Junior Horticultural Assistant, one Plant Collector, and one Typist. The holders of the two pre-existing posts of Junior Horticultural Assistant retired early in the year and the posts were filled by recruitment. Dr. Chew Wee-Lek was Acting Director for the period 24th February to 13th March, while the Director was away from Singapore on field work.

III. LABOUR

3. During the year the Gardens labour force was raised from 91 to 99. Health was generally good with only 2 per cent of the working days being lost due to sickness. Work gangs carried out their duties satisfactorily and there was no notable incident. As in previous years, 9 labourers were employed in the upkeep of paths, boundaries and shelters in the Nature Reserve (7 at Bukit Timah, 2 at Kranji) and 7 (2 men, 5 women) in the Herbarium. The women worked as specimen mounters.

IV. WATCHMEN

4. The number of watchmen was increased from 18 to 20 to provide static night guard at a new orchid nursery. Watchmen in general carried out their duties satisfactorily.

V. TECHNICAL ASSISTANCE SCHEMES

5. Departmental facilities were made available for training in botany and horticulture under the following heads:

(1) *Colombo Plan Technical Cooperation Scheme*

- (a) One Senior Fellowship in Taxonomy
- (b) One Senior Fellowship in Ecology
- (c) One Senior Fellowship in Horticulture
- (d) Two Junior Fellowships in Herbarium Procedures and Plant Collecting
- (e) Six Junior Fellowships in Horticulture and Elementary Gardening Practice.

Mr. Montien Srisuko, Technical Assistant of the Royal Thai Department of Forests continued to fill the fellowship in Taxonomy, and was here throughout the year. Details of his work are given in paragraph 34.

(2) *Rehabilitation and Retraining Scheme*

Three trainees were accepted from the Social Welfare Department for training as gardeners. These men were cured T.B. cases.

(3) *Other Schemes*

(i) The Miyazaki Prefectural Administration in Japan sent Mr. Tatsuo Kawashima, a horticultural officer, for six months to gain experience in tropical plants and horticulture. He arrived on 27th October and remained throughout the rest of the year.

(ii) Two gardeners from the Housing and Development Board and two from the Water Department of the Public Utilities Board were put through a course of general gardening practice.

VI. WORKS AND BUILDINGS

6. All the Gardens' roads were resurfaced by the Public Works Department and roadside drains were repaired. Approval was given for the expenditure of \$100,000 on the construction of a Library building and extension to the Herbarium. The new restaurant, for which funds were provided in the Development Estimates 1965, was completed during the year and put into use from 1st May, and the lease of the old tea kiosk was terminated from that date.

VII. BOTANIC GARDENS ORDINANCE AND BY-LAWS

7. Provisions of the Ordinance and administration of the By-laws (Botanic Gardens Rules, 1958) worked satisfactorily. A few cases of petty pilfering were reported. Vehicular traffic continued to be the major problem. Ministry approval was obtained for the closure of the Gardens to all traffic and the cooperation of the Traffic Police and the Public Works Department was sought in the provision of parking facilities on the public roads surrounding the Gardens. Closure is expected to come into effect in 1967. This will very greatly enhance the value of the Gardens as a place for quiet relaxation, and will not cause most of the visitors any inconvenience as some 80 per cent anyhow enter on foot.

VIII. VISITORS

8. Most notable visitors during the year were Mr. B. M. Sneddon, Attorney-General of Australia, Mr. Denis Healey, Secretary of State for Defence, London, and Mr. Son Sann, Deputy Prime Minister, Cambodia. Other notable visitors included:

Dr. A. B. Cribb, University of Queensland.

Dr. T. C. Whitmore, Forest Research Institute, Kepong.

Mr. R. Smith, Director of Agriculture, Sabah.

Dr. M. R. Stanton, Tropical Products Institute, London.
Dr. W. Rudlin, Ford Foundation, New York.
Dr. Yoshio Kobayashi, Natural Science Museum, Tokyo.
Mr. Masami Soneda, Nagao Institute, Tokyo.
Mr. Luan Prachak Tonggai, Fisheries Department Bangkok.
Mr. Maurice Lecoufle, St. Leger, France.
Dr. Bassett Maguire, New York Botanical Garden.
Prof. Norio Kundo and party of 3, Institute for Breeding Research,
Tokyo.
Mr. C. W. Brookson, U.N. Special Fund, Thailand.
Mr. E. Barnes, B.B.C. Television, London.
Miss R. Gill, B.B.C. Television, London.
Prof. Z. Michael, Hebrew University, Israel.
Prof. C. W. Wardlaw, Manchester University, England.
Dr. S. K. Mukherjee, Indian Agricultural Research Institute, New
Delhi.

9. Many eminent scientists called at the Gardens, and the following stayed for a few days and made use of the department facilities for their work.

Dr. Ding Hou, Rijksherbarium, Leiden. (Malesian flora).
Dr. E. Loveland, Marine Colloids, Massachusetts. (Marine algae).
Miss B. T. Chiu, London University. (Marine algae).
Dr. Maxwell Doty, University of Hawaii. (Marine algae).
Prof. F. Ehrendorfer, Institute of Systematic Botany, Graz, Austria.
(Malayan flora).
Dr. A. Kanis, Rijksherbarium, Leiden. (Malesian flora).
Mr. K. M. Kochumen, Forest Research Institute, Kepong. (Malayan
forest flora).
Mr. M. M. Chandapilla, Rubber Research Institute, Kuala Lumpur.
(Rubber estate weeds).
Dr. Mitsuo Kajimura, University of Shimane, Japan. (Marine algae).

10. The facilities of the Gardens, Herbarium and Library were as usual made freely available to members of the staff and sponsored students of the Universities of Singapore and Malaya, and to other official organisations, local and overseas. The usual very large number of casual visitors came daily to the Gardens.

IX. CONCERTS

11. The Singapore Police Force Band gave Sunday afternoon concerts on 27th February and on 20th March. The People's Association Band played on Christmas Day afternoon. The Band Masters and their instrumentalists are sincerely thanked for these concerts.

X. LIBRARY

12. Library accommodation remained in the unsatisfactory situation recorded in the previous Annual Reports. However, some relief is in sight with the approval of funds for the construction of a proper building (please see paragraph 6). The Library accession register contained 8,940 bound volumes at the end of the year in addition to the considerable quantities of unbound volumes, separates and other material (e.g. maps, microfiche, microfilm, etc.). Exchange agreements exist with 315 addresses for the Department's research periodical, "*The Gardens' Bulletin, Singapore.*"

XI. PUBLICATIONS

13. *Gardens' Bulletin, Singapore*, volume 21, part 3 was issued on 12th April and contained the following papers:

Munir, A. A.: A revision of *Congea* (Verbenaceae).

Munir, A. A.: A revision of *Sphenodesme* (Verbenaceae).

Soepadmo, E.: Five new species of *Quercus* L. subgen. *Cyclobalanopsis* (Oersted) A. Camus from Malasia.

Turner, G. L.: New records of plant diseases in Sarawak for the years 1963 and 1964.

Wee, Yeow-Chin: The distribution of *Annonaceae* and *Myristicaceae* on Singapore Island.

14. Revenue from the sale of publications prepared by the Department and published by Government amounted to \$8,931.90.

XII. AGRICULTURAL PESTS SUPERVISORY COMMITTEE

15. The Director was a member throughout the year.

XIII. UNIVERSITY OF SINGAPORE COURT

16. Mr. H. M. Burkill, Director, represented the Botanic Gardens on the University Court as Government's nominee. Dr. Chew Wee-Lek, Botanist, also served on the Court as the Court's own electee.

XIV. COMMONWEALTH WAR GRAVES COMMISSION

17. The Director continued to be the Commission's representative in Singapore and was responsible for the maintenance of the War Graves Cemetery at Kranji under instructions from the Commission's Eastern Region Headquarters at New Delhi. Mr. Lam Hin Cheng, Curator, was in executive charge. Funds for the maintenance of the Kranji Cemetery were provided by the Committee. Other information may be found in the Commission's own reports.

XV. NATURE RESERVES

18. The Board of Trustees remained unchanged throughout the year. The following were members:

Appointed by the President

1. Mr. O. K. Abraham

2. Mr. Tan Jake Hooi

Appointed by the Minister for Culture and Social Affairs

3. Mr. Poh Soo Jin
4. Mr. Kiat Jun Ngui
5. Dr. T. P. Paran
6. Professor J. L. Harrison

Ex-officio

7. Director, Botanic Gardens.

One board meeting was held.

19. Paths and shelters at Bukit Timah were upkept and the boundaries of all the reserves were maintained. Fourteen permits were issued for the taking of scientific specimens. The Military continued to use the Water Catchment Reserve for exercises.

XVI. METEOROLOGICAL RECORDS

20. Rainfall in the Gardens was near the average for the past 53 years, with 96.03 inches recorded at the office site on 177 days. As in previous years, rainfall at the site at the top of Bukit Timah was higher than in the Gardens, 141.06 inches being recorded on 174 days. Though the number of rain-days was nearly the same at both sites, precipitation was invariably heavier at Bukit Timah. March, November and December were the wettest months, and February the driest. Details are at Appendices II-IV.

XVII. CONFERENCES

21. Mr. A. G. Alphonso, Curator, attended the Fifth World Orchid Conference at Los Angeles, U.S.A., between 13th and 22nd April as a Singapore delegate. He presented a paper to the Conference entitled "The need for Conservation of Malaysian Orchid Species." He was elected to the International Orchid Committee on Classification, Nomenclature and Registration. Details of the concurrent orchid show are given under "Exhibitions" in paragraph 56 of this report.

22. Dr. Chang Kiaw Lan, Botanist, attended the Eleventh Pacific Science Congress at Tokyo, Japan, between 22nd August and 9th September and read a paper entitled "Criteria for the Classification of *Lentinus* species". The Department gratefully acknowledges the assistance of the American Embassy, the Asia Foundation and the Industrial Research Unit of the Economic Development Board in covering her expenses in attending the Congress and the United State-Japanese Algal Culture Conference held concurrently in Hakone.

XVIII. STATE GIFTS OF PLANTS

23. On the occasion of the state visit of Mr. Lee Kuan Yew, Prime-Minister of Singapore, to New Delhi, six mature orchid plants were presented to the Vice-President and the Prime-Minister of India on 1st September.

24. On the occasion of the state visit of Dr. Zakir Hussain, Vice-President of India, a gift of two mature orchid plants was made to His Excellency on 14th October.

25. Orchid blooms were made available for the Prime-Minister's overseas visit to the United Kingdom and India for presentation to Her Majesty the Queen, the wife of the British Prime-Minister, Mrs. Harold Wilson, the President of India and the Prime-Minister of India.

BOTANICAL RESEARCH

XIX. PLANT COLLECTING

26. Three major expeditions were undertaken: Dr. Chew Wee-Lek, Botanist, collected limestone plants in the Fourth Division, Sarawak, with personnel of the Sarawak Forest Department; Mr. H. M. Burkill, Director, joined the Fifth Thai-Danish Expedition working over the islands and western coastline of Peninsular Thailand mainly to collect marine algae; Mr. A. G. Alphonso, Curator, visited the Kinabalu area to collect plants, principally orchids, for cultivation. These collections yielded some 897 numbers for the Singapore Herbarium, and 203 numbers (737 plants) for the Gardens. Duplicate materials of all these were obtained and are in the process of distribution under the exchange programme. The generous assistance of the Forest Departments of Malaya, Sarawak and Sabah, and the National Park Board, Sabah, and of Mr. G. Seidenfaden, Professor G. Larsen and Mr. Tem Smitinand, leaders of the Fifth Thai-Danish Expedition is gratefully acknowledged.

27. A number of minor expeditions of a few days duration were made, and details of this collecting work are given in Appendix VII. There were, in addition, many single day forays too numerous to list.

XX. EXCHANGE AND ACQUISITIONS

28. The Herbarium profited by a larger intake of material (6,096 specimens) on exchange than was sent out (3,137 specimens), due largely to generous receipts from the Forest Departments of Lae, the British Solomon Islands Protectorate, Sabah and Sarawak. With a regular annual acquisition from these sources, the Singapore Herbarium is rapidly becoming valuably rich in specimens from Eastern Malaysia (political) and east Malesia (geographical). Details of receipts and despatches on exchange with 38 other institutions are tabulated in Appendix VI. The Herbarium mounters prepared 19,068 specimens, and 15,509 sheets were indexed and laid in.

XXI. LOANS OF HERBARIUM MATERIAL

29. Loans of herbarium materials to and from 26 other institutions were made during the year, either for the prosecution of our own research or in collaboration with other specialists. The very large number of sheets

(11,332) sent out on loan is indicative of the value of the Singapore Herbarium collections in the international study of tropical botany. Details of loans are listed in Appendix VI.

XXII. TAXONOMY

30. Dr. Chew Wee-Lek, Botanist, continued his studies towards preparing a monograph on the *Urticaceae*. He made preliminary examination of *Piperaceae* (Pepper family) with a view to starting a revision of this family, and continued his work on the Malaysian limestone flora and on the climbing plants of the Malay Peninsula.

31. With several years of field collecting material to hand, the Director began a study of the marine algal genus *Avrainvillea*, and the aerophilous genus *Trentepohlia*. Many anatomical drawings were prepared of both genera, and a series of phenological observations were made on an area of *Trentepohlia aurea* growing near the Singapore Herbarium.

32. Dr. Chang Kiaw Lan, Botanist, undertook floristic and taxonomic studies of local species of Agaricales and Polyporales, and a special study was made of a collection of *Lentinus*. Attempts in culturing *Termitomyces*, an edible mushroom, renowned for its high culinary value, were made.

33. Mr. Hardial Singh, Botanist, made morphological examinations of the leaf sclereids of *Fagraea*, *Raphidophora* and *Scindapsus* with a view to testing these as diagnostic characters against the currently accepted taxonomy. Two papers on this were prepared.

34. Two retired members of the staff, Mr. Sinclair and Dr. Furtado, continued to work in an honorary capacity. Mr. Sinclair completed a draft text for his revision of the genus *Horsfieldia*. Dr. Furtado undertook many determination, corrections of sheets in the Herbarium, supplied latin diagnoses of new taxa, and supervised the work of the Colombo Plan Fellow, Mr. Montien Srisuko, who was engaged on a revision of the genus *Lagerstroemia*. Mr. Montien's work was well advanced by the end of the year.

35. The Department has worked in the closest collaboration with the Flora Malesiana Foundation of Leiden, and has assisted the Departments of Forests, Malaya, Sarawak and Sabah and the Rubber Research Institute of Malaya, commercial organisations, schools, other local bodies and private individuals with determinations.

HORTICULTURE

XXIII. GARDENS MAINTENANCE

36. The labour force carried out their duties satisfactorily. Nurserymen and specialist workers were fully occupied with the maintenance of collections and propagation. The work of the general gang which in recent years has become loaded with duties not previously done by it fell somewhat in arrears.

A major call on the gang's time was an extensive tree pruning and lopping exercise carried out along Cluny Road and Tyersall Avenue where there was a danger of timber falling in the roadway. Though the area outside the Gardens is not strictly the Gardens' responsibility, it was agreed with the Chief Parks Officer that, for expediency, the Gardens should do this work.

37. Species and cultivar collections were added to by exchange and by field collecting, particularly the orchid and fern collections. The completion of the second orchid nursery, the extension to the Fern House and repairs to the introduction section of the Aroid House gave relief to the accommodation of new acquisitions. It is unhappily necessary to record serious damage to the Cactus and Succulents Collection by monkeys. Their depredations also extended to the destruction of aroids planted along the edge of Maranta Avenue. The thick growth of *Dieffenbachia* at this site which is of little attraction was thinned out for the planting of a display of other aroids, but all these were uprooted, leaving only untouched the *Dieffenbachia* which is highly poisonous.

38. The long-tailed macaque monkeys (*Macaca fascicularis* = *M. irus*) remained the most serious and destructive pest. Six were shot. Several permits were issued during the year to persons wishing to trap them, but no one had any success. Any consistently high standard of horticulture is impossible in the presence of these vermin and their complete elimination is desirable.

39. The cannas on either side of Main Gate Road were replanted and manured. Additional angle iron supports were put up for the bougainvilleas on Lawns B and E, there being plants of Golden Glow, Killie Campbell, Mary Palmer, Mrs. Maclean, *cypheri*, Wellington, Maharajah of Mysore, Calcutta, Brilliant, *glabra* dark form. Formosa and Jubilee added to the collection on Lawn B. Beds of various colours of *Lantana camara* were planted on Band Stand Hill, and new beds of *Polygonum*, *Pancreatum zeylanicum*, *Zephyranthes* and *Cooperanthes* were made on Lawn G near the Plant House steps.

40. Several trees in the Gardens had to be removed, the largest being an enormous "tembusu" (*Fagraea fragrans*) on Lawn T which had a girth of 30 ft. at breast height. This tree which was struck by lightning 3 years previously was showing progressive die-back and decay. The tree was estimated to be about 80-90 years old.

41. The following new plantings have been done: *Ficus irregularis*, L. 26; *Pongamia pinnata*, L32, L34, L35; *Cinnamomum cassia*, D178; *Pinus caribae*, D246; *Pinus merkusii*, D140; *Pinus insularis* D42, D107; D701; *Diospyros discolor*, D185; *Cassia torra*, L42B; *Cassia corymbosa* var. *plurijuga*, L42A; *Latena loddigesii*, K6; *Byrsonima crassifolia*, C39; *Araucaria hunsterii*, H62; *Cassia spectabilis*, H61; *Jasminum odoratissimum*, H63; *Thevetia peruviana*, A47; *Hyophorbe verochaffetii*, K31; *Licuala grandis*,

K19; *Phoenix canariensis*, K95; *Cyrtostachys randa*, K100; *Washingtonia robusta*, K104; *Terminalia samoensis*, F63; *Terminalia macadami*, F62; *Cupressus arizonica*, D86, D92, D99; *Casuarina rumphiana*, E34; *Cassia bakeriana*, D215; *Strychnos nux-vomica*, F64; *Erythrina speciosa*, F65; *Erythrina corallodendron*, F48; *Erythrina sandieriana*, F46; *Fagraea auriculata*, D194, D209; *Cyrtostachys lakka*, D216; *Dictyosperma furfuraceum*, K38; and *Spathodea campanulata*, U12, U13, U14, V6, V7, V8, VII.

42. To the hedging materials established in trial lengths near the office reported in the Annual Report 1965 (paragraph 43), sections of *Hemigraphis alternata* and *Duranta plumieri* have been added. All five species, that is *Bougainvillea sandieriana*, *Malpighia coccigera*, *Ehretia microphylla*, *Bixa orellana* in addition to the two foregoing, are forming compact hedges.

43. A total of 1,694 wooden plant-name boards and 57 signboards were prepared or renewed, and nearly ten thousand metal tag labels embossed. Notice boards were placed at the Dalvey Gate and Tyersall Gate.

44. The depredations of the coconut beetle (*Oryctes rhinoceros*) and the Red Stripe Weevil (*Rhynchophorus ferrugineus*) were kept within bounds by regular spraying of palms and control of potential nursery sites. Hornets and bees establishing swarms on the Gardens' trees were occasionally troublesome and had to be burnt out. The Chief Fire Officer is thanked for the use of one of his ladders to get at one nest which was all but beyond reach from the fully extended ladder with a fire brand on a long pole. The large combs of the Greater and Lesser Indian Bee were attacked by eagles foraging for honey and this provoked the bees to going for any innocent passer-by.

45. Conventional litter-baskets proved to be useless in the presence of monkeys that scavenged in them and strewed their contents over the ground. Consequently, a new type with a top cover has been designed, and twenty have been put up in the Gardens. Four garden seats were constructed in the shelter on Lawn V. The wooden bridges at the upper and lower ends of the Lake were repaired.

46. The Director of Primary Production supplied twelve pure white Peking Ducks. Mrs. Edith Cho Chak Nam of Singapore presented 16 Peking ducklings and 4 goslings. The survivors of these, together with two brown "farmyard" ducks, unofficially released by an unknown person, have settled down in the Lake and spend the night on the Island. They have become a considerable attraction to visitors.

XXIV. HORTICULTURAL EXCHANGE

47. Seed and plant exchanges continued to be an important aspect of the Horticultural Division's activity. One seed collector was kept fully engaged in obtaining material, and two nurserymen were employed in germinating seed in the introduction houses where new material is established.

Appendices VIII and IX list the names of institutions with which exchanges were made in the year. These addresses indicate the world-wide nature of the Botanic Gardens' relations and collaboration.

XXV. ORCHID RESEARCH

48. During the year 87 hybrid pods were harvested from the Gardens collection; 27 pods of known parentage were accepted from Singapore growers, 10 from Malaysia and 48 from England. Of these 172 pods, 121 gave viable seed. The number of flasks now under culture is over 2,400. The seedlings of 798 flasks were removed for potting. The flask culture medium continued to be, as previously, Vacin's formula, 10 per cent coconut water, banana pulp and peptone. 1,669 seedlings were potted on from the seedling houses to be grown in the open and more than 3,000 plants were transferred from Orchid Nursery I to beds in Orchid Nursery II.

49. As usual, plants in prime bloom were displayed in the public section of the Orchid Nursery. More than 100 plants were constantly maintained on view, and these were changed weekly.

50. The following hybrid families were registered:

BGS. 1841 — *Vanda Ling* (*V. Kapoho* x *V. insignis*).

BGS. 1883 — *Dendrobium Mohamed Nur* (*D. Ursula* x *D. Alice Spalding*) named in honour of the late Haji Mohamed Nur bin Mohamed Ghous, Herbarium Assistant, Botanic Gardens, Singapore.

BGS. 2173 — *Dendrobium Ngadiman* (*D. trilamellatum* x *D. schulleri*) named in honour of the late Inche Ngadiman bin Haji Ismail, Plant Collector, Botanic Gardens, Singapore.

BGS. 2196 — *Aranda Bintang* (*A. hookeriana* var. *Luteola* x *V. tazeri*).

BGS. 2197 — *Vanda Yiong* (*V. Kapoho* x *V. Tazeri*).

BGS. 2233 — *Aranda Tourism Singapura* (*V. Kapoho* x *A. breviscapa*) named and registered on behalf of the Singapore Tourist Promotion Board.

BGS. 2302 — *Vanda Kupu-kupu* (*V. Ruby Prince* x *V. Ellen Noa*).

BGS. 2502 — *Dendrobium Sri Temasek* (*D. Indonesia* x *D. Champagne*), in recognition of an old historical name for Singapore.

BGS. 2521 — *Vandaenopsis Catherine* (*V. Norbert Alphonso* x *Phal. denevei*).

BGS. 2654 — *Arachnopsis Napier* (*Arnps. Eric Holttum* x *Phal. denevei*), named in honour of William Napier, an early Merchant of Singapore who owned at one time a part of the land now the Singapore Botanic Gardens.

BGS. 2684 — *Vanda Bellasan* (*V. Rubella* x *V. sanderiana*).

BGS. 2694 — *Dendrobium Sujatha* (*D. Brown Curls* x *D. trilamellatum*).

BGS. 2910 — *Renantanda Lily Josephine Wong* (*V. Kapoho* x *Ren. coccinea*).

BGS. 2924 — *Dendrobium David Wu Dah Wei* (*D. mirbellianum* x *D. Mustard*).

51. Plants of fifty orchid species in the species collection flowered during the year and were duly identified. 4,400 sprays of blooms were supplied for State banquets and Government functions.

EXTENSION WORK

XXVI. SUPPLY OF PLANTING MATERIAL

52. Revenue from the sale of plants, other than orchids was \$3,200.90. There was a decline in sales to Malaysia attributable to tighter restrictions on the import of plant material across the Causeway. The total number of plants sold in the year was 14,714 of which 1,528 were tree seedlings. Revenue from the sale of orchids amounted to \$15,494 on 5,315 plants. This sum was very nearly the same as in 1965 (\$15,726). Total plant sales revenue was \$18,926.90.

53. The Gardens continued to supply planting material free of charge to Government Departments, charitable institutions, state-aided schools and other official and quasi-official organisations. To these, 5,823 plants were provided. The Gardens supplied materials for class work and examinations to schools and the Ministry of Education. 4,375 pot plants were loaned for decoration at official and charitable functions.

XXVII. ADVISORY WORK

54. Tree planting schemes were drawn up for:

- (1) Secondary Technical School, Parry Avenue.
- (2) Secondary Technical School, Rangoon Road.
- (3) Secondary Technical School, Bukit Timah Village.
- (4) Secondary Technical School, Lowland Road.
- (5) New Remand Prison, Queenstown.
- (6) Compounds of Holiday chalets, Changi.
- (7) Project D506.
- (8) Project 523.
- (9) Secondary School and Vocational School, Bukit Timah Village.
- (10) MacPherson Secondary and Primary School.
- (11) Upper Changi Road School.
- (12) Toa Payoh School.
- (13) Mount Vernon Road School.

Planting advice was also given to:

- (14) Schools; Willow Secondary School, New Town Secondary School, Koek Ming Public School, Sin Nan School, Jalan Kayu Primary School, Lim Chu Kang Integrated School, Kim Seng East School.
- (15) Government institutions: Pasir Laba Camp, St. Andrew's Orthopaedic Hospital, T.V. Singapura, Singapore Airport, Teachers' Training College, Woodbridge Hospital Nurses Hostel.
- (16) Other bodies: The Indian High Commission, Royal Navy, Family Planning Centre.

55. Innumerable requests for advice received from private individuals and commercial firms by post and telephone and from callers at the office were dealt with. The Singapore community as a whole is entitled to receive the best assistance available in these matters and in this work the Botanic Gardens has a major role to play in implementing Government's policy for the beautification of Singapore. To provide such a service, there is need for the relevant grades of staff and nursery facilities to be augmented.

XXVIII. EXHIBITIONS

56. The most important exhibition of the year was held at Los Angeles, U.S.A. in conjunction with the Fifth World Orchid Conference 13-22 April. The Botanic Gardens sent a consignment of over 400 sprays of orchid blooms, and this exhibit was awarded the prize for the best in its class. Awards to individual plants went to *Vanda Candlelight*, a Botanic Gardens hybrid, and to *Aeridachnis Bogor*, an introduced hybrid raised at the Botanic Gardens. Mr. Alphonso was a member of the International Judging Panel for classes other than those with Botanic Gardens exhibits.

57. The Singapore Gardening Society Flower Show was held by 4-6 March and the Malaysian Orchid Society Show on 14-16 October, and at both of these the Botanic Gardens contributed extensively in exhibits and manpower, judging and administration. The Botanic Gardens sent a railway wagon load of orchid and foliage plants to Kuala Lumpur for display at the Malayan Agri-horticultural Association exhibition on 28-31 July. To enable Federation residents to have easier access to Botanic Gardens planting material, a larger quantity of orchid seedlings and other plants were taken to this exhibition, and \$2,248 was realised as revenue as compared with \$1,917 in the 1965 exhibition.

58. Orchid blooms were sent to the following overseas exhibitions:
Floral Festival Taranaki, New Plymouth, New Zealand.
Delhi Agri-horticultural Society Show, New Delhi, India.
Westminster Abbey Flower Festival, London, England.
Selangor Orchid Society Show, Kuala Lumpur, Malaysia.

59. Participation in these exhibitions play a very important part in publicising the Singapore cut-flower trade which is based primarily on orchid blooms and the basic research work of this Department. Statistics for the value of cut-orchid blooms exports show a remarkable increase: 1957—\$34,000; 1960—\$128,000; 1964—\$270,000; 1965—\$362,000; 1966—\$750,000.

XXIX. CULTURAL SOCIETIES

60. The Department gave considerable assistance to the Malaysian Orchid Society and the Singapore Gardening Society. Mr. Ang Gek Choo was a committee member of the former, while Mr. Lim Hin Cheng and Mr. Tan Kim Ho were respectively the Vice-President and Hon. Secretary of the latter. Most of the monthly meetings of the latter were held in the Gardens. Mr. H. M. Burkill was a Committee Member of the Singapore Branch of the Malayan Nature Society.

STAFF OF THE BOTANIC GARDENS, 1966

(Divisions I, II and technical posts of Division III)

(Date of first appointment to the Botanic Gardens Service is shown in brackets.)

<i>Appointment</i>	<i>Holder</i>	<i>Notes</i>
Director	H. M. Burkill, M.A. (Cantab.) F.L.S. (12-11-54)	
Botanist	Chew Wee-Lek, B.Sc. (Malaya) Ph.D. (Cantab.) (1-10-56)	Acting Director 24-2 to 13-3.
	Chang Kiaw Lan (Miss), B.Sc. (Malaya), Ph.D. (Cantab.) (7-7-59)	
	Hardial Singh, B.Sc. (Singapore) (1-11-63)	
Curator	A. G. Alphonso (1-1-40) Lam Hin Cheng (1-7-57)	
Librarian	Tan Kim Ho, B.Sc. (Malaya) (1-4-58)	
Executive Officer	D. P. Lazaroo (11-3-63)	
Laboratory Assistant (Special Grade)	Bajuri bin Sappan (14-9-37)	
Horticultural Assistant	Ang Gek Choo (18-5-61)	
Herbarium Assistant	Md. Shah bin Haji Md. Noor (3-2-55)	
Artist	Juraimi bin Samsuri (1-9-45)	
Junior Horticultural Assistant	Aziz bin Pakiri (25-5-33)	Retired w.e.f. 1-3.
	Wong Siew Hang (11-2-35)	Retired w.e.f. 25-5.
	Herbert Wee Sip Hean	Assumed duty w.e.f. 13-5.
	Stanley Chia Jiew Thian	Assumed duty w.e.f. 1-7.
	N. Krishnan	Assumed duty w.e.f. 25-4.

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1966

Reading daily at 9.30 a.m. local time at Gardens Office

1966	Total Rainfall	Highest fall in 24 hours	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Dry Bulb Temp.	Mean Wet Bulb Temp.	Mean R.H.
	inches	inches		°F	°F	°F	°F	°F	°F	%
January	6.82	1.30	15	86.1	91.5	73.7	71.0	79.4	76.2	86.5
February	2.66	0.59	11	89.3	93.0	75.0	72.5	79.4	76.2	86.5
March	12.55	2.76	20	90.0	93.5	74.7	72.0	81.3	73.5	83.2
April	7.45	2.24	15	90.7	96.0	76.2	74.5	81.2	77.8	85.2
May	5.16	1.13	13	90.6	94.5	76.7	73.5	83.6	79.4	81.4
June	5.61	2.59	10	89.4	93.5	76.4	72.5	82.7	79.1	85.1
July	7.60	3.45	12	88.4	92.5	76.4	72.5	82.4	78.5	82.7
August	7.08	1.98	11	89.0	95.0	76.4	70.0	85.3	78.6	82.6
September	5.90	1.58	15	90.3	94.0	76.3	71.0	81.8	78.0	83.9
October	9.28	2.67	18	89.1	93.0	75.8	72.5	83.0	78.6	82.1
November	12.33	2.96	18	88.6	92.5	74.8	72.0	81.6	78.5	85.7
December	13.39	2.47	19	86.7	90.0	74.4	72.0	80.5	77.6	86.8
						74.0	72.0	79.4	76.5	86.8
Total	96.03	..	177	..	..	..	..	..	..	..
Mean	8.00	..	..	89.0	93.2	75.4	72.1	81.8	77.7	84.3

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1966

Reading daily at 8.00 a.m. local time at "Orchid Enclosure" from 1-1-66 to 31-12-66

51

1966		Total Rainfall	Highest fall in 24 hours	No. of days Rainfall	Mean Maximum Temperature	Highest Maximum Temperature	Mean Minimum Temperature	Lowest Minimum Temperature	Mean Dry Bulb Temperature	Mean Wet Bulb Temperature	Mean R.H.	Mean Grass Minimum Temperature	Mean Earth 4" Temperature	Mean Earth 1' Temperature	Mean Earth 4' Temperature	Mean Solar Radiation Temperature	Mean Daily hours of Sunshine
		ins.	ins.		°F	°F	°F	°F	°F	°F	%	°F	°F	°F	°F	°F	Hours
January	..	6.76	1.20	15	87.9	92.5	72.2	70.0	74.6	73.9	96.3	72.1	79.9	81.6	82.4	..	5.06
February	..	2.50	0.63	11	90.7	93.5	76.0	71.0	72.7	71.3	94.6	72.7	81.7	83.8	83.3	..	5.90
March	..	12.01	2.40	20	90.1	94.5	73.5	71.5	76.1	75.3	96.4	73.2	82.2	83.8	83.8	..	5.54
April	..	6.86	1.98	14	90.8	94.0	75.0	73.0	77.5	76.7	96.2	74.3	82.8	84.6	84.0	..	5.61
May	..	5.14	1.29	14	90.3	93.0	75.1	72.5	78.2	74.1	96.1	71.1	82.7	84.5	84.4	..	6.01
June	..	6.14	3.10	10	89.9	94.5	74.5	71.0	77.2	76.3	95.7	70.8	81.9	83.5	83.9	..	6.34
July	..	7.56	3.62	13	88.8	91.5	74.8	72.0	77.8	76.7	94.6	71.8	81.5	82.8	83.8	122.0	5.75
August	..	7.05	2.12	9	88.6	91.5	74.5	70.0	77.5	76.8	95.2	72.1	81.7	83.8	83.8	123.6	5.17
September	..	5.57	1.49	14	89.4	92.0	73.9	71.5	77.8	76.9	95.6	72.7	82.4	84.3	84.3	126.1	6.21
October	..	9.14	2.60	18	88.2	91.0	73.7	72.0	77.0	76.1	95.0	72.0	81.3	82.8	83.4	125.5	5.42
November	..	11.61	2.84	19	88.5	92.0	73.3	71.0	76.1	75.3	96.6	72.1	80.7	80.7	83.4	122.2	4.47
December	..	11.94	1.66	20	87.9	90.5	73.3	71.5	75.7	74.7	96.3	72.2	80.0	81.3	82.3	121.2	3.97
Total	..	92.28	..	177	..	..	..	..	..	..	..	..	..	..	..	..	..
Mean	..	7.69	..	..	89.3	92.5	74.1	71.4	76.5	75.3	95.7	72.3	81.6	83.1	83.6	123.4	5.45

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE, 1966

Reading daily at 8.00 a.m. local time at Bukit Timah from 1-1-66 to 31-12-66

1966		Total Rainfall	Highest fall in 24 hours	No. of days rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	R.H.
		inches	inches		°F	°F	°F	°F	°F	°F	%
January	.. ..	15.08	2.22	17	84.8	89.7	73.6	71.0	76.0	74.7	91.2
February	.. ..	9.39	2.22	11	85.3	88.5	72.9	68.7	76.8	74.7	90.1
March	.. ..	10.28	2.22	19	86.3	89.2	73.6	69.8	77.1	74.8	89.8
April	.. ..	12.78	2.96	15	86.8	91.0	74.3	69.9	78.9	76.1	88.2
May	.. ..	17.64	3.47	17	86.5	90.0	74.3	69.9	78.6	76.4	89.6
June	.. ..	7.87	2.60	10	85.6	88.5	73.8	68.5	78.3	75.7	88.4
July	.. ..	8.00	3.20	10	85.7	88.5	75.1	71.5	78.3	76.0	89.8
August	.. ..	8.57	2.50	11	85.9	88.5	74.6	69.5	78.0	75.8	89.8
September	.. ..	5.55	1.80	12	86.8	89.8	74.5	70.0	78.3	76.2	98.5
October	.. ..	12.87	3.47	16	85.8	89.7	74.2	71.0	77.9	75.7	90.0
November	.. ..	22.85	3.47	19	85.4	90.2	73.1	69.0	77.2	73.1	90.1
December	.. ..	10.18	3.47	17	85.3	89.3	73.3	69.3	76.8	74.5	89.6
Total	.. ..	141.06	..	174	..	..	..	..	..	..	..
Mean	.. ..	11.75	..	..	85.8	89.4	73.9	69.8	77.7	75.4	89.8

METEOROLOGICAL REPORT

KLANJI WAR GRAVES CEMETERY

Recorded daily at 8.00 a.m.

1-1-66 to 31-12-66

Month	Total Rainfall inches	No. of days with rain	Highest fall in 24 hours inches
January	8.48	11	2.05
February	8.55	5	2.45
March	6.13	9	2.03
April	4.10	4	1.60
May	6.47	6	2.30
June	3.03	3	1.50
July	5.91	9	1.25
August	8.10	7	1.86
September	3.98	4	1.68
October	5.68	8	1.15
November	14.46	14	2.30
December	8.55	11	1.05
Total ..	83.44	101	..

SUMMARY OF DISTRIBUTION OF HERBARIUM MATERIAL
ON EXCHANGE AND LOAN

IAPT Code	Institution	EXCHANGE		LOAN	
		In	Out	In	Out
A	Arnold Arboretum, U.S.A.	371	432	492	—
B	Berlin Botanic Gardens, Germany	—	79	19	—
BH	Bailey Hortorium, U.S.A.	—	43	—	—
BISH	Bishop Museum, Hawaii	3	22	—	—
BKF	Thai Forest Department, Bangkok	44	27	74	—
BM	British Museum, U.K.	—	273	167	12
BO	Herbarium Bogoriense, Indonesia	242	—	1,698	58
BR	Botanic Gardens, Brussels, Belgium	120	—	—	—
BRI	Botanic Gardens, Brisbane, Australia	1	67	2	—
BSI	Botanical Survey of India, Poona, India	—	—	24	—
BSIP	Forest Department, Br. Solomon Island	1,433	—	—	—
C	Botanical Museum and Herbarium, Copenhagen, Denmark	—	306	—	—
CAL	Botanic Gardens, Calcutta, India	2	1	94	—
CANB	CSIRO, Canberra, Australia	—	1	—	—
CGE	Botany Department, Cambridge University, England	51	—	—	344
DD	Forest Research Institute, Dehra Dun, India	—	32	23	—
G	Botanic Gardens, Geneva, Switzerland	—	98	—	—
E	Royal Botanic Garden, Edinburgh, U.K.	—	—	316	—
K	Royal Botanic Gardens, Kew, U.K.	30	361	6	35
KEP	Forest Research Institute, Kepong, Malaya	802	23	291	6,245
KLU	Botany Department, University, Malaya, Kuala Lumpur	12	—	—	611
L	Rijksherbarium Leiden, Holland	5	479	1,449	2,195
LAE	Forest Department, Lae, New Guinea	859	228	23	15
LWU	Botany Department, Lucknow University, India	—	—	—	12
	<i>Carried forward</i>	3,975	2,472	4,678	9,517

SUMMARY OF DISTRIBUTION OF HERBARIUM MATERIAL
ON EXCHANGE AND LOAN—continued

IAPT Code	Institution	EXCHANGE		LOAN	
		In	Out	In	Out
	<i>Brought forward</i> ..	3,975	2,472	4,678	9,517
MAU	Mauritius Herbarium	—	30	—	—
MICH	Botany Department, University Michigan, U.S.A.	—	82	—	—
NY	New York Botanical Garden, U.S.A. ..	—	88	—	—
OS	Ohio State University, Ohio, U.S.A. ..	—	12	—	—
P	Natural History Museum, Paris, France ..	407	29	10	—
PNH	Manila Museum, Philippines	—	47	64	—
PUH	Botany Department, University, Philippines	—	24	—	—
SAN	Forest Department, Sabah	504	—	16	—
SAR	Forest Department, Sarawak	931	170	7	1,709
SIU	Botany Department, University, Illinois, U.S.A.	—	—	—	28
UBC	Botany Department, University, British Columbia, Canada	—	11	—	—
UC	Botany Department, University of Califor- nia, U.S.A.	—	89	129	—
WTC	Botany Department, University of Washing- ton, U.S.A.	—	48	—	—
Z	Botanic Gardens, Zurich, Switzerland ..	—	4	—	—
—	Carpenter, Mrs. R., R.A.F., Gan ..	69	—	—	—
—	Ceylon Fisheries Department	—	21	—	—
—	Post, Dr. E., Hamburg, Germany ..	—	11	—	—
—	Rubber Research Institute, Malaya ..	—	—	—	38
—	Seidenfaden, Mr. G., Denmark ..	—	—	—	30
—	University of Cracow, Roumania ..	200	—	—	—
—	University of Delhi, India	10	—	—	—
	Total ..	6,096	3,137	4,904	11,332

SUMMARY OF MAIN PLANT COLLECTING EXPEDITIONS—1966

APPENDIX VII

Personnel	Date	Locality	Collections
Chew Wee-Lek with J. A. R. Anderson, Forest Department, Sarawak	1—23 February ..	Gunong Api, Benarat, 4th Division, Sarawak	230 numbers—Limestone flora for herbarium.
Chew Wee-Lek with the Kepong/Leiden party, Wong Yew Kuan, T.C. Whitmore, Ding Hou	11—21 August ..	Gunong Bubu, Perak	51 numbers for herbarium 3 numbers (4 plants) for cultivation.
Chew Wee-Lek Chang Kiaw Lan with E. J. H. Corner, Wong Yew Kuan, T. C. Whitmore	29 September—6 October	Cameron Highlands	45 numbers for herbarium 60 fungi for herbarium 4 numbers (5 plants) for cultivation.
H. M. Burkill (on casual leave)	1—3 January	Mersing, Tk. Sari	6 Phanerogams for herbarium 14 Algae for herbarium.
H. M. Burkill with 5 Thai-Danish Expedition ..	21 February—13 March	West Coast, Peninsular Thailand, Terutao to Ranong	27 numbers—vascular plants for herbarium 135 numbers—marine algae for herbarium 5 numbers—Trentepohliaceae for herbarium 19 numbers—(46 plants) orchids for cultivation.
H. M. Burkill Sanusi bin Sarih Mohd. Noor bin Jumaat Samsuri bin Ahmad H. M. Burkill (on casual leave)	4—10 July	Pulau Pemanggil, Johore	54 numbers marine algae 11 numbers (7 plants) orchids for cultivation.
A. G. Alphonso Sidek bin Kiah	28 July—5 September 13—30 September	Bahau, Fraser's Hill, Batu Caves, Cape Rachado Kinabalu, Sabah	23 numbers, mostly Trentepohliaceae, for herbarium. 178 numbers (606 plants) orchids for cultivation 54 numbers for herbarium.
Hardial Singh	15—26 January	Sg. Buloh, Batu Caves, Selangor	146 numbers for herbarium.
Hardial Singh	21—26 November	Alor Bukit, Pontian, Johore	47 numbers for herbarium.

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM PLANTS
AND SEEDS WERE RECEIVED IN 1966

ALGERIA	Faculte des Sciences de L'Universite d'Alger; Jardin d'Essai du Hamma.
AUSTRALIA	Parks Department, Townsville; King's Park and Botanic Gardens, Perth; Botanical Gardens, Adelaide; Mr. N. L. Wills, Queensland.
AUSTRIA	Botanischer Garten der Universitat, Wien.
BRAZIL	Instituto de Botanica, Sao Paulo.
CAMBODIA	Dr. Chao On; Mr. Dy-Phon.
CHILE	Jardin Botanico Nacional, Vina de Mar.
FINLAND	University Botanic Garden, Turku.
FRANCE	Jardin Botanique, Caen; Jardin Botanique, Nantes; Jardin Botanique, Besancon; Jardin Botanique de la ville Rennes.
GERMANY	Botanischer Garten der Technischen Hochschule, Aachen; Botanischer Garten der Universitat, Munster; Botanischer Garten, Essen; Dr. Wilmar Schwabe, Strabe.
GREECE	University of Athens.
HUNGARY	Hortus Botanicus Academiae Scientiarum, Vacratot.
IRELAND	National Botanic Gardens, Dublin.
ITALY	Gardina Zoologies, Naples; Giardino Botanico Hanbury, Ventimiglia.
JAPAN	Faculty of Agriculture, Hokkaido University, Sapporo; The Governor of Tokyo; Mr. Junzo Oguro, Tokyo; Experimental Station of Medicinal Plants, Kasukabe; Miyazaki Botanical Gardens.
MALAYSIA	Botanic Gardens, Penang; Forest Research Institute, Kepong; Mr. E. F. Allen, Agricultural Research Centre, Sabah; Mrs. Richard Tan, Jesselton; Mr. Ruslan, Kuala Lumpur; Dr. F. M. Dourado, Perak; Mr. Cheah Kheng Chong, Perak; Mr. P. G. Herklots, Sarawak.
NETHERLANDS	Hortus Botanicus, Groningen.
NEW GUINEA	Department of Forests, Lae; Mr. J. S. Womersley.
NORWAY	Hortus Botanicus Universitatis, Oslo.
PAKISTAN	Mr. Munir Ahmad abid Chaudhury, Sind University, Hyderabad.
PHILIPPINES	Mrs. Patricia K. Manuel; Mrs. Corazon M. de Leon.

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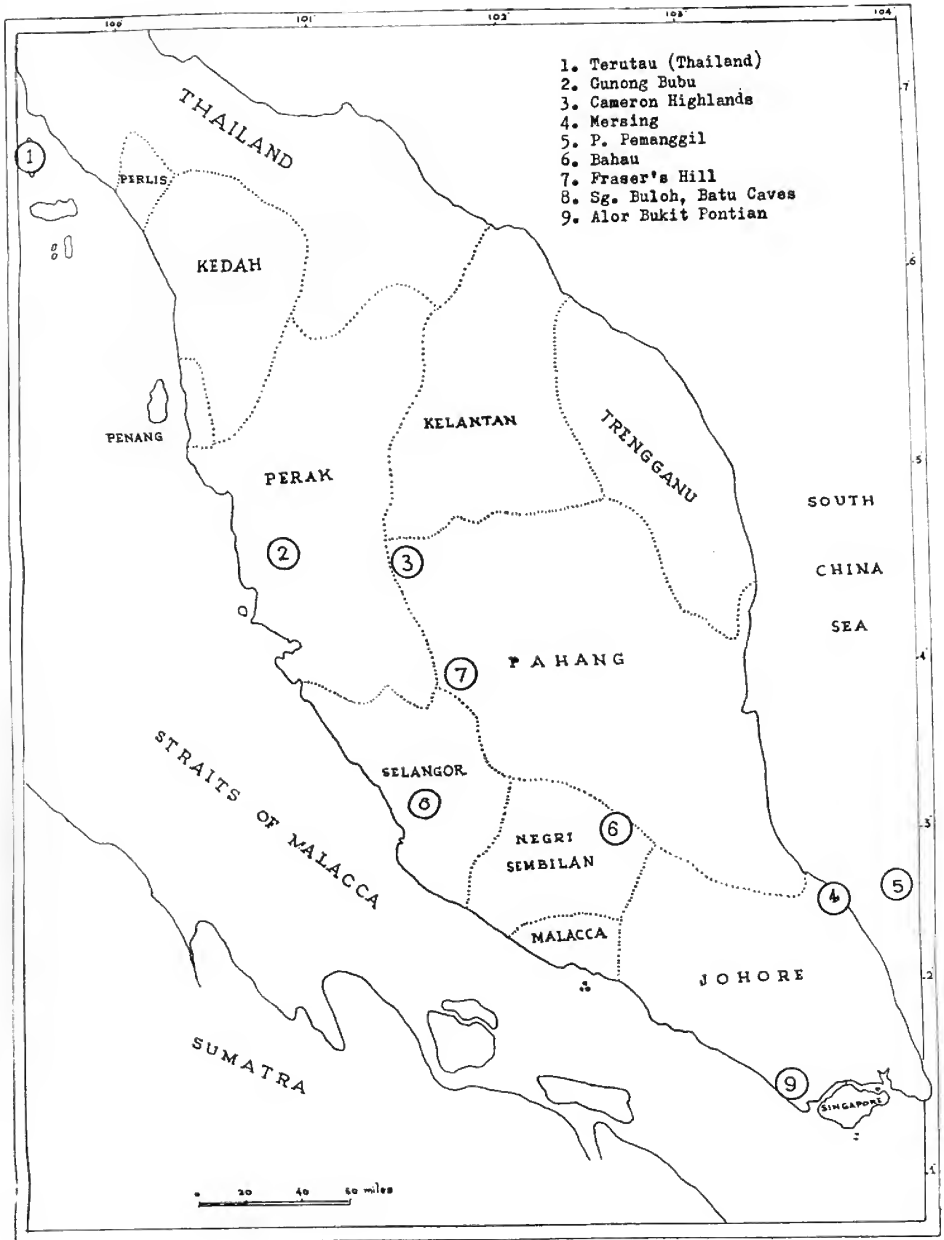
POLAND	Institutum Plantarium Medicenarium, Libelta.
PORTUGAL	Instituto de Botanica 'Dr. Goncalo Sampaio', Campo Alegre, Porto; Hortus Botanicus, Coimbra.
ROMANIA	Gradina Botanica a Universitatii 'Babes-Bolyai', Cluj; Gradina Botanica a Universitatii, Bucuresti.
SINGAPORE	Mr. Teng Koh Teo; Mr. Morgan Khoo; Mr. Jumali bin Kafrawi; Mr. Ronald Ma; Dr. Hsuan Keng; Mrs. Edith Cho Chak Nam; Mr. Loke Che Sung; Mr. Abdul Aziz bin Pakiri; Mr. Lee Sai Kwang; Mr. R. T. Downes; Syed Yusoff Alsagoff; Mr. Moreira; Mr. R. E. Dean; Mr. Paul Chan; Mrs. Max Lewis; Mr. W. G. Thurston; Mr. How Yee Peng; Mr. R. Scott; Mrs. T. C. Whang; Singapore Works Brigade.
SOLOMON ISLANDS	Dr. T. C. Whitmore, Honiara.
SOUTH AFRICA	Mr. J. E. A. Carver, Durban North.
U.A.R.	Orman Botanic Gardens, Cairo.
U.K.	Royal Horticultural Society Garden, Surrey; Mr. L. A. Livermore, Lancaster; Department of Botany, Birmingham University; Botanic Gardens, Glasgow.
U.S.A.	Huntington Botanic Gardens, California; Honolulu Botanic Gardens, Hawaii; Botanic Gardens, University of California, Los Angeles.
U.S.S.R.	Hortus Botanicus Academiae Scientiarum, Minsk.

INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS
AND SEEDS WERE SENT IN 1966

ARGENTINA	Instituto de Botanica Agricola, Buenos Aires.
AUSTRALIA	Botanical Gardens, Adelaide; Plant Quarantine Department, Canberra; City Council of Townsville, Queensland.
AUSTRIA	Botanischer Garten der Universitat, Wien.
BAHAMAS	Mr. Stanley Smith.
BELGIUM	Dr. J. Marton, Cent.
CAMBODIA	Mr. Dy-Phon; Dr. Chao-On.
CANADA	National Research Council.
CZECHOSLOVAKIA	Academia Scientiarum, Dhiibonice; Agricultural Research Station, Semperk-Temenice; Hortus Botanius Institute Pedagogice, Kosice; Institutum Natural Sciencium, Praha; Irg. Frantisek Popesil, Lendnice.
FINLAND	University of Turku; University of Helsinki.
FRANCE	Jardin Botanique de L'Universite, Besancon; Jardin Botanique 'Lees Cedres', Paris.
GERMANY	Botanischer Garten der Universitat Warburg; Botanischer Gartens, Munchen; Wolfgang Goethe University, Frankfurt; Botanischer Garten der Technischen. Dresden; Botanischer Garten; Darmstadt.
GHANA	Kwame Nkrumah University, Kumasai.
GUAM	Mr. Paul Souder, Ogawa.
HONG KONG	Urban Services Department.
HUNGARY	Hortus Experimentalis Instituti Horticulturae, Szentes.
INDIA	National Botanic Gardens, Lucknow; Indian Agricultural Research Institute, New Delhi; Government Degree College, Chindwara.
ISRAEL	Mr. Anosh Garyn, Jerusalem.
IVORY COAST	Centre d'adopodoume, Abidjan.
JAPAN	The Governor of Tokyo; Mr. R. Hatta, Takeda Herbal Gardens, Kyoto; Mr. Junzo Oguro, Tokyo; Mr. Y. M. Miyazaki, Shizeoka Prefecture.
LIBERIA	Liberian Agriculture, Monrovia.
MALAYSIA	Mr. P. G. Herklots, Kuching; Mr. J. Morris, Tawau; Botanic Gardens, Penang; University of Malaya, Kuala Lumpur; Majlis Bandaran, Ipoh; Department of Agriculture, Kuching; Mr. F. M. Corpuz, Jesselton; Mr. G. L. Carson, Sandakan; Dr. F. M. Dourado, Ipoh; Mr. Aw Kheng Huat, Perlis; Mr. Cheah Kheng Cheong, Perak.
MAURITIUS	Dr. P. O. Wiehe.
NEW GUINEA	Department of Forests. Lae; Mr. J. S. Womersley; Mdm. Andre Miller.
NEW ZEALAND	Mr. L. W. Woods.

- NIGERIA Mr. J. T. Swarbrick, Hadan; University of Ibadan.
- PHILIPPINES Mrs. Corazon M. de Leon; Miss Mary B. Fermin; Mrs. Patricia K. Manuel.
- POLAND Hortus Plantarium Academic Medicenaliu, Kniewskieg.
- PORTUGAL Instituto Botanico Universidade, Coimbra.
- SAUDI-ARABIA Mr. and Mrs. H. D. Boynton, Dhahran; Mr. and Mrs. G. A. Galliozzi, Dhahran.
- SINGAPORE Television Singapura; University of Singapore; General Hospital; Trafalgar Home; Land Office; Teachers' Training College; Health Education Centre; Ramakrishnan Mission Boys' Home; St. Andrew's Hospital; Prisons Department; Changi Prison; Police Reserve Unit; Red Cross Tanah Merah Camp; Queenstown Fire Station; Geylang Fire Station; Inland Revenue Department; Public Health Department; Social Welfare Department; Central Police Station; Corrupt Practices Investigation Bureau; Ulu Pandan Sewerage; Pasir Laba Camp; Singapore Airport; Light Industries Services; Woodbridge Hospital; Orchard Road Police Station; Assembly House; Lim Chu Kang Agricultural Station; People's Defence Forces; Mr. Loke Che Sung; Syed Yusoff Alsagoff; The Istana; Ahmad Ibrahim Secondary School.
- SOLOMON ISLANDS Forest Herbarium, Honiara.
- SOUTH AFRICA Mr. J. E. A. Carver, Durban North.
- SOUTH VIETNAM Jardin Botanique, Saigon.
- SPAIN Mr. Jose Equilleor Sores, Madrid.
- TAIWAN Forestry Research Institute.
- TANZANIA Mr. Griffith Cunningham, Dar Es Salaam; Kirkone College.
- THAILAND Ministry of Education, Bangkok.
- TUNISIA Institute Nasional de la Recherche Agronomique de Tunisia, Ariana.
- U.A.R. Ministry of Agriculture, Cairo; Orman Botanic Gardens, Cairo.
- U.K. Dr. Stanton, London; London University Botanical Supply Unit; Surrey; Royal Botanic Gardens, Kew; Agricultural Research Council, Wantage; Tropical Products Institute, London; Dr. R. E. Holttum, Kew.
- U.S.A. University of Science and Technology, Ames, Iowa; University of California, Botanic Gardens, Berkeley; Mr. Harrison G. Yucum, Tucson, Arizona; Department of Arboreta. and Botanic Gardens, California; Fair-child Tropical Gardens, Miami; Missouri Botanical Gardens; Mr. Leonid Enari, California; Purdue University, Indiana; Mr. G. Stanley, San Francisco; University of Hawaii Arboretum, Honolulu.
- U.S.S.R. Hortus Botanicus Principalis Academiae Scientiarum, Moscow; Hortus Botanicus Academiae Scientiarum, Ashkabad; Hort Botanici Academiae Scientiarum, Ukraine.

MAP INDICATING LOCATION OF MALAYAN PLACE-NAMES
MENTIONED IN THIS REPORT



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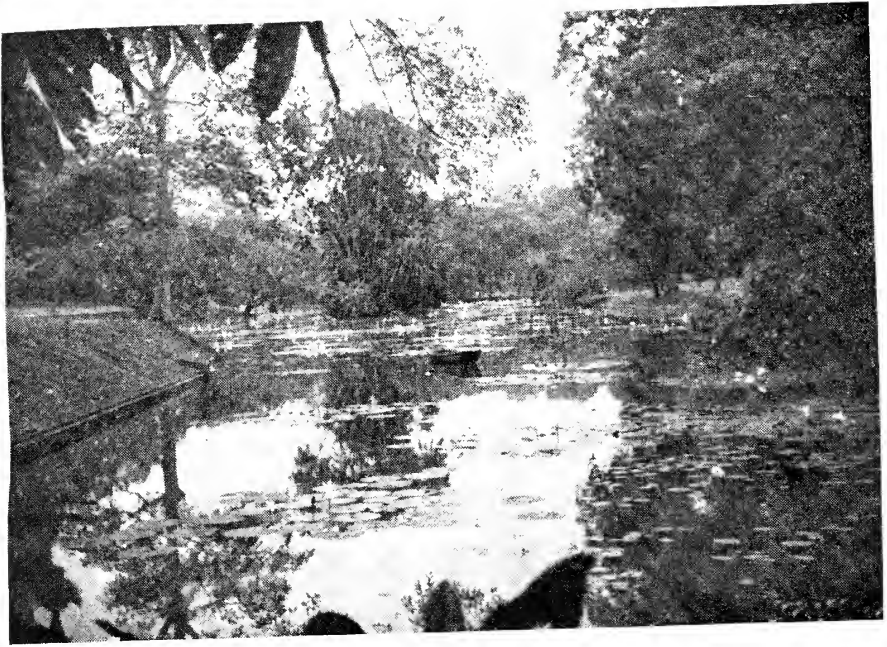
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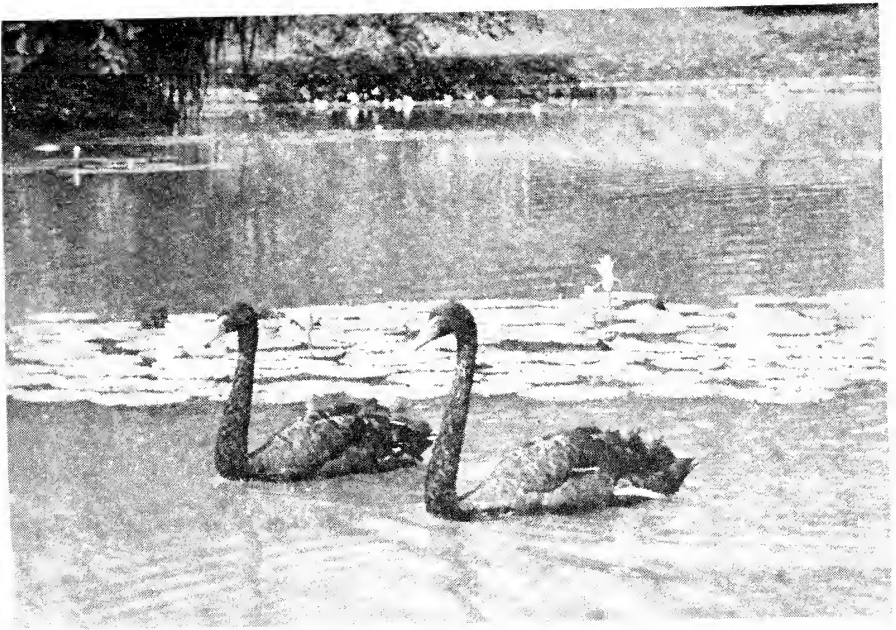
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Botanic Gardens Lake — morning scene with open *Nymphaea* flowers.



West Australian Black Swans (*Chenopsis atrata*) on the Botanic Gardens Lake — see para. 70 of this report.

(*Photograph by courtesy of Sin Chew Jit Poh, Singapore.*)

SOME E PLANTS



Piper crocatum



Scindapsus pictus



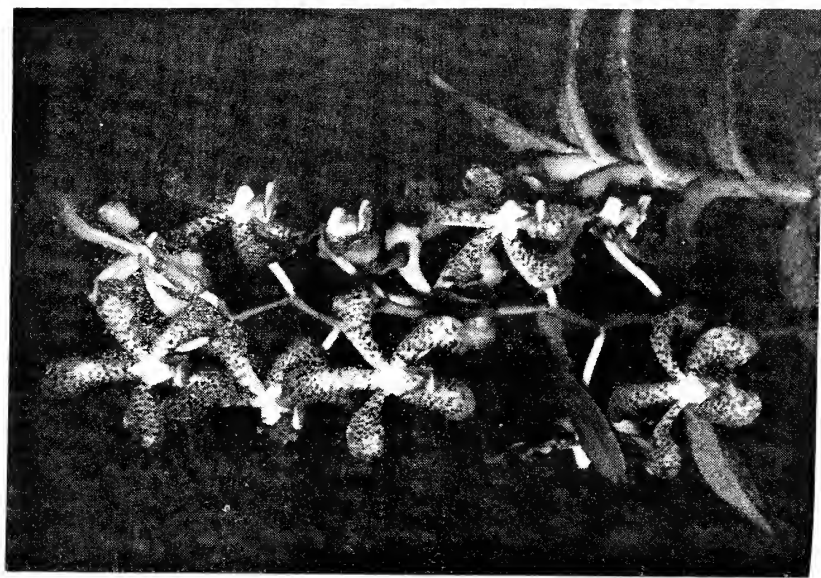
Kaemphera pulchra



Episcia fulgida



Orchid hybrid BGS. 3621 : *Dendrobium Daina Manescu*.



Orchid hybrid BGS. 1806 : *Aranda Majula*.

I. FUNCTION

To conduct research into the regional flora and to provide a taxonomic service in support of technological activity concerning Malesian plant life: to conduct research into tropical horticulture.

II. STAFF

2. There has been no change in establishment. The Director was away on overseas leave from 17th July to 26th November, during which time Dr. Chew Wee-Lek acted. Mr. Lam Hin Cheng, Curator, was seconded on 26th June to the Tree Planting Unit of the Public Works Department, and from that date Mr. Ang Gek Choo, Horticultural Assistant, was acting Curator as well as covering the duties of his substantive post. One Junior Horticultural Assistant's post was vacant from 21st June to 29th December. Haji Mohd. Amin bin Haji Eksan, Ranger, was awarded the Long Service Medal (*Pingat Bakti Setia*) in the National Day Honours 1967. He retired on 15th November after 33 years 10 months' service.

III. LABOUR

3. The labour force remained at 99 as at the end of 1966. This figure included two men and five women employed in the Herbarium. There were in addition nine labourers employed in general upkeep work in the Nature Reserves — seven at Bukit Timah Nature Reserve and two at Kranji Nature Reserve. Health has been good and duties were satisfactorily carried out.

IV. BOTANIC GARDENS ORDINANCE AND BY-LAWS

4. The provisions of the Ordinance worked satisfactorily. The By-laws (Botanic Gardens Rules, 1958) were amended to legalise the exclusion of all vehicular traffic from the Gardens (*Gazette* Notification No. S 98 of 2nd June, 1967). Traffic was excluded from 5th June. This has very greatly improved the utility of the Gardens as a place for recreation. One letter of complaint was published in the press and was replied to. No complaint was made direct to the Department: on the contrary, there have been several favourable comments. Since closure, about 20 cases per month of unauthorised entry have been reported by the watchmen, mostly motorcycles and bicycles and entering via the Main Gate, and private cars and taxis by the Office Gate. Offenders pleaded ignorance and have so far been only cautioned. Prosecution under the Botanic Gardens Ordinance is cumbersome and in this respect there is need to amend the schedule of public roads to include the Botanic Gardens roads and paths so that such offences may be dealt with under the Road Traffic (Composition of Offences) Rules 1958.

V. WATCHMEN

5. The number of watchmen employed remained at twenty. These gave static night guard at two points and patrols by day. Duties were carried out satisfactorily.

VI. TECHNICAL ASSISTANCE SCHEMES

6. Departmental facilities were available for training in botany and horticulture under the following heads:

(1) *Colombo Plan Technical Cooperation Schemes*

- (a) one Senior Fellowship in Taxonomy;
- (b) one Senior Fellowship in Horticulture;
- (c) four Junior Fellowships in Herbarium Practice;
- (d) six Junior Fellowships in Horticulture and Elementary Gardening.

Mr. Montien Srisuko, Technical Assistant of the Royal Thai Department of Forests, held the Senior Fellowship in Taxonomy till 1st May, completing a tenure of 18 months from 8th November, 1965.

(2) *Rehabilitation and Retraining Schemes*

One trainee was accepted from the Labour Department, one from the Public Utilities Board, three from the Public Works Department, two from the Housing and Development Board and one from the Singapore Military Forces, for training in elementary gardening.

(3) *Other schemes*

(a) Mr. Tatsuo Kawashima, a horticultural officer of the Miyazaki Prefectural Administration in Japan, who started a course of study on tropical plants and horticulture on 27th October, 1966, completed his study on 3rd April.

(b) The Department participated in the Junior Chamber of Commerce of Singapore and the Vocational Guidance Steering Committee's Youth Week in Commerce and Industry held from 14th to 19th August, and accepted six sponsored students to work in the Gardens to gain gardening experience.

(c) Two students were accepted from the College of Agriculture, Serdang, and put through a short course of practical horticulture.

(d) A course on horticultural research and commercial practice lasting two weeks was arranged for Mrs. Leung Wang Tak-Kan, Gardens Assistant of the Urban Council and Urban Services Department, Hongkong. She was in Singapore from 13th to 29th March, after a tour of horticultural organisations in Malaya.

(e) Students from the Singapore Polytechnic and the University of Singapore, and student-teachers of the Teachers Training College were given assistance for various academic activities.

VII. WORKS AND BUILDINGS

7. The old tea kiosk was converted by the Public Works Department into a plant house. The new tea kiosk proved to be too small and plans were drawn up for its extension. A contract was signed in September for the construction of the library and herbarium extension but work was suspended after one week, and remained so till the end of the year.

8. The Public Works Department began a programme of tar-sealing footpaths which hitherto had been laterite-covered. The paths round the Lake, on the Bandstand Hill and those leading to the Plant House were done, other paths being left untouched due to a shortage of funds.

9. The Public Works Department continued repairing and renewing roadside drains and about three-quarters of the work was completed before the end of the year when this work too was stopped due to insufficient funds.

10. The Public Works Department installed a 3,000-gallon water tank on Lawn D together with a pipe supply system covering Lawns A, B and C. Water is drawn from the Lake.

11. The perimeter fencing of the new Orchid Enclosure (Orchid Nursery 2) on Lawn X was electrified in order to keep monkeys out.

12. The following schemes were put up and accepted for implementation under Development Estimates 1968:

(1) Installation of electric lighting in the Gardens	...	\$ 78,450
(2) Fountain in the Lake	...	\$138,000

VIII. VISITORS

13. Most notable visitors were: Mr. S. C. Shirley Corea, Deputy Speaker, House of Representatives, Colombo, Ceylon; Mr. Vernon Wilcox, Minister of Transport, Victoria, Australia; Sir Sydney Caine, lately of the London School of Economics, U.K., and at one time Vice Chancellor of the University of Singapore; Mr. G. Darling, Minister of State Board of Trade, U.K., and Mr. Chan Chee Seng, Parliamentary Secretary to the Minister for Social Affairs, Singapore.

14. Many prominent men of science and letters called at the office, including:

Prof. J. Ashida, Kyoto University, Japan.

Prof. N. Ata, Professor of Pharmacy, Osaka College of Pharmacy,
Japan

Dr. S. Boonkird, Forest Industry Organisation, Bangkok, Thailand.

Mr. J. R. Cowell, Royal Horticultural Society, London, U.K.

Dr. D. Düvel, Institute of Applied Botany, University of Hamburg,
Germany.

Mr. J. D. Firth, Superintendent Parks and Gardens, Victoria, Australia.

- Mr. J. E. Forster, Director, Eastern Region Commonwealth War Graves Commission, New Delhi, India.
- Dr. J. Gaudet, State University of New York, U.S.A.
- Dr. G. Hadley, University of Malaya, Kuala Lumpur.
- Mr. D. M. Henderson, Royal Botanic Garden, Edinburgh, U. K.
- Prof. M. Hirano, Kyoto University, Japan.
- Dr. W. H. Hodge, National Science Foundation, Washington, U.S.A.
- Dr. M. Hutoh, Kyoto Pharmaceutical College, Japan.
- Dr. K. Iwatsuki, Botanical Department, Kyoto University, Japan.
- Prof. B. M. Johri, Professor of Botany, University of Delhi, India.
- Prof. N. Kitagawa, Nasa University of Education, Japan.
- Dr. G. A. Letts, Director of Agriculture, Northern Territories, Australia.
- Prof. B. Lining, University of Stockholm, Sweden.
- Dr. J. B. Lowry, University of Malaya, Kuala Lumpur.
- Mr. J. N. Maclet, Director of Botanic Gardens, Papeete, Tahiti.
- Mr. L. Mattsson, Director, UNESCO Science Cooperation Office for Southeast Asia, Djakarta, Indonesia.
- Dr. M. Naosuke, Sinjuku Botanical Garden, Japan.
- Prof. P. J. Randle, Professor of Biochemistry, University of Bristol, U.K.
- Dr. D. R. Reymoller, University of the Philippines, P.I.
- Dr. A. Sleep, University of Leeds, U.K.
- Dr. Y. Tachibana, Botanical Garden of Osaka City University, Japan.
- Prof. M. Tagawa, Kyoto University, Japan.
- Prof. T. Shimizu, Shinshu University, Japan.
- Dr. S. Ueno, National Science Museum, Tokyo, Japan.
- Ing. A. Vergara, Director del Campo Experimental de Hule "El Palmar", Mexico.
- Dr. J. E. Wallen, Head, Office of Oceanography and Limnology, Smithsonian Institution, U.S.A.
- Prof. H. Wanner, Institute for General Botany, University of Zurich, Switzerland.
- R. J. Weaver, Professor of Viticulture, University of California, U.S.A.
- Mr. B. E. Weber, Game Department, Seremban, Negri Sembilan.
- Dr. W. E. Westman, Cornell University, U.S.A.
- Mr. B. Wood, Chemara Research Station, Layang-layang, Johore.

15. Visiting workers were:

Mr. B. L. Burt, Royal Botanic Garden, Edinburgh, U.K. (Malesian flora, Gesneriaceae).

Mr. J. Carrick, University of Malaya, Kuala Lumpur (Phytochemical survey of Malayan Flora).

Dr. J. J. Gaudet, University of Malaya, Kuala Lumpur (Malayan flora).

Dr. C. den Hartog, Rijksherbarium, Leiden, Holland (Malesian Marine phanerogams).

Mr. E. Hyams, London, U.K. (Materials for a book on world famous and important botanic gardens).

Mr. A. Martin, Royal Botanic Garden, Edinburgh, U.K. (Tropical horticulture).

Dr. W. Meijer, Forest Department, Sabah (Forest botany).

Dr. B. C. Stone, University of Malaya, Kuala Lumpur (Malayan flora).

Dr. T. C. Whitmore, Forest Research Institute, Kepong, Selangor (Forest botany).

16. The facilities of the Gardens, Herbarium and Library were made freely available to members of the staff and sponsored students of the University of Singapore, Nanyang University, and the Singapore Teachers' Training College as well as other official organisations.

17. The usual very large number of casual visitors came daily to the Gardens.

18. Conducted tours were arranged for:

(a) St. Joseph's Institution Historical Society;

(b) Anglo-Chinese School Science Society;

(c) Royal Air Force Seletar Secondary School;

(d) Teachers of the British Army School;

(e) Delegates of the 4th General Assembly of Asian Broadcasting Union.

IX. LIBRARY

19. The library accommodation remained in the unsatisfactory situation stated in the previous Annual Reports. The prospect of relief recorded in last year's report did not materialise with the suspension in September, of the contract in September for the construction of the building to house the library. Work is expected to restart early in 1968. The library accession register showed a holding of 9,052 bound volumes by the end of the year, in addition to which there is an extensive holding of unbound volumes, separates and other miscellaneous materials. *The Gardens' Bulletin, Singapore*, was exchanged with 318 addresses throughout the world.

X. PUBLICATIONS

20. Two parts of *The Gardens' Bulletin, Singapore*, were issued during the year containing:

Volume XXII, Part I, 20th January, 1967.

Whitmore, T. C.: Notes on the Systematy of Solomon Islands Plants and some of their New Guinea relatives, I-VII.

Markgraf, F.: *ibid*, VIII and IX.

van Royen, P.: *ibid*, X.

Holtum, R. E. and B. M. Allen: The tree ferns of Malaya.

Green, S.: Notes in the distribution of *Nepenthes* species in Singapore.

Holtum, R. E.: Isaac Henry Burkill, 1870-1965, an obituary.

Burkill, H. M.: *ibid*, a bibliography.

J.P. and H.M.B.: H. B. Gilliland, 1911-1965, an appreciation. (Obituary.)

Hsuan Keng: Observations on *Ancistrocladus tectorius*.

Turner, G. J.: New records of plant diseases in Sarawak for the year 1965.

Volume XII, Part II, 27th December, 1967.

Stone, B. C.: Materials for a monograph of *Freycinetia* (Pandanaceae). I.

Munir Ahmad *abid*: A revision of *Symphorema*, Verbenaceae.

Allen, B. M.: Malayan Fern Notes, V.

Skvortzov, B. V.: Notes on the *Flagellata* of Hongkong.

Hardial Singh: Sclereids in *Fagraea*.

Sinclair, J.: Notes on Sapotaceae.

Sinclair, J.: A note on *Myriophyllum*.

Stone, B. C.: Studies of Malesian Pandanaceae I.

Ashton, P. S.: Taxonomic Notes on Bornean Dipterocarpaceae, III.

Anon: Burkill's Dictionary of the Economic Products of the Malay Peninsula, Edition 2. (A note on publication.)

21. Revenue from the sale of publications prepared by the Department and published by Government amounted to \$9,037.

22. Papers written by the staff and published elsewhere were:

Burkill, H. M.: Operation Flora Malesiana, *Pelita* 5 (1) 15-19, 1967. (Revenue to government \$200.)

Alphonso, A. G.: Conservation of Orchid Species — An Important Role by the Botanic Gardens, *Brooklyn Botanic Gardens Handbook for 1967*.

Tan Kim Ho and Bajuri Sappan: Orchid Chromosome Counting in Singapore. *Malayan Orchid Review* 8 (5) 140-2, 1967.

XI. UNIVERSITY OF SINGAPORE COURT

23. Mr. H. M. Burkill, Director, represented the Botanic Gardens on the University Court as Government's nominee. Dr. Chew Wee-Lek, Botanist, served on the Court as the Court's own electee.

XII. AD HOC SCIENTIFIC COMMITTEE

24. The Director continued to serve on this Committee which was convened by the Deputy Prime Minister in 1966 to consider the formation of a Singapore Academy of Science and a Scientific Council for Singapore. Meetings were continued in the first part of the year and work came to fruition with the establishment of both bodies in July. Mr. H. M. Burkill was elected to the Council of the Singapore Academy of Sciences.

XIII. COMMONWEALTH WAR GRAVES COMMISSION

25. The Director continued to be the Commission's representative in Singapore and was responsible for the maintenance of the War Graves Cemetery at Kranji under instructions of the Commission's Eastern Region Headquarters at New Delhi. Funds for the maintenance of the cemetery were provided by the Commission. Other information may be found in the Commission's own reports.

XIV. NATURE RESERVES

26. The Board of Trustees remained unchanged throughout the year. Mr. Tan Jake Hooi's appointment lapsed on 4th February, on which date he was reappointed for another term of three years. The Board consisted of:

Appointed by the President

1. Mr. O. K. Abraham
2. Mr. Tan Jake Hooi

Appointed by the Minister for Culture and Social Affairs

3. Mr. Poh Soo Jin
4. Mr. Kiat Jun Ngui
5. Dr. T. P. Paran
6. Professor J. L. Harrison

Ex-officio

7. Director, Botanic Gardens.

27. Excision of 11 acres from the Water Catchment Reserve for the creation of the Macritchie Park was approved by the Board.

28. The Reserves at Bukit Timah, Kranji and Pandan were maintained in good order. There was vandalism at Bukit Timah and two of the shelters were burnt down. Organised pilfering of timber at the old Japanese Road area of the Macritchie Reservoir was stopped by police action when three persons were arrested and subsequently fined \$20 each in the Magistrate's Court.

29. The Military continued to use the Water Catchment Area for exercises. Twenty-one permits were issued to various individuals and institutions to collect biological specimens for study.

XV. TREE PLANTING CAMPAIGN

30. During the course of the year the tree planting and beautification campaign was reactivated and Mr. Lam Hin Cheng, Curator, was seconded with effect from 26th June to the Public Works Department (Tree Planting Unit) to take charge of planting on roadsides and open spaces. As previously the Botanic Gardens supplied advice and planting materials for this campaign and other similar projects.

31. Planting schemes and/or planting materials were provided for:
- (1) Bukit Batok Boys' Hostel (orchid garden).
 - (2) Pasir Panjang Boys' Hostel (orchid garden).
 - (3) Government Abattoir, Jalan Kimia.
 - (4) Public Utilities Board Changi Holiday Bungalow.
 - (5) Prisons Headquarters.
 - (6) Training Depot of the People's Defence Force, Haig Road.
 - (7) Ponggol Vocational School.
 - (8) MacPherson Primary School.
 - (9) Bedok Primary School.
 - (10) Swiss Cottage Secondary School.
 - (11) Holland Village Secondary School.
 - (12) Post Office at Lim Ah Pin Road.
 - (13) Siglap Malay School.
 - (14) Jalan Hwi Yoh Secondary School.
 - (15) Jalan Bukit Merah Secondary School.
 - (16) The Leslie Rayner Sheltered Workshop for the Paralysed.
 - (17) 5 m.s. Pasir Panjang Road Combined Clinic.
 - (18) Teluk Kurau East Primary School.
 - (19) Teluk Kurau Malay Boys' School.

32. Besides the schools listed above, planting material was issued free to 128 other schools on request of the school principals.

33. Planting advice was given to the Senior Executive Engineer (Roads), Public Works Department; The Medical Superintendent, General Hospital; The Singapore Polytechnic; and the Singapore Military Forces. Planting materials were provided to establish a new nursery at the Ulu Pandan Sewerage Treatment Works for the S.E.E. (Sewerage) P.W.D.

34. The foregoing activities resulted in the supply of 18,681 tree seedlings to the Tree Planting Unit, 9,727 to the Housing and Development Board, 1,009 to the Economic Development Board, 2,352 to 141 schools, and Community Centres, other Statutory Boards and charitable institutions—a total of 31,770 tree seedlings. In addition 11,065 shrubs and other plants were supplied to complement the trees planted. Public purchases of tree seedlings amounted to 3,654. Thus the Department's contribution in 1967 to the Tree Planting Campaign and towards the general beautification of the Republic has been the raising and provision of 46,489 plants.

XVI. CONCERTS

35. There were eight band concerts given in the Gardens during the year: two by the People's Association Band; one by the Singapore Infantry Regiment Band; one by the Singapore Police Force Band, and four by school bands. Bandmasters and their instrumentalists were cordially thanked for their performances which were well attended and appreciated by the public.

XVII. PROVISION OF PLANT MATERIALS FOR

STATE FUNCTIONS

36. Six mature orchid plants were supplied for a state gift to the President of India, and another six for the wife of the Prime Minister of Japan. Two hundred and sixty orchid sprays were supplied at the request of H.E. The President or the Prime Minister for use as state gifts to:

- (1) The President of India, through the High Commissioner for Singapore in New Delhi.
- (2) Mrs. Eisako Sato, wife of the Prime Minister of Japan.
- (3) The Rt. Hon'ble Mr. George Brown, U.K. Minister for Foreign Affairs.
- (4) Mrs. L. B. Johnson, wife of the President of the United States of America.
- (5) Mr. J. V. Rob, retiring U.K. High Commissioner in Singapore.
- (6) Madam Son Sann, wife of the Deputy Prime Minister of Cambodia.
- (7) H.R.H. Princess Monique Sihanouk of Cambodia.
- (8) Mr. John Blanch in connection with the death of Mr. Harold Holt, Prime Minister of Australia.

37. 1,196 sprays of orchid blooms were supplied to the following offices for state banquets and other Government functions:

- (1) The High Commissioner for Singapore in the United Kingdom.
- (2) The Ambassador of Singapore in Cambodia.
- (3) Istana and Sri Temasek.
- (4) Ministry of Social Affairs.
- (5) Ministry of Health.
- (6) Parliament House.
- (7) St. Andrew's Orthopædic Hospital.

38. 2,790 sprays of orchids were supplied to the Prime Minister's office and 600 to the Foreign Affairs office together with other cut flowers and greenery.

XVIII. CONFERENCES

39. The 2nd Symposium for Scientific and Technological Research in Malaysia and Singapore was held at the University of Malaya, Kuala Lumpur, 1-4 February, and was attended by Mr. H. M. Burkill, Director, and Mr. A. G. Alphonso, Curator. The following papers were read in the Biological Sciences Section:

- H. M. Burkill: The Singapore Botanic Gardens — an example of international collaboration.
- Chew Wee-Lek: Botanical Research in the Botanic Gardens, Singapore.
- A. G. Alphonso: Horticultural Research in the Botanic Gardens, Singapore, with particular reference to orchid breeding.

40. While on overseas leave Mr. H. M. Burkill attended the Field Meeting of the British Phycological Society held in the Scilly Isles, Great Britain, 4th-9th September, and gave a talk on Malayan Seaweeds.

XIX. METEOROLOGICAL RECORDS

41. The year was unusually wet with a precipitation of 126.69 inches, 28 inches over the recorded 54-year average of 98.17 inches. Though average monthly rainfall records smooth out to a pattern of 6 to 11 inches precipitation, the year experienced extremes of wetness in January of 21.58 inches, and in November and December of 20.51 and 25.10 inches respectively. Rainfall at Bukit Timah was, as usual, heavier than in the Gardens. Details of rainfall and certain other meteorological phenomena at the Botanic Gardens, Bukit Timah and the Commonwealth War Graves Commission Cemetery at Kranji are given in Appendices II to V.

XX. SOCIETIES AND EXHIBITIONS

42. The staff continued to give assistance to both the Singapore Gardening Society and the Orchid Society of S.E. Asia (formerly the Malaysian Orchid Society) with talks and demonstrations. Mr. Tan Kim Ho was Hon. Secretary of the Orchid Society and Mr. A. G. Alphonso and Mr. Ang Gek Choo were Committee members. Mr. Alphonso was also Vice-President of the Singapore Gardening Society for the year 1967-68. Mr. H. M. Burkill served on the Singapore Branch Committee of the Malayan Nature Society.

43. The flower show organised by the Singapore Gardening Society was held between 31st March and 2nd April, and was officially opened by Inche Yusof bin Ishak, President of the Republic. Mr. Ang Gek Choo was Hon. Show Manager and Mr. Lam Hin Cheng Hon. Show Secretary. Show judges included Mr. H. M. Burkill and Mr. A. G. Alphonso. Due to circumstances beyond the Society's control, the Annual Orchid Show of the Orchid Society of S.E. Asia could not be held.

44. The Department put up two floral displays on an exhibition scale for state banquets held at the Singapore Conference Hall to mark: (1) National Day Celebration, and (2) the visit of the Prime Minister of Japan.

45. An unexpected problem of the interior floral decorator was alarmingly demonstrated during the preparations for the second of these occasions. A bull-frog, small in body but very loud in voice, slipped in amongst the potted plants and as the work of banking and arranging was nearing completion on the eve of the banquet, he set up his usual evening serenade. Consternation struck the horticultural team for the possibilities of frog-barracking during the after-dinner speeches could not be countenanced.

To seek out the miscreant all had to be dismantled and the work progressed till long after midnight, but without avail. Several of the catering staff were pressed into a "killer squad" with torch and knife should it give tongue during the banquet. Fortunately the wise frog took note and kept quiet.

46. As is customary pot plants were loaned to Government departments, schools, statutory boards, community centres and charitable institutions for special functions. A total of 6,271 pots were so loaned. The figure for 1966 was 4,375, and the increased demand, while being greatly welcomed, has necessitated diversion of some Gardens labour to nursery work.

47. Cut orchid flowers were sent to the following places for exhibition:

- (1) Delhi Agri-horticultural Society, New Delhi, India.
- (2) Bombay Agri-horticultural Society, Bombay, India.
- (3) Birmingham and Midland Orchid Society, Birmingham, England.
- (4) Special, Orchid Exhibition of the Botanic Gardens, Glasgow Scotland.
- (5) The North of England Horticultural Society Spring Show, Harrogate, England.
- (6) Mostra Internazionale del Fiore (International Flower Show) Trieste, Italy.

The exhibit at the North of England Horticultural Society show was awarded a Certificate of Merit. Grateful acknowledgement is made to Messrs. B.O.A.C. and Air India for transport facilities.

XXI. PLANT SALES SERVICE

48. The revenue for plant sales amounted to: Plants and seeds, other than orchids, \$5,838.80 on a total of 17,250 plants; orchids, \$9,486, on 3,357 plants. Total plant sales revenue was \$15,324.80. The sale of plants other than orchids was up on last year's sale by \$2,600 which may be ascribed to a greater public interest in Singapore in gardening and household decoration. The orchid sales were appreciably lower than last year, primarily due to the Gardens inability to participate in the main agri-horticultural shows in Malaysia at which the Gardens customarily sold plants, and to the formalities in the import of plants into Malaysia from Singapore.

49. Here-to-fore, plants, except for bulky ones, had been sold lifted from the beds and soil-free, or as seedlings established in used milk or cigarette tins. This practice was stopped and the majority of material was from early in 1967 sold as established plants in plastic bags. Thus plants could be sold without uprooting and so could be replanted in the purchaser's garden with a greatly improved chance of survival. The plant sales list was revised and several additions were made to it.

50. The Nursery Gate was opened to cars for purchasers to reach the Plant Sales office and the roadway within the Nursery was metalled.

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XXII. ADVISORY SERVICE

51. Requests for advice came from innumerable sources and on a very wide range of subjects. The most usual topic was on garden plants and landscaping. It is obvious that there is need in Singapore for a nucleus of nurserymen competent and able to provide such a service on a commercial basis. The Police and Customs Department were again regular requirers for determination of plants thought to be *ganja* (*Cannabis sativa*). The Veterinary Department requested help in a case of pigs being poisoned, and the Brunei Medical Department on an autopsy involving a poisonous toadstool (*Hygrophorus* sp.).

52. Dr. Chew Wee-Lek gave a talk on "The work of the Botanic Gardens" to the Science Society of the Anglo-Chinese School, and Mr. A. G. Alphonso gave a talk on "Orchids of the Malaysian Region" to the same Society.

XXIII. PLANT COLLECTING

53. Two major botanical expeditions were undertaken, both as a contribution to UNESCO's limestone flora research programme: Dr. Chew Wee-Lek, Botanist, collected on Tiang Bakap and Gunong Santubong in the First Division, Sarawak, and Mr. Hardial Singh, Botanist, visited the limestone hills of Pukae and Khao Yai in Peninsular Thailand. Many shorter expeditions to obtain herbarium material were also made. Those outside Singapore are listed in Appendix VII.

54. Mr. A. G. Alphonso undertook three main expeditions to collect plants for cultivation, principally orchids, gingers and ferns. These expeditions were to northwest Malaya into areas previously rich in orchids but where certain species are threatened with extermination by avaricious or ignorant collectors. On two of the trips he was accompanied by Mr. Cheang Kok Choy, Superintendent of the Penang Waterfall Gardens. Plants collected have been divided between the Penang and Singapore Gardens so that even if some species are collected to extinction they will at least be preserved under cultivation.

XXIV. HERBARIUM MATERIALS

55. Some 10,000 numbers were mounted, registered and indexed, and laid in the herbarium. 5,000 sheets were repaired. Damage to old specimens mounted on to paper which has become brittle is a growing problem and will necessitate a considerable amount of attention.

56. Exchanges were continued and the Herbarium received 5,951 specimens from 15 botanical institutions the bulk of these coming from the Forest Research Institute, Kepong, Malaya, the Forest Department, Lae, New Guinea, and the Forest Department British Solomon Islands. Despatches from the Herbarium amounted to 4,045 numbers sent to 24 institutions, principally to the Rijksherbarium, Leiden, Holland, Royal Botanic Gardens, Kew, U.K., and the Arnold Arboretum, Harvard University, U.S.A. Particulars of all exchanges are given in Appendix VI.

57. Materials on loan were both received and sent out. Material received amounted to 2,753 specimens, of which 2,600 were Piperaceae from the Herbarium Bogoriense, Indonesia, for Dr. Chew's study. Nine institutions received material from the Herbarium totalling 2,852 specimens of which 1,080 went to the Forest Research Institute, Kepong. Particulars are given in Appendix VI.

XXV. TAXONOMIC RESEARCH

58. Work on the flora continued with studies in the following fields: Urticaceae (Nettle family), Piperaceae (Pepper family), Climbing Plants by Dr. Chew Wee-Lek; Algae by Mr. H. M. Burkill; Lentinus (Fungi) by Dr. Chang Kiaw Lan; the genus *Anadendrum* by Mr. Hardial Singh. Dr. Chang made attempts to cultivate the symbiotic termite mushroom *Termitomyces* but without success. If the proper conditions can be determined culture ought to be possible as success has been reported elsewhere. *Xylaria*, another termite fungus, was successfully grown and fruiting bodies obtained.

59. Mr. Montien Srisuko, Colombo Plan Fellow from the Royal Thai Department of Forests, finished his work on *Lagerstroemia* prior to returning home. The two retired members of the staff, Dr. C. X. Furtado and Mr. J. Sinclair, who had been working in an honorary capacity for some years, worked in the herbarium till April and May respectively, when both left for overseas, but their return is expected after a break of several months.

60. Dr. Chew Wee-Lek was invited to serve on the Standing Committee on Pacific Botany of the Pacific Science Association of the University of Hawaii in Honolulu.

XXVI. GARDENS MAINTENANCE

61. All the mixed borders on Lawn O were dug and compost was worked in. Later, chemical fertiliser was added, and the reward was obtained in later months with excellent displays of flowers. The secret, which is an open one, for successful growing of garden plants in tropical condition where soil quickly compacts and root growth is impeded, is unremitting cultivation. On Lawns A and B the Canna beds were cultivated and replanted to give colour for the December 1967 and January 1968 holiday period. Bougainvilleas of Lawns A and B were pruned and manured, and further angle-iron supports were put around them.

62. A hedge outside the fence along Holland Road from the Main Gate, and along Tyersall Avenue was planted with *Hemigraphis alternata* and *Acalypha siamensis*. Climbers were trained onto the fence using *Bougainvillea* 'Ishbel Greensmith', *B.* 'Mary Palmer', *B.* 'Killie Cambell', *B. glabra*

var *cypheri*, *B. buttiana*, *Strongylodon macrobotrys*, *Mucuna bennettii*, *Allamanda cathartica*, *Beaumontia multiflora*, *Passiflora quadriglandulosa*, *Chonemorpha penangensis*, *Ipomoea digitata*, *Congea velutina*, *Cassia splendida*, *Petrea volubilis*, *Tristellateia australasica* and *Pseudocalymma alliaceum*.

63. New lawn plantings were: *Tabebuia* 'Moir's variety', *Solanum wrightii*, *Araucaria excelsa*, *A. cunninghamii*, *A. columnaris*, *Orthosiphon stamineus* 'Blue', *Duranta plumieri* 'variegated', *Caesalpinia pulcherrima* 'Pink', *Bougainvillea* 'Double Pink', *B.* 'Pink', *B.* 'Dark Red'; *Muniltia* sp. 119/64, *M.* sp. 104/64, *Congea tomentosa*, *Juniperus chinensis*, *Gardenia carinata*, *Ficus irregularis*, *Millettia atropurpurea*, *Kopsia fruticosa*, *Erythrina vespertilo*, *E. speciosa*, *E. corallodendron*, *Cassia biflora*, *C. bakeriana*, *C. alata*, *Canarium indicum*, *Ravenia spectabilis*, *Neomarica* sp., *Reevesia thyrsoides*, *Filicium decipiens*, *Vitex trifolia*, ssp. *littoralis* var. *steenisi*, *Gmelina arborea*, *Lagerstroemia indica*, *L. grandiflora*, *Hemigraphis drymophila*, *Colvillea racemosa*, *Moraea bicolor*, *M. iridioides*, *Calliandra* sp., *C. inaequilatera*, *Hibiscus mutabilis*, *Dalbergia oliveri*, *Elateriospermum tapos*, *Saraca thaipingensis* and *Schizostachyum brachrycladum*.

64. Seventy-eight dead or dangerous trees were removed or pruned. Storm damage brought down the large *Araucaria cunninghamii* on Lawn B. This tree was 70 years old. Five large trees outside the Gardens fence on Cluny Road were removed as they were considered a danger to traffic and the houses opposite.

65. The management of the Lake has, throughout its existence, been constantly troublesome. Disbalance in the biota, thought to be due to the decimation of the vegetarian fish in the Lake by the carnivorous fish and turtles known to be present, led to an explosive outgrowth of *Hydrilla verticillata*. *Salvinia* sp. also became too abundant. The Lake was drained in April for cleaning. The *Nymphaea* plants were lifted and stored in the silt pits above the Lake, and considerable quantities of weed were removed. A large quantity of silt was also taken out and used for levelling the banks. One turtle, which was given to the National Museum, and 40 Aruan were caught, and whatever fish were left were poisoned with 'Endrex'. The exposure of the bottom of the Lake led to a large germination of dormant *Nymphaea* seed which was welcome, but *Nelumbium* seed also germinated and the plants had to be eradicated. *Hydrilla* also reappeared, and to exercise control, 300 Lampan Java and 200 Common Carp were released in the Lake. Grateful acknowledgement is made to the Primary Production Department for the supply of these fish.

66. Signwriters prepared 30 signboards and 1,066 wooden plant name boards. 9,315 aluminium tag labels were made.

67. The collections of ferns, begonias, aroids, cacti, succulents, gingers and other groups of plants were maintained in good condition. The old Tea Kiosk was converted into a plant house and cacti and succulents were put out on display there.

68. The pot plant nursery was expanded to meet increasing demands for loans and for display purposes within the Gardens.

69. Monkeys remain the worst pest. Two attempts were made to eliminate them by poison baiting with a-chlorolose. This chemical has been used with marked success in dealing with bird populations near airports, but both attempts on the Gardens monkeys were failures. During the year two permits were given to trap monkeys: none was caught. Ten were shot but shooting presents many difficulties, not least the recognition by the monkeys of anyone carrying a gun.

70. The ducks and geese which had been on the Lake since 1966, had to be removed during the cleaning operation. On refilling of the Lake only the ducks were released: the geese which liked to graze the lawn grass were often aggressive to visitors. On 14th September a pair of Black Swans (*Chenopsis atrata*) were released on the Lake. These birds were presented by the Zoological Gardens Board of Western Australia, and flown from Perth to Singapore by the Royal Air Force.

XXVII. HORTICULTURAL EXCHANGE

71. Seed and plant exchanges continued to be an important aspect of the Horticultural Division's activity. One seed collector was kept fully engaged in obtaining material for outward despatch, while two nurserymen were employed in germinating and establishing incoming material. Appendices VIII and IX list the names of the institutions to which material is sent and from which material is received.

XXVIII. ORCHID RESEARCH

72. With the completion of Orchid Nursery 2 on Lawn X, the collections of ground orchids were moved there. Potted orchids have been concentrated in the original nursery.

73. During the year, 156 cross-pollinated pods were harvested, 32 pods of known parentage were accepted from Singapore growers, 39 from Malaysia and 42 from England, a total of 269 pods. Seed was germinated from 200 of them. Over 2,000 flasks have been in constant use for culturing seedlings. The contents of 988 flasks were removed for potting. The flask culture medium remained, as previously, based on Vacin's formula plus 10 per cent young coconut water, banana pulp and peptone. 3,703 seedlings were moved on from the seedling houses to the open.

74. The following hybrid families were registered:

- BGS. 3621 — *Dendrobium* Doina Manescu (*D.* Indonesia x *D. gouldii* blue), named after the wife of the Roumanian Minister for Foreign Affairs on the occasion of her visit to the Botanic Gardens on 29th May.
- BGS. 3751 — *Dendrobium* Hiroko Sato (*D.* Tan Seah Boey x *D.* Noor Aishah), named after the wife of the Prime Minister of Japan on the occasion of her visit to the Botanic Gardens on 26th September.
- BGS. 718 — Vandachnis Scarlet Runner (*Arachnis* Ishbel x *Vandopsis* lissochiloides).
- BGS. 1088 — Aranda Tyersall (*Arachnis* Maggie Oei x *Vanda* Ellen Noa).
- BGS. 1806 — Aranda Majula (*Arachnis* Maggie Oei x *Vanda* insignis).
- BGS. 1849 — Aranda Jessie (*Arachnis* hookeriana var. *Luteola* x *Vanda* Ellen Noa).
- BGS. 1936 — *Vanda* Swee Sian (*Vanda* Trisum x *Vanda* luzonica).
- BGS. 3378 — *Vanda* Verna Maria (*Vanda* Josephine van Brero x *Vanda* Henrietta Ho).
- BGS. 3509 — Burkillara Henry (*Aeridachnis* Bogor x *Vanda* Ellen Noa), a newly-flowered trigeneric cross named after the late I. H. Burkill, Director of the Botanic Gardens, Straits Settlements, 1912–25.
- BGS. 3592 — *Dendrobium* Wee Cheow Loy (*Dendrobium* Verninha x *Dendrobium* Yellow Curls).

STAFF OF THE BOTANIC GARDENS, 1967
(Divisions I, II and technical posts of Division III)

(Date of first appointment to the Botanic Gardens Service is shown in brackets.)

<i>Appointment</i>	<i>Holder</i>	<i>Notes</i>
Director	H. M. Burkill, M.A. (Cantab.) F.L.S. (12-11-54)	On leave 17-7 to 26-11.
Botanist	Chew Wee-Lek, B.Sc. (Malaya) Ph.D. (Cantab.) (1-10-56)	Keeper of the Herbarium. Acting Director 17-7 to 30-11.
	Chang Kiaw Lan (Miss), B.Sc. (Malaya), Ph.D. (Cantab.) (7-7-59)	
	Hardial Singh, B.Sc. (Singapore) (1-11-63)	
Curator	A. G. Alphonso (1-1-40)	
	Lam Hin Cheng (1-7-57)	On secondment to Tree Planting Unit, P.W.D. from 26-6.
Librarian	Tan Kim Ho, B.Sc. (Malaya) (1-4-58)	
Executive Officer	D. P. Lazaroo (11-3-63)	
Laboratory Assistant (Special Grade)	Bajuri bin Sappan (14-9-37)	
Horticultural Assistant	Ang Gek Choo (18-5-61)	Acting Curator from 26-6.
Herbarium Assistant	Md. Shah bin Haji Md. Noor (3-2-55)	
Artist	Juraimi bin Samsuri (1-9-45)	
Junior Horticultural Assistant	N. Krishnan (25-4-66)	Ceased on 21-6.
	H. Wee Sip Hean (13-5-66) S. Chia Jiew Thian (1-7-66) Quek Wai Yan	Assumed duty 30-12.

METEOROLOGICAL REPORT

BOTANIC GARDENS SINGAPORE, 1967

Reading daily at 9.30 a.m. local time at Gardens Office from 1-1-67 to 31-12-67

1967	Total Rainfall	Average 1914—1967	Highest fall in 24 hours	No. of days Rainfall	Mean Maximum Temp.	Highest Maximum Temp.	Mean Minimum Temp.	Lowest Minimum Temp.	Mean Dry Bulb Temp.	Mean Wet Bulb Temp.	Mean R.H.
	inches	inches	inches		°F	°F	°F	°F	°F	°F	%
January ..	21.58	10.97	5.33	21	85.6	90.5	73.3	70.0	78.2	75.2	87.0
February ..	13.43	7.39	5.88	10	86.0	90.5	73.3	71.0	78.9	75.3	84.8
March ..	4.18	8.24	0.74	7	88.7	92.8	74.3	71.0	81.8	76.1	78.7
April ..	8.68	8.12	2.11	18	89.3	93.0	75.5	72.8	82.0	78.1	83.8
May ..	5.77	7.45	1.86	13	88.9	95.0	76.1	73.5	82.1	79.0	83.0
June ..	5.29	6.69	1.88	12	88.9	95.5	76.8	72.5	82.1	78.3	83.8
July ..	5.71	6.22	0.86	14	89.2	92.0	75.3	71.0	80.5	77.0	84.9
August ..	6.22	6.89	1.14	11	91.7	94.5	76.5	73.0	81.8	77.5	80.7
September ..	5.52	7.31	2.00	9	89.4	93.5	75.5	72.5	82.5	77.9	80.7
October ..	4.70	7.97	0.90	16	89.9	93.5	75.1	72.5	82.3	77.8	81.3
November ..	20.51	10.60	3.21	23	86.7	90.5	73.5	70.0	80.5	77.4	86.6
December ..	25.10	10.34	4.18	20	84.9	88.5	72.7	70.5	77.3	74.9	89.2
Total ..	126.69	98.17	5.88	174	..	..	..	..	..	..	..
Mean ..	..	..	..	..	88.2	92.5	74.8	71.7	80.8	77.0	83.7

METEOROLOGICAL REPORT

BOTANIC GARDENS SINGAPORE, 1967

Reading daily at 8.00 a.m. local time at "Orchid Enclosure" from 1-1-67 to 31-12-67

1967		Total Rainfall	Highest fall in 24 hours	No. of days rainfall	Mean Maximum Temperature	Highest Maximum Temperature	Mean Minimum Temperature	Lowest Minimum Temperature	Mean Dry Bulb Temperature	Mean Wet Bulb Temperature	Mean R.H.	Mean Grass Minimum Temperature	Mean Earth 4" Temperature	Mean Earth 1' Temperature	Mean Earth 4' Temperature	Mean Solar Radiation Temperature	Mean Daily hours of Sunshine
		inches	inches		°F	°F	°F	°F	°F	°F	%	°F	°F	°F	°F	°F	hours
January	.. ..	22.42	5.62	22	87.1	91.5	72.1	69.0	74.2	73.4	96.5	71.1	78.6	80.4	81.2	122.7	4.60
February	.. ..	13.46	5.93	10	87.9	91.5	72.1	69.5	74.3	73.6	96.6	71.2	79.4	80.4	81.2	123.1	5.05
March	.. ..	2.11	0.58	7	90.7	94.2	72.7	70.5	75.1	74.5	96.4	71.6	81.5	83.2	82.5	129.9	7.12
April ..	.. ..	7.71	1.75	18	89.4	92.5	73.6	71.0	77.0	76.4	96.7	73.1	81.3	83.9	83.8	125.4	4.92
May ..	.. ..	5.30	1.88	13	88.8	92.5	75.0	72.5	77.5	76.8	96.7	74.0	81.9	83.2	83.5	125.0	5.56
June ..	.. ..	4.76	1.60	10	88.8	91.5	75.1	70.0	78.0	76.6	94.3	73.2	81.4	82.9	83.6	124.0	5.13
July ..	.. ..	4.78	0.84	13	88.5	90.5	74.0	70.5	76.8	75.6	94.6	73.1	81.3	82.3	83.1	130.1	5.76
August	.. ..	5.73	2.53	11	89.2	91.5	74.9	72.5	77.2	76.0	94.4	73.1	81.9	86.2	83.8	134.3	6.73
September	.. ..	5.68	2.20	9	88.7	91.8	73.8	72.0	77.0	76.2	96.6	72.5	81.4	83.1	83.6	136.9	6.41
October	.. ..	4.73	0.81	16	89.5	93.5	74.0	69.5	76.5	75.6	95.6	72.5	81.6	83.7	83.9	132.5	5.59
November	.. ..	19.35	3.22	24	81.0	91.5	73.5	72.0	75.8	75.2	97.2	72.2	79.9	81.7	82.7	130.5	4.32
December	.. ..	23.65	5.15	20	86.4	92.0	72.8	70.5	74.4	73.6	95.7	71.7	78.6	79.9	80.8	123.6	3.27
Total	.. ..	119.68	32.11	173	..	..	..	..	..	..	..	..	..	..	..	..	..
Mean	.. ..	..	..	..	88.0	92.0	73.6	70.8	76.1	75.3	95.1	72.4	80.7	82.6	82.8	128.2	5.37

METEOROLOGICAL REPORT

BOTANIC GARDENS SINGAPORE, 1967

Reading daily at 8.00 a.m. local time at Bukit Timah from 1-1-67 to 31-12-67

1967	Total Rainfall	Highest fall in 24 hours	No. of days rainfall	Mean Maximum Temp.	Highest Maximum Temp.	Mean Minimum Temp.	Lowest Minimum Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	R.H.
	inches	inches		°F	°F	°F	°F	°F	°F	%
January	19.27	4.23	20	83.8	87.5	72.2	68.5	75.7	73.6	90.5
February	16.17	9.10	12	83.5	88.0	72.3	69.3	75.6	73.7	91.0
March	8.88	3.47	10	85.9	91.0	73.0	68.9	76.4	74.5	91.3
April	14.47	3.47	15	86.2	89.7	74.6	71.0	78.2	76.0	90.0
May	5.64	2.50	14	82.5	89.7	75.0	70.0	79.1	77.0	90.7
June	10.78	3.47	12	84.9	89.0	75.3	69.7	78.2	76.2	89.2
July	6.03	1.80	11	85.7	94.3	75.6	68.9	78.9	76.2	91.3
August	3.76	1.45	10	86.2	88.6	74.9	70.5	78.5	75.9	88.5
September	2.95	0.67	9	85.9	89.0	74.3	71.0	78.1	75.7	88.7
October	5.15	1.55	10	86.7	90.0	73.9	68.5	78.7	75.7	86.4
November	17.13	2.75	20	84.7	88.5	72.7	70.0	76.6	74.8	91.3
December	19.88	4.47	16	82.8	87.6	72.9	69.0	75.2	73.6	92.5
Total	130.11	38.93	159	..	..	..	..	..	..	..
Mean .. ..	..	..	..	84.9	89.4	73.9	69.6	77.4	75.2	90.1

METEOROLOGICAL REPORT

KRANJI WAR GRAVES CEMETERY

Recorded daily at 8.00 a.m.

1-1-67 to 31-12-67

Month					Total Rainfall	No. of days with rain	Highest fall in 24 hours
					inches		inches
January	..	..	..	..	16.58	14	3.60
February	..	..	..	..	13.05	10	3.70
March	..	..	..	..	6.51	5	3.75
April	..	..	..	..	10.90	12	2.00
May	..	..	..	..	10.85	10	2.87
June	..	..	..	..	5.67	5	2.35
July	..	..	..	..	3.82	6	1.10
August	..	..	..	..	1.33	3	0.63
September	..	..	..	..	4.20	3	3.25
October	..	..	..	..	9.50	13	3.25
November	..	..	..	..	14.07	15	3.15
December	..	..	..	..	21.87	15	5.60
Total ..					118.35	111	—

SUMMARY OF DISTRIBUTION OF HERBARIUM MATERIAL
ON EXCHANGE AND LOAN

Code	Institution	EXCHANGE		LOAN	
		In	Out	In	Out
A	Arnold Arboretum, U.S.A.	—	519	—	—
AAH	Arnold Arboretum, Jamaica Plain, U.S.A.	—	87	—	—
AAU	Botanical Institute, Aarhus, Denmark	71	143	—	—
BH	Bailey Hortorium, Ithaca, U.S.A.	—	86	—	—
BKF	Forest Department, Bangkok, Thailand	—	59	—	—
BM	British Museum, Great Brit in	65	—	25	—
BO	Bogor Herbarium, Indonesia	—	—	2,600	6
BRI	Botanic Gardens Brisbane, Australia	—	73	—	3
BSIP	British Solomon Islnds, Honiara	716	—	—	—
C	Botanical Museum and Herbarium, Copenhagen, Denmark	—	200	—	—
CANB	C.S.I.R.O. Division of Plant Industry, Canberra, Australia	—	4	—	—
CANTY	Canterbury Museum Christchurch, New Zealand	—	11	—	—
CGE	Botany School, Cambridge University, Great Britain	—	23	—	574
E	Royal Botanic Garden, Edinburgh, Great Britain	11	192	—	302
FL	University of Florence, Italy	—	54	—	—
G	Botanic Gardens, Geneva, Switzerland	—	118	—	—
K	Royal Botanic Gardens, Kew, Great Britain	—	658	3	—
KE	Kent State University, Herbarium, Kent, Ohio, U.S.A.	2	—	—	—
KEP	Forest Research Institute, Kepong, Malaysia	3,122	—	—	1,080
KLU	University of Malaya, Kuala Lumpur, Malaysia	113	—	—	248
KYO	Kyoto University, Japan	400	—	—	126
L	Rijksherbarium, Leiden, Netherlands	—	702	125	476
LAE	Forest Department, Lee, New Guinea	1,019	367	—	—
M	Botanische Staatssammlung, Munich, Germany	—	13	—	—
MEL	National Herbarium of Victoria, Melbourne, Australia	44	—	—	—
MICH	University of Michigan, Ann Arbor, U.S.A.	—	2	—	—
NY	New York Botanical Garden, U.S.A.	—	118	—	—
PNH	National Herbarium, Manila, Philippines	125	64	—	—
SAN	Forest Department, Sandakan, Sabah, Malaysia	79	113	—	—
SAR	Forest Department, Kuching, Sarawak, Malaysia	27	187	—	—
TSB	Instituto Botanico della University, Trieste, Italy	77	—	—	—
UC	University of California, Berkeley, U.S.A.	—	79	—	—
US	Smithsonian Institution, U.S.A.	—	173	—	—
	Semperk, Czechoslovakia	—	—	—	37
	University of Singapore	80	—	—	—
	Total	5,951	4,045	2,753	2,852

SUMMARY OF MAIN PLANT COLLECTING EXPEDITIONS—1967

Personnel	Date	Locality	Collections
Chew Wee-Lek	8th—23rd March ..	Tiang Bakap and Santubong, Sarawak	200 nos. limestone flora for herbarium. 23 nos. orchids for cultivation.
H. M. Burkill	5th—7th February ..	Pekan and Lanjut, Pahang ..	25 nos. marine and fresh water algae for herbarium. 6 nos. other families.
H. M. Burkill	23rd—27th March ..	Pulau Undan, Malacca ..	18 nos. marine algae for herbarium
H. M. Burkill (on casual leave)	26th February—3rd March	Doi Suthep, Thailand	12 nos. fresh water algae for herbarium.
Hardial Singh	29th August—13th September	Pulau and Khao Yai, Peninsular Thailand	55 nos. limestone flora for herbarium.
A. G. Alphonso Sanusi bin Sarih with Cheang Kok Choy, Superintendent, Penang Gardens	16th—25th January ..	P. Kundi, Penang Hill, Tiger Hill, Waterfall Gardens, Penang Bt. Perak, Bt. Hijau, Padang Terap, Kedah Wang Mu, Bt. Hisam, Padang Besar, Perlis	41, nos. orchids, 8 nos. other families. 27 nos. orchids, 25 nos. other families. 26 nos. orchids, 8 nos. other families. All for cultivation.
A. G. Alphonso Sanusi bin Sarih	5th—15th July ..	Penang Hill, Penang Kaki Bukit, Padang Besar, Bitong, Perlis P. Langkawi, Kedah	14 nos. orchids, 3 nos. other families. 21 nos. orchids, 3 nos. other families. 32 nos. orchids, 10 nos. other families. All for cultivation.

APPENDIX VII—*continued*

Personnel	Date	Locality	Collections
A. G. Alphonso Sanusi bin Sarih with Cheang Kok Choy, Superintendent, Penang Gardens	1st—10th October	P. Pangkor, Perak	11 nos. orchids, 10 nos. other families.
		G. Bubu Maxwell's Hill, Perak ..	36 nos. orchids, 34 nos. other families.
		Western Hill, Penang Hill, Penang ..	28 nos. orchids, 7 nos. other families.
		Wang Gunong, Kaki Bukit, Perlis ..	25 nos. orchids.
		Gunong Jerai, Kedah	40 nos. orchids, 5 nos. other families.
			All for cultivation.
A. G. Alphonso Sanusi bin Sarih Sidek bin Kiah	24th—25th November ..	Kluang Forest Reserve, Johore ..	7 nos. orchids for cultivation. 10 nos. general for herbarium.

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM PLANTS
AND SEEDS WERE RECEIVED IN 1967

ARGENTINA	Institute of Agricultural Botany, Buenos Aires.
AUSTRALIA	Mr. N. L. Wills, Rochedale; Mr. E. Todd, Toronto, N.S.W.; Townsville Botanic Gardens, N. Queensland.
BRAZIL	Institute of Botany, Sao Paulo.
BULGARIA	Botanic Gardens of the Institute of Agronomy, Plovdiv.
CHILE	National Botanic Gardens, Vina del Mar.
EIRE	National Botanic Gardens, Dublin.
FINLAND	University of Helsinki.
FRANCE	Botanic Gardens, Besancon; Botanic Gardens, Nantes; Botanic Gardens, Marseilles.
GERMANY	Botanic Gardens of the University, Frankfurt-am-Main; Botanic Gardens of the University, Halle (Saale); Botanic Gardens, Cologne; Botanic Gardens of the University, Giessen; Botanic Gardens, Technical High-school, Aachen; Messrs. Fritz Heiden Co., Worth/Donau; Botanic Gardens of the University, Freiburg; Botanic Gardens of the University, Greifswald.
HOLLAND	Botanic Gardens, Amsterdam.
HUNGARY	Botanic Gardens of the University, Szeged.
INDIA	Commonwealth War Graves Commission, New Delhi; Indian Agricultural Research Institute, New Delhi.
ITALY	Commonwealth War Graves Commission, Rome; Institute of Botany of the University, Bologna; Botanic Gardens of the University, Torino; Botanic Gardens of the University, Modena.
INDONESIA	National Gardens, Bogor.
JAPAN	Mr. N. Matsuzaki, Shinjiku National Park, Tokyo; Botanic Garden, Hokkaido University, Sapporo; Mr. Kazumasa Kojima, Nagoya.
KENYA	Commonwealth War Graves Commission, Nairobi.
LAOS	Mr. Allen D. Kerr, Vientiane.
MALAYSIA	Botanic Gardens, Penang; Mr. Lee Ewe Boon, Alor Star; Dr. F. M. Dourado, Ipoh; Mr. Palmer, Johore; Mr. Robey, Malacca; Mr. Aw Kheng Huat, Perlis; Forest Department, Sandakan, Sabah; Mr. P. C. Macartney, Jesselton, Sabah.
MAURITIUS	Sugar Industry Research Institute, Reduit.
NETHERLANDS	Institute of Horticulture Plant Breeding, Wageningen.
NEW CALEDONIA	Mr. Gaston Cheval, Noumea.

NEW GUINEA	Department of Forests, Lae; Mrs. Andre Miller, Lae Botanic Gardens.
NIGERIA	Botanical Garden, University of Ibadan, Ibadan.
PHILIPPINES	Miss Mary B. Fermin, Manila; Mrs. K. Manuel, Manila; Mrs. Corazon M. de Leon, Manila.
PORTUGAL	Garden and Museum, Lisbon.
SINGAPORE	Mrs. Lee Kip Lee; Mrs. Sng Choo Eng; Mr. Waudby; Singapore Orchids Ltd.; Mr. Syed Yusof Alsagoff; Koh Keng Hoe Orchid Nursery; Mr. T. P. Tan; Mr. Lim Sim Pang; Mr. Seow Soon Kee; Mrs. Max Lewis; Mrs. Choo Kim San; Mr. R. Scott.
SOLOMON ISLANDS	Forest Herbarium, Honiara.
SOUTH AFRICA	Mr. J. Carver, Durban, Natal.
SWEDEN	Botanical Garden, Lund; Botanic Gardens of the University, Uppsala.
SWITZERLAND	Botanic Gardens, St. Gallen.
THAILAND	Mr. Rapee Sagarik, Department of Horticulture, Kasetsart University, Bangkok.
UNITED KINGDOM	The Royal Horticultural Society Gardens, Wisley, Surrey; Mr. W. R. Price, Royal Botanic Gardens, Kew; Botanic Gardens, Glasgow.
U.S.A.	California State Polytechnic College, San Luis Obispo; Honolulu Botanic Gardens, Hawaii; Dr. A. E. Wilson, Florida; Mr. Forrest Elliott, Oregon; Palm Society, Miami; Mr. David Barry, Jr., Los Angeles; Mr. Rudolf Liesenhenné, Santa Barbara.
ZAMBIA	Ministry of Agriculture, Mount Makulu Research Station, Chilanga.

INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS
AND SEEDS WERE SENT IN 1967

ALGERIA	Institute Scientifique Cherifien, Rabat.
ARGENTINA	Institute of Agricultural Botany, Buenos Aires.
AUSTRALIA	Mr. Harrison, Department of Health, Canberra; Botanic Gardens, Darwin.
AUSTRIA	Botanic Gardens, Vienna.
BELGIUM	Botanic Gardens, Antwerp.
BERMUDA	Department of Agriculture and Fisheries, Paget East.
BRUNEI	Mr. C. J. Merton, State Forest Officer; Mr. Charles Huddart, Seria.
CANADA	The Montreal Botanical Garden, Montreal.
CZECHOSLOVAKIA	National Institute of Science, Prague; Botanic Gardens of the Institute of Pedology, Kosice; Botanic Gardens of the Veterinary University, Brno; Mr. Vyzkumny Ustav Krmivarsky, Brno; Botanic Gardens, Pruhonice.
EGYPT	Ministry of Agriculture, Cairo.
FINLAND	Botanical Institute, University of Helsinki; Botanical Garden, University of Turku.
FRANCE	Botanic Gardens of the University of Besancon; Institute of Botany, University of Strasbourg; Institute of Botany, University of Paris; Museum National D'Histoire Naturelle, Paris; Department of Botany, University of Paris, Paris; Centre National de Recherches Agronomique Versailles.
GERMANY	Ruhrland U — Heimat Museum, Essen; Botanic Gardens of the Technical Highschool, Dresden; Messrs. Fritz Heiden Co., 8404 Worth/Donau; Botanic Gardens, Darmstadt; Botanic Gardens of the University of Tubingen.
GHANA	University of Science and Technology, Kumasi; Kwame Nkrumah University of Technology, Kumasi.
GUAM	Land Office, Agana.
HOLLAND	Botanic Gardens, Rijksuniversiteit, Leiden.
HONG KONG	Urban Council and Urban Services Department; Mr. Alex Mitchell.
HUNGARY	Botanic Gardens of the Hungarian Academy of Sciences, Vacratot; Agro-botanic Gardens of the University, Godollo; Dr. Jelenits Istvan, Budapest; Botanic Gardens of the University, Szeged.
INDIA	Indian Agriculture Research Institute, New Delhi; Forest Research Institute, Dehra Dun; Professor B. M. Johri, University of New Delhi; Messrs. Brooke Bond Ltd., via Department of Plant Protection, Quarantine and Storage, Madras.

IRAQ	Dr. M. S. Kettaneh, University of Mosul.
ITALY	Institute of Botany of the University, Pisa.
JAPAN	Mr. Kozumasa Kojima, Nagoya; Kosobe Horticultural Station, Kyoto University; Kyoto Takeda Herbal Gardens, Kyoto; Mr. Hiroshi Kuroki, Miyazaki City; Ofuna Botanic Garden, Kanagawa-ken; Mrs. Hiroko Sato.
MALAYSIA	Mr. Aw Kheng Huat, Perlis; Mr. John Carrick, University of Malaya; Botanic Gardens, Penang; Dr. T. C. Whitmore, Selangor; Dr. F. M. Dourado, Ipoh; Mr. J. Morris, Tawau.
MEXICO	Mr. Vernon T. Dickens, Del Rio Lerma 219, Mexico City.
NEW GUINEA	Department of Forests, Lae; Department of Agriculture, Port Moresby.
NEW ZEALAND	New Zealand Breweries Ltd., Wellington; Mr. H. G. Gilpin, Christchurch.
NIGERIA	Botanic Garden, University of Ibadan, Ibadan; Nigerian Institute for Oil Palm Research, Benin City.
PHILIPPINES	Mrs. P. K. Manuel, Manila; Mrs. Corazon M. de Leon, Manila.
POLAND	Garden of the Academy of Medicine, Warsaw; Botanic Gardens of the University, Poznan; Szkoly Glownez Gosp, Wiesz.
PORTUGAL	Institute of Botany of the University, Coimbra.
SINGAPORE	Sun Kee Nursery; Singapore Island Club; Singapore Orchids Ltd.; Hq. F.A.R.E.L.F.; Koh Keng Hoe Orchids Nursery; Mrs. Francis Taye; Mr. Syed Yusof Alsagoff; Consul-General of Vietnam, Shaw House; Primary Production Department; Trafalgar Home; Primary Production Department, Central Research Station; Bukit Batok Boys' Hostel; Pasir Panjang Boys' Hostel.
SOUTH AFRICA	Mr. J. E. A. Carver, Durban, Natal; Dr. J. M. Rogaly, Wentworth, Natal.
SPAIN	Mr. Jose Equilleor Sorreo, Madrid.
TAIWAN	Hengchun Tropical Botanic Garden, Hengchun.
TANZANIA	Kirukoni College, Dar-es-Salaam.
THAILAND	Mrs. Narchaleo Sumavong, Bangkok; Mr. Rapee Sagarik, Bangkok.
U.A.R.	Ministry of Agriculture, Horticulture Department, Cairo, Egypt.

UNITED KINGDOM

Department of Botany, St. Andrew's University; University of London, Botanical Supply Unit; Mr. P. J. Ferrao, Mychett; Tropical Products Institute, London; Mr. H. N. Brown, Hindley Green, Lancashire; The Royal Botanic Gardens, Kew.

U.S.A.

Mr. Rex D. Pearce, North Carolina; International Association for Plant Taxonomy, California; Prof. Grady L. Webster, Purdue University, Indiana; Honolulu Botanical Gardens, Hawaii; United States Department of Agriculture, Agriculture Research Service, California; Department of Arboreta and Botanic Gardens, Arcadia; Mr. Ladis Laus Cutak, Missouri Botanical Gardens; The Tucson Botanical Gardens, Arizona; Mr. Michael J. Koutnik, Wisconsin; Mr. Melvin S. Lud, Washington D. C.; Mr. Richard A. Hamilton, University of Hawaii; Mr. John R. Prybot, Massachusetts; Mr. Robert L. See, Miami; Mr. R. J. Rodin, Biological Science Department, San Luis Obispo; California State Polytechnic College, San Luis Obispo; Mr. Richard T. Drukker, Los Angeles; Dr. H. Kamemoto, University of Hawaii.

U.S.S.R.

Botanic Gardens of the Academy of Sciences, Latvia; Botanic Gardens of the Principal Academy of Sciences, Moscow; Botanic Gardens of the Academy of Sciences, Ashkhabad; Botanic Gardens 'Arcta-Alpinus', Murmansk; Botanic Gardens 'Tominianus', Kiev; Botanic Gardens of the Academy of Sciences, Ervan; Botanic Gardens of the Academy of Sciences, Ukraine; Botanic Gardens, Tomsk.

YUGOSLAVIA

Institute for the Application of Nuclear Energy, Zemun.

ZAMBIA

Mr. Makulu, Chilanga.

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BOTANIC GARDENS SINGAPORE

ANNUAL REPORT FOR THE YEAR 1968

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BOTANIC GARDENS
Annual Report
1968

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I. FUNCTION

To provide a botanical and horticultural service

II. STAFF

2. Mr. Lam Hin Cheng, Curator, remained on secondment to the Trees and Parks Division of the Public Works Department for the whole of 1968. Dr. Chang Kiaw Lan, Botanist, was seconded on 2nd May to the Primary Production Department. Mr. Tan Kim Ho, Librarian since 1st April, 1958, resigned and left the service on 1st June. The post of Librarian has been retitled Library Officer as an appointment in the Common-user Library Service, and arrangements have been made with the Director, National Library, to fill this vacancy in early 1969. Mr. Ang Gek Choo, Horticultural Assistant, acted as Curator throughout the year until he left for Australia on 3rd November on a U.N. Fellowship in Landscape Design. He will be away for six months. Mr. Herbert Wee, Junior Horticultural Assistant, acted as Horticultural Assistant since 3rd November and Mr. Kadim bin Tassim, Plant Collector, acted as Junior Horticultural Assistant *vice* Mr. Wee.

3. In the subordinate grades, one post of Ranger, Nature Reserves, and one of Plant Collector were filled by promotion. Inche Rohani bin Arip, Office-Boy, was transferred to the Postal Services on promotion to Postman on 2nd December, 1968, and the post of Office-Boy remained vacant for the rest of the year.

4. The Botanic Gardens records with deep regret the death on 15th February, 1968 of James Sinclair, Botanist 1948-62, who worked in an honorary capacity at the Singapore Herbarium till May 1967 in order to complete his work on the Myristicaceae. The progress of this work is reported in para. 24.

III. LABOUR

5. The labour force numbered 107. This figure included two men and five women employed at the Herbarium and eleven daily-rated watchmen. The distribution of grades was: Overseer one; Head Mandores four; Mandores six; Gardeners 22; Labourers 51; Motor Mower Drivers six; Tree Climber one; Mechanic II one; Carpenter II one; Mason II one; Signwriters II two; Watchmen eleven. In addition to the foregoing, six labourers and one mandore were employed at Bukit Timah Nature Reserve and two at Kranji Nature Reserve. Inche Martorojah bin Kassan, Mandore, Nature Reserves, was awarded the Long Service Medal on retirement.

6. With promotions, retirements and resignations, five new daily-rated officers were appointed, but four of them had either resigned or absconded within three months of appointment. The fifth, a son of a member of the Gardens Labour force, remained in service.

IV. BOTANIC GARDENS ORDINANCE AND BY-LAWS

7. The exclusion of vehicular traffic from the Gardens from June, 1967 has greatly enhanced the pleasure of peaceful relaxation enjoyed by visitors to the Gardens. Twenty watchmen were employed for day patrolling and night-time static duty. Two cases of wilful damage were caught red handed. In the first, the sundial was wrenched off its pedestal and the culprit compounded the offence with a payment of \$30.60. In the second case, scratching on bamboo culms was meted with a Magistrate's fine of \$15.

V. WORKS AND BUILDINGS

8. The library wing of the Herbarium was constructed in the first half of the year and taken over on 5th September. The building consists of: ground floor — general preparation area; middle floor — senior officers' work rooms; top floor — library. The top floor is on the same level as the middle floor of the existing Herbarium and the two are connected. The frame of the wing is designed to carry an additional floor if and when further extension is necessary.

9. Road lighting and floodlighting in the Gardens were installed and switched on for one week in August during National Day celebrations, and nightly as from 23rd November.

10. Messrs. Favre-Leuba Watch Co. presented a floral clock to the Gardens and this has added a new attraction. The installation was done concurrently with the laying of electric cables for the Gardens lighting. Mr. Ho Cheng Choon, Parliamentary Secretary to the Ministry of Law and National Development (National Development Division), received the clock on behalf of the Government from Mr. H. A. Favre, Managing Director of the Watch Company, at an official ceremony on 12th November.

11. Proposals for extension of the new tea kiosk referred to in the 1967 Annual Report, para. 7, were held in abeyance pending a review by the Ministry of plans for a new and larger project.

12. The P.W.D. paved the following paths:

- (1) In the rockery between the Potting Yard and the plant house.
- (2) In the rockery between Liane Road and the Potting Yard.
- (3) In Dell Rockery on Lawn F.
- (4) Through the Gardens jungle.

13. A new plant house was built at the Potting Yard and was brought into use for the expanding begonia and fern collections. A soil-burning shed at the Potting Yard had to be closed down because of complaints from neighbouring residents about the smoke. The soil-burning clamp was removed to the Plant Propagation Nursery. There were also 39 garden seats built by Gardens resources. Ten notice boards were put up by the P.W.D. to replace the old boards.

VI. GARDENS MAINTENANCE

14. The plants were well maintained and routine spraying of fungicides and insecticides and regular manuring were carried out. Extensive clearing of undergrowth and jungle areas was effected to extend the areas under horticulture; the cleared areas were turfed, and new beds were made and planted. The following areas were cleared:

- (1) North and south ends of the plant sales nursery, and the bank of Lawn Y adjoining Lawn W. A number of old trees were felled. This has enlarged the plant propagation and plant sales nursery to meet with increasing demands for planting materials.
- (2) Lawn S, a part of the Gardens Jungle, was cleared of undergrowth, and turfed. A start has been made to under-planting the tree canopy with flowering shade-tolerant bushes.
- (3) South end of Lawn G was cleared and turfed.
- (4) The roadside bank outside the perimeter fence along Cluny Road was cleared of shrubs and turfed. Though this land is outside the perimeter fence it is nevertheless Gardens land, the boundary being the roadside drain.
- (5) The aroid rockery between the Potting Yard and Liane Road was cleared and replanted.

15. A formal garden was laid out in the Plant House quadrangle using *Ehretia microphylla* for miniature hedges dividing up the area around the central fountain. Crazy paving and tree trunk blocks were used for paths. Plants used were *Plumbago capensis*, *Pilea cadierei*, *Alternanthera paronychioides*, *Thuya compacta*, *Juniperus conferta*, *Osbeckia* sp., *Lantana sellowiana*, *Coreopsis grandiflora*, *Zephyranthes lindleyana*, *Portulaca grandiflora*, *Zinnia linearis* and *Hemigraphis colorata*. Grass species was *Zoysia japonica*.

16. The slope on Lawn J between Lower Ring Road and the Sun Dial, was selected as the site for the floral clock. (See also para. 10). A considerable quantity of soil had to be filled in order to obtain a proper slope for the face which was made up of various multi-coloured *Coleus*, *Artemisia* sp., *Hemigraphis colorata* and *Alternanthera paronychioides*. The Singapore crest and lion on either side of the floral clock were also made up of decorative plants, and the whole was headed by the words *Majulah Singapura* done with *A. paronychioides*.

17. In order to conceal the chain link mesh perimeter fence, *Erysibe* sp. was planted to climb up and to trail over the fence along the section between the Main Gate and the plant house. This quick growing creeper gives a very effective screen and can now be seen in many gardens in Singapore. An *Acalypha siamensis* hedge was planted along the perimeter between Cluny Road and the Nursery Gate. *Gustavia superba* was planted on the steep slope, on Cluny Road side by the Nursery.

18. The two Australian Black Swans (*Chenopsis atrata*) and the Peking Ducks placed on the Lake have been responsible for the depletion of the *Nymphaea* and other aquatic plants. To prevent the complete disappearance of water plants, the northern end of the Lake has been fenced off to exclude the birds from this end where water lilies and other plants still flourish. An attempt to increase the number of the Black Swans was unsuccessful. Five eggs received from the Director, Royal Botanic Gardens, Kew, were sent for incubating at the Sembawang Research Station. Only one developed, but this too did not hatch.

19. The Lawns were well maintained and regular mowing was carried out. The extra labourers sent by P.W.D. for training in the Gardens permitted weeding of lawns of *Elephantopus scaber* which had tended to spoil the appearance of the turf. A large number of lawn plantings were made, principally to Lawns H, O and W. A feature of this has been the establishment of plantings of *Acalypha siamensis* for topiary work. Several trees within the Gardens which were considered to be in a dangerous condition were removed. 696 wooden labels were made or renewed, 3,698 aluminium tags were made and 21 signboards were prepared. A programme of checking all lawn plans and plant labels was begun with a view to bringing out a new Gardens Guide.

20. Monkeys remained the major pest, and 47 were shot during the year, mainly in the period September/October. The watchman-shooter became so well known to the monkeys that eventually he could not get near them, with or without a gun. Because of this, no shooting of monkeys could be carried out for some time. A new pest appeared in the form of a cochchafer, *Holotrichia bidentata*. Several lawns were affected with browning and dying turf caused by sporadic outbreaks of grubs of this species in the earlier part of the year. Outbreaks were reported also on at least one of the major golf courses of Singapore. Control was effected with an aqueous dressing of Chlordane and Heptachlor. These outbreaks were the first recorded of this species.

VII. PLANT COLLECTING

21. Three major collecting expeditions were undertaken, two for orchids and living plants for cultivation, in Kedah, Penang and north Perak, and the other for botanical material in Penang. Mr. Burkill made collections while on leave at Penang Hill and at points along the East Coast of the Peninsula, and four 1-day visits were made to the Gunong Panti area to collect tree seeds for the Tree Planting Campaign. Details of these and other collecting trips outside Singapore are listed in the Appendix. Many collecting trips were also made within Singapore.

VIII. HERBARIUM MATERIALS

22. The completion of the new wing in August relieved congestion in the herbarium. The mounters were able to undertake more work than routine mounting: repairs of damaged sheets holding old collections and indexing and registration of collections were undertaken. 16,654 specimens were indexed

and catalogued, and 8,545 were mounted. Botanists had improved bench space and the vacated ground floor of the herbarium will relieve the close stacking of storage cabinets on the other floors. The herbarium annexe, hitherto occupied by a part of the library collection, was cleared of books and will now assume its originally intended function as a spirit, carpological and timber collection room.

23. The Herbarium received 9,708 specimens under the exchange programme and distributed 1,758 in return. The greater part of the receipts came from New Guinea and the Solomon Islands enhancing the already important collections from eastern Malaysia held in the Singapore Herbarium. Materials loaned to eleven institutions totalled 3,054 specimens, the more important being The Botany Department of the University of Malaya, The Forest Research Institute, Kepong, The Forest Herbarium of the Commonwealth Forestry Institute, Oxford and the Leiden Herbarium. Particulars are given in Appendix VI.

IX. BOTANICAL RESEARCH

24. Work on the flora continued in the following fields: Marine algae — Mr. Burkill; Urticaceae (Nettle Family) and Piperaceae (Pepper Family) — Dr. Chew Wee-Lek; Lentinus (Fungi) — Dr. Chang Kiaw Lan till her secondment to the Primary Production Department. Mr. Hardial Singh's work is reported under Orchid Research. Dr. Furtado, pensioner, continued his studies of Palms and gave very welcome assistance with Latin diagnoses of new species. Preparation for publication of the manuscript of the Grass Flora left by the late Professor H. B. Gilliland of the University of Singapore was nearly completed. The late Mr. J. Sinclair's monograph on *Myristica* (Nutmeg Family) was put together and seen through to publication.

X. ORCHID RESEARCH

25. During the year 154 hybrid pods were harvested from the Gardens nursery; 47 pods of known parentage were accepted for germination from Singapore growers, 44 from Malaya, five from Sarawak, 69 from England and one from New Guinea. Of these 320 pods, 236 gave viable seed. There were more than 2,000 flasks in constant use culturing seedlings. Seedlings from 987 flasks were taken out for potting. The flask culture medium used, as previously, was based on Vacin's formula plus 10 per cent young coconut water, banana pulp and peptone. 3,841 mature seedlings were removed from seedlings houses to be grown in the open and repotted into bigger pots or planted in beds. 40 beds were dug or redug for planting and replanting.

26. 168 orchid species and hybrids were given on exchange and 113 orchid species and 14 flasks containing about 1,000 seedlings were received. These exchanges were with persons in Singapore, Malaysia, Thailand, Philippines, Cambodia and Japan. One plant was received as a gift.

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27. The following hybrid families were registered:

- BGS. 3512 — Aranda Adam Malik (*Arachnis* Maggie Oei x Aranda Grandeur) named after the Indonesian Minister for Foreign Affairs on the occasion of his visit to the Botanic Gardens on 19th March, 1968.
- BGS. 2817 — *Dendrobium* Khin Mae Than (*D.* Gillian x *D. gouldii* var. *saipan*) named after Madam Ne Win, wife of H. E. General Ne Win, Chairman of the Revolutionary Council of the Union of Burma on the occasion of her visit to the Botanic Gardens on 21st April, 1968.
- BGS. 3613 — Holttumara Indira Gandhi (*Aranthera* Anne Black x *Vanda dearei*) named after the Prime Minister of India on the occasion of her visit to the Botanic Gardens on 20th May, 1968.
- BGS. 3753 — *Dendrobium* Ismail ibni Ibrahim (*D.* Syaj x *D.* Noor Aishah) named after H. H. The Sultan of Johore.
- BGS. 2188 — *Vanda* Berjaya (*V. sumatrana* x *V. lamellata* var. *boxallii*).
- BGS. 3182 — *Vanda* Tan Be Gnoh (*V.* Manisaki x *V. tesselata*).
- BGS. 3590 — Aranda Chia Shui Mae (*Arachnis hookeriana* var. *luteola* x *V.* Muthiya).

Awards of Merit (Orchid Society of S.E. Asia) were given to *Arachnis* Capama 'Merah' and to *Arachnis* Capama 'Puteh'.

28. In order to avoid duplication of work, an arrangement was made with the Primary Production Department in connection with its work of providing orchid planting materials for raising cut flowers by market gardeners. The main hybridising programme would continue but facilities were promised for the work of that Department's geneticist to undertake crossing, obtain cytological materials and have access to all the Gardens' breeding records. In order to give the P.P.D. a start on multiplying material of cut-flower potential, the Botanic Gardens withdrew from public sales all materials considered to have such potential and now passes one half of all seedlings of such crosses over to the P.P.D. The remaining balance, while being an integral part of the Gardens gene-stock, remains under observation for large scale commercial potentialities. The Gardens also provided 200 cuttings of selected hybrids to be added to the P.P.D.'s nucleus of multiplication materials. While this work is still at an early stage, accelerated large scale vegetative propagation methods must be introduced, and approval has been obtained for a botanical officer of the Gardens to go to the University of Hawaii to study meristem culture. Mr. Hardial Singh, Botanist, has been selected for this course which is likely to begin in the latter part of 1969. Meanwhile he has been assigned to the Orchid Section to initiate investigations on mass vegetative propagation of orchids. Work was conducted on hybrids of *Arachnis*, *Vanda* and *Renanthera*, and is being continued.

XI. LIBRARY

29. The need for a proper library building was felt as far back as 1952, but work on it only commenced in early 1968, with the building of a wing to the Herbarium in which one floor level has been designed for the library. The wing was handed over for use on 5th September. Because funds

were insufficient only the reading room of the Library is airconditioned, while the storage area is dehumidified. By the end of the year all the books had been moved in. The library register showed a holding of 9,066 bound volumes. There is a very extensive quantity of reprints and other loose papers, and there is a considerable backlog of binding. With the passing of decades of improper storage there is also a formidable amount of damaged binding in urgent need of repair.

XII. PUBLICATIONS

30. Two issues of *The Gardens' Bulletin, Singapore* came out during the year containing the following papers:

Volume 22, part 3, 29th June, 1968.

Soepadmo: A revision of the genus *Quercus*.

Burkill *et al*: Some studies of Malayan Agarophytic and Alginophytic seaweeds.

Kostermans: New species of Dipterocarpaceae, etc.

Skvortzov: On some species of *Euglena*.

Skvortzov: On a new species of the genus *Collodictyon*.

Skvortzov: New genera of primitive green Flagellata, etc.

Hardial Singh: Sclereids in *Raphidophora* and *Scindapsus*.

Alphonso: "Gardening in Hot Countries" — a review.

Vol. 23, 30th December, 1968.

Burkill: James Sinclair, 1913–1968. An obituary.

Sinclair: Floræ Malesianae Precursores — XLII, the Genus *Myristica*, etc.

31. Revenue from the sale of publications prepared by officers of the Department and published by Government, amounted to \$9,034.10.

32. Descriptions of new hybrids were regularly supplied to the Orchid Society of S.E. Asia for publication in the *Orchid Review*. Also published was Dr. Chew Wee-Lek's "Conservation of Habitats" in *IUCN. Switzerland, Publ. 10 (1968)*.

XIII. NATURE RESERVES

33. The terms of appointment to the Board of Trustees, of Professor J. L. Harrison, Dr. T. P. Paran, Mr. Poh Soo Jin and Mr. Kiat Jun Ngui lapsed. The vacancies were filled by the appointment of Mr. H. R. Armstrong, Mr. Woon Lin Ching, Mr. Khoo Chong Phun and Mr. Chong Toh Goo. The Board consisted of the following at the end of the year:

1. Director of Botanic Gardens (*Ex-officio* Chairman)
2. Mr. O. K. Abraham
3. Mr. Tan Jake Hooi
4. Mr. H. R. Armstrong
5. Mr. Woon Lin Ching
6. Mr. Khoo Chong Phun
7. Mr. Chong Toh Goo.

34. The Reserves at Bukit Timah and Kranji were maintained in good order throughout the year except for a fire during the very dry weather of March at the Bukit Timah Nature Reserves which destroyed about 5 acres of secondary regeneration. The burnt area has since been planted over with 132 trees to establish an arboretum and it is intended to extend this planting in the contiguous secondary forest area. The Pandan Reserve was maintained till 7th November when the land was taken over by the Jurong Town Corporation for development. Aerial photographs were taken of the reserves for record, development and research purposes.

35. Twenty-three permits were issued to various individuals and institutions for carrying out observations and for collecting specimens within the Reserves. The Military continued to use the Water Catchment Area for training.

XIV. METEOROLOGICAL RECORDS

36. The year was marked by an unusually dry spell lasting 6 weeks during February and March. This was reflected in low day time relative humidity though night time humidity continued to be as usual near 100 per cent. and in the unusual amount of direct sunshine, the normal figure of 5-6 hours rising to over 8 hours daily. This 'drought' resulted in an extremely prolific flowering of seasonally receptive trees and in an abundant fruiting season of all forest trees over the Singapore Nature Reserves and into southern Johore. This also provided additional tree seedling material for the tree planting campaign. The dry weather broke in March, the second half of which was extremely wet and resulted in the highest monthly rainfall for the year being recorded. As usual Bukit Timah attracted a great deal more rain than was recorded in the Botanic Gardens, 145 inches as against 97 inches at the Gardens office. Details of meteorological recordings are given in Appendices II to V.

XV. TECHNICAL ASSISTANCE, TRAINING AND EDUCATIONAL SCHEMES

37. Departmental facilities were available for training in botany and horticulture under the following heads:

(1) *Colombo Plan Technical Co-operation Scheme*

- (a) One Senior Fellowship in Taxonomy.
- (b) One Senior Fellowship in Horticulture.
- (c) Four Junior Fellowships in Herbarium Practice.
- (d) Six Junior Fellowships in Horticulture and Elementary Gardening.

It is disappointing to record that none of these was taken up during the year.

(2) *Training Schemes*

- (a) The Housing and Development Board sent 2 groups of school leavers with Cambridge School Certificate qualification for a six-month intensive horticultural course. Trainees were assigned to various sections of the Gardens. Demonstrations on horticultural practice and lectures on elementary botany and horticulture were given and at the end of the course the trainees sat for a written examination. Of the 24 examined, seventeen were successful.
- (b) The Department participated in the Singapore Junior Chamber of Commerce and the Vocational Guidance Steering Committee's Youth Week in Commerce and Industry from 12th to 16th August.
- (c) The botanical artist of the Oil Palm Genetics Laboratory, Chemara Research Station, Layang-Layang, Johore, was given a 7-week course of training in botanical art work.
- (d) A gardener of the Singapore Island Country Club was accepted for training in tree pruning.
- (e) From the Public Utilities Board seven men were sent to the Gardens for three months' training in gardening, one of whom was still under training at the end of the year.
- (f) Two men from the National Recreation Centre, Kallang, were put through a course in gardening lasting two months.
- (g) By far the largest number sent for instruction in gardening came from the Parks and Trees Division of the Public Works Department. A total of 312 men were sent, of whom 232 successfully completed the course, while 44 are still undergoing training. They were sent in groups starting on 6th March at monthly intervals, each group receiving three months training on the correct methods of sowing seed, vegetative propagation, tree pruning, composting, preparation of beds, turfing, lawn maintenance and all general aspects of elementary gardening.

(3) *Educational Assistance*

As in previous years, the staff was involved in supplying fresh specimens for school examinations for both the Chinese and the English streams. A total of 40,000 specimens were supplied and as these were required in quantity on specific dates, their collection presented major difficulties. Available plant resources in Singapore proved inadequate and collection of some material had to be made out of Singapore. Planning, under conditions of the strictest secrecy, required four months.

38. The Director was supervisor to two botany honours students of the University of Singapore, and Dr. Chew Wee-Lek of one student.

Dr. Chew was also on the Board of Examiners of the University of Singapore for a Ph.D. student. Both Mr. Burkill and Dr. Chew were members of the University Court.

39. The Director gave two lectures to the "Know your Singapore" course of the Department of Extra-mural studies of the University of Singapore, and Mr. Ang Gek Choo and Mr. Alphonso gave a series of talks pertaining to horticulture over Radio Singapore.

XVI. SOCIETIES AND EXHIBITIONS

40. Mr. Burkill retired by rotation from the Committee of the Singapore National Academy of Science in February, but continued to serve on the Biological Sciences Subcommittee. Dr. Chew Wee-Lek was elected to the Committee and became Honorary Secretary to the Academy. Members of the Gardens participated in the Academy Annual Congress held in August. Mr. Burkill was Rapporteur for the Botanical Sciences Section and Chairman of the Equatorial Environment Section of the Biological Sciences Symposium, and Convenor of the Earth Sciences Symposium. Mr. Burkill read a paper on "The Functions of Botanic Gardens in Urban Life", Dr. Chew on "Role of Nature Reserves in an Urbanised Society" and Mr. Alphonso on "Singapore's Roadside Trees" in the Symposium on Plants in Urban Life.

41. The staff continued to give assistance to the Singapore Gardening Society, The Orchid Society of S.E. Asia and the Singapore Branch of the Malayan Nature Society with talks, demonstrations and field outings. Mr. Alphonso and Mr. Ang Gek Choo were committee members of the Orchid Society till April, and thereafter Vice President and Honorary Secretary respectively. Mr. Burkill served on the Singapore Branch Committee of the Malayan Nature Society. For the first time the Singapore Gardening Society and the Orchid Society ran a joint "Singapore Horticultural Show" 5th-8th September at the Singapore Turf Club. Mr. Alphonso was Show Chairman, Mr. Ang Gek Choo Honorary Show Manager, and Messrs. Burkill, Alphonso, Lam Hin Cheng, Ang Gek Choo and Bajuri bin Sappan were on the panel of judges.

42. In the census of visitors to the Gardens taken 5th-13th October, it was shown that 15.3 per cent of the visitors came into the display area of the Orchid Nursery.

43. Cut orchid blooms were sent to the exhibitions organised by:

- (a) Japan Orchid Friends Association (Ranyu-kai) Japan.
- (b) Delhi Agri-Horticultural Society, India.
- (c) Mostra Internazionale del Fiore, Trieste, Italy.
- (d) Selangor Orchid Society, Kuala Lumpur.
- (e) Science Exhibition, University of Singapore.
- (f) The Siam Society of Plant Culture, Thailand.
- (g) Sarawak Orchid Show, Kuching.

44. The Gardens exhibit at the Delhi Show won the Ram Subhag Singh Challenge Cup for the best exhibit of tropical and subtropical flowers. The Garden exhibit at Trieste was awarded a Certificate and a gold medal.

XVII. VISITORS

45. The year was marked by the visits of a number of very eminent foreign dignitaries. They included:—Mrs. Indira Gandhi, Prime Minister of India; Madam Ne Win, wife of the Chairman of the Revolutionary Council of Burma; Mr. Kang Ryang Wook, Vice-President of North Korea; Mr. Adam Malik, Foreign Minister of Indonesia, and Mr. Tep Hun, Minister for Justice, Cambodia and Leader of the Cambodian Delegation for Orchid Cultivation. Private visits were made by T. R. H. Norodom Buppha Devi and Sisowath C. Monirak of Cambodia; ACM. Dawee Chullasapya, Chief of Staff, Ministry of Defence, Thailand, and Mr. Harold Sam Kessinger, Judge, U.S. High Court (retired), and Personal Representative of the President, Rotary International, and Mr. A. J. Ellender, U.S. Senator.

46. Many prominent men and women of science and letters called at the Gardens. A list of the visitors appears in Appendix X.

47. The facilities of the Gardens Herbarium and Library were made freely available to sponsored students of the University of Singapore, Nanyang University, The Singapore Teachers' Training College and other official organisations.

48. A large number of casual visitors came daily as usual to the Gardens. In order to gauge this number accurately, a count was made between 5th and 13th October inclusive. For a week period (2 weekends averaged) 18,123 persons entered the Gardens during the hours of opening 6 a.m. to 7 p.m. An interesting aspect was that the number between 6–7 a.m. was greater than for the next 2 hours till after 9 a.m. Daily figures were: Monday 1,578; Tuesday 1,552; Wednesday 1,718; Thursday 1,139; Friday 1,573; Saturday 3,007; Sunday 7,616; total 18,123. The hours of opening were extended from 7 p.m. to 10 p.m. from 23rd November.

49. A conducted tour was arranged for the Delegates to the Natural Rubber Conference held in Kuala Lumpur 28th August–5th September. The delegates were shown the oldest samples of Malayan rubber extant, and old records connected with the introduction of *Hevea brasiliensis* through the Singapore Botanic Gardens.

XVIII. PROVISION OF PLANT MATERIALS FOR OFFICIAL PURPOSES

50. Four mature orchid plants (one each of *Vanda* Sanada Kuma, *Vanda* Verna Maria, *Dendrobium* Louisæ, Sappanara Ahmad Zahab) were provided for presentation to H.M. The Emperor of Japan when the Prime Minister visited Japan in October; a plant of *Dendrobium* Khin Mae Than was presented to Madam Ne Win, and one of *Dendrobium* Ismail ibni

Ibrahim to H.H. The Sultan of Johore. 885 orchid sprays were provided for state gifts on 18 occasions, and 1,085 sprays were provided for National Day state banquets in Singapore, London and New Delhi.

51. At the present time the Department is providing cut flowers for office decoration which amounted during the year to:

3,000 sprays to the Prime Minister's Office, thrice weekly;

1,820 sprays to the Ministry of Foreign Affairs, twice weekly;

372 sprays to the Ministry of Law and National Development, once weekly;

335 sprays to the Ministry of Interior and Defence, once weekly; and

458 sprays to the Public Service Commission, once weekly.

52. Decoration was arranged for four state banquets held at the Conference Hall: Chinese New Year banquet on 9th February; banquet in honour of the Prime Minister of India, Mrs. Indira Gandhi, on 19th May; banquet in honour of the Prime Minister of Australia, Mr. John Gorton on 10th May and the National Day banquet on 14th August. The floral display at each of these called for skilful planning, and each was in itself a flower show. For the four banquets nearly 4,000 pot plants and about 450 orchid plants were used.

53. 832 orchid cuttings and seedlings were given free to eight Social Welfare Homes for the establishment of nucleus collections from which to raise cut flowers and to provide a source of occupation for the resident inmates.

XIX. ADVISORY SERVICE

54. Numerous requests were received for identification of plants. These came generally from businessmen, hospitals, members of the public and science teachers and students. In most cases identification was possible, though it must be stated that stomach washings from the hospitals of suspected food poisoning did present peculiar difficulty.

55. Advice on planting and lay-out of gardens was given to Government departments, schools, Statutory Boards and Community Centres. The total number of plants supplied free to government departments, schools, etc., was 26,687, of which 6,889 were tree seedlings. Some 9,000 pot plants were let out on loan to government and civic organisations for special functions. This was an increase of about 40 per cent over the figure for 1967.

56. Mr. A. G. Alphonso served as a member on the following Committees: (1) for Singapore's participation in the World Exposition, 1970, in Osaka, Japan; (2) for Jurong Parks; (3) the Panel of Advisers to the Public Utilities Board for Recreational Development of Parks, and (4) continued as a member of the International Orchid Commission on Classification, Nomenclature and Registration. Mr. Burkill assisted Mr. E. H. Tong, Director of Whipsnade Zoo, England, who visited Singapore to advise the P.U.B. on the feasibility of establishing a zoo in the Seletar Reservoir

Water Catchment, and was Planting Advisor to the Singapore Island Country Club New Course Committee. Dr. Chew was a member of the Advisory Council of the Southeast Asian Ministers of Education Secretariat for the establishment of a Centre for Tropical Biology at Bogor, Indonesia.

XX. PLANT SALES SERVICE

57. In order to step up supply of material for public and private consumption under the Garden City policy of Government, the plant sales nursery was almost doubled in size by clearing the undergrowth at both the north and south ends of the nursery. At the south end this made way for an expansion of the canna beds, the stock of cannas being completely depleted by demands from schools. The northern end was filled with additional pot plants to meet requests for loans for pot plant decoration by government departments, statutory boards, etc. Two small ponds were made in the nursery for raising aquatic plants. New plants, not on the sales list were also propagated in quantity and made available for sale. To enable members of the public to purchase plants after normal office hours, the times for the sale of plants were changed as follows:—Mondays to Fridays—10 a.m.–2 p.m. and 3.30–6.30 p.m., and Saturdays—10 a.m.–2 p.m. Evening sales have proved popular. Orchid planting material has been on sale at the same times, and the release of unflowered seedlings has been stepped up from once to twice weekly.

58. There was a marked increase in revenue from the sale of plants which rose from \$5,838.50 in 1967 to \$18,664.40. The total number of plants and cuttings was 46,513 of which 8,136 were tree seedlings. Orchid sales realised \$14,372 from 4,759 plants, cuttings and seedlings. The total revenue was a record \$33,036.40.

XXI. CONCERTS

59. There were 23 band performances during the year: six by the Singapore Infantry Regiment; two by the Singapore Police Force; two by the People's Association; eight by various Schools; one by the Indian Navy; one by the New Zealand Infantry Regiment; one by the Australian Infantry Regiment. Bandsmen, bandmasters, commanding officers and Headmasters are cordially thanked for their performances which were well attended and much appreciated by the public. With electric illumination available in the Gardens, it is intended to introduce concerts after dark and it is hoped that there will be bands coming forward to display their talent.

XXII. COMMONWEALTH WAR GRAVES COMMISSION

60. The Director continued to be the Commission's representative in Singapore and was responsible for the maintenance of the War Graves Cemetery at Kranji under instructions from the Commission's Eastern Region Headquarters at New Delhi. Funds for the maintenance of the Cemetery were provided by the Commission in whose reports further information may be found.

STAFF OF THE BOTANIC GARDENS 1968

Divisions I, II and technical posts of Division III

(Date of first appointment to the Botanic Gardens Service is shown in brackets)

<i>Appointment</i>	<i>Holder</i>	<i>Notes</i>
Director	H. M. Burkill, M.A. (Cantab.) F.L.S., (12-11-54)	
Botanist	Chew Wee-Lek, B.Sc. (Malaya) Ph.D. (Cantab.) (1-10-56)	Keeper of Herbarium and Assistant to Director
	Chang Kiaw-Lan, Miss, B.Sc. (Malaya), Ph.D. (Cantab.) (7-7-59)	On secondment to Primary Production Department w.e.f. 2-5-68.
	Hardial Singh, B.Sc. (Sing.) (1-11-63)	
Curator	A. G. Alphonso (1-1-40)	
	Lam Hin Cheng (1-7-57)	On secondment to Trees and Parks Division, P.W.D. throughout the year.
Librarian	Tan Kim Ho, B.Sc. (Malaya) (1-4-58)	Resigned w.e.f. 1-6-68.
	Vacant	1-6-68 to the end of the year.
Executive Officer	D. P. Lazaroo (11-3-63)	
Laboratory Asst. (Special Grade)	Bajuri bin Sappan (14-9-37)	
Horticultural Assistant	Ang Gek Choo (18-5-61)	Acting Curator 1-1-68 to 2-11-68. 3-11-68 on a U.N. Fellowship in Australia.
Herbarium Assistant	Mohamed Shah bin Haji Mohamed Nur (3-2-55)	
Artist	Juraimi bin Samsuri (1-9-45)	
Junior Horticultural Assistant	H. Wee Sip Hean (13-5-66)	
	S. Chia Jiew Thian (1-7-66)	
	Quek Wai Yan (30-12-67)	

METEOROLOGICAL REPORT

BOTANIC GARDENS SINGAPORE, 1968

Reading daily at 9.30 a.m. local time at Gardens Office from 1-1-68 to 31-12-68

1968	Total Rainfall	Average 1914—1968	Highest fall in 24 hours	No. of days Rainfall	Mean Maximum Temp.	Highest Maximum Temp.	Mean Minimum Temp.	Lowest Minimum Temp.	Mean Dry Bulb Temp.	Mean Wet Bulb Temp.	R.H.
	inches	inches	inches		°F	°F	°F	°F	°F	°F	%
January ..	9.01	10.92	4.85	8	85.5	91.0	71.9	68.5	78.9	74.8	82.8
February ..	0.58	7.26	0.47	2	90.0	92.5	72.5	69.5	82.0	76.1	75.0
March ..	13.85	8.33	4.74	13	88.5	93.5	73.8	69.0	81.3	77.1	82.0
April ..	5.83	8.06	1.58	19	90.1	94.0	75.1	72.5	83.0	78.4	80.7
May ..	10.66	7.49	2.09	18	90.1	95.2	74.9	72.5	81.5	78.9	87.3
June ..	4.41	6.64	2.38	9	91.8	95.5	75.1	72.5	82.8	78.9	83.0
July ..	5.16	6.19	1.03	21	88.4	93.5	75.1	72.5	80.7	77.8	85.9
August ..	7.40	6.89	1.93	16	89.3	96.0	74.7	72.0	80.8	78.0	87.5
September ..	6.58	7.28	1.97	11	90.2	94.0	75.2	71.0	83.0	78.5	81.3
October ..	8.22	7.97	3.48	15	89.0	93.0	74.1	71.5	82.4	78.3	82.0
November ..	13.64	10.64	2.10	23	87.3	91.5	73.6	70.5	81.2	77.6	83.6
December ..	11.96	10.35	2.68	16	86.0	90.0	73.7	70.8	78.9	76.3	87.4
Total ..	97.30	98.02	4.85	171	..	..	..	..	..	..	..
Mean ..	..	..	..	..	88.8	91.6	74.1	71.1	81.4	77.6	83.2

METEOROLOGICAL REPORT

BOTANIC GARDENS SINGAPORE, 1968

Reading daily at 8.00 a.m. local time at "Orchid Enclosure" from 1-1-68 to 31-12-68

1968			Total Rainfall	Highest fall in 24 hours	No. of days rainfall	Mean Maximum Temperature	Highest Maximum Temperature	Mean Minimum Temperature	Lowest Minimum Temperature	Mean Dry Bulb Temperature	Mean Wet Bulb Temperature	Mean R.H.	Mean Grass Minimum Temperature	Mean Earth 4" Temperature	Mean Earth 1' Temperature	Mean Earth 4' Temperature	Mean Solar Radiation Temperature	Mean Daily hours of Sunshine
			inches	inches		°F	°F	°F	°F	°F	°F	%	°F	°F	°F	°F	°F	hours
January	..	..	9.28	4.85	8	87.8	93.5	71.2	68.0	73.4	72.5	95.5	69.9	78.1	79.7	79.9	125.4	5.15
February	..	..	0.49	0.35	2	90.6	94.5	71.4	68.5	73.7	72.3	93.1	68.2	79.1	81.5	81.6	137.3	8.10
March	..	..	13.15	4.32	13	89.5	94.0	73.2	69.2	75.4	74.5	95.7	71.5	80.4	82.2	82.4	136.8	5.79
April ..	..	..	5.34	1.51	19	90.2	92.0	74.2	71.5	76.2	75.6	97.4	72.0	81.7	83.3	83.0	136.0	5.81
May ..	..	..	9.49	1.52	16	88.6	93.0	74.3	72.0	76.7	75.9	94.1	72.3	81.2	82.8	83.0	132.8	5.34
June ..	..	..	4.43	2.44	9	90.1	93.2	74.3	72.5	76.4	75.5	96.1	71.9	81.7	83.4	83.2	134.1	6.52
July ..	..	..	4.97	0.90	21	87.7	91.2	74.2	72.0	77.1	76.0	94.7	72.0	81.2	82.9	83.1	129.5	4.59
August	..	..	7.03	1.83	20	88.3	92.5	74.2	71.0	77.2	76.1	94.6	70.4	81.2	83.2	83.1	130.2	5.49
September	..	..	6.44	1.78	12	89.0	91.5	74.6	70.5	77.4	76.3	94.8	71.3	81.5	83.6	83.9	134.0	6.00
October	..	..	7.73	2.86	16	88.2	91.0	72.5	70.2	76.8	75.8	95.0	72.4	80.7	83.0	83.4	131.8	5.42
November	..	..	11.72	1.81	21	88.5	92.0	72.1	69.0	76.0	75.1	95.7	71.5	80.0	82.0	82.6	129.8	5.50
December	11.31	2.67	16	88.5	92.0	72.5	69.8	82.2	74.6	96.0	72.1	80.0	81.7	82.2	127.5	4.13
Total	91.38	4.85	173
Mean	88.9	95.2	73.2	72.8	76.5	75.0	95.2	71.3	80.6	82.4	81.8	132.1	5.82

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APPENDIX IV

METEOROLOGICAL REPORT

BOTANIC GARDENS SINGAPORE, 1968

Reading daily at 8.00 a.m. local time at Bukit Timah from 1-1-68 to 31-12-68

1968			Total Rainfall	Highest fall in 24 hours	No. of days rainfall	Mean Maximum Temp.	Highest Maximum Temp.	Mean Minimum Temp.	Lowest Minimum Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	R.H.
			inches	inches		°F	°F	°F	°F	°F	°F	%
January	..	..	12.56	4.23	8	83.1	89.5	72.6	68.8	75.7	73.6	90.0
February	..	..	1.05	0.80	3	85.8	89.7	72.8	69.6	76.8	73.9	88.1
March	..	..	21.65	3.47	16	85.9	89.2	73.2	69.0	77.4	75.1	89.0
April	..	..	13.83	3.20	15	82.7	89.7	74.1	70.7	72.8	75.5	87.1
May	..	..	14.38	2.60	16	86.5	90.3	73.7	71.0	78.2	75.8	89.0
June	..	..	10.93	2.50	9	87.0	91.3	74.3	69.0	73.8	72.2	88.8
July	..	..	12.13	3.35	17	85.9	88.9	74.0	68.5	77.4	75.4	91.2
August	..	..	9.84	1.95	15	86.0	88.5	73.4	69.5	76.9	74.5	88.9
September	..	..	7.90	2.50	12	85.8	89.8	74.6	71.0	78.0	76.0	90.9
October	..	..	12.73	3.47	14	86.2	89.5	73.9	70.0	77.2	75.1	90.0
November	..	..	14.30	2.60	17	85.7	94.0	70.6	55.0	77.8	75.2	87.7
December	..	..	14.00	2.35	14	86.0	89.1	72.4	69.0	76.7	74.5	89.1
Total	..	..	145.30	4.23	156	..	..	..	..	..	..	..
Mean	..	..	..	..	..	85.5	89.9	73.3	68.4	76.9	74.7	89.1

METEOROLOGICAL REPORT

KРАНJI WAR GRAVES CEMETERY

*Recorded daily at 8.00 a.m.
from 1-1-68 to 31-12-68*

1968					Total Rainfall	Highest fall in 24 hours	No. of days rainfall
					inches	inches	
January	..	..	..	..	10.89	4.95	7
February	..	..	..	..	0.75	0.75	1
March	..	..	..	..	12.10	2.05	13
April	..	..	..	..	5.50	2.52	6
May	..	..	..	..	7.40	1.65	12
June	..	..	..	..	5.30	1.90	7
July	..	..	..	..	3.42	0.50	9
August	..	..	..	..	6.27	1.40	10
September	..	..	..	..	2.68	1.25	6
October	..	..	..	..	7.95	2.45	8
November	..	..	..	..	11.65	3.15	14
December	..	..	..	..	6.43	1.80	12
Total ..					80.34	4.95	105

DETAILS OF HERBARIUM SPECIMEN MOVEMENTS

IAPT Code	Institutions	EXCHANGE		LOAN	
		In	Out	In	Out
A	Arnold Arboretum, U.S.A. .. ..	..	370	..	..
AAH	Arnold Arboretum, Jamaica Plain, U.S.A. ..	..	158	..	..
AAU	University of Aarhus, Aarhus, Denmark ..	123	127	..	..
BH	Baily Hortorium, Mann Library, Ithaca, New York, U.S.A. .. ..	..	98	..	..
BISH	Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A. .. ..	..	..	..	40
BKF	Forest Department, Bangkok, Thailand ..	218	..	..	..
BM	British Museum, Great Britain .. ..	..	..	3	..
BO	Bogor Herbarium, Indonesia .. ..	..	..	..	51
BSIP	Forestry Department, Honiara, British Solomon Islands Protectorate	2,768	..	..	..
C	Botanical Museum and Herbarium, Copen- hagen, Denmark	310	..	11	48
CAL	Indian Botanic Gardens, Calcutta, India ..	..	..	..	2
E	Royal Botanic Garden, Edinburgh, Great Britain .. ..	..	127	..	..
FHO	Forest Herbarium, Department of Forestry, University of Oxford, Great Britain .. ..	..	..	..	765
K	Royal Botanic Gardens, Kew, Great Britain	238	448	6	..
KEP	Forest Research Institute, Kepong, Malaysia	495	3	..	603
KLU	University of Malaya, Kuala Lumpur, Malaysia	399	..	..	946
KYO	Kyoto University, Japan	86	..	4	..
L	Rijksherbarium, Leiden, Holland	350	296	..	228
LAE	Forest Department, Lae, New Guinea ..	2,743	..	..	..
P	National Museum of Natural History, Paris, France .. ..	..	..	..	20
PNH	Philippines National Herbarium, National Museum, Manila, Philippines	457	..	..	..
SAN	Forest Department, Sandakan, Sabah ..	69	..	..	..
SAR	Sarawak Forest Department, Kuching, Sarawak	1,311	18	..	..
US	Smithsonian Institution, U.S.A. .. ..	..	113	..	..
	Craiova, Romania	100	..	..	..
	Shimshu University, Matsumoto, Japan ..	..	..	..	310
	Portsmouth, Hants., Great Britain ..	41	..	..	..
	University of Texas, U.S.A. .. ..	..	..	..	41
	Total ..	9,708	1,758	24	3,054

SUMMARY OF MAIN PLANT COLLECTING EXPEDITIONS—1968

Personnel	Date	Locality	Collection
H.M. Burkill (on leave)	12-19 May	Penang Hill	18 nos. Trentepohliaceae.
H. M. Burkill	{ 23 June 30 June 14 July 1 September	{ Gunong Pantl and G. Muntahak area	{ 6 nos. } 1 no. } Forest tree seed for tree planting. 9 nos. } 19 nos. }
H. M. Burkill (on leave)	22-29 October	East Coast	34 nos. miscellaneous materials for herbarium and for cultivation.
Hardial Singh	September	Muka Head, Pantai Aceh, Pulau Betong, Penang	49 nos. herbarium material.
A. G. Alphonso			
with Sanusi bin Sarih	5 April	Penang Hill	7 nos. (141 plants) orchids for cultivation.
with Sanusi bin Sarih and Cheang Kok Choy	6 April	Titi Kerawang, Jalan Masjid, Penang	4 nos. (155 plants) miscellaneous.
with Sanusi bin Sarih and Cheang Kok Choy	8-11 April	Bintang Hijau, Maxwell's Hill, Kg. Semanggol, G. Hijau, Port Weld Road, Jalai, Kerangan, Pondok Trujung, Ulu Sapitang, Perak	5 nos. (21 plants) orchids.
with Sanusi bin Sarih and Cheang Kok Choy	12 April	Bt. Enggang, Naka, Nami, Kedah	3 nos. (73 plants) miscellaneous.
			49 nos. (188 plants) orchids.
			36 nos. (106 plants) miscellaneous.
			9 nos. (33 plants) orchids.
			2 nos. (22 plants) miscellaneous.

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APPENDIX VII—*continued*

SUMMARY OF MAIN PLANT COLLECTING EXPEDITIONS—1968

Personnel	Date	Locality	Collection
A. G. Alphonso			
with Samsuri bin Ahmad ..	22 October ..	Penang Hill	20 nos. (220 plants) orchids.
with Samsuri bin Ahmad and Cheang Kok Choy	23–27 October ..	Merbok, Gurun, Yen, Weng, Baling, Kedah	21 nos. (159 plants) miscellaneous. 43 nos. (311 plants) orchids.
with Samsuri bin Ahmad and Cheang Kok Choy	27–28 October ..	Kroh, Tasek, Klian Intan, Perak ..	82 nos. (206 plants) miscellaneous.
with Samsuri bin Ahmad and Cheang Kok Choy	30 October ..	Kepong, Selangor	10 nos. (50 plants) orchids. 15 nos. (48 plants) miscellaneous.
			1 no. (110 plants) miscellaneous.
A. G. Alphonso			
with Sanusi bin Sarih ..	24 November ..	Jemaluang, Mersing, Johore ..	8 nos. (13 plants) orchids.
Sanusi bin Sarih	17 July ..	Bukit Bekok, Johore	12 nos. (21 plants) miscellaneous. 23 nos. (39 plants) orchids.
			3 nos. (3 plants) miscellaneous.

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM PLANTS
AND SEEDS WERE RECEIVED IN 1968

AUSTRALIA	Norfolk Island Administration; Royal Botanical Garden, Sydney.
BAHAMAS	Mr. Stanley Smith, New Providence.
BRAZIL	Dr. Albert Widmer, Ubatuba, Instituto di Botanica, Sao Paulo.
FRANCE	Establissements Verspuy, Le Puy.
GHANA	Kwame Nkrumah University & Technology, Kumasi.
INDONESIA	Kebun Raya, Bogor.
INDIA	Commonwealth War Graves Commission, New Delhi.
JAPAN	University of Kanazawa, Ishikawa-ken.
MALAYSIA	Botanic Gardens, Penang; Mr. Woo Heng Kee, Petaling Jaya; John Dransfield, Kuala Lumpur; Istana, Johore Bahru; Mr. M. E. L. Robey, Malacca.
MEXICO	Mr. R. T. Dickins, Calle de Rio.
NETHERLANDS	Hortus Botanicus, Amsterdam.
NEW GUINEA	Department of Forests, Lae.
PHILIPPINES	Augusto G. Syjuco, Rizal; Dr. H. Valmayor, Laguna.
RHODESIA	Mr. J. Avery, Salisbury.
SINGAPORE	Mr. F. Waudby; University of Singapore; Syed Yusuf Alsagoff; Dr. Hsuan Keng; Mr. John Ede, Dr. & Mrs. Heaslett, Mrs. Shepherd; Mr. Alan Choe.
SOLOMON ISLANDS	Forestry Department, Honiara.
U.S.A.	Mr. J. W. Strobel, Florida; Tucson Botanical Gardens, Arizona; California Jungle Gardens, Los Angeles.
UNION OF SOUTH AFRICA	Mr. J. E. A. Carver, Durban.
ZAMBIA	Ministry of Agriculture, Chilanga.

INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS AND SEEDS WERE SENT IN 1968

ARGENTINA	Instituto de Botanica Agricola, Buenos Aires.
AUSTRALIA	Mr. Ernest Todd, N.S.W.; Mr. Harrison, Canberra; Mr. N. L. Wills, Queensland; Darwin Botanic Gardens, Northern Territory; Mrs. W. N. Cobley, Western Australia; Redlands Horticultural Research Station, Queensland; Townsville City Council, Queensland.
BRUNEI	Brunei Shell Petroleum, Seria.
CANADA	Montreal Botanical Gardens; University of Alberta, Edmonton; Carleton University, Ottawa.
CZECHOSLOVAKIA	Agricultural Research Station, Semperk-Temenice; Botanicka Gardens, Brno; University Botanical Gardens, Bratislava; Botanicka Zaharada University, Praha 2; Academia Scientiarum Hortus Botanicus, Pruhonice; Hortus Botanicus Institute Pedagogice, Kosice
DENMARK	Botanical Museum, Copenhagen.
FINLAND	University of Helsinki.
FRANCE	Jardin Botanique de L'Universite, Besancon; Central National de Recherches Agronomique, Versailles; Institut de Botanique, Strasbourg; Museum National D'Histoire Naturelle, Paris; Laboratoire de Botanique Faculte des Sciences, Toulouse.
GHANA	Kwame Nkrumah University of Technology, Kumasi.
GUAM	Mr. Paul Souder, Ogawa.
HONG KONG	Urban Services Department.
HUNGARY	Institutum Botanicum et Hortus Botanicus Universitatis, Szeged.
INDIA	Indian Agricultural Research Institute, New Delhi; Mr. A. R. Shah, Allahabad; Forestry Research Institute, Dehra Dun; Karnatak University, Mysore; National Botanic Gardens, Lucknow.
IRAQ	University of Mosul.
ISRAEL	Ministry of Agriculture.
ITALY	Instituto de Orto Botanico dell'Universite, Napoli.
IVORY COAST	Centre D'Adiopodoume, Abidjan.
JAPAN	Governor of Miyazaki Prefecture; Izu Plant Experimental Station, Shizuoka Prefecture; University Tokyo; Mr. Toshichiko Satake, Hiroshi-ken; Dr. Toshio Miyata, Saitoma-ken.
KENYA	Grahame Bell Ltd., Nairobi.
MALAYSIA	Mr. J. Morris, Tawau; Department of Agriculture, Jesselton; Dr. Ting Wen Poh, Kuala Lumpur; Mr. John Robertson, Jesselton; Kuching Municipal Council, Sarawak; Penang Botanic Gardens.
MAURITIUS	Sugar Industry Research Institute, Reduit.
MEXICO	Mr. Jesus Patino, Navarette; The Rank Organisation, Del Rio Lerma; Mr. Carlos Prieto, Mexico City.
NETHERLANDS	Professor van Steenis, Oegstgeest.

NEW GUINEA	Department of Forests, Lae.
NEW ZEALAND	Mr. L. W. Woods, Wellington.
NIGERIA	Nigerian Institute for Oil Palm Research, Benin City; University Botanical Gardens, Ibadan.
PHILIPPINES	Mrs. Augusto G. Syjuco, Rizal; Dr. H. Valmayor, Laguna.
PORTUGAL	Instituto Botanico de Universidade, Coimbra.
PUERTO RICO	Federal Experimental Station, Mayaguez.
RHODESIA	Botanic Gardens, Salisbury.
SEYCHELIE ISLANDS	Department of Agriculture.
SINGAPORE	Mr. R. E. Dean; Mrs. Monica Chan; Trees & Parks, P.W.D.; People's Association, Kallang; General Hos- pital; Singapore University; Housing & Development Board; Educational T.V.; Urban Council & Urban Services Department; St. Andrew's Orthopaedic Hos- pital; Public Utilities Board; Kranji War Cemetery; Ramakrishna Boys' Home; Social Welfare Department; Nanyang University; Teachers' Training College; Cheshire Home; Primary Production Department.
SOLOMON ISLANDS	Forest Herbarium, Honiara.
SPAIN	Mr. Jose Equilleor Sorres, Madrid.
SWITZERLAND	Conservatoire et Jardin Botanique, Geneva.
THAILAND	Mr. Nartholeo Elumawong, Bangkok.
TUNISIA	Service Botanique, Ariana.
U.A.R.	Orman Botanic Gardens, Giza.
U.K.	Tropical Products Institute, London; Royal Botanical Gardens, Surrey; Mr. T. C. Whitmore, Southampton; Major V. F. Howell, Surrey.
UNION OF SOUTH AFRICA	Mr. J. E. A. Carver, Durban; Doleside Estate Nursery, Pkliprivier; Botanic Gardens, Durban
U.S.A.	Department of Arboreta & Botanic Gardens, California; Medical College of Virginia, Richmond; Honolulu Botanic Gardens, Hawaii; Cornell University, New York; Fairchild Tropical Garden, Florida; Missouri Botanical Gardens; State Polytechnic College, Califor- nia; Ohio State University, Columbus; Ernest de Saram, Florida; Edwin A. Menninger, Florida; Mr. Jose Montoya-Gomez, California; University of California, Berkeley; Mr. David Barry Jr., Honolulu; Mr. W. J. Brudy, Flora.
U.S.S.R.	Hortus Botanicus Academiae Scientiarum, Askhabad; Hortus Botanicus, Kiev; Horti Botanici Academiae Scientiarum, Ukraine; Botanical Garden of Academy of Science, Armaniae.
WEST GERMANY	Ruhrland-u-Heimat Museum, Essen; Botanischer Garten der Universitat, Marburg; Botanischer Garten der Universitat, Tubingen.
ZAMBIA	Mt. Makulu Research Station.

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BOTANIC GARDENS

SINGAPORE

annual report 1969

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BOTANIC GARDENS
annual report 1969

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I. STAFF

1. With the retirement of the Director, Mr. H. M. Burkill, on 31st July, 1969, Dr. Chew Wee-Lek, Botanist, acted in his place. Mr. Hardial Singh, Botanist, left on 7th June, 1969 for Hawaii to take a course leading to a higher degree in Horticulture and Dr. (Miss) Chang Kiaw Lan was recalled on 1st July, 1969 from secondment to the Department of Primary Production. The vacancy of Library Officer was filled by Miss Ng Soot Hong who was transferred from the National Library. Mr. Ang Gek Choo, Horticultural Assistant was promoted to Curator, Parks and Trees Division of the P.W.D., while Mr. Lam Hin Cheng, Curator, remained on secondment to the same Division.

2. Mr. Bajuri bin Sappan (Laboratory Assistant, Special Grade) and Mr. Hamidon bin Zin (Foreman Gardener) were awarded the Long Service Medal on retirement.

II. HERBARIUM MATERIALS

3. Over 9,000 specimens were mounted and indexed, and over 1,000 were repaired. During the year 32 botanical institutions exchanged, loaned or borrowed materials. 10,122 herbarium specimens were received in exchange against 3,697 specimens issued. In particular, the Herbarium was enriched with specimens from Honiara in the Solomon Islands, the Forest Department in Lae, the Forest Research Institute in Kepong and the Forest Department in Kuching in Malaysia. Materials numbering 3,360 specimens were loaned out. Particulars are given in Appendix I.

III. BOTANICAL RESEARCH

4. Floristic and taxonomic work was carried out as follows: Marine algae — Mr. H. M. Burkill; Piperaceae — Dr. Chew Wee-Lek; plants of Pulau Weh — Dr. Chang Kiaw Lan. Mr. Hardial Singh continued with trials on apical meristem culture of local orchid hybrids and brought up-to-date the location of species of trees in the lawns of the Gardens. Dr. C. X. Furtado continued his investigations on the taxonomy of the genus *Hyphaene*, a palm genus.

IV. ORCHID RESEARCH

5. 216 hybrid pods were harvested from the Gardens Orchid Nursery. In addition, 25 pods were accepted for germination from Singapore growers, 10 from Malaysia, 58 from the United Kingdom and 5 from New Guinea. Of these 314 pods, 231 produced viable seeds. 1,044 flasks were taken out and seedlings potted. The flask culture medium used, as previously, was based on Vacin's formula plus 10 per cent young coconut water, banana, pulp and peptone.

6. 132 orchid species and hybrids were received in exchange for 59 orchid species and hybrids and five flasks containing 225 seedlings. The exchanges were with persons in New Guinea, Malaysia, Singapore, Thailand and Australia.

7. The following hybrids were registered:

- BGS. 2876 — *Vanda Pata* (*V. Ruby Prince* x *V. Alice Fukunaga*)
- BGS. 3708 — *Aeridachnis Alexandra* (*Aeridachnis Bogor* x *Arachnis flos-aeris* var. *insignis*)
- BGS. 3710 — *Dendrobium Polly Woo* (*D. Schubert* x *D. mirbellianum*)
- BGS. 3582 — *Vanda Shu Jane Mai* (*V. Dolores Anne* x *V. Alice Fukunaga*)
- BGS. 3643 — *Renantanda Chia Shui Hai* (*Vanda Mary Foster* x *Renanthera storiei*)
- BGS. 3631 — *Renantanda Chia Shui May* (*Vanda Oriole* x *Renanthera storiei*)

V. BOTANIC GARDENS COMMITTEE

8. To adjust to the changing needs in providing more services and amenities to the public and maintaining the botanical and horticultural research, the functions of the Botanic Gardens have been split up into two divisions, namely a Horticultural Division and a Botanical Division. The Horticultural Division is headed by a Curator who is responsible to a Committee known as the Botanic Gardens Committee comprising the following officers:

Mr. Chang Kwang Seh	—	Acting P.A.S., Ministry of National Development — Chairman
Mr. Yap Neng Chew	—	Deputy Director of Public Works
Mr. Chong Toh Goo	—	Executive Engineer, Parks and Trees Division, P.W.D.
Mr. A. G. Alphonso	—	Curator, Botanic Gardens

9. The appointment of the Botanic Gardens Committee has helped immensely in the execution of horticultural projects, resulting in tremendous improvements to the Gardens and the provision of additional amenities for the public.

VI. WORKS AND BUILDINGS

10. A footpath was laid round the periphery of the lake and the road on the northern end of the lake in front of the Tea Kiosk was re-aligned.

11. Towards the end of the year, a footpath was constructed on Lawn J, leading from the Tea Kiosk to the Sun Dial and Floral Clock.

12. Twenty-eight garden seats were made and placed at suitable locations.

13. Four portable floating fountains, on loan from the P.W.D., were installed in the lake. They are illuminated at night.

14. On the northern end of the lake, in the Dell Rockery, a miniature waterfall was constructed. This has been a source of great delight to visitors, particularly children.

15. The old summer house in front of the Orchid Enclosure was dismantled and in its place a gazebo was erected. The gazebo was transferred to the Botanic Gardens from the old Admiralty House at Grange Road.

16. Two "flower-box" type litter bins were constructed and 20 conventional type bins were added to the various lawns, bringing the total of litter bins to 72.

17. Planting of trees and shrubs to beautify the Cluny Road Car Park was carried out by the Department.

VII. GARDENS MAINTENANCE

18. A group arrangement using foliage and flowering plants was made on Lawn X, by the path leading to the Sun Rockery. This improved the landscape effect of the area.

19. On Lawn W, a landscaped garden with a lily-pond, boulders, tropical ferns, cycads, aroids and allied plants was constructed. The tree ferns which are rarely found growing in the lowlands are often admired by tourists and visitors.

20. At the main gate near the two "lions" a rock arrangement highlighting a gigantic Nest Fern, *Asplenium nidus*, was made. Consisting only of local ferns, this arrangement has also been much admired by tourists and visitors.

21. A marsh garden, in which water plants such as Lotus, *Sagittaria*, *Monocharia*, *Papyrus*, and sedges were planted, was created on a depression in the terrain of Lawn A.

22. More water plants were grown in the lake in order to add interest and to break the monotony of a wide expanse of water. A pair of white swans flown out from Denmark were received on 24th December, 1969.

23. The *Hemigraphis alternata* hedge growing along the fence on Napier Road and Tyersall Avenue was replaced with *Acalypha siamensis*.

24. The lawn maps indicating the positions of plants were checked and brought up-to-date. 1,118 wooden labels were made or renewed, 4,646 aluminium tags were made and 16 signboards prepared during the year.

25. Several trees within the Gardens which were considered dangerous to life and limb were removed. On 9th and 10th December unusually heavy rainfall caused floods in many parts of the island. In the Gardens, a tembusu, estimated to be more than 50 years old and a big fig, *Ficus callophylla*, were blown down by strong winds and were disposed of.

26. The plants were well maintained and routine spraying of insecticides and fungicides and a regular programme of manuring were carried out.

27. Monkeys continued to be a big pest, damaging many of the newly planted saplings. During the period under review 27 monkeys were shot within the Gardens.

VIII. ENVIRONMENTAL HEALTH ACT, 1968

28. The Department assisted in the enforcement of this Act in respect of persons littering the Botanic Gardens. For this purpose, all watchmen and Junior Horticultural Assistants were appointed authorised officers under the Act. During the year 36 "tickets" were issued to offenders for littering in the Gardens.

IX. ADVISORY AND EXTENSION SERVICE

29. Some 300 plant specimens were supplied for identification by educational and government institutions, commercial organisations and the public. Other botanical information was supplied vis-a-vis conservation of fruit, methods of mushroom cultivation, and medicinal usage of local plants. The Department also co-operated with foreign scientists in botanical aspects of research.

30. More than 10,000 pot plants were let out on loan to government and civic organisations for special functions. Some 75,869 plants and cuttings, including 4,328 tree saplings, were supplied to schools, government departments, quasi-government bodies, etc. The Primary Production Department was supplied with 53 orchid plants and cuttings and Istana Negara received 205 orchid plant cuttings.

31. Assistance was given to the Public Utilities Board in landscaping and planning the Seletar Reservoir Gardens. A number of large flower beds were constructed and planted with various plants particularly Canna and Mussaenda. Bougainvillea poultonii and Acalypha wilkesiana were planted on either side of the road which ran on top of the dam.

32. Assistance was also given to the Jurong Town Corporation in the construction of Jurong Park. A large number of ornamental plants and saplings were supplied to the Corporation to start off its new plant nursery.

X. 150TH ANNIVERSARY OF THE FOUNDING OF SINGAPORE

33. In conjunction with the 150th anniversary celebrations the Gardens was spruced up. The chewing gum tree (*Dyera laxiflora*), suitably labelled as being over 150 years old, was flood-lighted.

34. The Gardens participated in an exhibition at Princess Elizabeth Walk organised by the Ministry of National Development. Both orchids and flowering plants were used in the display. In addition there was an educational exhibit which depicted orchid flask culture and the various stages in orchid breeding work. Drawings of plants of economic importance were also on display.

35. On the occasion of National Day more than 2,270 orchid sprays were sent to various Singapore embassies and missions overseas.

XI. EDUCATIONAL ASSISTANCE AND TRAINING SCHEMES

36. Inche Abdul Rahim bin Mohd. Rashid, a field assistant from the College of Agriculture, Serdang, was attached to the Gardens for two weeks (18th August–30th August) to study orchid flask culture, nursery technique, care and maintenance of pot plants and other aspects of general horticulture.

37. Mr. Davy Chai from the Municipality of Kuching, Sarawak undertook a six-month horticultural course in the Gardens.

38. Mr. Ling Cheng Lai from the War Cemetery in Taiping was here for three months on an elementary gardening course.

39. In connection with career week, four boys and four girls from various schools were assigned to the Gardens. They were given demonstration on flask culture of orchids, potting and the use of insecticides and fungicides. They were also taught elementary gardening.

40. In January, two soldiers from SAFTI and in December two soldiers from Forces Education, Fort Canning Camp, were at our Nursery for two-week periods learning elementary gardening.

41. The Botanic Gardens continued with the training scheme for gardening recruits sent by the Housing and Development Board. Five batches comprising 46 boys were sent during the year.

42. Towards the end of the year the department was kept busy with the supply of plant material to the Ministry of Education for the Cambridge examinations.

XII. EXHIBITIONS

43. A total of 654 sprays of cut orchids was sent overseas to exhibitions organised by:

1. Japan Orchid Friends Association, Tokyo.
2. Pacific Air Travel Association Conference, Bangkok.
3. Delhi Agri-Horticultural Society of India, New Delhi.
4. Birmingham and Midland Orchid Society, Birmingham.
5. Queensland Orchid Society, Brisbane.
6. BOAC Summer Display, London.
7. 6th World Orchid Conference, Sydney.
8. Women's Bazaar in Phnom Penh.

44. Our orchid flowers won the following awards: the Dr. B. P. Pal Challenge Cup from the Delhi Agri-Horticultural Society of India, and a Gold Medal from the Birmingham and Midland Orchid Society.

45. The Orchid Society of Southeast Asia organised a three-day open air exhibition of some of the choicest orchid plants at the grounds by the Band Stand. Two local nurseries also put up group displays of foliage plants for the occasion.

XIII. SUPPLY OF PLANTS AND FLOWERS FOR OFFICIAL PURPOSES

46. One plant of *Aeridachnis Alexandra* was presented to H.R.H. Princess Alexandra during her visit in August.

47. Four plants (D. Barbara Moore, D. Lim Chong Min, Sappanara Ahmad Zahab, V. Patricia Low) were sent as State gifts to the wife of the Cambodian Head of State and the Queen in November.

48. Seven plants (3 plants V. Jean Kinloch-Smith, 2 plants Sappanara Ahmad Zahab, 1 plant *Oncidium Josephine* and 1 plant V. Louise de Waldner) were given to the Princess Norodom Bopha-devi and Prince Sisowathchivan Monirak during their visit in December.

49. Two plants *Mucuna bennettii* were sent to Princess Bopha-devi in April as a State gift.

50. An Orchid House was completed to accommodate the orchid plants in preparation for the visit of H.R.H. Princess Alexandra and her husband, Mr. Angus Ogilvy on 8th August, 1969. An orchid plant, *Aeridachnis Alexandra*, was named after her.

XIV. PLANT SALES

51. A revised list of plants available for sale with new prices became effective from 1st October, 1969.

52. Revenue obtained from the sale of plants and planting materials, amounted to \$30,002.60.

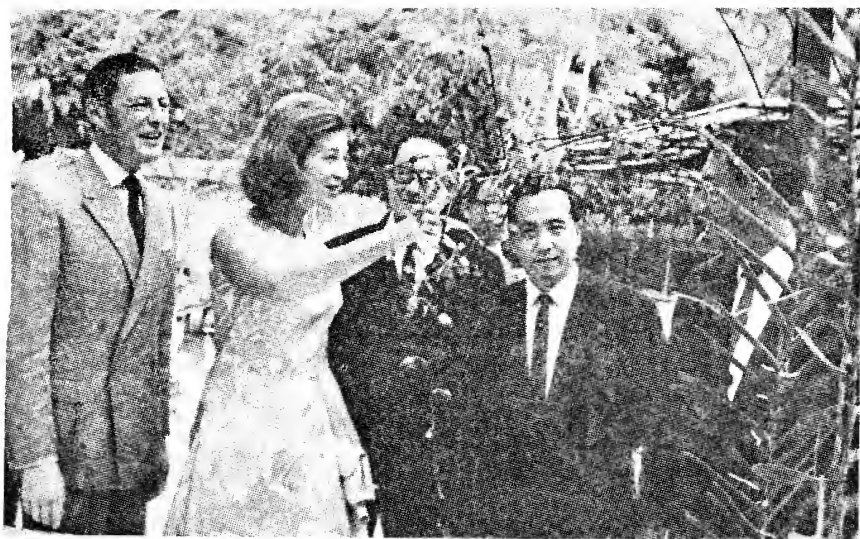
XV. CONCERTS AND BAND PERFORMANCES

53. There were 31 band performances during the year: Singapore Infantry Regiment 6; Police 6; People's Association 4; People's Defence Forces 1; Schools (various) 10; Teachers Military Band 1; Ramblers Musical Party 1; 1st Royal New Zealand Regiment 1; Sin Wah Musical and Dramatic Association gave a musical concert of Chinese folk songs.

54. For the first time, a moonlight band performance was held on 26th October, 1969, between 8.15 p.m. and 9.15 p.m. The Police Band was in attendance. A good crowd turned up for the performance. Because of the good response more moonlight performances will be organised in future.

XVI. VISITORS

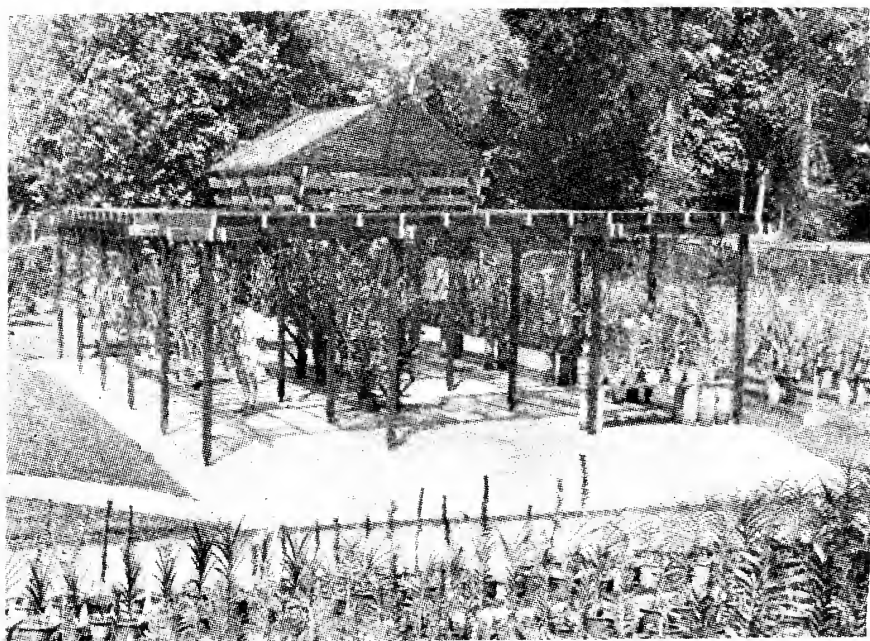
55. A very large number of people visited the Gardens daily to relax and enjoy themselves. Tourists are delighted at the sight of our orchids and



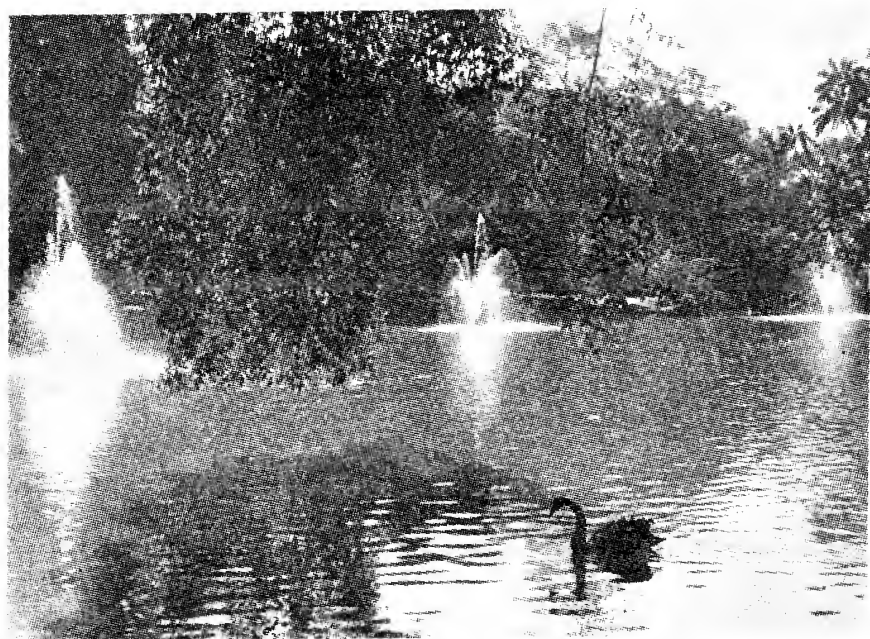
H.R.H. Princess Alexandra admiring the orchid hybrid named after her
From L. to R.: The Honourable Mr. Angus Ogilvy; H.R.H. Princess Alexandra;
Mr. Chang Kwang Seh, Chairman, Botanic Gardens Committee; Mr. Tan Chok Kian,
Permanent Secretary, Ministry of National Development and Mr. A. G. Alphonso,
Curator, Botanic Gardens



Aeridachnis Alexandra named after H.R.H. Princess Alexandra



The new Orchid House at the Botanic Gardens



The newly installed floating fountains at the Botanic Gardens Lake

are fascinated by our monkeys. In order to gauge the number of visitors to the Gardens accurately, a count was made from 14th October, 1969 to 20th October, 1969. During this period 28,010 persons entered the Gardens from 6 a.m. to 10 p.m., as compared to a similar count in October 1968 when the number of visitors was 18,123 from 6 a.m. to 7 p.m.

XVII. PLANT COLLECTING EXPEDITIONS

56. There were very few plant collecting expeditions during the year due mainly to the heavy commitments of the horticultural division as a result of the "Garden City" campaign and the secondment of horticultural officers from the Botanic Gardens to the Parks and Trees Division. A list of the *collecting trips* appears in Appendix II.

XVIII. PLANT EXCHANGE

57. The Botanic Gardens continued its exchange of plant and planting material with various horticultural and botanical institutions and private collectors. A list of such institutions and collectors appears in Appendices III and IV.

XIX. SOCIETIES

58. Assistance was given to the Singapore Gardening Society and the Orchid Society of S.E. Asia by way of lectures and demonstrations on various aspects of horticulture. A number of the Singapore Gardening Society's meetings were held at the Botanic Gardens.

XX. CONFERENCE

59. The 6th World Orchid Conference was held in Sydney, Australia, between 12th and 18th September. Mr. A. G. Alphonso, who represented the Singapore Botanic Gardens, presented a paper on "Growing of Vandaceous Orchids in the Singapore region".

XXI. LIBRARY

60. For the first time, the scattered library collection was brought together and made accessible in its entirety. Several months were spent in sorting out materials after which the task of cataloguing and indexing commenced. The Universal Decimal Classification system was used to classify the books. Serials and reprints were arranged on the shelves by their titles and authors respectively.

61. The library had a holding of 9,320 bound volumes at the end of the year. The extensive collection of reprints continued to grow. The library had 365 exchanges for the Gardens' Bulletin and the Annual Report of the Botanic Gardens.

XXII. PUBLICATIONS

62. Two issues of *The Gardens' Bulletin*, Singapore, were published during the year containing the following papers:

Volume 24, 9th August, 1969.

- | | |
|------------------------------------|--|
| Auctores: | Notes on the Systematy of Malayan Phanerogams. |
| Keng, H: | Flora Malesianae Precursores XLVIII. A Revision of Malesian Labiatae. |
| Turner, G. J.: | New Records of Plant Diseases in Sarawak for the years 1966 and 1967. |
| Furtado, C. X.
and Srisuko, M.: | A Revision of <i>Lagerstroemia</i> L. (Lythraceae). |
| Prowse, G. A.: | Some New Desmid taxa from Malaya and Singapore. |
| Keng, H.: | Notes on the Flowers of <i>Orchidantha longiflora</i> (Lowiaceae). |
| Nayar, M. P.: | The Status of the Genus <i>Catanthera</i> F. v. Muell (Melastomaceae). |
| Chew, W.-L.: | Discocnide (Urticaceae). |
| Chew, W.-L.: | Nothocnide (Urticaceae) in Malasia. |

Volume 25, part 1, 4th October, 1969.

- | | |
|-----------------|--|
| Chew, W.-L.: | A Monograph of <i>Dendrocnide</i> (Urticaceae). |
| Holttum, R. E.: | A new genus and new species of Malesian Orchids. |
| Lim, G.: | <i>Calostoma Sarasini</i> from Malaya. |
| Chew, W.-L.: | A Monograph of <i>Laportea</i> (Urticaceae). |

63. The horticultural division continued to supply descriptions of new hybrids for publication in the "Orchid Review" of the Orchid Society of Southeast Asia.

64. Revenue from the sale of publications of the Department amounted to \$2,283.80. This figure excludes revenue collected by the Government Printer.

XXIII. NATURE RESERVES

65. With the lapse of Mr. O. K. Abraham's term of appointment to the Board of Trustees, the vacancy was filled by Mrs. M. Knight. With Mr. Burkill's retirement, Dr. Chew Wee-Lek became the next Chairman. The Board at the latter half of the year comprised:

1. Director of Botanic Gardens (*Ex-officio* Chairman)
2. Mrs. M. Knight
3. Mr. Tan Jake Hooi
4. Mr. H. R. Armstrong
5. Mr. Woon Lin Ching
6. Mr. Khoo Choong Phun
7. Mr. Chong Toh Goo

66. The Reserves at Kranji and Bukit Timah were maintained in good order. 15 trees in the Bukit Timah Reserve were uprooted during storms and heavy rain. Vandals set one hut on fire and litter baskets were stolen. By the end of the year a total of 450 trees had been labelled. Herbarium specimens of these were kept for easy reference.

XXIV. COMMONWEALTH WAR GRAVES COMMISSION

67. The Director continued to be the Commission's representative in Singapore, and was responsible for the maintenance of the War Graves Cemetery at Kranji, under instructions from the Commission's Eastern Region Headquarters at New Delhi. Funds for the maintenance of the Cemetery were provided by the Commission in whose reports further information may be found.

MOVEMENT OF HERBARIUM MATERIALS

Code	Institution	Exchange		Loan	
		In	Out	In	Out
A	Arnold Arboretum, U.S.A.	—	498	—	—
AAU	Botanical Institute, Aarhus, Denmark	207	406	—	—
B	Berlin Botanic Gardens, Germany	—	—	—	171
BISH	Bishop Museum, Honolulu, Hawaii	215	—	—	11
BKF	Forest Department, Bangkok, Thailand	71	—	—	—
BM	British Museum, Great Britain	—	—	—	99
BO	Herbarium Bogoriense, Indonesia	—	—	—	399
BRI	Botanic Gardens, Brisbane, Australia	—	26	—	—
BSIP	British Solomon Islands, Honiara	4,608	—	—	—
C	Botanical Museum and Herbarium, Copenhagen, Denmark	—	115	—	29
CANB	CSIRO. Division of Plant Industry, Canberra, Australia	331	—	—	—
CANTY	University of Canterbury, Christchurch, New Zealand	—	—	—	24
E	Royal Botanic Garden, Edinburgh, Great Britain	—	—	—	10
FHO	Forest Herbarium, University of Oxford, Great Britain	54	—	—	—
G	Botanic Gardens, Geneva, Switzerland	—	171	—	—
HBG	Botanik und Botanischer Garten, Hamburg, Germany	108	467	—	—
K	Royal Botanic Gardens, Kew, Great Britain	—	582	—	252
KEP	Forest Research Institute, Kepong, Malaysia	1,208	82	—	291
KLU	University of Malaya, Kuala Lumpur, Malaysia	180	—	—	335
KYO	Kyoto University, Japan	83	—	—	—
L	Rijksherbarium, Leiden Netherlands	—	750	—	1,504
LAE	Forest Department, Lae, Papua and New Guinea	1,623	—	—	—
<i>Carried forward ...</i>		8,688	3,097	—	3,125

Code	Institution	Exchange		Loan	
		In	Out	In	Out
	<i>Brought forward ...</i>	8,688	3,097	—	3,125
MASS	University of Massachusetts, Amherst, U.S.A.	—	—	—	32
MEL	National Herbarium of Victoria, Melbourne, Australia	—	76	—	—
SAN	Forest Department, Sandakan, Sabah	378	—	—	—
SAR	Forest Department, Kuching, Sarawak	847	—	—	—
SUVA	Department of Agriculture, Suva, Fiji	103	—	—	—
UC	University of California, Berkeley, U.S.A.	—	523	—	—
Z	Botanic Gardens, Zurich, Switzerland	—	—	—	199
	Memorial University, Newfoundland, Canada	20	—	—	—
	Ministry of Agriculture, Malaysia	—	1	—	—
	University of Singapore	86	—	—	4
	Total ...	10,122	3,697	—	3,360

1969 COLLECTIONS

Personnel	Date	Locality	Collections
H. M. Burkill	2-1-69	Kota Tinggi, Johore, 25 m.s.	1 no. (4 plants) miscellaneous.
A. G. Alphonso and Sanusi bin Sarih	21-3-69	Bukit Brinchang, Cameron Highlands	11 nos. (30 plants) orchids.
	to		3 nos. (3 plants) miscellaneous.
	23-3-69	44 m.s. Brinchang, Cameron Highlands	13 nos. (40 plants) orchids.
		Bukit Brinchang, Cameron Highlands	6 nos. (9 plants) miscellaneous.
			40 nos. (79 plants) orchids.
A. G. Alphonso and Sanusi bin Sarih	24-3-69	Tiger Hill, Penang	15 nos. (43 plants) miscellaneous.
			6 nos. (53 plants) orchids.
A. G. Alphonso and Sanusi bin Sarih	24-3-69	Ipoh Road, Selangor, 4 m.s.	4 nos. (4 plants) miscellaneous.
			104 plants <i>Typha angustifolia</i> .

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM
PLANTS AND SEEDS WERE RECEIVED IN 1969

ANGOLA	Instituto de Investigacao, Caixa Postal 406, Agronomica de Angola.
AUSTRALIA	Mr. Jack Schenk, Queensland; Mrs. Wright, Labradour, Queensland; Botanic Gardens, Adelaide; Farm Produce and Exporters, Wongan Hill; King's Park and Botanic Gardens, Perth; Zoological Gardens, Perth.
BELGIUM	Plantentium der Rijksuniversitat, Gent.
BRAZIL	Instituto de Botany, Caixa Postal 4005; Sao Paulo.
BR. SOLOMON ISLANDS	Forestry Department, Honiara.
BULGARIA	University Botanic Gardens, Sofia.
CANADA	Botanic Gardens, Ottawa; University of Alberta, Edmonton.
FIJI	Department of Agriculture, Suva.
FINLAND	Botanicus Universitatis Ouluensis, Oulu.
FRANCE	Jardin Botanique de la Ville et de l'Université, Besancon.
GERMANY	Botanischer Garten, Universität Wien; Botanischer Garten, Stad Kassel; Botanischer Garten, Stadt Essen; Botanischer Garten, Friedrich-Scheller-Universität; Botanischer Garten, Universität Freiburg; Botanischer Garten, Köln; Botanischer Garten, Universität Giessen; Botanischer Garten, Hamburg.
GREECE	Commonwealth War Graves Commission, Old Phaleron.
HUNGARY	Forest Research Institute, Savar.
ITALY	Commonwealth War Graves Commission, Rome; Hortus Mortolensis, Giardino Botanico, Ventimeglia; Orto Botanico dell Instituto Tecnicoper, Udine.
INDONESIA	Kebun Raya, Bogor.
JAPAN	Takeda Herbal Garden, Kyoto; National Institute of Hygienic Science, Nayloroshi, Hokkaido.
KENYA	Commonwealth War Graves Commission, Nairobi.
MALAYSIA	Botanic Gardens, Penang; Mr. Corbett, Perak; Mr. Yong, Pahang; Dunlop Estate Ltd., Negri Sembilan; Dunlop Malaya Ltd., Malacca; Pusat Perchubaaan Persekutuan, Tanah Rata, Pahang.
NETHERLANDS	University Botanic Gardens, Leiden.
NEW GUINEA	Division of Botany, Department of Forests, Lae; Mr. F. G. Driver, Port Moresby; Botanic Gardens, Lae.
PHILIPPINES	Mr. C. Parson, Pasay City; Prof. Lucio Quimbo, College of Forestry, Laguna.
PORTUGAL	Instituto de Botanica, Campo Alegri.
RHODESIA	Dr. J. Avery, Salisbury.
SINGAPORE	Housing and Development Board; Mr. P. K. Hwang; Mr. J. Ede; Mr. Sng Choo Eng; Seng Heng Orchid Nursery; Syed Yusof Alsagoff.

APPENDIX III—*continued*

- SWEDEN Botanic Garden, University of Lund; Universitats Botaniska, Tradgard, Uppsala.
- THAILAND Mr. Rapee Sagarik, Kasetsart University; Tonglor Orchids, Bangkok.
- U.K. Mr. H. N. Brown, Lancashire; National Botanic Gardens, Dublin; Botanical Supply Unit, University of London.
- U.S.A. Department of Agriculture, Beltsville; Honolulu Botanic Gardens, Hawaii; New Crop Research Branch, Washington; Botanical Gardens, Tucson, Arizona; University of Hawaii, Honolulu.

INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM
PLANTS AND SEEDS WERE SENT IN 1969

ALGERIA	Institut Scientifique, Cherifun, Rabat.
ARGENTINA	Instituto de Botanica de Agricola, Buenos Aires.
AUSTRALIA	Parks and Reserves Department, Townsville; Readlands Horticultural Research Station, Queensland; Mr. and Mrs. Kirkwood, Cairns, Queensland; Mr. Ernest Todd, Toronto, New South Wales; C.S.I.R.O., Victoria; Lone Pine Nursery, West Australia; Zoological Gardens, Perth.
BRAZIL	Instituto de Botanica, Sao Paulo.
BR. SOLOMON ISLANDS	Department of Agriculture, Honiara.
CHILE	Jardin Botanique, Vina Del Mare.
CZECHOSLOVAKIA	Botanica Zahrada, University of Karlovy; Botanic Gardens of the University, Brateslava; Botanicka Gardena, Veterinadera Universitato; Czech Botanical Supply Society, Ortrava; Hortus Botanicus, Kovice.
DENMARK	Botanical Museum, Copenhagen.
FINLAND	University of Helsinki; University of Turku.
FRANCE	Botanical Vegetale Applique, Paris; Central National de Researches Agronomique, Versailles.
GERMANY	Botanischer Garten, Universität Tubingen; Botanischer Garten, Universität Marburg; Botanischer Garten, Dresden; Ruhrland U. Heimat Museum, Stadt Essen.
GHANA	Botanic Gardens, Kumasi; Kwame Nkrumah University of Technology, Kumasi.
GUAM	Mr. Paul B. Sander, Agana.
HONGKONG	Mr. Horace Kadoori.
HUNGARY	Institutum Botanicum et Hortus Botanicus Universitatis, Szeged; Hortus Botanicus Academiae Scientiarum, Vacratot.
INDIA	University of New Delhi; National Botanic Gardens, Lucknow; Mrs. Manorama, Ahmadabad.
ISRAEL	Oceanographic and Limnological Research Co., Haifa.
ITALY	Orto Botanico, Via Floria 223.
JAPAN	Governor of Miyazaki, Miyazaki; Takeda Herbal Garden, Kyoto; Mr. Toshihiko Satake, Hiroshima; Izu Experiment Station of Medical Plants, Schizuoka.
MALAYSIA	Botanic Gardens, Penang; University of Malaya, Selangor; Taiping War Cemetery, Perak; Agricultural Research Centre, Tuaran, Sabah; Department of Agriculture, Kota Kinabalu, Sabah; Borneo Abaca Ltd., Tawau.
MEXICO	Ministry of Agriculture; Ing. Angel Vergaria, Vera Cruz.
NEW GUINEA	Department of Forests, Lae.
PHILIPPINES	U.P. College of Forestry, Laguna.
POLAND	Hortus Plantarium Academiae, Warszawa.

PORTUGAL	Instituto Botanico der Universidade, Coimbra.
PUERTO RICO	Federal Experiment Station, Mayaguez.
RHODESIA	Botanic Gardens, Salisbury.
SOUTH AFRICA	Mr. J. E. A. Carver, Durban.
SPAIN	Mr. Jose Equilleor Sorres, Madrid.
TAIWAN	Hengchun Tropical Botanic Gardens.
THAILAND	Mr. Nartholeo Elumawong, Bangkok.
TUNISIA	Service Botanique, Ariana.
U.A.R.	Orman Botanic Gardens, Giza.
U.K.	University of Aberdeen, Scotland; University of Reading, England.
U.S.A.	California Institute of Technology, Pasadena; Tucson Botanic Gardens, Arizona; Mr. W. J. Brudy, Cocoa Beach, Florida; Department of Agriculture, Pasadena, California; Honolulu Botanic Gardens, Hawaii; Botanic Gardens, Arcadia; University of California.
U.S.S.R.	Hortus Botanicus, Kiev; Botanical Garden of the Academy of Science, Armaniae; Hortus Botanicus, Tomsk; Hortus Botanicus Academiae Scientarium, Askhabad; Hortus Botanicus Scientarium, Mosqua.

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*Botanic
Gardens*

70 ANNUAL REPORT

12/211

BOTANIC GARDENS
1970 ANNUAL REPORT

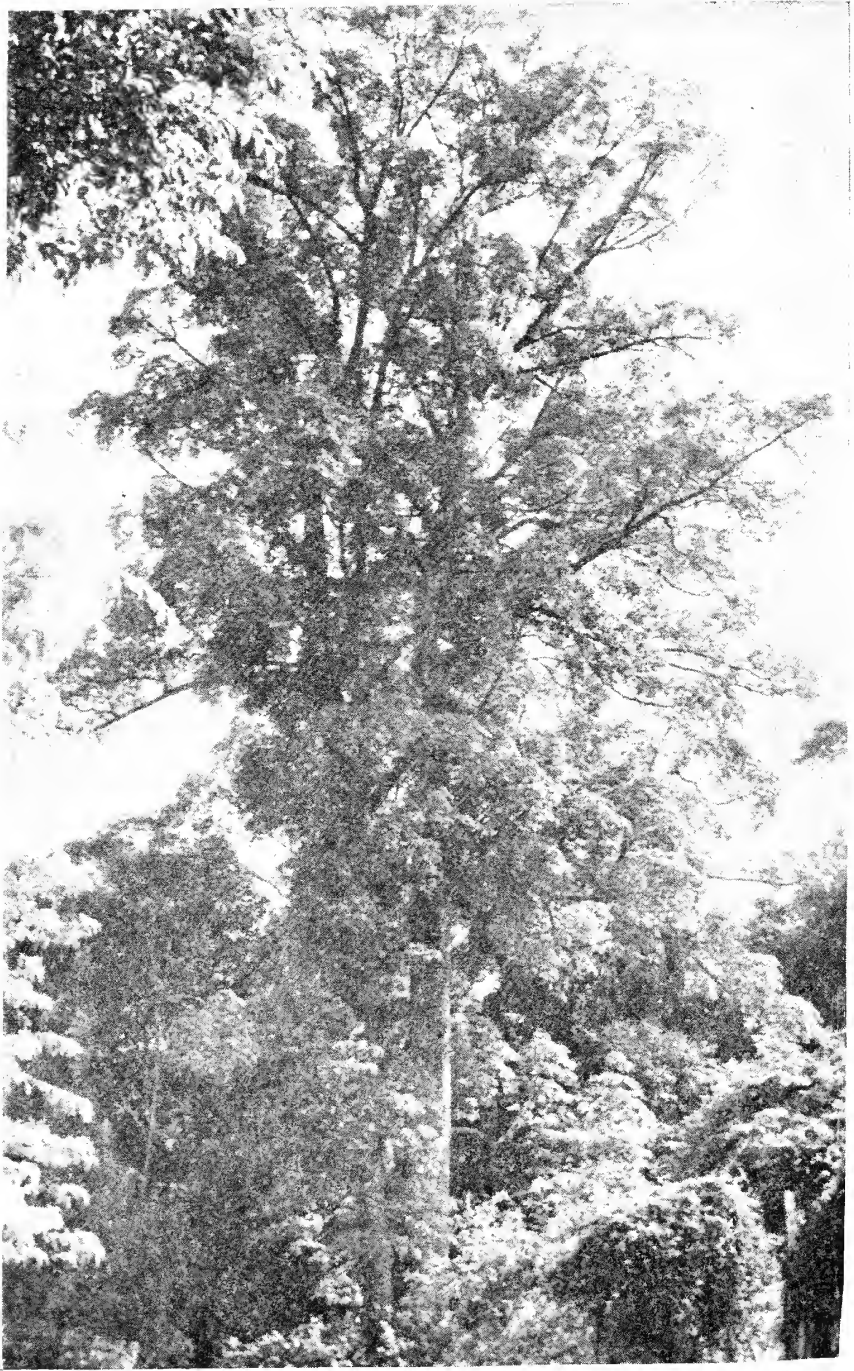
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The Jelutong (*Dyera laxiflora*) is probably over 150 years old

I. ORGANISATION

1. The botanical and horticultural divisions which functioned separately in 1969, were integrated into one unit on 1st March, 1970.

II. STAFF

2. Mr. A. G. Alphonso was appointed Acting Director with effect from 1st March, 1970, following the resignation of Dr. Chew Wee Lek, Botanist. Miss Geh Siew Yin joined the staff as Botanist and Mr. Ng Kok Wah as temporary Horticultural Assistant in June. Che Kadim bin Tassim was appointed Junior Horticultural Assistant in October. Miss Ng Soot Hong, Library Officer, resigned in August.

3. The Department experienced some difficulty in retaining the services of daily rated labourers and watchmen. Of the 18 daily rated watchmen and 15 labourers sent to the Department, 9 watchmen and 6 labourers left the service.

4. Marmo bin Somodikomo *alias* Marmoh bin Sumodikermo, Labourer, was awarded the Long Service Medal.

III. HERBARIUM MATERIALS

5. Some 12,000 specimens were mounted and 11,000 were indexed, while over 700 sheets were repaired. The Herbarium received 6,422 specimens under its exchange programme and distributed 3,344 in return. The greater part of the receipts came from the Solomon Islands, the Forest Research Institute in Kepong, and the Department of Forests in New Guinea. Materials loaned to thirteen institutions totalled 1,837 specimens. Particulars are given in Appendix I.

IV. ORCHID RESEARCH

6. During the year 161 hybrid pods were harvested from the Gardens Orchid Nursery. In addition, 20 pods were accepted for germination from Singapore growers, 18 from Malaysia and 1 from India. Of these 200 pods, 134 produced viable seeds. More than 2,000 flasks were constantly used for seedling culture. Seedlings from 839 flasks were taken out and potted. The flask culture medium used, as previously, was based on Vacin's formula with the addition of 10 per cent young coconut water and banana pulp. In all, 2,687 matured seedlings were removed from the seedling houses to be grown in the open. 45 beds were dug or re-dug for planting and replanting.

7. 261 orchid species and hybrids were received in exchange for 271 orchid species and hybrids. The exchanges were with persons in Singapore, the Philippines, Australia, Japan and Ceylon.

8. The following hybrids were registered:

BGS. 3794 — *Dendrobium* Michiko (*D. Concham* x *D. Noor Aishah*)

BGS. 3537 — *Aranda* Elizabeth Douglas-Home (*Arachnis* Maggie Oei x *Vanda* Radman).

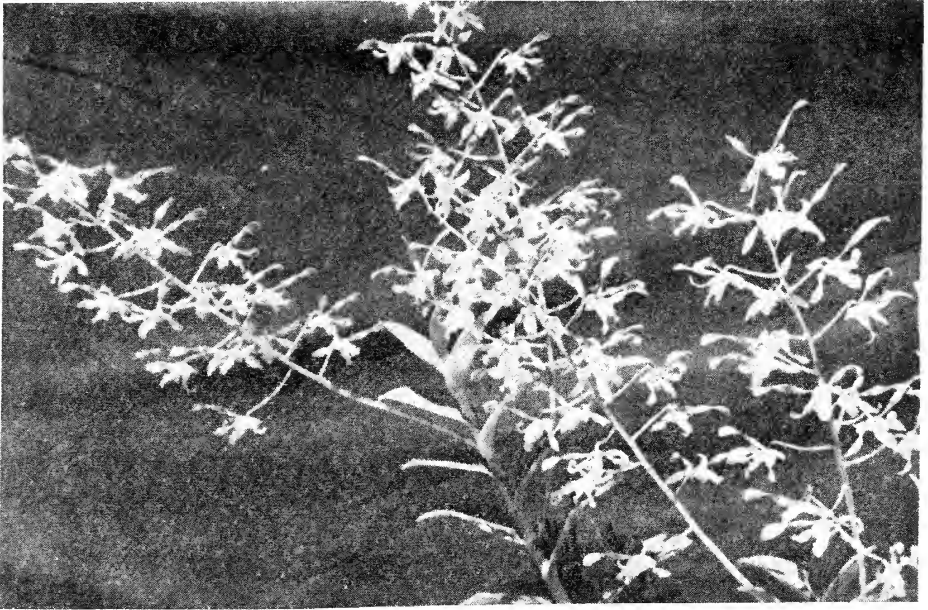
BGS. 3402 — *Renantanda* Akihito (*Vanda* Manila x *Renanthera coccinea*).

V. GARDENS IMPROVEMENTS AND MAINTENANCE

9. The following projects were undertaken by the Public Works Department for the Gardens:

- (i) laying of sewer lines to serve the Tea Kiosk Toilet;
- (ii) construction of a new Orchid Display Pavilion; and
- (iii) construction of 6 shelters.

10. With the completion of the new orchid display pavilion, more flowering orchid plants were put up for display to the public. As an innovation, plants in flasks, community pots, thumb pots and 3-inch size pots were also displayed to indicate the various stages in the growth of orchid plants.



Dendrobium Michiko

11. The plants in the Gardens were well maintained throughout the year by routine spraying of insecticides and fungicides, regular manuring and general care. The biggest pests were still the monkeys, four of which were shot in 1970.

12. A cover crop, *Indigofera endecaphylla*, was introduced on Lawns B, D, K, H, O and X to cover up plant beds. It had grown rapidly and enhanced the general appearance of the lawn.

13. A number of newly introduced plants were planted on Lawns M and X. One of them, the Eucalyptus, though endemic to Australia, is growing reasonably well under local conditions.

14. New plantings were made on various other lawns.

15. Group arrangements using foliage, flowering and cover plants were featured around the Bandstand to improve the appearance of the area.

16. The floral clock was completely replanted with multicoloured *Coleus*, *Artemisia* sp., *Hemigraphis colorata* and *Alternanthera paronychioides*.

17. The Canna beds on either side of the Main Gate Road were manured and replanted.

18. Heavy rains caused a number of tree casualties in the Gardens during the year. Unusually heavy rain on the night of 13th October, 1970 brought down five big trees near Liane Gate.

19. The lawn maps indicating the positions of plants were checked and brought up to date. During the year 1,683 wooden labels, 8,949 aluminium tags and 83 signboards were made.

20. Ten additional fancy litter bins were installed in the Gardens.

21. 47 "tickets" were issued to offenders for littering in the Gardens.

VI. ULU PANDAN NURSERY

22. A new nursery at Ulu Pandan was started in April, primarily for the growing of orchid plants. It was used temporarily for reproduction of ornamental plants urgently needed in larger quantities for the Garden City Campaign.

VII. ADVISORY AND EXTENSION SERVICE

23. Some 500 plant specimens were identified for institutions, research workers, commercial firms, schools and members of the public. Specimens were also supplied to several institutions for botanical phytochemical surveys abroad.

24. 7,920 pot plants were loaned to government departments, statutory boards, and charitable organisations for decoration purposes. 2,943 trees, 8,126 shrubs, and 501,036 climbers and hedges were supplied to schools, government departments and statutory boards.

25. Assistance was rendered to the Division of Genetics, University of Malaya in cytogenetical research of orchid hybrids.

26. The Department undertook the construction and establishment of a marsh garden at the Istana. The marsh garden was divided into two sections and landscaped with boulders and appropriate plants.

27. In preparation for the Commonwealth Heads' of Government Meeting in January 1971, 443,500 climbers and hedges, 2,077 tree saplings and 4,100 shrubs were supplied to the Parks and Trees Division, P.W.D., for use in their campaign to beautify the city.

28. In connection with 'The Garden and You' series organised by the Broadcasting Division, Ministry of Culture, three talks over Television Singapura on the planting of saplings, climbers, and shrubs were given by Mr. Herbert Wee Sip Hean, Horticultural Assistant.

29. Mr. Herbert Wee Sip Hean served as advisor and judge at various competitions organised by Malaysia-Singapore Airlines, People's Association, Singapore Gardening Society and Singapore United Estates (Pte.) Ltd.

VIII. EDUCATIONAL ASSISTANCE AND TRAINING SCHEME

30. A record number of 4,000 plants and plant material for educational purposes was supplied to the Ministry of Education.

31. A Colombo Plan Scholar from East Pakistan, Mr. Md. Abdul Khalaque, arrived in December for training in herbarium practice.

32. The Department conducted 15 two-week crash training courses in connection with the "Keep Singapore Green and Beautiful" campaign. The trainees were from government departments, statutory boards, the Army and the public. In all 406 persons attended these classes.

33. The Department took in 200 trainees for a six-month practical gardening course which was conducted with the objective of providing the public with trained gardeners in horticulture. The trainees were posted to various sections of the Gardens, Woodleigh and Alexandra nurseries to learn various aspects of horticulture such as sowing of seeds, plant propagation, potting and maintenance of lawns.

34. The Department also trained 56 Gardening Apprentices sent by the Housing & Development Board.

IX. EXHIBITIONS AND HORTICULTURAL SHOWS

35. The Department assisted in the establishment of a tropical garden, the main theme of the Singapore Pavilion, at the Expo '70 in Osaka, Japan.

36. Cut orchid blooms, orchid plants, palms and ferns from the Gardens were displayed. Gardens' officials also supervised and inspected flowering orchid plants sent by a local nursery for display at the Exposition.

37. The Acting Director, Mr. A. G. Alphonso, who served on the Singapore Expo '70 Committee, helped with the planning and construction of the garden. Mr. Lam Hin Cheng, Curator, together with Mr. Ang Gek Choo, Curator of the Parks and Trees Division, were selected to manage the pavilion. A local horticultural show to publicise Singapore's participation at Expo '70 was put up at Shell House. This department displayed various orchids and foliage plants.

38. 1,114 cut orchid blooms were sent overseas to exhibitions organised by:

1. Japan Orchid Friends Association, Tokyo.
2. Delhi Agri-Horticultural Society of India, New Delhi.
3. Queensland Orchid Society, Brisbane.
4. Asian Ladies Friendship Society, Tokyo.
5. Botanic Gardens, Saigon.
6. Singapore Hospitality Suite at the PATA Conference, Auckland.
7. Opening Ceremony of the Singapore Tourist Promotion Board Office, Sydney.

39. Following a request from our High Commission in Canberra, the Gardens participated in an exhibition featuring 'Famous Gardens Promotion' in conjunction with the International Garden Conference held in Canberra.

40. The staff continued to give assistance to the Singapore Gardening Society and the Orchid Society of South East Asia. The Gardens contributed extensively by way of administration, exhibits, man-power and judges to the 'Singapore Horticultural Show', a joint function of the two societies held from 8th - 11th October.

Mr. Herbert Wee Sip Hean was Manager of the Show, with Mr. A. G. Alphonso and Mr. Quek Wai Yan officiating as judges.

X. SUPPLY OF PLANTS AND BLOOMS FOR OFFICIAL PURPOSES

41. One plant of Dendrobium Michiko was sent to the Crown Princess of Japan in February. This plant (D. Concham x D. Noor Aishah) was named after Her Royal Highness to commemorate her visit to the Botanic Gardens.

42. 465 sprays of orchid blooms were sent to the following VIPs as state gifts:

1. Lady Douglas-Home, U.K.
2. Mr. Ian Macleod, U.K.
3. Mr. Denis Pile, Australia.
4. Mrs. Willy Brandt, W. Germany.
5. Mr. Keith Holyoake, New Zealand.
6. The Crown Princess Michiko, Japan.
7. Mrs. Eisaku Sato, Japan.
8. Mrs. Ohya, Japan.



One of the many fanciful litter bins

43. Arrangements with ornamental plants for state and government functions at the Singapore Conference Hall, the Istana, various hotels and other government buildings were carried out as usual during the year.

44. A total of 2,603 sprays of orchid blooms were supplied to the following for state banquets and government functions:

1. The Istana.
2. Singapore's Permanent Representative in the United Nations, New York.
3. Singapore High Commissioner in New Delhi, India.
4. Singapore High Commissioner in Canberra, Australia.

XI. GARDEN CITY CAMPAIGN

45. During the period under review, the Botanic Gardens produced the following plants in connection with the Garden City Campaign: 26,960 tree saplings, 146,870 ornamental shrubs and 1,068,000 climbers and hedges.

46. Work started in March on the mass propagation of four selected climbers and hedges namely, *Vernonia elliptica*, *Tristellateia australasiae*, *Acalypha siamensis*, *Hemigraphis alternata*.

XII. PLANT SALES

47. The prices of certain trees, shrubs, hedge plants and climbers offered for sale were reduced.

48. An additional plant sales centre situated along the Floral Mile, Dunearn Road, commenced operation in the latter part of the year.

49. Revenue from the sale of plants rose from \$30,002.60 in 1969 to \$56,379.05.

XIII. PLANT COLLECTIONS, EXCHANGE AND INTRODUCTION

50. 635 specimens for the herbarium were collected from Johore and Taman Negara in Pahang during various trips made in co-operation with the Forest Research Institute in Kepong, the Geography Department of the University of Singapore, and Dr. E. A. Heaslett of Singapore. Collections of live plants for cultivation were undertaken at Perlis, Pulau Langkawi, Penang and Perak. Assistance was also given by the Penang Botanic Gardens. Details of collections are listed in Appendix II.

51. The Botanic Gardens has constantly played a major role in the introduction of plants into Singapore. Plants not only from other countries but also from indigenous flora are being introduced into cultivation. To facilitate this, a larger Plant Introduction Unit has been set up. In 1970, 394 species were acquired, out of which 3 were purchased and 8 received as gifts from visitors; the rest were obtained on an exchange basis. A plant collecting trip to north of W. Malaysia was undertaken in early December.

52. 135 plants were removed from the Unit for planting out in the Gardens' lawns.

53. The Botanic Gardens continued its exchange of plants and planting material with various horticultural and botanical institutions and private collectors. A list of such institutions and collectors appears in Appendix III and IV.

XIV. CONCERTS AND BAND PERFORMANCES

54. There were 35 band performances during the year by the People's Association, Police, Singapore Infantry Regiment, Singapore Girl Pipers, various Schools, Australian Army Force, 1st Battalion Royal New Zealand Infantry Regiment, Special Constabulary, and the City of Perth Brass Band.



Prince Akihito and Princess Michiko admiring the orchid *Dendrobium Michiko*. This plant was named after Princess Michiko

XV. VISITORS

55. The Gardens welcomed a large number of visitors during the year, including many eminent foreign dignitaries. Most notable of the visitors to the Gardens included:

Crown Prince Akihito and Princess Michiko of Japan.

Mr. Mirko Tepavac, Secretary of State for Foreign Affairs, Yugoslavia, and Mrs. Tepavac.

Mr. C. W. Court, Minister for Industrial Development, W. Australia, and Mrs. Court.

Mr. Fairall, King's Park Botanic Gardens, Perth, Australia.

Dr. A. Malcolm Gill, Fairchild Tropical Gardens, Miami.

Mr. H. W. Caulfield, Curator, Brisbane Botanic Gardens, Australia.

Prof. G. S. Puri, Liverpool Regional College of Technology, U.K.

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Mr. R. D. Barker, Commonwealth Scientific Industrial Research Organisation, Canberra, Australia.
Dr. Hiroshi Inamura, Kyushu Agricultural Experiment Station, Japan.
Mr. Yoshikiyo Ohkawa, Agricultural, Forestry and Fisheries Research Council, Tokyo, Japan.
Mr. D. W. Shoobridge, Director of Parks and Gardens Branch, Australia.
Prof. Richard A. Hamilton, University of Hawaii, Honolulu.
Mr. Wrigley, Canberra Botanic Gardens, Australia.
Prof. Ramon V. Valmayor, College of Agriculture, Laguna, Philippines.
Prof. Yoshimasa Hirata, Nagoya University, Japan.
Dr. William T. Stearn, British Museum, London.
Prof. Hiroshi Mitsuhashi, Hokkaido University, Japan.
Ex-King Leopold of Belgium.

XVI. LIBRARY AND PUBLICATIONS

56. The Library had 314 exchanges for the Gardens' Bulletin and the Departmental Annual Report.

57. New additions to the library collection included 187 books, 1,703 issues of periodicals and 174 reprints.

58. One issue of the Gardens' Bulletin and a booklet entitled 'Selected Plants and Planting for a Garden City' were published during the year.

59. Revenue from the sale of publications by the Department amounted to \$2,710.66. This figure does not include sales of the same publications by the Government Printing Office.

XVII. COMMITTEES

60. Mr. A. G. Alphonso served on the Board of Directors of the Jurong Bird Park (Pte.) Ltd. He was also a member of the following committees:

1. Singapore Expo '70 Committee
2. Jurong Park Committee
3. Sentosa Golf Course Committee
4. Garden City Action Committee.

XVIII. NATURE RESERVES

61. Mr. A. G. Alphonso became Chairman of the Board of Trustees vice Dr. Chew Wee-Lek. Mr. Chong Toh Goo was re-appointed for a further term of two years. The Board comprised the following members:

1. Acting Director of Botanic Gardens (*Ex-officio* Chairman)
2. Mrs. M. Knight
3. Mr. Tan Jake Hooi
4. Mr. Chan Sik Kwan
5. Mr. Woon Lin Ching
6. Mr. Khoo Chong Phun
7. Mr. Chong Toh Goo

62. The labour force of Kranji and Bukit Timah Reserves concentrated on the improvements of road safety such as levelling roadsides, paths and repairing steps; general maintenance; and cleaning. The summit hut at Bukit Timah was rebuilt while a new hut was erected at the end of Upper Quarry Road and the rest were renovated.

63. A barrier was installed to control entry of motorised vehicles during the prohibited hours.

64. A total of 81 trees suffered damage during heavy rain and storm.

65. Over 600 young trees were identified for the purpose of labelling.

66. The Bukit Timah Nature Reserve became part of the Bird Sanctuary under the Bird (Sanctuary) Order, 1970, and convicted offenders are liable to a maximum fine of \$1,000.

XIX. COMMONWEALTH WAR GRAVES COMMISSION

67. The Acting Director continued to be the Commission's representative in Singapore and to be responsible for the maintenance of the War Graves Cemetery at Kranji. Funds for the maintenance of the Cemetery were provided by the Commission in whose reports further information may be found.

MOVEMENT OF HERBARIUM MATERIALS

Code	Institutions	Exchange		Loan	
		In	Out	In	Out
A	Arnold Arboretum, U.S.A.	138	422	—	—
AAH	Arnold Arboretum, Jamaica Plain, U.S.A.	—	86	—	—
AAU	Botanical Institute, Aarhus, Denmark.	—	138	—	—
AD	University of Adelaide, South Australia.	232	22	—	—
BISH	Bishop Museum, Honolulu, Hawaii.	175	39	—	—
BKF	Royal Forest Department, Bangkok, Thailand.	—	161	—	—
BM	British Museum, Great Britain.	—	144	—	520
BO	Herbarium Bogoriense, Indonesia.	—	156	—	188
BSIP	British Solomon Islands Protectorate, Forestry Department, Honiara.	2,922	—	—	—
C	Botanical Museum & Herbarium, Copenhagen, Denmark.	—	329	—	—
CANTY	University of Canterbury, Christchurch, New Zealand.	—	—	—	2
CGE	University of Cambridge, Great Britain.	24	—	—	—
E	Royal Botanic Gardens, Edinburgh, Great Britain.	—	83	—	—
G	Botanic Gardens, Geneva, Switzerland.	—	55	—	—
HBG	Botanischer Garten, Hamburg, Germany.	49	117	—	—
K	Royal Botanic Gardens, Kew, Great Britain.	—	470	—	2
KEP	Forest Research Institute, Kepong, Malaysia.	1,665	—	—	223
KLU	Department of Botany, University of Malaya, Kuala Lumpur, Malaysia.	69	121	—	316
L	Rijksherbarium, Leiden, Holland.	22	579	—	1
LAE	Department of Forests, Lae, Papua and New Guinea.	726	224	—	—
MICH	University of Michigan, Ann Arbor, U.S.A.	—	20	—	—
PNH	National Herbarium, Manila, Philippines.	—	104	—	—
SAN	Forest Department, Sandakan, Sabah.	174	—	—	—
SAR	Forest Department, Kuching, Sarawak.	—	74	—	—
U	Botanical Museum & Herbarium, University of Utrecht, Netherlands.	—	—	—	106
Z	Botanic Gardens, Universitet, Zurich, Switzerland.	—	—	—	284
	Chemistry Department, University of Malaya, Kuala Lumpur, Malaysia.	48	—	—	—
	Department of Agriculture, Bangkok, Thailand.	43	—	—	—
	Memorial University, Newfoundland, Canada.	20	—	—	—
	D.S.I.R. Plant Diseases Division, Auckland.	—	—	—	15
	Institute of Nature Conservation, Rio de Janeiro, Guanabara, Brazil.	102	—	—	—
	University of Kentucky, Kentucky, U.S.A.	—	—	—	128
	University of Miami, Florida, U.S.A.	—	—	—	42
	University of Singapore.	13	—	—	10
	Total ...	6,422	3,344	—	1,837

PLANT COLLECTIONS 1970.

Personnel	Date	Locality	Collections
Mohd. Shah b. Mohd. Noor, Samsuri bin Ahmad with Dr. E. A. Heaslett	31st May	Sg. Bantan, Labis Forest Reserve, Bekok, Johore.	40 nos. miscellaneous materials for herbarium.
Samsuri bin Ahmad with Dr. E. A. Heaslett	28th June	Sg. Juasseh, Labis, Johore.	46 nos. for herbarium.
Samsuri bin Ahmad with Dr. E. A. Heaslett	5th July	Gunong Panti, Johore.	18 nos. for herbarium.
Mohd. Shah bin Mohd. Noor, Mohd. Noor bin Jumaat, with Dr. T. C. Whitmore, Forest Research Institute, Kepong, Malaysia.	9th to 22nd July	Taman Negara, Pahang. Ulu. Sg. Sat, Kuala Kelepah, Kuala Sepia, Ulu Sg. Sepia, Kuala Aur, Jeram Perahu, near Kuala Chamir, Jeram Panjang and Kuala Tahan.	310 nos. miscellaneous materials for herbarium.
Samsuri bin Ahmad with Dr. E. A. Heaslett	19th July	Sg. Panjang, Labis, Johore.	19 nos. for herbarium.
Mohd. Shah bin Mohd. Noor, Mohd. Noor bin Jumaat, Ahmad bin Shukor with Dr. R. Hill, Geography Department, University of Singapore.	18th to 19th August	Lok Heng Estate, Bukit Tangga Tujoh via Kota Tinggi, Johore.	58 nos. for herbarium.
Samsuri bin Ahmad with Dr. E. A. Heaslett	6th September	Chabang Dua, Sungei Juasseh, Labis, Johore.	11 nos. for herbarium.
Mohd. Shah bin Mohd. Noor, Sanusi bin Sarih with Dr. P. Grubb of the University of Cambridge.	20th to 25th September	Jalan Mersing and Gunong Blumut, Kluang, Johore.	123 nos. miscellaneous materials for herbarium.
Samsuri bin Ahmad with Dr. E. A. Heaslett	4th October	20th m.s. Jalan Mersing, Kluang, Johore.	13 nos. for herbarium.
Sanusi bin Sarih	28th September	Gunong Blumut, Johore.	21 nos. (173 plants) orchids. 21 nos. (64 plants) miscellaneous.
Miss Geh Siew Yin & Miss Lee Wai Chin	3rd to 6th December	Pulau Langkawi	18 nos. (111 plants) orchids. 20 nos. (72 plants) miscellaneous.
Miss Geh Siew Yin & Miss Lee Wai Chin	6th December	Kaki Bukit, Perlis.	21 nos. (44 plants) orchids. 9 nos. (17 plants) miscellaneous.
Miss Geh Siew Yin, Miss Lee Wai Chin and Sanusi bin Sarih	7th to 10th December	Maxwell Hill, Perak.	36 nos. (119 plants) orchids. 72 nos. (283 plants) miscellaneous.
Miss Geh Siew Yin, Miss Lee Wai Chin and Sanusi bin Sarih	11th December	Penang Hill, Penang.	19 nos. (209 plants) orchids. 35 nos. (174 plants) miscellaneous

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM PLANTS
AND SEEDS WERE RECEIVED IN 1970

AUSTRALIA	Dolcon Nurseries, New South Wales; Cairns Botanic Gardens, Queensland; Canberra Botanic Gardens; Ernest Todd, New South Wales; Kirkwoods Tropical Orchids, Queensland.
BRAZIL	B. V. Skvortzov, Instituto de Botanica, Sao Paulo.
CANADA	University of Toronto.
CEYLON	Chandra Gunasekera, Colombo.
CZECHOSLOVAKIA	Academia Scientiarum Slovaca.
FINLAND	Hortus Botanicus Universitatis Turkuensis.
FRANCE	Orto Botanico Dell 'Universite; Etablissements Versepuy, Le Puy.
GHANA	Botany Department, University of Ghana, Legon.
INDIA	Lalbagh Botanic Gardens, Mysore; Ganesh Mani Pradhan, West Bengal.
INDONESIA	Hortus Botanicus Bogoriensis, Bogor.
ITALY	Giardini Botanici di Villa Taranto; Giardino Sperimentale di S. Bernardino D' Tarana; Hortus Mortolensis, Ventimiglia; Istituto di Botanica, Pisa.
JAPAN	Botanical Experiment Station, Kagoshima University; Botanical Gardens of Osaka City University; National Institute of Hygienic Sciences, Hokkaido; M. Togashi, Tokyo.
MALAYSIA	Penang Botanic Gardens; Forest Research Institute, Kepong.
NETHERLANDS	Hortus de Wolf.
NEW GUINEA	Division of Botany, Department of Forests, Lae.
PHILIPPINES	Mr. A. L. Syjuco, Rizal.
POLAND	Hortus Botanicus Universitatis Varsaviensis, Warszawa.
PORTUGAL	Institut Botanique de L'Universite, Coimbra; Institute de Botanica, Campo Allegre; Jardin Botanico da Universidade de Lisboa; Universidade de Lourenco Marques, Mocambique.
PUERTO RICO	William Pennock, Agricultural Experiment Station.
RHODESIA	John Avery, Salisbury.
SINGAPORE	George Chan; Choo Yoke Koon; S.H. Goh; P.K. Hwang; Jumali Kaprawi; Koh Keng Hoe Orchid Nursery; Mrs. Lee; Public Utilities Board; Quek Kiah Huat; Mrs. S. Rajaratnam; Teng Kok Teo; W.G. Thurston.
THAILAND	Cmdr. Watana Sumawong, Bangkok.
U.K.	The Royal Horticultural Society Garden, Surrey; University Botanic Gardens, Oxford; University of London, Botanical Supply Unit.
U.S.A	Prof. Hamilton, Hawaii; Huntington Botanic Gardens California; O. M. Kirsch, Hawaii; Longwood Gardens, Pennsylvania; United States Department of Agriculture, Washington.
WEST GERMANY	Botanischer Garten der Stadt, Essen.
YUGOSLAVIA	Hortus Botanicus, Zagreb.
ZAMBIA	Department of Agriculture, Mount Makulu Research Station, Chilanga.

INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS AND SEEDS WERE SENT IN 1970

AFRICA	A/C Department, P.O. Box 1636, Accra.
ALGERIA	Institut Scientifique Cherifan, Rabat.
ARGENTINA	Division de Exploraciones Introduccion de Plants.
AUSTRALIA	W.K. Rosel, Victoria; Kirkwood Tropical Orchids, Queensland; Denis Mainwood, Adelaide, Rural Youth Organisation, Queensland; J. W. Wrigley, Department of the Interior, Canberra; Dolcon Nurseries, New South Wales.
BRAZIL	B.V. Skvortzov, Sao Paulo.
CZECHOSLOVAKIA	Davidek Vaclav; Botanic Gardens of the University, Karloveska, Bratislava; Czechoslovakia Botanical Society, Ostrava.
DENMARK	Prof. Larsen, Botanical Institute, Gardens University.
FRANCE	J. E. Vidal, Museum National D'Histoire Naturelle, Paris; Jardin D'Essais Du Hamma Alger.
GERMANY	Botanischer Garten der Technischen Hochschule, Dresden; Botanischer Garten der Universitat Tubingen, Romelinstrasse; Botanischer Garten der Universitat Marburg, Pilgrimstein 4.
GUADELOUPE	Station D'Amelioration des Plantes, Petit-Bourg.
HONGKONG	Urban Service Department, Gardens Division.
INDIA	I.S. Jetley, Punjab.
ITALY	Universita de Napoli, Orto Botanico, Napoli.
JAMAICA	Mr. N.R. Gauntlett, Kingston.
JAPAN	Dr. Toshio Miyata, Tokyo; Toshihiko Kamada, Nagashima Botanic Gardens, Kagoshima; T. Momoo, Osaka; Makoto Togashi, Tokyo; Yoshikiyo Okawa, Tropical Agricultural Research Office, Tokyo; Toshihiko Satake, Hiroshima; Kyoto Takeda Herbal Gardens.
MALAYSIA	Lim Yew Hoe, Selangor; Penang Botanic Gardens.
PHILIPPINES	R. V. Valmayor, University of Philippines, Los Banos; Mr. A. L. Syjuco, Rizal; N. Quisumbing, Rizal.
POLAND	Hortus Plantarium Academical Medical, Warszawa.
PUERTO RICO	William Pennock, Agricultural Experiment Station, Rio Piedras.
RHODESIA	T. H. Muller, Herbarium Botanical Garden, Salisbury; J. Avery, Salisbury.
SPAIN	Encarnita Monserrat Datil, Madrid.
TAIWAN	Plant Industries Division, Taipei; Taiwan Forestry Research Institute, Heng Chuan.
U.K.	G. H. Addison, Sussex.
U.S.A.	Thomas Allin, New York; Richard P. Eckels, Palmetto, Florida; Harrison G. Yocum, Tucson Botanical Garden, Arizona.
U.S.S.R.	Hortus Botanicus Academiae Scientiarum Latvensis; Botanic Gardens, Tomsk; Hortus Botanicus Sibiricus, Tomsk.
ZAMBIA	J. Anton-Smith, Mount Makulu Research Station, Chilanga.

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SINGAPORE
BOTANIC
GARDENS

ANNUAL
REPORT
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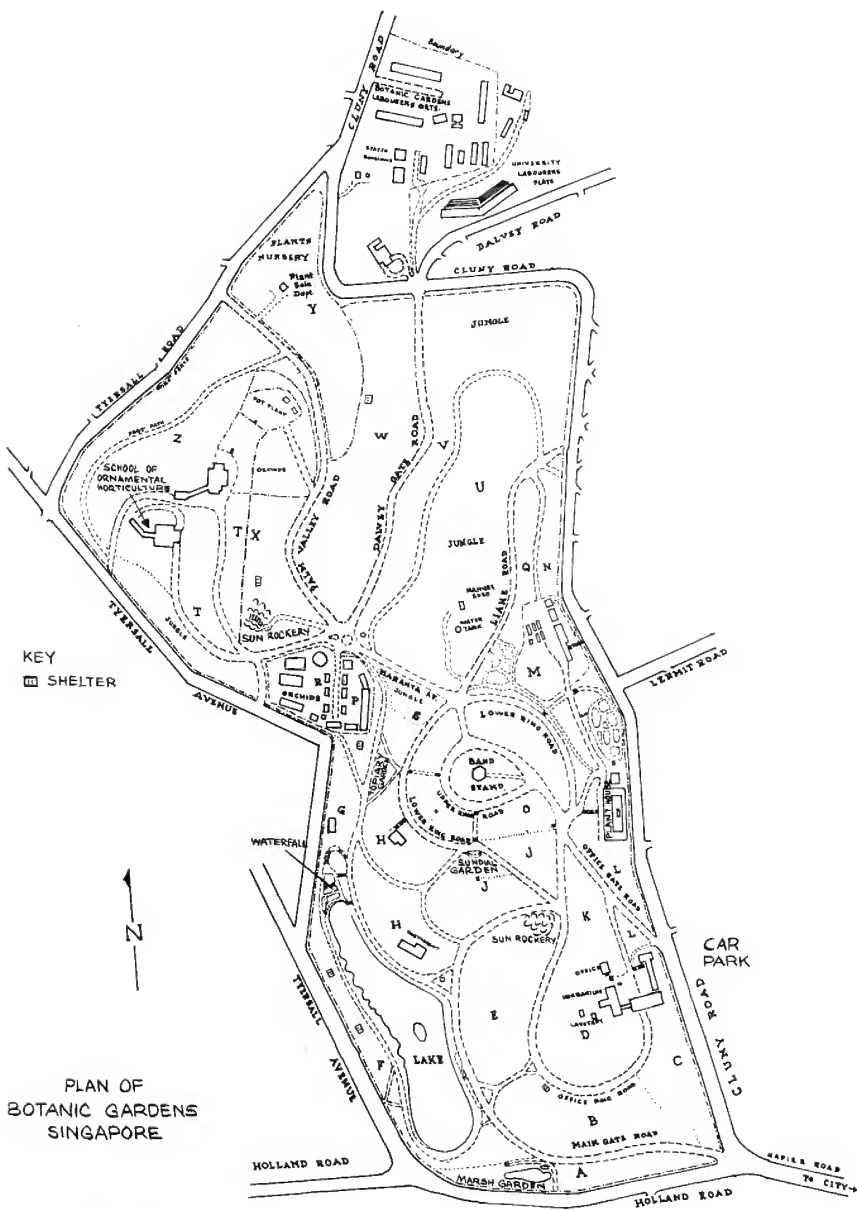
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Scale: 1mm = 25 ft.

Introduction

The Botanic Gardens, comprising an area of some 80 acres of land, was first established in the year 1859.

Situated at the junction of Cluny Road and Holland Road, its vast grounds have become the focal point for recreational pleasure for Singaporeans residing near and far. It is also rated as one of the top tourist attractions for overseas visitors in Singapore.

Besides being a recreational ground, the Gardens also provides ample facilities and materials for botanical and horticultural research.

It maintains a Herbarium and an Orchid Research unit — facilities which are much appreciated by professional research workers and orchid enthusiasts.

The Herbarium

The Herbarium was first started in 1880 to house collections of dried and preserved specimens for research and academic purposes. To date, close to half a million specimens have accrued over the years. Of these, a total of 300,000 specimens have already been indexed.

Specimens for the herbarium are collected mainly from neighbouring countries and adjacent territories, and include many important collections of ferns, palms, gingers and grasses.

Herbarium specimens are mounted on sheets and arranged according to the Bentham & Hooker system of classification. Some of the oldest specimens are as much as 160 years old. The Herbarium provides a vast reservoir of information to botanists and research workers who need to refer to accurately named plant specimens.

Dendrobium Mata'aho.



Orchid Research

The Orchid Research Section undertakes work in the hybridisation of orchids to produce free flowering plants and better quality blooms. Viable seeds produced as a result of hybridisation are sown in culture media. The resulting seedlings are grown to maturity and on flowering, the hybrid plants are registered and given new names.

During the year, a total of 786 attempts were made at hybridisation. Out of these, 202 hybrids pods were harvested. Only 128 produced viable seeds which were cultured.

This section also undertakes the exchange of different species and hybrids of orchids with various countries. A total of 406 orchid species have been received in exchange for 388 species from countries including Australia and Japan. Apart from orchid research, orchid blooms were supplied for domestic use in the various Ministries.

The orchid industry has netted over \$1 million for Singapore, in the export of cut orchid blooms to foreign countries. The most popular orchids which find a ready market overseas include *Arachnis Maggie Oei*, *Aranda Wendy Scott*, *Aranthera James Storie* and *Oncidium Golden Shower*.

The Gardens has brought under control prevalent diseases such as those caused by *Phytophthora palmivora* on Vandas and *Pectobacterium carotivorum* on Dendrobiums and Phalaenopsis.

The most difficult problem has been the elimination of virus attacks on the plants. This was partially controlled by maintaining strict phytosanitary measures.

The number of orchid species and hybrids in the Orchid Section amounts to about 900.

23 new hybrids flowered for the first time during the year.

New orchid hybrids registered in 1971 were: —

Dendrobium Sirima Bandaranaike

(D. Herbert Ong x D. ostrinoglossum)

Dendrobium Sarasvathi Giri

(D. Harlequin x D. Noor Aishah)

Dendrobium Mata'aho

(D. Grace Goo x D. gouldii)

Improvements to the Gardens

One of the highlights of the Gardens during the year was the introduction of an Orchid Demonstration Centre.

The Centre provides an opportunity to members of the public who are orchid enthusiasts to learn the technique of orchid breeding in culture media. At the demonstration, photographs showing the various stages in the production of orchid seedlings are displayed and supported by actual specimens. In addition, the actual process of orchid breeding in culture media is also demonstrated. No fee is charged for the demonstrations.

To improve the aesthetic appearance of the Gardens, a sundial garden was constructed during the year. The sundial is supplemented by a system of fountains housed in four rectangular pools amidst lush, green, ornamental and aquatic plants. It has proved to be a source of delight to many a visitor, young and old.

The campaign to make Singapore a clean and green city has generated an increasing demand for trained Horticulturists and Landscape Designers. A School of Ornamental Horticulture is therefore planned to be housed in the former Director's bungalow in the Gardens itself. Renovation is being carried out to the bungalow to provide the School with up-to-date laboratories and working facilities.

The School of Ornamental Horticulture is scheduled to commence in 1972 with the introduction of a 2-year course leading to a Diploma in Ornamental Horticulture. It is expected that about 20 candidates will participate in the course.

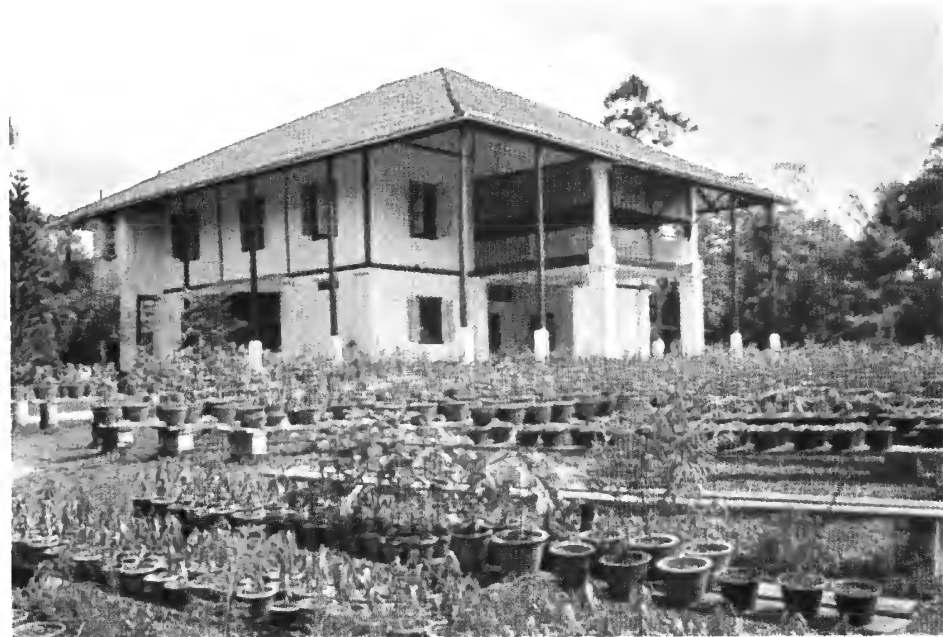
The Orchid Demonstration Centre where one can learn the technique of culturing orchid seedlings in culture media.





Sundial Garden — A source of delight to many a visitor.

The School of Ornamental Horticulture — soon to turn out Landscape Designers and Horticulturists.



Plant Introduction Unit

A total of 1,425 new plants were introduced into Singapore via exchanges, purchases, gifts and collections in neighbouring countries. Of these, 1,023 were obtained through exchanges carried out with botanical and horticultural institutions, nurseries and private collectors all over the world.

A number of plants introduced in previous years have been utilised for roadside planting in Singapore. Some of them have adapted exceedingly well to the local environment. Among these are the Rain Tree (*Enterolobium saman*), Flame of the Forest (*Delonix regia*), Mexican Lilac (*Gliricidia sepium*) and the Cherry Tree (*Muntingia calabura*). Among the ornamental plants introduced, the following have been especially successful in parks and home gardens: —

- Cape Honeysuckle (*Tecomaria capensis*)
- Yellow Bells (*Stenolobium stans*)
- Peacock Flower (*Caesalpinia pulcherrima*)
- The hybrid Mussaendas
- The Jade Vine (*Strongylodon macrobotrys*) and
- The New Guinea Creeper (*Mucuna bennettii*)

Warszewiczia coccinea — a plant introduced into Singapore and expected to gain popularity.





Baeckia frutescens — another recently introduced plant in Singapore.

In recent years, *Araucaria excelsa* and *Cycas revoluta* have been in great demand for their decorative value. Two fairly new introductions which are expected to gain popularity are *Warscewiczia coccinea*, which resembles Poinsettia (*Euphorbia pulcherrima*) in having scarlet bracts and *Baeckia frutescens*, a graceful shrub with fine needle-like foliage borne on pendulous branches.

During 1971, 27 species of newly introduced plants were distributed to the Parks & Trees Branch and 15 species to the Primary Production Department. Among these are *Aralia elegantissima* an attractive small tree with dissected leaves of an unusual red-brown colour and *Toona sinensis* a quick growing shade tree suitable for roadsides and parks.

Others include: —

Araucaria excelsa 'hybrid' — a variety of the Norfolk Island pine, with soft fernlike foliage.

Eugenia jambos — a fruit tree suitable for house gardens.

Bauhinia acuminata, with large white flowers.

Ruellia lorentziana, with violet blue flowers.

Petunias (16 varieties); and

Ruta graveolens — a low shrub with dissected glaucous leaves.

Ulu Pandan Nursery

This nursery commenced operation in 1970 when it was found that space for the production of potted plants was insufficient within the Botanic Gardens.

Much of the nursery is devoted to the production of potted plants for decorative purposes. Besides these a variety of shrubs, palms, aquatic plants and tree saplings are also grown.

To meet the ever-increasing demand for cut orchid blooms, a quarter of the total nursery acreage has been planted with terrestrial orchids. Most of these are grown in beds sited on the slopes of the nursery. 35 new beds were dug during the year and planted with 5,442 terrestrial orchids.

The number of plants produced by the nursery in 1971 totalled 258,498.

The Orchid Nursery at Ulu Pandan planted with terrestrial orchids.



Advisory and Extension Service

As in previous years, the Botanic Gardens received numerous requests for identification of plant specimens from the public.

Plants were also supplied to various Government bodies. A breakdown of plants supplied are: —

	Parks & Trees Branch	Other Govt. Bodies
Trees	678	2,629
Palms	—	468
Shrubs	1,162	5,698
Foliage Plants	473	573
Climbers & Hedge Plants	286,343	315,124
Others	2	108

Pot plants were made available for loan to government bodies and charitable organisations for special occasions.

A large number of saplings was also supplied to various organisations who responded to Singapore's first annual Tree Planting Day on 7th November, 1971.



Cacti of many varieties thrive in the Cacti House.

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Educational Assistance and Training Schemes

As in previous years the Botanic Gardens provided facilities for trainees, who were awarded Colombo Plan fellowships, and apprentices from various Statutory Boards in Singapore.

In 1971, 1 Colombo Plan trainee underwent a course on Herbarium Practice and 73 apprentices were trained in practical gardening.

Assistance was also given to various research workers and students from academic institutions locally and abroad.



Visit of President Giri and Mrs. Giri of India.

Exhibitions and Societies

The Gardens played a major role in the Horticulture and Aquarium Fish Show held at the National Development Building.

A total of 355 cut orchids were sent to overseas exhibitions in New Delhi, Adelaide, Tokyo and Brisbane. The department also participated in the 2nd Science Congress organised by the National Academy of Science.

Visitors

Among the distinguished visitors to the Gardens in 1971 were Mrs. Sirima Bandaranaike, Prime Minister of Ceylon, President V. V. Giri of India and Mrs. V. V. Giri, Queen Mata'aho of Tonga Island and the King and Queen of Nepal. Orchid plants named after the above dignitaries were presented to them as State gifts.

Other distinguished visitors included the many Commonwealth Heads of States who had participated in the Commonwealth Conference in Singapore during the year.



Her Majesty Queen Mata'aho of Tonga at the Orchid Centre.

Plant Sales

The Plant Sales Centre at Dunearn Road was enlarged by the acquisition of a site adjacent to it. It was envisaged that this would provide a better service to the public and generate more sales, as a greater variety of plants for sale could be offered with the expansion of the centre. The centre is open daily including Sundays from 9 a.m. to 7 p.m.

Besides plants, the centre offers inorganic fertilisers, dry sludge and untreated sludge which are cheaply priced and recommended for local plants. Information booklets which give useful tips on the types of trees to plant and how to look after them are also on sale. A total of \$37,652 was collected from the sales during 1971.

The Plant Sales Centre at the Floral Mile where popular garden plants are sold at reasonable rates.



Library and Publications

The Botanic Gardens maintains a collection of botanical and horticultural books consisting of 9,652 volumes and 240 titles of serials. The books are mainly in the English Language with other publications in Dutch, French, German and Latin.

The Library is used strictly for reference only, and is mainly for the use of staff members, botanists and research workers. Interested members of the public may obtain permission from the Director to make use of the library during normal office hours.

During the year, new additions to the library numbered 140 books, 1,370 issues of periodicals and 295 reprints.

Plant Collections and Exchanges

A total of 722 specimens of plants were collected for the Herbarium.

522 species of live plants for cultivation were also collected in several trips to Malaysia which included Johore, Perak, Pahang and Penang.

Expeditions to Indonesia and Sarawak were also undertaken by staff members.

Miscellaneous

For lovers of band music, the Botanic Gardens organises band performances during the evenings. Popular local bands such as the Singapore Girl Pipers and the Teachers Military Band perform on the lawns to the delight of many appreciative audiences. During the year, a total of 33 bands performed in the Gardens.

On important functions, the Botanic Gardens undertakes floral arrangements. Such functions during the year included the Commonwealth Heads of States Conference, the ASEAN Standing Committee Conference, the National Day Banquet, Opening of Parliament and the State Banquet in Honour of President Giri of India.

State gifts to overseas VIPs in the form of 533 sprays of orchid blooms were sent during the year.

A Band performance in the Gardens.



Nature Reserves

The Nature Reserves, comprising of the Water Catchment Area (2,717 ha), Bukit Timah Reserve (66 ha) and Kranji Reserve (14 ha), provide visitors an excellent opportunity to observe the extremely rich flora and fauna indigenous to this region.

The only remnant of Singapore's original vegetation outside of the Botanic Gardens, may be found at the Bukit Timah Reserve. This is situated on the highest hill on the island and is well supplied with paths and sheltered seats at vantage points. The road to the summit is open to vehicular traffic except during the following hours:

- Weekdays 4 p.m.-8 p.m.
- Saturdays 2 p.m.-8 p.m.
- Sundays 8 a.m.-8 p.m.

A total of 27 permits were issued in 1971 to individuals and organisations to allow specimens to be collected in the Nature Reserves for research and teaching purposes.

Administration

1971 was a year of achievement for the Botanic Gardens Staff. In recognition of their service and contribution to the development of the Gardens, 5 staff members were awarded National Day Honours:

	<i>Award</i>
1. Mr. A. G. Alphonso, Acting Director of Botanic Gardens	Public Administration. Medal (Silver).
2. Mr. Lam Hin Cheng, Curator	Public Administration. Medal (Bronze).
3. Mr. Herbert Wee Sip Hean, Horticultural Assistant	Efficiency Medal.
4. Mr. Quek Wai Yan, Horticultural Assistant	Efficiency Medal.
5. Mr. Arumugan Mookya, Foreman Gardener	Efficiency Medal.

During the year, the Ag. Director of the Gardens served on various committees including the Sentosa Golf Course Committee, Garden City Action Committee and on the Board of the Jurong Bird Park (Pte.) Ltd. and Nature Reserves Board.

He also continued to be the representative of the Commonwealth War Graves Commission in Singapore.

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Conserved by



