13. マレイシア農科大学農学部「熱帯作物遺伝資源保存センター」の概要説明資料

Tropical Crops Germplasm Center (TCGC)

Faculty of Agriculture
Universiti Pertanian Malaysia

Universiti Pertanian Malaysia (UPM), as a center for biological research and education, recognizes the importance of plant germplasm/gene conservation. In 1991, UPM established the Germplasm Unit with field facilities for keeping live plant germplasm specimens. Later in 1992, the Tropical Crops Germplasm Center, under the Faculty of Agriculture of the university was established. The center aims at collecting, maintaining, characterizing and evaluating tropical crop germplasm for future use in research, teaching and breeding. The Center is equipped or to be equipped with laboratories for research and practice of seed storage, pollen and tissue cryo-preservation, DNA studies and storage, and tissue culture. The Germplasm Unit provides the field facilities for maintenance of living specimens and field evaluation.

Objectives of the Center

The TCGC was established with the following objectives:

1. Collection, conservation and utilization of the diverse genetic resources of tropical crop and plant.

2. To coordinate and to provide facilities for scientists working on tropical crop germplasm from various departments or institutions within the country and the region.

3. To provide facilities for training and post-graduate studies in germplasm conservation.

4. To share or exchange information on various aspects of tropical crop germplasm for future agricultural development in the region.

The establishment of the TCGC and plant germplasm conservation in Malaysia

Malaysia is a country rich in genetic variation of tropical fruits and plants. Systematic germplasm collection in Malaysia has been carried out on major crops such as oil palm, rubber, cacao and rice. Germplasm preservation on other crops has been done only on selected genotypes for specific breeding programs. Such collections have been attempted by Malaysian Agricultural Research Development Institute (MARDI) and by scientists from other institutions and universities. MARDI has been collecting germplasm for durian, mangosteen, and rare fruit species. Universiti Malaya has a good collection of *Citrus* spp. Universiti Kebangsaan Malaysia has collected many species of taro and yam. Universiti Pertanian Malaysia (UPM), has been actively collecting germplasm of various crops including sweetpotatoes, starfruits and its relatives, pulasan, langsat, ornamental trees and plants and medicinal plants.

Preservation of genetic resources will ensure continuous availability of genes to support the present and future demands of the agriculture industry in the country

and the world. In January 1992 the IRPA (Intensification of Researches in Priority Areas) Seminar Assessment Committee recommended collection and conservation of germplasm especially for crops of Malaysian origin. The National Agriculture Policy has stressed that germplasm collection and screening should be a major agriculture research activity in the country. Plant genetic conservation will benefit the country and the world, directly and indirectly, toward:

Industrialization

Agriculture is now considered more as part of an industrial system. It provides raw materials for down stream processing. The government of Malaysia recognizes the significant contribution of agriculture toward her GNP, food supply and supporting her industrial system. As part of the industrial system, agriculture should be able to meet the demand for bulk production of specific varieties (for any crops) suitable as raw materials for specific processing technique for specific products, either food or non-food. In the long run, a good collection of genetic materials will benefit the country and the world to meet the demands for new varieties. Without genetic conservation many useful genes will not be available for future use.

Environment

Development, directly or indirectly, will eradicate potential plant genotypes and genes from the earth. Planting of few established varieties or clones is fast replacing the genetically useful landraces and other unselected genotypes. The world community very much concern about the reduction in bio-diversity as shown at the 1992 Rio Environmental Convention where a treaty on bio-diversity to preserve biological species was signed. Undoubtedly, there is a need to conserve plant and animal diversity for conserving the environment. Availability of plant genetic resources will make future programs to conserve environments possible. For example, to green the hot and highly polluted urban areas will need plants with the genes that enable them to grow under such conditions.

The establishment of the TCGC was timely. Hopefully, the center will enable coordination of plant germplasm conservation activities within the University and other institutions within the country. This surely will make conservation works in the country more effective and more beneficial.

Teaching in genetic resources related subjects

A total of four universities in the country is currently offering courses on genetic resources or courses that include topics related to genetic resources (Table 1). Eight institutions are conducting researches, directly or indirectly, on genetic resources. The research conducted includes genetic variation studies, evolution, biosystematic and breeding.

UPM is the only agriculture university in the country and it has good facilities and expertise in agricultural studies. The university has more than 500 hectares of farm area. Thus, the establishment of the TCGC at UPM was rather proper. With its complete laboratory and field facilities the center is a very suitable place for training in germplasm conservation.

Table 1. Institutions involve in teaching and research on genetic resources in Malaysia

Institution	Teaching on subjects related to genetic resources	Research on area related to genetic resources
Universiti Pertanian Malaysia	yes	yes
Universiti Kebangsaan Malaysia	yes	yes
Universiti Malaya	yes	yes
Universiti Sains Malaysia	yes	yes
Universiti Malaysia Sarawak	?	?
Malaysian Agriculture Research and Development Institute	no	yes
Forest Research Institute of Malaysia	no	yes
Palm Oil Research Institute of Malaysia	no	yes
Rubber Research Institute of Malaysia	no	yes

Structure Organization of the Center

The Tropical Crop Germplasm Center is under the Faculty of Agriculture, Universiti Pertanian Malaysia. The Germplasm Unit under the Farm Division will provide field facility for the center. The establishment of the center was supported by the Dean of the Faculty of Agriculture, Vice Cancelor of UPM and Government of Malaysia.

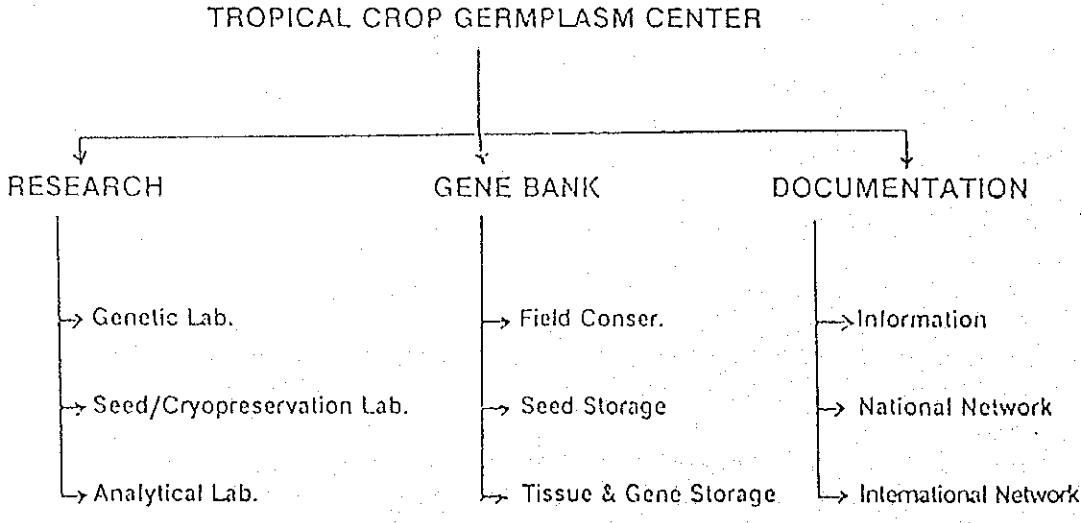

Figure 1. Structure Organization of the Tropical Crop Germplasm Center.

The TCGC is divided into three sections namely Research, Gene Bank and Documentation (Figure 1). The Research section has three laboratories; Genetic Laboratory, Seed and Cryo-preservation Laboratory and Analytical Laboratory. The Gene Bank section responsible for seed storage, gene and tissue storage and living specimens' maintenance in the field. The Documentation section will manage information on germplasm and networking with local and international institutions. The TCGC is housed in the Seed Technology Building with a floor space allocated of about 300 square meters.

Facilities of the Center

The center is currently partially equipped. The following equipments are necessary for the center to efficiently carry her activities.

Equipment	Estimate (RM)
Modular walk-in cold room (-18°C) for base collection	100,000.00
Modular walk-in cold room (0°C) for active collection	100,000.00
Stand-by generator (for the above cold rooms)	40,000.00
Alluminium pack sealing machines	10,000.00
Large capacity cryovats for cryo-preservation in liquid Nitrogen. Come with cryocanes and containers (2 units)	200,000.00
Differential scanning calorimeter	150,000.00
UV Spectrophotometer	100,000.00
SFC&SFE	150,000.00
Nuclear Magnetic Resonance	500,000.00
GCMS	1,500,000.00
Florescence microscopes	100,000.00
Ultra centrifuge	200,000.00
HPLC	200,000.00
Workstation and Personal computers	200,000.00
Scanner	50,000.00
Printers (Laser)	50,000.00
Laser Disk Units	50,000.00
Graphic data processor	50,000.00
4WD Vehicle (for germplasm collection)	100,000.00
Travelling (germplasm collection, 5 years)	150,000.00
Total	4,000.000.00

Activities of the Center

Germplasm collection.

Collection of germplasm for crops mentioned earlier will be done in Malaysia, Southeast Asian and from other tropical regions. Priority, however, will be given to collecting and preserving germplasm from within Malaysia. Collection in other countries will only be done when necessary and financially feasible. The crop germplasms to be collected and preserved include:

Tropical Fruits. It includes popular fruits, domesticated but rare fruits, and fruits that are still in the wild. The list of the fruits is shown in Appendix 1. Many of the fruit species are in fact endangered and need immediate action for conservation.

Medicinal and Aromatic Plants. Plants with medicinal value or aromatic. The list of medicinal and aromatic plants of tropical origin is shown in Appendix 2.

Tropical Vegetables and Ulam (traditional vegetable). Vegetable are those plants or plant parts consumed after cooking whereas ulam are those taken raw. Many tropical vegetables and ulam have medicinal value but some do not. The list of tropical vegetable and ulam are in Appendix 3.

Tropical Food Crops. Tropical food crops are many and priority is given to tuberous crops. The list of tuberous crops is in Appendix 4.

Characterization and evaluation.

All germplasms collected are characterized and evaluated. This is done to detect duplication and to identify characters of economic value. Characterization will be based on morphological, physiological, biochemical and molecular characteristics.

Basic Research.

Basic researches on genetics, diversity, evolution, biosystematic, hybridization, seed science and technology, and preservation technology are conducted to obtain information on the possible uses and to facilitate utilization of the germplasm. Utilization of the germplasm will be more effective if important problems such incompatibility of crosses could be solved and important genes put into ready-to-use form.

Documentation and Database Management.

All germplasm information are stored in database retrievable and accessible to users. Data to be stored include background, characteristics, photo images and crossing information.

National and International Networking.

The center will develop linkages with other national and international institutions for exchange of materials, information and expertise. Nationally, the center coordinates germplasm conservation activities of other institutions (UKM, UM, USM, UNIMAS, MARDI, PORIM, RRI, CORAM and FRI) on certain crop species. The center will keep all information on germplasm handled by different institutions. The center will also develop linkage with international organizations involve in tropical crop germplasm such as IBPGR, CIP, SAPPRAD and IITA.

Training.

The center provides facilities for students (undergraduate & graduate) and researchers to do their scientific investigations. Such facilities include supervision,

laboratory, field plot and research documents.

Staff of the Center

The Center will be headed by a Director (Chairman) with several researchers and assistants from various departments in the Faculty of Agriculture and from other faculties who are actively working on tropical crop/plant germplasm. The center will provide space and facilities for researchers to do their works. Those actively working on tropical crop germplasm in the Faculty of Agriculture and directly involved in the establishment of the center are:

Prof Yap Thoo Chai (Chairman). Grain crop and vegetable breeding. *Program leader* (IRPA), improvement of food crops. *President*, Malaysian Scientific Association.

Mohd Said Saad (Secretary). Tropical fruit and food crop breeding, tropical crops germplasm conservation and utilization. *Member*, Germplasm Unit Committee; *Project Leader*, Malaysia-SAPPRAD sweetpotato improvement program; *Member,* National committee on mutation breeding in crop plants.

Prof Shinya Iyama (Member). Tropical fruit germplasm collection, germplasm database development and documentation. *Member*, Genetic Resources Committee, Science Council of Japan (1984-1991).

Prof Chin H. F. (Member). Seed technology - cryo-preservation of tropical seeds (embryo). *Member*, IBPGR, ISTA, National Committee of Plant Genetic Resources.

Asso. Prof Hor Y. L. (Member). Cryo-preservation of tropical fruits and crops, and seed technology. *Head*, IBPGR Research Team on Preservation Techniques of Recalcitrant Seeds.

Dr. Abd Ghani Yunus (Member). Tropical Crop Germplasm preservation and characterization. *Officer In-charge*, Germplasm Unit, UPM.

Dr. Saleh Kadzimin (Member). Collection and preservation of orchid's germplasm. *Member,* National committee on mutation breeding in crop plants.

Ahmad Abdul Rahman. He is attached to the Department of Biology, Faculty of Science and Environmental Science, UPM. Mr. Ahmad is actively working on medicinal plants of tropical origin.

APPENDIX 1

LIST OF TROPICAL FRUITS IN PENINSULAR MALAYSIA

Scientific Name	Local Name
Popular fruit	
Achras zapota	Ciku
Anacardium occidentale	Gajus
Ananas comosus	Nenas
Anona muricata	Durian Belanda
Artocarpus communis	Sukun.
Artocarpus heterophyllus	Nangka
Artocarpus integer	Cempedak
Averrhoa carambola	Belimbing Manis
Bertholletia excelsa	Buah Brazil
Bouea gandaria	Kundang
Carica papaya	Betik
Citrullus vulgaris	Tembikai
Citrus aurantifolia	Limau nipis
Citrus grandis	Limau besar
Citrus microcarpa	Limau Kasturi
Citrus paradisi	Limau Gedang
Citrus reticulata	Limau Cembul,limau langkat
Citrus sinensis	Limau Cula,limau manis
Citrus spp.	Limau (others)
Dimocarpus longan	Longan
Durio zibethinus	Durian
Garcinia mangostana	Manggis
Lansium domesticum	Duku/Langsat
Mangifera caesia	Binjai
Mangifera foetida	Bacang
Mangifera indica	Mangga
Mangifera odorata	Kuinin
Mangifera petandra	Mangga Pauh
Musa sapeintum	Pisang
Myristica fragrans	Buah Pala
Nephelium lappaceum	Rambutan
Nephelium malaiense	Mata Kucing
Nephelium mutabile	Pulasan
Psidium guajava	Jambu Batu
Tamarindus indica	Asam Jawa
Minor Fruits	
Anona reticulata	Nona Kapri
Anona squamosa	Nona Sri Kaya
Artocarpus odoratissima	Marang
Artocarpus rigidus	Tempunik
Averrhoa bilimbi	Belimbing masam
Baccaurea motleyana	Rambai
Baccaurea sapida	Tampoi
Cryphomandra betacea	Tree Tomato
Diospyros discolor	Buah mentega
Diospyros kaki	Pisang Kaki
Eriobotrya japonica	Loquat
Eugenia aquea	Jambu Air

Eugenia jambos	Jambu Mawar
Eugenia malaccensis	Jambu Bol
Eugenia spp.	Jambu susu
Ficus carica	Ara
Flacourtia inermis	Rokam Masam
Garcinia atroviridis	Asam Gelugor
Gnetum gnemon	Melinjau
Gullielma speciosa	Peach Palm
Lecythis zabucajo	Sapucaia
Phyllanthus distichus	Cermai
Punica granatum	Delima
Salacca edulis	Salak
Sandoricum koetjape	Sentul .
Spondias cytherea	Kedondong
Sterculia monosperma	Kelumpang
Ziziphus mauritiana	Bedara

Rare Fruits

Aegle marmelos	Bilak
Alphonsea elliptica	Pisang-Pisang
Anona glabra	Nona (pond-Apple)
Antidesma bunius	Buni
Arthocarpus lowii	Miku
Artocarpus gomeliana	Tampang
Artocarpus spp.	Bangkong
Baccaurea grillithii	Larah
Baccaurea langeolata	Rambai Hutan
Borassus flabellifera	Lontar
Bouea oppositifolia	Remenia
Canarium commune	Kenari
Carissa congesta	Kerandang
Castanopsis inermis	Barangan
Clausena lansium	Wampi
Cynometra cauliflora	Nam Nam
Dialium indicum	Keranji
Erioglossum rubiginosum	Mertajam
Eugenia cumini	Jambulan
Eugenia michelii	Cermai Belanda
Eugenia polyantha	Salam
Eugenia pseudosubtilis	Kerian
Feronica limonia	Gelinggai
Flacourita indica	Kerkup Kecil
Flacourtia jangomas	Kerkup
Flacourtia rukam	Rokam Manis
Garcinia cowa	Kandis
Garcinia dulcis	Mundu
Garcinia prainiana	Cerapu
Garcinia xanthochymus	Asam Kandis
Mangifera lagenifer	Lanjut
Mangifera longipetiolata	Sepam
Mangifera microphylla	Rawa
Mangifera quadrilida	Asam Kumbang
Manilkara kauki	Sauh
Muntingia calabura	Buah ceri
Nephelium eriopetalum	Lotong
Nephelium glabrum	Redan
Nephelium litchi	Kelengking

Passiflora edulis	Markisa
Passiflora laurifolia	Buah Susu
Passiflora quadrangular	Timun Belanda
Phyllanthus emblica	Buah Melaka
Sandoricum nervosum	Kecapi
Spondias pinnata	Amra

APPENDIX 2

LIST OF MEDICINAL PLANTS

Scientific Name	Local Name
Abrus precatorius Linn.	saga kecil, saga akar
Abutilon indicum Dm.	kembang johor
Acalypha siamensis Oliv.	te
Acasia farnesiana Will.	bunga siam
Achras zapota Linn.	chiku
Achyranthes aspera Linn.	nyarang songsang
Acrotrema costatum Jack.	punai tanah
Adenanthera pavonina Linn.	saga
Adenia populifolia Engl.	telayang
Adenostemma viscosum Forst.	rumput tahi babi
Aeschynanthus sp.	sawai
Afzelia retusa Kartz.	malapari
Aganosma marginata G.Don.	sekati lima
Ageratum conyzoides Linn.	misai kucing, rumput jalang
Aglaia salicifolia Ridl.	-
Alastonia augustiloba Miq.	pulai
Alastonia scholaris R.Br.	pulai
Alastonia spathulata Blume.	pulai puteh
Albizzia myriophylla Benth.	tebu gajah
Aleurites moluccana Will.	buah keras
Allomorphia alata Scort.	puding hutan
Allomorphia exigus Blume.	keduduk hutan
Allomorphia malaccensis Ridl.	lidah buaya
Allophylus ternatus Lour.	cincang
Alpinia chinensis Koenig.	langkuas sina
Alpinia conchigera Grill.	langkuas ranting
Alpinia galanga Swartz.	langkuas benar
Alpinia javanica Blume.	tepus puteh
Alpinia malaccensis Rosc.	langkuas melaka
Alpinia melanocarpa Ridl.	langkuas ranting
Alpinia mutica Roxb.	cengkenam
Alpinia rafflesiana Wall.	tepus kijai
Alpinia scabra Benth.	lengkuas raya
Alpinia speciosa Rosc.	langkuas melaka
Alternanthera sessilis B.Br.	serapat, kereman
Amomum cardamomum Linn.	pelaga
Amomum lappaceum Ridl.	tepus rambutan
Amomum ochreum Ridl.	tepus batu
Amomum squarrosum Ridl.	tadah embun
Amomum testaceum Ridl.	katepus
Amomum uliginosum Ridl.	tepus merah
Anaxagorea scortechinii King.	sekobang kecil
Anona incertae	akar bukit, meroyan ungu
Anona muricata Linn.	durian bengala, durian mekah
Anona reticulata Linn.	nona kapri
Anplectrum diraricatum Triana.	lidah kucing, kopok
Anplectrum glaucum Triana.	kayu metah
Anthocephalus indicus Rich.	kelapayan, kelampi
Antidesma ghaesembilla Gaerth.	kuncur puteh, gucek
Antidesma montanum Blume.	guncak gajah
Apama corymbosa Solar.	maja pahit
Apama tomentosa Solar.	serengkong

Aplostelis flabelliformis Ridl.	sehelai setahun
Aralidium pinnatifidum Miq.	sebalai
Archytaea vahlii Choisy.	tualang padang
Ardisia colorata Roxb.	kayu lupa dahan,
Ardisia crenata Roxb.	mata ayam, sireh puyoh
Ardisia littoralis Andr.	daun bisa hati
Ardisia oxyphylla Wall.	daun mata itek
Aristolochia tagala Cham.	akar ketola, petola hutan
Aromadendron elegans Blume.	cempaka hutan
Artemisia capillaris Thumb.	rumput roman
Artemisia vulgaris Linn.	baru cina, bunga ayam
Artocarpus integrifolia Linn.	nangka
Artocarpus kunstleri Hook.f.	terap
Asclepias curassavica Linn.	bunga tunjong, bunga emas
Atalantia roxburghiana Hook.f.	limau pagar
Averrhoa bilimbi Linn.	belimbing buluh, masam
Averrhoa carambola Linn.	belimbing manis, belimbing besi
Azima tetracantha Lam.	pekan, sung ilai
Baccaurea brevipes Hook.	setambun lilin,rambai ayam
Baccaurea motleyana Muell.	rambai
Baeckea frutescens Linn.	cucor atap
Baliospermum axillare Blume.	maharaja lela
Baliospermum montanum Muell.	akar kerak nasi
Barleria lupulina Lindl.	setawar, sakelian, bisa
Barleria prionitis Linn	bunga landak, sekunyit.
Barringtonia macrostachys Kurz.	putat darat
Barringtonia racemosa Roxb.	putat kampongputat padi
Barringtonia spicata Blume.	gajah beranak, putat nasi
Barringtonia sumatrana Miq.	putat darat
Basella alba Linn.	ramayong
Bauhinia acuminata Linn.	bunga perak
Bauhinia bidentata Jack.	dedaup, katup-katup
Bauhinia calycina Ridl.	keretu hutan, tapak kuda
Bauhinia flammifera Ridl.	kekatup
Bauhinia griffithiana Prain.	akar kempaga
Begonia isoptera Dryand.	riang batu
Beilschmiedia pahangensis Gamble.	medang saleh, pinang pergam
Beilschmiedia tonkinensis Ridl.	perapoh
Benincasa cerifera Sari.	kundur
Bidens pilosa Linn.	kancing baju
Biophytum adiantoides Wight.	daun payong
Biophytum reinwardtii Walp.	-
Bixa orellana Linn.	kesum,kesumba keling
Blastus cogniauxii	daun puding
Kaempferia galanga Linn.	cekor
Kaempferia rotunda Linn.	temu puteri
Kalanchoe laciniata DC.	setawar
Koompassis malaccensis Benth.	kumpas
Kopsia larutensis King.	cabai hutan
Labisia pothoina Lindl.	kacit fatimah,rumput palis
Lagerstroemia flos-reginae Retz.	bongor
Lansium domesticum Jack.	langsat
Lantana aculeata Linn.	bunga tahi ayam
Lapisanthes kunstleri King.	terentang
Laportea stimulans Miq.	jelatang gajah
Lasianthus filiformis King.	sekentut
Lasianthus oblongus King.	temberak hutan
Lasianthus stipularis Blume.	

Lasianthus villosus Ridl.	medang
Lawsonia inermis Linn.	inai
Leea curtisii King.	memali
Leea gigantea Grilf.	memali
Lepionurus sylovestris Blume.	ciprah
Leptonychia glabra Torez.	selusoh semang
Leucas zeylanica R.Br.	ketumbit
Leuconotis eugeniifolius DC.	aguh
Leucopogon malayanus Jack.	jiring atap,cucur atap
Limnophila erecta Benth.	-
Limnophila villosa Blume.	-
Litsea amara Blume.	medang
Loranthus ferrugineus Roxb.	dedalu api merah
Loranthus grandifrans King.	dedalu api gajah
Loranthus pentandrus Linn.	dedalu api puteh
Luvunga scandens Ham.	susok ayam hutan
Macaranga denticulata Muell.	mesepat
Macaranga griffithiana Muell.	mahang
Macaranga incisa Gage.	mahang
Macaranga megalophylla Muell.	selaru,menkubang
Macaranga tanaria Muell.	tampu puteh
Macaranga triloba Muell.	mahang
Maesa ramentacea Wall.	gambir badak,jelai
Mallotus anisophyllus Hook,f.	kayu kering
Mallotus barbatus.	balik angin
Mallotus cochinchinensis Lour.	mesepat hitam
Mallotus floribundus Muell.	mahang,mempasuh,tampin
Mallotus macrostachyus Muill.	mesepat,balik angin
Mallotus philippinensis Muell.	rambai kucing
Marumia nemorosa Blume.	senuduk
Melastoma decemlidum Roxb.	senduduk
Melastoma malabathricum Linn.	senduduk
Melochia corchorifolia Linn	lemak ketam,bayam rusa
Melodorum cylindricum Hook,f.	tepak
Melodorum lanuginosum Hook,f.	selusoh semang,larak api
Memecylon dichotomum Clarke.	bebuas
Memecylon minutiflorum Miq.	sedawai hitam
Memosa pudica Linn.	rumput malu,semalu
Merremia convolvulacea Hallier,f.	ulan pelandok
Merremia umbellata Hallier,f.	ulan tapak pelandok
Merremia vitifolia Hallier,f.	ulan raya
Mezoneuron sumatranum Walk.	gorek,mentiong,
Michelia champaca Linn.	cempaka
Micromelum hirsutum Oliv.	cerek-cerek
Mikania scandens Willd.	selepat tungau
Millettia sericea Benth.	jemerah,sekebah,
Mimusops elengi Linn.	bunga tanjung
Mischocarpus lessertianus Ridl.	kelat puteh
Mitragyne speciosa Korth.	biak-biak
Momordica charantia Linn.	peria
Morinda citrifolia Linn.	mengkudu besar
Morinda elliptica Ridl.	mengkudu kecil
Mucuna biplicata Teysm.	kacang paleh
Muraya exotica Linn.	kemuning
Mussaenda glabra Vahl.	balek adap
Mussaenda villosa Wall.	balek adap
Myristica fragrans Linn.	buah pala
Myxopyrum nervosum Blume.	chiput-chiput

Neolitsea zeylanica Merrill.	teja betina
Nephelium lappaceum Linn.	rambutan
Nephelium mutabile Blume.	pulasan
Neptunia oleracea Lour.	kangkong putri
Nicolaia speciosa Horan.	kantan
Notonia grandiflora DC.	
Ochanostachys amentacea Mest.	petaling
Ocimum basilicum Linn.	kemangi,ruku padang
Ocimum canum Sims.	kemangi
Oldenlandia corymbosa Linn.	penang
Oldenlandia diffusa Roxb.	penang
Oldenlandia heynei Don.	penang
Ophiorrhiza communis Ridl.	peparu
Ophiorrhiza singaporensis Ridl.	rumput lumor
Oroxylum indicum Vent.	bikir angkup,bekak,daun jauk
Otophora resecta Ridl.	setengok
Oxonitra latifolia Hook,f.	larak kucing
Paederia foetida Linn.	sekentut
Pajanelia multijuga DC.	bekak gunong
Pangium edula Reinw.	kepayang
Parkia speciosa	Petai
Pauzolzia indica Gaudich.	ubi itek,gubai
Pavetta indica Linn.	jejarum
Payena lucida DC.	bedara tiong
Pedilanthus tithymaloides Poit.	lalipan,tentulang jantan
Pegosteman heyneanus Benth.	nilam
Pellionia duvauana Brown.	sisek keli,pipi keli
Peltophorum dasyrachis Kurtz.	kerayong
Pentaphragma begoniifolium Wall.	salang suwang
Pericampylus incanus Miers.	minyak pinyang
Peristrophe acuminata Nees.	setawar ular,tangkai jering
Peristrophe tinctoria Nees.	mala pudak
Peronema canescens Jack.	sungkai
Phaseolus calcaratus Roxb.	kacang sepit
Phyllagathis rotundifolia	kacit Fatimah,tapak gajah
Phyllanthus frondosus Wall.	meroyan putri
Phyllanthus niruri Linn.	dukong anak,rami buah
Phyllanthus urinaria Linn.	naga buwana,naga jimat
Phyllochlamys spinosa Bureau.	pokok temiyang
Physalis minima Linn.	letup-letup
Piper argyrites Ridl.	sireh harimau puteh
Piper bitle Linn.	kerakap,sireh melayu
Piper caninum Blume.	sireh puteh
Piper cubebs	cabai tali
Piper porphyrophyllum Brown.	sireh harimau
Piper ribesioides Wall.	sireh murai
Piper sarmentosum Roxb.	sireh dudok
Piper stylosum Miq.	kadok hutan
Pithecolobium clypearia Benth.	petai belalang
Pithecolobium lobatum Benth.	jering
Pittosporum ferrugineum Ait.	belalang puak
Plantago major Linn.	sejumbok
Polyalthia beccarii King.	mengala hutan
Polyalthia hypolenca Hook,f.	-
Polygonum barbatum Linn.	larak hutan
Polygonum chinense Linn.	tebok seludang,
Polygonum minus Huds.	semuloh
Polygonum pedunculare Will.	kesum

Polygonum tomentosum Willd.	
Polytrema vulgare Clarke.	johong beraleh
Pometia pinnata Forst.	sekeras akar
Portulaca oleraceae Linn.	kasai
Portulaca pilosa Linn.	gelang
Premna pyramidata Wall.	penawar
Pseuderanthemum sp.	bebuas,piat
Psidium guava Ridl.	cheraka-cheraka
Psophocarpus tetragonolobus DC.	jambu biji
Psychotria montana Blume.	kacang belimbing
Psychotria rostrata Blume.	selada
Psychotria sarmentosa Blume.	telor ayam
Psychotria stipulacea Wall.	gilik
Pterocarpus indicus Will.	salang
Pterospermum blumeanum Korth.	sena
Pueraria phaseoloides Benth.	bayor
Punica granatum Linn	tampang urat,ulan susu
Quisqualis densiflora Wall.	delima
Randia curtisii King.	redani, tambun tahi
Rennellia paniculata King.	akar bumi
Rhinacanthus communis Nees.	-
Rhodamnia cinerea Jack.	mempoyan
Rhodamnia tomentosa Wight.	kemunting
Ricinus communis Linn.	jarak
Rinorea echinocarpa Korth.	
Rinorea kunstleriana King.	gemotan pacat
Rourea humilis Blume.	akar balah
Rourea similis Blume.	ribu hutan jantan
Rubus alceifolius Poir.	asam susok,tampu rengat
Ruellia repens Linn.	seranam
Salacia flavescens Kurz.	sireh iput
Salacia grandiflora Kurz.	serapat akar
Salacia sp.	rajah beraleh
Salix tetrasperma Roxb.	dedalu
Sandoricum indicum Cav.	sentol
Sandoricum nervosum Blume.	ketapi
Saprosma glomerulatum Klng.	sekentut
Saprosma ternatum Hook.f.	kesimbuk
Sauropus albicans Blume.	cekor manis
Sauropus parvifolius Ridl.	merajah santah
Schefflera affinis Ridl.	bajang beranak,bengkak rengat
Schefflera heterophylla Harms.	serenggang
Scoparia dulcis Linn.	pokok kelambu
Sida carpinifolia Linn.	medang melukut
Sida rhombifolia Linn.	jerun,senanguri
Sideroxylon ferrugineum Hook.	nasi-nasi,pelangas
Sindora sp.	sampar hantu
Solanum ferox Linn.	terong asam
Solanum nigrum Linn.	kelampong puyoh
Solanum sarmentosum Nees.	terong puyoh
Solanum torvum Sw.	terong pipit
Solanum verbascifolium Linn.	daun telinga kerbau,
Sonerila nidularia Stapt.	kacit Fatimah,
Sonneratia acida Linn.	berembang
Sonneratia griffithii Kurz.	berembang
Spathoglottis plicata Blume.	wah
Stachytarpheta jamaicensis Vahl.	rumput tahi babi
Stephania rotunda Lour.	daun nasi betina

Stereospermum limbriatum DC.	chichah
Strobilanthes flaccidifolius Nees.	tarum siam.
Symplocos rubiginosa Wall.	kelap
Synedrella nodiflora Gaertn,f.	getang
Tamarindus indicus Linn.	asam jawa
Tetracera assa DC.	mempelas licin
Tetracera fragrans Ridl.	mempelas
Thumbergia grandiflora Roxb.	pokok tuah
Thumbergia laurifolia Lindl.	ketuwah
Tinospora crispa Miers.	petawali,seruntun
Torenia polygonoides Benth.	rumput kerak nasi
Toller dependens Klotz.	telinga beruang
Trema amboinensis Blume.	mengkirai
Trevesia cheirantha Ridl.	tapak itek,tapak harimau
Trichosanthes wallichiana Wight.	jari buaya
Tropidia curculigoides Lindl.	serugat,rancang hantu
Uncaria farrer DC.	kait-kait
Uraria crinita Desv.	keretok babi
Uraria lagopoides DC.	korat tanah
Urena lobata Linn.	pulut-pulut
Urophyllum glabrum Wall.	bebulu
Urophyllum hirsutum Hook,f.	serikan
Uvaria micrantha Linn.	daun ekor bukit
Uvaria purpurea Blume.	medang salak
Vanda hookeriana Reich.	tulang
Vandellia crustacea Benth.	rumput jari cicak
Vernonia javanica DC.	kayu kepialu,berambong
Veronica cinerea Less.	cenderong hari,jendung hari
Vigna catiang Walp.	kacang perut ayam
Vites repens Wight.	riang batu
Vitex pubescens Vahl.	halban
Vitex trifolia Linn.	legundi
Vitis cinnamomea Wall.	gundak api
Vitis hastata Miq.	asam riang
Vitis lawsoni King.	akar roh papan
Vitis novemfolia Wall.	akar kum papan
Vitis trifolia Linn.	lakum
Wedelia biflora DC.	serunai laut
Wikstroemia ridleyi Gamble.	depu
Willughbeia sp.	jitan,aguh
Xanthophyllum sp.	minyak beruk
Xylopia ferruginea Hook,f.	jangkak
Xylopia malayana Hook,f.	meroyan angin
Zanthoxylum hirtellum Ridl.	kayu sekatok
Zingiber aromaticum Val.	lempoyang
Zingiber cassumunar Roxb.	bonglai
Zingiber gracile Jack.	langkuas antan
Zingiber griffithii Bak.	temu huma
Zingiber officinale Rosc.	halia benar,halia bara
Zingiber ottensii Val.	lempoyang hitam
Zingiber puberula Ridl.	lempoyang anjing
Zingiber spectabile Griff.	tepus tanah
Zingiber zerumbet Blume.	lempoyang pahit

AROMATIC PLANTS

Scientific Name	Local Name
Aglaia odorata	Telur Belangkas
Angelouia sp.	-
Brunfebia pancillora	Yesterday, today, tomorrow
Cananga odorata	Kenanga
Cestrum nocturnam	Santalia
Chonemorpha fragrans	Getah Gerip merah
Fragraea fragrans	Tembusu
Gardenia jasminoides var. fortuniana	Bunga Cina
Gardenia carinata	Cempaka Hitam
Hoya sp.	-
Jasminum sambac	Melor
Michelia champaca	Cempaka Kuning
Michelia alba	Cempaka Putih
Mimusops elengi	Pokok Tanjung
Murraya paniculata	Kemuning
Nycthathes arborstrilis	Seri Gading
Pelargonium graveolans	Jermin
Plumeria sp.	Kemboja
Pogpstemum hortensis	Nilam Patchouli
Polianthus taberosa	Sundal Malam
Porana paniculata	Bridal Creeper
Quisqualis indica	Drunken sailor, Rangoon creeper
Stephanotis floribunda	-
Telosma cordata	Tonkin
Vallaris glabra	Kesidang
Vetiveria zizanoides	Vetiver grass
Wrightia religiosa	Melati/Jelita

APPENDIX 3

LIST OF TROPICAL ULAMS (TRADITIONAL SALAD) AND VEGETABLES

Scientific Name	Local Name
Achras sapota	Ciku (pucuk)
Anacardium occidentale	Pucuk janggus
Carica papaya	Daun Betik (papaya leaves)
Cassia glauca	Gelenggang (pucuk)
Claoxylon longifolium	Pucuk salang
Commelina nudiflora	Rumput tapak itek/rumput aur
Cosmos caudatus	Ulam raja
Cucurma domestica	Kunyit
Curcuma mangga	Temu pauh
Curcuma viridiflora	Temu kuning (rizom muda dan bunga)
Curcuma zeodoria	Temu hitam (rizom muda dan bunga)
Diplagium esculentum	Pucuk paku (Fern shoot)
Garcinia atroviridis	Pucuk Asam Gelugor
Gnetum gnemon	Daun meninjau (Gnetum leaves)
Hydrocotyle asiatica	Pegaga (Indian pennyworth)
Ipomea batatas	Daun ubi keledek (sweet potato shoot)
Ipomea aquatica, I. reptans	Kangkung (swamp cabbage/water convulvolus)
Kaempferia galanga	Cekur
Lagenaria vulgatis, L. leucantha	Labu jantung (Bottle gourd)
Leucaue leucocephola	Petai belalang (pucuk dan buah)
Limnocharis flara	Paku rawan
Lycopersicum esculantus	Terong Belanda
Manihot utilissima	Pucuk ubi kayu (Tapioca leaves)
Manuardica charantia	Peria katak
Melia excelsa	Sentang
Memordica charantia	Peria (Bitter gourd/balsam pear)
Mentha avensis	Daun Pudina (Mint)
Morinda citrifolia	Pucuk mengkudu
Moringa oleifera, M. Pterygosperma	Merungai (Drumstick,french pods)
Musa paradisiaca	Pisang (jantung)
Nicolaia speciosa	Kantan
Nothopanar scutellarium	Semengkok
Ocimum basilicus	Kemangi
Oevanthe javanica	Selom
Parkia speciosa	Petai
Pentaphragma begoniaefolium	Salang Suang
Piper sarmentosum	Pucuk kaduk
Pithecellobium jiringa	Jering (buah)
Pithecellobium bubalinum	Kerdas (biji)
Polygonum minus	Kesum
Sasbania grandiflora	Daun geti (sasbenia)
Sauropus androgynus	Cekur manis
Solanum melongena	Terung (Egg plant/brinjal)
Vitex zerumbet	Lamundi
Vitis repens	Riang-riang
Zingiber officinale	Halia (rizom muda)

APPENDIX 4

LIST OF TROPICAL TUBEROUS CROPS

Scientific Name	Local Name
Amorphophallus campanulatus (Roxb.) Bl. ex Decna	Ubi kekek
Amorphophallus variabilis Bl.	Kembang bangkai
Coleus parviflorus Benth.	Ubi keling
Colocasia esculenta (L.) Schott	Keladi
Colocasia gigantea (Bl.) Hook . f.	Keladi gajah
Dioscorea alata L.	Ubi
Dioscorea bulbifera L.	Ubi atas
Dioscorea esculenta (Lour). Burk	Ubi kemili
Dioscorea hispida Dennst.	Gadung
Dioscorea pentaphylla L.	Ubi sakai
Ipomoea batatas (L.) Lam.	Ubi keledek
Manihot esculenta Crantz	Ubi kayu
Merremia mammosa Hall. f.	Bidara upas
Pachyrrhizus erosus	Kacang bengkuang

JICA