

Adapting agriculture to climate change:  
collecting, protecting and preparing crop wild relatives

# Malaysia



# Seed Collecting Guide

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The content of this collecting guide is intended only as a general reference for future collecting missions; the contents and data within are not guaranteed to be complete, correct, timely, current or up-to-date at the time of publishing. For general information and resources on collecting crop wild relatives, visit [cwrdiversity.org](http://cwrdiversity.org).

### **Cover photos**

TOP LEFT: Sorghum, CREDIT: RBG Kew;

TOP RIGHT: Wild bananas, CREDIT: RBG Kew;

BOTTOM LEFT: *Ipomoea* seeds, CREDIT: Sheldon Navie;

BOTTOM RIGHT: Pigeonpea, CREDIT: Swathi Sridharan/ICRISAT.

This work was undertaken as part of the initiative “Adapting Agriculture to Climate Change” which is supported by the Government of Norway. The project is managed by the Global Crop Diversity Trust with the Millennium Seed Bank of the Royal Botanic Gardens, Kew, in partnership with national and international genebanks and plant breeding institutes around the world. It is implemented in accordance with the International Treaty on Plant Genetic Resources for Food and Agriculture. For further information see the project website: [www.cwrdiversity.org/](http://www.cwrdiversity.org/)

Many individual scientists, herbaria, genebanks and specialist institutes are contributing advice and information to the Project and these guides. The Project aims to collect the wild relatives of 29 key crops, conserve them in genebanks, and prepare them for use in plant improvement programs to breed new crop varieties adapted to future climates.



MILLENNIUM  
SEED BANK  
PARTNERSHIP



The boundaries and names shown on the maps included in this guide do not imply official endorsement or acceptance by the Adapting Agriculture to Climate Change Project. Data source: GADM, Version 1.0 via [diva-gis.org](http://diva-gis.org)

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The Harlan and de Wet Crop Wild Relatives Checklist was developed by Holly Vincent and Nigel Maxted at the University of Birmingham.

UNIVERSITY OF  
BIRMINGHAM

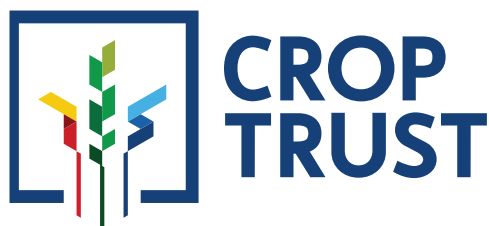


International Center for Tropical Agriculture  
Since 1967 *Science to cultivate change*

The Gap Analysis work which informed the list of species included in this guide, and all the map files, were produced by the Gap Analysis team at CIAT: Andy Jarvis, Nora Castañeda, Colin Khoury and Julian Ramirez-Villegas.

RBG Kew is involved in the research and collection phases of the project. This collecting guide was developed based on the work of the Millennium Seed Bank Enhancement Project Species Targeting Team.

Royal Botanic Gardens  
Kew



The Crop Wild Relatives Project is led by the Global Crop Diversity Trust. This work was undertaken as part of the initiative.

Specimen data was kindly provided to this project by many individuals and organisations who are listed on the website: <http://www.cwrdiversity.org/home/data-sources>

This data set will be made available for download. Please refer to the website for more information on this dataset.

This collecting guide has been compiled by:

**Ruth Harker**

Collecting Guide Compiler  
Conservation Science Department  
Herbarium, Library Art & Archives  
Royal Botanic Gardens, Kew

**Dr Ruth Eastwood**

Crop Wild Relatives Project Co-ordinator  
Millennium Seed Bank Partnership  
Conservation Science Department  
Royal Botanic Gardens, Kew

This collecting guide consists of species profiles and information sheets contained within this folder, alongside a CD which contains localities of the taxa in an excel file.

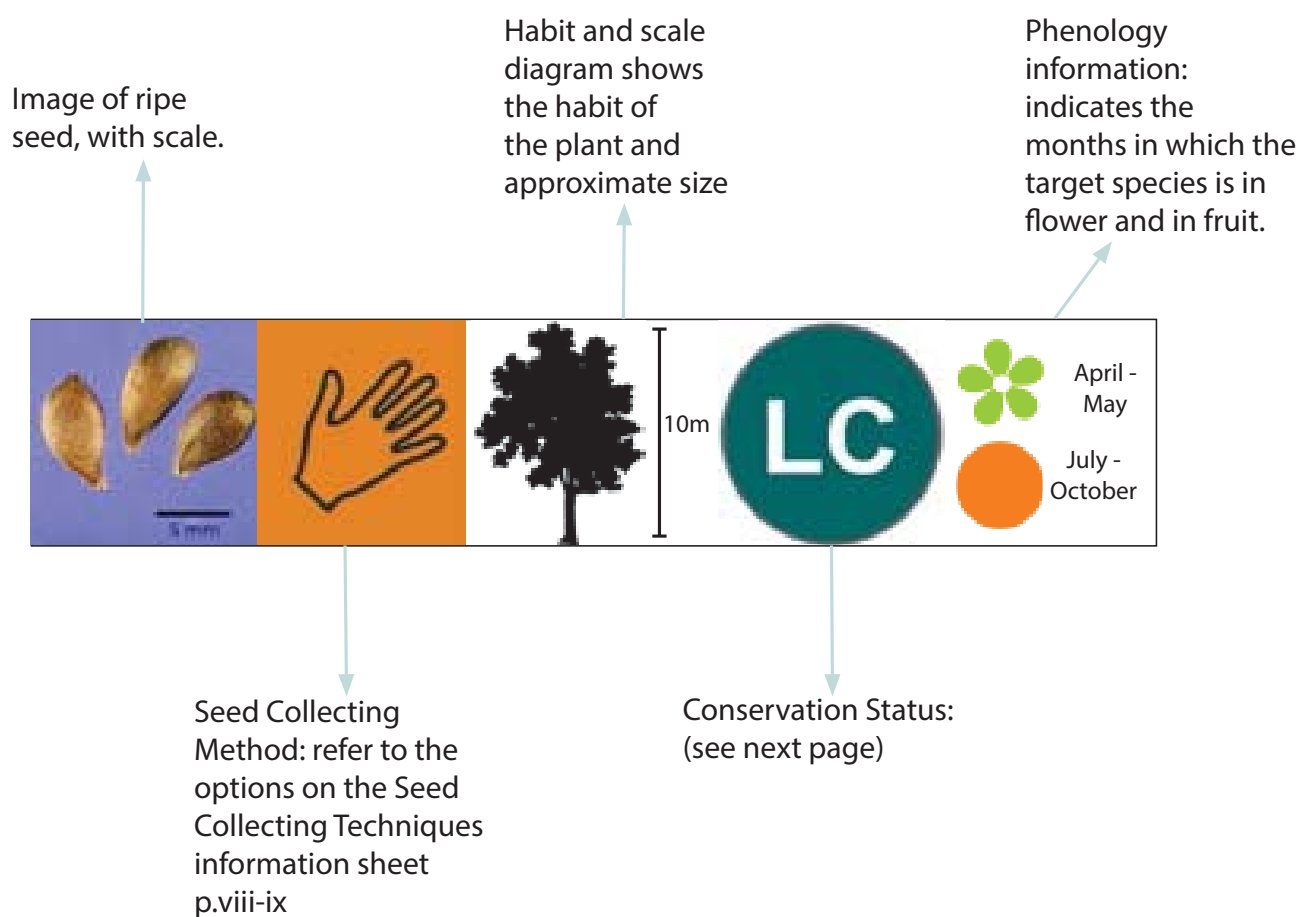
The species included in this guide are a selection of the wild relatives of the 29 key crops which this project covers (African Rice, Alfalfa, Apple, Bambara groundnut, Banana, Barley, Bread Wheat, Butter Bean, Carrot, Chickpea, Common Bean, Cowpea, Eggplant, Faba bean, Finger millet, Grasspea, Lentil, Oat, Pea, Pearl millet, Pigeon pea, Plantain, Potato, Rice, Rye, Sorghum, Sunflower, Sweet potato, Vetch). It is not a definitive guide to the Crop Wild Relatives in this country.

The guides are designed to be used both in the planning of a collecting trip, and also in the field.

At the front of this guide there is a phenology table showing the flowering and fruiting times of all the taxa to indicate which species may be found at a certain time of year, or when to collect target species.

Synonyms for each species are listed in the Appendix at the end of this guide.

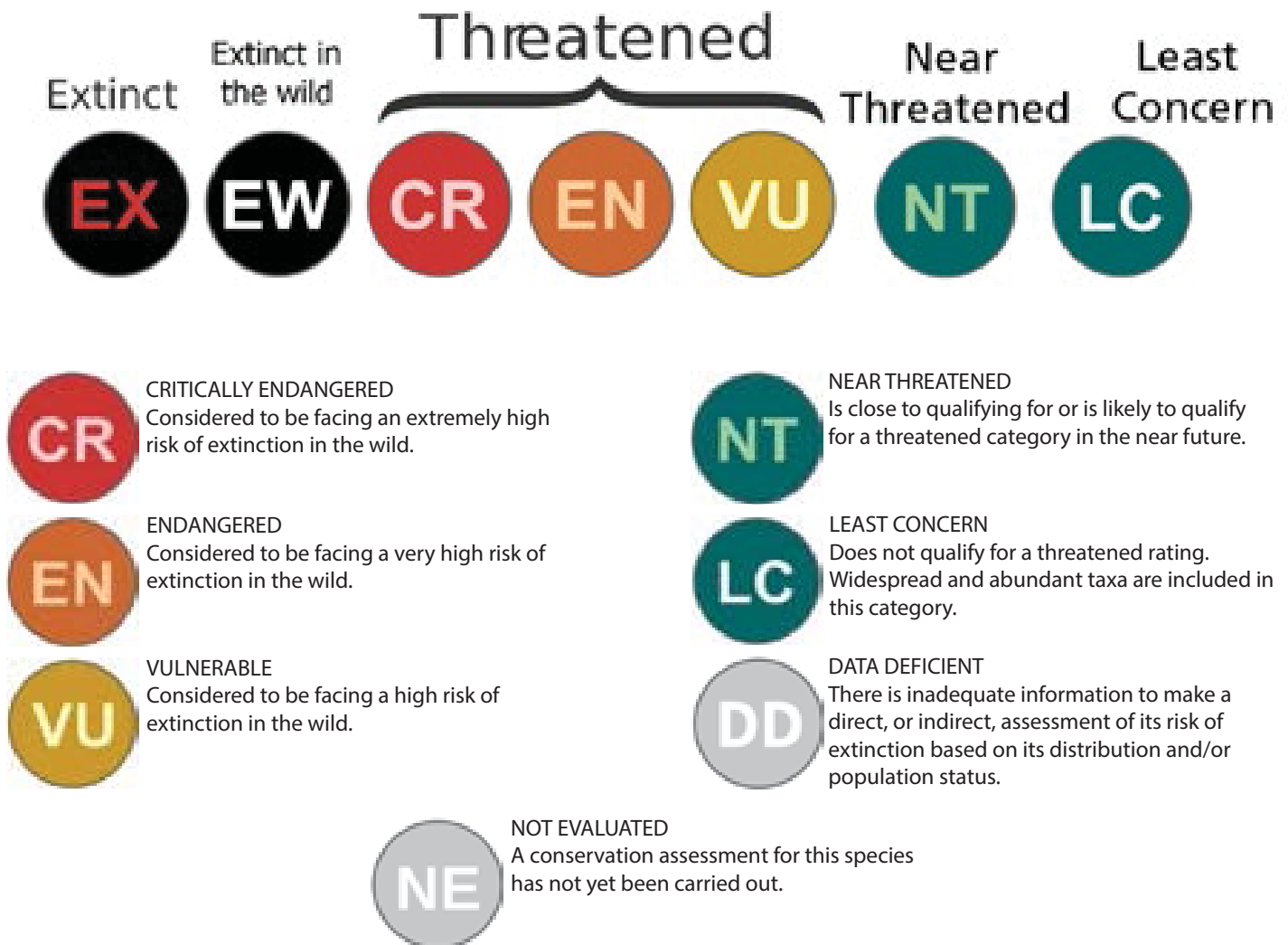
On each species profile, there is a collection of images to help identify the target species, accompanied by a series of symbols :



# Conservation Assessments

## Conservation Status:

Assessments are completed using 2001 IUCN Red List Categories and Criteria version 3.1 with the following categories:



Where a full conservation assessment has not been completed, a preliminary conservation rating may be indicated. Preliminary assessments are produced using specimen locality data and GIS, which calculates two parameters accepted by IUCN as suitable measures of range: namely extent of occurrence (EOO) and area of occupancy (AOO). These values derived for each species are then compared with thresholds set out by IUCN under Criterion B.

Where a preliminary conservation assessment has been calculated this is indicated by the word PRELIM:

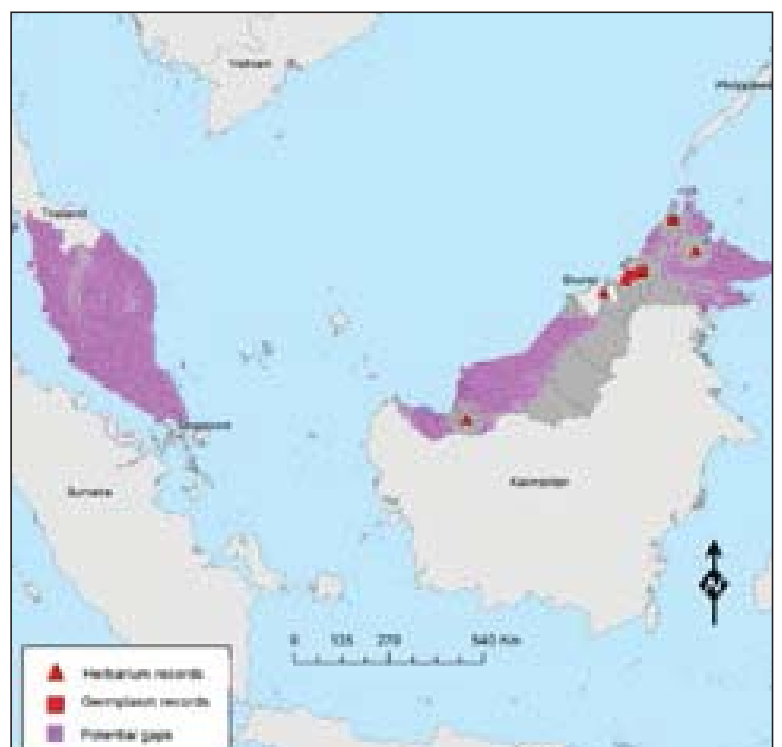


# Maps

Two maps are provided for each target species. The first map shows a point distribution of all the known localities of this species based on herbarium specimen records and existing data-sets. The area shaded on this map shows the predicted distribution based on Maxent.



The second map shows the potential gaps in gene bank collections, where seed collections should be targeted.



# Useful resources

The following resources are available online.

## Kew technical information sheets

- Assessing a potential seed collection:  
<http://brahmsonline.kew.org/Content/Projects/msbp/resources/Training/02-Assessing-population.pdf>
- Post-harvest handling of seed collections:  
<http://brahmsonline.kew.org/Content/Projects/msbp/resources/Training/04-Post-harvest-handling.pdf>

Other sheets covering the following topics are available from

<http://brahmsonline.kew.org/msbp/Training/Resources>

- Protocol for comparative seed longevity testing
- Measuring seed moisture status using a hygrometer
- Selecting containers for long-term seed storage
- Low-cost monitors of seed moisture status
- Small-scale seed drying methods
- Equilibrating seeds to specific moisture levels
- Identifying desiccation-sensitive seeds
- Seed bank design: seed drying rooms
- Seed bank design: cold rooms for seed storage
- Cleaning seed collections for long-term conservation

## ENSCONET seed collecting manual for wild species

[http://ensconet.maich.gr/PDF/Collecting\\_protocol\\_English.pdf](http://ensconet.maich.gr/PDF/Collecting_protocol_English.pdf)

## Seed conservation: turning science into practice

<https://academic.oup.com/aob/article/95/5/888/201951>

## Collecting plant genetic diversity: Technical guidelines (Bioversity)

[http://cropgenebank.sgrp.cgiar.org/index.php?option=com\\_content&view=article&id=390&Itemid=557](http://cropgenebank.sgrp.cgiar.org/index.php?option=com_content&view=article&id=390&Itemid=557)

## FAO – Commission on Genetic Resources for Food and Agriculture

<http://www.fao.org/nr/cgrfa/en/>

## IUCN Red List Categories and Criteria (Version 3.1)

<https://iucn-csg.org/red-list-categories/>

## Plants of the World Online

<http://plantsoftheworldonline.org/>

For more information about the Crop Wild Relatives Project and to access the Harlan and de Wet Crop Wild Relatives checklist, please visit the website:

[www.cwrdiversity.org](http://www.cwrdiversity.org)



# Identification Keys

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Interactive identification keys can be accessed using the links below.

[Kew Grassbase interactive identification key](http://www.kew.org/data/grasses-db/ident.htm)

<http://www.kew.org/data/grasses-db/ident.htm>

# Seed Collecting Techniques

Michael Way and Kate Gold, Seed Conservation Department

Seed collecting from wild plants requires care, resourcefulness and determination. There are many different collecting techniques. The most appropriate technique will depend on the species, particularly the type of dispersal unit (fleshy fruit, dry fruit, individual seeds etc). This information sheet outlines the manual techniques most commonly used to make seed collections of adequate quality and quantity, for long term conservation.

## Hand picking of whole fruits

The most basic and flexible of techniques, hand picking or plucking, has many benefits. Consider though, if you can use a more efficient technique.

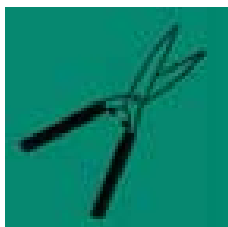


Plucking is particularly suitable when:

- target fruits can easily be selected by eye (e.g. due to colour or texture change of fruit coat, or swelling of fruit);
- non-target (e.g. immature or damaged) fruit cannot be excluded from the collection by more efficient techniques;
- fruits are easily accessible and collectors can tie buckets or similar containers around the waist, releasing both hands for collecting;
- collecting many-seeded fleshy or dry indehiscent fruits; and
- making small seed collections.

## Pruning clusters of fruit

This technique is typically used to collect tree seeds. Cut groups or clusters of fruits using secateurs or tree pruners. Assess for ripeness and damage before adding seeds to the collection.

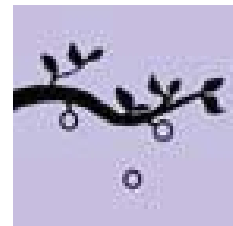


This is a very effective technique when:

- seed is clustered at the distal (terminal) parts of branches;
- the species is abundant and a small associated loss of branch and foliage is acceptable;
- seed is beyond reach of the collectors and has to be obtained using tree pruners.

## Shaking branches

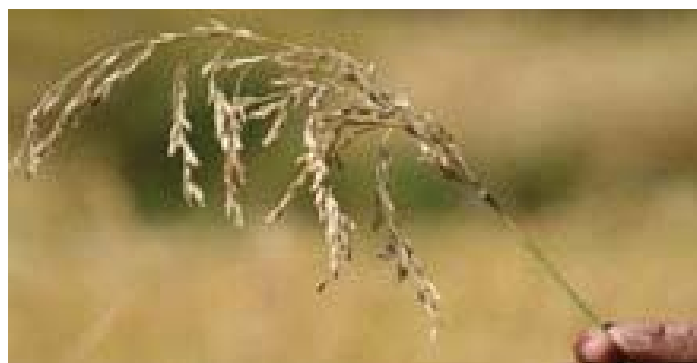
Careful shaking of branches will sometimes dislodge the best available seed, which can be collected in buckets or on a tarpaulin held or spread out beneath the plant. Start with gentle taps, and carefully check each sample of seed dislodged. Light shaking will often dislodge fully ripe fruits and seeds, leaving immature, poorly developed and damaged seeds to be retained on the parent plant. Too-heavy beating of branches may cause damage to the tree, and may also dislodge other plant material and associated insects, necessitating additional cleaning of the collection.



Shaking branches may be useful when collecting:

- dehiscent fruits with medium large seeds;
- seeds with irritant plumes (e.g. *Cercocarpus* of the Rosaceae);
- spiny trees such as *Prosopis* (Fabaceae);
- on level, open terrain suitable for tarpaulin use.

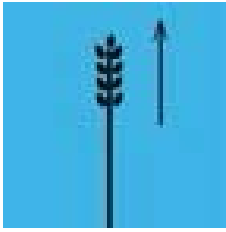
This technique may not be suitable for light, plumed seed from Bombacaceae and Asclepiadaceae, which may be carried away by air currents.



ABOVE: Stripping seed heads may be appropriate for grasses  
Credit: Global Crop Diversity Trust/Britta Skagerfält

## Stripping entire seed-heads

This is a popular technique for collecting seed from grasses and may be suitable for other species with erect inflorescences (seedheads). Grasp the seedheads at the base with a gloved hand and slide the hand upwards, dislodging many or all of the seeds. This technique may introduce a proportion of immature seeds into the collection. Such seeds might need further postharvest ripening which can be time consuming and is best avoided.

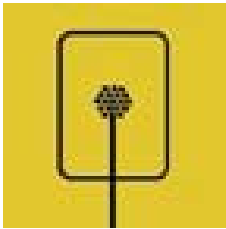


The stripping technique is most suitable for:

- dense, mono-specific stands of target species with no weed or other species present; and
- inflorescences which are completely and consistently at the natural dispersal stage.

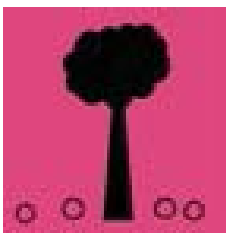
## Bagging seed-heads

If there is frequent access to the collecting site, and if seeds would otherwise be lost, fix a well-tied mesh bag loosely over pre-dispersal seed heads. Seeds are captured as soon as they are shed, and can be periodically removed. This has been successfully used on a small scale, e.g. for collecting *Fouquieria* sp.



## Collecting from the ground

You will frequently find seeds on the ground below trees or shrubs, but they will often be damaged by pests or pathogens. The seeds may have been on the ground for several months, and could even date from the previous year. Such seed will have aged and life-span in storage will be reduced. Inspect the seed carefully, noting any variation in the fruit, seed coat and internal tissues.



In general, only collect from the ground when:

- the parent tree(s) can be determined without doubt;
- you are certain that you are collecting recently dispersed seeds;
- seeds have not suffered significant damage from pests or pathogens; and
- other techniques or collecting options are unsuitable.

## Collecting fleshy fruits

- Collect fleshy fruits directly into strong plastic bags or tubs with as much air as possible.
- Pack the bags in a rigid plastic container to ensure that the fruits are not squashed and help prevent them getting too hot and fermenting during transit.
- You may need to remove the seeds from fleshy fruits either during or immediately after the field trip.



ABOVE Collecting small seeds into paper bags  
Credit: Ruth Harker/ RBG Kew

## Containers

Collect into buckets, cloth or paper bags, and check each person's sample carefully before combining into a single population collection.

Using buckets has the advantage of allowing you to monitor the quality of the collection whilst associated insects disperse freely.

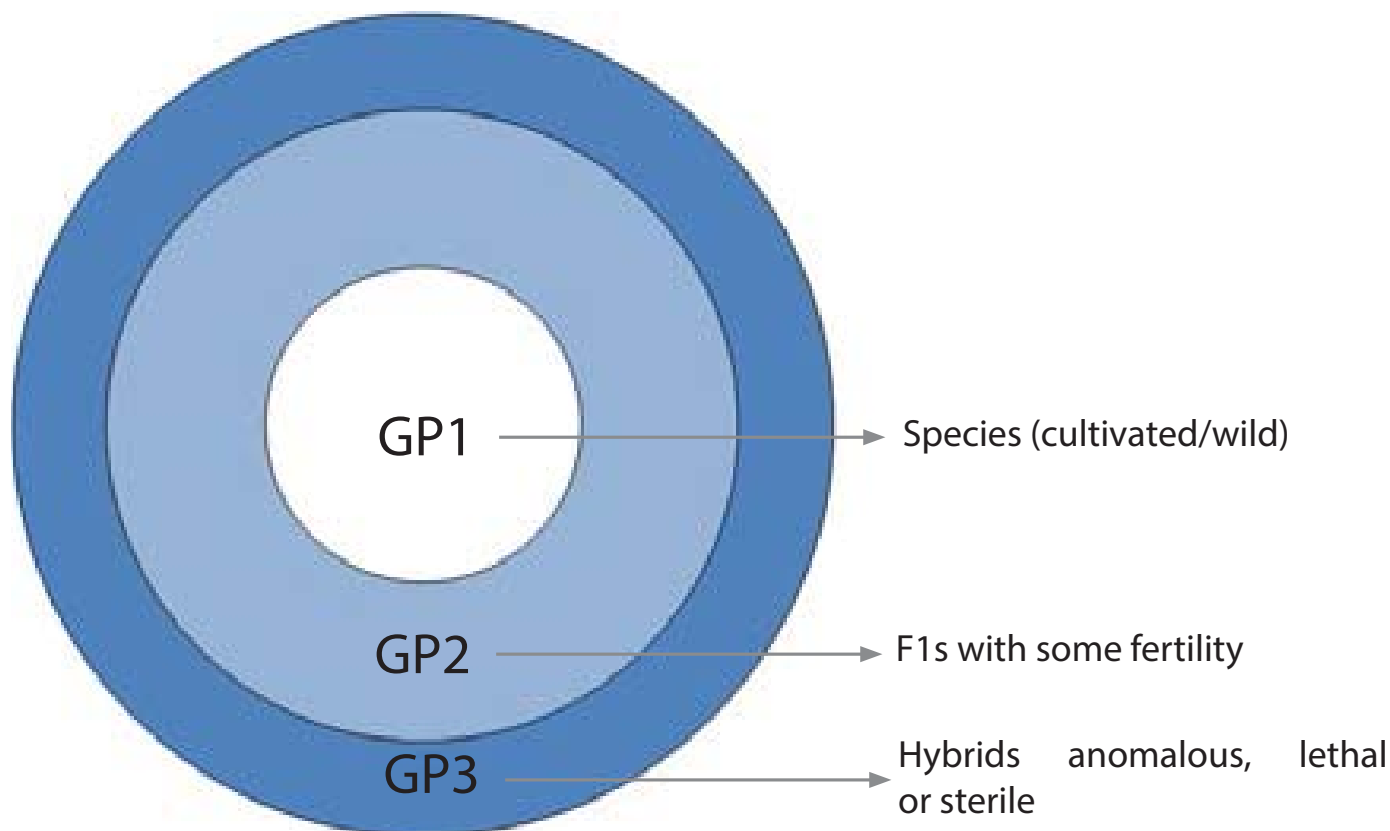
Place collections of dry, ripe seed into cloth or paper bags for transit. Store any awned seed or hooked fruit, that would damage or get stuck in cotton bags, in cardboard boxes or strong paper bags. Never collect or store seeds in plastic bags.

Label all seed containers inside and out with a unique collection number, and seal them securely. It is best to prepare sufficient labels before filling the containers.

Each target species in this guide is a wild relative of a crop. On each species profile it is indicated how closely related the target species is to the crop using either the Gene Pool concept or the Taxon Group concept. Species more closely related to the crop are higher priorities for collecting.

## Gene Pool Concept

Harlan and de Wet, 1971



## Taxon Group Concept

Maxted et al. 2006

Taxon Group 1 – cultivated/wild form of the crop

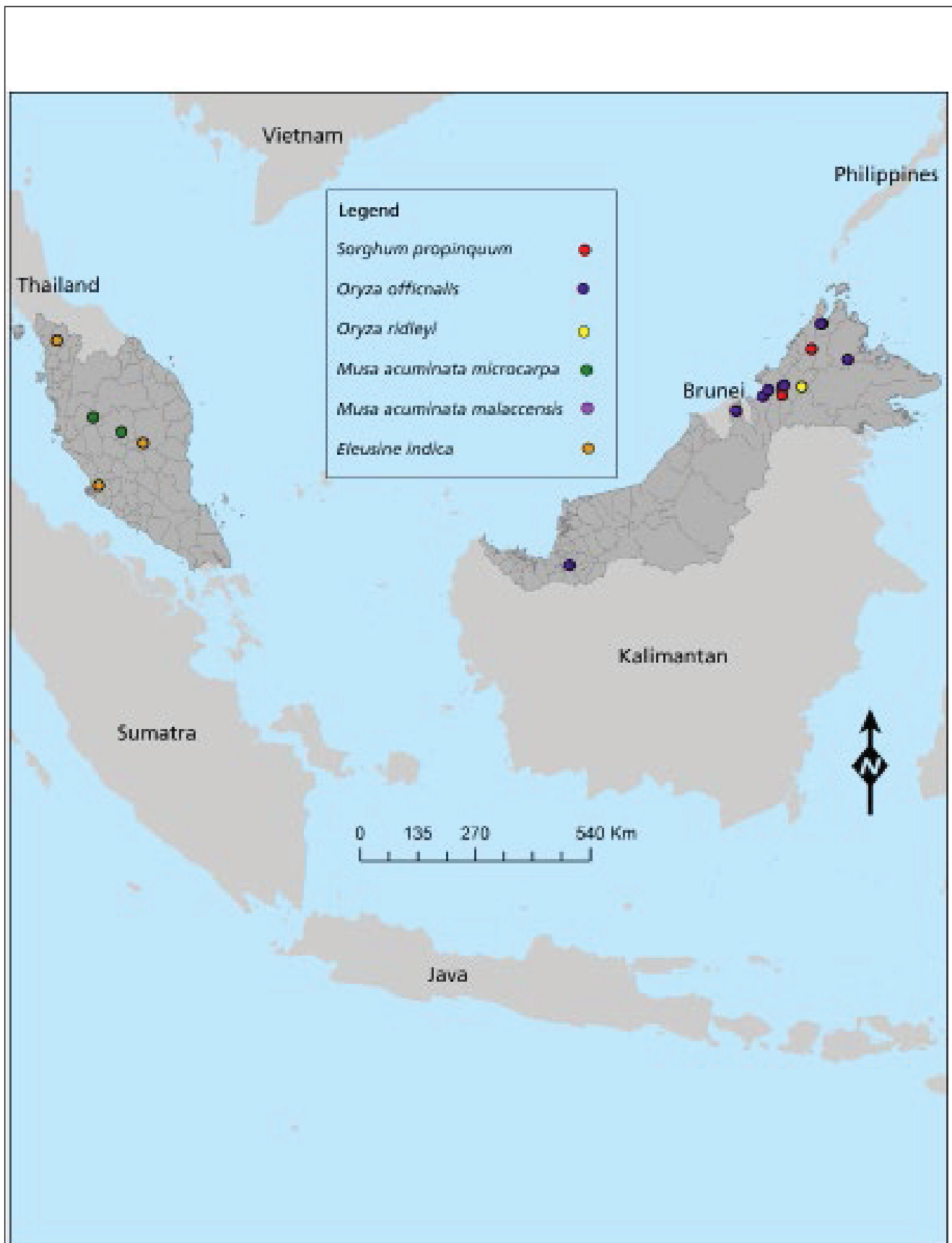
Taxon Group 2 – species in same series/section as crop

Taxon Group 3 – species in same subgenus as crop

Harlan, J. and J. de Wet (1971). Towards a rational classification of cultivated plants. *Taxon* 20: 509-517.

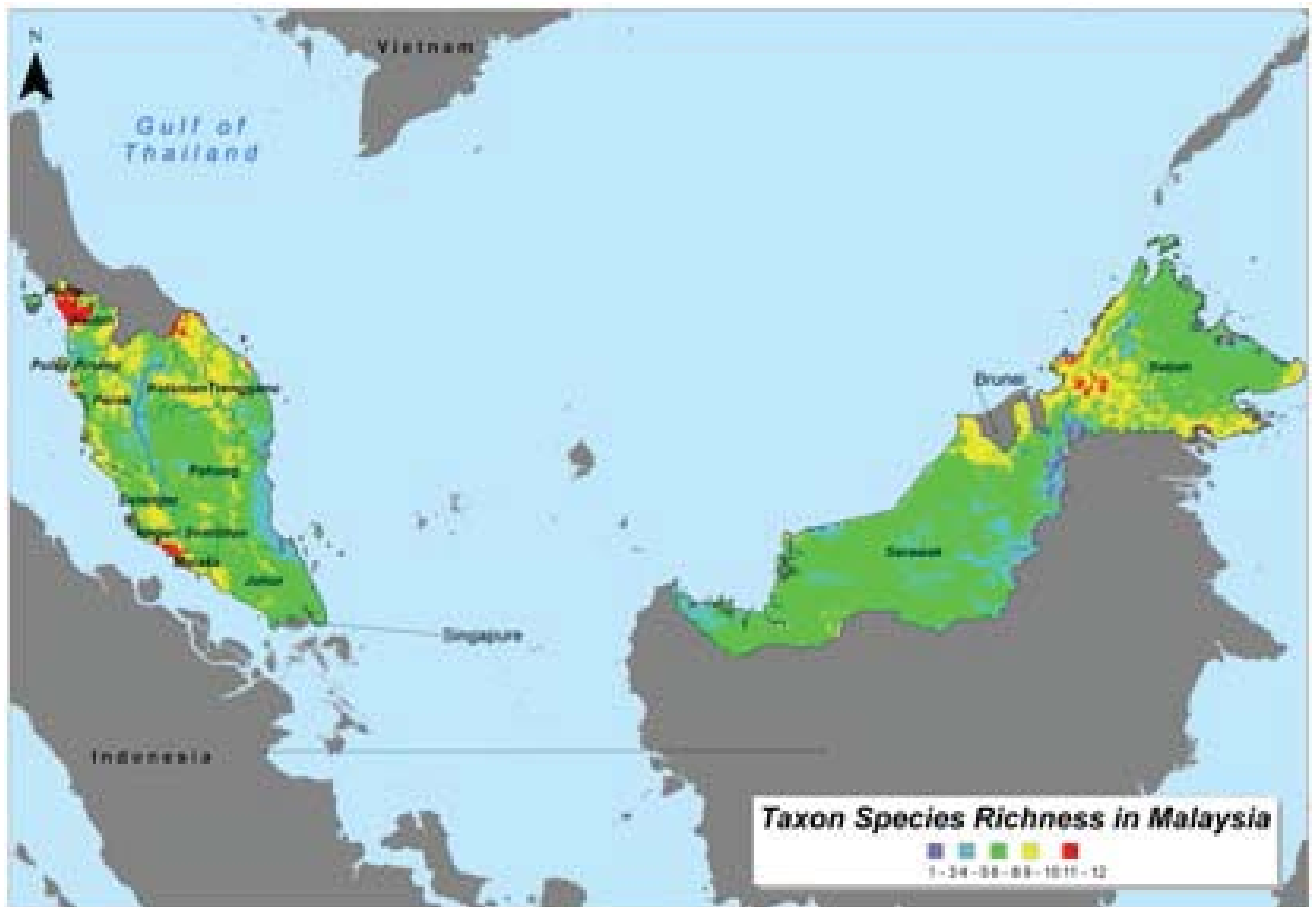
Maxted, N., B.V. Ford-Lloyd, S.L. Jury, S.P. Kell and M.A. Scholten (2006). Towards a definition of a crop wild relative. *Biodiversity and Conservation* 14: 1-13.

Known occurrences of all taxa in this guide, as a point distribution

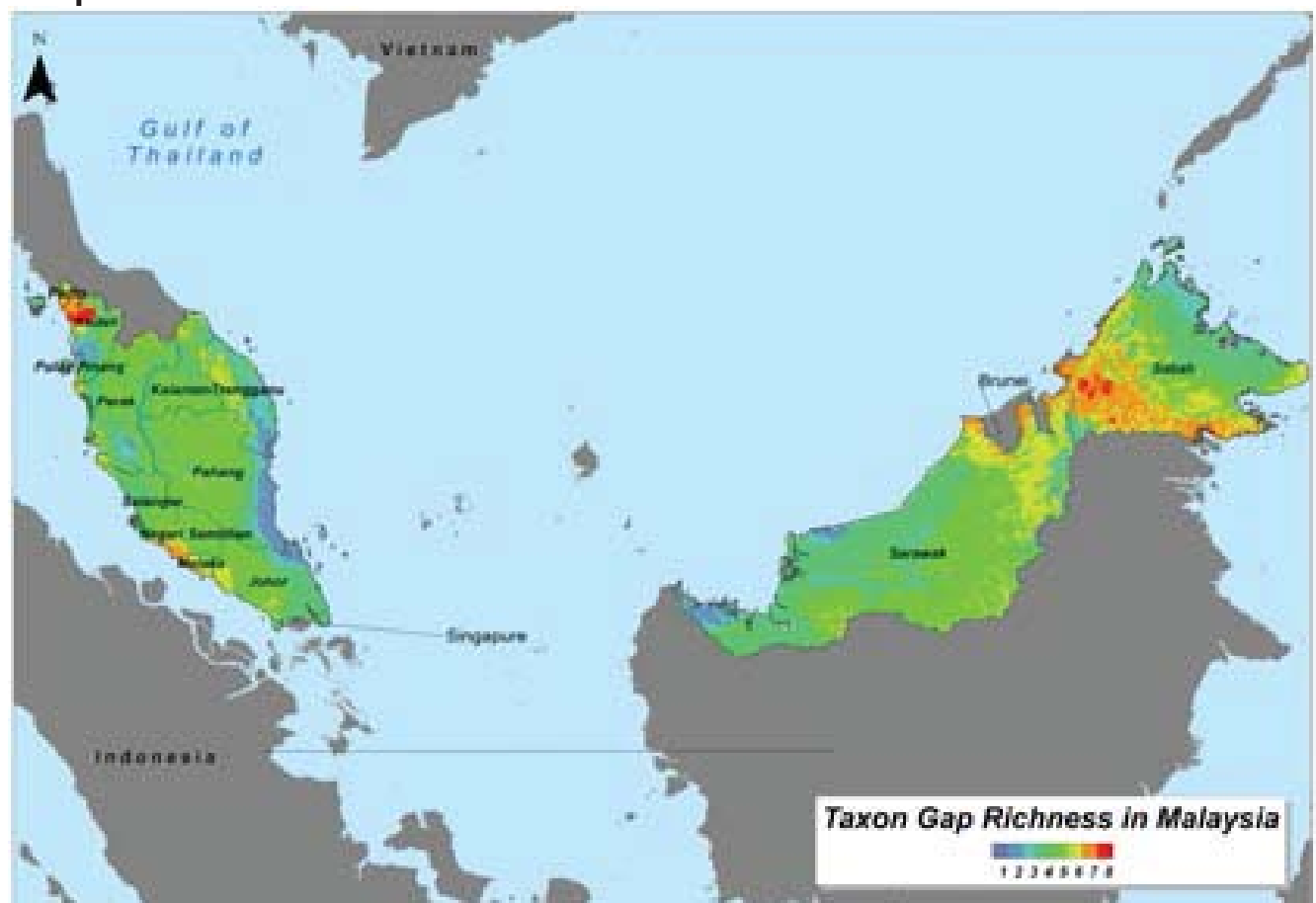


Occurrences in Malaysia of all taxa in this guide

## Species richness



## Gap richness



# Species in this guide

| Family         | Taxon   | Genepool          | Collection Priority | Sheet      |
|----------------|---|-------------------|---------------------|------------|
| Convolvulaceae | <i>Ipomoea cairica</i>  | Sweet potato      | Low                 | 1          |
| Convolvulaceae | <i>Ipomoea littoralis</i>   | Sweet potato      | High                | 2          |
| Convolvulaceae | <i>Ipomoea tiliacea</i>   | Sweet potato      | High                | 3          |
| Leguminosae    | <i>Cajanus crassus</i>  | Pigeon pea        | High                | 4          |
| Leguminosae    | <i>Cajanus goensis</i>  | Pigeon pea        | Low                 | 5          |
| Leguminosae    | <i>Cajanus scarabaeoides</i>                                      | Pigeon pea        | Low                 | 6          |
| Leguminosae    | <i>Vigna hosei</i>  | Bambara groundnut | Low                 | 7          |
| Musaceae       | <i>Ensete glaucum</i>   | Banana            | Low                 | 8          |
| Musaceae       | <i>Musa acuminata</i> subsp. <i>acuminata</i>                     | Banana            | High                | Table p 21 |
| Musaceae       | <i>Musa acuminata</i> subsp. <i>malaccensis</i>                   | Banana            | High                | Table p 21 |
| Musaceae       | <i>Musa acuminata</i> subsp. <i>malaccensis</i> var. <i>minor</i> | Banana            | High                | Table p 21 |
| Musaceae       | <i>Musa acuminata</i> subsp. <i>siamea</i>                        | Banana            | High                | Table p 21 |
| Musaceae       | <i>Musa acuminata</i> subsp. <i>truncata</i>                      | Banana            | High                | Table p 21 |
| Musaceae       | <i>Musa acuminata</i> var. <i>microcarpa</i>                      | Banana            | High                | Table p 21 |
| Musaceae       | <i>Musa balbisiana</i> var. <i>balbisiana</i>                     | Banana            | High                | 9          |
| Musaceae       | <i>Musa beccarii</i>  | Banana            | Low                 | 10         |
| Musaceae       | <i>Musa borneensis</i>  | Banana            | Low                 | 11         |
| Musaceae       | <i>Musa gracilis</i>  | Banana            | Low                 | 12         |
| Musaceae       | <i>Musa violascens</i>  | Banana            | Low                 | 13         |
| Poaceae        | <i>Oryza meyeriana</i> var. <i>granulata</i>                      | Rice              | Low                 | 14         |
| Poaceae        | <i>Oryza meyeriana</i> var. <i>meyeriana</i>                      | Rice              | Low                 | 15         |
| Poaceae        | <i>Oryza officinalis</i>  | Rice              | Low                 | 16         |
| Poaceae        | <i>Oryza ridleyi</i>  | Rice              | Low                 | 17         |
| Poaceae        | <i>Sorghum propinquum</i>   | Sorghum           | High                | 18         |
| Solanaceae     | <i>Solanum cumingii</i>   | Sorghum           | High                | 19         |
| Solanaceae     | <i>Solanum virginianum</i>  | Sorghum           | Low                 | 20         |





| Taxon  | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <i>Musa beccarii</i>                         |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Musa borneensis</i>                       |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Musa gracilis</i>                         |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Musa violascens</i>                       |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Oryza meyeriana</i> var. <i>granulata</i> |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Oryza meyeriana</i> var. <i>meyeriana</i> |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Oryza officinalis</i>                     |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Oryza ridleyi</i>                         |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Sorghum propinquum</i>                    |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Solanum cumingii</i>                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <i>Solanum virginianum</i>                   |     |     |     |     |     |     |     |     |     |     |     |     |

KEY



Species in flower



Species in fruit

data gathered from literature and herbarium specimens

Wild relative of sweet potato

Morning glory, Mile-a-minute vine

**HABIT:** Perennial herb with twining and trailing stems, reaching up to 5 m. Roots tuberous and plant rooting at nodes. Plants hairless.

**LEAVES:** Round in outline, 3-10 cm long and wide, deeply 5-segmented with basal segments often lobed; leaf stalk 2-6 cm long.

**INFLORESCENCE:** Axillary, 1-3 flowered.

**FLOWER:** Corolla fused, funnel-shaped, 3.5-6 cm long, 6-8 cm wide, violet (rarely white), with darker violet hairless mid-petal bands, throat usually darker. Stamens and style included in flower tube. Calyx 0.4-0.8 cm long.

**FRUIT:** An almost globe-shaped capsule, 9-12 mm wide, with 2 chambers, splitting into 4 valves, contains up to 4 seeds.

**SEEDS:** Dark brown to black, 5-6 mm long, flattened ovoid, hairy with pale brown long hairs on outer ridges.

**Habitat:**

A common inhabitant of swampy grassland, riverine edges and roadsides, where it may cover extensive areas.

**Distribution:**

Throughout tropical Africa; also from the eastern Mediterranean region through Asia to Taiwan.

**Altitude:** Up to 1650 m

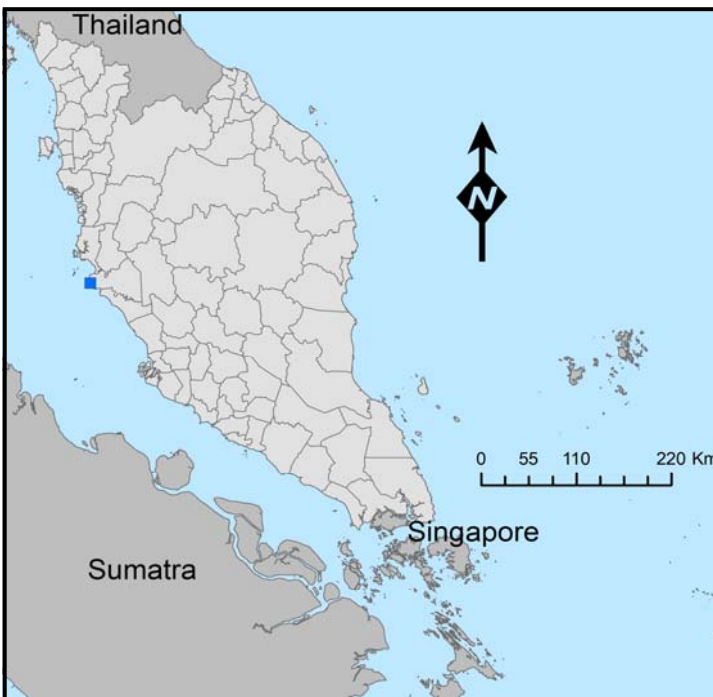
*Ipomoea cairica*

May be confused with:  
*Ipomoea batatas*

Deeply 5(-7)-lobed leaves.



Leaves entire.



All populations priority  
for collection.

**References:** Hyde, M.A., Wursten, B.T., Ballings, P. & Dondeyne, S. (2013). Flora of Mozambique: Species information: *Ipomoea cairica* var. *cairica*. [http://www.mozambiqueflora.com/speciesdata/species.php?species\\_id=147580](http://www.mozambiqueflora.com/speciesdata/species.php?species_id=147580), retrieved 22 May 2013; Thorp, J.R., Wilson, M, Weeds Australia - [www.weeds.org.au](http://www.weeds.org.au)

CONVOLVULACEAE

Wild relative of sweet potato

*Ipomoea cairica* (L.) Sweet

Morning glory, Mile-a-minute vine



Steve Hurst @ USDA-NRCS PLANTS Database



up to 5 m



Nov - Jul

Nov - Jul

**HABIT:** Perennial herbs, stems prostrate, rooting at nodes, or twining, slender, mostly glabrous.

**LEAVES:** Petiole 0.5-7 cm, leaf blade ovate to oblong, occasionally circular or reniform, 5-10 x 1-7.5 cm, glabrous or nearly so, base cordate, margin entire or minutely undulate to angular, or  $\pm$  3-lobed, apex acute, obtuse or emarginate, mucronulate.

**INFLORESCENCES:** Usually 1- flowered, occasionally few-flowered, peduncle 0.1-3 cm; bracts early deciduous, 1-2 mm, pedicel 1-4 cm, glabrous; calyx unequal, glabrous, outer 2 lobes concave, oblong-elliptic, 6-10 mm, apex acute to obtuse, inner 3 lobes elliptic to nearly circular, 0.8-1.2 cm; corolla pink or pink-purple, with a darker center, funnelform, 3-4.5 cm, glabrous; stamens included, filaments unequal, glandular pubescent on basal 1/2; pistil included, ovary glabrous; stigma 2-lobed.

**FRUIT:** Capsule depressed-globose, 5 x 6-10 mm, calyx lobes persistent at base. Seeds up to 4 per fruit, black, ovoid, 3.5-4 mm, glabrous.

**Habitat:**

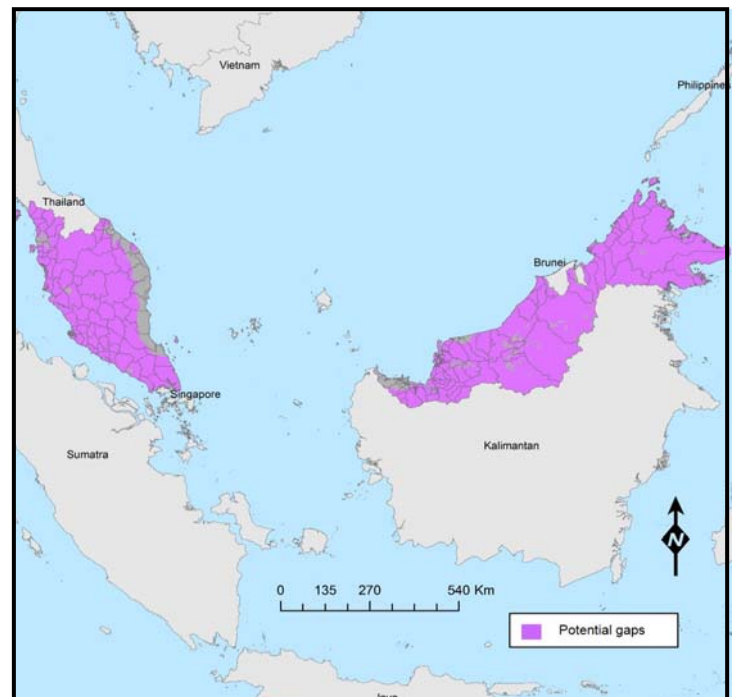
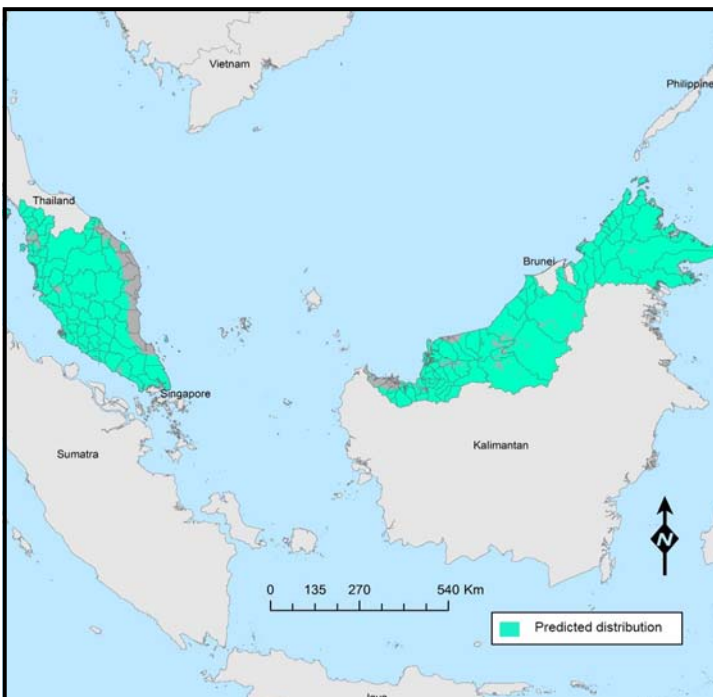
Sandy seashores, coastal thickets, forest floors.

**Distribution:**

Hainan (Nanhai Zhudao), Taiwan, Cambodia, India, Indonesia, Japan (Ryukyu Islands), Malaysia, Myanmar, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Africa, N Australia, Pacific Islands.

**Altitude:** 0 - 100 m

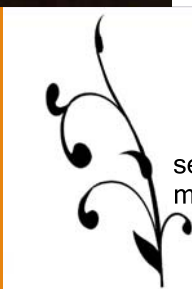
|   |   |
|---|---|
| <i>Ipomoea littoralis</i>   | May be confused with:<br><i>Ipomoea batatas</i> |
| Perennial. Although flowers similar size, pedicels are longer 1-4 cm. | Annual. Flowers with pedicel 0.2 - 1 cm.        |



**References:** Flora of China [http://www.efloras.org/florataxon.aspx?flora\\_id=2&taxon\\_id=210000740](http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=210000740)



No seed image available



several m long



Jan - Jul

No data

**HABIT:** Stems twining, slender, several metres long, glabrous or hirsute, lignescent.

**LEAVES:** Ovate, 5-15 by 3-10 cm, cordate at the base, acuminate, with an acute or mucronulate acumen, mostly entire, glabrous or appressed-pilose; petiole slender, 3-7 cm.

**INFLORESCENCES:** Axillary; peduncles solitary or in pairs, as long as, or often longer than the petiole, 4-15 cm, cymosely few- to several-flowered. Pedicels 5-12 mm. Bracts minute, narrow-lanceolate.

**FLOWERS:** Sepals glabrous or sparsely fimbriate at the margins, nearly equal in length or the outer ones shorter; outer sepals oblong or ovate-lanceolate, acute, mucronulate, 5-10 mm long, inner ones elliptic, acute or obtuse, often with a less distinct mucronate, to 10 mm long. Corolla funnel-shaped, ca 4-6 cm long, glabrous, pink or purple, often with a darker centre, or rarely white. Stamens and style included; filaments sparsely pubescent nearly to the apex. Ovary glabrous.

**FRUITS:** Capsule globular, 2-celled, 4-valved.

**SEEDS:** 4, glabrous or pilose along the edges.

**Habitat:**

In open anthropic areas, grasslands, savannas and edges of forests in the Amazon Rainforest, Caatinga, Cerrado, and Atlantic Rainforest phytogeographic domains.

**Distribution:**

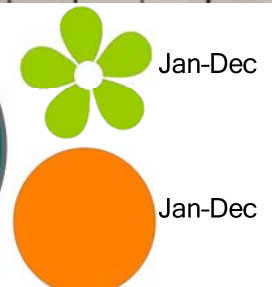
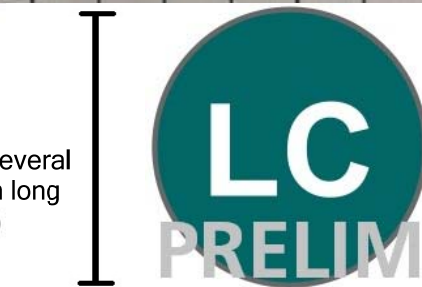
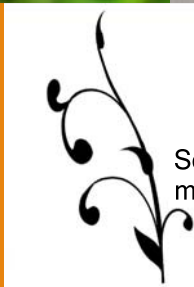
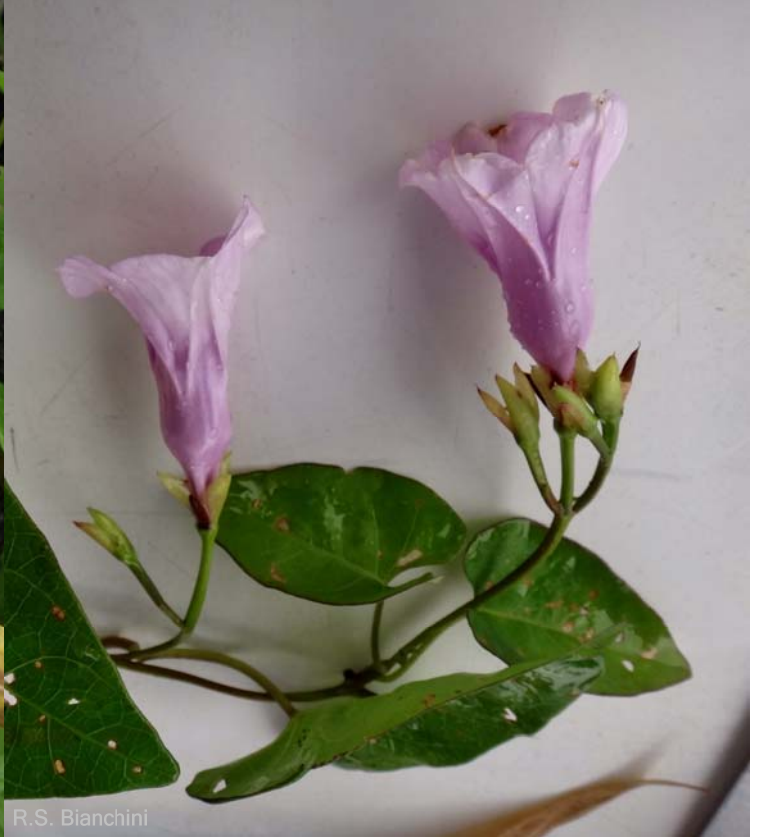
Native to Australia and New Zealand, South Eastern Asia, and the Caribbean, Central and South America. In Brazil in the North (AM, PA, RO, RR, TO); Northeast (BA, CE, MA, PE, SE); Central West (DF, GO, MS, MT); Southeast (ES, MG, RJ, SP), and South (PR, SC).

**Altitude:** 0 - 1050 m

|  |  |
|--|--|
| <i>Ipomoea tiliacea</i>                            | May be confused with:<br><i>Ipomoea batatas</i>            |
| Corolla funnel shaped 4-6 cm.<br>Capsule globular. | Corolla funnel shaped 3-4.5 cm. Capsule depressed globose. |

Reported from  
Malaysia, but no  
localities known.

All populations priority  
for collection.



Tertiary Gene Pool relative of *Cajanus cajan* (L.) Millsp.

**HABIT:** Perennial climbers, supported by trees. Branches brownish pubescent (hairs very short), terete, firm, length up to 10 m. Stipules minute, ca 1 mm, triangular, caducous.

**LEAVES:** Pinnately trifoliolate, petiole 4-11 cm, rachis 0.3-1 cm. Leaflets coriaceous, thick, lower surface brownish pubescent, also on the thick prominent ribs, glandular-punctate, upper surface dark green, thinly puberulous especially on the veins; top leaflet subtrapezoid, acuminate, 3.5-10 cm long, 3-9.5 cm wide, below the middle narrowing to the rounded or cordate base, apex acuminate-cuspidate, side leaflets obliquely so, 3.5-10 cm long, 2.5-7.5 cm wide, petiolules 2-3 mm.

**INFLORESCENCE:** Racemes crowded, 3-6 cm, up to ca 20 flowers, 1-2 flowers per node.

**FLOWER:** Corolla yellow, marcescent, pedicels 4-10 mm, in fruit firm. Bracts large, elliptic-ovate, apex obtuse, fringed or acute, 10-15 mm long, 6-12 mm wide, thinly pubescent, caducous. Calyx pubescent (interior also), tube 4-6 mm, teeth triangular, shorter than the tube.

**FRUIT:** Pods sturdy, oblong, ends rounded acuminate, 2.5-5 cm long, 0.8-1.4 cm wide, (4-)5-6 seeds, shortly puberulous, sticky, transverse depressions oblique or straight, deep when fully developed.

**SEEDS:** Rectangular-rounded, ca. 4-5 mm long and wide, 3 mm thick, black with cream mosaic, or cream, strophiole 1 x 2.5 mm, divided, yellowish white.


**Habitat:**

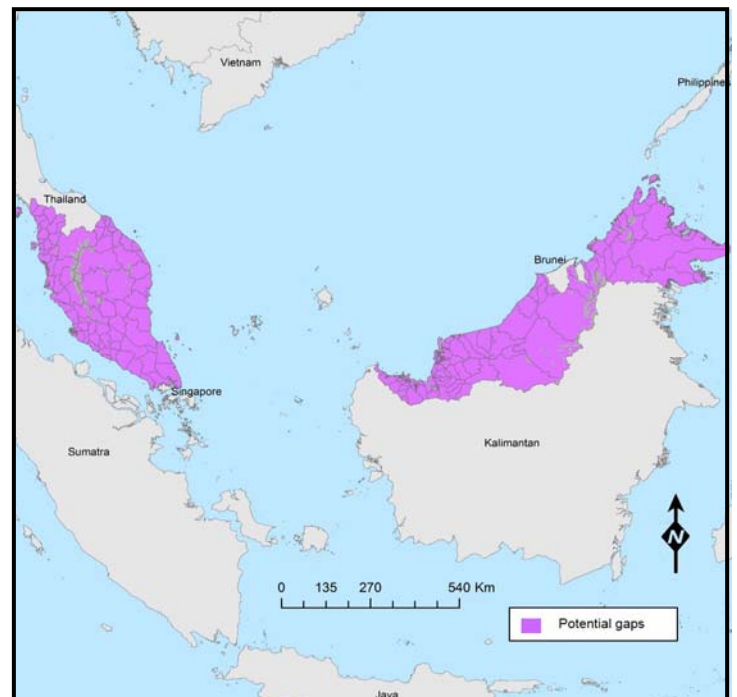
Climber in trees of dry forests (sal, teak, pine) or shrub vegetation, along streams or on dry soils, on alluvium, loam schists, granite rocks.

**Distribution:**

China, Papua New Guinea, Southcentral and Southeastern Asia.

**Altitude:** 0 - 800 m

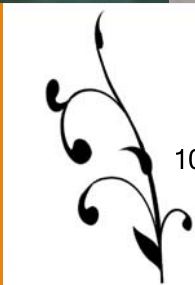
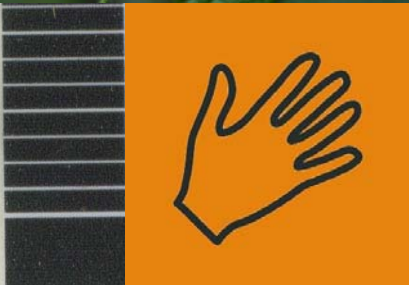
|                               |   |
|-------------------------------|---|
| <i>Cajanus crassus</i>        | May be confused with:<br><i>Cajanus goensis</i>   |
| End of pod rounded acuminate. | Apex of pod beaked.  |



**References:** van der Maesen, L.J.G. (1985). *Cajanus* DC. and *Atylosia* W. & A. (Leguminosae). A revision of all taxa closely related to the pigeonpea, with notes on other related genera within the subtribe Cajaninae. Wageningen Papers 85-4.



Tertiary Gene Pool relative of *Cajanus cajan* (L.) Millsp.



LC  
PRELIM  
Jan - Mar  
Jan - Mar  
4

Gene Pool 3 relative of *Cajanus cajan* (L.) Millsp.

**HABIT:** Vines, woody, twining, to several meters tall, yellow-brown villous except for corolla. Stems densely hairy when young, later glabrescent, to dark brown. Stipules ovate-lanceolate, 7-12 mm, persistent.

**LEAVES:** Pinnately trifoliolate, terminal leaflet ovate to ovate-elliptic, 5-10 × 3-5.5 cm, densely villous when young, later glabrescent, base rounded, apex acuminate with hard mucro. Petiole 3-7 cm long.

**INFLORESCENCES:** Peduncle a few centimetres long, bracts ovate, densely villous. Flowers ca. 3 cm long, pedicels slender, 11-15 mm; calyx campanulate, lobes linear-lanceolate, lowest lobe ca. 2 × as long as tube; corolla yellow, standard obovate-elliptic, ca. 2.8 cm, base with an inflexed auricle on each side, apex slightly emarginate, wings broadly elliptic, base with auricle on one side, keels sickle shaped, slightly shorter than wings, clawed, without auricle. Ovary linear, densely villous, style long, curved, glabrous, stigma capitate.

**FRUIT:** Pod long elliptic, 4-6 × ca. 1 cm, straight, densely villous, apex beaked.

**SEEDS:** 5-7, brown, subspherical, ca. 4 mm in diam., wider than long; strophiole acute and white, succulent.


**Habitat:**

Roadsides, river valleys.

**Distribution:**

China, Bangladesh, India, Indonesia, Laos, Malaysia, Myanmar, Thailand, Vietnam.

**Altitude:** 1000 - 1300 m

|  |   |
|--|---|
| <i>Cajanus goensis</i>   | May be confused with:<br><i>Cajanus crassus</i> |
| Apex of pod beaked.<br> | End of pod rounded acuminate.                   |

Reported from  
Malaysia, but no  
localities known.

All populations priority  
for collection.

**References:** Flora of China [http://www.efloras.org/florataxon.aspx?flora\\_id=2&taxon\\_id=242309513](http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=242309513)

Gene Pool 3 relative of *Cajanus cajan* (L.) Millsp.



No seed image available



several m long



Jan - Feb

Feb - Jul

Secondary Gene Pool relative of *Cajanus cajan* (L.) Millsp.**HABIT:** Perennial, woody, creepers or twiners, stems to 2 m. Stems slender, ± pubescent.**LEAVES:** Pinnately 3-foliolate; stipules small, ovate, hairy, usually deciduous; petiole 1-2 cm; stipels absent; petiolules extremely short; leaflets papery or nearly leathery, with glandular spots, sparsely pubescent on both surfaces, denser abaxially, basal veins 3, obviously convex below; terminal leaflet elliptic or obovate-elliptic to obovate, 1.2-4 × 0.8-1.5(-3) cm, apex obtuse or rounded; lateral leaflets smaller, obliquely elliptic to obliquely obovate.**INFLORESCENCE:** Raceme axillary, usually less than 2 cm, 1-5-flowered; peduncle 2-5 mm, densely brown to dull brown villous.**FLOWER:** Calyx campanulate, 5-lobed, or 4-lobed with upper 2 incompletely connate, lobes linear-lanceolate. Corolla yellow, ca. 1 cm, usually deciduous, standard obovate, with emarginate auricle and claw at base, wings narrowly elliptic, slightly curved, base auriculate, keels curved at apex, densely very pale brown villous. Ovules several.**FRUIT:** Pod oblong, 1.5-2.5 × 0.4-0.6 cm, leathery, densely villous, transversely constricted between seeds.**SEEDS:** 2-7, dark brown, ellipsoidal, ca. 4 mm, strophiole convex.**Habitat:**

Fields, roadsides, grassy slopes, coastal areas.

**Distribution:**

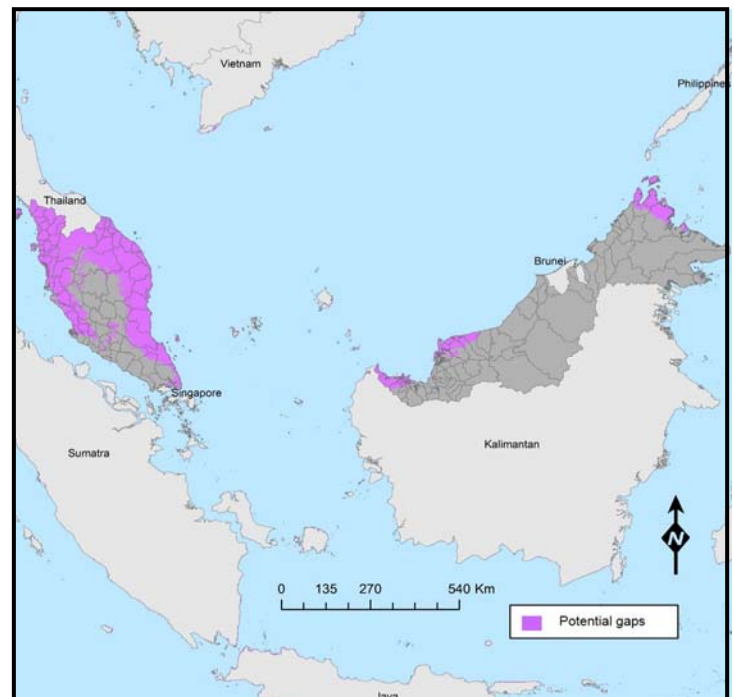
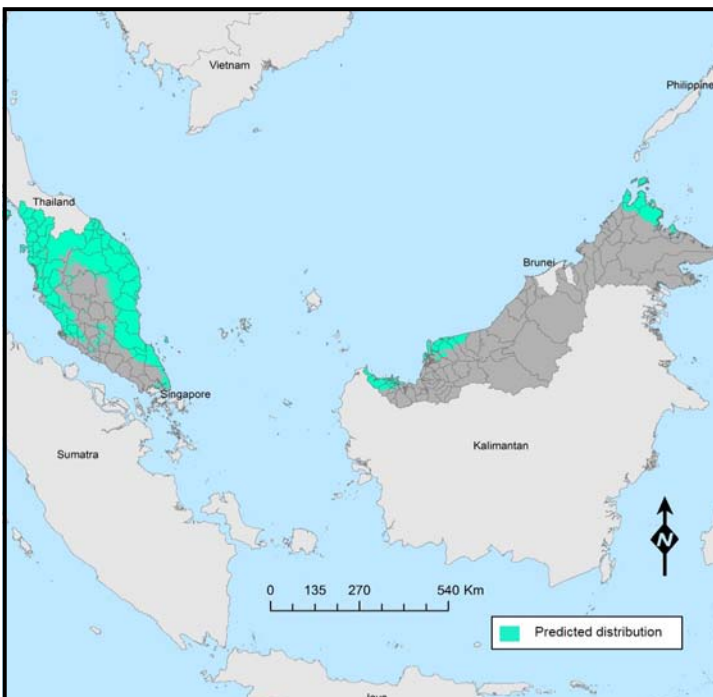
China, Bangladesh, Bhutan, Cambodia, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam; Africa, Oceania.

**Altitude:** 100 - 1500 m*Cajanus scarabaeoides*

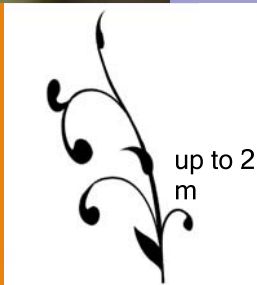
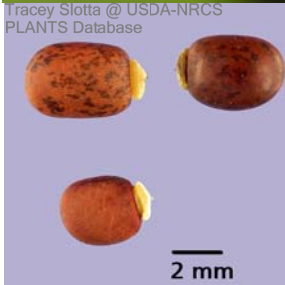
Perennial creepers or twiners; leaflets small (1.2-4 cm long), elliptic to obovate; pods narrow (0.4-0.6 cm wide), slightly rounded in cross-section.

May be confused with:  
*Cajanus platycarpus*

Annual creepers; leaflets larger (3-8 cm long), ovate; pods broad (1-1.5 cm wide), flattened in cross section, papery.

**References:** Flora of China, Volume 10, p232 via [www.efloras.org](http://www.efloras.org) [http://www.efloras.org/florataxon.aspx?flora\\_id=2&taxon\\_id=242309519](http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=242309519)

Secondary Gene Pool relative of *Cajanus cajan* (L.) Millsp.



**HABIT:** Annual or perennial, creeping. Stem glabrous to villous, hairs up to 0.8 mm.

**LEAVES:** Leaflets 3, 1.5-9 × 1.5-2.5 cm, obtuse and mucronulate at the apex, rounded-obtuse at the base, pubescent; petiole 1.5-8 cm; rhachis 0.2-1.5 cm; stipules 2.5-3 × 0.8 mm, bilobed at the base with lobes unequal, 3-nerved. Peduncle 2-8 cm × 0.2-0.8 mm, slightly pubescent; rhachis 0-2 cm long, 1-12-noded, internodes 2-3 mm.

**FLOWER:** Yellow, 7-8 × 7-10 mm; pedicel 1-3 mm, expanding as pod matures; bracteoles c. 1 mm, 1-nerved. Calyx slightly pubescent; tube c. 1 mm; lobes deltate, 0.8-1 mm, lower as long as the laterals, upper united in a rounded and emarginate lip. Standard with two U-shaped appendages; keel slightly twisted towards the left, without beak. Ovary 3-4-ovuled.

**FRUIT:** Pod 2-3 cm × c. 4 mm, linear-cylindrical, slightly curved, with short curved beak.

**SEED:** c. 5 × 3 mm; hilum 2 mm, almost central; rim aril reduced, not excentric.

**Habitat:**

Usually in disturbed areas and roadsides

**Distribution:**

Naturalized in coastal plains from Kenya to Mozambique, around Lake Victoria, and maybe elsewhere in Africa

**Altitude:** 21 - 1200 m

*Vigna hosei*

May be confused with:  
*Vigna parkeri*

Yellow flowers.

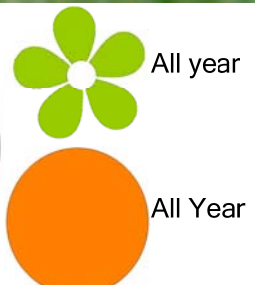
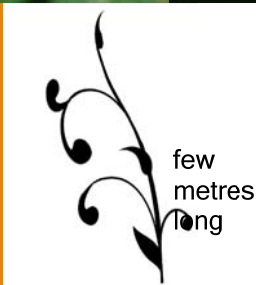
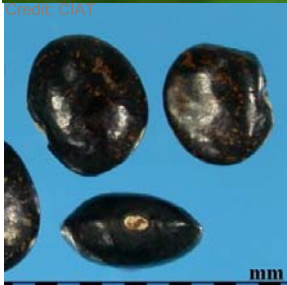


Blue to violet flowers, never forms subterranean pods.



Reported from  
Malaysia, but no  
localities known.

All populations priority  
for collection.



Taxon Group 4 relative of *Ensete ventricosum* (Welw.) Cheesm.

**HABIT:** Plants not stoloniferous, sap pale yellow-orange. Pseudostem yellow-green, with black-purple spots when old, cylindrical, up to 5 m tall (measured to crown of leaves at maturity), base swollen and jarlike.

**LEAVES:** Petiole short; leaf blade oblong, 1.4-1.8 m × 50-60 cm, glabrous, base cuneate, apex caudate.

**INFLORESCENCES:** Cylindric, up to 2.5 m long. Bracts numerous, imbricate, persistent. Flowers 10-20 per bract. Compound tepal ca. 2.5 cm, apex 3-cleft; free tepal obcordate, shorter than compound tepal, apex with a large mucro.

**FRUIT:** Berries purplish black, glaucous, obovoid-oblong, ca. 9 × 3.5 cm, base acuminate, apex rounded and with persistent perianth.

**SEED:** Black, globose, ca. 1.2 cm in diam., smooth.

**Habitat:**

Mountainous regions

**Distribution:**

China, India, Indonesia, Myanmar, Nepal, New Guinea, Philippines, Thailand.

**Altitude:** 800 - 2700 m

|                           |   |
|---------------------------|---|
| <i>Ensete glaucum</i>     | May be confused with:<br><i>Ensete superbum</i>                 |
| Slightly swollen at base. | Enormous swollen base of 2 -2.5 m in circumference at the base. |

Reported from  
Malaysia, but no  
localities known.

All populations priority  
for collection.



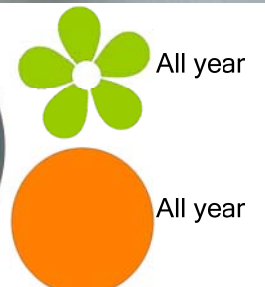
Taxon Group 4 relative of *Ensete ventricosum* (Welw.) Cheesm.



No seed image available



2-5 m



Primary Gene Pool relative of *Musa acuminata* Colla

**HABIT:** Pseudostems clumped, yellow-green, often with large, black markings, ca. 6 m. Petiole 60-75 cm, margin open, ca. 2 cm wide, often closed when young; leaf blade adaxially green and slightly pruinose or not, ovate-oblong, ca. 2.9 m × 90 cm, base auriculate, asymmetric.

**INFLORESCENCES:** Pendulous, ca. 2.5 m; peduncle and rachis glabrous. Bracts of bisexual and male flowers adaxially purple-red, abaxially brownish purple to yellow-green and pruinose, ovate to lanceolate, persistent, apex obtuse, reflexed after flowering; bracts of female flowers deciduous. Male flowers up to 20 per bract, in 2 rows. Compound tepal adaxially pale purple, abaxially pale purple-white, 4-5 cm, striate, teeth yellow to orange; free tepal milky white, translucent, obovate, ca. 1/2 as long as compound tepal, apex emarginate, shortly mucronate-apiculate.

**INFRUCTESCENCES:** Pendulous, with ca. 8 clusters ('hands') each of 15 or 16 berries in 2 rows.

**FRUIT:** Grey-green, obovoid, ca. 13 × 4 cm, distinctly angled at maturity, base narrowed into a stalk ca. 2.5 cm, apex contracted or not into a short, angled column ca. 2 cm.

**SEEDS:** Numerous, brown, oblate, 5-10 mm in diam., minutely warty.

**Habitat:**

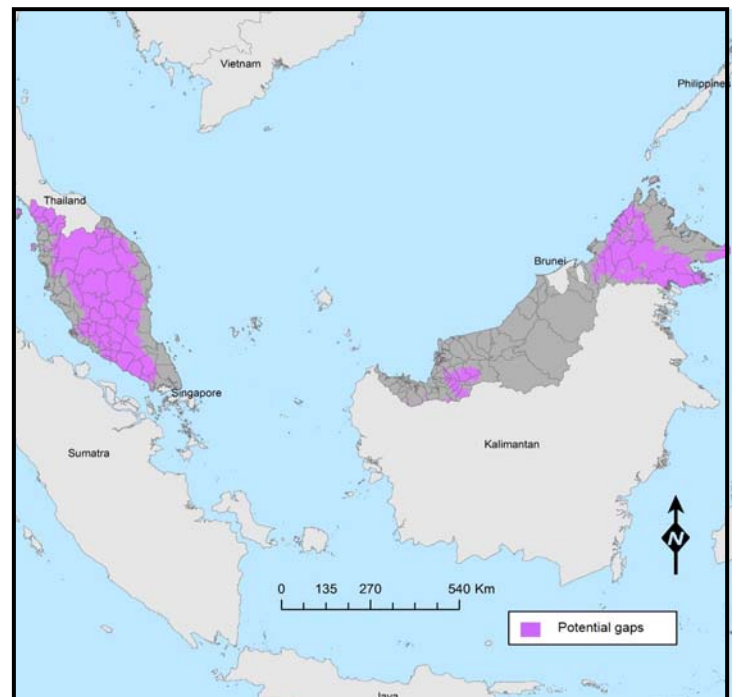
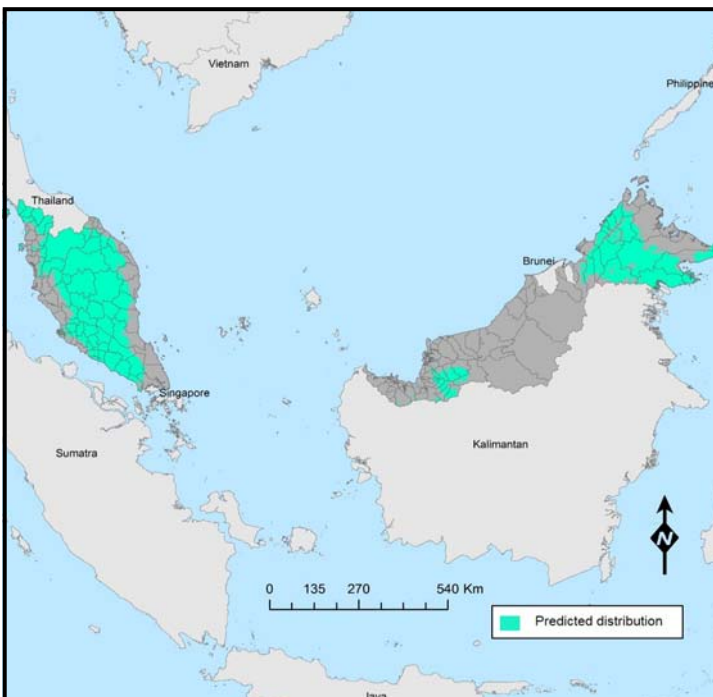
Ravines in evergreen forests

**Distribution:**

China, Papua New Guinea, Southcentral and Southeastern Asia.

**Altitude:** 0 -1100 m

|   |  |
|---|--|
| <i>Musa balbisiana</i> var. <i>balbisiana</i> | May be confused with:<br><i>Musa balbisiana</i> var. <i>bakeri</i> |
| Up to 6m tall.                                | Up to 3 m tall.  |

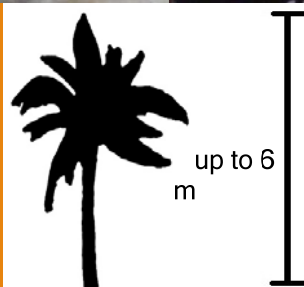


**References:** Kuo, M.L. (ed.) (2012). Flora of Taiwan, ed. 2, Suppl.: 1-414. Editorial Committee of the Flora of Taiwan, Second Edition, National Taiwan University

MUSACEAE

*Musa balbisiana* var. *balbisiana* Colla

Primary Gene Pool relative of *Musa acuminata* Colla



Taxon Group 4 relative of *Musa textilis* Nee

**HABIT:** Pseudostems 1 - 1.5 m, freely suckering; sheaths bright green, devoid of wax. **LEAVES:** Petioles up to 35 cm long, tightly clasping below, with erect or slightly incurved, narrowly purple and scarious margins above; leaves up to 100 x 30 cm., oblong-lanceolate, obtuse, the lamina halves slightly unequal, bright green in colour and devoid of wax. **INFLORESCENCE:** Small, erect, borne on a minutely (rough-) hairy peduncle, 2 cm. in diameter. **FEMALE FLOWERS:** The ovary 5-6 cm long, trilocular with ca. 170-250 biseriate ovules, the compound tepal 3-4 cm long. Male bud spindle-shaped, broadest about the middle, rounded-acute at the apex 10 x 3-4 cm. **MALE FLOWERS:** 2-5 per bract, uniseriate, each 4-5 cm long, the compound tepal 3.5-4.5 cm long, ribbed, yellowish white below shading to green at the tip, the free tepal 20-30 x 10-12 mm., whitish translucent near the base, tinged with green distally on the slender midrib, stamens 5, 35-40 mm. long, white, with copious chalky-white pollen.

**FRUIT:** Bunch small, erect and loosely packed, consisting of 2-5 hands of 1-3 fruits each; fruit shortly pedicellate, erect, cylindrical, bottlenecked at the tip, 5-15 x 2 cm.

**SEEDS:** Subglobose, 4-5 mm. in diameter, light brown in colour, finely warty-ribbed with prominent pale hilar scar 3 mm. in diameter and prominent umbo 1-2 mm. high and with a small apical pit at distal end of seed.

**Habitat:**

Tropical Moist Forest.

**Distribution:**

Sabah, Borneo

Altitude: 0 - 1600 m

|                      |  |
|----------------------|--|
| <i>Musa beccarii</i> | May be confused with:<br><i>No information available</i> |
|                      |  |

Reported from  
Malaysia, but no  
localities known.

All populations priority  
for collection.

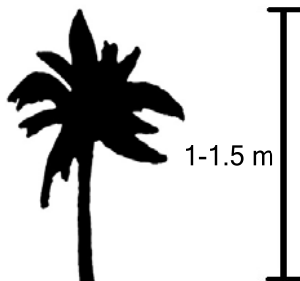
References:

Taxon Group 4 relative of *Musa textilis* Nee



RBG Edinburgh

No seed image available



Taxon Group 4 relative of *Musa textilis* Nee

**HABITAT:** Plant similar in appearance and size to a common banana. Leafstalks arcuate-spreading; margins of the sheaths glabrous, auriculate, clasping and corrugate. Bunch large, unilateral, pendant.

**INFLORESCENCE:** Male flowers uniseriate, 5-8 to each bract, white, greenish at the tip; bracts rose-vinous, reflexed, revolute at the apex. Perigonium (closed), two keeled, open above, semi-clasping; compound tepal provided at the tip with three spreading teeth, later reflexed, green, triangular, the middle one obtuse, the lateral ones terminated by a long filiform point; free tepal cymbiform, slightly inflated, acute at the apex; stamens included in the perigonium; pollen extruded unitedly in a viscosity at the mouth of the perigonium.

**FRUIT:** Glabrous, uniseriate, 14-16 cm long and 3-5 cm thick; seed obpyriform, rather large, about 1 cm long and 7 mm wide, tuberculate roughish in the upper half.

**Habitat:**

Tropical Moist Forest.

**Distribution:**

Sabah and Sarawak, Borneo.

**Altitude:** Umknown

|                        |  |
|------------------------|--|
| <i>Musa borneensis</i> | May be confused with:<br><i>No information available</i> |
|                        |  |

Reported from  
Malaysia, but no  
localities known.

All populations priority  
for collection.

**References:**

Taxon Group 4 relative of *Musa textilis* Nee



No seed image available



No data



No data

11

Taxon Group 4 relative of *Musa textilis* Nee

HABIT: 60 - 200 cm. high and 8 cm. in diameter at the base.

INFLORESCENCES: Female flowers the styles green with white stigmas, staminodes green, ovules biseriate and about 180 per ovary; male bud short lived dying off before fruit maturity, about 3 times as long as broad, strongly imbricate for nearly half its length and broadest about the middle; male flowers, the anthers fawny, bearing chalky white pollen.

FRUIT: 10 cm long, 2 - 2.5 cm wide, never more than 4 to a hand, in one row. Skin darkening somewhat from very pale green towards maturity, not yellow at ripeness, the flesh white.

SEEDS: Variably neatly cylindrical-truncate or ovoid-cylindrical.

**Habitat:**

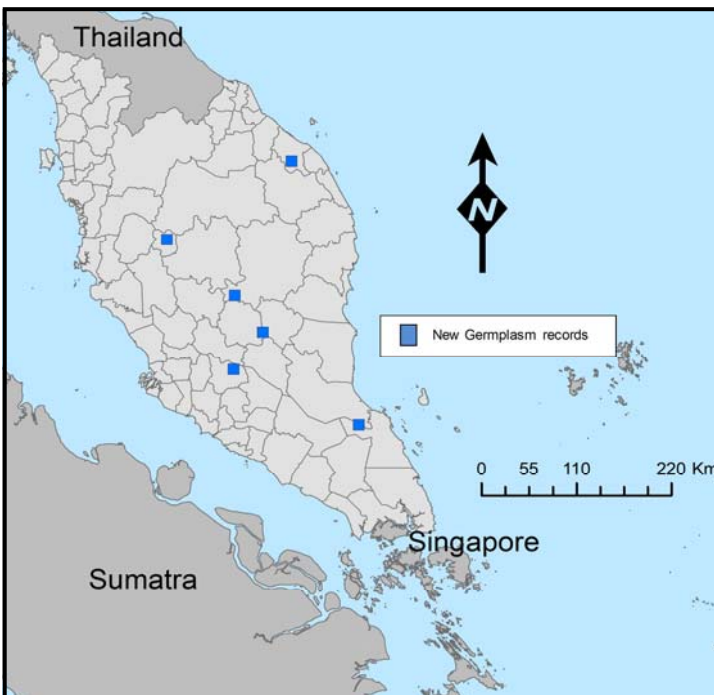
No information

**Distribution:**

Peninsular Malaysia.

Altitude: Collected: 38-107 m

|  |   |
|--|---|
| <i>Musa gracilis</i>   | May be confused with:<br><i>Musa violascens</i> |
| Smaller plant (60 - 200 cm high and 8 cm in diameter at the base), few large uniseriate fruits and slender deeply imbricate male bud broadest about the middle with narrower bract insertions. | Plants 4m tall.                                 |



All populations priority  
for collection.

References:



Taxon Group 4 relative of *Musa textilis* Nee



RBG Kew herbarium material

RBG Kew herbarium specimen



Up to 2 m



No data

No data

Taxon Group 4 relative of *Musa textilis* Nee**HABIT:** Pseudostems slender, 1 - 2 m, green, devoid of any perceptible wax bloom.**INFLORESCENCE:** Erect, very shortly exerted above the uppermost leaf-sheath, so that the lowermost cluster of flowers very often does not get free.

Female flowers 8 - 9 cm; ovary 3.5 - 4 cm, white, glabrous ; compound tepal 4.5 cm, white, its tip and lobes deep yellow.

Male bud in advanced blooming top-shaped, very acute, the bracts very strongly imbricate. Bracts pale violet or mauve, often splashed with white or with darker violet, green at the extreme tip.

Male flowers about 10 to each bract in two rows; compound tepal 4 - 5 cm long, white at base, green towards the tip, with yellow lobes.

**FRUIT:** Bunch compact. Individual fruit 4 - 7 cm long, about 2 cm in diameter, oblong, rather distinctly angled at maturity, narrowed or rounded into a subsessile base, usually narrowed more gradually to the apex, obsoletely or distinctly but not abruptly acuminate, the tip broadly truncate; pericarp about 1 mm. thick, blackening at full ripeness; pulp scanty, cream coloured.**SEEDS:** Numerous, cylindrical, 6 mm long, 4 mm in diameter, black, minutely tuberculate, the transverse line marking the perisperm chamber not conspicuous.**Habitat:**

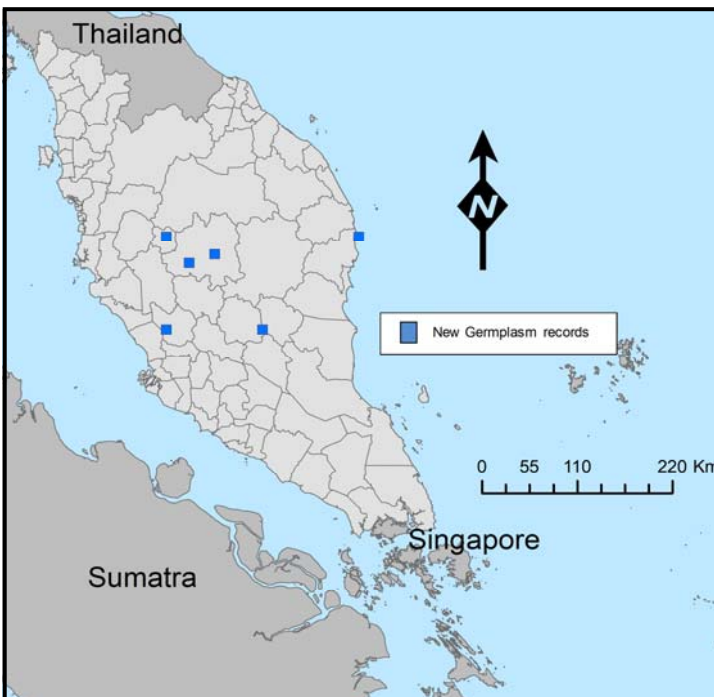
No information

**Distribution:**

No information

**Altitude:** Collected: 76 m

|                           |   |
|---------------------------|---|
| <i>Musa violascens</i>    | May be confused with:<br><i>Musa gracilis</i> |
| Larger plants, up to 4 m. | Plants 2 m tall.                              |



All populations priority  
for collection.

**References:**

Taxon Group 4 relative of *Musa textilis* Nee



No seed image available



4 m



Oct - Apr

Oct - Apr

**HABIT:** Perennial, loosely tufted or sometimes shortly stoloniferous. Culms erect or ascending, 0.3-0.7m tall.

**LEAVES:** Leaf sheaths shorter than internodes, auricles ciliate; leaf blades thin, 5-20 × 0.6-2 cm, inrolled when dry, abaxial surface smooth, adaxial surface scabrid along veins, margins scabrid, base rounded, narrowed at insertion, apex acuminate; ligule 1-2 mm.

**INFLORESCENCES:** Panicle narrow, erect, 3-15 cm; branches 2-5, inserted singly, 2-6 cm, unbranched, ascending, bearing few spikelets. Spikelets elliptic-oblong, 5-6.5 mm, length 2-3 times width, light green or gray; sterile lemmas narrowly lanceolate, slightly unequal, ca. 1 mm; fertile lemma irregularly granular, flanks sulcate, apex obtuse or shortly 3-toothed, awnless. Anthers 3.5-4.5 mm.

**FRUIT:** Caryopsis brown.

**Habitat:**

Hill forests, on well drained soils and damp places by streams.

**Distribution:**

China, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand

**Altitude:** 500 - 1000 m

|   |   |
|---|---|
| <i>Oryza meyeriana</i> var. <i>granulata</i>  | May be confused with:<br><i>Oryza meyeriana</i> var. <i>meyeriana</i> |
| Spikelets 5 - 6.5 mm; length 2-3 times width. | It has longer, (6-)7-10 mm spikelets, with length 3-6 × width.        |

Reported from Malaysia, but no localities known.

All populations priority for collection.

*Oryza meyeriana* var. *granulata* (Watt) Duist.

Tertiary Gene Pool relative of *Oryza glaberrima* Steud. and *Oryza sativa* L.

Jungle rice



RBG Kew

No seed  
image  
available

0.3-0.7  
m

NE

All year

All year

Tertiary Gene Pool relative of *Oryza glaberrima* Steud. and *Oryza sativa* L.

**HABIT:** Perennial, caespitose, culms erect 60-70(-100) cm long, nodes glabrous.

**LEAVES:** Leaf-sheaths 6-8 cm long, striately veined, smooth, glabrous on surface, auricles erect. Ligule an eciliate membrane, 1-2 mm long, white. Leaf blades linear, or lanceolate; 15-22 cm long; 16-20 mm wide, base broadly rounded, with a brief petiole-like connection to sheath, surface and margins scaberulous, apex acuminate.

**INFLORESCENCE:** Panicle open, linear, 3-4 cm long, bearing few spikelets, primary branches appressed, simple. Spikelets solitary. Fertile spikelets pedicelled. Pedicels linear, angular; bibracteate. Spikelets comprising 2 basal sterile florets and 1 fertile floret. Spikelets elliptic, or ovate, laterally compressed, 5-5.5 mm long, falling entire. Glumes absent or obscure. Basal sterile florets similar, barren, without significant palea, lemmas linear or lanceolate, 0.4-1 mm long, 0.1-0.2 length of spikelet, membranous. Lemma of fertile floret elliptic, laterally compressed, 5-5.5 mm long, coriaceous, keeled, 5-veined. Lemma surface granulose, margins interlocking with palea margins, apex acute, mucous. Palea elliptic, 5 mm long, coriaceous, 5-veined, 1-keeled, surface smooth, apex acute. Lodicules 2, membranous, anthers 6, stigmas 2.

**FRUIT:** Caryopsis with adherent pericarp. Disseminule comprising a floret.

**Habitat:**

No information.

**Distribution:**

South East Asia

**Altitude:** Unknown

|  |   |
|--|---|
| <i>Oryza meyeriana</i> var. <i>meyeriana</i>                   | May be confused with:<br><i>Oryza meyeriana</i> var. <i>granulata</i> |
| It has longer, (6-)7-10 mm spikelets, with length 3-6 × width. | Spikelets 5 - 6.5 mm; length 2-3 times width.                         |

Reported from  
Malaysia, but no  
localities known.

All populations priority  
for collection.

Tertiary Gene Pool relative of *Oryza glaberrima* Steud. and *Oryza sativa* L.



RBG Kew herbarium material

RBG Kew herbarium specimen



Secondary Gene Pool relative of *Oryza sativa* L and *Oryza glaberrima* Steud.

**HABIT:** Perennial. Culms erect or creeping and rooting at lower nodes, 1.5-3 m tall, 7-10 mm in diam.  
**LEAVES:** Leaf sheaths more than 3 times internode length, auricles inconspicuous; leaf blades thick, 30-50 × 2-3 cm, abaxial surface and margins scabrous, adaxial surface scattered villous, midrib stout, lateral veins inconspicuous, base narrowed, puberulous, apex acuminate; ligule 1-4 mm.  
**INFLORESCENCE:** Panicle loosely contracted, 30-50 cm, base often included in terminal sheath; branches 3-5 at lowest node, axils bearded, longest 10-25 cm, naked in lower half, apices of lowermost branches drooping. Spikelets broadly ovate-oblong, 4-5 mm, length 1.5-2 times width, yellowish green or tinged brownish black, deciduous; sterile lemmas linear-lanceolate, 1.5-2 mm, apex acuminate; fertile lemma papillose, keel and marginal veins with hard glassy hairs; awn 5-10(-25) mm, slender, scabrid. Anthers 1.5-2.5 mm.  
**FRUIT:** Caryopsis reddish brown

**Habitat:**

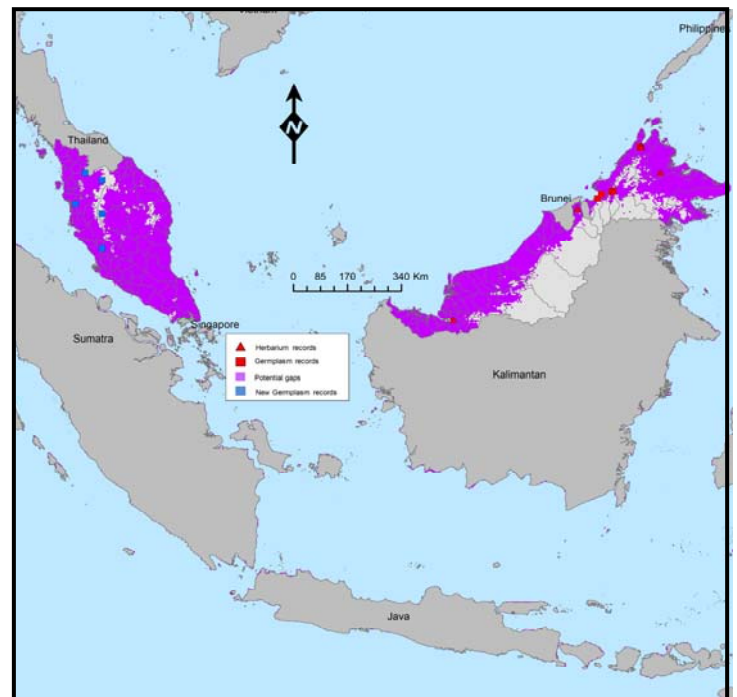
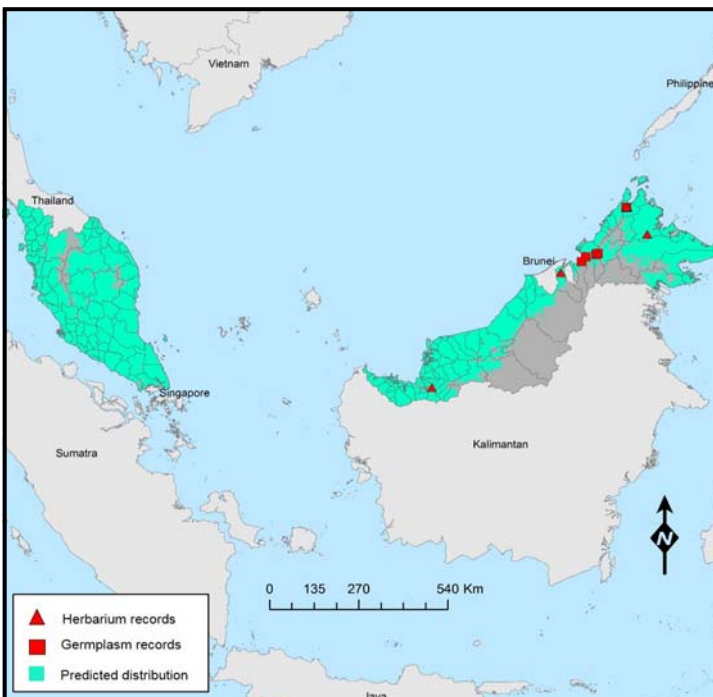
Low hills, alluvial plains, ditch banks.

**Distribution:**

China, Bhutan, Cambodia, India, Indonesia, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam.

**Altitude:** 0 - 1000 m

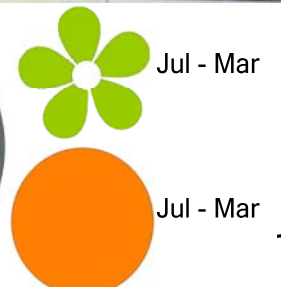
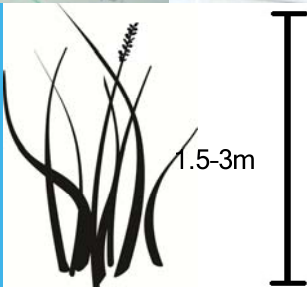
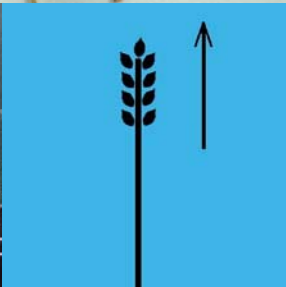
|   |  |
|---|--|
| <i>Oryza officinalis</i>  | May be confused with:<br><i>Oryza minuta</i>   |
| Lower panicle branches naked in lower half, and branches drooping. Spikelet length 1.5 - 2 x width. | Differs only slightly morphologically, the lowermost panicle branches having a shorter naked portion and ascending at the tip. It also has proportionately narrower spikelets with length 2-2.7 x width. |



**References:** Flora of China [http://www.efloras.org/florataxon.aspx?flora\\_id=2&taxon\\_id=200025785](http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=200025785)



Secondary Gene Pool relative of *Oryza sativa* L and *Oryza glaberrima* Steud.



Tertiary Gene Pool relative of *Oryza sativa* L. and *Oryza glaberrima* Steud.

**HABIT:** Perennial. Culms 100-150 cm long.

**LEAVES:** Leaf-sheaths smooth, glabrous on surface. Leaf-blades 15-30 cm long, 15-25 mm wide, surface smooth, margins scabrous, apex acuminate. Ligule an eciliate membrane, 3-5 mm long.

**INFLORESCENCES:** Panicle open, elliptic, 25-35 cm long, 10-15 cm wide, primary branches ascending, simple, scaberulous, 6-12 cm long. Spikelets appressed. Pedicels of fertile spikelets linear, angular, tip cupuliform. Fertile spikelets comprising 2 basal sterile florets and 1 fertile floret, without rhachilla extension. Spikelets oblong, laterally compressed, 8-9 mm long, 2-5 mm wide, falling entire. Glumes both absent or obscure. Basal sterile florets similar, barren; without significant palea. Lemma of lower sterile floret subulate, 6-7.5 mm long, 0.8 length of spikelet; scaberulous. Lemma of upper sterile floret subulate, 6-7.5 mm long, 1 length of lower sterile floret. Fertile lemma elliptic, laterally compressed, 7-8 mm long, coriaceous, keeled, 5 -veined. Lemma surface scaberulous, rough on veins, margins interlocking with palea margins, apex awned. Principal lemma awn 4-8 mm long overall. Palea elliptic, 9 mm long, coriaceous, 3 -veined, 1-keeled, keel spinulose. Lodicules 2, membranous, anthers 6, stigmas 2.

**FRUIT:** Caryopsis with adherent pericarp. Disseminule comprising a floret.

**Habitat:**

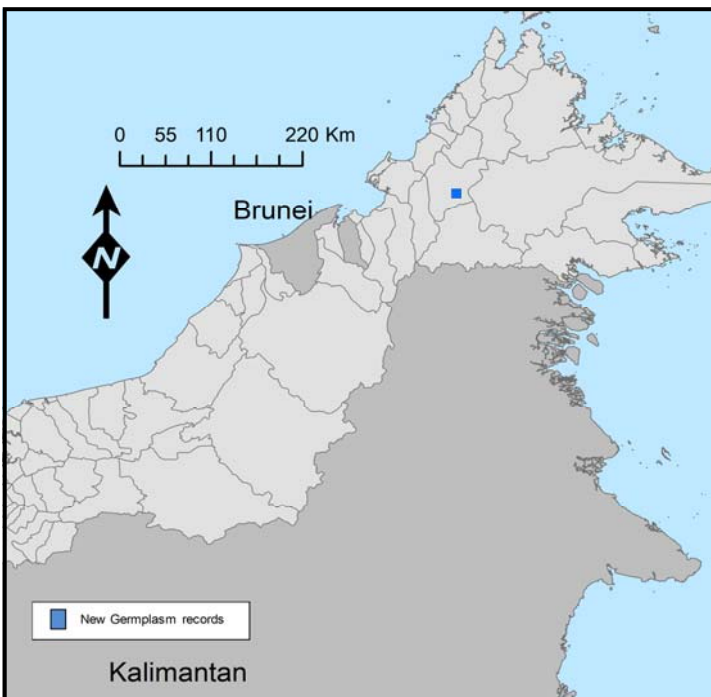
Found in old secondary, evergreen or dipterocarp forest; flooded rainforest; old rubber plantations; dense thickets or open spaces. Grows in marshes or riverbanks near streams in highly organic, friable soil such as decaying tree trunks; commonly in full shade.

**Altitude:** 0 - 200 m

**Distribution:**

Cambodia, Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea, and Thailand.

|   |   |
|---|---|
| <i>Oryza ridleyi</i>                        | May be confused with:<br><i>Oryza longiglumis</i>   |
| Sterile lemma shorter than palea and lemma. | Sterile lemma as long or longer than fertile lemma. |



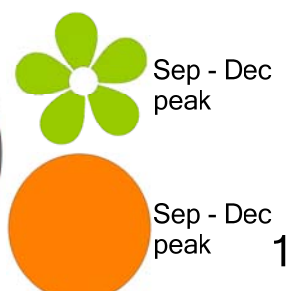
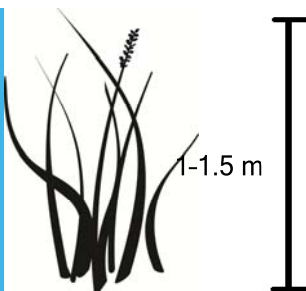
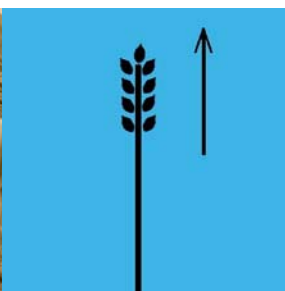
All populations priority for collection.

References:

Tertiary Gene Pool relative of *Oryza sativa* L. and *Oryza glaberrima* Steud.



RBG Kew herbarium material



Primary Gene Pool relative of *Sorghum bicolor* (L.) Moench

**HABIT:** Perennial, loosely tufted with a few stout rhizomes. Culms 1.5-3 m tall, up to 1 cm in diam., many-noded; nodes puberulous.

**LEAVES:** Leaf sheaths glabrous, ciliate at mouth and margins; leaf blades yellowish green, linear or linear-lanceolate, 40-90 × 3-5 cm, glabrous, midvein robust, margins ciliate; ligule 0.5-1 mm, puberulous.

**INFLORESCENCE:** Panicle open, ovate or broadly ovate, 30-55 cm; primary branches in whorls of 3-6; lower part bare, upper part branched, branches tipped by racemes; racemes fragile, composed of 3-7 spikelet pairs. Sessile spikelet ovate, 3.8-4.5 mm; callus obtuse, pubescent with pale hairs; lower glume subleathery, pale or purple-tinged, thinly pilose, 9-13-veined, veins distinct in upper part, apex acute to apiculate or tridenticulate; upper lemma acute or emarginate, awnless, rarely with short awn. Pedicelled spikelet staminate, linear-lanceolate, 4-5.5 mm, yellowish to pale purple.

**Habitat:**

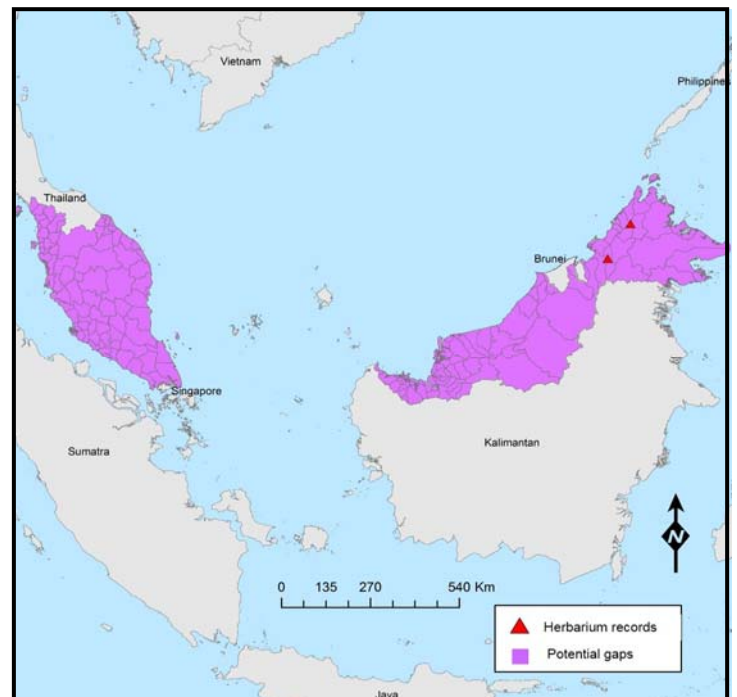
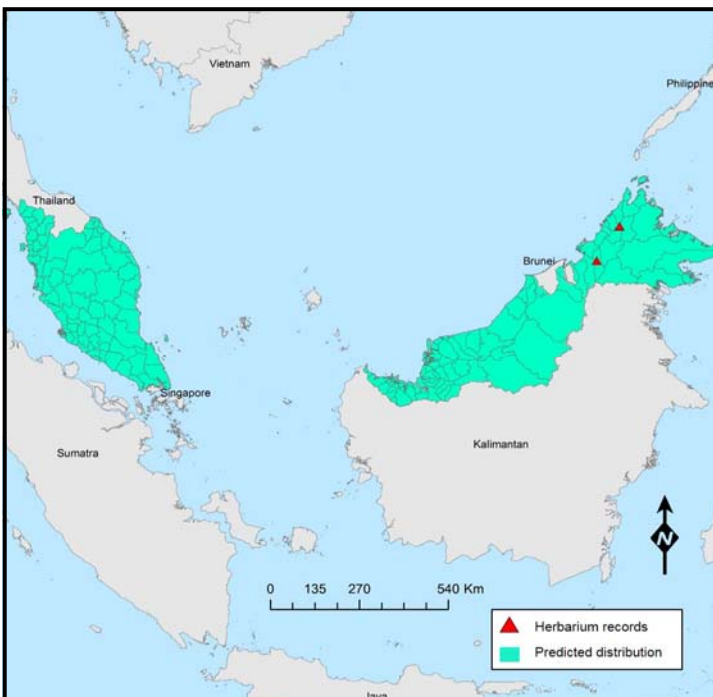
No info available

**Distribution:**

Native to Southcentral and Southeastern Asia.

**Altitude:** Unknown

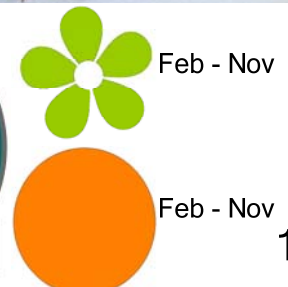
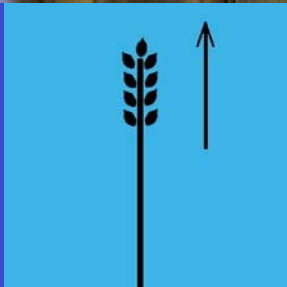
|  |   |
|--|---|
| <i>Sorghum propinquum</i>                          | May be confused with:<br><i>Sorghum bicolor</i>                                   |
| Perennial. Sessile spikelet pale or purple-tinged. | Annual. Sessile spikelet pale creamy-green to dark brown or blackish at maturity. |

**References:**

Primary Gene Pool relative of *Sorghum bicolor* (L.) Moench



No seed image available



Primary relative of *Solanum melongena* L.

Bitter apple

**HABIT:** Herbs or subshrubs, erect, 0.5-2 m tall, pubescent with stellate hairs, usually armed. Stems and branches shaggy tomentose with stalked many-rayed hairs, glabrescent, sparingly armed with mostly straight needlelike prickles.

**LEAVES:** Leaves unequal paired; petiole 1-4 cm; leaf blade ovate or elliptic, 5-12(-14.5) × 4-7 cm, tomentose with stalked and sessile, many-rayed hairs, with short stout prickles on veins, base obtuse or truncate, oblique, margin 5(-7)-sinuate lobed, apex acute or obtuse.

**INFLORESCENCE:** Extra-axillary, few-flowered scorpioid racemes, ca. 2.5 cm; peduncle very short. Flowers andromonoecious. Pedicel 0.5-2 cm.

**FLOWER:** Calyx campanulate, 6-9 mm × 1-1.5 cm; lobes deltate-lanceolate, ca. 5 × 2 mm, densely stellate hairy. Corolla purple-blue or white, stellate-rotate, 1.5-2 × 1.5-3 cm; lobes broadly deltate or ovate, ca. 10 × 5 mm, with stellate hairs abaxially. Filaments 1.5-1.8 mm, glabrous; anthers elliptic, 5-8 mm. Style 5-6 mm, glabrous.

**FRUIT:** Fruiting pedicel 2.5-5 cm, deflexed, sparsely stellate hairy, prickly; fruiting calyx persistent, slightly enlarged, hairy, prickly. Berry yellow, globose, 2-3 cm in diam., glabrous.

**SEEDS:** Seeds lenticular, 2-3 mm in diam.

**Habitat:**

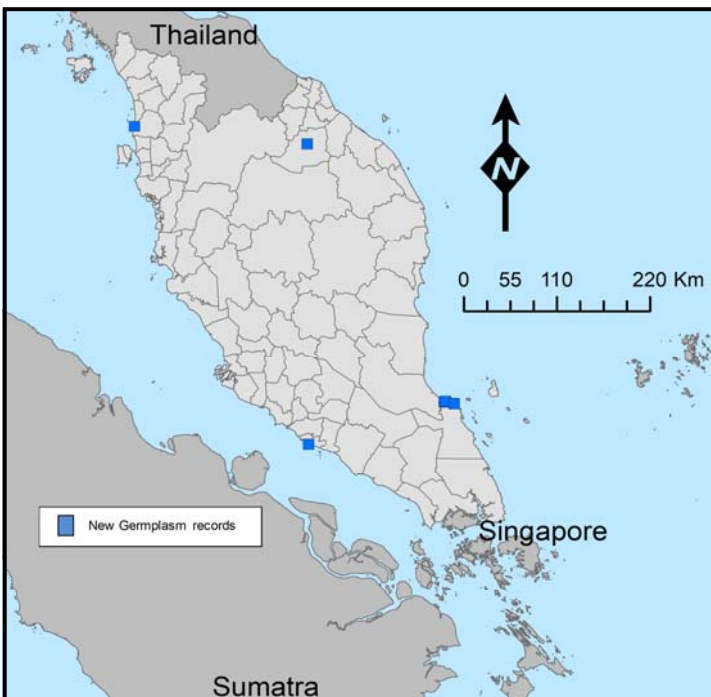
Degraded scrubland and secondary vegetation, thickets, slopes.

**Distribution:**

China (Guangdong, Guangxi, Guizhou, Hainan, Taiwan, Yunnan), Afghanistan, Bangladesh, India, Pakistan, Indonesia, Malaysia, Philippines, Thailand, Vietnam, Africa.

**Altitude:** 0 - 500 m

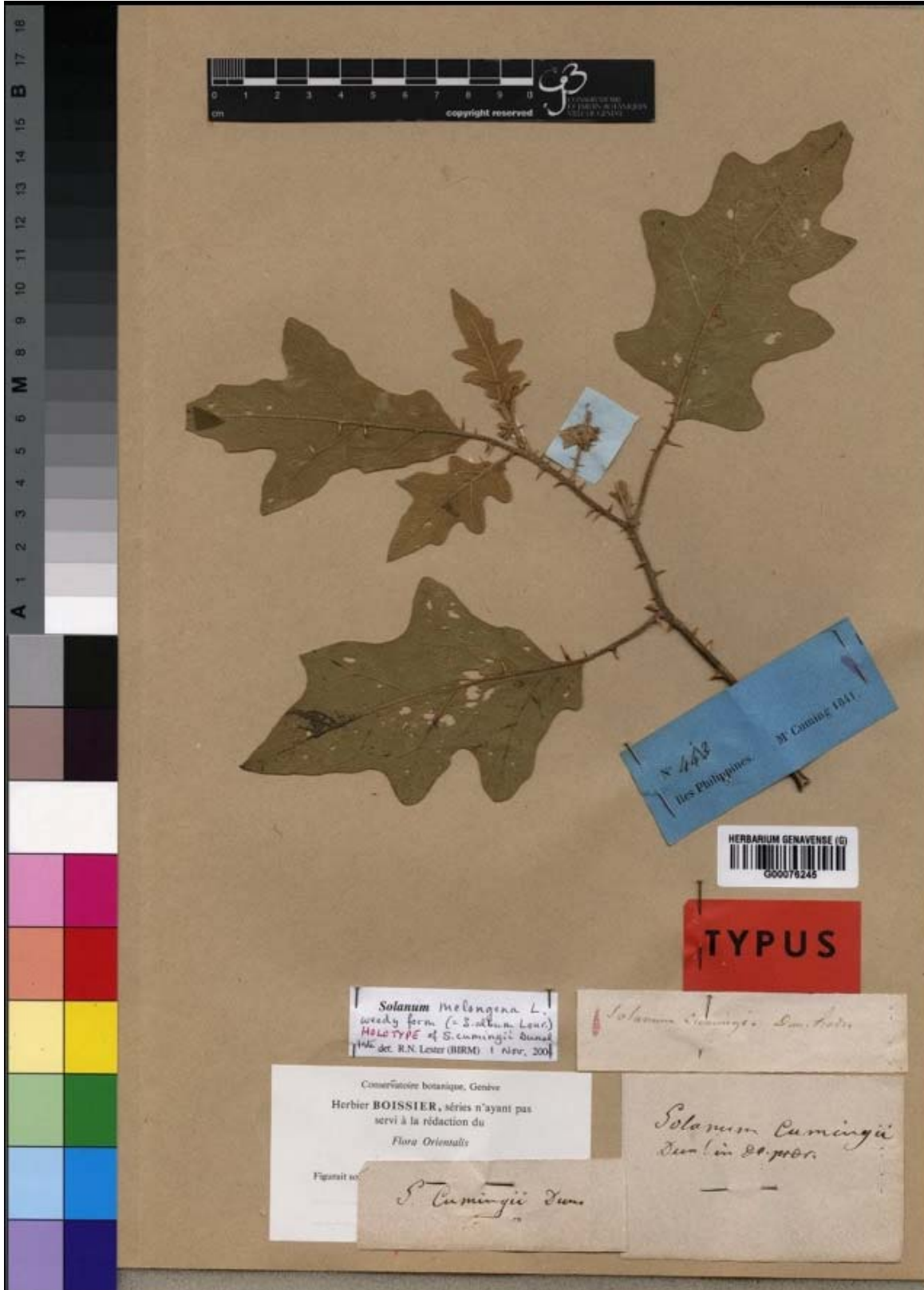
|                        |                       |
|------------------------|-----------------------|
| <i>Solanum insanum</i> | May be confused with: |
|                        |                       |



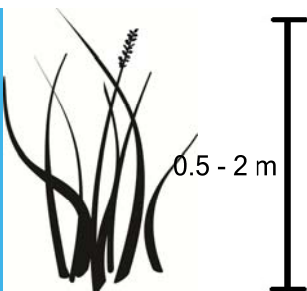
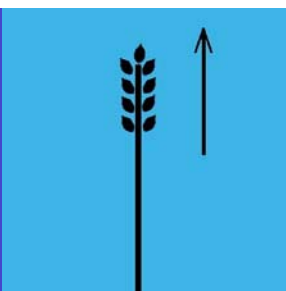
All populations priority  
for collection.

**References:** [http://www.efloras.org/florataxon.aspx?flora\\_id=2&taxon\\_id=200020609](http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=200020609)

Primary relative of *Solanum melongena* L.



No seed image available



**HABIT:** Herbs erect or creeping, sometimes woody at base, 0.5-0.7 m tall, copiously armed with sturdy, needlelike, broad-based prickles 0.5-2 cm × 0.5-1.5 mm, pubescent with 7-9-rayed stellate hairs, overall glabrescent.

**LEAVES:** Unequal paired; petiole 2-3.5 cm, prickly, with sessile stellate hairs; leaf blade ovate-oblong, 4-9 × 2-4.5 cm, pubescent and prickly along veins, glabrescent, base subcordate or unequal, margin usually 5-9-lobed or pinnately parted, lobes unequal, sinuate, apex acute.

**INFLORESCENCE:** Elongate racemes 4-7 cm, peduncle unbranched, copiously armed. Pedicel ca. 1 cm.

**FLOWER:** Calyx campanulate, ca. 1 cm in diam.; lobes oblong, pubescent, prickly. Corolla blue-purple, rotate, 1.4-1.6 × 2.5 cm; lobes ovate-deltate, 6-8 mm, densely pubescent with stellate hairs. Filaments ca. 1 mm; anthers ca. 8 mm. Style ca. 1 cm.

**FRUIT:** Fruiting pedicel 2-3.6 cm, with prickles and sparse stellate hairs. Fruiting calyx prickly, sparsely pubescent. Berry pale yellow, 1.3-2.2 cm in diam.

**SEEDS:** Subreniform, ca. 1.5 mm in diam.

**Habitat:**

Sandy river beaches.

**Distribution:**

China, Afghanistan, India, S Japan, Malaysia, Nepal, Sri Lanka, Thailand, Vietnam; Africa, SW Asia, Pacific Islands.

**Altitude:** 100 -1300 m

*Solanum virginianum*

May be confused with:  
*Solanum violaceum*

Prickles straight and needle-like.  
Berry pale yellow.



Prickles recurved. Berry orange.



Reported from  
Malaysia, but no  
localities known.

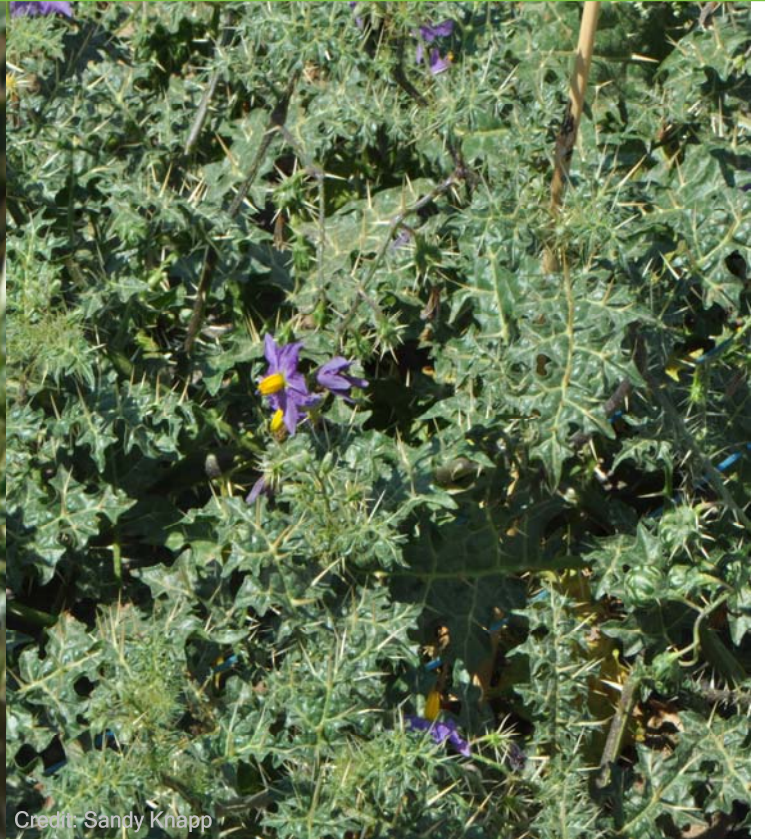
All populations priority  
for collection.



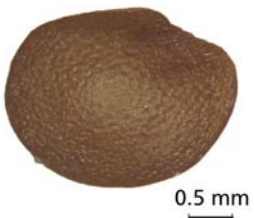
SOLANACEAE

Tertiary Gene Pool relative of *Solanum melongena* L.

*Solanum virginianum* L.  
Yellow-fruit nightshade



Gemma Toothill (c) Board of Trustees RBG Kew



# Musa acuminata subspecies and varieties

|  | Key features  | Distribution in Malaysia  | Easily confused with              | Distinguished by  |
|--|---|---|-----------------------------------|---|
| Musa acuminata subsp. malaccensis            | Slender plant, usually strongly waxy, with midribs commonly but not always bright red underneath, with a horizontal bunch and bright red non-imbricate male bracts.   | Characteristic of the central lowlands                            | Musa acuminata subsp. siamea      | Bracts bright red on outside, quickly deciduous, non imbricate in malaccensis; Bracts purplish red on outside with yellowish tips, often slightly persistent, usually imbricate in the young bud in siamea. |
| Musa acuminata subsp. malaccensis var. minor | Stems rather slender, about 6 feet tall. Leaves long, 14 inches across, apex truncate, 2 inches across with a short terminal process. Spike pendulous, rachis glabrous. Bracts oblong, obtuse, dark maroon, brown those of the male flowers, 3 inches long, 1 inch wide. Flowers 1 1/4 inch long. Corolla oblong, trifid at the tip, the small lobe half an inch long, yellowish white. Stamens: anthers linear, shorter, or as short as the flower. Style slender. Fruit in two rows, 2 inches long,         |   |                                   | Green pseudostems, leaves conspicuously waxy below, male flowers with red bracts, fruits large and broad. Var minor is basically a small form of Musa acuminata subsp. malaccensis                          |
| Musa acuminata subsp. siamea                 | Similar to subsp. malaccensis, but differing in that the plants are commonly (but not always) of shorter stature; there is less black and brown smudging on the pseudostems; the peduncle is often but not always glabrous; the fruits are commonly smaller and, above all, the male buds are imbricate and have bracts paler, more purple in tone, often slightly yellow streaked and with pale yellowish tips.  | Monsoon lands of northern Malaya, Thailand and Indochina.         | Musa acuminata subsp. malaccensis | Primarily: male buds are imbricate and have paler bracts, more purple in tone, often slightly yellow streaked and with pale yellowish tips.   |
| Musa acuminata subsp. truncata               | Found at higher altitudes than other subspecies   | Montane sp above 600m altitude. Penninsular Malaysia.             | Musa acuminata subsp. microcarpa  | Purple-black pseudostems; leaves not waxy below, male flowers with deep purple bracts, fruits slender and almost straight. Dry fruits 8.5-11 cm long by 1-1.25 cm wide.                                     |
| Musa acuminata subsp. microcarpa             | Characterised by the yellowish tinge and virtual waxiness of the foliage, by the intense chocolate brown pigmentation of sheaths and, often, midribs, by the fading purple flush on the peduncle and male rachis, by the plump, non imbricate male bud, by the bracts purple outside and pale red within and weakly rolled at the time of falling. Fruits commonly short and slender but variable in size and ovule number from 130 - 210 ovules per ovary. Bunches usually horizontal but sometimes oblique. | Lowland species of Sabah and Sarawak, no more than 900m altitude. | Musa acuminata subsp. truncata    | Purple-black pseudostems; leaves not waxy below, male flowers with deep purple bracts, fruits slender and almost straight. Dry fruits 5-8 cm long by 1.5-1.7 cm wide.                                       |

# Musa acuminata subspecies and varieties: image gallery

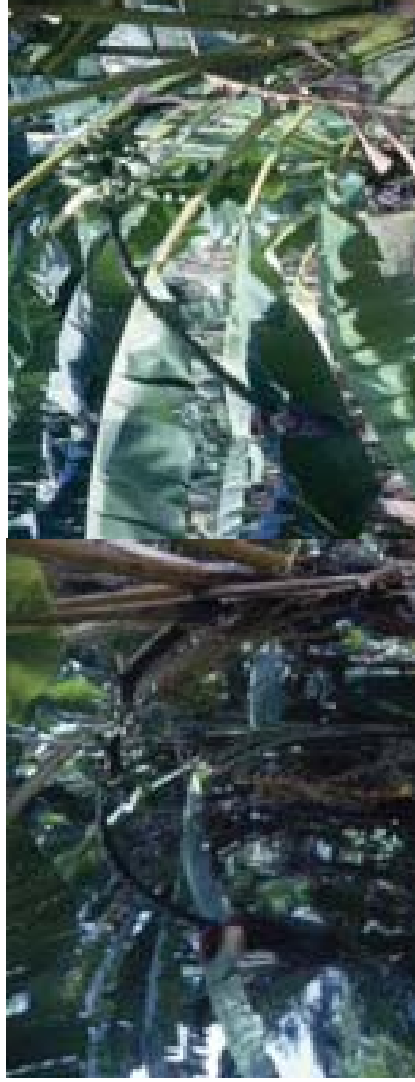


ABOVE: *Musa acuminata* subsp. *malaccensis*  
CREDIT A. D'Hont, CIRAD

RIGHT: *Musa acuminata* subsp. *malaccensis*  
CREDIT Daniells, Jeff / DEEDI



ABOVE: *Musa acuminata* subsp. *siamea*  
CREDIT: K Shepherd



ABOVE: *Musa acuminata* subsp. *truncata* CREDIT K Shepherd



ABOVE: *Musa acuminata* subsp. *microcarpa*  
CREDIT: K Shepherd

# Musa acuminata subspecies collections



*Musa acuminata* subsp. *malaccensis*



*Musa acuminata* subsp. *microcarpa*



*Musa acuminata* subsp. *acuminata*



*Musa acuminata* subsp. *truncata*



# Appendix - Synonyms

| Taxon   | Sheet       | Synonyms   |
|---|-------------|--|
| <i>Ipomoea cairica</i>  | 1           | <i>Batatas cavanillesii</i> (Roem. & Schult.) G. Don; <i>Batatas senegalensis</i> G. Don; <i>Convolvulus cairicus</i> L.; <i>Convolvulus cavanillesii</i> (Roem. & Schult.) Spreng.; <i>Convolvulus limphaticus</i> Vell.; <i>Ipomoea cavanillesii</i> Roem. & Schult.; <i>Ipomoea funaria</i> Larrañaga; <i>Ipomoea heptaphylla</i> Griseb.; <i>Ipomoea pentaphylla</i> Cav.; <i>Ipomoea rosea</i> var. <i>pluripartita</i> Hassl.; <i>Ipomoea senegalensi</i> Lam.; <i>Ipomoea vesiculosa</i> P. Beauv.  |
| <i>Ipomoea littoralis</i>   | 2           | <i>Convolvulus littoralis</i> Linnaeus; <i>Convolvulus denticulatus</i> Desrousseaux; <i>Ipomoea denticulata</i> (Desrousseaux) Choisy, non R. Brown.  |
| <i>Ipomoea tiliacea</i>   | 3           | <i>Convolvulus fastigiatus</i> Roxb.; <i>Ipomoea fastigiata</i> (Roxb.) Sweet; <i>Convolvulus tiliaceus</i> Willd.   |
| <i>Cajanus crassus</i>  | 4           | <i>Atylosia crassa</i> Prain ex King; <i>Atylosia volubilis</i> (Blanco) Gamble; <i>Cantharospermum volubile</i> (Blanco) Merr.; <i>Cantharospermum volubilis</i> (Blanco) Merr.   |
| <i>Cajanus goensis</i>  | 5           | <i>Dolichos ornatus</i> Wall. nom. nud.; <i>Atylosia barbata</i> (Benth.) Baker  |
| <i>Cajanus scarabaeoides</i>                                      | 6           | <i>Dolichos scarabaeoides</i> L.; <i>Atylosia pauciflora</i> (Wight & Arnott) Druce; <i>Atylosia scarabaeoides</i> (Linnaeus) Bentham; <i>Atylosia scarabaeoides</i> var. <i>argyrophyllus</i> Y. T. Wei & S. K. Lee; <i>Cajanus scarabaeoides</i> var. <i>argyrophyllus</i> (Y. T. Wei & S. K. Lee) Y. T. Wei & S. K. Lee; <i>Cantharospermum pauciflorum</i> Wight & Arnott; <i>Cantharospermum scarabaeoides</i> (Linnaeus) Baillon; <i>Dolichos medicagineus</i> Roxburgh; <i>Dolichos minutus</i> Wight & Arnott; <i>Rhynchosia biflora</i> Candolle; <i>Rhynchosia scarabaeoides</i> (Linnaeus) Candolle; <i>Stizolobium scarabaeoides</i> (Linnaeus) Sprengel   |
| <i>Vigna hosei</i>  | 7           | <i>Dolichos hosei</i> Craib; <i>Vigna oligosperma</i> Backer nom. Nud.   |
| <i>Ensete glaucum</i>   | 8           | <i>Ensete agharkarii</i> (Chakravorti) Hore, B.D.Sharma & G.Pandey; <i>Ensete calospermum</i> (F.Muell.) Cheesman; <i>Ensete giganteum</i> (Kuntze) Nakai; <i>Musa agharkarii</i> Chakravorti; <i>Musa calosperma</i> F.Muell. [Invalid]; <i>Musa gigantea</i> Kuntze; <i>Musa glauca</i> Roxb.; <i>Musa nepalensis</i> Wall.; <i>Musa troglodytarum</i> var. <i>dolioformis</i> Blanco  |
| <i>Musa acuminata</i> subsp. <i>acuminata</i>                     | table p. 21 | <i>Musa acuminata</i> var. <i>alansensis</i> Nasution; <i>Musa acuminata</i> var. <i>bantamensis</i> Nasution; <i>Musa acuminata</i> var. <i>breviformis</i> Nasution; <i>Musa acuminata</i> var. <i>cerifera</i> (Backer) Nasution; <i>Musa acuminata</i> var. <i>longipe-tiolata</i> Nasution; <i>Musa acuminata</i> var. <i>nakaii</i> Nasution; <i>Musa acuminata</i> var. <i>rutilipes</i> (Backer) Nasution; <i>Musa acuminata</i> var. <i>violacea</i> Kurz; <i>Musa acuminata</i> var. <i>zebrina</i> (Van Houtte ex Planch.) Nasution; <i>Musa briei</i> De Wild.; <i>Musa cavendishii</i> Lamb.; <i>Musa cavendishii</i> var. <i>hawai-ensis</i> N.G.Teodoro; <i>Musa cavendishii</i> var. <i>pumila</i> N.G.Teodoro; <i>Musa cerifera</i> (Backer) Nakai; <i>Musa</i> × <i>paradisiaca</i> var. <i>pumila</i> G.Forst.; <i>Musa rhinozerotis</i> Kurz; <i>Musa rumphiana</i> Kurz; <i>Musa</i> × <i>sapientum</i> var. <i>pumila</i> (N.G.Teodoro) Merr.; <i>Musa simiarum</i> Miq.; <i>Musa simiarum</i> var. <i>violacea</i> Kurz; <i>Musa zebrina</i> Van Houtte ex Planch.; <i>Musa zebrina</i> f. <i>cerifera</i> Backer; <i>Musa zebrina</i> f. <i>rutilipes</i> Backer |
| <i>Musa acuminata</i> subsp. <i>malaccensis</i>                   | table p. 21 | <i>Musa acuminata</i> var. <i>flava</i> (Ridl.) Nasution; <i>Musa acuminata</i> var. <i>malaccensis</i> (Ridl.) Nasution; <i>Musa flava</i> Ridl.; <i>Musa malaccensis</i> Ridl.   |
| <i>Musa acuminata</i> subsp. <i>malaccensis</i> var. <i>minor</i> | table p. 21 | <i>Musa malaccensis</i> Ridl. var. <i>minor</i> Ridl.  |
| <i>Musa acuminata</i> subsp. <i>siamea</i>                        | table p. 21 | None known   |
| <i>Musa acuminata</i> subsp. <i>truncata</i>                      | table p. 21 | <i>Musa truncata</i> Ridl.   |

# Appendix - Synonyms

|                                 |             |   |
|---------------------------------|-------------|---|
| Musa acuminata var. microcarpa  | table p. 21 | Musa acuminata var. microcarpa (Becc.) Nasution; Musa microcarpa Becc.  |
| Musa balbisiana var. balbisiana | 9           | Musa dechangensis J. L. Liu & M. G. Liu; Musa lushanensis J. L. Liu; Musa luteola J. L. Liu; Musa paradisiaca Linnaeus subsp. seminifera (Loureiro) Baker; Musa seminifera Loureiro.  |
| Musa beccarii                   | 10          | None known  |
| Musa borneensis                 | 11          | None known  |
| Musa gracilis                   | 12          | None known  |
| Musa violascens                 | 13          | None known  |
| Oryza meyeriana var. granulata  | 14          | None known  |
| Oryza meyeriana var. meyeriana  | 15          | Oryza abromeitiana Prodoehl; Oryza filiformis Buch.-Ham. ex Steud.; Oryza granulata Nees & Arn. ex Watt; Oryza indandamanica J.L.Ellis; Oryza meyeriana subsp. abromeitiana (Prodoehl) Tateoka; Oryza meyeriana subsp. granulata (Nees & Arn. ex Watt) Tateoka; Oryza meyeriana subsp. tuberculata W.C.Wu, Y.G.Lu & G.C.Wang; Oryza meyeriana var. granulata (Nees & Arn. ex Watt) Duist.; Oryza meyeriana var. indandamanica (J.L.Ellis) Veldkamp; Oryza triandra B.Heyne ex Steud.; Padia meyeriana Zoll. & Moritzi |
| Oryza officinalis               | 16          | Oryza latifolia Desvaux var. silvatica Camus; Oryza minuta Presl var. silvatica (Camus) Veldkamp.   |
| Oryza ridleyi                   | 17          | Oryza stenothyrsus K.Schum.   |
| Sorghum propinquum              | 18          | Andropogon propinquus Kunth   |
| Solanum insanum                 | 19          | Solanum cumingii Dunal  |
| Solanum virginianum             | 20          | Solanum xanthocarpum Schrad.; Solanum surattense Burm. f.   |