Department of Science, Information Technology and Innovation


# Collecting and preserving plant specimens, a manual

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# Contents



# List of figures

# Introduction

The Queensland Herbarium is the centre for research and information on Queensland ecosystems, plants, fungi and algae. The Herbarium, located in the Brisbane Botanic Gardens, Mt Coot-tha, houses more than 800,000 dried pressed specimens. We provide a plant identification and information service to the public. This manual has been written to assist those requiring plant identifications, and to anyone intending to contribute to the herbarium's collection.

# Why Collect?

Herbarium specimens are used for a variety of purposes. They:

- allow and support accurate identification of plants, algae, lichens and fungi
- provide a permanent record for a species occurring at a particular time and place
- form the basis of reliable distribution, habit and habitat information
- document the introduction and spread of invasive weeds over time
- are the reference point for the application of the scientific names
- provide the basic biological material for taxonomists, ecologists and other researchers
- serve as vouchers for seed collections, toxicological cases, biochemical analyses and biodiscovery.

### Voucher specimens

Some herbarium specimens are known as a 'voucher specimens'.

Voucher specimens serve as a basis of scientific study. Voucher specimens are collected from taxa that are the subject of research or investigation, generally resulting in a publication in a scientific journal or report. Their importance cannot be over-emphasized. If lodged in a recognised herbarium, they will endure in the collection for many years, and their identity can be checked and verified at any future time by linking it with the voucher reference in the publication. This means that research and survey data will remain useful many years after publication, even though names and classifications change. The advent of genetic techniques in plant taxonomy has increased the need for well-annotated, correctly identified specimens to be stored as vouchers for published sequences, reducing the need to resample at a future time.

Other voucher specimens serve as a reference for verifying the identity of plant photographs.

# Before you collect

### Permits

Before going on to private land you must request permission from the owner to access and traverse their land.

Collecting specimens in Queensland National Parks and State forests is illegal unless you have a permit. Permits to collect for scientific purposes can be obtained from http://www.ehp.qld.gov.au/licences-permits/plants-animals/

# Safety

### Protective equipment

It is advisable to take personal protective equipment such as sunscreen, a hat, long-sleeved shirt and long trousers, sturdy shoes, a first-aid kit, water and food on any collecting trip.  Make sure you have additional suitable equipment as required for the particular job. For example, gloves will be needed for handling prickly or sappy material, and a hard hat for collecting material from trees (see list of equipment on next page).

### Safe travel procedures

Always let someone know where you are, and when you expect to return. For prolonged journeys, details of your intended route and destination, call-in procedure and expected time of return should be left with someone who can raise help if necessary. If possible travel with someone and discuss safety issues before you leave. Make sure that the vehicle is suitable for the job, and functioning properly prior to leaving. Check all safety equipment such as satellite phones and recovery gear prior to leaving.

# Commonly used equipment

### For general collecting you may require

- day press that is light enough to carry around. This should include only a few cardboard corrugates, and a few dozen sheets of newspaper.
- a field press with many more corrugates and more newspaper. This can be left at the campsite, accommodation, or in the vehicle.
- spare corrugates and newspaper and some sheets of foam for bulky items
- secateurs to cut and trim specimens
- GPS for recording an accurate latitude and longitude. Alternatively, mark the position on a topographic map.
- a field notebook and pencil. This can be a pocket-sized notebook or a book of pre-printed specimen labels may be used.
- large and small plastic bags, to hold specimens temporarily
- small brown paper bags for collecting fruits, seeds, bryophytes and lichens
- a hand lens
- gloves, for handling prickly plant material, poisonous plants or plants with corrosive sap
- tie-on tags, often called jewellers tags (available at news agents)
- felt tipped pens and pencils for numbering collection and writing notes
- a camera for photographing the form of the plant, flower colour and its natural habitat. Plant photographs should be linked to a specimen voucher so that the identity of the phtograph can be checked in the future.

**In addition you may require**

- a trowel for digging out herbaceous plants with underground structures. For example, *Haemodorum* species have bulbs 15–20 cm below the surface and *Murdannia* species have tubers that will be left behind if you pull plants from above.
- plastic bottles with preserving liquid, to preserve fleshy plants or delicate flowers. This usually consists of 70% alcohol. Note: alcohol cannot be sent through the mail.

**For collecting specimens from trees you will need**

- a throwing rope or a pole pruner
- a hard hat
- binoculars to help you locate the optimum material.

# Selecting the plant material

Select vigorous, typical specimens. Avoid insect-damaged plants. Choose individuals that show the variation in leaf, flower and fruit size. It may be important to show morphological variation, involving the collection of individuals of different sizes or ages. Collect at least two sets of specimens (duplicates) and number each set. Keep one set for your reference, and send the duplicate set to the Herbarium for identification or as a voucher if required. The Queensland Herbarium does not return specimens.

A good specimen includes stems, leaves, flowers and fruits. Basal parts of grasses, sedges, ferns and bulbous plants are essential for identification. Underground parts e.g. tubers, rhizomes are important for some plant groups.

The plant material should be fertile i.e. in flower or fruit (both if possible), as these characteristics are often vital for identification. This might entail returning to the site when the plant is in flower/fruit. Some time should be spent looking at a number of individuals, and choosing one with a number of flowers or more mature fruits.

**Size of the specimen**

A specimen should ideally be 25–40 cm long and up to 26 cm wide, allowing it to fit on a standard herbarium mounting sheet which measures 42 x 27 cm. Conveniently, this is also the approximate size of newspapers.

Plant parts that are too large for a single sheet may be cut into sections pressed on a series of sheets, for example a palm or cycad frond.

Long and narrow specimens such as grasses and sedges can be folded once, twice or even three times at the time of pressing. In this way a plant of up to 1.6 metres high may be pressed onto a single sheet.

For very small plants, a number of individuals may be placed on each sheet.

**Features of the plant**

When collecting from trees or large shrubs, distinctive or notable features should be recorded, for example branching habit, height and width of the plant and details of the bark.

You may need to collect more than one specimen to show the range of variation that is present, for example mature and immature parts, juvenile and adult leaves, coppice shoots.

If the plant is dioecious, with male and female flowers on different plants, collect a specimen from each sex and label the specimens A & B.

## Handling plants during collection

For best results, specimens should be pressed within a few minutes of being removed from the plant. Many species wilt and fade soon after collection. A day press is convenient for short trips taken from the vehicle.

If specimens cannot be pressed at the point of collection, for example if it is raining or on steep terrain, they may be stored in large plastic bags. The bags should be kept moist, and the specimens not jammed in too tightly. Make sure that each bag is correctly labelled, using one bag per collection site. However, **storing specimens in plastic bags is not recommended** because it is easy for specimens to become damaged or mixed and they are more likely to go mouldy.

# Step-by-step plant collecting and pressing

**Figure 1. Find a specimen that is representative of the existing population. Collect both flowers and fruit if available.**

**Figure 2. Use secateurs for a clean cut of the stem. Collect two specimens if you wish to retain one sample for yourself.**

**Figure 3. Every specimen and its duplicates should be tagged. Jeweller's tags are used by most botanists. Write your name or initials and a unique collection number on one side, and the date and site number on the other side.  Use a pencil or waterproof pen.**

**Figure 4. Attach tags securely to each specimen.**


**Figure 5. Consider how the pressed specimen will appear. Its form at this time largely determines its ultimate appearance. Unnecessary twiggy shoots and excess material may be cut away.**

**Figure 6. Flatten out the specimen by closing the day-press and securely attaching the straps (in this case, Velcro straps).**

**Figure 7. Record the latitude and longitude of the site using a GPS unit. Alternatively, mark your position on a map, and record the grid reference.**

**Figure 8. Record site/habitat data (locality, soil/geology, vegetation type, associated species) and individual specimen data (habit, flower colour, abundance) in a notebook. All notes should be recorded at the collecting site and not at a later time.**

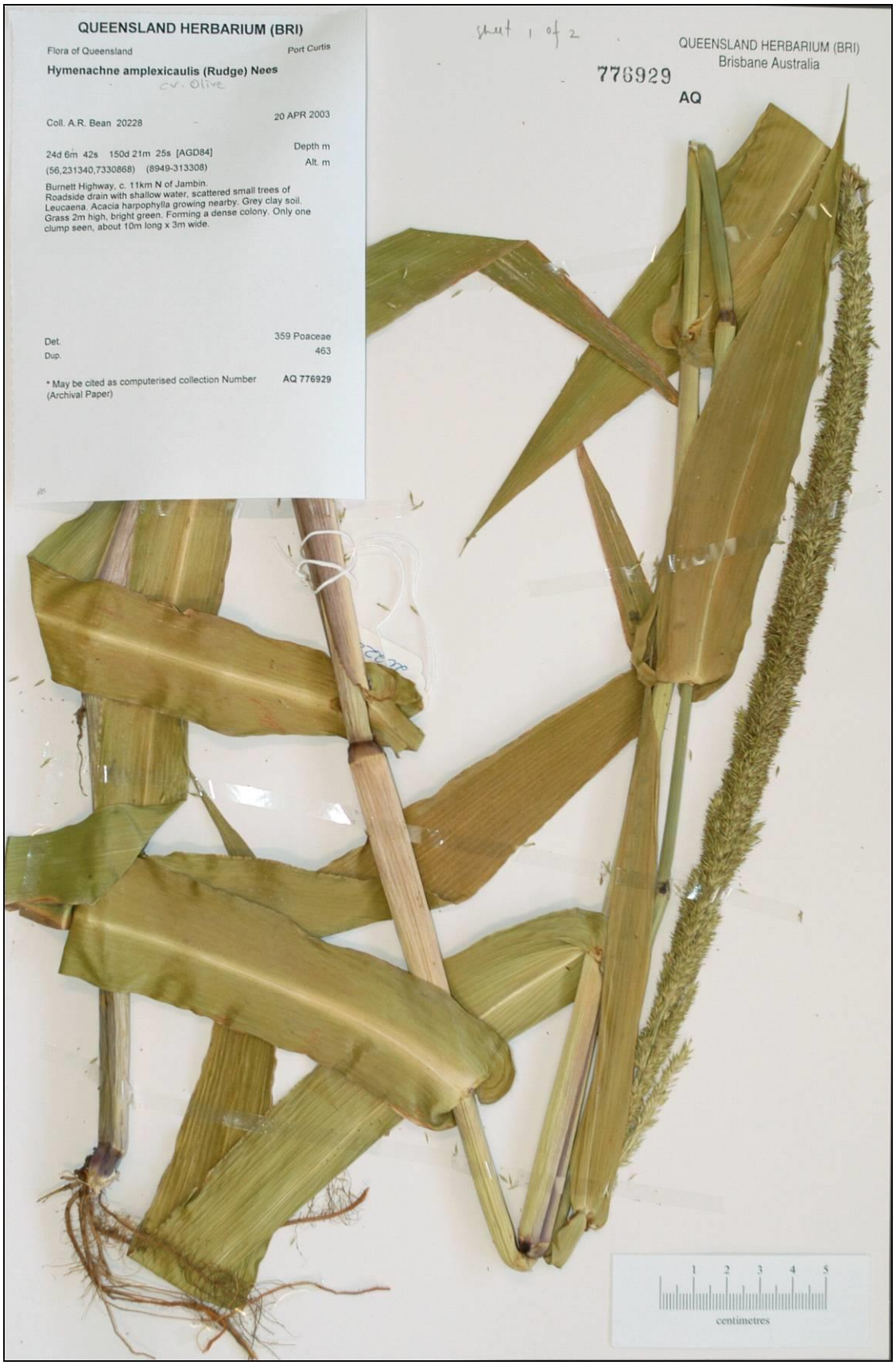


**Figure 9. Example of a mounted and labelled herbarium specimen. (*Hymenachne amplexicaulis*).**

# Data to be recorded in the field

Many botanists use a small notebook to record information about the specimens they collect, and the sites at which they collect them. Increasingly, apps are available to collect the data digitally.

The following information should be recorded before you leave the collection site, otherwise the chance of giving erroneous information is greatly increased.

1. A preliminary descriptive locality. This can be modified later after consulting maps, but the preliminary locality reminds you about which site it is.
2. GPS location. This can be recorded as latitude and longitude or AMG. Remember to also record the datum that you are using e.g. GDA94.
3. Habitat (site) data, including landform, slope, dominant plant species, structural formation, for example “open forest”, “open woodland”, or “shrubland”. Soil type and geology should be added if known. Record whether the collection site was a disturbed site such as a roadside, burnt area or grazed paddock. Regional ecosystem information may be recorded, but not as a replacement for actual observations on the site.
4. Information about the individual species collected at the site, particularly height, form, bark type, colour, texture (for trees and large shrubs), presence of rhizomes, presence and colour of sap in cut stems, colour of new growth and flower colour. Flower colour often changes on drying. Also record the relative abundance of the species, particularly for rare or threatened species or weeds.

# Drying specimens

It is essential to dry the specimens fairly quickly, to prevent the onset of fungal attack. Fungus affected specimens are of limited value to a Herbarium.

If your field trip involves car travel, specimens placed in presses on the roof rack will dry within a few days if the humidity is low.

In warm humid environments, the damp papers and corrugates must be replaced daily. In drier inland areas, every 2 or 3 days will suffice. After changing the papers and corrugates, the specimens should be again tightly packed in the press, otherwise they will not remain flat.

At the first paper change, adjust any undesirable features of the specimen, for example folded leaves, leaves all showing the same face, flowers obscured by leaves. Such adjustments will not be possible once the specimen has fully dried. Look for any evidence of insect attack, especially caterpillars in flowers, and remove any insects found.

### Drying in the field

Placing the presses in the sun during the day appears to have little drying effect except for the topmost and bottommost specimens. However, the sun is invaluable for drying the damp papers and corrugates once they have been removed from the press.

Collapsible field driers are useful in remote areas. Typically these consist of an outer metal frame with a wire grid where the press sits on top with a gas burner below on a very low flame.

**Drying when based in a powered building**

A fan heater (set on the lowest heat) will assist drying, provided you ensure the air is directed towards the press and has free access through the gaps in the corrugates. Placing specimens near an air conditioning unit will also assist with the drying process.

Some specimens tend to fall apart during the drying process, with the leaves detaching from the stem. This especially applies to specimens of *Erythrina*, *Ficus*, Loranthaceae, and mangroves. Leaf detachment can be prevented by dipping the newly pressed specimen in very hot water for 15 seconds, or placing it in a microwave oven for a similar time.

Alternatively, specimens can be placed in a large plastic bag with enough alcohol to thoroughly wet the foliage and stems. After 12–24 hours, remove the specimen and press between newspaper as previously described. Alcohol kills the plant tissues quickly and prevents leaf abscission. If you use alcohol then it is important to say so in the data you collect, as these specimens will no longer be useful for DNA studies.

If leaves detach, place them in a labelled paper packet and keep with the specimen. These can still be useful.

# Writing a final label to accompany the specimen

The data that accompanies a herbarium specimen is just as important as the specimen itself. Even a very good quality specimen is of no use to a Herbarium unless it has a written label with the information detailed below. Alternatively you may provide these data in an Excel spreadsheet – if you wish to do this, please contact the Queensland Herbarium for the current template.

**Collector’s name:** [mandatory] the name(s) of the person/people who collected the specimen, preferably no more than 2 people. You don’t need to include everyone who was on the trip.

**Collector's number:** [optional] A unique number, usually sequential, given by the collector as a private record.

**Date of collection:** [mandatory].

**Botanical name:** [optional] If you are unsure of the identity it is still helpful to suggest a name, or at least a genus.

**Locality:** [mandatory] A written description of the precise collection locality is necessary, AS WELL AS a latitude and longitude reading.  A GPS location alone is not sufficient. The locality description should be detailed enough to enable any person to revisit the approximate place of collection. On the other hand, the locality description should not be too verbose and should not include information better included under "Habitat". Commonly, the description includes distance and/or direction from a town or a well-known locality that is on a readily available map. It should be meaningful to someone not familiar with the local area.

Here are some examples of a **good** locality description:

W Claudie River, 10.3 km WNW of Lockhart River (GPS 12º 44’ 38” S; 143º 15’ 30” E)
Johnston Creek, 1 km N of Mt Etna, Grid Reference: 238951 (easting), 7436790 (northing); zone 56; Datum: GDA94 (WGS84).
Injune-Rolleston road, 86 km N of Injune, Grid Ref: 659470 (easting), 7222980 (northing); zone 55; Datum: GDA94.
23.4 km by road NNW of Proserpine P.O. on road to Dingo Beach

15.8 km S of Lake Cargellico on road to Rankins Springs

Here are some examples of a **poor** locality description:

Nolan Ck [ambiguous]
Rockhampton [too vague]
Laura-Coen [too vague]
SF64, Parish of Camboon, County of Dawson [maps giving this information not readily available; too vague]
Por 105 W of Comp 5 on Por 6 Parish of Bulli [maps giving this information not readily available]
SF144 [too difficult to establish where this state forest might be and where plant was collected]
548 km N of Mt Molloy [locality should be given from a nearby town, in this case, Coen]
Widbury [very few people would know where this is; no town mentioned]

**Geocode**: [mandatory] Copy the GPS reading obtained in the field, e.g. Latitude: 23º 46’ 43” S Longitude: 141º 17’ 29” E, Datum: GDA94 (WGS84); or determine a grid reference from a map. For Geocode, specify the format e.g. degrees, minutes, seconds, decimal degrees or degrees and decimal minutes (see specimen advice note at end of manual).

**Altitude**: [optional]

**Pastoral district**: [optional] Refers to the Queensland Pastoral districts, for example North Kennedy, Moreton, Darling Downs.

**Habitat**: [mandatory] Copy the information from the field note book, for example “flat area with woodland of *Eucalyptus populnea*, on grey clay soil.

**Habit etc.:** [mandatory] This information is copied from the field note book, for example “spreading shrub to 2 m” or “Tree 12 m high with basal stocking of hard tessellated grey bark; smooth and white above”.

**Abundance**: [mandatory] A comment on the frequency (number of individuals) of the plant at the site where you collected it, seedlings etc. You may use terms such as "common" or "occasional", or you may give the actual numbers of plants. If you can’t distinguish individual plants then record the approximate area covered. The abundance field is especially important for documenting the extent of rare or threatened species and the early spread of invasive weeds.

**Other notes**: [mandatory] Any other relevant information, for example, flower or fruit colour, perfume, regional ecosystem, a reference to a photographic image or material in spirit, or observed interaction with fauna.

# References

Australian National Botanic Gardens (2016). *Plant Collection Procedures and Specimen Preservation*. Australian Government, Canberra www.anbg.gov.au/cpbr/herbarium/collecting/index.html [accessed 12 Aug 2016].

Bridson, D. and Forman, L. (1992). *The Herbarium Handbook, revised edition*. Royal Botanic Gardens, Kew: London.

Victor, J.E., Koekemoer, M., Fish, L., Smithies, S.J., & Mossmer, M. (2004). Herbarium essentials: the southern African Herbarium user manual*. Southern African Botanical Diversity Network Report* No. 25. SABONET, Pretoria.

# Appendix A. Collecting Weeds

Strict hygiene must be observed when collecting specimens of species listed as Prohibited or Restricted invasive plants under Queensland's Biosecurity Act 2014 in order to prevent the further spread of these pests. Prohibited and Restricted invasive plants are listed on https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/383818/Restricted-plants-of-Qld.pdf

An exemption under the Biosecurity Act 2014 allows for persons to collect specimens of Prohibited and Restricted weed species for the purpose of identification by the Queensland Herbarium. The Queensland Herbarium has a set of weed hygiene protocols for the safe collection of weed material to prevent weed spread.

### Prior to travelling

Ensure that you have sufficient equipment and storage material for collecting and handling weed specimens. Include small and large sealable plastic bags (for dry material), a dust pan and brush, and information on weed infested areas. Contact your local government to find the location and details of clean-down facilities located nearby.

### Collecting your specimens

At the site, care must be taken to make sure reproductive material or propagules are not spread through the landscape by collecting activities. For example, seed heads may be collected separately (detached) and placed in sealed paper envelopes. Material that is already dry may be placed in sealed plastic bags.

Alternatively, where the reproductive material constitutes a large part of the specimen, the whole specimen may be sealed in a large paper envelope inside the press. Loose seeds and pieces should be placed in sealed envelopes, or discarded at the site of collection.

After you have pressed your sample make sure that reproductive material can’t fall out of the press or storage box. At each site, the storage area should be swept prior to leaving. Make sure that you dispose of any excess collection material at the site of collection.

Before departing the site, remove any attached seeds and plant parts from your boots, clothing, and equipment. Vehicles should be thoroughly cleaned. This includes removal of mud attached to the wheel arches and chassis, soil or organic material in the foot wells (in the cabin), engine bay and recesses and storage areas. Consult the vehicle clean-down procedures given by the Department of Agriculture and Fisheries at https://www.daf.qld.gov.au/plants/weeds-pest-animals-ants/weeds/preventing-weed-spread/cleandown

### Transportation

When transporting high-risk material, the whole press should be transported in such a way as to prevent seed falling from the press. For example, the press may be placed in a plastic storage box while in transit, in such a way that still allows moisture to escape. Material should be carried inside the vehicle, and not on roof racks unless in properly sealed containers.

### Processing and maintaining presses and specimens in the field

Processing of specimens in the field usually involves replacing damp paper with dry, trimming and tidying specimens and completing labels. These activities should be carried out in a clean area, preferably inside a building, and care should be taken so that all excess plant material, trimmings,

used newspaper and envelopes and other loose bits are collected into sealed plastic bags, which are then disposed of appropriately.

When specimens are completely dry they should be double sealed in a plastic bag (one inside another) suitable for transportation or posting. Packages sent to the Queensland Herbarium should be clearly labelled with the name or suspected name and declared status of the species on the outside of the packaging.

**References**

Harris, W., Morton, J., and Holland, A.E. (eds) (2008*). Difficult to collect plants: a manual for Weed Spotters.* CRC for Australian Weed Management, Adelaide.

Marchant, N., Gathe, J., & Lewington, M. (2001). *How to collect and record weeds.* Weed Information Network. Western Australian Herbarium, Department of Conservation and Land Management, The Natural Heritage Trust. Western Australia.

Morton, J. (2005). *Collect, Prepare and Preserve Weed Specimens.* CRC for Weed Management, Brisbane.

# Appendix B. Notes on the plant parts that need to be collected to identify some flowering plant families and groups

**Apiaceae**: ripe fruits are essential

**Asteraceae**: collection of mature achenes (fruiting structures) is essential. Always ensure that at least some of the collected heads are past flowering.

**Brassicaceae**: ripe fruits are essential

**Cucurbitaceae**: these species are often dioecious so collect male and female specimens. Flowers and fruits are best placed in spirit.

**Cyperaceae**: ripe fruits (nuts) are essential and collection of rhizomes and/or tubers is recommended.

**Deciduous plants**: Collect fallen leaves; these can be made pliable by soaking in water for 15–30 minutes.

**Lamiaceae**: record the smell of crushed leaves. Spirit material of flowers is highly desirable.

**Legumes** (Caesalpiniaceae, Fabaceae, Mimosaceae): mature pods are very important for identification. Some pods will shatter on drying. To retain seeds, place paper envelopes over pods in the press. Some legumes have underground pods or tubers. Carefully dig out the plant and gently brush away the soil.

**Loranthaceae**: fruiting specimens without flowers are difficult to identify. To prevent leaf-fall, dip material in very hot water or use a microwave oven, then dry in a press as usual.

**Myrtaceae**: For Eucalyptus and related genera, photographs or notes about the type of bark are essential. Collection of juvenile leaves is very helpful. For Melaleuca, include new (soft) vegetative growth.

**Rainforest plants**: flowers and fruits are desirable but not always essential. Collect branchlets with leaves and actively growing shoots from mature plants if possible.

**Orchidaceae**: it is essential to place some flowers in spirit. Photographs are useful.

**Poaceae**: collect the whole plant, including roots, rhizomes or stolons (except for bamboos).

**Solanaceae**: fruits in spirit are highly desirable

**Stylidiaceae**: flowers in spirit are highly desirable

# Appendix C. Collecting difficult plant groups

***Macro-algae and mucilaginous water plants***

Because these plants stick readily to newspaper it is best to prepare them as follows:

If small they can be floated onto a mounting sheet by laying the clean specimen in a tray of water and gently sliding the sheet underneath, then lifting it out with the specimen arranged appropriately on the sheet.

With larger plants such as water lilies, the specimen can be taken out of the water and carefully arranged on the sheet.

The sheet is then placed in a dry place to partially dry for perhaps a day. The specimen will be stuck or partially stuck to the mounting board.

Carefully press, preferably with waxed paper or nylon sheeting between the specimen and the usual newspaper.

**Bananas *(*Musa *spp.)***

A good collection of a banana (Musa sp.) comprises herbarium sheets of pressed material, written notes, spirit material and photographs.

Portions to include on herbarium sheet

- half lamina base + midrib, and upper section of petiole. Imagine the junction between lamina and petiole as forming the middle of the herbarium sheet. Cut off the top of the leaf, cut off the bottom of the petiole, and cut off one side of the lamina leaving the midrib intact, so that what remains will fit onto a herbarium sheet. One reference recommends collecting from the fourth-last fully developed leaf below the inflorescence.
- petiole base. Remove petiole very close to stem. Split petiole in half, longitudinally. Put both halves on a second sheet.
- one 'hand' of fruits. Include one fruit cut in longitudinal section
- one cluster of male flowers, attached to the subtending bract
- portion of the male peduncle (the hanging 'tail' between bunch and male flowers).

The reproductive parts should fit on one sheet i.e. 3 sheets in total.

Layers of foam should be used to allow parts to press properly, and because of the bulky and moist reproductive parts (especially the fruits), some weeks in a specimen drying oven are essential for the successful production of the dried specimen.

Things to note on the specimen label

Plants suckering freely or hardly suckering at all, colour of sap in suckers (watery, or red to violet, or milky), colour of pseudo-stem; older bracts strongly revolute or scarcely revolute, inflorescence erect or pendulous, total length of lamina and petiole, colour of fruit, colour of male flowers.

Portions to include in spirit material: use a large screw-top glass jar.  Include some male flowers, some female flowers, some fruits and a bract.

Things to photograph: whole plant, pseudo-stem (to show colour), whole inflorescence, bracts and male flowers.

### Cacti and succulents

Preparation

Cut large flowers longitudinally or cut one side and open like a fan and flatten.

Make longitudinal sections and cross sections (about 1cm thick) of the stem. Include roots if possible. Keep aside some flowers and a piece of attached stem for a spirit collection.

Pressing

Press in the normal way with cardboard and newspaper and tie into a bundle. Put the whole bundle into a plastic bag and add 1–2 cups of alcohol. Seal up and leave for 24 hours to fume. Place the bundle in an airy position away from any source of flame. Allow it to ‘dry out’. Place bundle into drying oven.

Succulents can be treated as for cacti, or frozen for 24 hours. Once frozen, the papers initially need changing 2–3 times per day.

**Note**: specimens sent to the Queensland Herbarium for identification may be sent in the fresh state, in a cardboard box or something similar, clearly labelled if spines are present.

### Cycads

Specimens will need to include a cone or at least a number of the sporophylls (scales) that make up a cone. Also include an entire leaf (i.e. the entire "frond", not just an individual pinnule (leaflet)) and an idea of how many leaves are present in the crown of the plant. As a leaf may be anything from 50 cm to 3 metres in length, they may be cut into c. 30 cm lengths for ease of handling.

### Fungi

Please refer to Leonard, P. (ed.) (2009). A Guide to Collecting and Preserving Fungal Specimens for the Queensland Herbarium. Queensland Herbarium, Department of Environment and Resource Management, Brisbane, or contact the Queensland Mycological Society at http://qldfungi.org.au/

**Caution**: Many fungi are toxic. Avoid inhaling spores. Wash hands after handling fungi.

### Grass trees (Xanthorrhoea)

Note the lengths of the flowering and non-flowering parts of the spike ("spear"), and of the trunk (if any) below the leaves. The middle part of the spike (including the base of the flowering/fruiting portion and the top of the smooth portion) should be collected, as should a few complete leaves, including the leaf bases if possible. Be very careful not to damage the plant when collecting leaf bases; grass trees grow very slowly and may be a hundred or more years old.

### Mosses, lichens and liverworts

Try to include fruiting bodies. These consist of tiny capsules or disks or "umbrellas" on stalks, or cupped to spherical appendages. Remove a few square centimetres of the plant mat gently from the substrate or, if adhering closely to bark, soil crust, or rock, cut or chip away pieces of the substrate with the plant in place. If the specimen is bulky or very wet, flatten it very carefully. Do not squash or press – place each specimen in a separate paper (not plastic) bag with a collection number and notes, and allow to air dry.

**Bamboos**

Bamboos comprise a section of the very large grass family Poaceae. Many species are in excess of 5 metres tall and some can reach 30 metres or more. One of the characteristics of most bamboos is that they rarely produce flowers, and so when you collect a specimen, the chances are that only sterile material will be available.

You will need to collect the following: a leafy sample from a terminal shoot; a sample of the stem or culm about 30cm long (you will probably need a small saw to remove this), and one or more culm sheaths. These are attached to the culm at the nodes, but are soon deciduous, so are most readily found lying on the ground at the base of the bamboo. Collect flowering sprigs if the flowers are present.

In your notes, record whether the species is tightly clumping, or 'running'; the stem colour and any striping, overall height, and the branching pattern at the nodes. Also note from which part of the plant you collected the stem section and the culm sheaths. Photographs of these features are also very helpful.

**Palms (Arecaceae)**

Record the label information on each piece with a tag. Photograph the plant and each entire part before sectioning. Place a common object such as a pencil in the photograph to provide scale.

Leaves

Measure the petiole, blade, rachis and leaflet lengths of pinnate leaves, the petiole and blade length of palmate (segments radiating from a single point) leaves and the petiole, blade and rib lengths of costapalmate (leaf stalk extending into leaf blade - rib) leaves.

If leaves are small, keep and press whole leaf.

For large leaves divide the petiole into mounting paper size pieces. Number the pieces on the tags to keep them in order of cutting.

Pinnate leaf. Take several pieces from the blade. Include tip. For each piece, apart from the tip, cut the rachis into a mounting sheet size length, remove the leaflets on one side leaving the stubs near the rhachis. Fold the other side back and forth to fit the mounting sheet.

Palmate leaf or costapalmate leaf. Keep the point of attachment to the petiole and ensure that the hastula is showing. Cut off one side of the blade, part of the other side and fold several times to fit the mounting sheet and press.

Inflorescence

If the flower cluster is small, fold and press all of it. If it is large, keep several portions including the base and also showing the origin of the side branches in successive order.

If applicable try to keep an entire inflorescence main stem with the side branches removed. Selected side branches from noted positions should be kept and pressed.

All of the spathe should be kept, cutting it into sections if necessary. Some flowers may be preserved in spirit.

Fruits

Fruits should be treated as for flowers. The cupule (or cup) at the base of the fruit should be kept. Large fruits may be dried quickly if cut in half.

**Pandans (Pandanus, Freycinetia)**

For details on collecting Pandans, see Stone (1983).

**References**

Argent, G.C.G. (1976). The Wild Bananas of Papua New Guinea. *Notes from the Royal Botanic Garden Edinburgh* 35: 77–114.

Bailey, L.H. (1946). The Palm Herbarium. *Gentes Herb. Ithaca* 7 (fasc. 2): 153–180.

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