

# Make your own Herbarium Specimens



**University of Melbourne Herbarium  
School of Botany**



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# Introduction

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University of Melbourne Herbarium

A herbarium (plural: herbaria) is a collection of preserved plant specimens. The specimens housed at The University of Melbourne Herbarium are predominantly dried and pressed, although herbaria often store 'wet' plant collections preserved in 70% ethanol.

Herbarium specimens form an important recorded of what plants grew where over time. They may have been produced as a voucher for an environmental survey or botanical research, and serve as a permanent record allowing anyone to go back and check the identification, re-sample or repeat research. The production of herbarium specimens is therefore an important, but often forgotten aspect of botanical studies

There are four main aspects to making good herbarium specimens:

- collecting
- pressing & preserving
- mounting
- labelling

Quality herbarium specimens are an important recourse and require both skill and dedication to produce. They require care when collecting and pressing together with accurate, detailed labels. Many specimens in The University of Melbourne Herbarium originated from student collections and with care and dedication your specimens may too end up as part of this important archival collection to be used by students and scientific researchers for centuries to come.



# Collecting

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## 2.1 What to collect

When collecting plants for herbarium or voucher specimens there are two basic points to remember:

- Include all available parts of the plant (i.e. all reproductive structures such as fruits, flowers and buds, as well as bark, leaves, juvenile or coppice foliage, etc)
- Include detailed notes about the plant and it's surroundings.



When in the field it is a good idea to collect two samples of the plant, one for dissection and identification, and another for the herbarium specimen. While in the field, always record details of the plant in your field note book. Do not rely on your memory! This information will later be included on the specimen label.

Before venturing out in to the field always consider the laws and ethics governing the collection of plant material. Collecting illegally can result in hefty fines and even jail.

The ideal specimen for identification and research is an entire plant, roots and all. Leaves alone are virtually useless. You should try to collect as much of the plant that is practical and possible given the size of the plant and which parts are most informative. In general aim to collect:

- At least the terminal parts of the aerial shoots including leaves and reproductive parts (leaves, flowers, buds and fruits).
- A representative sample (do not simply choose the biggest or prettiest).
- More than one specimen from a single plant if the plant is variable (e.g. juvenile leaves at the base, adult leaves higher up). These will be given the same collecting number.
- One specimen from different plants, ifd you are trying to show variation within a population. Specimens collected from different plants will have to be numbered separately.
- Collect at least a couple of specimens of each plant. Put one specimen in a plastic bag and keep it in the fridge for identification, and press the other.

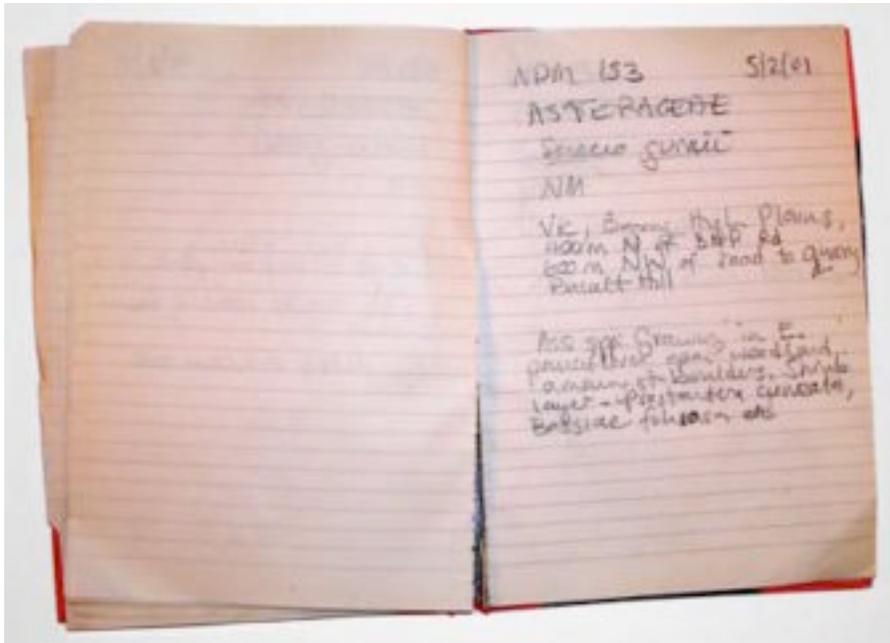
There are also specific collecting recommendations for different types of plants:

- Ferns, herbaceous angiosperms (eg grasses and herbs)
- Woody plants (shrubs and trees)
- Algae, lichens, mosses and other cryptogams
- Fungi

## 2.2 Field Notes

Without detailed, accurate information a herbarium specimen is almost useless. You should write notes while in the field collecting. *Do not rely on your memory!* A hard backed exercise book makes a great field note book. In your field note book you should:

- Use a waterproof pen or pencil so your notes are not lost in the rain or mist.
- Write your contact details in the front cover so the book can be returned to you if lost.
- Stick a copy of a herbarium label in the back cover to remind you what information is required.
- Use one page per specimen so you have additional room if you need to add information later.



## 2.3 Numbering and tagging

Record numbers are used to identify different herbarium specimens to their information in your field note book.

The best numbering system is the simplest: start from number 1 and continue for the rest of your collecting career. Use your initials in front of the number to differentiate your collection from someone else's (eg NDM 133).

As a general rule, the same number is given to parts collected from a single plant on the same day. If small herbs or grasses are being collected, such that several entire plants can fit onto a single sheet of mounting card, these specimens may be given the same collecting number if obtained from the same population.

Specimen numbers are recorded in your note book and on a tag that is attached to the specimen to link the two.



At The University of Melbourne Herbarium we use small tie-on cardboard tags called jewellers or strung tags (pictured above).

## 2.4 Specimen Preservation in the Field

Mesophytic plants and those with delicate petals wilt and shrivel quickly once picked, resulting in poor quality herbarium specimens.



The best but not necessarily the most practical way to reduce this, is to take your plant press into the field and immediately press specimens as you collect them.

As this is not always practical or possible, labelling specimens with tags then storing them in sealed plastic bags out of the sun, is ok on cool days.

To maintain specimen quality especially on hot days:

- maintain humidity inside plastic bags by swirling a small amount of water inside the bag first,
- dampen some folded handtowel and place this in the bag with the plants,
- put the specimen filled plastic bags straight into an iced cooler or eski.

Once picked, most specimens will maintain turgor for a few days if kept in a sealed plastic bag in the fridge prior to pressing.

Specimens such as aquatic plants and delicate flowers deteriorate rapidly. These should be kept in extremely humid air, or pickled or pressed immediately. Fungi sweat and become slimy if kept in plastic bags, these need to be dried immediately.

## 2.5 Collecting Ferns, Grasses and Herbs



Collect the entire plant including underground organ/s (roots, rhizomes, tubers, etc), inflorescences (flowers), infructescences (fruits) and other fertile structures.

If the plant is small it is a good idea to collect multiple plants (as long as they all come from the one population).

These can all be given the same collecting number and put on the same sheet of herbarium card.

## 2.6 Collecting Shrubs and Trees



In addition to the general points on collecting, it is also a good idea to collect bark (especially for eucalypts and many other trees) either from the trunk or ground, but make sure to note where it came from and how far up the tree.

If the plant shows adult/juvenile/coppice or sun/shade leaf differences then collect and note these differences.

## 2.7 Collecting Cryptograms



Collect the entire plant or colony of plants if they are growing close together. Include algae holdfasts and bryophyte sporophytes

## 2.8 Collecting Fungi



Fungi are very fragile, so be carefully when collecting, transporting and storing them. If the fungus is parasitic, remember to also collect some of the host specimen. When collecting macro fungi the entire specimen including the stipe and root-like mycelium is required.

If there is more than one specimen growing in the area collect two or three, showing different stages of development.

For more information on fungi the FungiMap website is a good resource.

## 2.9 Laws and ethics of collecting

### Laws

Prior to collecting, it is important to consider the legislation, ethics and health and safety aspects associated with plant collecting. When taking plants from public or private lands (reserves, state forest, road verges, railway lines, public gardens, cemeteries, schools), always seek consent of the landowner. This may mean contacting the Local Council that looks after the garden, speaking to the gardener in charge, farmer, caretaker, etc.

To collect from Victorian National or State Parks you must obtain a permit from Department of Sustainability and Environment (DSE). Collecting from public parks without an official permit is illegal and can incur large penalties. Ignorance is not a defence. Permits are generally only given to scientists associated with research institutions that are conducting important research. Being a botanist or collecting for this course will not save you from prosecution.

*Note: A number of Victorian native plants are considered rare and endangered and must NEVER be collected as they are legally protected by the Flora and Fauna Guarantee Act 1988 . In addition to these species, a number of communities are also protected e.g. alpine bogs, snowpatches and many grasslands, grassy woodlands and rainforest communities . A list of these species, communities and more information about protected flora in Victoria can be found at the DSE website.*

### Ethics

Always respect and care for the environment from which you are taking flora. No matter where you are collecting, always take only the minimum amount of material required and never collect more than 25% of a single population or more than 10% of the reproductive material.

Endeavour to collect away from the public eye, as others seeing you may not realise that you are collecting in the name of science.

### Health and Safety

The University of Melbourne has strict guidelines governing fieldwork. These aim to make off campus work safe for both the individuals undertaking the collecting and the environment they are working in.

The School of Botany also has a list of guidelines regarding plant collecting and collecting permits.

## Preserving and Pressing

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## 3.1 The Preserving Process

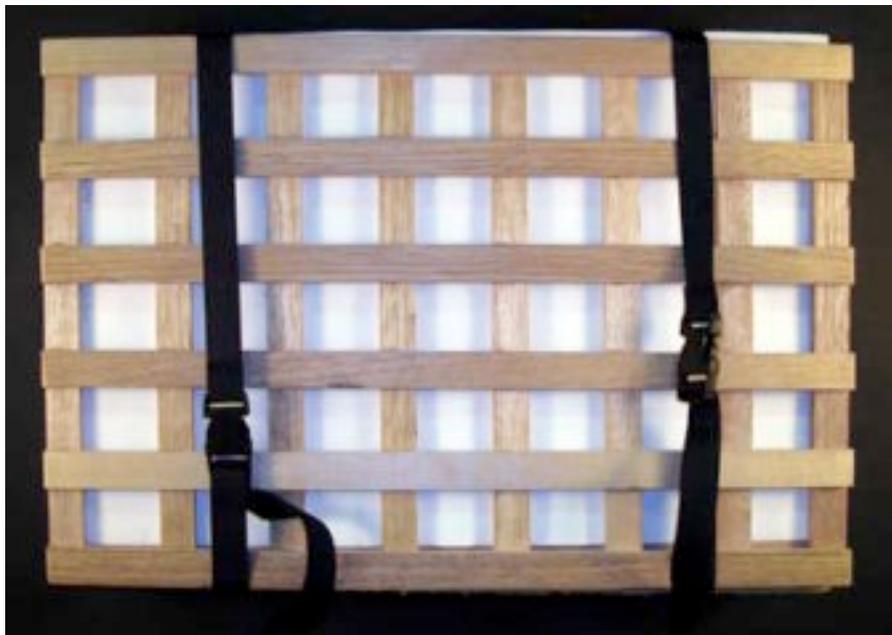
Herbarium specimens are generally preserved by pressing until dry, or pickling in a liquid. Pressing means to apply enough pressure to hold the plant in a position that best displays the botanical features while drying.

The keys to achieving well pressed plants are:

- Dry them as quickly as possible in a good plant press.
- Care for the specimens as they dry.

### Plant Press

Plant presses come in various forms but usually consist of two wooden boards or lattices (30 x 45 cm), cardboard and newspaper arranged like a sandwich (pictured below). Straps or belts are wrapped around the press to hold it together.



To construct a press open a sheet of newspaper, place your plant on one side and fold over the top of the specimen. Newspaper (Herald Sun or a folded Age is the perfect size) or large sheets of blotting paper are used as they absorb moisture from the specimens.

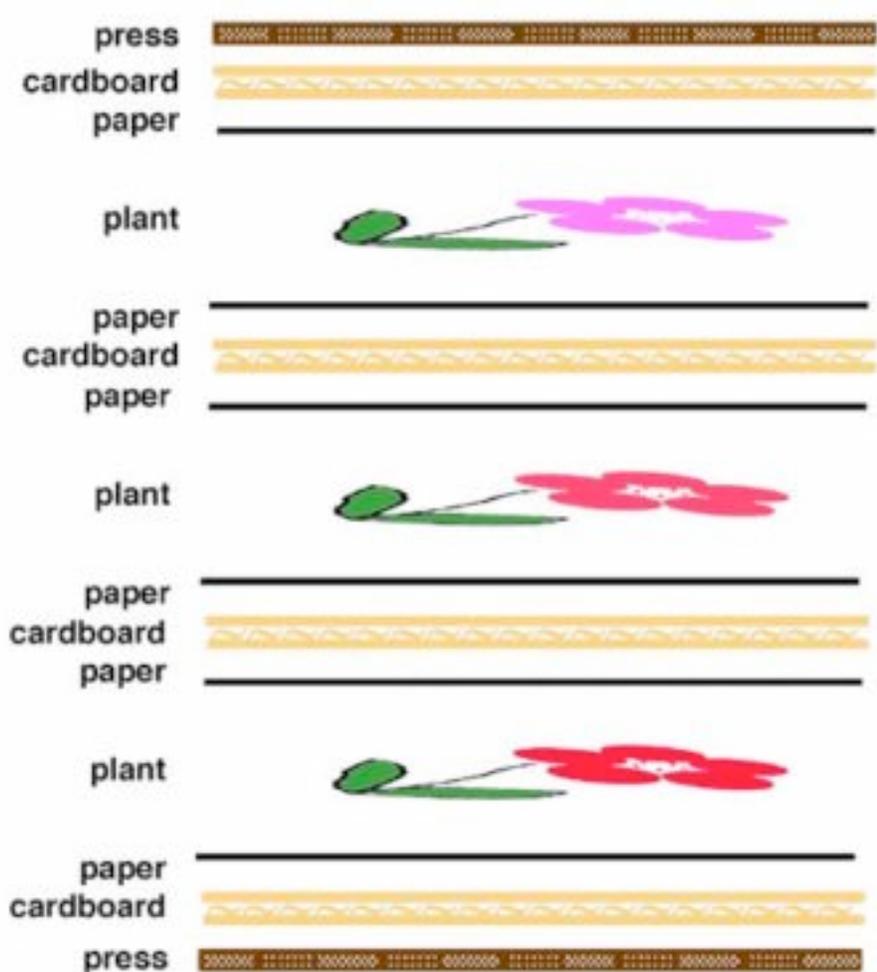
On top and below this plant/newspaper sandwich place a sheet of cardboard. Corrugated cardboard is better than solid cardboard as it allows the air to circulate within the press, helping the specimens to dry quickly. Cardboard is also important within the press as it provides flat surfaces to dry the specimens against.

To complete the plant press, stack several plant/newspaper/cardboard sandwiches together and place a wooden boards or lattices on the top and bottom (pictured). Lattice is also preferred as it helps the specimens to dry faster.

Around the stack, wrap rope, leather belts or nylon straps and tie or fasten to hold the press together and apply pressure. If you do not have a plant press, pressure may be applied by piling telephone or heavy textbooks on top. Either way, the pressure should be even across the specimen so they dry flat. Specimens with bulky parts (e.g. eucalyptus fruits) may require thick folds of newspaper around bulky fruits or branches so that pressure is

transferred to the less-bulky leaves and flowers. Remember, the aim is not to squash the water out of the specimens, just to hold them flat in position while they dry.

Simplified diagram of a plant press.



## Care while drying

Once in the press it is important that specimens are dried as quickly as possible to prevent them from going mouldy. Normally specimens take 7-14 days to dry depending on the air temperature, humidity and the dampness and/or succulence of the plants.

The following suggestions will help to dry your specimens quickly :

- Use a lattice press.
- Use cardboard with internal corrugations.
- Use blotting paper to absorb the moisture.
- Stand the press in a warm, dry place, e.g. a cabinet-type clothes drier set at low heat. Be careful not to burn the specimens or press.
- Replace the newspaper to remove moisture and fungal spores.

## Replacing Newspaper and Rearranging Specimens

It is important that specimens are checked regularly while drying to ensure that insect or fungal attack does not occur, and to reposition the plants. Initially Newspaper sheets should be replaced daily to remove moisture and spores. After the third day this can be done every 2-3 days until the specimens are dry.

When changing the newspaper re-position the specimens while they are still pliable. When rearranging, aim to achieve the following:

- Ensure all botanical features are showing, including both lower and upper leaf surfaces.
- Make sure the specimens will fit on the mounting card when dry, remembering to leave space in the bottom right hand corner for the label!



Keep a picture in your mind of what you want the final herbarium specimen to look like - once the specimen dries you won't be able to move it.

If your specimen is too big to fit on a single sheet of herbarium card pruning, overlapping or folding the specimen when pressing may help.

If all else fails, cut the specimen in half and mount it on two sheets of card. If you do this, however, you will have to put a label on each sheet and note the total number of sheets on each label (eg. "Sheet 1 of 2").

For long specimens (eg. grasses, sedges, daisies) fold the flowering stalk into a zigzag when drying to fit it on a single sheet (as left).

## Handling Specimens

Always handle your specimens with care to prevent them from breaking or parts from falling off. As they dry however, some plants inevitably drop their leaves, seeds or flowers. If this happens, collect these parts and put them into a labelled paper envelope alongside the drying specimens. These will be added to the herbarium specimen at the mounting stage.

By following the above notes you should create good quality specimens. Some specimens do however require a little more care when pressing and drying:

- Succulent or fleshy vascular plants and fruits
- Aquatic Plants
- Mosses, liverworts and other bryophytes
- Fungi

### 3.1 Preserving Succulents



Succulent or fleshy vascular plants and fruits are prone to fungal damage and require additional care.

To prevent this and also to aid drying, change the paper more regularly or use more absorbent paper such as blotting paper. Prior to pressing it may help to immerse or brush the specimen with alcohol to kill fungi (see Pickling for alternative ways to preserve fleshy plant parts).

If fleshy fruits are separate from the herbarium specimen, place them in a labelled paper bag and leave this next to the plant press rather than in it. Check and change the paper bag frequently.

### 3.2 Preserving Aquatic Plants



Aquatic plants usually need to be immersed in a tray of water to allow full expansion of branches and to show the habit of the plant.

Within the tray of water, mounting card is slipped under the floating specimen and both are slowly dragged out of the water together using a paint brush to carefully arrange the specimen on the card.

Marine algae contain sticky alginates in their cell walls so naturally stick to the mounting card. Place this card and specimen between newspaper sheets to dry.

### 3.3 Preserving Bryophytes (mosses, liverworts and hornworts)



Mosses, liverworts, lichens and other bryophytes do not need to be pressed.

Simply remove as much soil as possible and place the specimen/s in a paper bag to dry.

Check the specimen/s daily to check for insect or fungal damage and to change the bag.

### 3.4 Preserving Fungi



Fungi are not pressed. They are dried rapidly in paper bags or cardboard boxes.

The length of time required for drying varies from a few hours to a few days depending on the fleshiness of the specimen.

Macrofungal collections of multiple specimens should include one specimen cut in half longitudinally and a spore print. A spore print is produced by placing the fungal cap gill-side down on a sheet of paper and leaving it overnight. During this time the spores will be released and are useful for identification.

For further information regarding fungal herbarium specimens see Forman & Bridson (1991).

### 3.5 Spirit Collections

Spirit collections may also be called wet, pickled or alcohol collections. All refer to preservation of specimens in a solution to maintain the three dimensional structure. Spirit collections are predominantly used for preserving

succulent or delicate structures (eg. petalous flowers or fleshy fruits) that shrivel upon drying, or when the structure or shape of the specimens is required (e.g. botanical illustration, microscopy, etc).

Until recently, specimens were pickled in F.A.A. (Formaldehyde + Acetic Acid + Alcohol). FAA is no longer used however, as formalin has been found to be extremely toxic.

Today solutions such 70% ethanol (70% ethanol + 30% water) are preferred for wet collections. Sometimes 1% glycerol is added to stop the specimens becoming brittle. Such solutions are safer but protective clothing should still be worn when using ethanol. Ethanol is also highly flammable so precautions need to be taken regarding storage and use.

# Mounting

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To mount a specimen means to adhere it onto a sheet of herbarium card. A well mounted specimen should display both artistic and botanical qualities. It should be arranged on the card in a balanced, aesthetically pleasing way, paying attention to:



- Orientation and type of mounting card.
- Arranging and attaching the specimen.
- Position of label and accompanying annotations.
- Keeping loose parts in specimen bag.

## 4.1 Mounting Card

Official herbarium specimens are mounted on 29 x 43 cm archival quality (acid free) white mounting card (250 GSM). The direction of the card is "portrait" (vertical).

## 4.2 Arranging the Specimen

If pressed correctly, the plant specimen should fit perfectly on the mounting card. When arranging the specimen:



**Volunteer Novita mounting a specimen**

- Leave a 1cm border around the edge to allow space for holding when picking up the card.
- Single specimens should be centred on the mounting card and are usually placed vertically or diagonally across the sheet.
- Small plants with multiple specimens should be arranged in evenly spaced rows spread over the whole card.
- Orientation of the plants should represent their habit, i.e. usually flowers to the top and roots towards the bottom.
- Flip the specimens onto the side that displays the most botanical features (i.e. flowers, fruits, both sides of leaves, etc).

### 4.3 Attaching the Specimen

Specimens can be attached to the mounting card by gluing, sewing or with tape. Although gluing is the quickest method, it is also the least flexible as glued specimens can not be removed to expose the underside and can not be remounted.

At The University of Melbourne Herbarium archival white gummed tape is used for mounting. This is purchased in large rolls from which strips are cut at the desired length and width. Gummed tape is like a stamp or envelope, it must be moistened on the shiny side to become sticky. Once wet the tape dries quickly, particularly on hot days, so think about where you're going to place the tapes before you wet them.

As a rough guide, the width of the tape should equal the width of the branch being stuck down. The tape should be large enough to cover the branch or leaf and hang over each side of the branch by 0.5-1cm.

When using gummed tape:

- Tape should be centred over the branch/stem/leaf with equal length flaps on each side.
- Place tape perpendicular to the branch, stem or leaf midrib.
- Do not tape over important botanical information ie ligules, flowers, fruits, stipules, etc.
- Hide tapes under neighbouring leaves where possible.
- Use sufficient tape to secure specimen to the card so that it does not move, but not too much as it will destroy the beauty of the specimen. This usually equates to approximately 3-4 pieces of mounting tape for each 40 cm long main branch.
- Extra tape may be needed to support delicate specimen parts near edges of the card or heavy parts such as woody fruits.
- Each tape should cover only one branch/stem.

## 4.4 Specimen Bag/Envelope

Any parts of the specimen that break off must be kept. When dry place loose parts in a small polyethylene plastic bag or a paper envelope, fasten to the label and herbarium card with the specimen.

Points to remember regarding the specimen bags include:

- Use the smallest sized bag appropriate to the contents.
- Place a small label inside the plastic bag or write on the envelope details such as *species name*, *collector/s* and *date* to identify which specimen the bag belongs.
- Hang from top left hand corner unless this overlaps with the specimen..
- Fasten the bag with a plastic or 'owl' type paperclip as these don't have sharp edges. Paper envelopes may be stuck to the mounting card with glue.
- Do not place parts in a plastic bag until they are completely dry as they will go mouldy.

## 4.5 Attaching the Label

The label contains information about the specimen that has been copied from the field note book plus additional notes relating to the specimen's name and identification.

When attaching the label you should always:

- Place label in the lower right hand corner.
- Place 1cm in from the edge of the card to allow space for holding and to prevent damaging the label.
- Use archival clear gum glue.
- Glued down along the top edge only.
- Keep the label free from mounting tape and specimens.

## 4.6 Annotation Slips

*Determinavit* and *confirmavit* slips are small pieces of paper used to indicate determination (det.) or confirmation (conf.) of the specimen's nomenclature. Annotation slips usually indicate the species new name, date of identification and signature of the person who did the identification. The species name on the det. or conf. slip always overrides the name on the label. If numerous slips are present, the correct name of the species is that with the most recent date.



Det. and Conf. Slips are always:

- Only stuck down along *one end*. This is the end closest to the edge of the mounting card.
- Positioned 1-2 mm *above* and *in line* with the herbarium label. Place the det. slip next to the label if there is no room above the label.

Additional slips should be placed *above* previous slips on the right-hand side of the mounting card.

# Labelling

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MELBOURNE UNIVERSITY HERBARIUM (MELU)

Collector: \_\_\_\_\_ No: \_\_\_\_\_  
Date: \_\_\_\_\_ Det: \_\_\_\_\_  
Lat. ° ' S Long. ° ' E Alt. \_\_\_\_\_ m  
Locality: \_\_\_\_\_  
  
Habitat, habit and other data: \_\_\_\_\_

BR	NSW	QNSW	MEL	AD	PERTH	BT	E	US											
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**A sample herbarium label**

Without accurate information accompanying a herbarium specimen, it is almost worthless.

Traditionally herbarium labels were hand written, but today most herbaria use database systems from which labels are printed. A printable sample of The University of Melbourne label is available here or by clicking on the sample below. The following list illustrates the type of information and detail required on a herbarium label.

At a minimum your label should include:

- Family and scientific name of the specimen, including the authority.
- Collector's name/s.
- Date of collection.
- Locality where the plant was collected, including latitude and longitude.

If possible also include:

- Collector's specimen record number
- Name of the person who determined the identification
- Altitude
- Habitat or type of plant community
- Habit
- Any other details about the plant that may be important

Remember that the information on the label is specific to *your specimen* and may differ from the species description. Also, the more information you include the better.

When complete the herbarium label is attached to the bottom right hand corner of the mounting card.

## 5.1 Nomenclature

Nomenclature refers to the name of the specimen. Nomenclatural information is written in the space directly under the Melbourne University Herbarium (MELU) title, and includes the family and species names on separate lines. The family should be in CAPITAL letters, and the genus and second part of the species name (species epithet) should be in *italics* or underlined. Make sure only the genus name starts with a capital letter, not the species epithet.

Only use current plant names. Names can be checked by looking in a census, flora book or at The International Plant Name Index).

## 5.2 Authority

On your label the authority name/s are written after the species name. Authority names are frequently abbreviated so ensure you have the correct abbreviation. The authority is the person or people who first described the species name. The species name is followed by one or more peoples' names (frequently abbreviated). This is the 'authority' or author of the species. To find the authority of your specimen refer to a census, flora book or The International Plant Name Index website.

## 5.3 Collector's name/s

The collector is the person or people who picked the specimen. Your entry for collector should include the first and last name and the middle initial (eg Humphrey B. Bear)

## 5.4 No:

Specimen number given to the specimen usually by the collector. This is usually the collectors initials followed by a number (eg. HBB 54). Also see section on Numbering and Tagging Specimens.

## 5.5 Date

Date on the label refers to when the specimen was collected. To avoid confusion deciphering the month from the day, traditionally the date was written with the month as a roman numeral (eg. 3.V.1854). Today, however, the month is usually written in text (eg. 3 May 1854).

Always write the year in full (eg 2004, not '04) so that in centuries to come it will still be clear when your specimens were collected.

## 5.6 Det:

*Determinavit* (Latin) refers to the person who determined the name, or identified this specimen. If this is the same person as the collector, Det. can be left blank, or just the collector's initials written. Also see Annotation slips

## 5.7 Latitude and Longitude

These refer to the grid reference where the specimen was collected. They are best obtained by a GPS while out in the field, but can be calculated later using maps, a gazetteer or at the Geoscience Australia website. In Australia all specimens have a southerly latitude and an easterly longitude.

## 5.8 Alt.

Altitude is the height in metres above sea level where the specimen was collected. These can be obtained from a GPS or maps.

## 5.9 Locality

Locality is the place where the specimen was collected. When writing the locality, start from the largest area and conclude with the details. Include country, state, region, nearest town (distance and direction in km from P.O.), Park, Road or Street name, etc. You should include enough detail that someone else could relocate the population or even the exact plant you collected from.

## 5.10 Habitat, habit and other data

The bottom part of the label is for additional information about the plant that is not evident from the specimen itself but may be important to botanists, entomologists, gardeners etc.

Habitat refers to the vegetation type within which the specimen was growing (eg open *Eucalyptus obliqua* forest), while habit refers to the growth form of the plant from which the specimen was taken (eg shrub 1 m high x 1 m diameter). If the plant was collected from a garden, lawn or gravel roadside state this.

Other information may be ecological, taxonomic or general. For example flower colour, soil type, slope, aspect, plant height and width, associated species, bark colour and type, sap (eg. milky, resinous, etc.), distinctive odour, dioecy, abundance, pollinators, herbivory, etc.