

Imaging type specimens of algae, bryophytes, fungi and lichens: guidelines for Australasian herbaria

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1.0 Introduction

The methodology outlined in this document fulfils the minimum requirement for imaging of algae, bryophyte, fungi and lichen types for delivery to JSTOR. This document prescribes best-practice guidelines for imaging specimens. It does not provide recommendations on whether additional images should be taken at a higher resolution than is required by JSTOR and whether databasing and/or curation of specimens should be undertaken as part of the imaging workflow: these issues should be considered by each participating institution according to their own needs and priorities.

In contrast to vascular plants where images can often be used for taxonomic determination, there are limitations with images of algae, bryophytes, fungi and lichens. Taxonomically useful information is most often found at the micro-structural and anatomical levels and from both the vegetative and fruiting phases. Such characteristics cannot be captured during the imaging process. In addition, the handling and preparation required for the imaging of algae, bryophytes, fungi and lichens differs to that of vascular plants. These differences arise because of the difference in size of the specimens (specimens can range in size from a few millimetres to a number of centimetres), the presentation of the specimens (i.e. usually in packets or multiple packets or packets within packets), the collection of specimens on a variety of substrate e.g. rocks, bark and soil, and the amount of taxonomically useful information that an image of the specimen can provide.

In spite of the limitations, images of algae, bryophyte, fungi and lichen specimens and their associated labels, when available electronically, will allow researchers and/or curators to:

- easily verify label details, particularly when dealing with historical collections which may contain a large number of types but where the types are as yet un-studied and/or are not typified to today's standards and where specimen labels do not clearly correspond with protologue information
- assess the quality and quantity of the specimen i.e. type material may be depauperate or very small in size
- see where material of two different taxa are included within packets
- correctly identify potential type material for study i.e. select material to potentially request on loan
- view the organism in question and examine certain macro-structural features, and
- at a minimum, in many cases, make a generic determination.

The imaging process is undertaken using a Leaf Aptus II camera. The procedure can be broken down into three stages: preparation, imaging and completion. The complexity of the process will vary depending on the characteristics of the specimen being imaged.

Complicating factors will include:

- the need to take multiple images in order to capture all aspects and components of the specimen (e.g. where there is a large amount of accessory material such as notes, diagrams etc.)
- very small specimens requiring close-ups to be taken, and
- bulky specimens requiring stacking of images.

2.0 Equipment

- Leaf Aptus II camera
- Institutional ruler
- Nano colour chart
- Optional: Minitool ruler (Micro-Scale, 10mm, .1mm Div.)¹
- Metal weights, small ceramic/glass mosaic tiles or non-reflective glass or perspex sheet².
- Herbarium sheet and assortment of extra white cards
- Barcode scanner
- Curation materials to improve specimen storage post imaging (e.g. Mylar and polyester bags, tissue packets)

Refer to *JSTOR Resource Appendix B: Imaging Bulky Specimens* for setting up of Leaf Aptus II camera.

(**Note:** Institutions may also have written their own manual for imaging specimens with the Leaf Aptus II camera.)

3.0 Preparation and Imaging

(**Note:** see detailed example images in *Appendix I* covering various scenarios described in the following procedures)

- Select the type specimen to be imaged, scan the barcode using the barcode scanner and assess the various components that make up the type specimen to determine the layout of the specimen, labels, and number of images to be taken.
- Where necessary, remove the specimen from the herbarium packet³ and place on a piece of appropriately sized white card to efficiently highlight the specimen and set to one side.
- Carefully place the herbarium packet with the specimen label, barcode, type label, annotations and the specimen itself, on top of the white herbarium guide sheet⁴ (this should already have been set up in the centre of frame during the Leaf Aptus camera set-up). Metal weights, small mosaic tiles (non-reflective glass⁵ or perspex sheet) can be used to pin down packet edges. See example on pages 10, 17 and 18.
- Place colour chart⁶ and institutional ruler/scale with increments facing the specimen on the sheet. The area of placement of these tools is not standardised.

¹ Bulk order these tools (<http://minitoolinc.com/microtools.htm>)

² May need to experiment with ordinary or non-reflective glass or even perspex to see which is the most suitable material to use.

³ Procedure and tools used for removal of material at discretion of each institution.

⁴ Using a standard herbarium sheet provides consistency with JSTOR type images of ferns and seed plants.

⁵ Non-reflective glass or perspex will minimise glare from the camera flash.

⁶ The standard colour chart reference guide is useful for comparing standard colours to specimen material colour, within an image, in order to resolve distortions that may have occurred during its digital journey.

For mosses, the sporophytes should be oriented in an upwards direction (refer to Example 1 under 6.5 **Bryophytes – Mosses** in Appendix 1).

- Specimens may also include photographs, artwork⁷, field notes, microscope slides⁸, and letters. Depending on the number of photographs they may be imaged separately and superimposed back onto the sheet or imaged as a separate part. The total no. of images taken will depend on the specimen and its various components (refer to Example 6 under 6.2 **Fungi** and Example 1 under 6.3 **Lichen** in Appendix 1).
- Where there are multiple packets/smaller packets within packets or information on both sides of labels, packets, photographs or cards, reorganise the items on the sheet and take a second or third image as required. Close up detail shots can be taken at this stage if deemed necessary. Some specimens may also require stacking at the close up stage depending on the specimen or detail you are trying to capture e.g: slime moulds and lichens (refer to Example 5 under 6.2 **Fungi** and Example 2 under 6.3 **Lichen** in Appendix 1).
- Include the ruler (or microruler if available) in the close up shots.

⁷ Artworks associated with specimens may be stored separately (for example, in an art store, library or collection archive). Often, artworks feature micro-structural details which add value to the online image. So that a complete online type image can be produced, where possible, please ensure the artworks are retrieved and imaged with the plant material and notes.

⁸ The material on a slide is also part of the type material and should be included in the image. It may also be useful for a researcher to see at a glance that there are prepared slides. Alternatively, if the slides are not retrieved and included in the image, there should be a note in the database record alerting a researcher that slide preparation(s) exist.

Example of a moss type comprising numerous packets, photographs and labels.



Image 1



Image 2

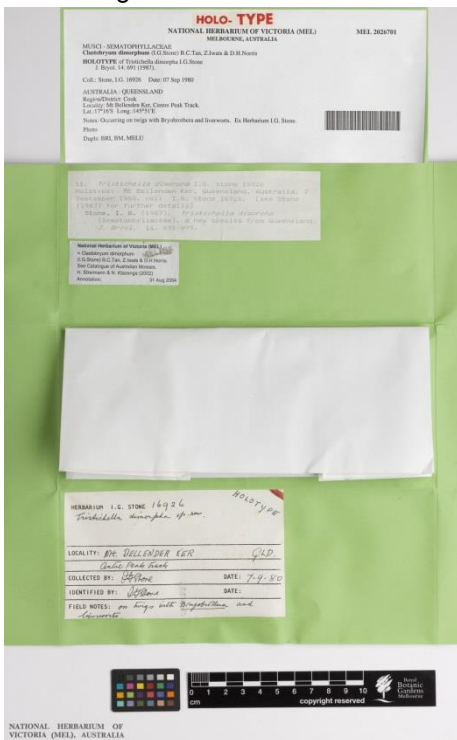


Image 3



Image 4

Four separate images taken then superimposed back onto sheets and resulting in three 600dpi images



MEL2026701



MEL2026701_a



MEL2026701_b

- When there are surplus or fragile fragments these can remain within a polypropylene bag or may be arranged in a dish/tray, if needed.
- Once imaged, it is recommended that the packet/folder or card label be either stamped with the 'Imaged Date' stamp e.g. **Imaged 2015** or a slip attached to the specimen which indicates the specimen has been imaged and with the date. If a date stamp is used, stamp the outer packet before returning the specimen into the packet to avoid any damage to the specimen. It is also advisable to update the database record to indicate that the specimen has been imaged. This will ensure that a specimen can be readily recognised as having been imaged when either the electronic record or physical specimen is accessed.
- Return the packet(s) back into the main packet/box (e.g. for lichen or fungi). Ensure that the table and any instruments used (e.g. tweezers, dishes etc) are wiped clean, to avoid cross contamination before imaging the next type.
- For algae mounted on a large sheet, follow the procedures for vascular types (refer to Example 1 under 6.1 **Algae** in Appendix 1).

3.1 Health & Safety and Curatorial Notes

- **It is critical that type specimens are handled with care particularly where specimens are extremely small and difficult to handle and could be lost or damaged during the imaging process.**
- Once imaged, the of specimens can be improved if required e.g. remove cellophane bag and replace with polypropylene bag, or for liverworts and mosses on soil, place in a small tissue packet, place loose labels in a mylar sleeve or polypropylene bag.

For Occupational Health and Safety reasons, it is advisable to not remove puff ball fungi (e.g. *Battaraea*, *Calvatia*, *Lycoperdon*, *Podaxis*, *Scleroderma* etc.....) from bags, as the copious spores released by the fruiting bodies of these fungi may act as an irritant or allergen. We also recommend washing (or wet-wiping) hands frequently to minimise exposure to volatile oils (liverworts) and other spores.

4.0 Processing images and completion

- Transfer images from iMac to PC as per Leaf Aptus II manual if necessary. Alternatively, all Adobe Photoshop© steps can be completed using the iMac.
- Use Adobe Photoshop©, to make a composite 'virtual sheet' image including any close ups, added notes and specimens.
- Use Adobe Photoshop© if the specimen itself is also imaged at a higher resolution e.g. 1200 dpi. The higher resolution image is then superimposed back onto the original scan of 600 dpi.
- Save the image or composite image at 600 dpi in a.tif format (around 200MB file size) using the institution number / specimen barcode as an identifier, and _a; _b for multiple sheets.

5.0 Acknowledgements and Resources

This document was prepared by members of the Australasian herbarium community who participated in a CHAH funded workshop, *Development of best-practice guidelines for digitising specimens in packets*, hosted by the Royal Botanic Gardens Victoria, 21 - 22 May 2015.

Resources

Appendix B: Imaging Bulky Specimens <http://about.jstor.org/content/global-plants-partner-resources>

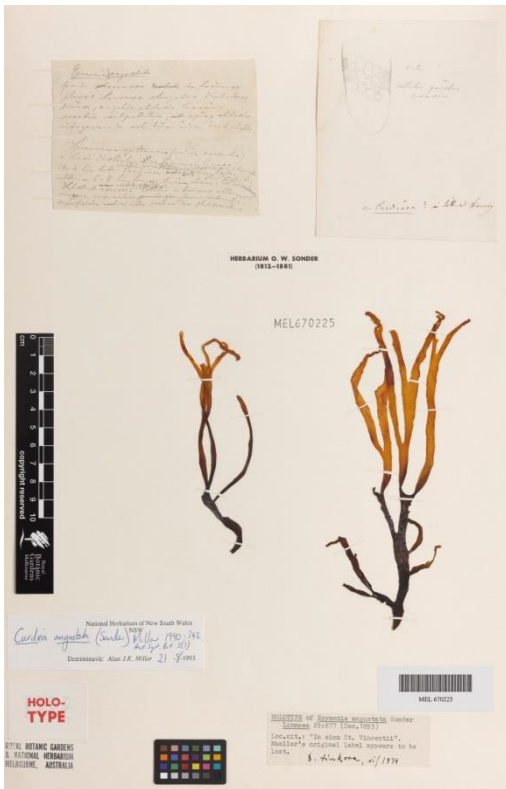
Appendix C: Digitizing of Bryophytes and Lichen Types <http://about.jstor.org/content/global-plants-partner-resources>

6.0 Appendices – Image Scenarios

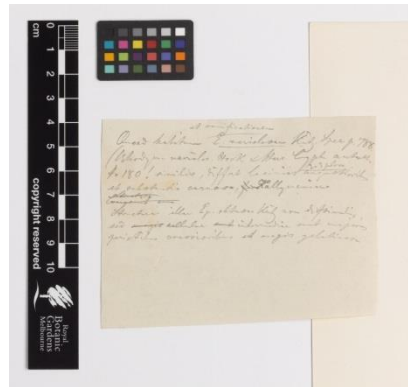
Appendix 1 Examples of scenarios in categories: Algae, Fungi, Lichen, Bryophytes: Liverworts and Moss

6.1 Algae

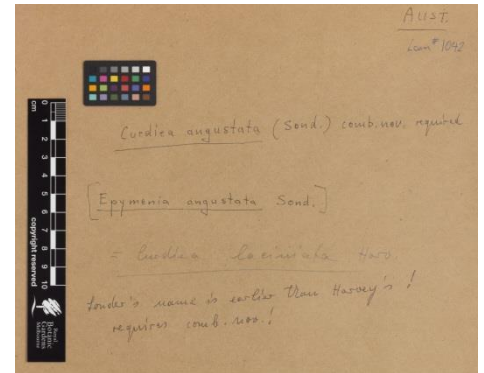
Example 1. Algae sheet with information on both sides of a label and a third handwritten label.



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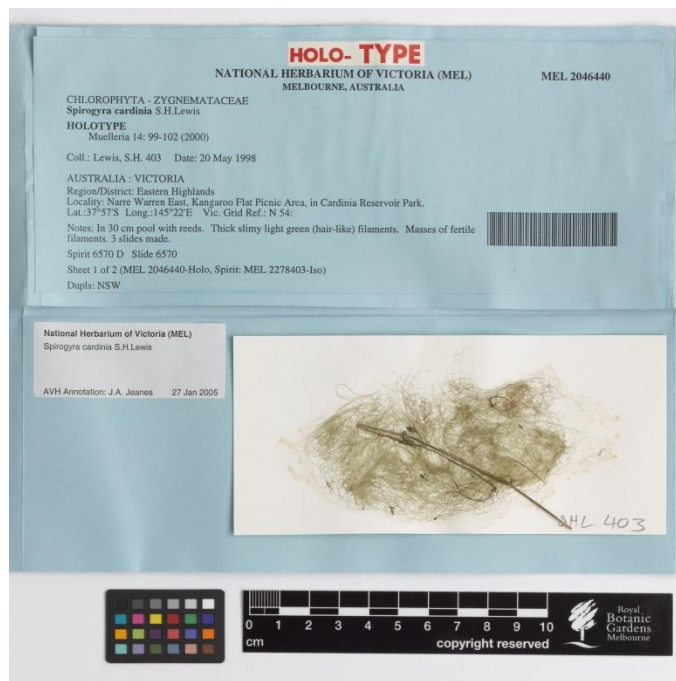


MEL670225_a



MEL670225_b

Example 2. Alga in a packet

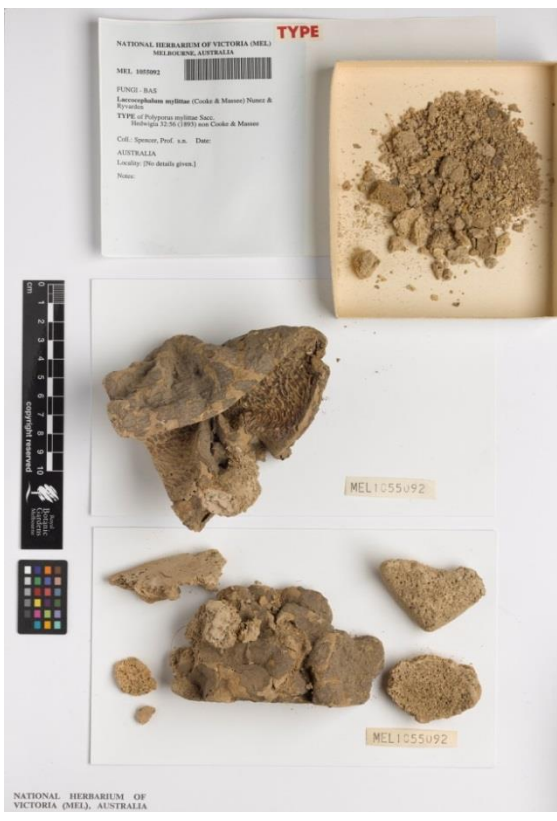


MEL2046440

6.2 Fungi

Example 1. Imaging a 'bulky' fungi specimen

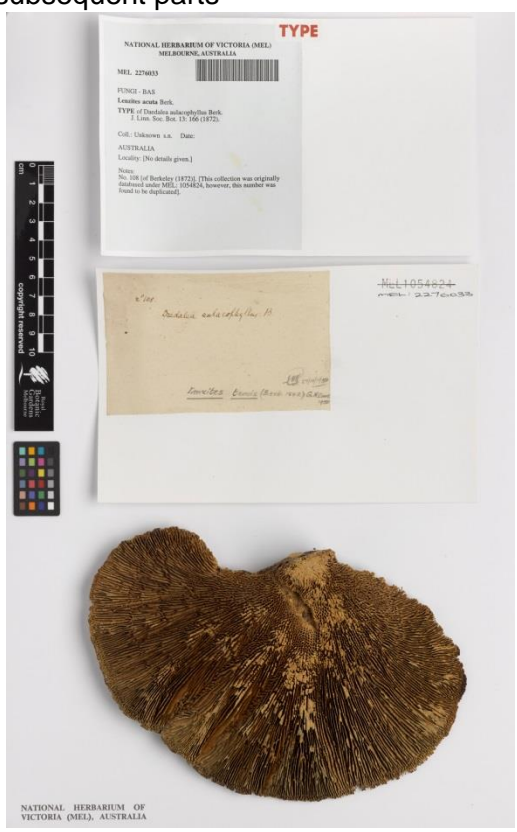
- fungi placed on a piece of appropriately sized white card
- material arranged to show both dorsal/ventral surfaces or cross sections



MEL1055092_a

MEL1055092

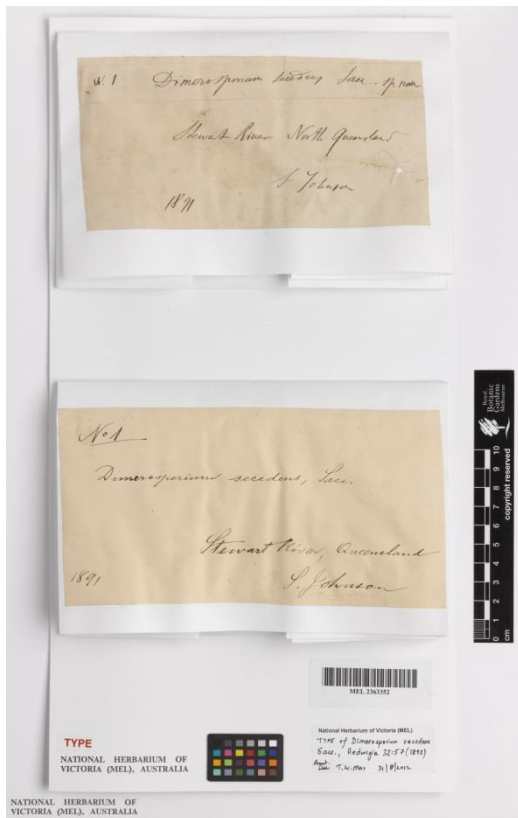
Example 2. Imaging a bracket fungus. Spore producing surface imaged first followed by subsequent parts



MEL2276033

MEL2276033_a

Example 3. Fungi on leaves – leaf spots. Packets imaged first, then specimen laid out and imaged.



MEL2363352



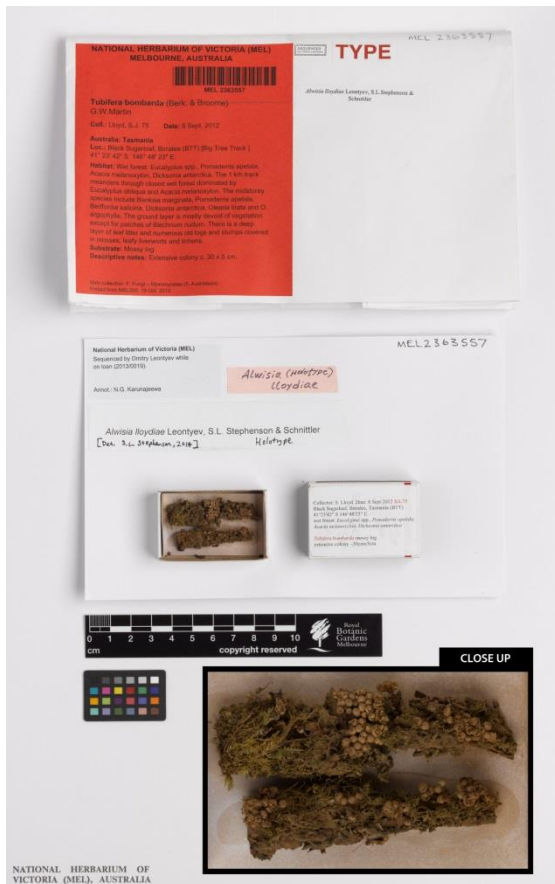
MEL2363352_a

Example 4. Fungi on leaves – leaf spots and illustration



MEL2363354

Example 5. Slime mould



MEL2363557

- Image the label with barcode, and type label, card with annotations and the specimen itself with the colour chart and ruler.
- Remove the specimen from the box (to reduce shadowing) and take a close up image. In this case, the specimen was bulky so three separate images were taken with different focal points and later stacked in Adobe Photoshop®.
- Include the microruler in the close up, if available.
- Make a composite image using all the above components.

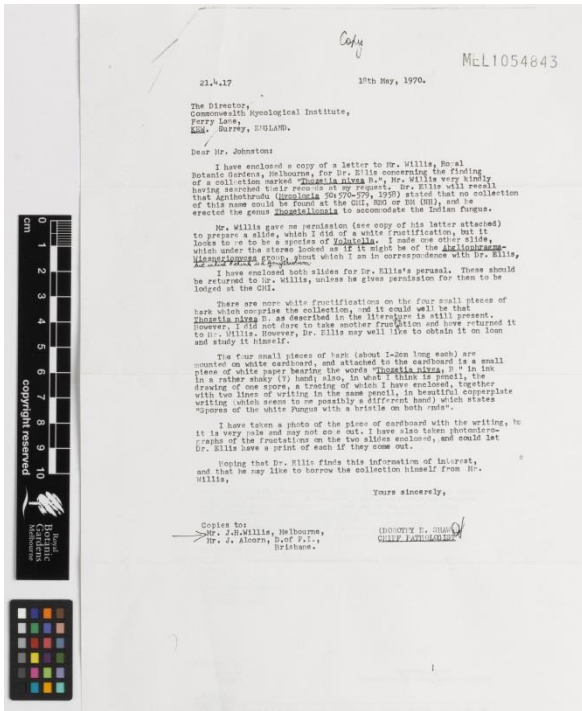
Example 6. Deuteromycotina with specimen, illustration, black and white photographs and letter



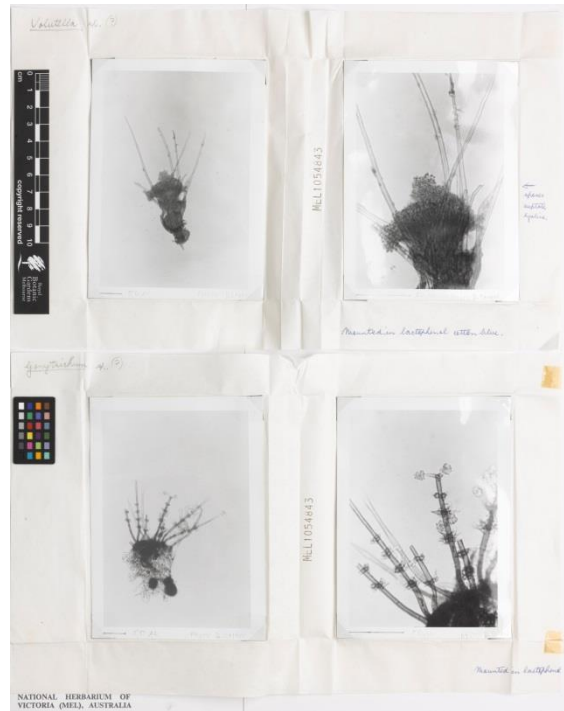
MEL1054843



MEL1054843_a



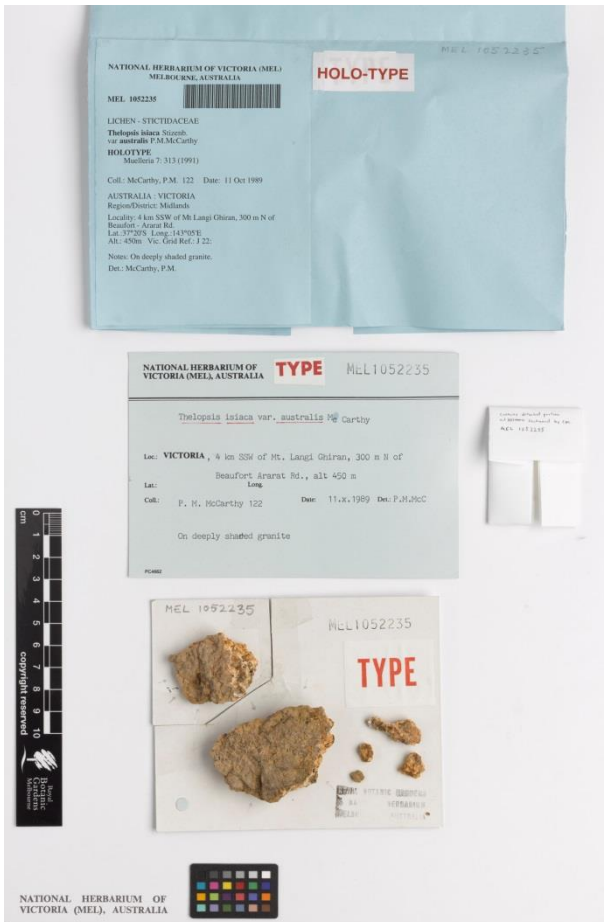
MEL1054843_b [Note: there are three additional pages to this letter and are not shown here]



MEL1054843_f

6.3 Lichen

Example 1. Where there is information on both sides of a label and additional specimen material in a packet, the item(s) should be re organised on sheet and a second image taken.



MEL1052235

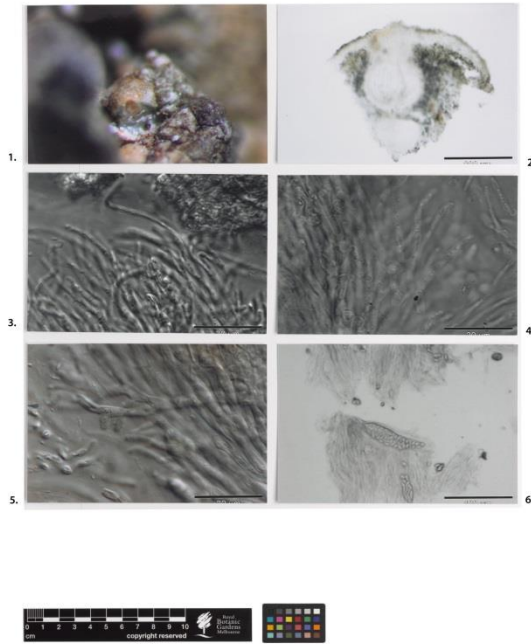


MEL1052235_a

In addition this specimen included illustrations and numerous photographs



MEL1052235_b



MEL1052235_c [Note: there are four additional images which include photographs and a key to the photographs which are not included here.]

Example 2. Close up detail shots can be taken if deemed necessary. Some specimens may also require stacking at the close up stage depending on the specimen or detail you are trying to capture. Include the ruler (or microruler if available) in the close up shots.



- Image the specimen label with bar code and type label, card with annotations and the specimen itself with the colour chart and ruler.
- Take a close up image including microruler, if available.
- Make a composite image using all the above components.

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6.4 Bryophytes – Liverwort

Example 1. Close up image of dorsal and ventral surface of liverwort



Image 1

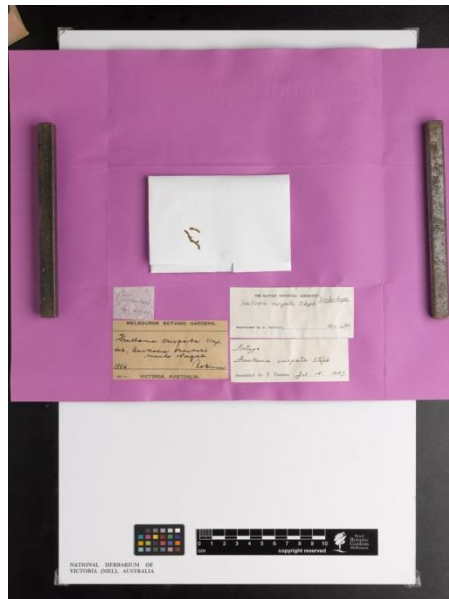


Image 2

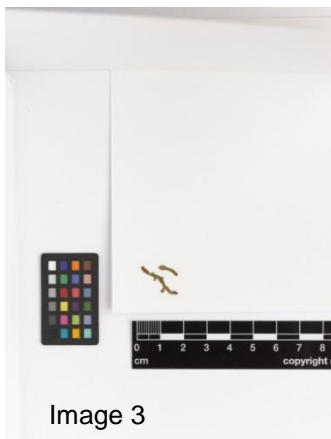


Image 3



Image 4



Four separate images, two of dorsal/ventral surface of the liverwort and then composite sheet.

Example 2. Close up of liverwort growing on soil.



Image 1



Image 2

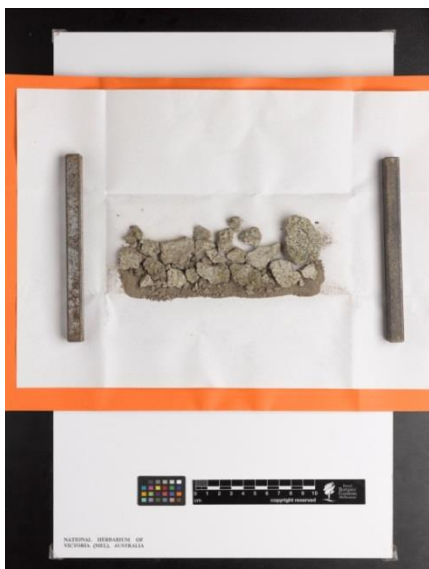
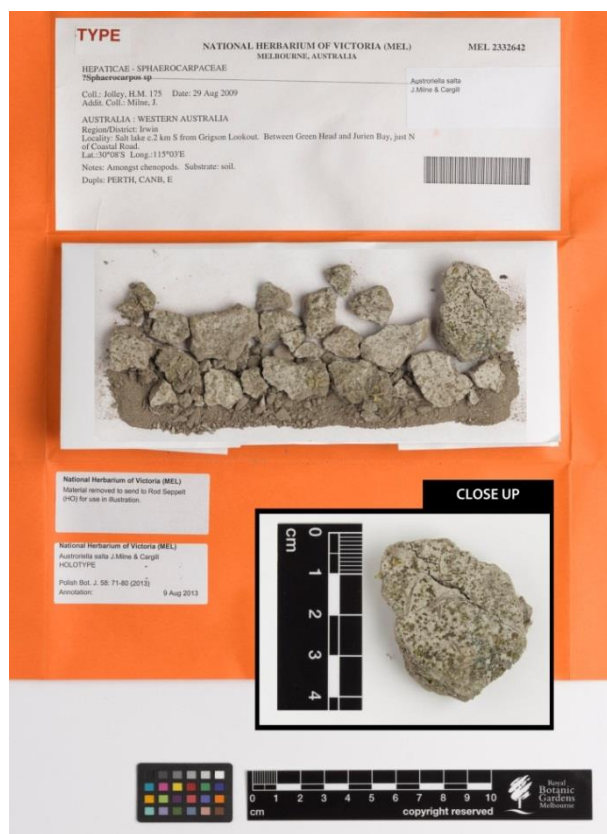


Image 3



Image 4

Four separate images; close up of liverwort colony and composite sheet.



6.5 Bryophytes - Moss

Example 1. Numerous packets, original description and moss specimen with sporophyte orientated in an upward direction.

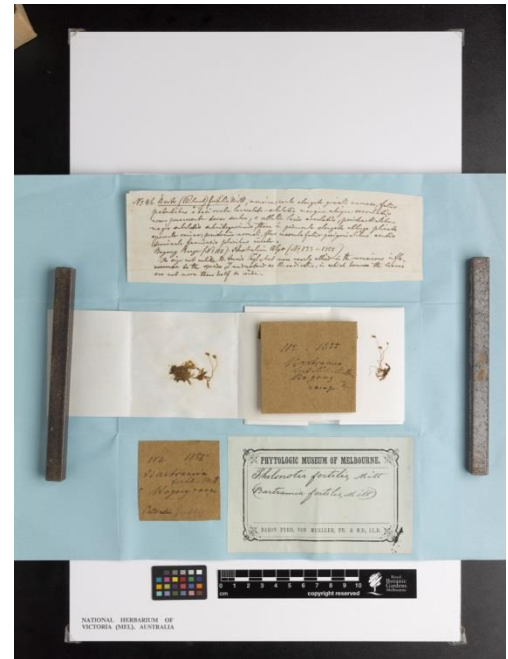
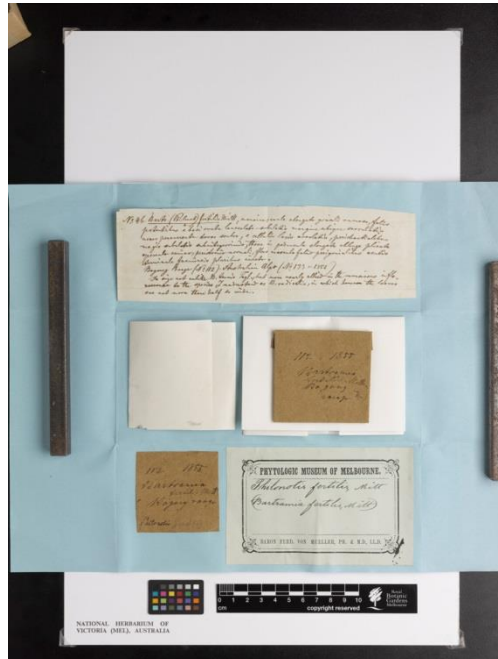
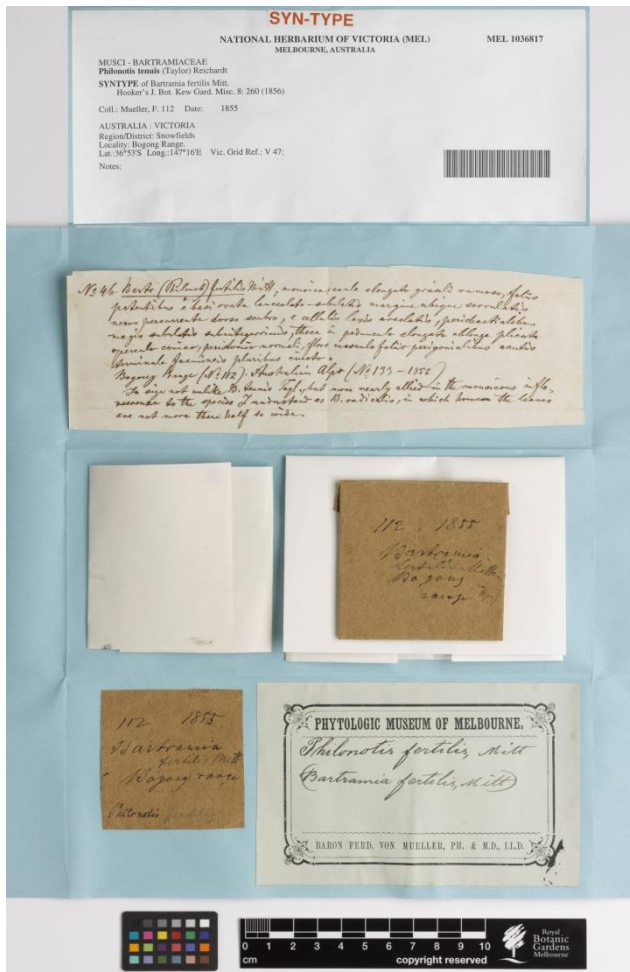


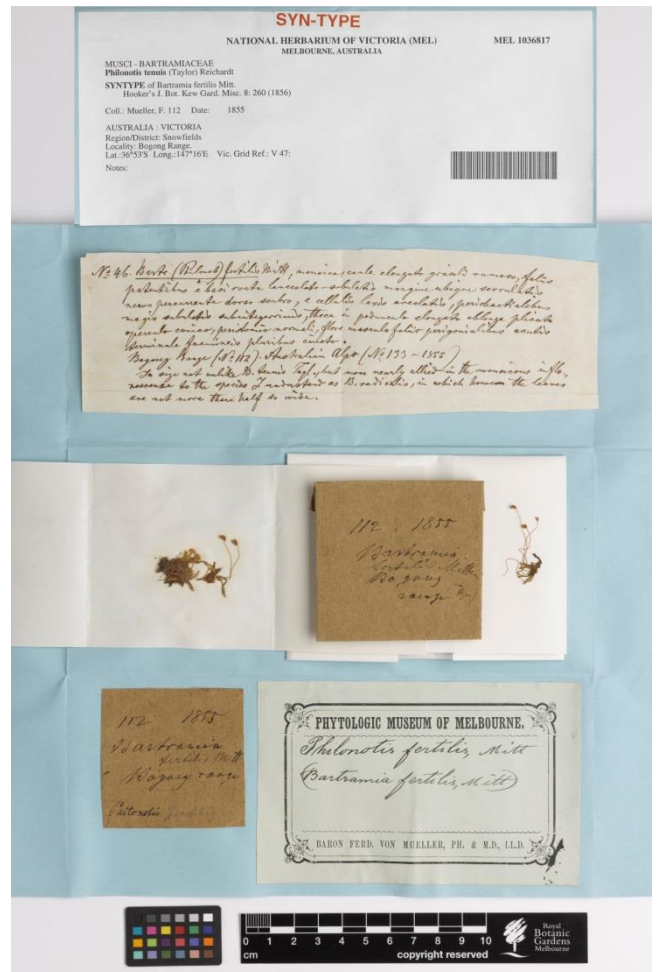
Image 1

Image 2

Image 3



MEL1036817



MEL1036817_a

Three separate images, two with moss specimen with packet closed and open, and two composite sheets.