RBGE Collections Care:
preparation and care of herbarium specimens

Herbarium specimens are a vital source of information for all aspects of plant science and also an important historical record or archive. Careful preparation, storage and handling will ensure that specimens remain in good condition for use by future researchers.

Contents

1. The Preparation of Herbarium Specimens

Flowering plants

Different herbaria use different methods for mounting plant specimens. At RBGE, dried pressed plants are glued, stitched and taped to supportive mounting boards so that they are strong enough to withstand repeated handling. The mounting board, label paper, capsules, tape and PVA (polyvinylacetate) adhesive are all archival quality (see **2.** below). White polyester/cotton thread is used for stitching.

Method:

- The dried pressed specimen is carefully arranged on a 42.5 x 26 cm sheet of mounting board so that it displays the maximum amount of taxonomic information.
- If collecting your own specimens, remember that correctly sized, well-pressed specimens are easier and faster to mount!
- The specimen, together with a detailed label and a paper capsule containing a loose sample of relevant plant parts, is glued to the board.
- After covering with tissue paper and a sheet of soft card, the specimen left to dry under a sandbag weight.
- Once dry, stems and leaf tips are given further support by 'strapping' with paper tapes. Bulky specimens are also stitched.

For further information see:

RBGE Herbarium: Basic plant collecting and pressing video
http://www.youtube.com/watch?v=2wFN9YmkBOQ
(also includes a brief demonstration of collecting leaf samples for storage in silica gel)

RBGE Herbarium: Mounting plant specimens video
https://youtu.be/HaaX5WzlAiI?t=108

Large fruits and seeds

If a plant has very bulky fruits or seeds they are packed in archival boxes for storage in the carpological collection, and cross-referenced to the herbarium sheet.

Plant material is also preserved in three-dimensional form in the spirit preserved collection. For further information see:

http://www.rbge.org.uk/science/herbarium/about-the-collections/spirit-collection

Issue 19 July 2010 of **NatSca News**
(article on maintenance of botanical spirit collections)

Conifers

Some conifer species eg *Picea* and *Abies*) quickly lose their needles when dry! To preserve them for mounting they are soaked in alcohol then immersed in 50% aqueous glycerol.

Bryophytes (mosses), lichen and fungi

Small, fragile plants like Bryophytes, lichen and fungi are preserved by putting them in paper capsules mounted on herbarium sheets.

Algae (seaweed)

Aquatic plants are mounted by floating on to herbarium sheets. For more information see:
SPNHC How to prepare seaweed specimens:
http://www.spnhc.org/media/assets/How_To_2.pdf

References

RBGE Guide to Collecting Herbarium Specimens in the Field **ISBN 978-1-910877-21-0, RBGE 2017**

Victor, J.E. *Herbarium essentials: the Southern African Herbarium user manual Pretoria* : Southern African Botanical Diversity Network, 2004 (a comprehensive and well illustrated guide to all aspects of specimen preparation, and herbarium work in general; includes instructions for bryophytes, fungi and aquatic plants) **http://www.sanbi.org/sites/default/files/documents/documents/sabonet-report-no-25-herbarium-essentials-southern-african-herbarium-user-manual.pdf**

Fish, L. *Preparing herbarium specimens* Pretoria: National Botanical Institute, 1999

2. Archival materials for plant mounting

Archival materials should contain no substances which will harm the specimen, and should have long term stability.

Acid-free paper

Acid-free mounting boards, capsules, adhesives and tapes are recommended. For further explanation see:

https://en.wikipedia.org/wiki/Acid-free_paper

Mounting board:
Mounting board should be strong enough to support the weight of the plant specimen: eg 550 microns for most flowering plants and 1100 microns for heavy woody plants. If the boards are to be cut from a larger sheet make sure 'the grain direction is parallel to the long dimension to assure ease in handling after specimens have been mounted' (PEL catalogue, accessed Oct 2017, link below).

If there is no budget for archival materials, then try to use firm mounting board that can support the weight of the specimen.

Capsules:
Capsules can be folded from archival paper if ready-cut ones are not available:

https://www.floridamuseum.ufl.edu/herbarium/methods/fragmentpackets.htm

Tape:
If at all possible, use an archival quality gummed paper tape (eg Lineco) for 'strapping'. *Do not use sellotape!* If there is no suitable glue and/ or tape, it may be better to stitch specimens.

Technical specifications

Check the technical specifications for the products you use: PVAC (polyvinyl acetate) adhesive, for example, comes in lots of different types, not all are archival quality. Also, suppliers may change the composition of a product over time, for example the kind of adhesive used on paper tape.

Supplier catalogues can be a useful source of information, eg:

Conservation by Design

PEL (Preservation Equipment Ltd)

Klug Conservation

Adhesives

There has been debate about the most suitable adhesives for plant mounting. The Canadian Conservation Institute (**CCI**) has published research evaluating PVAC adhesives:

http://www.tandfonline.com/doi/abs/10.1179/sic.1996.41.1.19

For further discussion of adhesives for plant mounting see:

Aitken, R. *What are the Most Appropriate Adhesives and Methods For Mounting Herbarium Specimens, Including Best Practice?* Dissertation for Preventive Conservation MA at Northumbria University, submitted September 2013

Clark, S. 'Preservation of Herbarium Specimens: an archive conservator's approach' in *Taxon* 35, November 1986, pp 679-80
http://www.bl.uk/blpac/lcnindex.html

Down, J. L. 'Adhesives Research at the CCI as it Relates to Herbarium Collections' in Deborah A. Metsger and Sheila C. Byers eds, *Managing the Modern Herbarium*, SPNHC 1999, pp 205-224

Gibson, J., 'Methyl Cellulose for Mounting Plant Specimens at the San Diego Natural History Museum' in Deborah A. Metsger and Sheila C. Byers eds, *Managing the Modern Herbarium*, SPNHC 1999, pp 358-360

Gunn, A. 'Past and present practice: the botanist's view' in R. E. Child ed, *Conservation and the Herbarium*, Institute of Paper Conservation 1994, p12

Horie, V. ‘Adhesives for Natural Science Specimens’ in NatSca News, ISSN 1741-3974, Issue 16 March 2009, pp 32 -36

Yesilyurt, J. ‘Botanical Related Adhesives’ in NatSca News, ISSN 1741-3974, Issue 16 March 2009, pp 30-31
McCoy, L. ‘Don’t Say Glue, It’s Adhesive’ ISSN 1741-3974, Issue 16 March 2009, pp 23-26

National Park Service ‘Preparing and Storing Herbarium Specimens’, *Conserve-o-Gram* 11/12 November 2009. Accessed 8/3/12; website no longer available due to closure of NPS Department.

3. The Care and Conservation of Herbarium Specimens

Over time, herbarium specimens may become damaged due to:

- a major disaster such as fire or flood,
- poor storage environment,
- careless handling,
- breakdown of the materials used to prepare them
- insect damage.

The RBGE Herbarium has a duty to provide a safe and secure environment for the collection. To protect the specimens from loss or damage, we have specifically designed storage and strict specimen handling guidelines. The condition of the collection is monitored, and repairs to specimens are carried out to appropriate conservation standards.

Safe storage environment

The herbarium collections are housed in a secure, purpose-built building. We monitor the temperature and humidity of the storage environment, aiming for a stable 20 degrees temperature and 50% relative humidity (extreme fluctuations in temperature or humidity can damage the fragile plant material and encourage insects).

Metal storage cabinets with rubber door seals protect the specimens from light, dust and insects.

Herbarium Beetle (*Trogoderma angustum*) and Biscuit Beetle (*Stegobium paniceum*) have the potential to cause serious damage to our herbarium collections if left unchecked.

In the past, pest management in the Herbarium often involved regular use of toxic chemicals. Health and safety concerns have led us to move away from this approach in favor of preventive and protective measures that are not based on chemicals.

This strategy is commonly termed ‘integrated pest management’ (IPM) and involves several measures used in combination, eg:

- freezing incoming specimens to -29 degrees Celsius for 5 days before they enter the Herbarium.

- maintaining a good storage environment
- careful monitoring for insect activity
- providing staff training and information

Handling guidelines

Careful handling of specimens will minimize the risk of physical damage to them:

- Specimens should always be kept horizontal and flat and must never be bent; hold both sides of the sheet when handling specimens; when carrying specimens, place them on a sheet of cardboard.

- Never shuffle specimens as the edges of sheets may cut underlying specimens.

- Look through specimens by stacking and unstacking each specimen individually with the plant facing up. Do not page through specimens like pages in a book, or stack specimens with the plant facing downwards.

- Never rest an object on a specimen.

- Specimens can be damaged by sunlight, dust, wind, and moisture, and should always be protected when not in use. If specimens are left out of a cupboard, they must be covered with a cardboard sheet.

- When storing specimens, do not pack them tightly onto one shelf; do not overfill genus and species covers.

- When replacing specimens in the cupboard, make sure the sheets are all aligned, as protruding edges may be damaged.

(Victor, J.E. *Herbarium essentials: the Southern African Herbarium user manual Pretoria* : Southern African Botanical Diversity Network, 2004, p41)

For information on how to pack specimens for posting see:

RBGE Herbarium: Packing specimens for loan
http://www.youtube.com/watch?v=6yrGFGw1j3o

Condition surveying

Older herbarium specimens may have been stored previously in poor conditions or been damaged from careless handling.

In order to identify the types of damage to specimens in the RBGE Herbarium collection, we carried out a condition survey during imaging and databasing of mounted herbarium specimens.

This allowed us to prioritize specimens for repair, and estimate the cost in terms of staff time and materials.

The most common problems are:

- Non-archival materials eg cellophane, sellotape, many types of polythene
- Surface dirt eg soot, dust
- Stains eg from pesticides
- Paper problems eg flimsy, distorted or torn sheets
- Loose attachments eg loose stapes or stitches; dried out glue
- Insect damage

Repairs

The techniques and materials we use to repair specimens have been developed with the help and advice of professional conservators. Repairs to specimens, particularly if they are types or important historical collections, should aim to interfere with the specimen as little as possible, and use archival materials and methods which are easily reversible.

A simple but effective solution for fragile or damaged specimens is to use a large capsule with a sheet of mounting board inside it to protect and support the fragile plant material.

If necessary get advice on how to treat damaged specimens from a professional conservator, particularly for type specimens, and those of particular historical or cultural significance. ICON (Institute of Conservation) provides ethical guidelines and professional standards for conservation, and list qualified conservators. Alternatively, you could approach conservation staff eg at a local museum.

The following table suggests some simple treatments suitable for older herbarium specimens:

Damage/problem	Conservation Treatment
Cellophane covering part of a specimen or as a bag containing seed will deteriorate rapidly and make it difficult to get a good digital image of the specimen.	Remove the cellophane and replace with an archival tissue flap or protective white paper four-flap folder or grey archival four-flap box.
Polythene covers make it difficult to image the specimen and can contain plasticisers which deteriorate. The bags with rigid plastic closures can damage the specimen when it's taken out for study.	Remove the polythene and replace with archival tissue flap or protective white paper four-flap folder or grey archival four-flap box.
Sellotape either dries out leaving the specimen loose, or leaves a sticky residue which attracts dirt and can damage other specimens.	Remove sellotape if this is possible without damaging specimen. Crepe rubber can be used to remove sticky tape residue. (Get professional advice before using solvents.) Resecure the specimen with water-activated gummed archival tape.
Metal paperclips and pins rust and damage the paper they're attached to.	
Dust or soot can obscure label information and surface details on a specimen. It is also abrasive and can speed deterioration of the mount. (NB Staining from chemical treatments eg insecticides may also cause mounts to deteriorate but we aren't able to treat this at present.)	Use 'smoke sponge' or soft cleaning brushes to remove as much dirt as possible without damaging the specimen.
Specimens on very thin mounting paper are easily damaged when handled eg the sheet may 'flip' causing stems to break. Thin mounting card can buckle or warp distorting and damaging the plant specimen.	Attach the sheet to a standard size (42 x 26.5cm) archival mounting board using small loops of water-activated archival gummed tape in the corners. Or, for very fragile specimens protect with a white archival four-flap folder with backing board.
Very bulky specimens can distort and damage specimens placed on top of them in the species cover, especially if these are on thin mounting paper.	Put the sheet in a light weight card four-flap folder or box placed at the bottom of the species folder; or if possible place the bulky specimen at the top of the folder
The edges of a very small herbarium sheet may cause damage to plant material on the specimen underneath it in the species cover.	Attach the sheet to a standard size (42 x 26.5cm) archival mounting board using small loops of water-activated archival gummed tape in the corners.
Mounting paper which is acidic can become very brittle and is easily damaged when handled. Label information may be lost as pieces break off.	Put the sheet in a white archival four-flap folder with backing board.
Torn herbarium sheets or labels can result in damage to the specimen or loss of label information.	Repair with Japanese tissue and suitable adhesive eg methyl cellulose.
Plant material which is not attached securely to the herbarium sheet (glue dries out or tapes/stitches come undone) is easily lost. This may seriously reduce the taxonomic value of the specimen. Very fragile flowers may be damaged when other herbarium sheets are placed on top.	Resecure loose pieces with methyl cellulose, or water activated archival gummed tape if it's clear where the loose piece(s) came from. Otherwise put the pieces in the capsule (attach a new one if necessary). Use a four-flap white archival paper folder with backing board for eg fragmenting seed heads (Compositae). Cover fragile flowers with an archival tissue flap.
Signs of insect damage include grazed flowers, insect droppings or larvae skins. Unchecked, herbarium beetles can destroy plant specimens.	Freeze all affected specimens at -30 for 5 days. Record cabinet location for future monitoring. Use a museum vac to remove droppings and damaged plant material. Restitch or tape badly affected specimens as necessary. Protect very fragile specimens with a white archival four-flap folder with backing board.

References and further information:

ICON Care and Conservation of Botanical Specimens

Metsger, D.A. *Managing the modern herbarium* Washington, D.C.: SPNHC, 1999 (Section III discusses archival materials for specimen preparation)

Stuessy, T.F. *Sampling the green world: innovative concepts of collection, preservation, and storage of plant diversity* New York: Columbia University Press, 1996 (Especially Chapter 15 Guidelines for Plant Storage Environments)

Child, R.E. *Conservation and the herbarium* Leigh : Institute of Paper Conservation, 1994

NatSca (Natural Sciences Collections Association

SPNHC (Society for the Preservation of Natural History Collections)

cool.conservation (information about all aspects of conservation: type eg 'herbarium' into search)

Synthesys has projects aimed at 'improving collections management, enhancing accessibility and conserving the unique value of European natural history collections', and provides a self-assessment survey for assessing standards of collections care in an institution.

4. The Art of Herbarium Specimens

Herbarium specimens are primarily of scientific importance, but they have also provided numerous artists with inspiration for their work, eg:

http://www.lornafraser.co.uk/

http://www.victoriacrowe.com/index.html

http://www.janehyslop.com/ **(*Herbarium Catalogue* 2008)**

Leafworks

Schulze, Sabine *The painter's garden: design, inspiration, delight* Ostfildern : Hatje Cantz Verlag 2006 (pp 342—343 artist Paul Klee's herbarium specimens)

Armstrong, C. *Ocean Flowers*, New York: The Drawing Centre 2004

Dinoto, A. *The pressed plant: the art of botanical specimens, nature prints, and sun pictures* New York : Stewart, Tabori & Chang, 1999 (also includes instructions for mounting seaweeds!).