

# Management of a Lichen Herbarium

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## Introduction

Lichen herbaria store preserved specimens of lichenized (and often lichenicolous) fungi. The main tasks of lichen (and all other) herbaria are as follows:

Taxonomic studies must be at least in part based upon herbarium specimens, of which the so called type-specimens are the most important. It is on these that descriptions of new taxa are based, and they serve in perpetuity as the reference for these names. For a new species to be validly published, the herbarium in which the type specimens are lodged must be specified. Locations, contents, acronyms etc. of the world's public herbaria can be found in "Index Herbariorum", compiled by Holmgren et al. 1990. A searchable internet-version is available at: <http://www.nybg.org/bsci/ih/>.

**Taxonomic,  
chemical and  
molecular studies**

Most secondary lichen substances remain stable in storage, and hence herbarium specimens are reliable subjects for chemical investigations. The ability of lichen thalli to accumulate pollutants means that older specimens may provide evidence of former environmental conditions.

Improved methods in molecular studies have also led to an increasing use of herbarium specimens (preferably not older than 10 years) as important subjects for taxonomic works. When old herbarium collections (e.g. from the last century) are examined, lichen phylogeny and the long term population dynamics of lichens will become promising fields of study.

- Floristic data** Herbarium specimens are an essential basis for the preparation of check-lists or floras of particular geographical regions. They can also provide an indication of changes over time in the distributions of species.
- Identification** Due to the rather complicated morphology of lichens, descriptions (and keys to taxa) are difficult to make or, if done, often are insufficient for a certain recognition of taxa. Illustrations can overcome this problem to some extent, but are unavailable in many cases. Thus, properly identified herbarium specimens are an indispensable tool for a correct identification of unnamed taxa.

## Experimental Details

### Preparation of lichens

Carefully prepared herbarium specimens are of vital importance for the quality of the whole herbarium. Although the 'Herbarium Handbook' of Forman and Bridson 1998 gives helpful advice on preparing phanerogams, collecting and preserving of lichens is dealt with only cursorily. [Note: While finishing the manuscript a book on 'managing the modern herbarium' (Metsger and Byers 1999) has been published]. General hints regarding the preparation of lichens can be found in, for example, Wirth 1995, Moberg and Holmsen 1992 and Hawksworth 1974. A brief summary of methods for preparing lichens for deposition in a herbarium is given below.

### Collecting lichens and preliminary field-preparations

Before collecting lichenized fungi (or indeed any biological specimens), the potential rarity of the species should be considered. Many countries require formal collecting permits, and these frequently come with a range of restrictions. In countries where some species are legally protected, collecting of rare, vulnerable or threatened species may be highly restricted or prohibited. Regardless, no collecting should deplete an entire stand.

For epiphytic lichens, the substratum must also be considered, and trees should not be damaged or killed. Depending on the growth habit of lichens and the type of substratum, different collecting-methods are appropriate. Easily removable (large foliose, umbilicate or fruticose) lichens must be collected with their attachment organs (but usually without substratum). Small foliose and all crustose lichens have to be removed with part of the substratum. Stout knives or caulking irons are used for bark, wood or soil; chisel and hammer help to remove lichens from

hard substrate (e.g. rocks). Fragile lichen species (e.g. Caliciales, or many fruticose taxa if totally dried) should be carefully wrapped in soft paper (e.g. uncoloured toilet paper). Rocks with crustose lichens (especially when wet) must be processed in the same way to avoid mutual abrasion.

In order to minimise space-requirements, freshly collected (often slightly to totally wet) specimens of foliose or fruticose lichens should be very slightly pressed and dried between uncoloured paper. With great care, rock substrates may have to be made thinner with a chisel or other specialised cutting equipment (see Figure 1), because too thick specimens unnecessarily can cause additional space problems. Specimens on bark, rock and especially soil are usually fixed to stiff card with wood glue. Additional protection against pressure (especially necessary in case of brittle lichens and/or substrate, e.g. delicate Caliciales, unpressed fruticose lichens or specimens on friable or earthy substrate) can be achieved by gluing small wooden rods (or rings of very strong cardboard) around the substrate or by putting it into small shatter-proof boxes. Never close the boxes before the lichen or the substrate or the glue is totally dry; mould fungi may destroy the whole specimen!

Foliose or fruticose lichen thalli and any substratum with lichens on each side must never be stuck directly onto cards. If a sample consists of many small pieces, these can be placed on cardboard between two layers of soft paper, which may prevent displacement. Sometimes it is necessary to group them within a small packet, which can be glued onto the card (see Figure 2a). Arranging packets inside each other should be reduced to a minimum as it slows down the access to the material.

After mounting on card, most lichens are usually placed into folded envelopes (see Figure 2b). Both cards and envelopes need to be of a long-lasting (acid-free) archival quality. It is advisable to print the herbarium name (or acronym) on the outside of every packet and on the cardboard. This prevents confusion when handling specimens from many different herbaria. At least for lichens on rocks and for any fragile material, specimens should be covered with a layer of soft paper (to protect the envelope, the label and the lichen). Duplicates of labels, placed inside the packets, are sometimes used for the same purpose.

For how to handle specimens for determination/examination see "Herbarium Problems".

## Preparation in the laboratory



Fig. 1. Home-made "rock-hacker" with interchangeable chisels and using a typical car "jack".

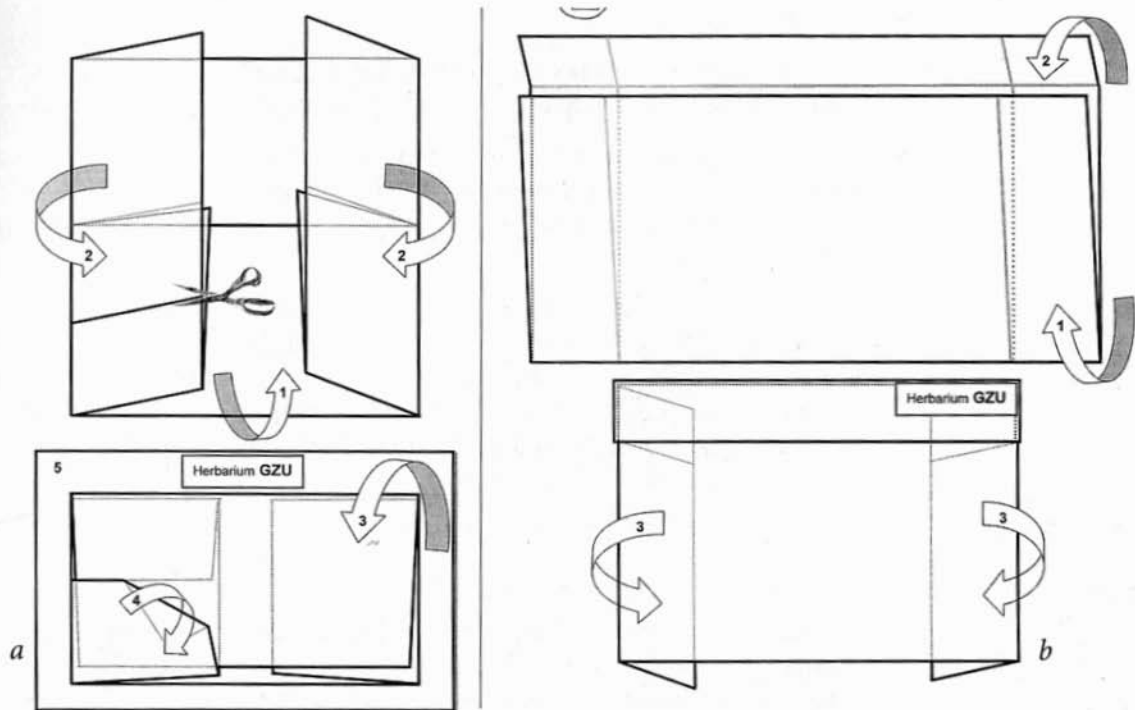


Fig. 2. Suggested design and fold-order for lichen herbarium envelopes. a. Inner envelope, folded (1-4) and glued onto the card (5). This would contain the specimen, or pieces of specimen. b. Typical, folded (1-3) herbarium envelope, within which card and lichen (as per 2a) are placed.

### Labelling

Badly labelled or unlabelled herbarium specimens are useless and should be discarded.

The most important data for labels are:

- The name of the taxon
- The location; location details typically include the political region, e.g. country and the precise location, followed by geographical co-ordinates; the actual distance from a large nearby town is often useful, and is preferable to a distance along a road, which may change in the event of road realignment; if the latter is specified, it should be indicated as "road-distance"

- Ecological notes, including substrate
- Date of collection; because different methods of indicating dates exist, it is recommended to give the month in roman numerals (or in letters)
- The collector's name, including collection number  
To make every single specimen unique, the collector should add a successive number (or a non repeating abbreviation of date and field number).
- Reducing subsequent investigation to a minimum, further information on the specimen (e.g. microscopical or chemical features) have to be added, either by writing it directly on the cardboard (this should only be done by the collector him/herself or by preparing annotation slips which are loosely attached to the specimen. Thus, particularly type material can be (and must be!) saved.

### Incorporation

After specimens have been decontaminated (see below), they can be incorporated into the herbarium. It is probably best to store lichen-envelopes flat, mounted on a sheet of paper. However, other methods, such as vertical filing of individual packets, are employed in various institutions. The advantage of rapid access to vertically filed specimens is more than offset by the disadvantages. For example, specimens can be easily damaged, and problems arise as a result of different envelope sizes or space may not exist for large envelopes, while small packets tend to slide under larger ones. Horizontally filed specimens can be easily retrieved, and of course any size of envelope can be stuck onto the sheets. However, handling is probably slower and extra costs for folders and cardboard sheets are involved. In case of a flat storage, envelopes or packets may be glued (or even pinned with needles) to sheets or kept loose. As loose packets on sheets tend to fall off, some form of 'fixing-method' is recommended. Depending on the size of the sheets and the envelopes, 2 - 8 packets can be fixed onto a single sheet. Several herbaria prefer to mount only one single envelope on a sheet, which has the advantage that enough space is provided for directly visible annotations, and that envelopes never have to be removed from the sheets. However, specimens stored in this way use much space. Depending on the thickness (and weight) of the specimens, 2 - 5 sheets may be placed inside a stronger and slightly larger folder. Alternatively, a few herbaria use big cardboard-boxes, which may be stacked horizontally. These boxes provide maximum protection for the specimens,

but handling is much less efficient. Where envelopes are glued to sheets but need to be removed for some reason, the sheet is torn from the packet but not *vice versa* to avoid damage (e.g. causing a hole at the back side of the envelope).

Because the classification of lichenized and lichenicolous fungi at the family level and above fungi is in a strong state of flux, I recommend arranging lichen taxa alphabetically by genus and species names respectively. Within each species, a geographical classification may be useful. For example you could use a different colour of species cover for different local region/country/continent. Using an additional striking colour for type-covers will allow easier handling of this most valuable component of the herbarium. In some herbaria, types are stored separately as well as important (mostly old) personal collections or exsiccata material. In case of the latter, I recommend avoiding a separate storage, at least of the numerous recent exsiccata, because it dramatically slows down loan management when it is necessary to search the same taxa in many different places.

Fully databased herbarium information also offers the possibility of keeping specimens in the same order that they are accessioned. This method has the advantage, that all specimens keep their original place even if there are taxonomic changes or space extensions. But again, loan management and identification work with comparison-material is made much more difficult.

## Arrangement

## Herbarium Problems

### Decontamination / herbarium conditions

Deep freezing (below  $-20^{\circ}\text{C}$  for three days) is the most widely used method for decontaminating incoming herbarium material. In addition, the whole herbarium unit should be fumigated periodically (e.g. every second year) although the need for this varies very much with local conditions such as humidity and the prevalence of certain insect pests. Nowadays very volatile gases (e.g. hydrogen phosphide) are used, which minimise health problems, but require a carefully sealing of every single room. Naturally this process is only undertaken by professionals!

Although lichens are known to be rather resistant to pests, soralia and algal layers of some nitrophilous taxa (e.g. Physciaceae and Teloschistaceae) can be entirely devoured. The main culprits are bark lice [*Liposcelis*



















