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Introduction

Herbarium vouchers are collected for species identification and species documentation. Although photo-documentation can be a great supplement to a herbarium, it is usually very difficult to identify species alone via photos. Botanical material collected as fresh, green material directly from plants contains a high percentage of water. Wet material decomposes quickly, so in order to preserve structures, specimens must be dried to prevent decomposition. Rapid drying maintains structure and colours. Some types of material can be dried by pressing them between water absorbing papers like newspapers. However, thick material cannot easily be dried alone by this method, and excess pressing risks to deform structures like stem thorns and large flowers. Such material is best oven-dried at high temperature. If material cannot be dried immediately, preservation in alcohol delays decomposition. Dried material maintained at low humidity can be kept for years without changes. Trees impose some special difficulties in herbarium collections since only part of the plant can be collected. This is contrary to e.g. herbs and grasses. For some species, leaves, flowers and fruits are so large, that only parts of the structures can practically be collected. This holds for instance for most palms.

Herbarium material may be stored in herbarium collections for future references. Large plant collections exist in most countries' national herbaria, where they are used for botanical taxonomic studies.

Collecting botanical vouchers

Modern taxonomy is based on descriptions of fertile material i.e. material containing flowers and fruits. Proper identification thus relies on the availability of such structures. Very often reproductive structures are seasonal and not always available. Flowers and fruits, which both are reproductive structures, are often not present on the same plant at the same time. Some plants can be identified on distinctive vegetative characters only, if these are precisely described in literature, but for most species fertile material is essential. Most trees bear their leaves and reproductive structures at great height and the mere collection imposes a challenge. Extended (long handled) pruners, advanced lines with flexible saws

Figure 1. Collecting plant material by the use of a pole pruner

or slingshots can bring down material. In other cases climbing is essential.

Essential structures

As a rule twigs with leaves, flowers and/or fruits should be collected. Leaves should preferably be full size; flowers and fruits preferably with entire inflorescence /infructescence. For monoecious species (male and females on the same tree but separate structures) both male and female parts should be collected. In dioecious species (male and female plants) complete vouchers are collected from each individual. In very bulky material,

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voucher herbarium specimens must be reduced in size. Large leaves may be folded; very large leaves cut so only petiole with base and apex is preserved. In very large leaves it may be necessary to reduce to some sections e.g. base of petiole, and for large compound leaves only mid sections. It is advisable to consult floras to see which structures are diagnostic for a particular group. Large inflorescenses are reduced to main axis with side-branches holding flowers or fruits. Most trees have relatively small flowers that can be kept entire. Some tropical fruits are very large and must be reduced to a section or pieces.

Temporary field storage and tags/labels

Each collection is stored separately in a plastic bag, or, for thorny material, in a strong rice bag. On each part is attached a tag/label with name, number and location. The number system is for internal use for references of additional field notes and photo documentation.

Preparing the specimen

Final preparation of the voucher herbarium specimens happens at the central camp. Final selection of material is done and the pieces are placed between 3-more layers of newspapers and cartoon board. Suitable size is about 30x40 centimetres. The material is sprayed with alcohol (70% household alcohol) and layers of newspaper and cartoon board placed on top. Then next specimen is prepared and the vouchers are stacked. When the stacked material is about 25-35 cm thick (pressed together) the collection is taped and placed in a closed plastic bag which is taped airtight. Note that pressing has primarily a function of drying and holding vouchers together. Pressing should be moderate not to deform or break the plant material. Material can now be stored for several days until the material can be oven-dried. For some small-size material, wooden plant presses with newspaper and cartoon board for ventilation can be used for preservation. If the material is only used for identification, the temporary material may be adequately preserved for short-time storage. Specimens that are collected for long-term storage must be oven dried.

Final drying

Prior to oven-drying, field voucher herbarium specimens are re-arranged between new sheets of newspaper, corrugated cardboard and plywood board. While re-arranging, layout of plant material may be improved e.g. by spreading out folded leaves and removing redundant material. Sequences of folded newspaper containing the herbarium material, corrugated cardboard and hard material like aluminum plates or thin plywood board alternates to a total height of about 40 centimeters. A

strap is tied around the pile to keep them in place. During oven-drying the material is placed on the oven shelf with the channels of the cardboard in a vertical direction. That gives the most efficient drying.

Fig. 2. Plant press consisting of two wooden frames and corrugated cardboard. The pile is held together by two straps.

Temperature during drying is about 70°C, and the drying process is normally 2-3 days. Material is checked every day to see the progress of the drying

Fig. 3. Oven drying of vouchers.

Field notes

Details on notebook information vary with purpose. It should as a minimum contain geographical position (GPS), possibly reference tree number, habitus, forest type and date of collection. All information is referred to

by a reference number which appears on the voucher and later added to the photo-documentation.
Data on large material that cannot practically be collected should preferably be included in field notes e.g. length of leaves, inflorescences, fruits and the like. In specific plant groups, specific indicators are important; for some palms for example colour of the roots, for several rain forest trees development of buttresses, and for several dry zone species the form of the crown. Some field notes are conveniently supplemented with photo-documentation.

Photo-documentation

Some details that may be lost during the drying process can be captured by field photos. Images where field photos can be a valuable supplement to herbarium specimens are for example colours, tree habitus, bark details and others, where material is not collected. Especially for species where material is significantly reduced in bulk, photos can be a valuable supplement. Examples are large leaves, stems, inflorescences and fruits. In collection of palms, photos are particularly important because of the size of vegetative material. It is important that the collector assures that the photos are correctly linked to the specimens, either by internal camera applications of some modern cameras or manual writing. Even relatively low resolution pictures taken by mobile phones can be valuable for documentation.

Figure 4. Series of supplementary pictures of *Daemonorops micrantha* taken in connection with collection of voucher herbarium specimens.

Recommended readings

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