

Naturalised and invasive succulents of southern Africa

M. Walters, E. Figueiredo, N.R. Crouch,
P.J.D. Winter, G.F. Smith,
H.G. Zimmermann and B.K. Mashope



5. Collecting succulent plants for deposition in a herbarium

by M. Walters

5.1. What is a plant specimen?

A preserved plant specimen is a dried and mounted or pickled voucher that is the botanical world's equivalent to the zoologist's stuffed animals, skins or insect collections that are kept in natural history museums (Fig. 25). Plant specimens are housed in herbaria which are permanent repositories of specimen collections and their associated data.



Fig. 25. A preserved specimen of an indigenous succulent, *Aloe arborescens* Mill., kept in the National Herbarium of South Africa (PRE). (Picture by SANBI)

5.2. How are plant specimens useful?

Herbarium specimens in the vast collections held by Herbaria all around the world are extremely valuable for a number of reasons. Not only are specimens useful when trying to identify plant material, they also provide a record of where and when a particular species was found growing. The information that can be found on the specimen label is valuable too, and may give clues as to, for instance, soil substrate the plant was found growing in. As classifying plants is not a static process, and plant names may therefore change as species concepts change or as new evidence for re-classification is found, specimens can be used to verify past identifications. Label information on herbarium specimens is also used as a way of determining the area of occupancy (AOO) of species, which is an important parameter to determine their conservation status (Red List status) (Hernández & Navarro, 2007). This method results in more accurate, less overestimated determinations of AOO, and will as a result produce more useful and valuable Red List assessments.

5.3. Why bother collecting voucher specimens for exotics?

There are many more ways in which specimen collections are useful, but as far as alien plants are concerned, physical specimens can be of particular use, when investigating points of entry and range expansion of these species over time. They also aid in the development of predictive habitat models that may give clues about habitat preference and potential for future spread.

Most people know better than to touch a cactus with their bare hands. The spines and fine glochids, in the case of representatives of *Opuntia* (prickly pears) and their relatives, found on most species can be very irritating and quite painful when lodged under the skin. So when appeals are made for collecting and pressing these plants, a general lack of enthusiasm is usually shown by professional botanists and by the public alike. Preparing preserved specimens of these plants with their unwelcoming, prickly habit may seem like more effort than it is worth. For this reason, cacti are often not collected and are thus poorly represented in herbaria (Leuenberger, 1987). This is particularly true for southern Africa where, except for one species (*Rhipsalis baccifera* subsp. *mauritiana*), cacti do not comprise part of the indigenous flora and are thus mostly ignored, even by environmental consultants and other specialist collectors. Unfortunately, because of this, potentially valuable information about these plants does not reach the people responsible for monitoring and controlling their spread. The collection of herbarium specimens greatly enhances the quality of invasions biology as a whole by providing study material for current and future studies (Carter *et al.*, 2007).

5.4. How to contribute to expanding herbarium plant collections

A basic 3-step process is followed to prepare useful herbarium specimens.

1. Collecting (Fig. 26)
2. Preparation and pressing (Fig. 27)
3. Identification and mounting

5.4.1. Collecting

Selecting the material

When selecting plants for pressing it is important to bear in mind that it is preferable for specimens to have flowers and/or fruit included to aid identification (Leuenberger, 1987; Victor *et al.*, 2004). A specimen consisting of sterile material accompanied by the correct information, however, is better than nothing and may be useful in providing pieces of the puzzle for a taxon as a whole. A specimen of, for example, an exotic plant should therefore be made regardless of whether the plant is flowering or not. Adding an illustration (drawing, photograph, print of an electronic image) to the specimen can considerably enhance its value.

In the case of smaller plants, it is best to collect the entire plant, including underground parts, while for larger plants, representative parts should be collected. These should include mature and immature parts, lower and upper leaves, buds and coppice shoots (Victor *et al.*, 2004).

Collecting

Once you have selected a plant it is best to place it in a plant press immediately or, if that is not possible, in paper bags. The use of plastic bags is discouraged as it causes sweating in succulent plants, which results in the formation of mould (Burgoyne & Smith, 1998). Large specimens can be bent or cut before placing them in a press. In the case of fat-bodied plants such as cacti, both longitudinal and cross-sections should ideally be prepared, pressed and dried. Care should be taken when working with spiny plants and it is advisable to wear protective gloves. Some plants (like those in the Euphorbiaceae) contain irritant plant sap and contact with the skin, mucous membranes and particularly the eyes should be avoided.

Fruits and flowers, as mentioned, are often critical for correctly identifying plants. This is particularly true for many cactus species, where dissection of the flowers or fruits facilitates correct identification. It is therefore often useful, not only to press, but also to collect whole fruits and flowers. These may be preserved —pickled— in jars with 50–70% diluted ethanol (Leuenberger, 1987).

To prevent the further spread of exotic plants, special care should be taken that no seeds or reproductive parts of the plant is dispersed during and after collecting (Carter *et al.*, 2007). This means not only the careful checking of equipment but also clothing and the bottoms of shoes, shoe laces and especially any velcro.

Auxiliary information

Ideally a specimen should be accompanied by photographs of the plant while still growing in its natural habitat. These are valuable complimentary identification tools that provide information on habit or other characters not always visible on dried, preserved specimens (Leuenberger, 1987).



Fig. 26. Collecting plant material for deposition in a herbarium. (Picture by SANBI)

Other relevant data should also be recorded on field labels, in collecting books or in portable electronic data-capturing devices, where possible. Essential information includes: Name of collector, date of collection and where it was collected (with map or GPS coordinates). Other useful information includes: altitude, aspect, vegetation type, geology, soil type, abundance (frequent or rare), plant size and height, stem diameter as well as details that may be lost upon drying, such as flower or fruit colour, presence and colour of sap or latex and scent (Victor *et al.*, 2004). It is not always possible to collect all this information but at the very least where, when and by whom the plant was collected should be recorded.

5.4.2. Preparation and pressing

While preparing a specimen of a herbaceous plant is reasonably straightforward, the same is not true for succulents, which are often bulky specimens. For a specimen of a succulent to be useful to taxonomists and other researchers it has to be handled and pressed correctly (Bridson & Forman, 1998; Victor *et al.*, 2004). Unlike other plants, many succulents have to be treated before pressing (Smith, 1991; Eggle & Leuenberger, 1996; Burgoyne & Smith, 1998).

After collecting, field presses and/or paper bags containing succulents should be put in a freezer at c. -4°C for 24 hours (smaller plants require less time in the freezer) (Leuenberger, 1982; Burgoyne & Smith, 1998, and references therein).

The specimens should then be placed in a microwave for a period of 1–5 minutes (depending on the size of the specimen), a few at a time (though bundles should not exceed 50 mm in thickness), or larger plants on their own, at 80% power, which leaves them pliable and easy to manipulate (Burgoyne & Smith, 1998).



Fig. 27. Plant presses with specimens drying in the sun during a field collecting expedition. (Picture by SANBI)

Other methods for removing succulent plant tissues involve scraping out of inner plant tissues, or dipping plants in boiling water or organic liquids. The method described above, however, causes the cells to burst, allowing the resulting watery substance to simply be poured off (Burgoyne & Smith, 1998). Specimens should be removed from the microwave once they turn a dull green, at which point they are ready to be dried in a plant press. Note, however, that microwaving a specimen can yield it useless in further studies that require the removal of small sections of material for chemical or molecular analyses. The accompanying specimen label should therefore indicate whether material was microwaved. Many taxonomists actively discourage the use of a microwave oven in pre-treating specimens and prefer other less destructive methods when removing moisture from material intended for depositing in a herbarium.

Plants should be arranged in the press in such a way as to provide the most information to the user. All plant parts should be shown clearly, both sides of a leaf should be visible and the curling of leaves should be avoided. Attaching a jeweller's tag conveying the collector's name and collection number to the specimen will ensure that the specimen can eventually be associated with the correct field notes compiled by the collector.

The plant press should be packed in the correct sequence as follows (from Victor *et al.*, 2004):

1. The wooden lattice frame
2. Corrugated cardboard or aluminium ventilator (corrugations run parallel to the short side)
3. Two sheets of drying paper (newspaper, cut to size, works well and is inexpensive)
4. Flimsy (thin, strong, slightly absorbent paper, such as unprinted newspaper) containing a specimen
5. Two sheets of drying paper, followed by flimsy containing a specimen
6. A ventilator after each 5–8 specimens, or after every second specimen, if the material is very bulky
7. Finish with a ventilator and the other wooden lattice frame

The drying process should not take place in too hot an environment and 45°C is considered ideal (Victor *et al.*, 2004). Damp drying paper should be changed daily for about the first week after which longer intervals can be allowed, unless atmospheric humidity is very high. Damp cardboard ventilators should also be changed and care should be taken that flimsies, though not requiring changing, do not adhere to the specimens (Victor *et al.*, 2004). A simple and rapid technique for drying damp newspaper flimsies and cardboard when out in the field is to spread these around on the dry ground in full sun securing them with stones. On sunny days they can be fully dried in 30 minutes or less.

5.4.3. Mounting and identification

At this point in the process specimens are usually handed over to experts as identification and mounting is done by herbarium staff. For more detailed information on the mounting of specimens please refer to Victor *et al.* (2004). Here we give a brief description of the process.

In the herbarium, the specimen is identified, a label is written, and these are then neatly arranged on a white mounting board (300–400 g and 270 × 420 mm) with the label in the lower right hand corner. Labels usually display at a minimum the unique collecting number, date and place of collection, the collector's name, the species and family names, and who determined (identified) the species. Specimens and plant parts are fixed to mounting boards with any or a combination of the following: envelopes, glue, strapping (strips of white, gummed or self-adhesive paper) or stitching.

Plant specimens may last indefinitely if they are properly prepared and cared for, kept away from water and protected against humidity and pests. In this regard it should be noted that all mounting sheets and paper used for preparing specimens and labels should be of archival quality. The same applies to the ink used for producing the labels. Each specimen is a permanent record of the occurrence of a species in time and space (Carter *et al.*, 2007) and in this way immortalises the collector, who contributes to the wealth of knowledge held in herbaria to be used by future generations of plant enthusiasts (Burgoyne & Smith, 1998).