A man with a large blue backpack is walking through a field of tall green plants with small blue flowers. He is wearing a blue jacket and a dark shirt. The text "CHAPTER 2" is overlaid on the top left of the image.

CHAPTER 2

collecting plants

*Where have all the flowers gone?
Gone to cupboards, every one!*

A botanist on a plant collecting expedition.

Herbarium specimens are resources that can provide a large amount of information on plant taxa, as well as on the flora and vegetation of a region. The quality of the specimens determines the scientific value of the collection, and collecting good specimens is the first step in preparing specimens of a high standard.

Collectors

Usually, the herbarium staff collects most of the material housed in the herbarium. In addition, the role played by outside collectors is of great importance to the development of a herbarium. Owing to budget constraints and the extensive geographical region that often has to be covered, herbarium staff usually cannot collect with the intensity needed for comprehensive coverage of a particular floral area. To be cost-effective, herbarium workers tend to collect only during a prime season (after good rains, for example), or when the most species are known to be flowering.

All collectors should be encouraged and trained to collect and prepare plant specimens of good quality, accompanied by properly completed labels. In this way, the herbarium obtains the maximum scientific information from each specimen.

Professionals

Professionals work at institutions—for example, universities, technikons, or research organisations—in fields related to plant taxonomy, such as nature conservation, landscaping, ecological surveys, or weed control. Some of these institutions may have their own herbaria; otherwise, they rely on national or provincial herbaria.

Amateur collectors and parataxonomists

Amateur botanists should be encouraged to send collections to the herbarium. They can make a significant contribution by collecting rare and interesting plants, in different seasons, or from unusual locations. Staff can cooperate with amateurs, providing them with the information they need in return for donated specimens.



This specimen was collected in 1862, but is still in very good condition because it was well preserved.

Students

Many educational institutions require their students to collect herbarium specimens as part of their coursework.

Types of collecting

Collecting plants differs from person to person and depends on the aims of the collector:

Research or specialised collecting
Collecting for taxonomic research concentrates on specific plant groups and is usually confined to plants within a specific family, genus, or species. Collection of voucher specimens for cytological or anatomical projects also falls into this category. It is important to prepare voucher specimens of good quality to ensure that the identity of the subject of the research can always be verified.

Researchers studying other aspects of the environment, for example, weeds for herbicide trials or vegetation studies, also collect plant species. Accurate plant names and voucher specimens are important for such projects.

Floristic collecting

Floristic collecting entails collecting all plant species in a certain area. Such areas include regions poorly represented in a specific herbarium, or areas where an unusual event has occurred (for example, fire after many years of fire protection, or unusually heavy rains). It could be an area of specific interest, for example, a nature reserve or specific geological formation. If the aim of a collecting trip is floristic collecting, planning is essential to avoid collecting in well-collected areas, while under-collected areas remain neglected.

What you need

Before you start collecting plants, you need permission to collect, as well as the right equipment, maps, vehicles, and emergency supplies. This section describes all of these prerequisites in detail.

vehicle equipment



storage boxes



Jerry cans



storage boxes



water can



sand tracks



high-lift jack

Additional equipment

- First aid kit
- Axe
- Spade
- Fire extinguisher
- Jumper cables
- Puncture repair kit
- Tow rope
- Fuel filter
- Brake fluid
- Fuses
- Insulation tape
- Light bulbs
- Spark plugs
- Electrical wire, 5 m length
- Fan belt
- Funnel
- Glue, epoxy or quick-set adhesive
- Shock absorbers, set
- Tyre pressure gauge

TIP

Find out which spare parts are essential from the dealer who services your vehicle.



collecting equipment



Plant presses, flimsies, drying paper, corrugated cardboard sheets.



prospecting or geological hammer

small hand spade



secateurs



tree loppers

small knife for lifting bryophytes off their substrate



Aquatic plant rake.

- Tissue paper and newspaper for bryophytes, fungi, and delicate flowers.
- Gummed cards for delicate flowers.
- GPS (Global Positioning System) instrument.
- Topographical, geological, and vegetation maps of the area concerned.
- Pencil or waterproof pen.
- One large plastic bag (approximately 550 x 850 mm) per collector, in which to put small bags of plants.



An assortment of plastic bags in which to put plants.

TIP

Brightly coloured paint or cards on collecting tools help locate them when lost.

collecting equipment



Hand lens of 10× magnification.



Brown paper bags of different sizes for seeds and fruits, bulbs, succulents, fungi, lichens, and bryophytes.



Leak-proof plastic bottles with preserving liquid or fixative if required for cytological, palynological, or anatomical studies.

Collector: J. Kroon		No. 3641	Date: 2 APRIL 2004
Provisional Name: <i>Gnossia</i>		Alt: 1360 m	
Region: North West Prov. Dist: 2625 CB		Lat: 25° 22' S Long: 30° 38' E	
Locality: Delareyville area		Delareyville Witkraal 141	
10 km north west of Delareyville		6 km from farmhouse	
Forest: Type: Open		Habitat: Nama Karoo	
Vegetation Type: Dry Cynbaopagan		Thicket: Nama Karoo	
Habitat: Thicket		Soil: Sandstone	
Substrate: Sandstone		Moisture regime: Semi-arid	
Soil type: Sandstone		Lithology: Sandstone	
Aspect: North		Biotic effect: None	
Life form: Shrub		Plant features: Flowers deep blue with white throat, sweetly scented, fruit red	
Plant name: <i>Gnossia</i>		Det.:	
Date: 2 APRIL 2004		No. of labels:	

22/03/2004 2527 DD 1360 m

Gauteng: 28 km SW of Brits near Harteboespoort Dam, Farm Rietfontein 613. Mixed bushveld. Hilly terrain with sandstone. Area disturbed and well-grazed.

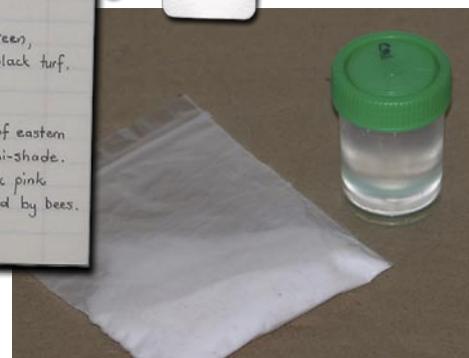
3405 ?
Small shrub, up to 1.5 m tall, much branched, growing near stream; leaves light green; flowers red, smelling cinnamon. Only a few plants seen.

3406 ? *Eragrostis*
Densely tufted, leaves flat, dark green, ± 600 mm tall, common in valley, in black turf.

3407 ?
Small herb, ± 200 mm tall, on hilltop of eastern slope, between rocks. Soil humus. In semi-shade. Leaves sticky; flowers pink with dark pink guidelines; small, red ripe fruits. Visited by bees.



Jeweller's tags for collector's name and number.



Silica gel to dry samples quickly if required for DNA studies.

Collector's register, or printed herbarium field labels. (A blank field label to photocopy is included on page 82.)

Collecting permits

Most southern African countries are signatories to the International Convention on Biological Diversity. It is advisable to be aware of the laws applicable to a certain area before collecting and to obtain the necessary permits. The ordinances or requirements for permits may vary from country to country, or within different provinces of a country. In South Africa, for example, permits are needed even for unprotected taxa, and special permission is required for threatened and protected taxa.

You can usually obtain permits from government departments in charge of the environment or indigenous plant control. Even with the necessary permit, you should still make prior arrangements with the local officers responsible for the area in which you want to collect. It is advisable to apply for a permit well in advance, as it may take several months to process.

Follow these general guidelines:

- Do not collect or transport any plants without a collecting permit.
- In addition to the permit, obtain the consent of the landowner before collecting any plants on private property.
- Additional permits are usually required for collecting in provincial nature reserves, municipal or private nature reserves, national parks, forestry areas, and game reserves.

Special permits

- **Phytosanitary Permits** may be needed when transporting plants across borders of some countries. They must be obtained from the country of origin.
- **CITES** (Convention on International Trade in Endangered Species) legislation regulates and controls the international trade in material obtained from plants considered to be endangered. Scientific material is not exempt from it. For the movement of CITES-listed material, you need both a CITES export permit from the source country and a CITES import permit from the relevant conservation authority.

Vehicle maintenance

It is very important to keep the maintenance of the collecting vehicle up to date; this reduces the chances of a serious breakdown occurring in the field.

Emergency supplies

- First aid kit containing such basics as bandages, splints, antiseptic solutions, pain killers, antihistamines, an anti-emetic for nausea, an anti-spasmodic for diarrhoea, rehydration



Gathering plant material in the field.



Pressing plants in the field.



Adiantum reniforme, a fern, prepared for pressing.

powder, water purifying tablets, and burn ointment.

- Enough water should be available for drinking to prevent dehydration, for washing hands, especially if dealing with poisonous plants, and for the vehicle.
- Each member of the collecting team should carry a box of matches to light a fire. In the event of them getting lost, it will enable them to produce a smoke signal or keep warm.
- Guide to snake identification.

TIP

Knowing how to give cardiac-pulmonary resuscitation (CPR) and how to deal with snakebite is important. A basic knowledge of first aid could be life saving, especially when you are collecting in remote areas. Contact an organisation that presents first aid courses in your area for more information.

Maps and map reading

Maps come in different scales: 1:1,000,000; 1:500,000; 1:250,000; 1:50,000 covering areas the size of the country to the size of a quarter degree. Select the best scale map for your needs.

The coordinate reading is always taken from the top left corner of the grid. The line of latitude is always the first coordinate, and refers to the number of degrees north or south of the equator. Because southern African countries are south of the equator, their position will always be plotted as number of degrees "S". The line of longitude indicates the position of any given point to the east or west of the Greenwich Meridian, which is at 0° and is thus indicated as "E" or "W". In the southern parts of Africa it will always be "E", given the fact that we are east of the Greenwich Meridian.

Every map has lines of longitude and latitude, and is named according to the intersection of these lines in the top left corner of the map. The uppermost line of latitude and the line of longitude on the left edge of the map are the two reference lines. The reading is given at the point where these lines cross. At this point, the degrees are indicated. These lines of latitude and longitude representing the degrees may be divided further. Each degree is divided into 60 minutes (60') and each minute into 60 seconds (60"). If the reference point is halfway between the

TIP

To make ordinary matches waterproof, keep matches and the striking surface of a matchbox in a film canister; or dip the match-heads in melted candle wax (remove the wax just before striking the match).

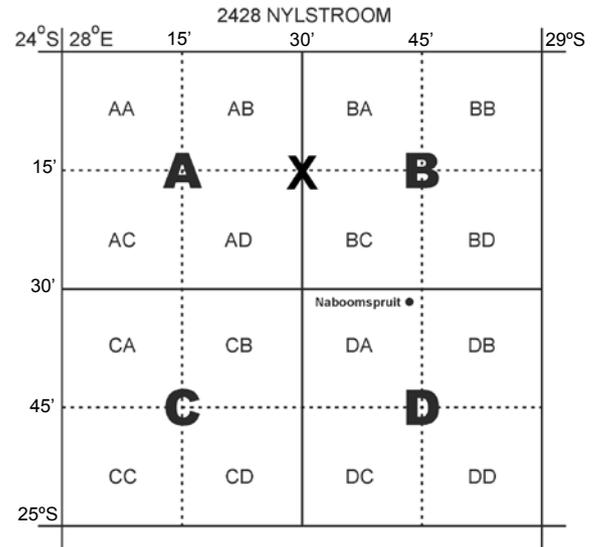
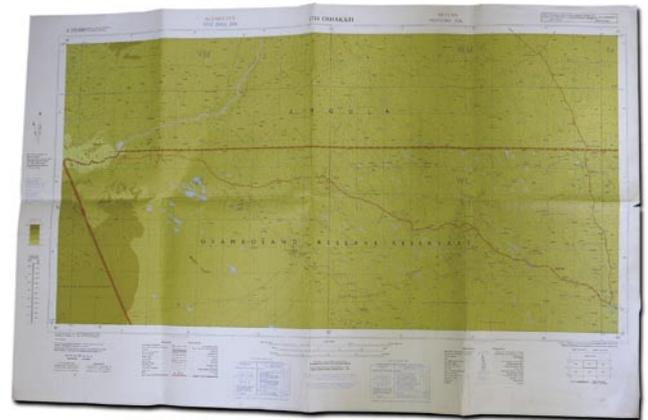


Diagram to work out quarter-degree grid references using lines of latitude and longitude.

lines of longitude in the diagram, at X, then it is at 30 minutes (30') and 0 seconds (0") past 28°E. X also lies 15 minutes south of the line of latitude. The position of X is therefore 24°15'0"S; 28°30'0"E.

Quarter-degree grid readings are often used to provide broad locality details on labels; for instance, the town Naboomspruit lies at 2428DA.



A 1:100,000 map.

Global Positioning Systems

If you are planning fieldwork in a region where there are no roads, a GPS (Global Positioning System) instrument is essen-

tial for orientation. The GPS gives latitude and longitude readings accurate to within a few metres. A GPS reading is an excellent way of obtaining an accurate locality of the plants collected, and should therefore be recorded on the specimen label.



A GPS and a map.

What to collect

The importance of collecting good plant specimens cannot be over-emphasised: good specimens are a prerequisite for accurate identifications and for adding value to a herbarium collection.

- Collect only plants in flower or fruit (both if possible), as most often the characters traditionally used for identification in the herbarium are found in these organs.
- Make specimens large enough to present a fair sample of the plant, its manner of growth, branching, and so on.
- Where possible, collect the entire plant: a good specimen comprises all the organs—underground parts, stems, leaves, flowers, and fruits. Basal parts of grasses, sedges, ferns, and bulbous plants are essential for identification.
- When collecting large plants, such as trees, shrubs, and large herbs, representative parts should be collected. Show the complete range of variation that is present by collecting mature and immature parts, lower and upper leaves, buds, and coppice shoots.
- Specimens too large for the mounting sheet can be bent, broken, or cut before they are pressed. Large or complex parts, such as fern fronds or cycad leaves, are collected only in part. The base, middle, and apex are usually adequate for most taxa.
- Many plants develop leaves and flowers at different times. Each separate stage can be collected independently and pressed as it appears. Great care must be taken to collect leaves and flowers from the same plant. (Note that different collector's numbers should be used.) Large plants such as trees and shrubs are generally marked in situ, while smaller

plants may be collected and cultivated.

- The identification of many plant groups depends on characters other than flowers and fruits. Find out which characters are important for various families or genera (see Fish 1999).
- Valuable information can be obtained by collecting the same species in different habitats, at different localities, and in different seasons (under different collector's numbers).
- Do not collect only the smallest individuals of a species merely because they will fit on a herbarium sheet or dry easily. Select individuals of average size. If possible, a number of plants should be collected to show the morphological variation within the population (size, for example). Enough samples of the specimen should be collected to fill a herbarium sheet; extra flowers are often particularly useful.
- Collect a number of duplicates. Duplicate specimens provide material for exchange or gifts to other herbaria and ensure that collections are not lost entirely, should a sheet be mislaid or damaged in one herbarium. This is especially important if a collection is later designated as a type specimen.
- Do not always be deterred from gathering what appears to be material belonging to a species already collected; it may prove to be different from the one with which you initially associated it.
- Weeds should be collected, as information gained from such material, for example, distribution records, possible introduction data and rate of invasion, could help with control.
- Although entire plants and duplicates should be collected, discretion must be used, especially if the plant appears



Plant material ready to be pressed.

to be rare. Where possible, collect at least one complete plant specimen to show the basal parts and roots, and one duplicate specimen that can be deposited in another herbarium. Should anything happen to the first specimen; a duplicate is available elsewhere.

Dealing with collected material in the field

When you have obtained suitable material, your next task is to deal with the specimens from the point of collection to the stage where they are placed in a permanent press. The ideal is to press material immediately.

If, however, there is insufficient time to press the specimens in the field, or if the collecting site is difficult to reach carrying presses, you can place specimens in plastic bags and press them later. Place each specimen in a small plastic bag, add a few drops of water if possible, and close the bag tightly. Placing each specimen in a separate bag saves time when pressing; there is less damage to the specimens, and flowers or fruits that may have dropped off are preserved. Therefore, collect into separate bags even if plants are too large for the bags to close. To make it easier to carry the small bags, place them in a single large plastic bag. Do not use the plastic bag method for specimens that are delicate or wilt easily. For such plants, a field press is necessary. A field press is lightweight and is closed by expandable straps. It has a device for carrying it around easily in the field. Some collectors prefer to collect directly into a field press rather than using plastic bags.



A field press.

TIP

A lightweight, temporary alternative to a field press is an A4-size notebook.

Bryophytes and lichens

Bryophyte and lichen collecting procedures are different from the standard collecting methods. Bryophytes, fungi, and lichens should not be pressed, as pressing distorts the form of the plants and destroys some of the critical morphological features. Van Rooy (1998, 1999) provides very good notes on collecting and preserving bryophytes (liverworts and mosses); these methods also apply to lichens.

How to collect bryophytes and lichens

1. Lift the specimen from the substrate by hand or with a knife, taking care to include the layer of soil or bark underneath the plant.
 - Collect lichens that grow on rocks from which they are difficult to remove by chipping off a piece of the rock with a hammer and chisel, or a geological pick.
 - Collect lichens on tree bark with the bark; then cut the specimen to size to fit in an envelope. (See “Envelopes” for instructions on folding your own envelopes.)
2. Place the specimen carefully into a brown paper bag.
 - Aquatic bryophytes (for example, species of the peat moss genus *Sphagnum*) hold large quantities of water; squeeze the water out before placing the specimen in the bag.
3. When the specimen is dry, remove the excess soil from the dried plant with a sieve, and place the specimen in an envelope.
 - Wrap terrestrial bryophyte specimens that are soft and delicate in tissue paper or newspaper to keep them intact.
4. Record the substrate for each specimen.

TIP

If possible, it is always better to press in the field than to collect into plastic bags—there is less chance of damage to specimens, mixed collections, and separated collections.



Bryophyte or lichen specimens filed in envelopes in drawers.



Labels on bryophyte envelopes and lichen boxes.

Recording information

The information recorded on the label is as important as the quality of the specimen. Apart from the collector's name and number and the locality, most of the label information concerns those aspects of the plant and its habitat that will not be visible on the dried specimen. The details on the label must be meaningful and unambiguous to anyone reading the label. All notes about the plants should be made in the field when the specimen is actually collected (or as soon as possible afterwards) and not at a later date. Experienced collectors will vouch how easily information can be forgotten or muddled if not written down immediately!

Enter each record in a field notebook, collector's register, or directly onto specially printed field labels (see Appendix 2). You can use any book as a collector's register and make notes about the locality and specimens collected before writing labels. Pre-printed field labels are useful—each label has most of the basic possibilities already printed on it, making it quick and easy to select the information applicable to the specimen in hand.

Basic label information

- **Collector's name and number** are unique to each specimen collected. All duplicates must be given the same collector's number as the original specimen. The collector's number is written on tags that can be attached to the specimen and its duplicates. The number is also written on the outside of the flimsies in which the specimen and its duplicates are pressed.
- **Date** when specimen was collected. The collection date gives valuable information on flowering and fruiting times of a taxon and can be used when planning trips to recollect a specimen, to continue research on the population, or to collect the taxon in other areas.
- **Locality** refers to the exact position of a specimen. Locality is measured by the latitude and longitude in degrees, minutes and seconds and, in the FSA (*Flora of southern Africa*) region, the quarter-degree grid square reference. When recording the locality, include the closest reference point (such as nearest town or well-known landmark) and the precise locality. This information is obtained from maps (1:250,000 or smaller) together with a GPS (Global Positioning System) instrument. Accurate localities give important information on distribution. They also enable collectors to return and collect in exactly the same place or from the same plant, for example, in the case of a tree.
- **Descriptive Notes**

Record the following information for each specimen:

- Details likely to be lost in the drying process, for example, flower and fruit colour and markings, smell, milky latex, and stickiness.
- Information on characteristics not observable from the specimen, for example, time of opening or closing of flowers, taste, parasitic host plant, and light conditions.
- Aspect, altitude, vegetation type (grassland, forest, and so on), geology.
- Life form, size of plant, height, diameter of stem (trees).
- Habitat and factors like soil type and moisture regime (swamp, sand, or rocks, open places, shade, and so on).
- For bryophytes, fungi, and lichens, record the substrate for each specimen.
- Abundance—whether frequent or rare.
- Uses and local common names.
- Whether serving as a voucher (for example, for a painting, drawing, photograph, or seed bank material).
- Pollinator. ▲

TIP

For more information on plant collecting, see the book *Preparing herbarium specimens* (Fish 1999).