

Collecting, Preparing, Identifying and Preserving Plant Specimen

Manual

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Introduction

The flora of Ethiopia comprises between 6500 and 7000 species of higher plants of which 12 % are endemic. It ranks fifth in tropical Africa. The country is a very important center of crop genetic diversity, and for this reasons it is serving as one of the 12 Vavilov centers. Large number of cultivated plants and their wild relatives are best set in several ecosystems in the country. Identification of plant resources that a country has is valuable to exploit the potential use of the beneficial plants or to limit negative impact of the harmful ones.

Herbarium is a systematically arranged collection of dried plants or specimens of plants. The arrangement of specimens in a herbarium could be either geographical or alphabetical for ease of reference. Specimens of plants are collected for a number of different uses. They can assist in accurate identification and provide a species record for a time and place. They can be a reference point to document scientific names and vouchers for research. For instance,

sorting troublesome weeds to species level and prioritization of problematic weeds is important for economical weed research and management activities. Plant classification is constantly changing. Shifts in species alignments and groupings are made as new evidence becomes known. Identifications are subject to change too. The experts who are engaged in the task thus can provide up-to-date taxonomic and ecological advisory service.

This manual aims to ensure the plant specimen collector know how to plan, observe, collect, document, press, identify and preserve plants to the best advantages of enriching the herbarium. Addis Ababa University Biology Department and Agricultural Research Centers like National Plant Protection Research Center of Ethiopian Institute of Agricultural Research located at Ambo can assist in identification of the specimen, which could not identify at the acting office level.

Collecting Specimen

Planning

Planning for collection and preparation of material needed for collection is crucial. Arrangements should include targeting collection locations and periods to obtain useful specimens, obtaining collection permits from appropriate agencies, and establishing official contact with government, herbarium, and research in the collection area. It is also crucial to plan and look for material needed for collection. The tools needed for collecting plants are:

- clippers to cut plants
- digger to dig plants
- plastic and paper bags to put plants in until plants are pressed
- a field notebook with name and address of the collector on it
- small tags to attach to the plant specimen;
- pencil

- map of the area (GPS unit is a helpful addition)
- plant press
- hand lens of 10 x magnification
- altimeter/GPS and
- camera

What to collect

Plant specimens to be collected should be as complete as possible. Collect the whole plant including the underground parts including bulbs, tubers, and rhizomes. In the case of larger herbs, it is possible to cut in to parts, to occupy two or more sheets. Representative plant samples that are dry, not wet with dew or rain should be picked. It is crucial to collect as much as can be mounted showing the main characters of the plant. A number of plants to show the range in size are much better than a single plant. At least two copies of specimens of each plant should be collected and prepared—one for acting office and the other for identification and then for the National Herbarium (if not preserved before). Flowers and fruits are very important; otherwise, it may not be possible to identify the plant material.

In case of a tree or shrub a typical branch or portion of the stem 20-30 cm long, showing the leaves in position and

with flowers and/or fruit is required. In the absence of open flowers, buds should be included. If variation in leaf form is apparent, specimens should include different parts of the same plant to represent this variation. Seeds can be useful in the identification of plants and should be included with the specimen if available.

The plant specimen shall be taken from its typical habitat. If a species normally grows in woodland, do not collect specimens growing by the roadside or in a clear land. Sometimes leaf shape, flower color and other characters are completely altered on plants growing in full sunlight.

Collecting plants

The best method is to start with a small area, go over the ground leisurely and thoroughly and get to know and collect the plants, taking a few at a time. It is surprising that a wide variety of plants can be found in a quite restricted area if this is searched systematically throughout the year. As the collector become familiar with the vegetation, the area can be gradually extended and collections made of plants not previously met with. A number of specimens can be collected and kept in a plastic bag for a few hours, until it is convenient to press them, unless conditions are very hot and dry. All dirt adhering to

the roots should be carefully knocked off or washed away. Loose seeds and fruit can be placed in a small paper packet to be pressed with the specimen.

Notes to be taken with a specimen

Every specimen should be accompanied by comprehensive notes retained in a collecting note book. Locality information and details of the appearance of the plant in the field are important for identification purposes. These are also necessary if the specimens are to be usefully incorporated into a herbarium collection.

After each specimen is collected, number it with the sequential code and make notes at the time of collection. The collection should start with number 1, and only one series of numbers should be used, the sequence being maintained no matter where or when the collection are made. Before any plant is take-off from a particular locality, an entry should be made in the collecting book giving the detailed information. Making of notes should be done in a small, hard-backed, note book kept especially for the purpose, and writing also must be clearly legible having only the most obvious abbreviations. The information recorded will be of the utmost assistance to the taxonomists/botanists working on the flora of the

country. It is important to collect as much as possible relevant information with each specimen. The following list explains what should be included with a specimen.

Flora of: Given country, region.

Family: Include family name as of scientific classification if known. If not, leave a space that can be filled in when identified.

Scientific name: Include Latin name if known. If not, leave a space, which can be filled in when identified.

Local name: Ask the farmers in the area to give you the local name. Specify the language.

Uses or economic value: Make notes on whether the plant is edible, used as medicine, poisonous, fed to animals, used for fuel or building material, etc.

Locality: Note the woreda, peasant association, nearest village names, etc. Describe a distance from large enough place or any permanent landmarks (nearby town, mountain, river, lakes, etc.). Altitude: Express in meters from sea level, give an approximation if not known precisely. Moreover, to locate the collection position, give

the longitude and latitude.

Habitat: Give the vegetation type such as forest, grassland, and farmer's field where the plant found. Describe the soil type (color and texture), terrain (slope or flat), wet or dry condition, full shade or sun.

Description: Describe whether it is an annual, biennial or perennial; erect (- cm high) or prostrate forming patches (- cm across); an herb, shrub or tree. Describe any vegetative features such as the shape and size of the plant, and flower and fruit color—often it changes after dry. Describe any other characteristics which may be noticeable and useful in identification, such as kind of bark (rough, smooth, stringy or fibrous), type of branching, leaf arrangement, whether growing singly or in clump, whether they grow gregariously in large number or singly, whether common or rare, type of plant smell or sap. Include only the information, which makes sense for the specimen you are collecting.

Collector (s) name: Give the name of the person(s) who collected the specimen.

Date: give the date, month, and year, and note whether it is in Ethiopian or European calendar.

Specimen no: start with number “1” and use only one series of numbers. Place this information separately in the folder with each specimen. Make it a carbon copy for each specimen. Make sure to keep the information on collecting book in case of along specimen information gets lost. Photographs of whole or part of the plant may be used to supplement the information included in the notes (a note in the field notebook 'photo taken' is then useful).

A typical flora label

Most herbaria have printed labels about 8 x 10 cm which are filled in and glued to each herbarium sheet. A typical label shown below provides room for all the essential information noted by the collector at the time of gathering, plus a catalogue number for the plant in the herbarium register.

Flora of Ethiopia	
Administrative region/zone:	_____
Family:	_____
Scientific name:	_____
Local name:	_____ language _____
Uses or economic value:	_____
Locality:	_____
Altitude:	_____ Latitude: _____ Longitude: _____
Habitat:	_____
Description:	_____ _____ _____
Collector name:	_____
Date:	_____
Specimen no:	_____

Pressing Specimen

Pressing is to flatten and dry the specimen. Normally a plant press used for such a purpose. If a plant press is not available, use heavy books or objects to flatten the specimens in their folders.

The material collected has to put into the press. The best specimens are plants that pressed as soon as possible after collection, before wilting and shriveling. Flowers with a lot of nectar may go moldy very quickly if excess nectar not shaken off before pressing. Spread out the plants in the folded sheets of thin paper (newspaper) of the same size as the boards and specimen number written on the bottom right hand corner of it. Arrange the plant on drying paper (newspaper) so it looks as natural as possible so that you can see distinguishing features. Turn over one or two leaves so that the backside will be visible. If the plant is very leafy, one has to carefully removes some of the materials so that different parts can be seen: Display

aspects of the flower, fruit and leaves where possible so that you can get different views. Normally specimens arranged following its nature i.e. apex up and base down in between the paper. Many larger specimens are best arranged diagonally. This provides both more length and width than positioning longitudinally. Over-long specimens folded to fit the sheet so that the apex points upward or the base downwards. Break if not too tough, or cut with scissors if woody. Large flower heads or fruits cut in half before pressing. Very thorny specimens should have their thorns broken or bent by putting the specimens between two boards and treading on them to flatten. Do this to avoid damaging other specimens in the press.

Succulent plants must be killed before pressing, because if dried in the normal way they will continue to grow, so kill by immersing in methylated spirits or some other alcohol for an hour, in petrol or kerosene for 15-30 minutes or put in boiling water for 5-10 minutes although this is not the desired method because it adds water. Specimens can be pickled in 70% ethyl alcohol. Place specimen as soon as possible after this treatment in between single sheets of absorbent blotters or semi-absorbent paper such as newspaper. Press the specimen in between sheets and use a double sheet as 'driers' between each single sheet. The press is then placed in warm (not hot), dry, circulating air.

Drying Specimen

Drying specimens takes about 7-10 days. Try to dry the specimens as fast as possible to prevent fungal infections and preserve the natural color. In order to insure rapid and thorough drying, extremely succulent materials such as cactus stems may need to be sliced open and some of the fleshy interior scraped out. Sheets of thick, preferably smooth-sided, center-corrugated cardboard such as used in cardboard carton sides, and foam sheets placed between layers of blotter/ the drying folders will assist air circulation through the press. These are particularly necessary when using a forced circulation of warm air. If such cardboard is not available, additional sheets of newspaper or wooden board, for example, plywood used to absorb moisture from succulent specimens.

If corrugated paper is used, put the press in a vertical position so the air can circulate being the corrugations

running parallel to the shorter sides. The drying papers should be checked for dampness, and changed when necessary to enhance the drying process until the specimens become dry. As the number of changes required will vary with the original succulence/water content of the plants and with the weather conditions, no exact guide can be given. Do not disturb the specimens in their paper folders; merely replace the double sheets in between. After one day, check the specimens and rearrange them if it is needed. Sometimes petals stick to newspaper as they dry and are impossible to remove without damage once they have become brittle. Changing the newspaper before the flower has dried completely helps to prevent this. Place the press in a dry warm place but avoid excess heat. If it is very damp, place the press over a heat source. The plant press straps have to be tightened periodically as the plant material shrinks.

When in the field for an extended time, drying can be aid by placing the pressed plants in a warm, sunny position during the day. In reasonably dry climates, drying is aid by securing the presses to the roof rack of the vehicle whilst driving in dry daytime conditions. If available, a hot-air fan directing air around the press will assist drying. Drying cabinets with a forced circulation of warm air used in large herbaria to shorten drying time and to lessen the

need to change drying papers, but are not necessary for small quantities of specimens.

Mounting Specimen

Mounting is the process of affixing a dried pressed plant and its label to a sheet of heavy paper. This provides physical support that allows the specimen to be handled and stored with a minimum of damage.

The pressed and dried plant specimen shall be mounted eventually on a herbarium sheet measuring about 51.5 x 26.5 cm. Mounting specimen prevents most fragile material from fragmenting and prevents specimens becoming separated from their labels. So the specimen need to be transferred to paper board and fixed on carefully with fixing medias like adhesive glue, plaster, thread, and tape.

Plants are generally positioned in a life-like arrangement, i.e., with roots or lower stem toward the bottom of the sheet and flowers toward the top. Easily reversible mounting media could be used, specimens should be

strapped to the sheet, rather than glued all over, and the specimen should be carefully arranged before it is attached so that it shows all features. Small pieces of material, which may be separated from the specimen (e.g. seeds), can be placed in small plastic bags and pinned to the sheet. The label holding specimen information shall be attached on the bottom right hand corner of the specimen.

Identifying Specimen

A thorough literature review and consultation with herbarium personnel will give you a good basis for starting the identification process. The identification of unknown plant material accomplished with the use of dichotomous keys; published plant descriptions, illustrations and photographs; and comparison with properly identified herbarium specimens. Nearly all classifications and keys are based on the sexual parts of the plant—the flowers and the fruit. One of the main reasons for this is that floral parts tend to remain much more stable through time and under different environmental conditions than do the vegetative parts and they better reflect the true relationships of plants. However, all parts, including underground organs may be needed for positive identification. A flower and a leaf would not be enough if the key called for stem and root characters. Notes about the plant should provide details of habit, growth form and so on.

Basic features and terms used in identifying flowering plants are *habitat*-terrestrial or aquatic, *life forms*-ephemerals, annuals, biennials, perennials, *growth forms*-trees, shrubs/bushes, herbs, climbers, *morphology*-root-rhizome, corm, fibrous, tap and tuber, *leaf*-alternate, opposite, whorled, fasciculate, simple, compound, base, margin, shape, *venation-reproductive characters/flower parts*-inflorescent, perianth, androecium and gynoecium

Preserving Specimen

Because herbarium specimens intended for long-term study and storage, it is critical that all supplies used for mounting be both durable and archival. Archival denotes materials that are free of acids and other compounds that may cause them or the specimen to degrade or discolor over time.

The long-term preservation of dry plant specimens is largely dependent on protection from pest attack. A range of pests attack dried plant material. The most common pests are insects and fungi, though rodents and other large animals can cause damage in poor storage conditions. Insects eat the material, the paper surrounding the material, and the adhesives and mounting media. Such insect pests range from psocids (book lice), which attack mainly the softer parts such as flowers and soft fruits, to tobacco beetles and carpet beetles, which can bore holes through the toughest of specimens. Many insects are

particularly sensitive to relative humidity levels and do not thrive at levels below 50%.

Fungal (mold) attack is mainly a danger either to damp specimens, through incomplete drying during specimen preparation, or to collections that become wet later through flood, other water damage or improper storage conditions. Specimens with sugary exudations or large quantities of nectar are also particularly attractive to fungi, and need special care during drying to ensure that they dry fast enough to prevent mold growth.

The most common and acceptable specimen treatments for pest control are:

Freezing specimen

Freezing the specimens is the technique least dangerous to human health, and is very simple. The specimens must be frozen to -18°C or colder and kept at that temperature for at least 48 hours. In practice, when specimens are frozen in domestic deep-freezers in bulk and/or in boxes, it is necessary to freeze them for 72 hours, i.e., 3 days and 3 nights to ensure that the centers' of thick specimen and specimens in the middle of large bundles are reduced to a low temperature for long enough time to kill all pests.

Treating specimen with microwave

To kill any animal life with a potential threat of destroying specimen they may be kept in a microwave. Microwave treatment is a fast method for small numbers of specimens. For all types of microwave, 1-2 minutes per dried plant specimen treatment should be adequate.

Poisoning specimens with a chemical

A traditional method of pest control was to poison the specimens with a chemical to make them unpalatable or deadly to pests. However, this is not recommended due to obvious health hazards.

Using insect deterrent chemicals

A number of chemicals have been used or proposed for use as insect deterrents. Of that naphthalene (commonly found as 'moth balls') is probably the most commonly used in herbaria because of its reputation for reasonable effectiveness in insect control, coupled with low toxicity to human.

Treating fungal pests

If fungus grows on the specimens, these can be brushed with alcohol or methylated spirits (denatured alcohol). However, this may alter the specimen unacceptably for chemical and other investigative research, and only kills the fungus present on the specimen; it does not correct the problems that allowed the fungus to develop. Specimens treated for fungal attack should be clearly annotated as such, including date and treatment given.