

Plant Collection and Herbarium Techniques

K. Maden

Tribhuvan University

Department of Botany

Post Graduate Campus, Biratnagar, Nepal

E-mail: kamal_maden@yahoo.co.uk

The collection of plants began in the 16th century. Later, J.P. Tourefort (ca 1700, France) used the term herbarium for plants (Bridson and Forman 1999). Plant collections are essentials for taxonomic researches because they serve as voucher specimens. They also help to identify the family, genus and species. So a herbarium is basically a storehouse of botanical specimens, which are arranged in the sequence of an accepted classification system, and available for reference or other scientific study.

Once mounted and deposited in the herbarium, the collections are referred to as herbarium specimens. Such herbarium specimens can be stored for many years and as such, they serve as: (i) historical collection, (ii) reference collection for checking the identity of newly collected plants, (iii) as an aid in teaching, and as a source of research material. Taxonomic research, therefore, relies upon a collection of preserved plants built up over a long period of time- the herbarium. Materials required for plant collection.

- i) plant cutter (secateur), pruner, digger, knife, leather gloves.
- ii) field note book, pencil, permanent ink pens, magnifying glass, digital camera, flora book (colorful), forceps.
- iii) flimsies or newspaper, blotters, corrugated plates, herbarium pressure, straps, tissue paper, plastic (poly) bags, herbarium bags.
- iv) drying table, mountain survival blanket,

clipper, heater.

- v) firstaidbox, topographicmaps, computer, binocular

Collection procedure

Twig with good flowers need to be collected for the specimen. The portion of the specimen should have to contain clear phyllotaxy and the branching system. For small herb, collection of more specimens as could fix on the herbarium sheet (up to six) is desirable. In general, secateurs are used to cut the twigs, while for a bit height or down, pruner is used, and for spiny specimens, such as *Berberis mucrifolia*, leather glove is required. For ferns and herbs, digger is applied to take out underground portion. Some plants stem lies horizontally under the ground; for example, some *Salix* and *Myricaria* species. In such cases, the underground portion should be cleaned from the soil particles, etc. If it is stem, then, specimens have be contained branching manner.

Aquatic plants are filmy or somewhat filamentous and are difficult to be arranged on the sheet. A sheet of mounting paper is placed under a floating or submerged minute plants, and then slowly raising the paper until the specimen is lying on the paper and out of the water. Then paper is lifted making a slope carefully, so that it facilitates water runoff. These plants need to be shaken well before putting in flimsies. Some plants can be put in

plastic bags. The plants that easily damage or can be lost among larger plants from the same collection site can be placed in small bags within the larger bag. Diseased plants, depauperate specimens, infected twigs, etc. should be avoided.

At the time of collection, it is usually not possible to identify many specimens in the field. Therefore, botanists identify the specimens that have been pressed and dried. The specimens are grouped into bundles according to location. The confirmed specimens should contain their botanical name, including author. The collection number can be used as a specimen tag. These number usually begin with 1, 2, 3, etc., and continue indefinitely. Plant collectors sometimes use a modified system, beginning each new year (2004-1, 2004-2, 2005-1, 2005-2, 20040512-1, 20040512-2, etc.). Instead of tags, collection number also can be written in flimsies by marker.

Field Note

After specimen collection, a field record is noted in small pocket sized notebook. Date of collection, location (name of place or distance from definite point), collection number, if possible, name of the specimen, and description of the floral parts that may change after drying are noted down. The good quality specimens also become worst if it does not have good field record. Topographic map is essential for the location. It needs to examine the floral parts carefully, if small by using magnifying lens. The characters should tally with the literature and pictures of the books. From various angles, the flower photos require to be taken.

Dorsal and ventral leaf view photos are also essential for the further identification confirmation. Digital camera should have at least 5-mega pixels so that close up image can

be taken even if the flower is too small. The range, latitude and longitude as well ecology of plant need to be noted down by GPS (Global Positioning System) and eyesight vision. Likewise specimen's microhabitat; means associated species should be mentioned, at least five species. Finally the distribution status of plant also needs to be mentioned, either the collected species is rare, frequent, common, locally common or occasional. Duplicate specimens of one species that are collected on the same date and same locality should be given the same collection number.

Pressing

When time and carrying facilities permit, the most usual method is to press each specimen as it is collected. Another method is to accumulate the specimens in vasculum (also black colored plastic bags can be used for short duration, especially in high altitude) and pressed later. Specimens should be of good quality with good field note. Collection numbers have also to be written in the flimsies (newspaper or blank newspaper). The specimens are kept gently within newspaper. Parts of flower are much carefully spread without overlapping in original shape. If the specimens are long, then it needs to be folded in V and N or Z shape. Unnecessary overlapping leaves and other parts must be avoided. Large leaf, if palmately compound, split in half lengthwise and one half is discarded. If pinnately compound, a branch is only kept. A few leaves may be turned over to show lower and upper view. If there is bulgy rhizome, needs to cut or dissect longitudinally by knife, so that moisture evaporates through there. If the specimen is gymnosperms, like *Abies spectabilis* (leaves fall before dry), the specimens needs to deep in the glycerin before pressing. Flowers with gamopetalous corollas should have to be pressed a few flowers

separately and some of these split open and spread. If flower is large, cotton padding is often helpful to dry quickly.

The specimens thus kept inside flimsies, are covered by on either side by blotters and then it is put herbarium pressure. After press is filled or all the specimens pressed, the plant press is closed and pressure applied by means of tightening the straps. Hard and dried fruits and cones- need not preserve and press, but have to keep in special boxes. The final appearance of the specimen depends on how it is pressed and dried (Jones and Luchsinger 1986).

Re-pressing

The specimens are repressed in the evening in the camp. The blotters are changed, if they are moistened. But flimsies need not change. The specimens are kept with the new blotters. After blotter, for ventilation and equal heat diffusion, aluminum plates (corrugates 12 X 18 in.) are placed. The process is repeated for each specimen. Thus racked specimens are designated as corrugated-blotter-flimsies with specimen-blotter-corrugated. Then it is tied up inside the herbarium pressure or plant pressure by two straps or belts around the outside. It is usually constructed of a sturdy metal, plywood, or wooden grid frame 30 x 46 cm or 12 X 18 in. (Woodland 1997). The herbarium pressure equipment can be inexpensively made from wood scraps, old cardboard boxes, old newspaper, and small rope. The final data is recorded in the computer using Microsoft Excel program, before specimens repressed for drying in the field. Thus prepared database is helpful in future

Drying Techniques

Drying techniques are of two types; those

accomplished without heat, and those with the aid of artificial heat. Drying with the aid of artificial heat is the prevalent method. It is accomplished by means of heated dry air passing up and through the canal of the corrugate. Corrugates, often referred to as ventilators, are used in presses when plants are dried by means of artificial heat (Lawrence 1951). It is as sheet of pasteboard or thin aluminum metal, with fluted ducts. It provides air passages through the press for movement of dry heated air.

The dryer with the herbarium pressure is covered by mountain survival blanket. It is heat resistant blanket that is attached to stand with clips. At the base (single) for coming and at the tip, for out going air, series ventilations need to keep. The best heat source is heater. Stove can be used as an alternative source. The usual time period for drying specimens is 12 hours. But it depends upon the material; and also dryer set, humidity, the type of heat source, climate, and temperature affect the drying period. Too high a temperature for too long a time period will cause a specimen to become brittle and discolored. Too short a drying period or too low a temperature will keep the specimens, moist to touch, and possibly cause mildew. Specimens will need to be checked regularly until dry. A specimen is not dry if it is still limp when picked up and cool and moist to the touch. The pressures become loose when the plants are dry.

The most common method of drying is without applying heat. Plants are placed in pressing papers between the blotters of the plant press. No corrugates are used. The press is locked up for about 24 hours, this is known as the sweating period. It is then opened, and as blotters are removed each pressing sheet is turned back, the specimens are examined, and parts rearranged as the situation demands.

The difference between a poorly and a well-arranged specimen usually results from the attention given at this stage of the process. After rearrangement the folder sheet is lifted on to a fresh dry blotter and covered by another dry blotter. The new pile of blotters and specimens is then locked up in the press and allowed to stand for another 24 to 36 hours, when the process of replacing wet blotters with dry one is repeated. A third change of blotters follows usually after 2 to 3 days. Blotters must be change 3-4 times; every wet blotter removed must be dried, usually by placing in the sun and reused. About a week is required for completion of drying. Dried specimens are packed with much care. Fungi as well as insects damage if proper care is not given till the permanent storage.

Mounting herbarium specimens

Mounting is the process by which a specimen is attached to a herbarium sheet and a label affixed at the lower right corner. Specimens are mounted on sheets of standard size herbarium paper (29 X 43 cm). North American standard size sheets are 29 x 41.5 cm or 11.5 x 16.5 in. (Woodland 1997). Most herbaria use a glue or paste to fasten specimens to the sheets. The specimen may be attached by various methods. A common method involves smearing a glass plate with a water-soluble paste, placing the specimen on the paste, and then transferring the glued plant to the mounting sheet. Small paper envelopes called fragment packets are attached to the sheet to hold seeds, extra flowers, or any part of the specimen.

Poisoning

Precaution should be taken to protect herbarium specimens from damage by insect

pests. The most destructive insects are herbarium beetle, cigarette beetle, booklice, and silverfish. Insect repellants such as naphthalene ball or Para dichlorobenzene are sometimes placed in small quantities in herbarium cabinet. Although dangerous and hazardous to health, mercuric chloride is believed to be valuable because it provides long-term protection against insect attack. Besides the insect pest, the moulds and mildew are constant threat to material stored in damp condition or in areas of high humidity. Naphthalene and LPCP are believed to have fungicidal properties, however, Thymol is quite effective as a fungicide.

Label

Herbarium label is an important and essential part of permanent plant specimens. The size and shape of label may vary slightly but will usually be a rectangular and range between 10 x 15 cm (4 x 6 in.). The best position for the main label is generally thought to be the bottom right; this makes the label easier to read when kept in genus covers which open on the right hand side. Ideally a space should be left above the label to allow for the future attachment of determination slips. Generally herbarium label should contain the following information-

- 1.Heading- name of the institution in which the specimens originated /deposited.
- 2.Scientific name- Genus, specific epithet, author, or authors
- 3.Family-
- 4.Localilty-
- 5.Range, latitude and longitude-
- 6.Habitat-
- 7.Date of collection-
- 8.Name of collector(s)-
- 9.Determined by-

10. Remarks-

Acknowledgements

The author is thankful to Royal Botanic Garden Edinburgh and Royal Nepal Academy of Science and Technology for the opportunity to be involved in 20 days joint venture field trip (May 8-28,2004) as a Darwin Scholar in Sagarmatha National Park, Nepal.

References

Bridson, D. and L. Forman 1999. *The Herbarium*

Handbook. Royal Botanic Gardens, Kew. 3rd Edⁿ (Edi.), pp: 4.

Jones, S. B. and A.E. Luchsinger 1986. *Plant Systematics*. McGraw-Hill, Inc., New York. p:193.

Lawrence, G. H. M. 1951. *Taxonomy of Vascular Plants*. The Macmillan Company, New York, U.S.A. pp: 234-262.

Woodland, D. W. 1997. *Contemporary Plant Systematics*. Berrien Spring, Michigan, United States of America; 2nd Edⁿ, pp: 37-53.