

**GUIDE  
TO PLANT COLLECTION  
AND  
IDENTIFICATION**

by

**Jane M. Bowles PhD**

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## CHAPTER 1

### THE NAMES OF PLANTS

#### **The history of plant nomenclature:**

Humans have always had a need to classify objects in the world about them. It is the only means they have of acquiring and passing on knowledge. The need to recognize and describe plants has always been especially important because of their use for food and medicinal purposes. The commonest, showiest or most useful plants were given common names, but usually these names varied from country to country and often from district to district. Scholars and herbalists knew the plants by a long, descriptive, Latin sentence. For example *Cladonia rangiferina*, the common "Reindeer Moss", was described as *Muscus coralloides perforatum* (The perforated, coral-like moss). Not only was this system unwieldy, but it too varied from user to user and with the use of the plant.

In the late 16th century, Casper Bauhin devised a system of using just two names for each plant, but it was not universally adopted until the Swedish naturalist, Carl Linnaeus (1707-1778) set about methodically classifying and naming the whole of the natural world.

#### **The names of plants:**

In 1753, Linnaeus published his "*Species Plantarum*". The modern names of nearly all plants date from this work or obey the conventions laid down in it.

The scientific name for an organism consists of two words:

- i) the genus or generic name,
- ii) the specific epithet.

The generic name and specific epithet may be from any source, but they are always treated as Latin. The generic name is usually a noun. For example, the name *Quercus* is simply Latin for oak. The specific epithet is usually an adjective, but can be another noun or the name of a person. Thus in *Quercus rubra*, "rubra" means red; in *Quercus prinus*, "pinus" is another noun for another sort of oak, and *Quercus muehlenbergii* is named after the eighteenth century minister and botanist G.H.E. Muhlenberg.

#### **The correct form of plant names:**

The scientific names of plants should always be underlined or written in *italics*. The generic name is always written with a capital initial letter, and the specific epithet should always have a lower case initial letter. (Sometimes specific epithets honoring people are given a capital letter, but a small letter is always correct and therefore safer). The name is only correct and complete if it is followed by the name of the person or people who first described it or assigned the name to it. Often, for convenience, these names are abbreviated. For example, "L." always stands for Linnaeus. The correct names of the Red Oak, Chestnut Oak and Chinquapin Oak are:

*Quercus rubra* L.  
*Quercus prinus* L. and  
*Quercus muehlenbergii* Engelm.

The first two species were described by Linnaeus, but the third was named by George Engelman

(1809-1884), the German-American botanist whose collections are in the Missouri Botanical Gardens, St. Louis.

Once a plant has been given its full, correct name in a text, further references to it (provided they are unambiguous) may be shortened to the initial letter of the generic name followed by the specific epithet. The authority may be dropped. Thus the three oak species may now be referred to as *Q. rubra*, *Q. prinus* and *Q. muehlenbergii*.

### **Plant classification:**

Plants are classified according to their assumed relatedness. A unit of classification, at whatever level, is called a taxon (plural taxa). There is a strict hierarchy of taxa of which the species is the lowest natural unit. The hierarchy is: species, genus, family, order, class and division. There are, however, several possible subgroups at each level. An example from Radford *et al.* (1974) illustrates ascending ranking:

*"Quercus alba* L., *Quercus laevis* Waite, *Quercus falcata* Michaux and *Q. bicolor* Willdenow are four species in the genus *Quercus*. *Quercus* L., *Fagus* L. and *Castanea* Miller are three genera in the family **Fagaceae**; **Fagaceae** and **Betulaceae** are two families in the order **Fagales**. **Fagales**, **Urticales** and **Piperales** are three of the many orders in the sub-class **Dicotyledonidae** in the class **Angiospermopsida**, which is in the sub-division **Spermatophytina** in the division **Tracheophyta**."

Field botanists are mostly concerned with the sub-class and at the family level and below.

### **The use of common names:**

Latin names often seem long and unpronounceable, and the system of naming (nomenclature) is complicated and involved. So why use them? Why not use common or vernacular names that are easy to remember and usually have a meaning in everyday language? Some of the reasons are listed below.

1. Common names are not universal. They are usually only applicable to a single language. Thus the same plant may have numerous common names. Canadian government employees should be aware that the Chinquapin Oak is also known as Chene a Chinquapin and Chene Jaune.
2. In most parts of the world only a very small proportion of the species have any common names. Insistence on calling plants by common names usually means that the scientific name is translated or species are lumped under a generic name. The resulting names are often as cumbersome as the Latin descriptions used until Linnaeus' time. *Carex aenea* Fernald (or simply *Carex aenea*) is certainly no harder to remember than "Fernald's Hay Sedge" which is one of its common names.
3. The convention of a generic name and a specific epithet is not used for common names. Sometimes closely related plants have completely different names. For example, in the genus *Eupatorium*, *E. maculatum* L. and *E. purpureum* L. are known respectively as Spotted Joe-Pye Weed, and Sweet Scented Joe-Pye Weed, but *E. fistulosum* Barrat goes under the name of Trumpetweed, *E. rugosum* Houtt. is known as White Snakeroot and *E. perfoliatum* L. is also called Boneset. There is no indication from the name that they are all in the same genus.

4. It is quite common that two unrelated species have the same common name. For example, two common woodland plants are Snowberry and Creeping Snowberry. The first, *Symphoricarpos albus* (L.) Blake is a relative of the honeysuckles, whereas Creeping Snowberry (*Gaultheria hispidula* (L.) Muhl.) is in the Ericaceae or Heath Family.

The case against common names is exemplified by the genus *Pyrola*, common plants of the northern woodland. The common names for *Pyrola* are Shinleaf or Pyrola. The name Shinleaf on its own implies one particular species, *Pyrola elliptica* Nuttall, but may also refer to the genus. *Pyrola asarifolia* Michaux is known not only as Pink Pyrola or Pink Shinleaf, but also as Bog Wintergreen. The name Wintergreen also applies to at least five other genera. Wintergreen (*Gaultheria procumbens* L.) is also known as Checkerberry. *Chimaphila maculata* (L.) Pursh has the common names Spotted Wintergreen or Striped Wintergreen, and *Monesis uniflora* (L.) Gray is called One-flowered Wintergreen or One-flowered Pyrola. These three, at least, are in the same family. Less closely related are *Trientalis borealis* Rafinesque, which is known both as Chickweed Wintergreen and Starflower, and *Polygala paucifolia* Willdenow, which is called Fringed Polygala and Gaywings as well as Flowering Wintergreen.

#### **The meaning and origin of plant names:**

One of the reasons why people shy at scientific names is that they are unfamiliar, and sometimes rather long and they may seem difficult to pronounce. Understanding and therefore remembering names of plants becomes much easier, simpler, and more interesting, if the meaning or the origin the name is known. Many of the specific epithets are very common. They describe color, shape of leaves, habit, number of parts, size, habitat, place of origin and so on. Most of these are Latin, but unfortunately, to confuse the issue, some are Greek. For example, epithets describing four leaves could be either *quadrifolius* (Latin) or *tetraphyllus* (Greek), they both mean "four-leaves". Nevertheless, many of the Greek and Latin words which go to make up species epithets are the origins of many English words, and the meaning of names can often be interpreted by someone with no Classical background. A list of words common in species epithets is given in Appendix I.

Specific epithets which honour people may be recognized because they end in 'ii' if the name ends with a consonant, 'i' if the name ends with a vowel except a, and 'e' if the name ends with an a. Naming a plant after a colleague was (and is) a good way of complimenting him or her, especially as, if he or she was a botanist, the favour might be returned. The names of some North American species of the genus *Sphagnum* conjure up a wonderful image of a mid-nineteenth century bryological ring:

*Sphagnum girgensohnii* Russow;  
*Sphagnum russowii* Warnstorf;  
*Sphagnum warnstorfii* Russow; and  
*Sphagnum wulfianum* Girgensohn.

Generic names are not always so easy to interpret, but there is no reason why *Carex* should be more difficult to learn than Sedge, or *Prunus* than Cherry or *Pinus* than Pine. Linnaeus showed unlimited imagination in inventing names for the plants he was cataloguing. Many, such as *Quercus*, retained their ancient Latin names, others merely described some aspect of the plant. *Aster*, for example, means "star" and clearly describes the flowers. Sometimes Linnaeus was much more fanciful. Bog Rosemary, known at that time as *Erica palustris pendula*....., caught his attention. He imagined that



the beautiful flesh-pink flowers imitated the "beauty of a fine female complexion". The plant, growing on hummocks in the middle of bogs, reminded him of Andromeda, legendary princess of Ethiopia, whose beauty lasted only as long as she was a virgin. In order to save her country from a terrible flood she was chained to a rock and left to be ravaged by a dreadful sea monster. Linnaeus saw the sea monster in the toads that inhabited the bogs in which he found the plant. He named the genus *Andromeda* after the distressed virgin (Black, 1979).

Often Linnaeus named new genera after friends and colleagues. In 1748, on Linnaeus' recommendation, the Swedish Royal Academy sent Peter Kalm, a former student, on a collecting trip to North America. When he returned in 1751 Linnaeus honoured him by naming the Laurels '*Kalmia*' after him. One of his favourite plants, the beautiful and delicate Twinflower, Linnaeus kept for himself and named *Linnaea borealis* L.

**Word endings:**

Because plant names are Latin or Latinized, unlike English words, they have a gender. In most cases the ending of the generic noun indicates its gender. For example, nouns ending in -a are always feminine, those ending in -us are often masculine, and -um indicates neuter. In Latin, an adjective, or other modifier, has to have the same gender as the noun it modifies, so that the ending of the specific epithet usually agrees with ending of the generic noun, for example, *Kalmia ployfolia*, *Lathyrus latifolius* and *Vaccinium angustifolium*. Most plant names, however, are feminine, including many whose generic name ends in -us. The commonest endings are listed below:

<b>Noun:</b>	<i>masculine</i>	<i>feminine</i>	<i>neuter</i>
<b>Endings:</b>	-us	-a	-um
	-er	-ra	-rum
	-is	-is	-is
	-r	-ris	-re

Some endings remain the same for all three genders, so that the specific name is the same regardless of the gender of the noun. Some examples are -ans, -ens, -x, and -or (Radford et al. 1974). Not all plant names obey these rules, however, and exceptions can always be found.

## CHAPTER 2

# PLANT COLLECTING

### **The purposes of collecting:**

Today there are two main reasons for collecting plants. The first is to obtain records and specimens of plants, either for a personal collection or to be stored in an herbarium. Properly run herbaria where specimens are suitably stored and catalogued have great scientific value. They are almost always pleased to accept good, correctly labeled specimens and are generally willing to allow serious workers access to their collections. The merits of personal collections are less obvious. Small collections of common plants can have great value as reference for identification. Wide scale gathering of rare or endangered plants for personal collections should be discouraged however. In England, over-enthusiastic collection by amateurs, together with loss of habitat has caused the extinction or near-extinction of a number of plants, especially orchids. It is now illegal to pick or collect any plant in many jurisdictions without the consent of the landowner. Increasingly many areas in the world require a permit for plant collecting. You should always check with the landowner and the law before collecting plants.

The second major reason for plant collecting is in order to later identify an unknown specimen encountered during fieldwork. Often these specimens consist of small, atypical plants with no flowering or fruiting parts. As herbarium specimens they are often next to useless. Nevertheless, any vegetation survey should include, where possible, collection of at least one specimen of each species encountered. This is known as the voucher collection and should either be kept by the worker for future reference if needed, or stored in a local herbarium.

### **What to look for in a specimen:**

Specimens for collection should be as complete as possible. Ideally flowers and fruit should be included, as well as vegetative parts. Clearly, in most cases, this is impossible since ripe fruit and flowers do not usually occur at the same time. Often, however, remains of growth from the previous year can be found at the base of the plant or on another specimen nearby. Only collect fruits or seeds if you are certain that they belong to the same plant or the same species.

Specimens should be typical and healthy, with at least some fully expanded leaves where possible. Avoid taking diminutive individuals because they fit into a press more easily or are easier to reach. Take the plant from its typical habitat. If a species normally grows in woodland, do not collect specimens growing by the roadside or in a clearing. Sometimes leaf shape, flower colour and other characters are completely altered on plants growing in full sunlight.

### **What to collect:**

The whole of small vascular plants should be collected including the underground portion. Roots, trailing or underground stems and storage organs are often helpful (and sometimes essential) in identifying specimens. A strong knife or small trowel is helpful for digging out a plant. Excess soil can be shaken off, or washed off carefully if water is available.

Mosses and lichens should also be taken whole. Where they grow in mats a good handful should be removed. Ideally the specimen should be pure, not mixed with other species. Sometimes it is necessary to pick out individual plants one by one. In this case at least half a dozen to a dozen

specimens should be taken. Mosses and lichens growing in cushions or clumps, or closely growing on the substrate should be cut away with some of the substrate. Thus the specimen consists of bark, rotting wood, soil, humus and so on as well as the plant. This ensures that the growth form of the plant is retained. Soil can be removed much more easily once the specimen has dried. Again "clean" specimens containing only one species should be aimed at, though this is sometimes impossible. If fruiting bodies are available, these too should be collected or identification may be impossible.

When taking the whole plant is out of the question, specimens containing all essential features (all leaf types, twigs, flowers, fruits and so on) must be cut from the plant. If the species is a large herb such as a thistle, the specimen should include basal leaves as well as enough stem to show the range of stem leaves and flowering and fruiting material. Shrubs and old and new twigs, buds where possible and fruit and/or flowers. If lower and upper leaves are different, or there is significant variation between a shaded and unshaded side of a tree, then collections should be made from both. To minimize damage to parent trees and to specimens, twigs should always be cut off cleanly with a sharp knife or pruners. Breaking the twig can strip the bark and ruin a specimen or cause unnecessary harm to the tree or shrub from which it was taken.

### **How to collect:**

Ideally, collections of vascular plants should be put immediately into a field press, because this produces the best looking specimens. A traditional field press is described by Savile (1979). Field presses are rather bulky to carry around and may prove impractical in some cases. I use a collecting scroll made of a rolled-up strip of plastic table covering. Starting at one end, the plants are rolled into the scroll one by one. The collecting scroll is described by Bowles (1986).

Collecting into plastic bags is another option. A range of bag sizes should be available. Small plants can be placed singly, or two or three together if necessary, in a suitably sized bag. Plastic bags are not recommended for serious collecting because the risk of damaging the specimen is very great. Petals are likely to be knocked off, and stems will almost certainly be bent or broken. Collecting into a field press or a traditional vasculum, a sort of metal satchel, prevents this. The bag should then be blown up by mouth and knotted to seal it, or use a zippered bag. Blowing up the bag adds a small amount of moisture and helps to cushion the contents. Full bags can be carried in a larger bag or rucksack. Care should be taken to keep collections as cool as possible and prevent them from being crushed.

With each plant, and firmly attached to it if several plants are collected together, should be a label bearing a collection number which corresponds to numbered notes in the collecting book. Jewelers' tags are an excellent means of labeling plants. The label is often left on the dried specimen, but can be used again.

Mosses and lichens should always be collected in paper bags or envelopes. These have the advantage of allowing the plant to be dried in the same bag. Notes can be written directly on the bag.

### **Notes to take:**

Every specimen should be accompanied by comprehensive notes retained in a collecting note book. These notes may not only aid in identification of the material, but will later be used to complete the information on the herbarium label. It is far better to take too many notes than too few, and is dangerous to trust information to memory, especially as there may often be several months or more

between collection and processing. The notes should contain the following information.

1. Collection number: This is a serial number specific to a collector and a specimen. The number may start at 1 and continue through the collector's life time. Other people augment the serial number with notes of name, place, date and so on. For example, JS/ONT/82/237 may be specimen #237 collected by John Smith in Ontario in 1982. This kind of number is sometimes easier to interpret, and new numbers can be started for new collections.

2. The name of the plant: This is important as it helps the collector remember the individual specimen even if the labels are accidentally lost or mixed. Even if the collector has no idea what the specimen is, it is sometimes useful to give a completely arbitrary name such as "Lacy Moss" or "Big Leaf". This has a double advantage in vegetation surveys in that this name can then be applied to other specimens of the same species if they are encountered before the material has been identified. This way there is no need to collect the plant more than once or try to remember if it is "Unknown #34" or "Unknown #35"

3. Locality: This should be as detailed as possible, including the name of towns, roads lakes and so on in the vicinity, as well as Township, County or District. The latitude and longitude or the UTM Grid Reference and Map Number are also important. Handheld GPS units make recording accurate locations much easier than it used to be.

4. Description: This should include everything about the plant that is not obvious on the herbarium specimen. Essential items are the height, type of bark, whether the stem is upright, sprawling or drooping, obvious smells, whether the plant is clumped, single or growing in patches, and the presence of creeping or underground stems. Flower and fruit colour should also be noted as these often fade on dried specimens.

5. Habitat: This should include the general habitat as well as more specific details of micro-habitat. Important points are type of soil or other substrate (sand, clay, granite, dead wood, other vegetation), associated species, moisture and aspect (fully exposed on a south facing bank; in a damp hollow under dense scrub, etc). The more careful and detailed such notes are the more useful they become.

6. Date.

7. Names of collector(s).

8. Notes: Space should be left to note the name of the person who makes the final determination (identification), the date on which it is made and the place where the specimen is sent or stored. The receiving herbarium will add their own accession number to the specimen.

Some herbaria and professional collectors have form-style collecting books with printed serial numbers. Carbon copies of field notes are made on perforated pages. These pages are torn out and placed with specimens when they are pressed. The original is retained in the notebook and kept for records. Even without a printed notebook, collecting and note taking can be done very efficiently if a constant format is used.



**Pressing and drying vascular plants:**

The most important thing to do with freshly collected material is to dry it out as fast as possible. This prevents fungal infections and preserves colour.

Vascular plants must be pressed and dried as soon as possible after they are collected. Usually this means that plants should be pressed the day they are collected. It is an important aspect of plant collecting that enough time be left at the end of the day to process the specimens. If this includes identification, this stage may be quite slow. When plants have to be left overnight they should be put in a cool place. Sometimes woody specimens can be placed in water for a day or so to force buds or restore wilting leaves.

**The plant press:**

The plant press is designed so that plants can be dried quickly while being pressed flat. It consists of two cross-slatted wooded frames about the size of a folded newspaper. Plant specimens are laid in folded newspaper between layers of blotter, foam sheets and corrugated cardboard. The newspaper provides a folder for the plant. The paper, blotter and foam draw the moisture away from the specimen. The cardboard allows air circulation within the press to speed up the drying process, and helps keep the specimens flat. Plants in their newspaper folders are piled in layers of alternating padding and cardboard on one of the wooden frames. When laying out of the specimens is complete, the second frame is laid on top of the pile which is compressed and strapped as tightly as possible with two adjustable straps. Standing on the press while you fasten the straps helps get them properly tight. You have to be a bit of an acrobat to do this by yourself, but it is quite possible. The press is then placed to dry in warm (not hot), dry, circulating air. After 24 hours the paper and blotters should be changed to enhance the drying process. The straps have to be tightened periodically as the plant material shrinks. After this, the specimens may be left undisturbed for several months or weeks until they are completely dry. Often the press will be emptied soon after the specimens are dry, so that the card, blotters and foam can be reused. Dried specimens can be stored and transported in their newspaper folders in a cardboard carton.

Herbaria have special drying cabinets in which the presses are dried. In the field drying is not so easy, but it should have priority as specimens are easily ruined if they remain damp. A press left upright on a rock, or kept on a car roof rack, where air can circulate will dry much faster than one left lying in a tent, vehicle or room. Heaters in motel rooms on low heat can also be pressed into effective service. However drying specimens too fast can result in scorching and shriveling. Portable driers that use light bulbs or candle lanterns for heat are rather bulky, but a good idea if space and weight are not a problem. For fuller information on drying and maintaining presses see Savile (1979).

**Laying out the specimens for pressing:**

Two important points should be borne in mind when plants are prepared for the press. These are i) that the dried specimen should fit neatly onto a standard herbarium sheet of 420 x 297 mm and ii) that as many features as possible should be visible on the mounted specimen.

There are a number of tips which, if followed, will help towards producing attractive and worthwhile mounted material. With experience, all collectors develop their own techniques.

If a specimen is too tall to fit in the press or on the herbarium sheet, make a zig-zag bend in the

stem. This shortens the effective length of the specimen without any of the material being lost. Plants with many long, narrow leaves such as grasses will bend and press more neatly if a piece of paper with a slit in it is placed over the elbow of the bend to hold all the leaves together.

Too many leaves on a herbarium sheet look untidy and can obscure detail. Where it can be done without destroying information, snip off some of the leaves, but ALWAYS leave part of the petiole so that it is evident that leaves have been removed.

Branches that are not naturally flat can be made easier to press if the angles or twigs are bent in the appropriate direction before the plant is laid on the newspaper. Care should be taken not actually to sever twigs or leaves.

The specimen should be laid out so that there is minimum of overlap between parts. Sometimes this involves spreading the plant unnaturally. Start near the folded edge of the newspaper and hold the parts in the desired position. Fold over enough newspaper to cover these parts and hold it down with the flat of the hand. Then move to the next portion of the plant, arrange it and fold down a few more centimeters of newspaper. Continue until all the newspaper is folded down and the flats of two hands can cover the whole sheet. You will find that you sometimes need all three hands as well as your chin for this process, but it will be worth it when you finally see the specimen mounted.

When stems are very thick they can be sliced lengthwise so that they are less bulky. Leaves of plants with thick stems do not always get sufficiently pressed and may tend to wrinkle. Using foam sheets helps prevent this because the foam molds itself around the specimen and ensures an even pressure throughout. The end of woody stems should be sliced diagonally so that the colour of the wood and pith are displayed.

Leaves or petals which have wilted, or are folded over, will not always lie flat for pressing. A piece of wet newspaper will "stick" them in place. By the time the newspaper is dry the leaf will have stabilized and cause no more trouble. On every mount, the back of at least one leaf should always be visible. Sometimes this involves twisting a petiole to obtain the desired effect.

If there are several flowers on a specimen, some should always be pressed open and flat so that the inside is displayed. This can usually be achieved by careful, deliberate pressure with the thumb before the newspaper is folded shut.

Loose seeds and fruit can be placed in a small paper packet and pressed with the specimen. Later this packet will be glued to the herbarium sheet. Some conifers lose most of their needles on dried specimens. Once the material is dried, the needles can be shaken off and placed in a packet.

Once plants are pressed, changing the paper after the first 24 hours not only enhances drying, but allows the collector to make cosmetic adjustments to the specimen while it is still supple. Folded leaves are the main problem. These can be prised open with a mounted needle and pressed flat the second time round. Sometimes petals stick to the 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.

Pressing plants can be a long and laborious process. It will take considerably less time if you avoid

reading all the advertisements and news items in the old newspapers. Sometimes, however, these can help considerably in elevating boredom!

**DON'T FORGET TO MAKE SURE THAT EACH SPECIMEN IS PROPERLY LABELED!**

A specimen without a label is worthless.

### **Mounting specimens:**

Once material is pressed and thoroughly dried, it is mounted on herbarium sheets. The standard size for these sheets is 420 x 297 mm. They should be made from stiff, acid-free, paper or cardboard of good quality so that they will not turn yellow or crack with age.

Specimens should be laid on the sheet in an attractive, space-filling way. Space should be left in the lower right hand corner for the herbarium label. The sheet should be as full as possible without being crowded. When the arrangement is satisfactory, the specimen may be stuck to the sheet. Traditional methods require pasting the plant onto the sheet and reinforcing it with strips of tape or plastic stripping. The disadvantages are that pasting does not allow easy removal of parts for examination; tape is unsightly and may obscure important details; the ingredients for plastic stripping are highly carcinogenic, and in the presence of moth balls the plastic may become tacky.

One easy, cheap, efficient and attractive method of mounting plants is to use special herbarium glue. This is a white glue contains no ingredients which are likely to harm or alter the specimen, it is strong, and dries transparent. Elmers Glue-all is not quite as good, but makes a reasonable substitute. It can be dabbed along stems, through roots, under leaves and below flowers and it dries in less than an hour. Specimens should be glued so that there are no loose parts and then dried flat with weights where necessary.

Many herbaria have their own preferred method of mounting specimens and prefer to mount material themselves. Before you donate material check with the herbarium.

### **The label:**

Most herbaria have printed labels about 8 x 10 cm which are filled in and glued to each herbarium sheet. A typical label is shown on the next page. Such a label 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. Most herbaria now keep specimen records in a database and have programs which create labels automatically. Before collecting and donating specimens to a herbarium, you should find out the field names, sizes and codes for the database they use so that you can provide information in a consistent format.

### **Mosses and Lichens:**

If mosses and lichens have been collected in paper bags or packets, they can be spread out to air dry either on or in the packets. Some of the larger species should be pressed lightly in a newspaper folder so that they are not so bulky when packaged, but mosses and lichens should never be placed in a press for vascular plants. Although mosses are not particularly susceptible to mold if they are allowed to remain damp, they may continue to grow in the package, and the new growth is often very different from normal tissue and may confuse the identification.

**SOMEWHERE HERBARIUM**  
**PLANTS OF .....**

**Name:**

**Locality:**

**Lat:**

**Long:**

**Habitat:**

**Notes:**

**Collector:**

**#:**

**Date:**

**Det. by:**

**Date:**

**Acc.#:**

Bryophytes do not need to be pressed to prevent their wilting because soaking the dried specimen in water will restore it to its original form, and may even allow growth to re-continue. Lichens are changed very little on drying.

**Herbarium packets:**

Once moss and lichen specimens are dry they may be stored permanently in specially made herbarium packets. These should be made of good quality, 100% rag, 21 x 27 cm bond paper that will not yellow or become brittle. This paper is folded as shown in Figure 3. If the packets are folded around a 10 x 15 cm index card they will be stiffer and of uniform size. They may be stored in card index boxes or shoe boxes. Information may be written directly on the front of the envelope or on an herbarium label pasted onto it. The advantages of these packets over paper bags or commercial envelopes is that they can be opened flat for examination of the specimen.

## CHAPTER 3

# PLANT IDENTIFICATION

### **The specimen:**

Before identification of a plant can begin it is necessary to have the best possible specimen. 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 (see Chapter 1). Bryophyte and lichen specimens should include capsules and fruiting bodies where possible.

It is best to use fresh material for identification. When this is out of the question and preserved specimens have to be identified, the importance of good pressing and mounting techniques will be made very clear.

### **Equipment needed:**

The most obvious need is a good reference book or books. The best books have at least elementary keys. Line drawings or detailed paintings are more useful than most professional taxonomists would care to admit. Colour photographs, although attractive, and showing the plant in its natural habitat, are often next to useless because they cannot show the range of detail which can be incorporated into a drawing.

Another essential piece of equipment is a hand lens, dissecting microscope, or some kind of magnifier. Even on large plants with big flowers, some of the features are very small and positive decisions can only be made if all the features are clearly visible.

Other equipment, although not vital, will make life easier. Included in this category are very fine forceps, two mounted needles and a sharp scalpel or razor blade. In addition, lichens may be impossible to identify without three chemicals and droppers for spot testing. These chemicals are concentrated potassium hydroxide, calcium hyperchlorite (bleach) and phenylenediamine. Clear instructions for making up these chemicals are given in Hale (1980). As most bryological keys are based on cell characteristics, determinations are limited unless a compound microscope, glass slides, cover slips and a stain such as methylene blue are available. Obviously this equipment cannot be carried in the field, and many bryophytes, once they are known, can be recognized under a hand lens.

One very useful piece of equipment which is, unfortunately, not always available, is an experienced botanist who knows the flora and can confirm identifications. Botanists usually have a stock of salient features by which they can recognize plants even without flowers or fruit. These characters are not always clearly stated in reference books. It follows that a note book and pencil will always prove useful.

### **Keys:**

Apart from flipping through a picture book or asking an expert, keys are the most direct way of identifying plants. A botanical key is a series of specially arranged statements. Working through

a key separates plants with and without key characters and gradually narrows down the number of possibilities. Eventually, if all goes well, the number of possibilities is reduced to one and the specimen is identified. A very simple example, based on Gleason (1978) illustrates the principle of a key. It relies on the fact that Indian pipe (*Monotropa uniflora* L.) is the only North American species without chlorophyll and with a singular, regular flower:

```

Plant without green colour
  Flowers regular, radially symmetric
    Flowers solitary, one to a stem ..... Indian pipe
    Flowers several on each stem ..... Some other species
  Flowers irregular ..... Some other species
Plant with green colour ..... All other species
  
```

This is an indented key and probably the most common type used in floras. Each pair of mutually exclusive sentences is printed in the same column, beginning with the same word. When the pair is far apart on the same page or on different pages a letter is used in front of each statement so that both members of a pair are easily recognized. Indentation continues with each successive sentence until the end point is reached.

Another type of key uses the same principle, of pairs of statements, but they are arranged differently. Statements are numbered and lettered (83a, 83b), and are printed together. At the end of each statement is another number which indicates the next pair of statements to be considered. This type of key is used particularly when long descriptions or pictures are included in the key. Sometimes both sorts of keys are combined.

Keys in which only one character at a time is considered are called monothetic. They are of limited use because sometimes the character in question is not visible. Most keys are polythetic where possible and contain statements which consider a number of characters.

Keys can be extremely frustrating to use at first. They may call for features which your specimen does not have, or demand a decision on pairs of statements like:

```

Stem more or less hairy, sometimes not.
Stem hairless or nearly so.
  
```

Sometimes an educated guess has to be made and steps retraced if the first choice leads nowhere. To find that a species description bears no resemblance to a carefully keyed out specimen can be very discouraging. Nevertheless, keys are the quickest and most accurate means of identifying unknown plants. Use of keys becomes easier with practice and familiarity. Careful examination of the specimen and full consideration of both statements always makes key use easier. Finding that a particularly difficult specimen actually matches its description is a reward in itself.

**Technical terms:**

One of the main reasons why keys and plant identification guides appear so difficult to use is because of the large number of technical terms involved. This is unavoidable. Any subject in any field is filled with technical terms, and in order to master the subject, the terms must be understood. The purpose of using such terms is not, as you might suppose, to confuse the masses, but to be very precise about descriptions. The following passage from Mark Twain "A Tramp Abroad" , taken

from Crum (1976) superbly illustrates the need for special terms in order to precisely describe harnessing a horse:

"The man stands up the horses on each side of the thing that projects from the front end of the wagon, throws the gear on top of the horses, and passes the thing that goes forward through a ring, and hauls it aft, and passes the other thing through the other ring and hauls it aft on the other side of the horse, opposite to the first one, after crossing them and bringing the loose end back and then buckles the other thing underneath the horse, and takes another thing and wraps it around the thing I spoke of before, and puts the other thing over each horse's head, and puts the iron thing in its mouth, and brings the ends of these things aft over his back, after buckling another one round under his neck, and hitching another thing on the thing that goes over his shoulders, and then takes the slack out of the thing I mentioned a while ago and fetches it aft and makes it fast to the thing that pulls the wagon, and hands the other thing up to the driver."

The great thing is not to be afraid of new terms, and to learn to feel comfortable using them. All floras have their own glossaries. Although it may be slow work to start with, you will soon become familiar with the more common terms. Appendix II defines and illustrates some of the more common descriptive terms used in keys and floras. The structure of plants and names of parts is also given.

**Unidentifiable plants:**

Some plants do not seem to be identifiable even if they are carefully keyed out and all the essential parts are present. These plants should be sent to an expert for determination. If a likely candidate is not known locally, the specimen will have to be sent away. It may be sent directly to a local herbarium, but usually it pays to find out who is the best person to identify the particular plant or plants you have, and whether they would be willing to do your determinations. Sometimes this service has to be paid for, but usually it is done free if the specimen is donated to the person or establishment.

Other specimens are unidentifiable because they are incomplete. Usually the best method is to compare the unknown with all the known plants of the same survey and see if the characters match. A local expert may recognize the specimen, but usually botanists and herbarium staff are unwilling to tackle incomplete specimens. In the last resort the species may have to remain unknown and appear as "*Carex* sp." or "Moss 83" in reports.

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## APPENDIX I

### THE MEANING OF SPECIFIC EPITHETS

The majority of specific epithets are a description of some aspect of the plant. Often the epithet is a composite of two words: a descriptive prefix pertaining to colour, number, shape and so on, and a suffix, usually the name of the part referred to. Other epithets consist of a single word relating to habitat, size, locality, season and so on. Below are some of the more common words found in species names. The letters G. or L. refer to the Greek or Latin origin of the word. For more comprehensive lists see Radford et al. (1979) or Borror (1960).

#### Words pertaining to number

uni-	one L.	octo-	eight G., L.
mono-	one G.	novem-	nine L.
bi-	two L.	ennea-	nine G., L.
di-	two G.	decem-	ten L.
tri-	three G.	deca-	ten G.
quadri-	four L.	haplo-	single G.
tetra-	four G.	diplo-	double G.
quinque-	five L.	pauci-	few L.
penta-	five G.	oligo-	few G.
sex-	six L.	multi-	many L.
hexa-	six G.	poly-	many G.
septem-	seven L.		
hepta-	seven G.		

#### Words pertaining to shape and size

angusti-	narrow L.	lanci-	lance-shaped L.
brachy-	short G.	lati-	wide, broad L.
brevi-	short L.	macro-	big, giant G.
fill-	thread-like L.	mega-	very big G.
fimbri-	thread-like G.	micro-	small G.
glosso-	tongue-like G.	ovi-	egg-shaped L.
grandi-	big L.	pachy-	thick G.
hetero-	different G.	parvi-	small L.
lepto-	slender G.	platy-	wide, broad L.
longi-	long G.	tenui-	slender, thin L.

## Colours

aeneus	brassy, bronze	luteus	deep yellow
albus	white	niger	black
aureus	golden yellow	purpureus	purple
brunnescens	becoming brown	roseus	pink, rosy
candidus	shining white	rubus	red
flavus	yellow	rufus	reddish
glaucus	bluish grey	violaceus	violet
lividus	lead coloured	virens	green

## Habitats

agrestis	of cultivation	montanus	of mountains
alpinus	of the Alps	nemorosus	of woodlands
aquaticus	of water	palustris	of marshes
campestris	of fields	pratensis	of meadows
fluviatilis	of rivers	riparius	of river banks
fontinalis	of springs	saltuensis	of forests
lacustris	of lakes	sativis	of cultivation
littoralis	of shores	sylvaticus	of woods
maritimus	of the sea	terrestris	of dry ground

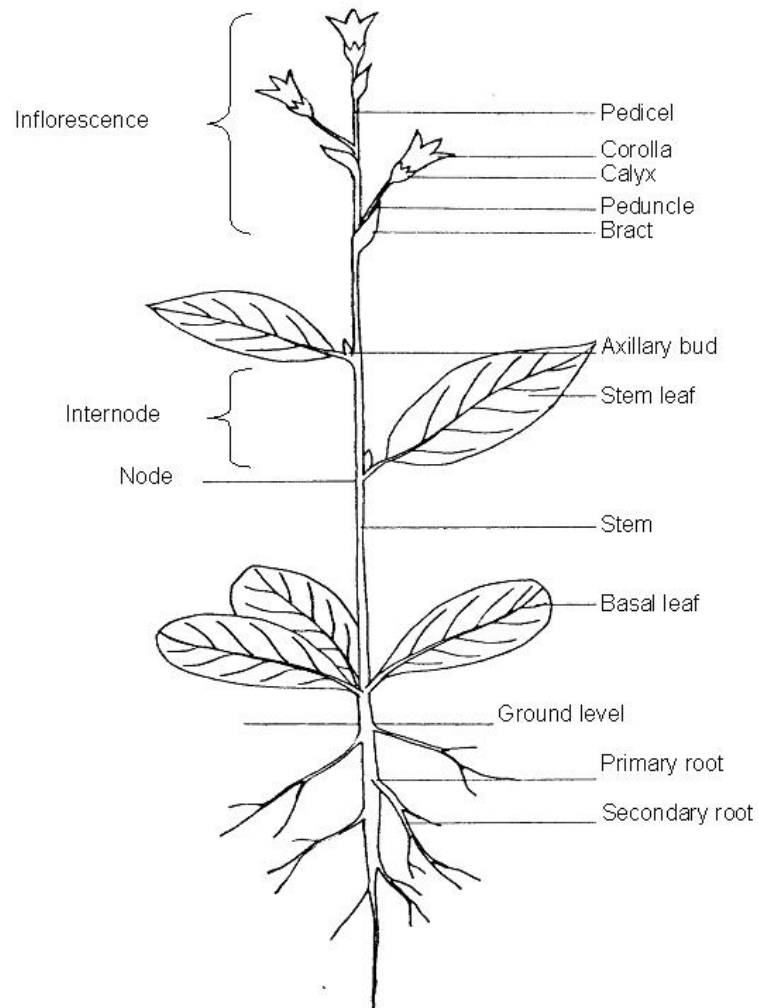
## Habits

aborescens	tree like	procumbens	flat, sprawling
erectus	erect	repens	creeping
fruticosus	shrubby	reptans	creeping
patens	spreading	stoloniferus	with stolons

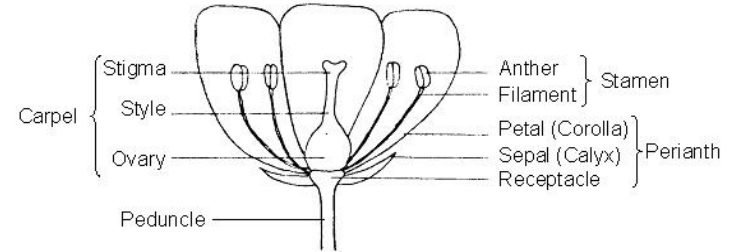
APPENDIX II

ILLUSTRATED GLOSSARY

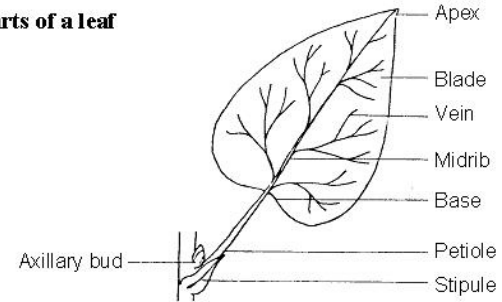
Structure of a flowering plant



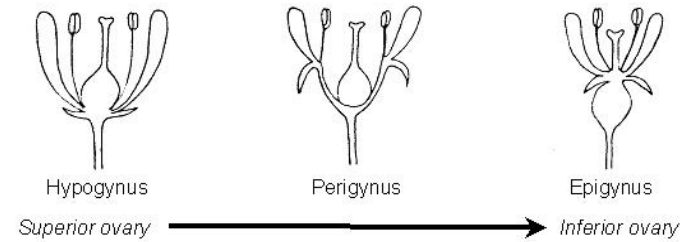
Parts of a flower



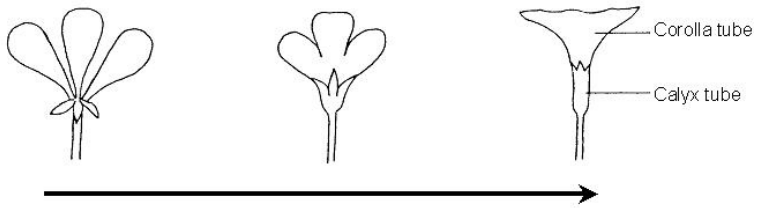
Parts of a leaf



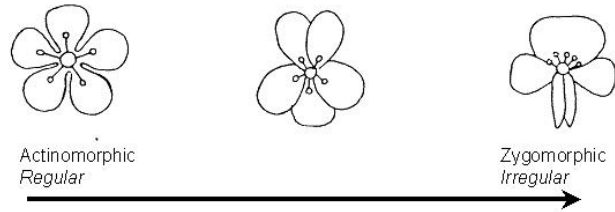
Types of receptacle / position of ovary



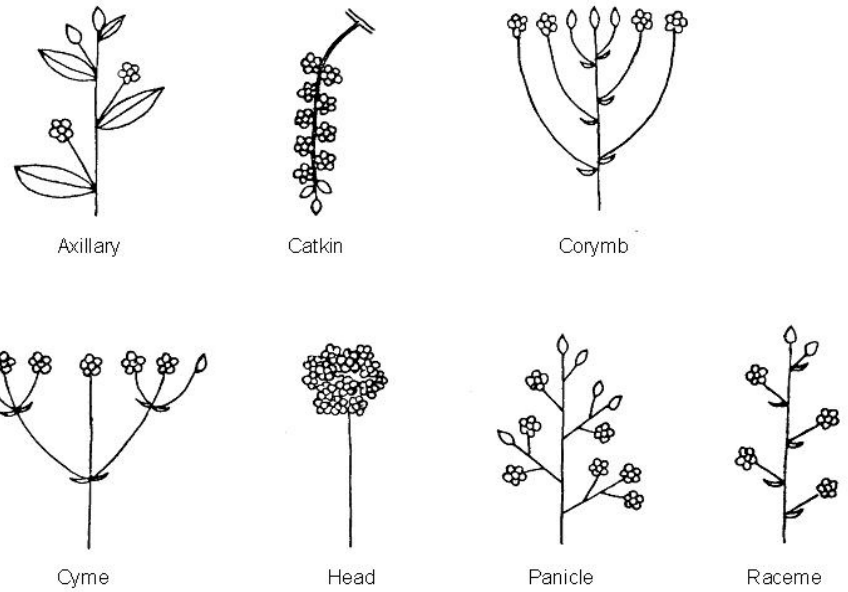
**Fusion of sepals and petals**



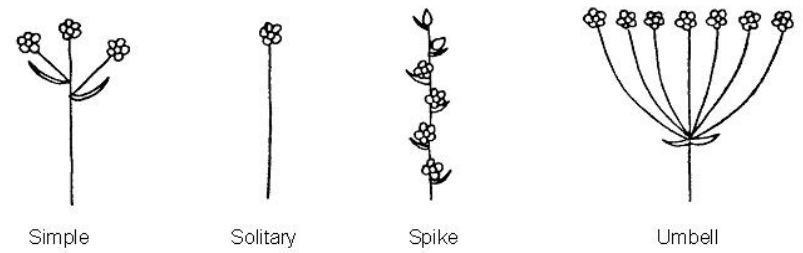
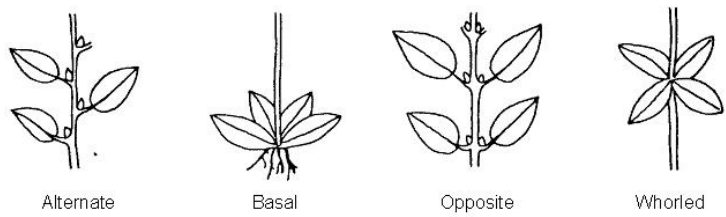
**Symmetry of flowers**



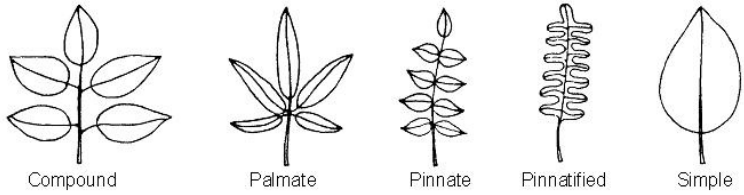
**Arrangement of flowers**



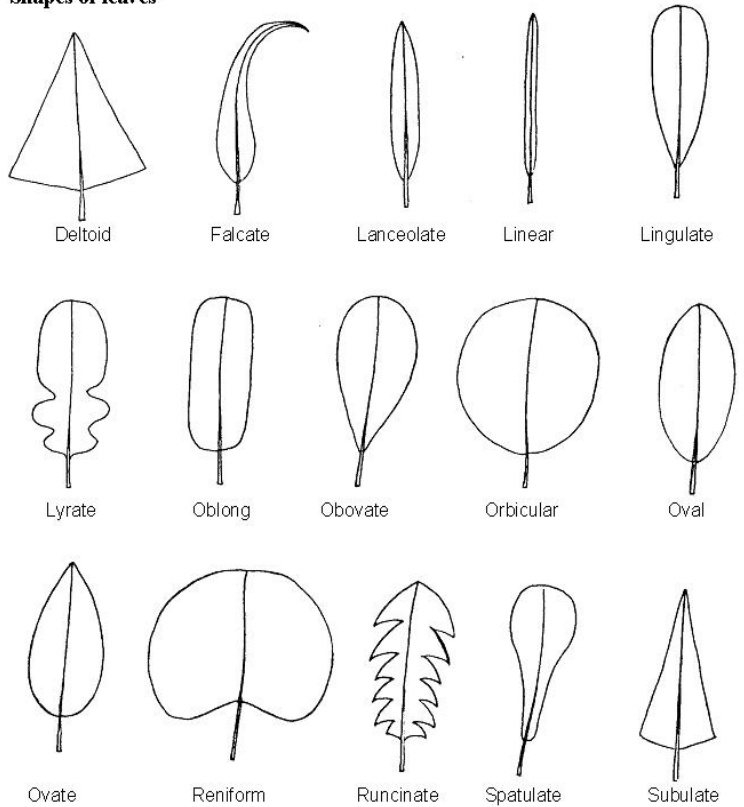
**Leaf arrangements**



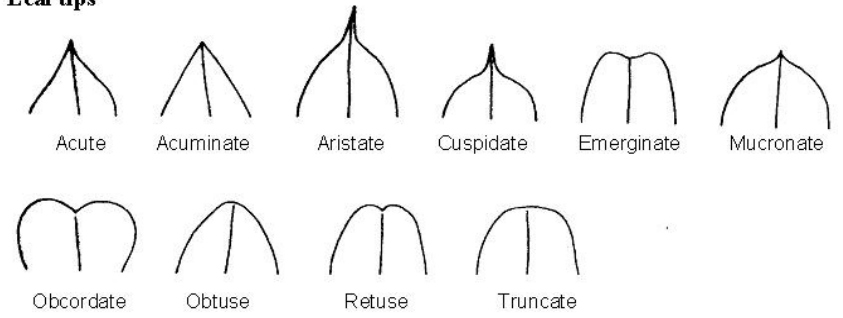
**Types of leaf**



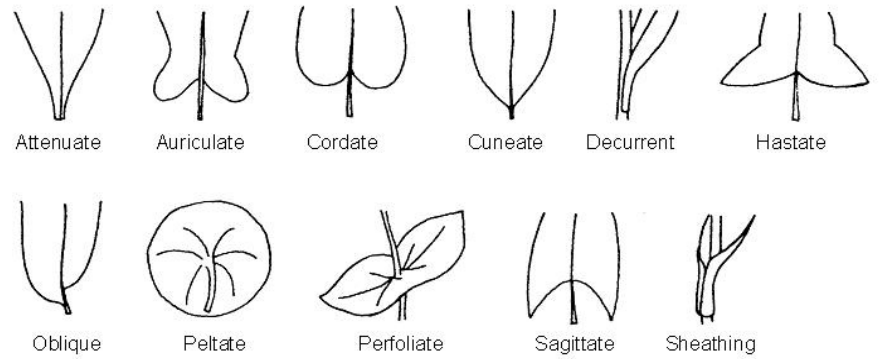
**Shapes of leaves**



**Leaf tips**



**Leaf bases**



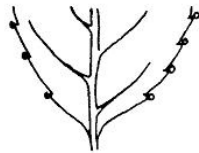
**Leaf shapes in cross-section**



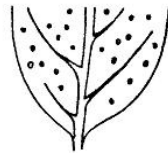
**Surface and texture**



Ciliate



Glandular



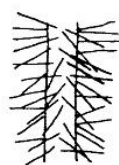
Resinous



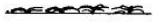
Barbed



Bristly



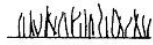
Hirsute



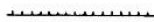
Floccose



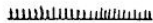
Papilose



Pilous



Puberulent



Pubescent



Sericeous



Strigose



Tomentose



Velutinous



Villosus

**Leaf margins**



Crenate



Crenulate



Dentate



Denticulate



Double serrate



Entire



Lobed



Recurved



Serrate



Serrulate



Sinuate



Undulate

**Types of underground organs**



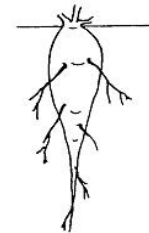
Bulb



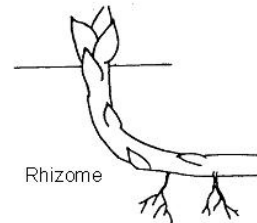
Corm



Fibrous roots



Taproot

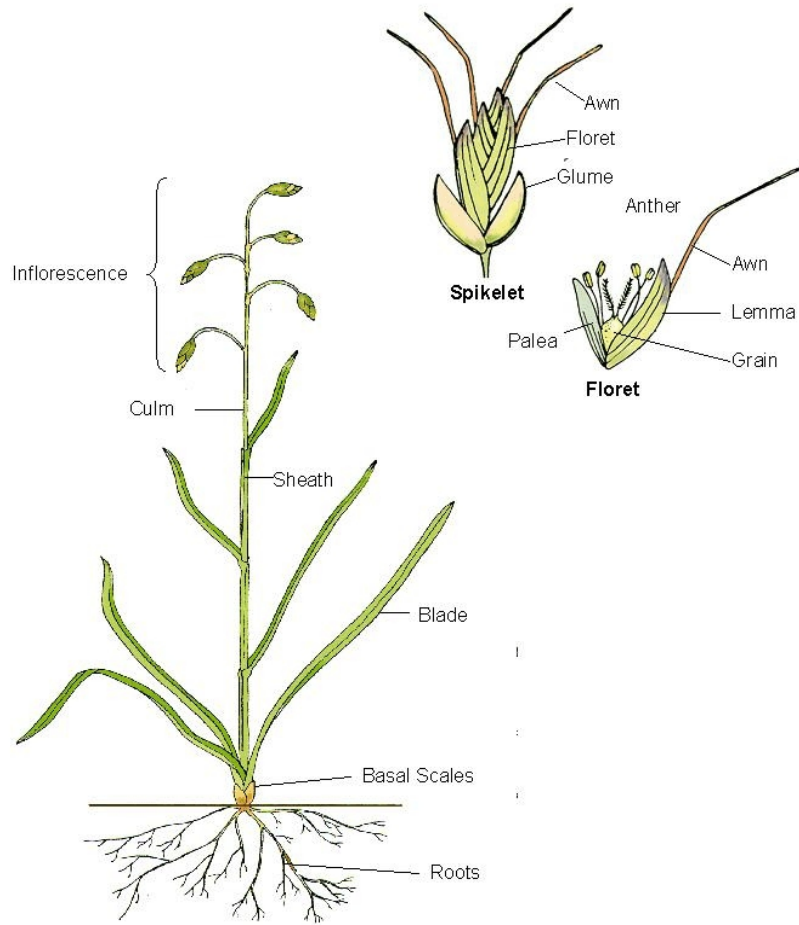


Rhizome



Stolon

**Structure of grasses**



**THE STRUCTURE OF BRYOPHYTES**

Mosses

Liverworts

