

Topic 10: **The Market Place & Plant Modifications:**
An application of your botanical knowledge.

A. Introduction to Plant Modifications & the Market Place

You have fastidiously examined the structure and growth of the organs of angiosperms in the previous labs. With this background, we ask you to first examine and interpret selected examples of modifications of these organs and then, in part D, to interpret structures taken from the supermarket. This should provide lots of fodder for dinnertime or grocery store conversations. All can be interpreted using the terms you have been learning regardless of how bizarre they may look to you.

Use your own powers of deduction, your textbook and any available supplemental sources to answer the questions that accompany each exhibit.

An outline for today's lab is below. The meat and, today, the POTATOES of the lab start on page 2.

B. Modified Leaves

C. Modified Stems

D. Modified Shoots

E. Interesting Roots

F. Succulence

G. Armed Plants

H. Market Place



Opuntia weintiana
(Venezuela).
Copyright © 2005
by Fabian A.
Michelangeli

B. Modified Leaves

Leaves are commonly “modified” from their usual function in capturing light rays for photosynthesis. There are many possibilities, some of which you may see today. Some common modified leaf homologs include:

SUCCULENT LEAF = Where the leaf is fatter than normal, possessing extensive water-storage parenchyma internally.

Various **FLORA ORGANS** such as **SEPALS**, **PETALS**, **STAMENS**, and **CARPELS**, are all **HOMOLOGS** of leaves.

BRACT = a leaf, reduced in size and typically not as green or photosynthetic as its full-on vegetative counterpart. Often subtending flowers and inflorescences, sometimes on horizontal stems.

SHEATHING LEAF = leaves sometimes sheathe the stem at their base for some length before ending at the node. These sheaths are sometimes tubular.

SHEATH LEAF = a leaf that does not have a petiole or blade, and simply ensheathes the stem (e.g., those on a young bamboo shoot).

SCALE = very small, thin, and non-photosynthetic; often on subterranean stems such as rhizomes, or the “bud scales” of winter buds on trees and shrubs.

SPINE = a sharp, pointy leaf homolog.

SPINY margins = when the margins are leaves have small spines.

VARIEGATION = leaves are typically all green, although the presence of yellow or white streaks means that the leaves are variegated.

NEEDLES = many conifers have leaves that are needle-like in shape.

TENDRILS = these are thin, coiling structures that aid vines in their climbing. Often, tendrils are modified leaves or parts of leaves.

PITCHER LEAF = Part or all of a leaf that is shaped and functions like a pitcher, holding water and trapping insects for later digestion. Plants that have such leaves are often called “pitcher plants.”

FLY TRAP LEAF = Where the blade acts to trap unsuspecting insects for later digestion by plant-produced enzymes (e.g., Venus fly trap).

TANK EPIPHYTES = the overlapping leaves of some rosette-habit epiphytic species form tanks that collect water and leaf or animal matter.

YOUR TASK: Record the plants listed at this station, and describe which of the above modifications of leaves are present. Make drawings for your own study.

Start with *Agave* (century plant) and describe all of the modifications present. *Agave* also has something else peculiar about its leaves, what are the whitish impressions in the undersurfaces of the leaves from?

C. Modified Stems

Stems are, in certain species, modified during development and evolution for functions other than support (of the leaves) and conduction of water and sugars between leaf and root.

TUBER = A swollen, typically underground stem modified for carbohydrate (starch) storage.

THORN = a pointy whole lateral stem branch that does not form leaves.

RHIZOME = an underground, horizontal stem; often a means of vegetative (asexual) reproduction.

STOLON or RUNNER = an above ground, horizontal stem; often a means of vegetative (asexual) reproduction.

CLADOPHYLL = a stem that is flatted to look like and/or function like a leaf.

Go through the plants set up and apply terms as appropriate. Record answers below.

D. Modified Shoots

Examples of whole shoots that are modified include FLOWERS, BULBS, and CORMS.

FLOWER = a determinate shoot with modified leaves, some of which bear sporangia.

BULB = usually a subterranean shoot with a very short stem and tightly packed succulent leaves.

CORM = a subterranean shoot consisting of a short, but swollen stem and dry and papery or membranous leaves.

SHORT SHOOTS = short, usually lateral or axillary side-shoots, that are much-shortened relative normal shoot, yet are not quite BULBS or CORMS. Many conifers have them, and some angiosperms.

Go through the plants set up and apply terms as appropriate. Record answers below.

E. Interesting Roots

Roots may be variously modified for storage, solely anchorage, and even photosynthesis!

STORAGE ROOT = swollen roots or parts of roots specialized for storage (e.g., starch).

PROP ROOT = some plants such as corn, some palms, and mangrove trees have roots which serve to prop and support the stem like flying buttresses do on some buildings.

ADVENTITIOUS ROOT = a root borne lateral from stem tissue! Roots are usually borne as branches from the original primary root. These allow stem cuttings to root, thereby allowing vegetative propagation.

AERIAL ROOT = adventitious roots that borne from aerial parts of the stem (i.e., those parts not in contact with the soil. Many vines including the woody vine poison-ivy produce aerial roots for anchorage to some substrate such as a tree. The aerial roots of many **EPIPHYTIC** or vining orchids may also be photosynthetic.

TAP ROOT = the tap root is not necessarily unusual (most dicot plants have one), but sometimes, particularly in certain edible agricultural species, the tap root can be very large and conspicuous.

PNEUMATOPHORE = these enable plants to breathe air in habitats that have waterlogged soil. The roots may grown down from the stem, or up from typical roots. The surface of these roots are covered with lenticels which take up air into spongy tissue which in turn uses osmotic pathways to spread the needed oxygen throughout the plant as needed.

Go through the plants set up and apply terms as appropriate. Record answers below.

F. Succulence

Various organs or combinations thereof may become SUCCULENT and function (in part) in water storage. This often leads to interesting shapes and sizes of the succulent organs.

Go through the plants at this station, list them below and describe the organ(s) that are succulent.

Start with *Aloe*. Go further by taking a thin cross-section of the succulent organ, stain with toluidine blue, and make a wet-mount. View with microscope. Draw what you see. Is the organ one big bag of water or is the succulent region more of a tissue comprised of cells.

G. Armed Plants

Plants can be armed with spines, thorns, or prickles which serve any of a variety of functions.

SPINE = modified from a leaf or part of a leaf.

STIPULAR SPINE = sometimes the stipules (those usually pair appendages at the base of a leaf--sometimes appearing on the stem at the node but technically still apart of the leaf) are modified into spines. Since they are part of the leaf, they are a type of spine.

THORN = modified from a stem. Since it is stem, thorns can also branch!

PRICKLES = modified epidermal protrusions (from the epidermises of leaves, stems, or what have you).

With the armed plants on display, list them below and describe which of the above terms apply.

H. The Market Place Exercise

Exactly what part of the plant do you eat if you eat each of the vegetables and fruits on display in the laboratory? Edible parts include:

leaves
blades
petioles
axillary buds
flower buds
hairs
stems
roots
flowers plus stem

usually called vegetables, but vegetables is just a lay term

ripening from the carpels or ovary of a flower and containing seeds (although seedless forms are sometimes bred).

technically, these are “fruits”, even if they are not sweet or fun to eat.

seeds

Technically seeds, although sometimes called “nuts” by lay persons. A Nut, however, is technically a type of fruit.

For each plant on display, record on the following pages your decision as to which part(s) is (are) eaten.

Example: you may be about to eat a part that is obviously a flower bud. Your interpretation then will be recorded as **flower bud**. However, you know that a flower is partly stem and partly leaf, so **add** this explanation to your first interpretation.

For each fruit record the **type** of fruit as well. For example, a grape is a **berry**. Use the fruit classification key from your Angiosperm/Fruit Lab if needed.

One more example:

common name	lay term (e.g., “fruit”, “nut”, or “vegetable”)	general, yet botanically correct, term for the parts eaten	additional technical interpretation of the parts eaten
celery	vegetable	petioles of the leaves	Eaten are the petioles of the leaves. The “strings” of the celery are actually bundles or strands of collenchyma. Collenchyma is often found in petioles to allow the leaves to flex and bend without damage. The flexible support provided by the collenchyma strands makes them “chewy.”

H1.

common name	lay term (e.g., “fruit”, “nut”, or “vegetable”)	general, yet botanically correct, term for the parts eaten	additional technical interpretation of the parts eaten

H2.

common name	lay term (e.g., “fruit”, “nut”, or “vegetable”)	general, yet botanically correct, term for the parts eaten	additional technical interpretation of the parts eaten

H3.

common name	lay term (e.g., “fruit”, “nut”, or “vegetable”)	general, yet botanically correct, term for the parts eaten	additional technical interpretation of the parts eaten

H4.

common name	lay term (e.g., “fruit”, “nut”, or “vegetable”)	general, yet botanically correct, term for the parts eaten	additional technical interpretation of the parts eaten

H5.

common name	lay term (e.g., “fruit”, “nut”, or “vegetable”)	general, yet botanically correct, term for the parts eaten	additional technical interpretation of the parts eaten

H6.

common name	lay term (e.g., “fruit”, “nut”, or “vegetable”)	general, yet botanically correct, term for the parts eaten	additional technical interpretation of the parts eaten

H7.

common name	lay term (e.g., “fruit”, “nut”, or “vegetable”)	general, yet botanically correct, term for the parts eaten	additional technical interpretation of the parts eaten

H8.

common name	lay term (e.g., “fruit”, “nut”, or “vegetable”)	general, yet botanically correct, term for the parts eaten	additional technical interpretation of the parts eaten

H9.

common name	lay term (e.g., “fruit”, “nut”, or “vegetable”)	general, yet botanically correct, term for the parts eaten	additional technical interpretation of the parts eaten

H10.

common name	lay term (e.g., “fruit”, “nut”, or “vegetable”)	general, yet botanically correct, term for the parts eaten	additional technical interpretation of the parts eaten

Space for additional items from the market basket (using the format above):