Dendrology or Tree Identification

Falls into the oldest area of science called

Taxonomy

Taxis: Latin meaning arrangement or order

nomy: refers to knowledge

Taxonomy is the knowledge of order or classification of plants.

Plant Classification

Classification is simply grouping and ranking into a hierarchy of categories with each level having the characteristics of those levels above.

Linnaeus (1753), founder of modern classification systems.

Classification of living things:

Biologists use a formal system of classification. At each level, organisms are grouped by similarity of characteristics.

		Gymnosperms	Angiospearms
Kingdoms		Plantae	Plantae
Phyla (animals) or Divisions (plants)		Pinophyta	Magnoliophyta
Classes		Pinopsida	Magnoliopsida
Orders		Pinales	Fagales
Families		Pinaceae	Fagaceae
Genera		Larix	Quercus
Species		laricina	rubra
author:		(Du Roi)K. Koch	L.
common names:	eastern larch, hackmatack, juniper		northern red oak

It is very important for a resource manager to be able to at least identify a plant to the genus level, preferably to species level.

Plant Classification

The most important taxon for us is the "species"

A species is a biological concept that means a collection of individuals so similar that they suggest common parentage and the offspring from sexual reproduction is expected to produce individuals that are similar to the parents.

Species – both a singular and plural word abbreviated as sp. if singular and abbreviated as spp. if plural

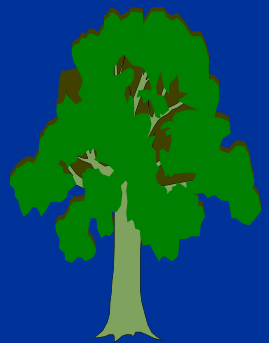
Note: Specie refers to "coined money"

Nomenclature

Is the system and terminology used to name species

A species has two names:

- common or vernacular name
- scientific name



Common or **Vernacular name**

The term vernacular name is preferred by some over common name because “common” implies the name is used everywhere while “vernacular” suggests a regional usage.

Vernacular names are based on:

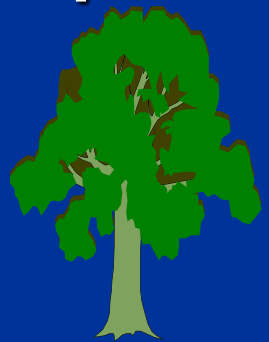
- Typical habitat
- Distinctive feature
- Locality or region
- Utility
- In commemoration
- Adaptation from another language

Common or Vernacular Name

Some species have multiple vernacular names, none of which are really the "common name".

Example: **American hornbeam, bluebeech,** and **ironwood** are names that are regionally applied to ***Carpinus caroliniana***.

Some common names are used for different species in different regions.



Example: ironwood is often used for both *Carpinus caroliniana* and *Ostrya virginiana*

Nomenclature

To avoid confusion often associated with the use of common names, it is generally better to use the scientific (Latin) binomial name for a species- **the official, internationally recognized name.**

Advantages:

Avoids confusion often associated with use of common names

Allows clear, efficient communication among professionals

Disadvantages:

Have to learn all that Latin stuff (but you will)

May be difficult to communicate with non-professionals

The taxonomists occasionally change the names

Scientific or Latin Name

The scientific name of a species has three parts:

- **Generic name – Genus name (*upper case*)**
- **Species epithet – Unique identifier within the genus (*lower case*)**
- **Author – person who originally described species**

(Lists on pp 466-481 in Farrar give some background information about various botanical authors and meanings of some latin tree names).

Bur oak Quercus macrocarpa Michx.

Note: scientific name is either typed in "*italics*" or underlined!

Scientific Names

Pinus elliotii* var. *densa

What does "var" imply? A variety of slash pine.

Pinus* X *sondereggeri Sonderegger pine

What does the "X" imply? A recognized, natural hybrid.

***Gleditsia triacanthos* cv. Moraine**

What does the "cv." imply? A cultivar.

Derivations of Scientific Names

Generic:

- In commemoration
- Descriptive
- Fanciful/mythological/poetic
- Native land

Specific:

- Descriptive of appearance or structure
- Descriptive of habitat
- Uses
- Original locality
- Resemblance to another plant
- Commemorative
- A noun (rather than adjective)

Tree Identification

Tree identification takes into account:

- Form
- Leaves
- Bark
- Twigs
- Flowers/fruit/cones
- Taste (careful!) / smell
- Geographic area
- Habitat

} Where are you?

Tree Identification in the Forest

Many types of characteristics can be used to identify tree species.

The characteristics we will use in this class include the Size and Form (general shape, size, crown characteristics), leaves, buds, twigs, flowers, fruit or cones, bark, and habitat characteristics.

Farrar gives some tips for quick recognition of species which may be similar to each other. The Forests of Maine guide (on our web site) has pages that compare the ash, maple, cherry, and oak species.

Tree Identification

Dichotomous Key (summer or winter- see Farrar)

Species identification is aided by the use of dichotomous keys.

These are based on the principle of alternate choice: two contrasting characters are presented for the user to choose between; that choice leads to 2 more pathways, etc, until finally a genus or species is identified.

In order to use a key and understand the species descriptions, *you must understand the terminology!*

Features used to key it out

Example: We want to identify the tree these needles came from. Starting at the first couplet, choose the descriptions that fit the specimen. The lines in red indicate the correct choices in the key.

	SEE GLOSSARY PAGE 14	GO TO
1.	Leaves are needle-, awl- or scale-like; conifers	2
1.	Leaves are broad and veined, not as above; hardwoods or broad-leaf trees	9
2.	Leaves needle-like	3
2.	Leaves awl- or scale-like, or both	7
3.	Leaves flat, tips blunt, and occur singly	4
3.	Leaves angular in cross section, tips pointed	5
4.	Leaves taper, twigs limber; cones shorter than 1 inch	Eastern Hemlock p. 48
4.	Leaves parallel-sided, twigs stiff; cones over 2 inches	Balsam Fir p. 46
5.	Leaves occur singly, never clustered	Spruce p. 37
5.	Leaves occur in clusters, also singly in larch	6
6.	Leaves in clusters of 2–5 with papery sheath at base[1]	Pine p.25
6.	Leaves in clusters[2] of 8 or more on spurs; papery sheath lacking	Tamarack p. 50

We now know the tree is a pine. We then go to the species table to figure out what species of pine it is.

PINES *The Important Distinctions*

Use of Dichotomous Identification Keys

When using a key it is necessary to:

- **Know technical terms in the key.**
- **Read all alternatives completely.**
- **Use more than 1 example of the unknown specimen.**
- **Use a ruler or scale if measurements are given.**
- **Use a hand lens to observe the minute characteristics.**

Variation in Species Identification

Realities of species identification

- No two trees are exactly alike. Even within a species, trees express their traits differently.
- Characteristics used to identify species are rarely as clear and straightforward as the definitions you get in class or in books.
- One of the most important concepts in dendrology is that **natural variation** is present in all species.
- However, each species has an expected "**range of variation.**" Learning this range of variation is best accomplished by repeatedly observing species in their native environment.

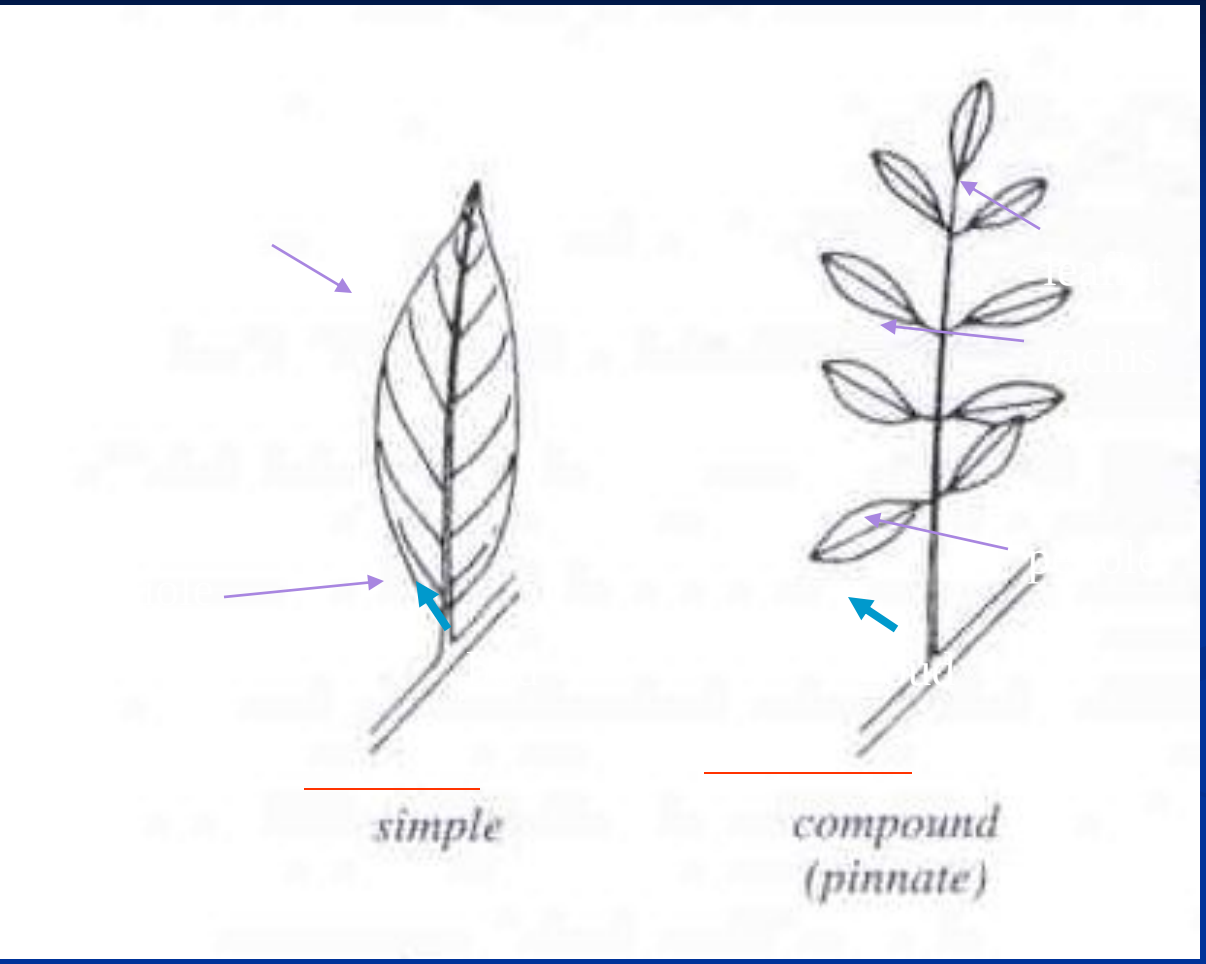
Vegetative Morphology

Leaves, twigs, buds, bark, habit (size and form)

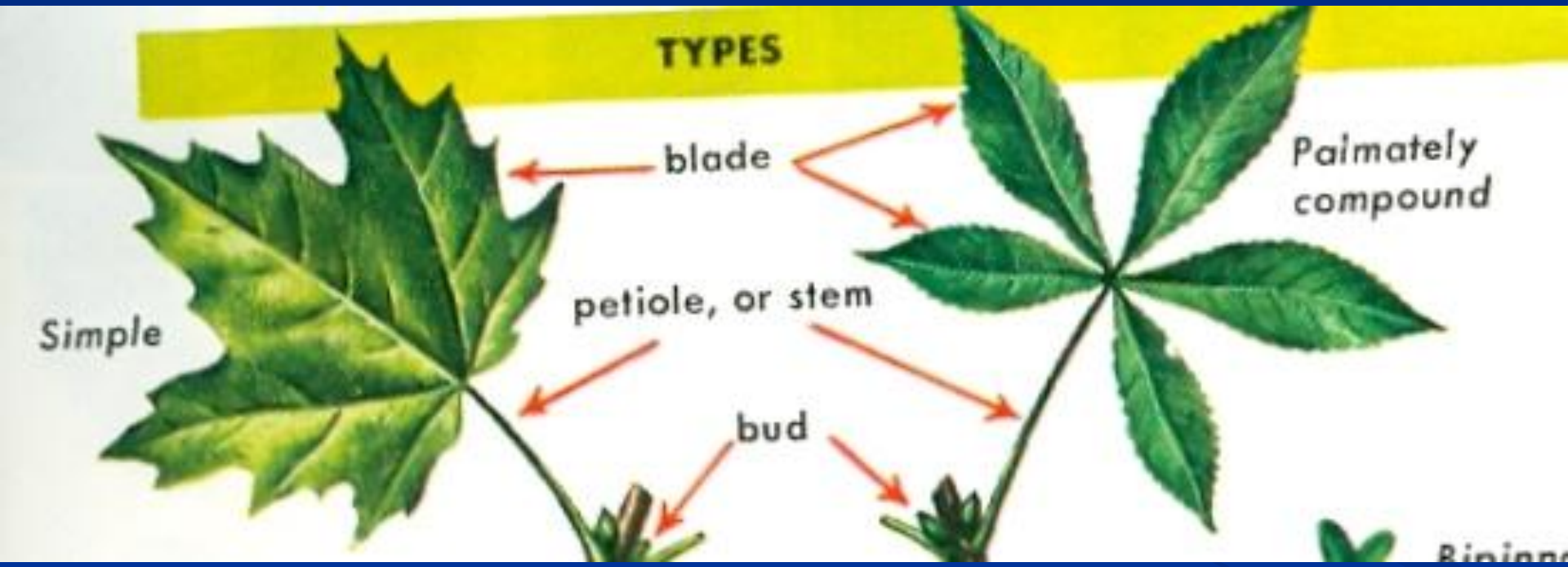
Leaf Type & Parts

--simple

--Compound



Leaf Types and Parts

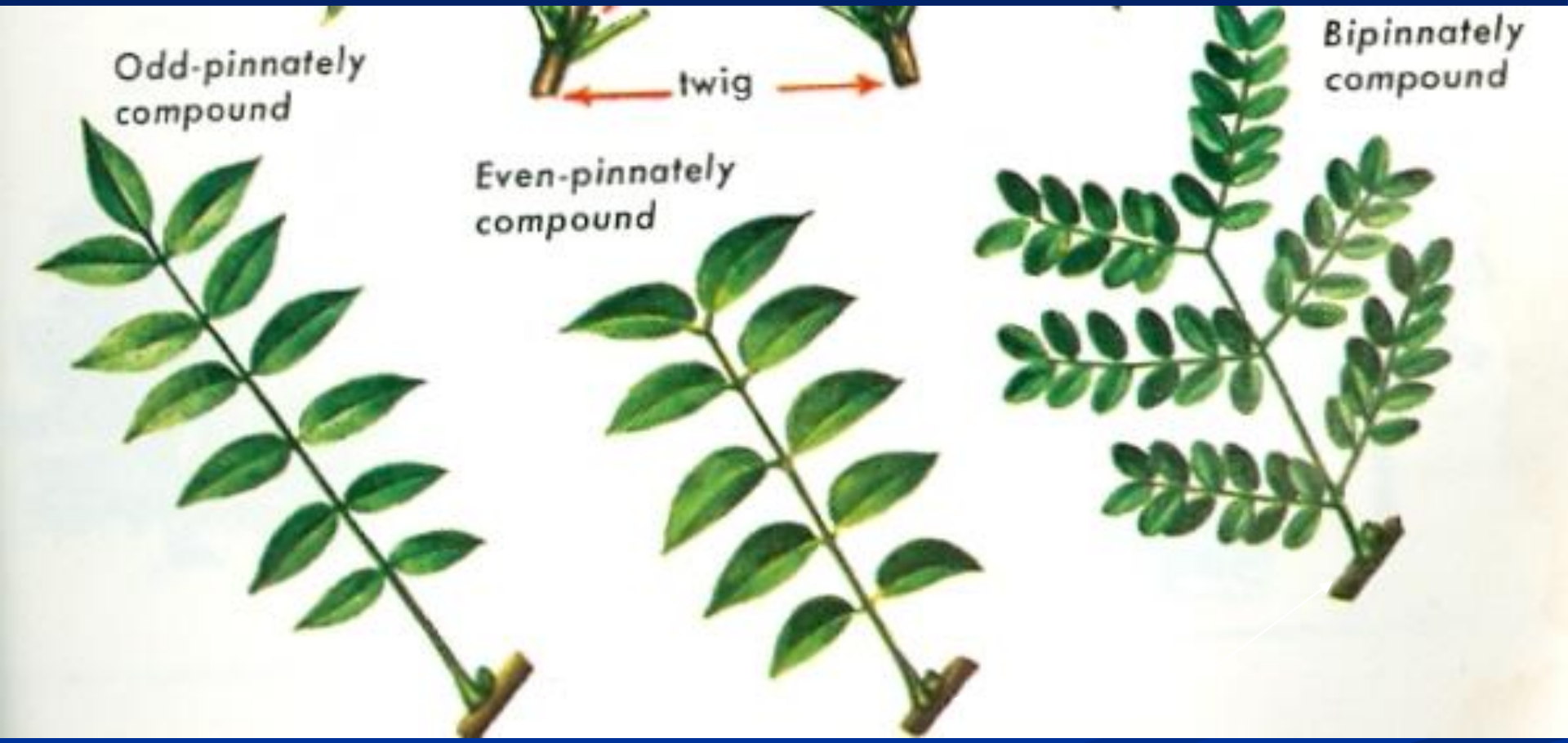


Leaf Type (leaf complexity):

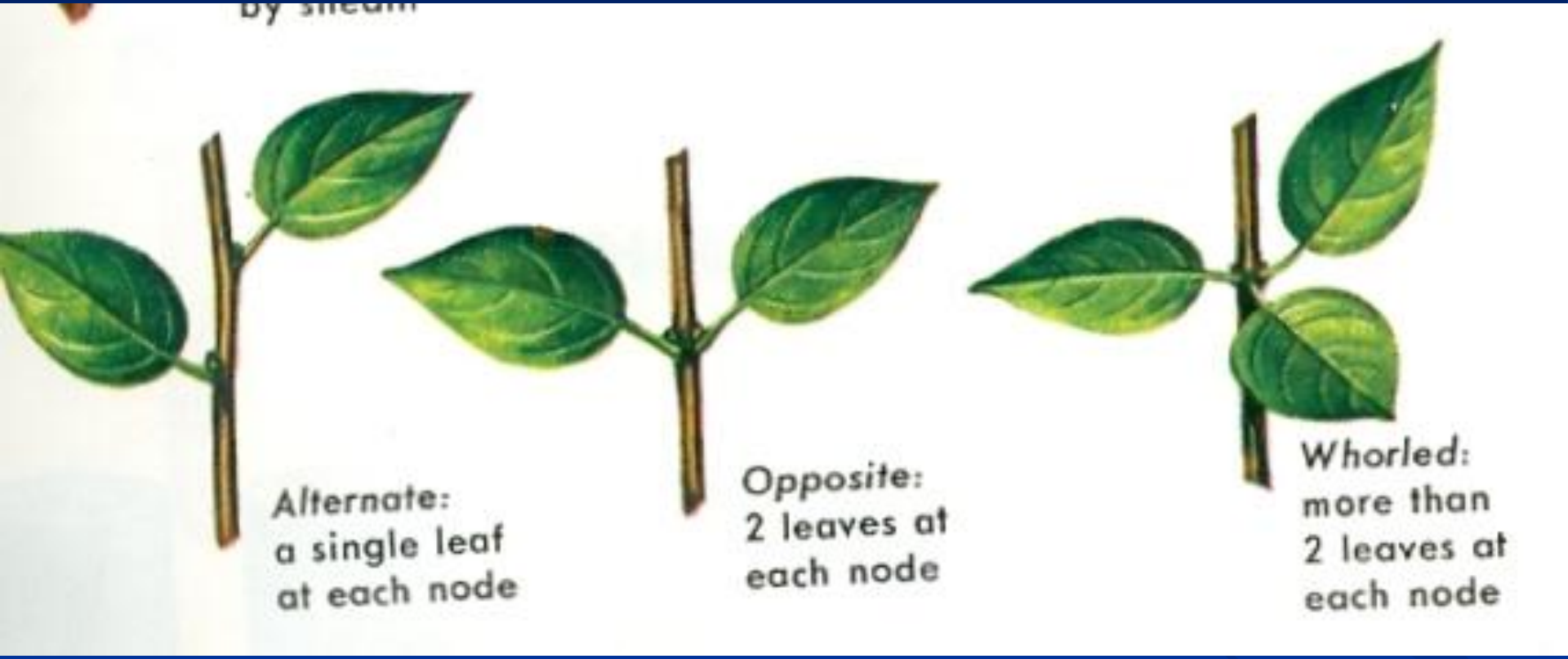
Simple versus compound

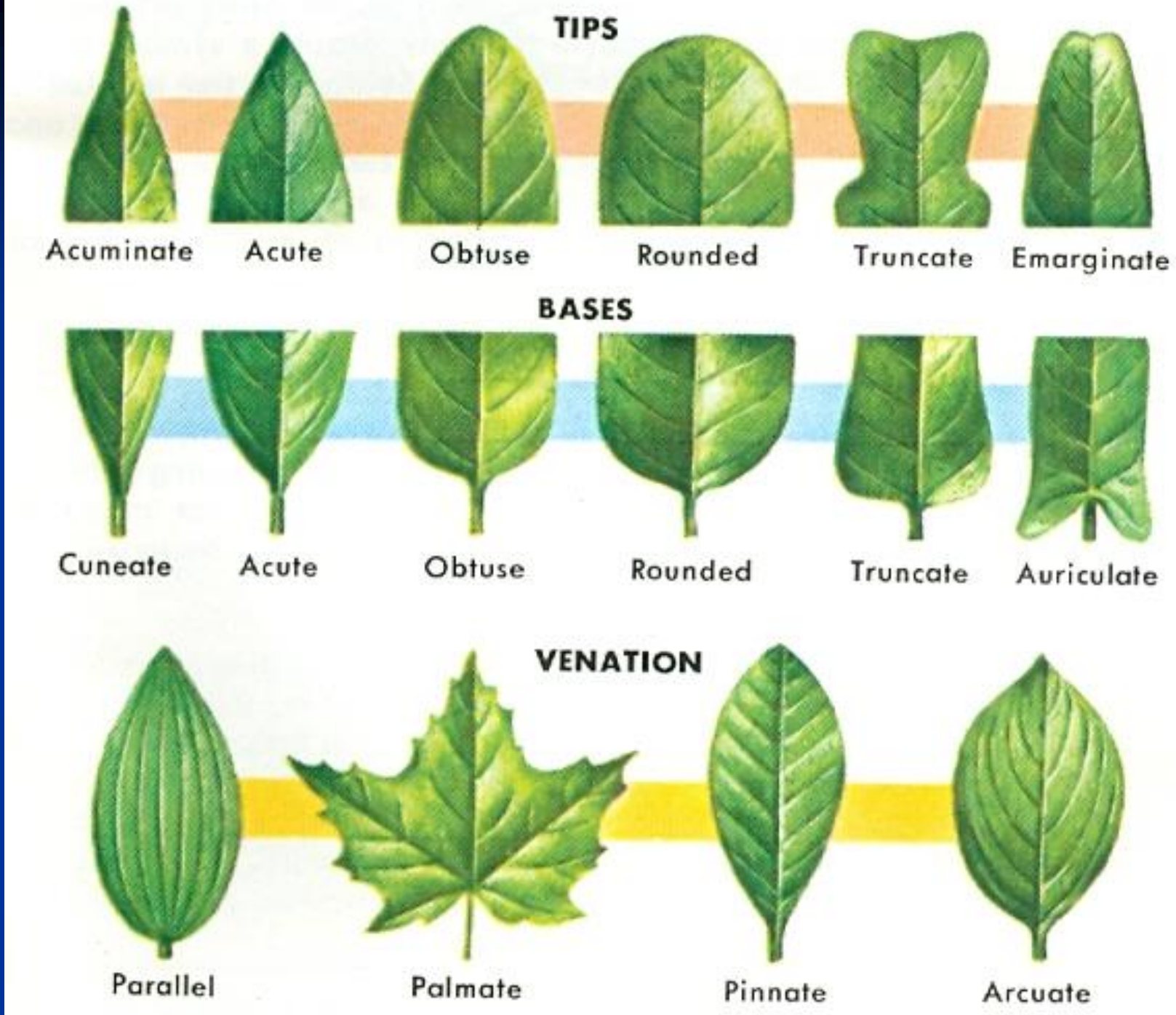
- **Simple** means 1 blade per bud (blade is 1 piece)
- **Compound** means more than 1 blade per bud (blade is divided into separate leaflets)
  - **Palmately** compound
  - **Pinnately** compound

Pinnately Compound Leaf

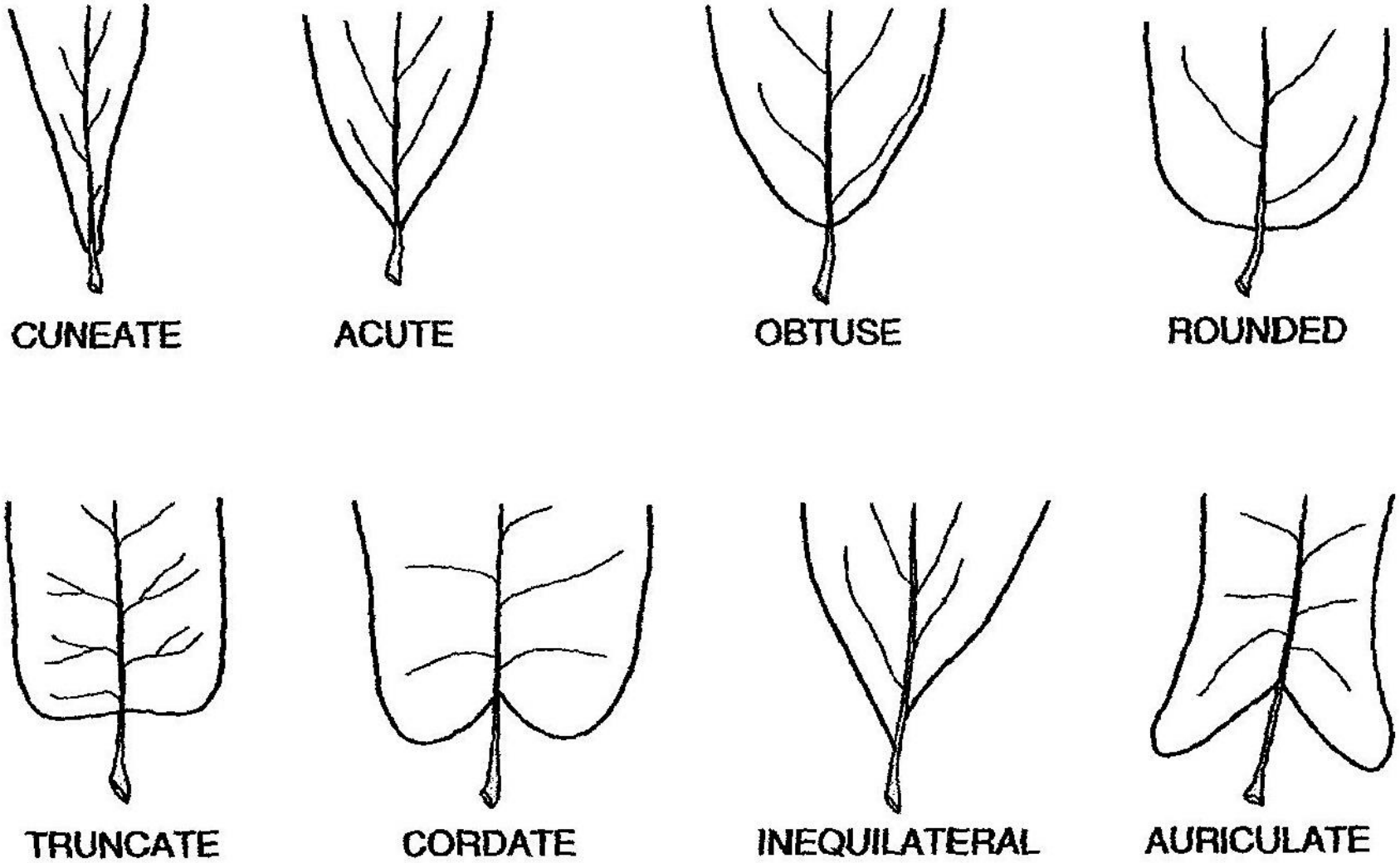


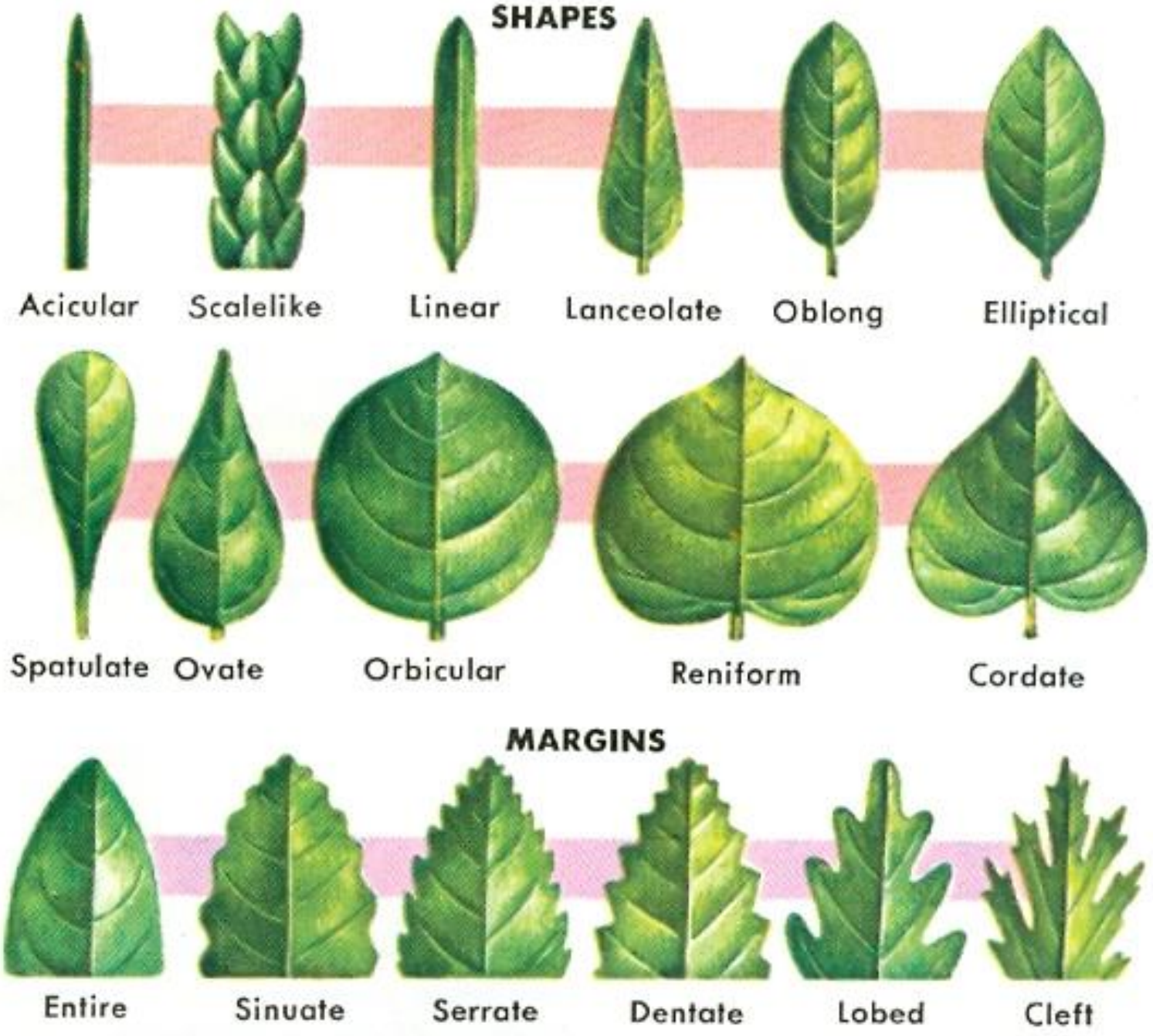
Leaf Arrangement



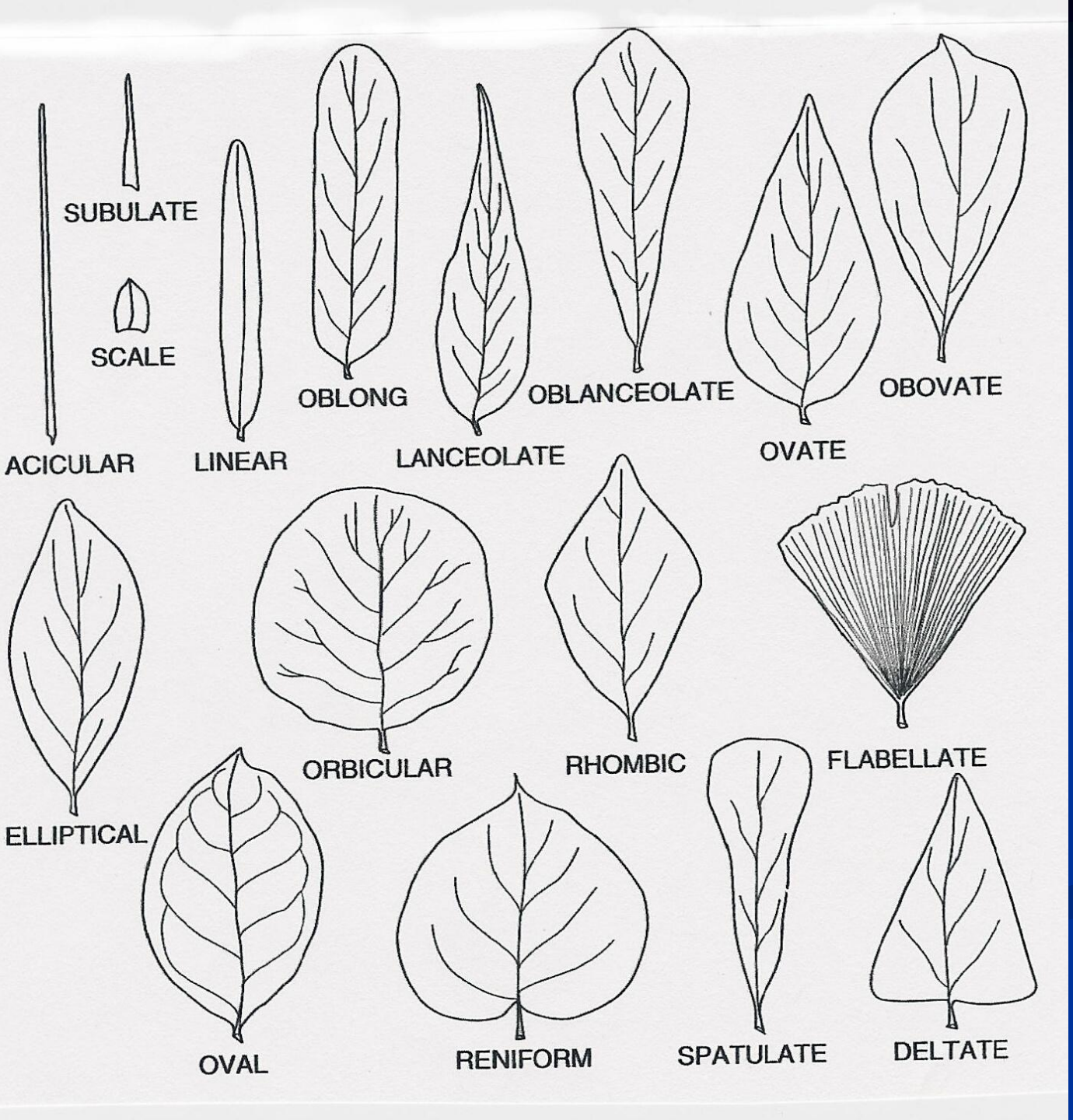

TIPS
Acuminate
Acute
Obtuse
Rounded
Truncate
Emarginate
BASES
Cuneate
Acute
Obtuse
Rounded
Truncate
Auriculate
VENATION
Parallel
Palmate
Pinnate
Arcuate

Leaf Bases

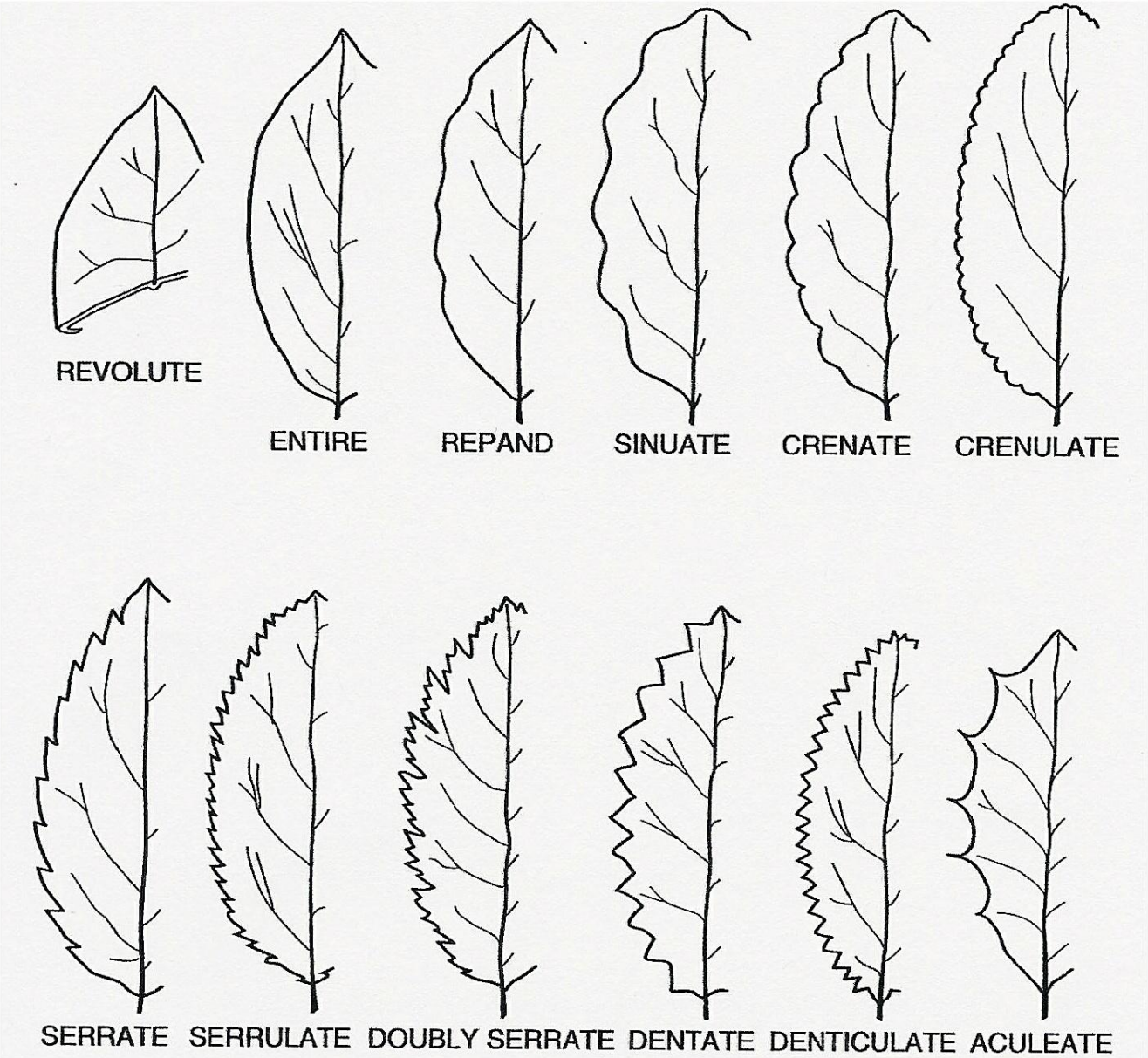

CUNEATE
ACUTE
OBTUSE
ROUNDED
TRUNCATE
CORDATE
INEQUILATERAL
AURICULATE


SHAPES
Acicular
Scalelike
Linear
Lanceolate
Oblong
Elliptical
Spatulate
Ovate
Orbicular
Reniform
Cordate
MARGINS
Entire
Sinuate
Serrate
Dentate
Lobed
Cleft

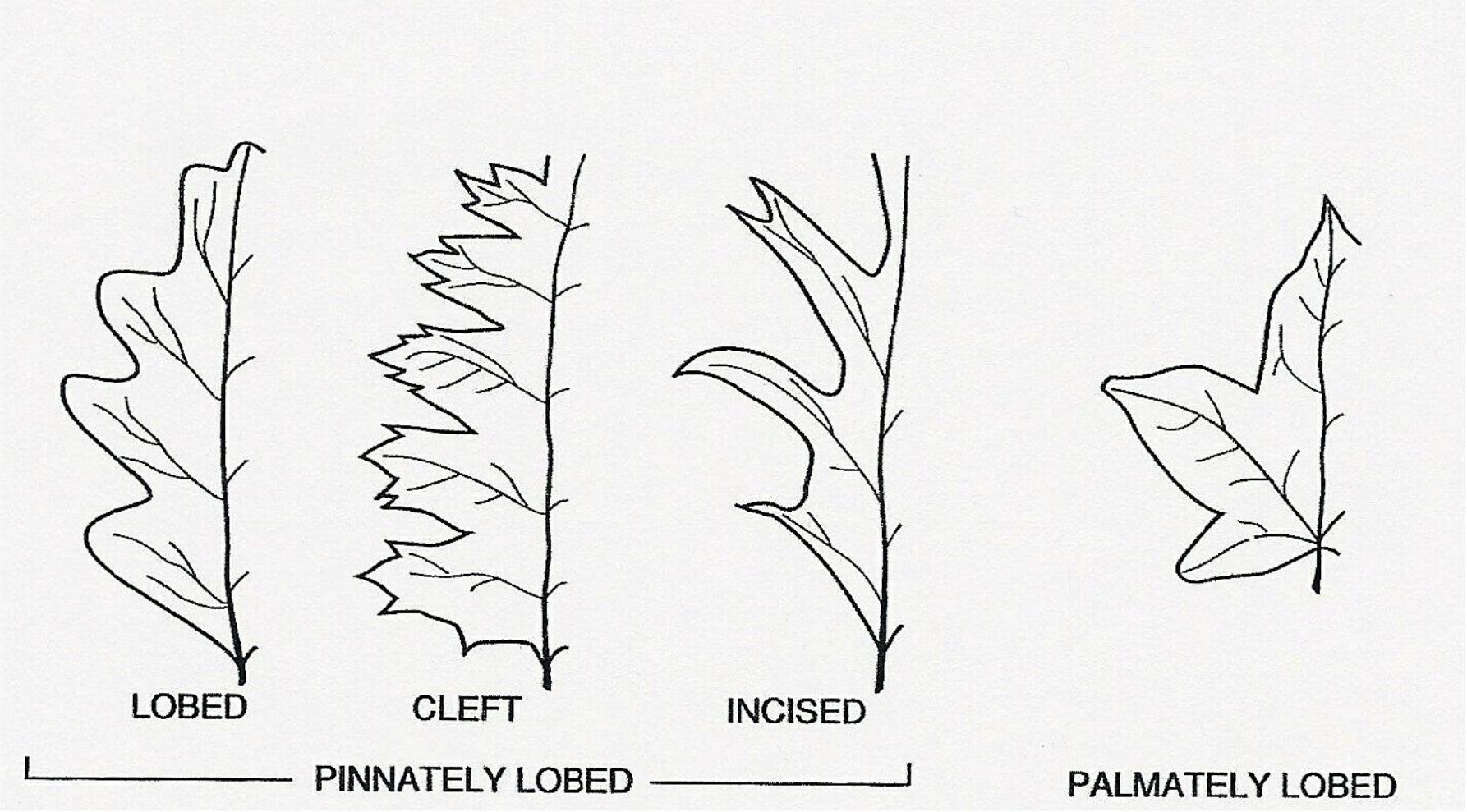
Leaf Shapes


SUBULATE
SCALE
ACICULAR
LINEAR
OBLONG
LANCEOLATE
OBLANCEOLATE
OVATE
OBOVATE
ELLIPTICAL
ORBICULAR
RHOMBIC
FLABELLATE
OVAL
RENIFORM
SPATULATE
DELTATE

Leaf Margins



Leaf Lobing

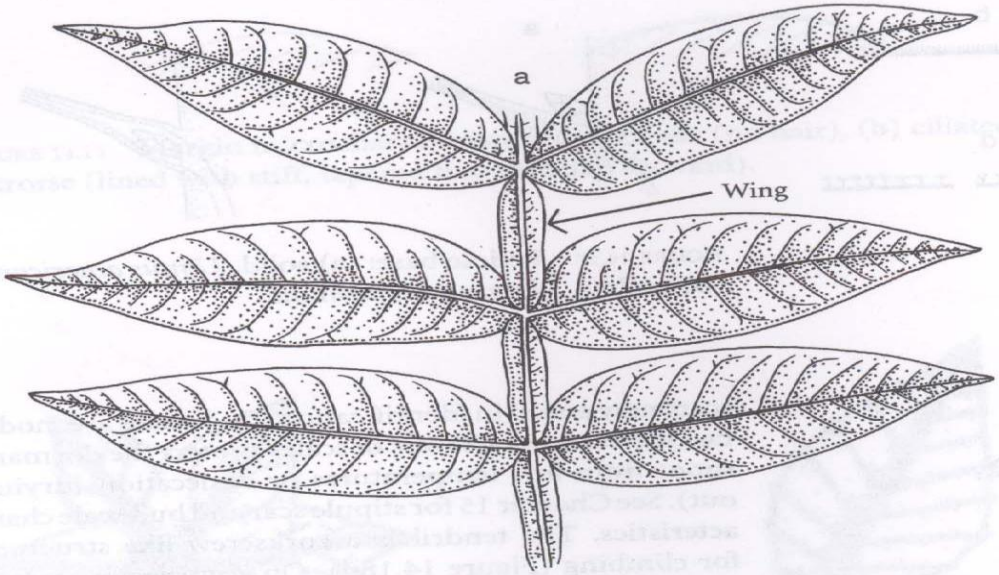


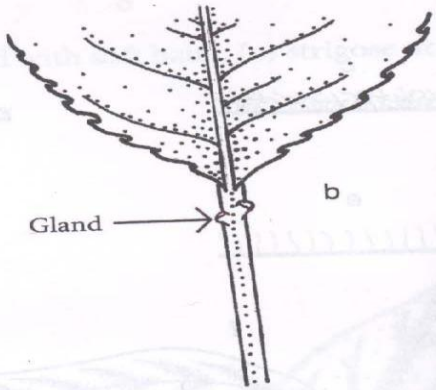
Petiole Characteristics*

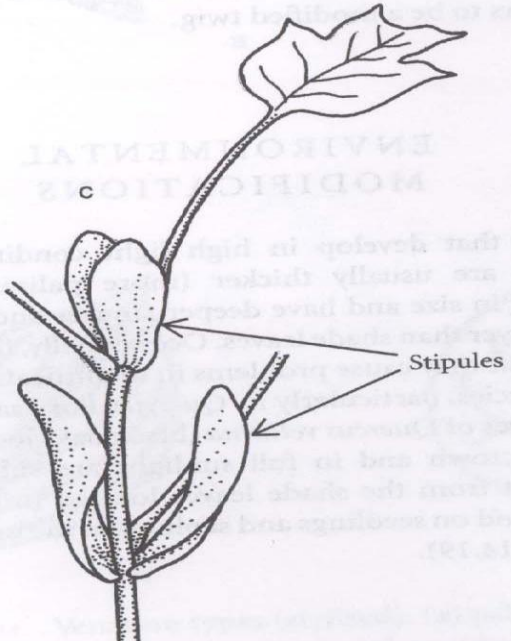
Petiole shape: (a) round, (b) grooved, (c) ridged, (d) flattened.

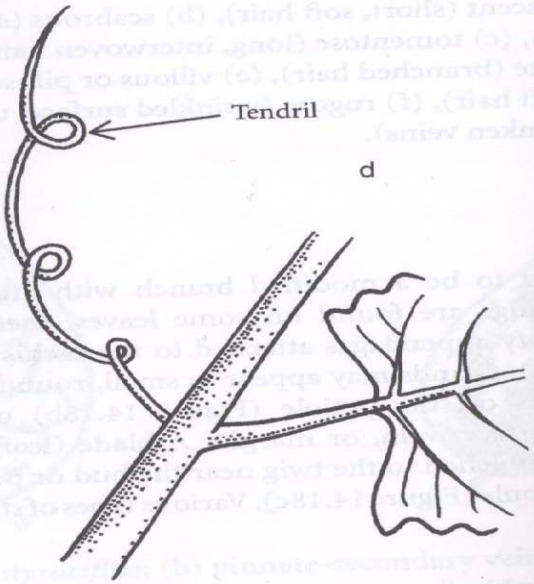
* Remember that the petiole is the non woody stalk below a simple or compound leaf, it is not the same as the twig which is woody.

Modified Structures



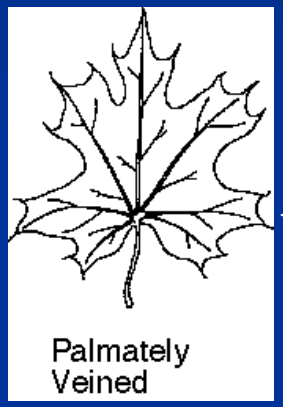






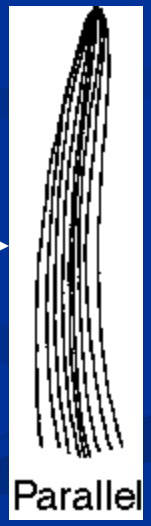
Leaf Venation (vein patterns):

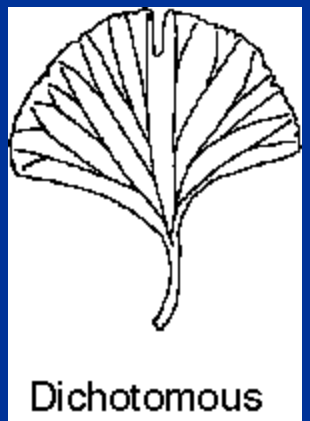
Pinnately veined: one main vein with all secondary veins branching off that main vein



Palmately veined: two or more primary veins arising from the base of the leaf blade

Parallel veined (striate): all veins run the vertical length of the leaf (typical in grasses, etc)





Dichotomously veined: repeated forking or Y-branching

Venation


Pinnate


Palmate


COPYRIGHT J.R. MANHART
Dichotomous


Parallel

Leaf Surfaces

Glaucous – Covered with whitish or bluish waxy coating

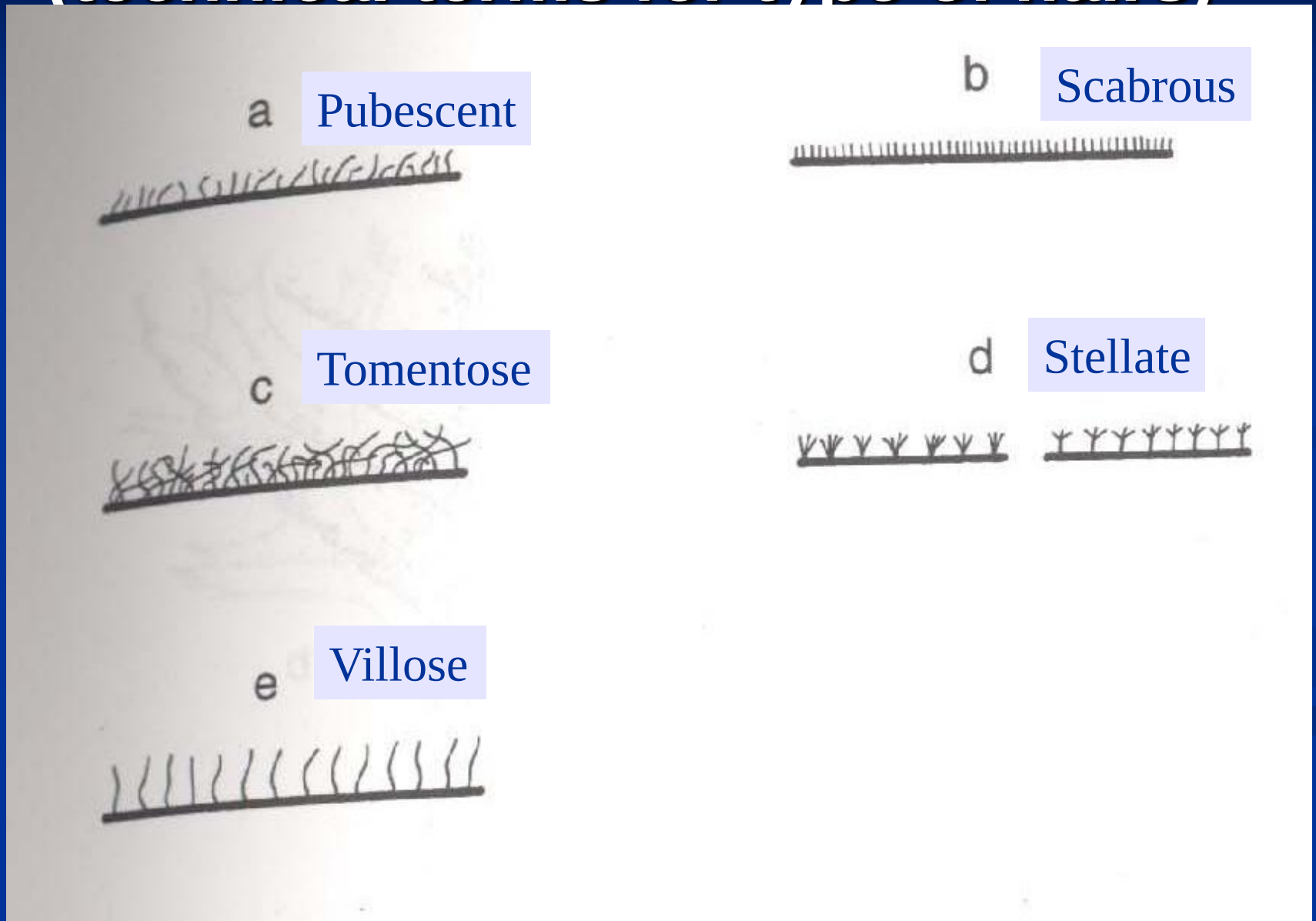
Glabrous – Smooth, hairless

Pubescent – Covered with short, soft hairs

Tomentose – Covered with short, matted or tangled, soft, wooly hairs

Scabrous – Rough, due to structure of epidermis or presence of short, stiff hairs

Blade Surface Characteristics
(technical terms for type of hairs)



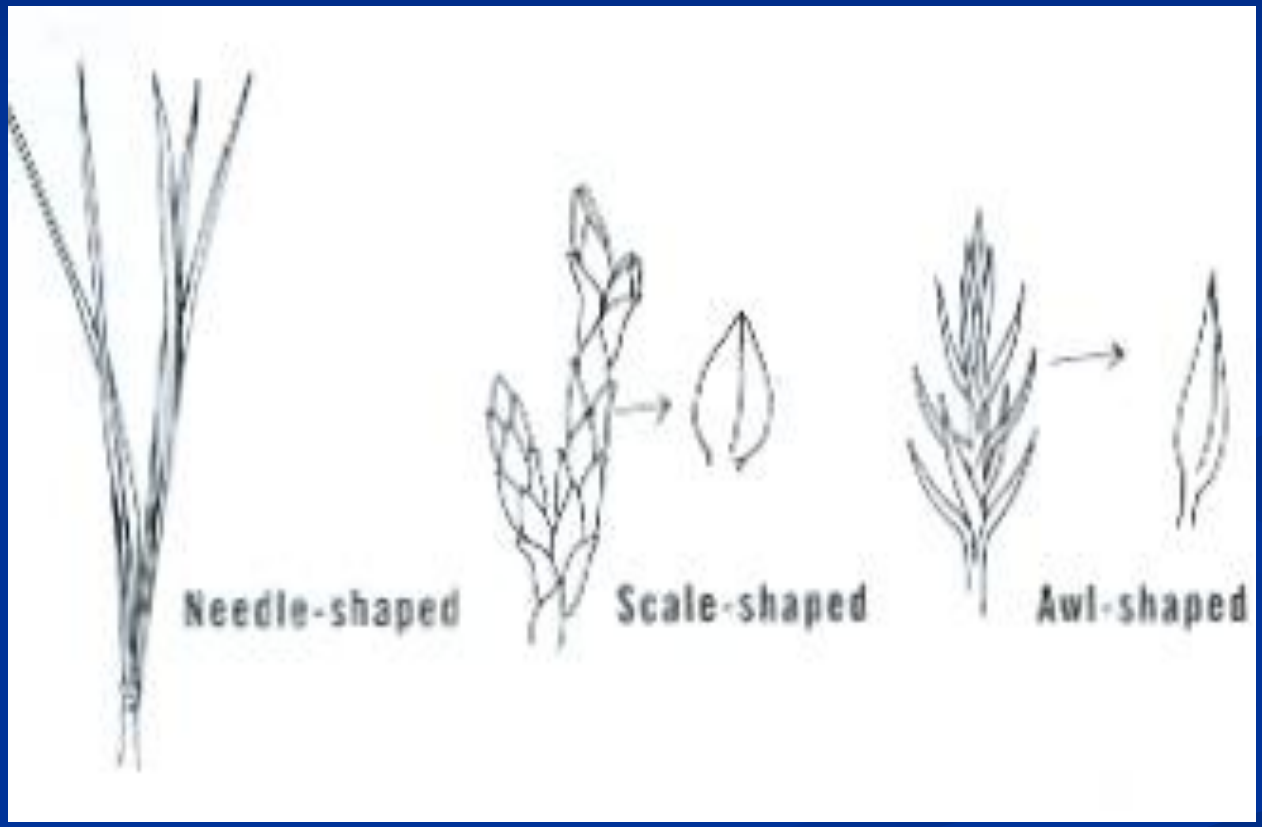
LEAVES may be deciduous (shed annually), or they may be evergreen or persistent (remaining on tree one to many years). Most cone-bearing trees and some broad-leaved trees are evergreen. Leaf arrangement may be obscure at growing tips, where leaves may not have reached full size. Leaves of some trees bear stipules (not shown), small leaflike appendages at base of petiole.

ARRANGEMENT

Fascicled:
bundles of 2 to 5
enclosed at base
by sheath

Clustered:
in false whorls
at tips of spurs,
without sheath

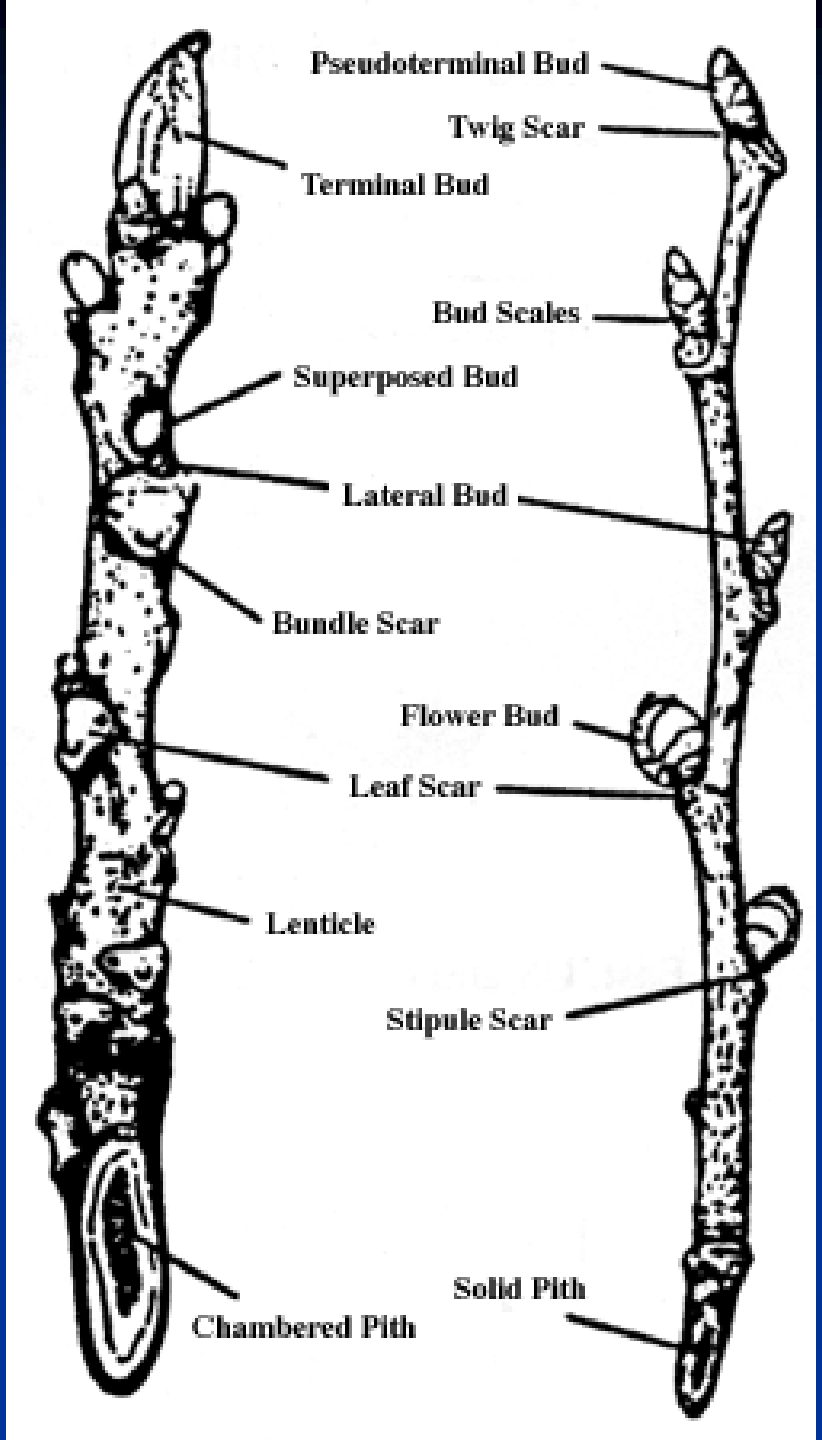
Pine Needles Cedar Needles Juniper Needles



Twigs and Buds are also a useful feature for species identification.

See Farrar pp 5 & 6 for drawings of twig and bud anatomy.

Fraxinus americana - K . Carter



- Types of buds:

- terminal
- pseudoterminal
- lateral
- superposed (more than one bud per leaf axil; occurs rarely)
- floral
- vegetative

- “Primary” tree growth occurs through the growth of shoots from buds.

Types of buds

- true terminal
- pseudoterminal
- lateral

Photos by K. Carter

TWIGS & BUDS

Terminal buds: at apex of twig; usually larger than lateral buds

Imbricate scales: overlapping like shingles

Lateral buds: along twigs, in axils of previous season's leaves, at leaf scars

Pith forms core of twig. It varies in color, texture, and shape in cross section. May be solid,

pith solid

American Sycamore

Pseudo-terminal bud: actually a lateral bud located at apex of the twig

Valvate scales: joined along edges; as in clam shell

Red Alder

Leaf Scars indicate point of attachment of leaf stem. Shape may be distinctive

chambered (open spaces with thin partitions), or diaphragmed (spongy with denser partitions)

Black Walnut

pith chambered

Buds may be classified as naked or scaly

Viburnum alnifolium Photo: K. Carter

Acer saccharum

Photo: D. Kimbler, UW-M Botany Collection

Bud scales may be:

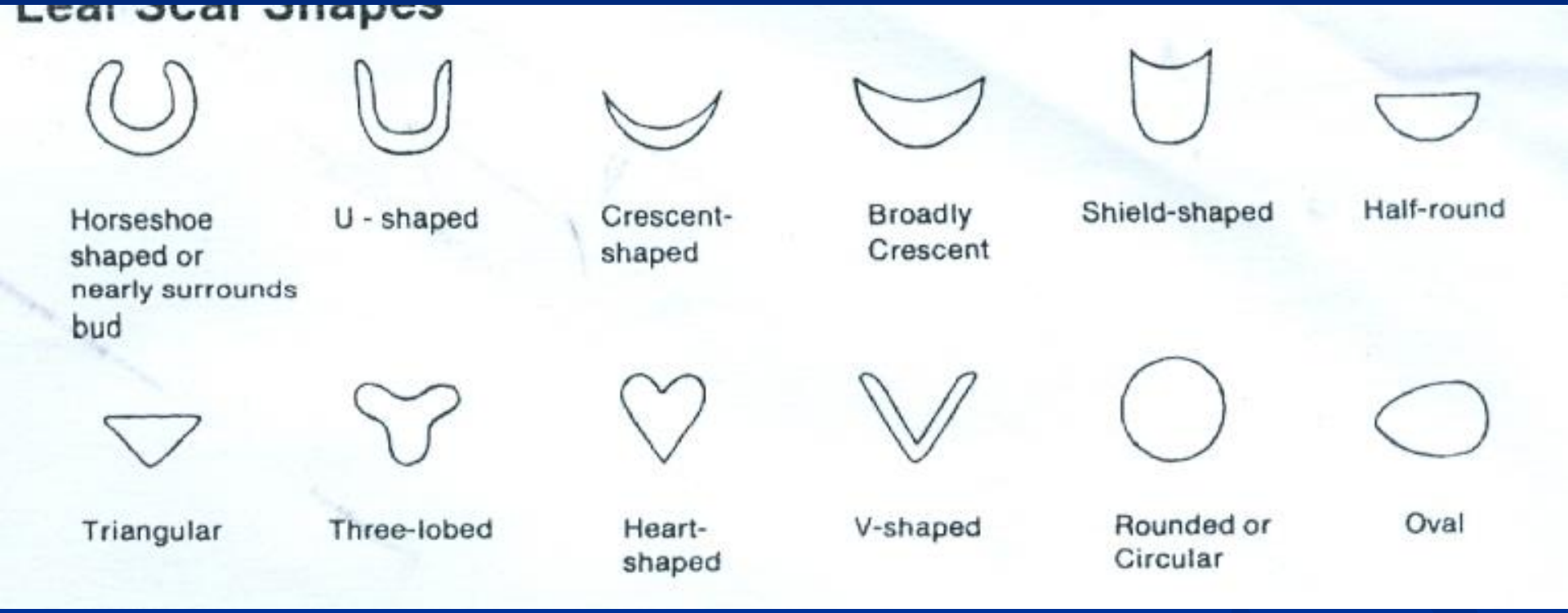
- Imbricate (multiple overlapping scales)
- Valvate (2 or 3 non-overlapping scales)
- Single, cap-like scale

Photos by D. Kimbler, Univ. Wisconsin-Madison Botany Collection

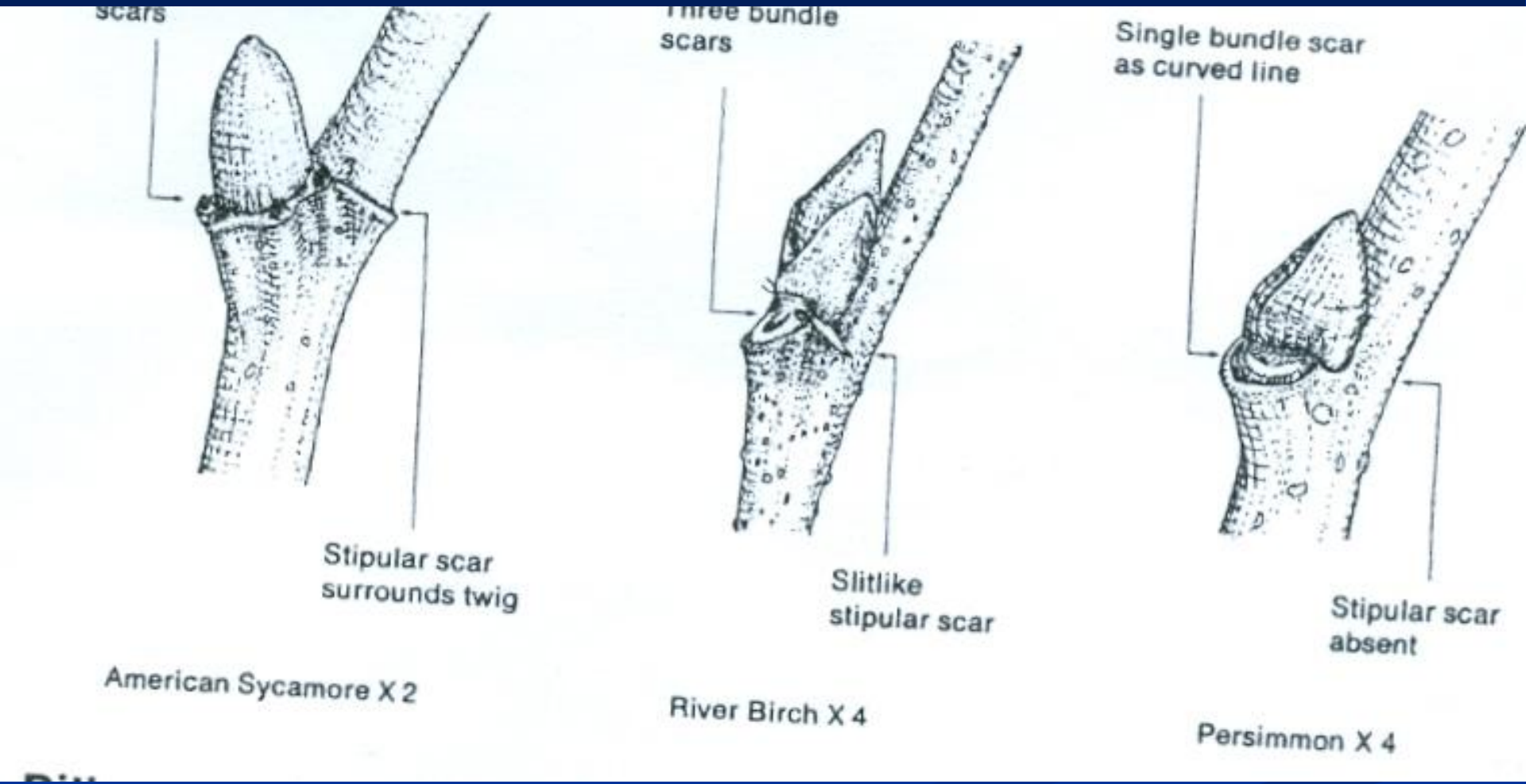
Photos by Darren Kimbler, UW-M Botany Collection

***Acer saccharinum* twig showing flower buds**

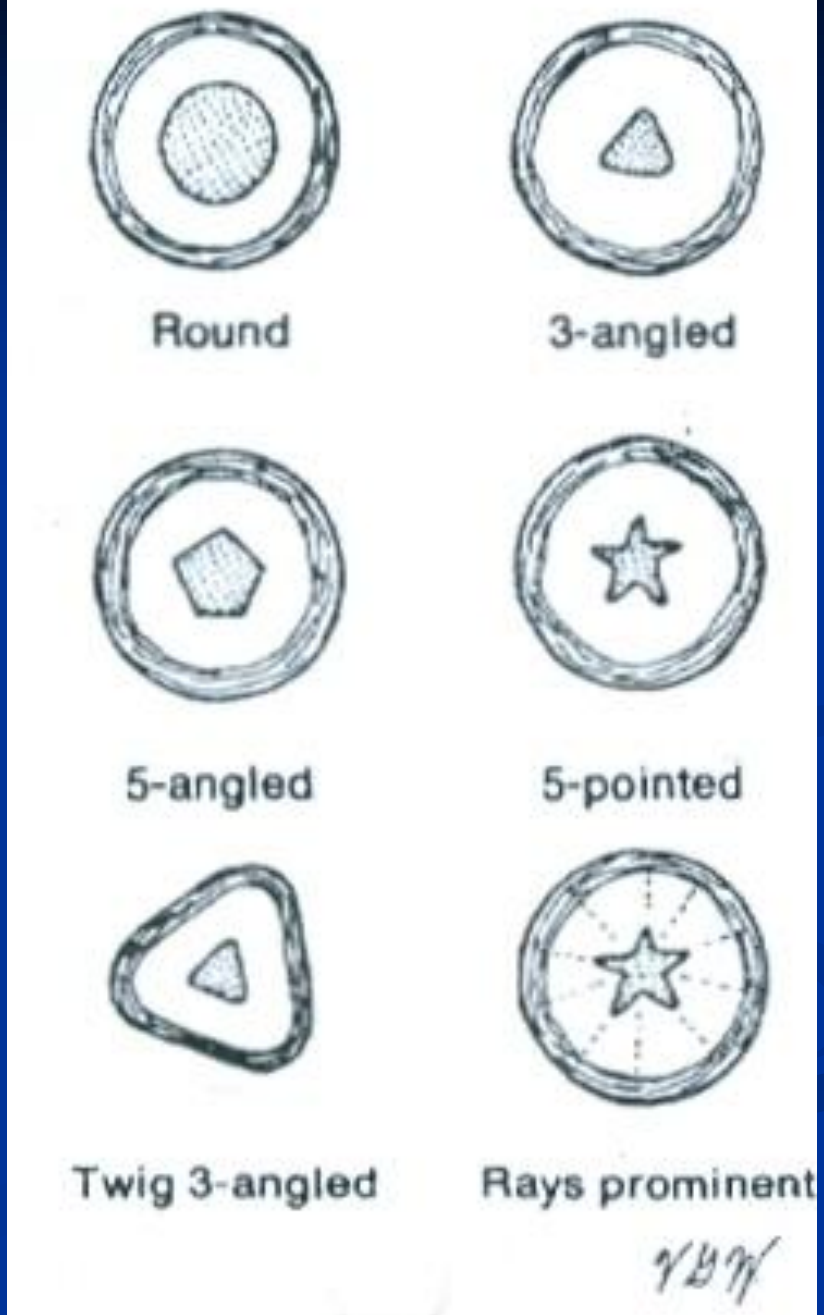
Leaf Scar Shape



Stipule Scar Characteristics



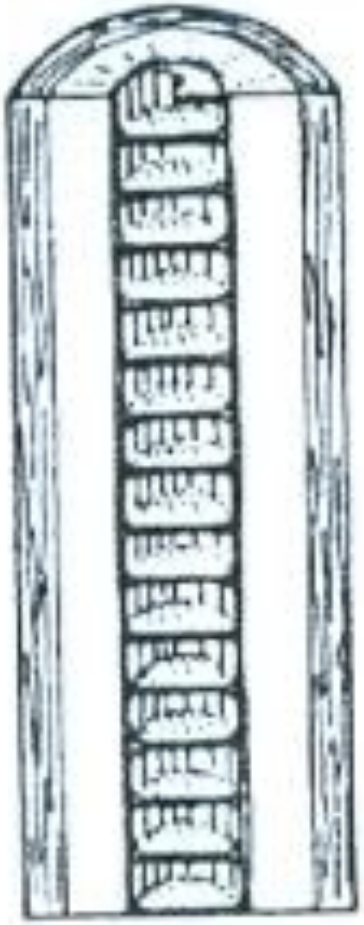
Pith Shapes


Round
3-angled
5-angled
5-pointed
Twig 3-angled
Rays prominent

Pith Characteristics

Homogenous
(solid)

Diaphragmed
(solid with
partitions)



Chambered
(hollow with
partitions)

Bark

- Tree species have characteristic bark features
- Features vary with age, growth rate, habitat
- Best learned by observation & experience

Bark Characteristics

Reproductive Morphology

Flowers, cones, fruits & seeds

Reproductive Morphology

Flowers and Fruits

Flowers can be perfect or imperfect

Perfect = both male and female parts (pistils and stamens) present in same flower

Imperfect = male and female parts in separate flowers

Reproductive Morphology

Trees can be either monoecious or dioecious

Synoecious = *together house* – male and female organs contained within one structure – perfect flowers

dogwood, cherry, basswood, black locust

Monoecious = *one house* – male and female flowers on same tree – imperfect or perfect flowers

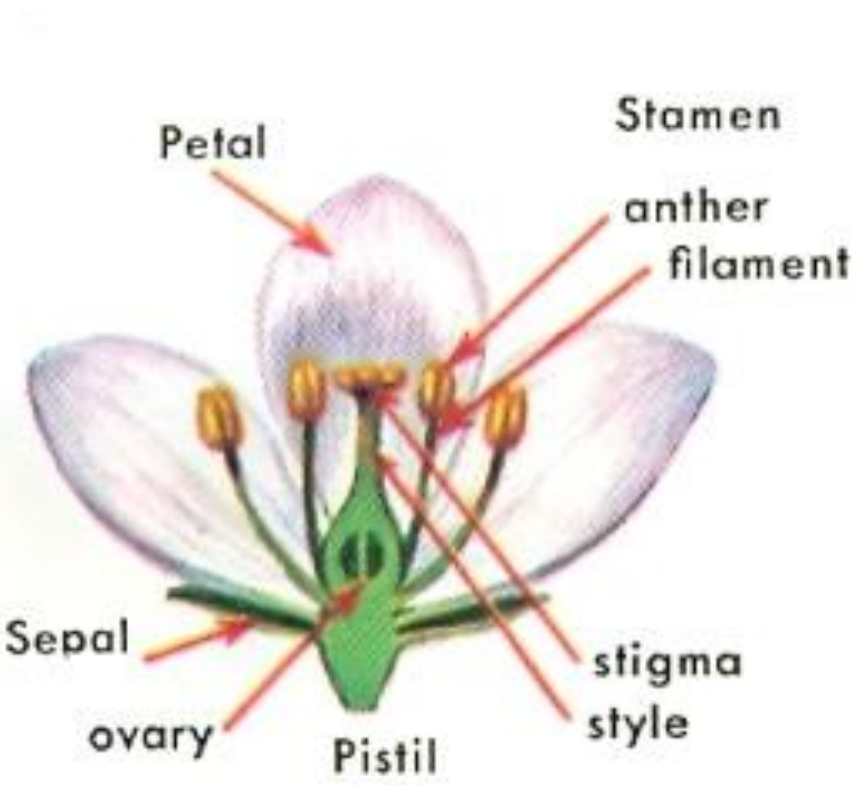
Most conifers, oaks, hickories, birch

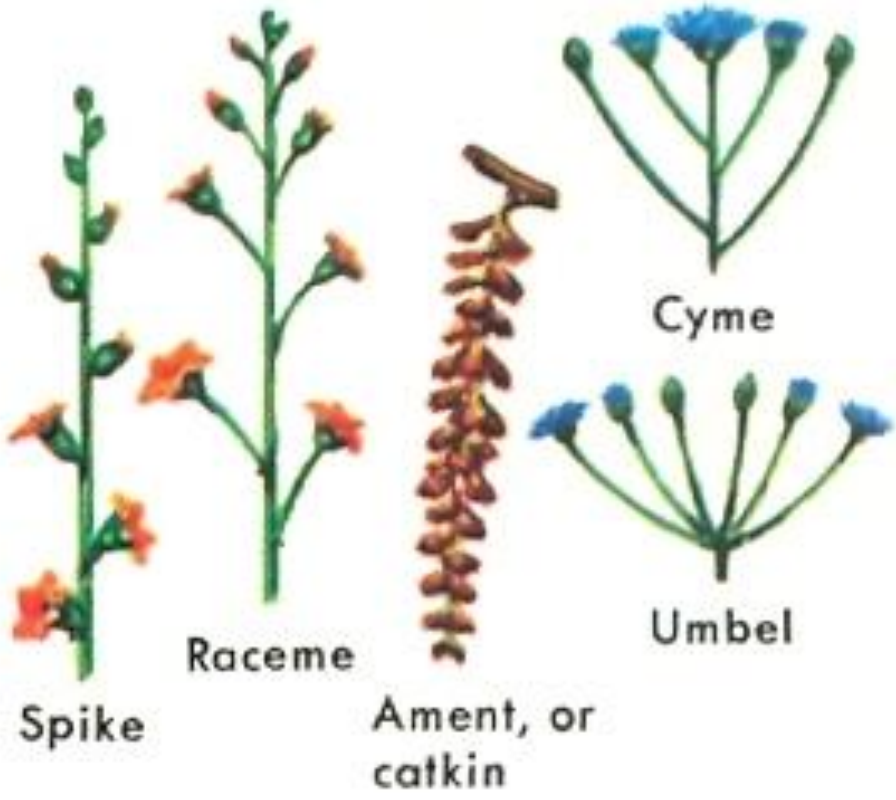
Dioecious = *two houses* – male and female flowers on separate trees – imperfect flowers

willow, poplar, ginko, ash, juniper

A species with perfect flowers is by definition monoecious.
A species with imperfect flowers could be either monoecious or dioecious.

FLOWERS


Petal
Stamen
anther
filament
Sepal
ovary
Pistil
stigma
style


Spike
Raceme
Ament, or
catkin
Cyme
Umbel

Flowers - InflorescenceTypes

Cyme (cylindrical)

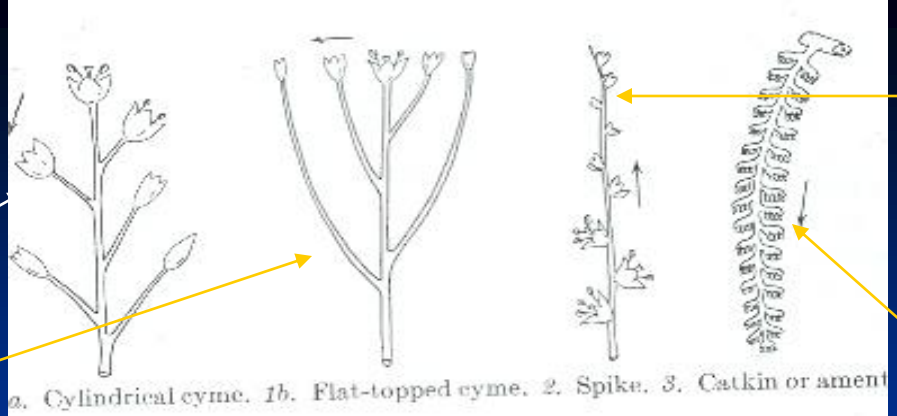
(Flat-topped)

Panicle

Raceme

Umbel

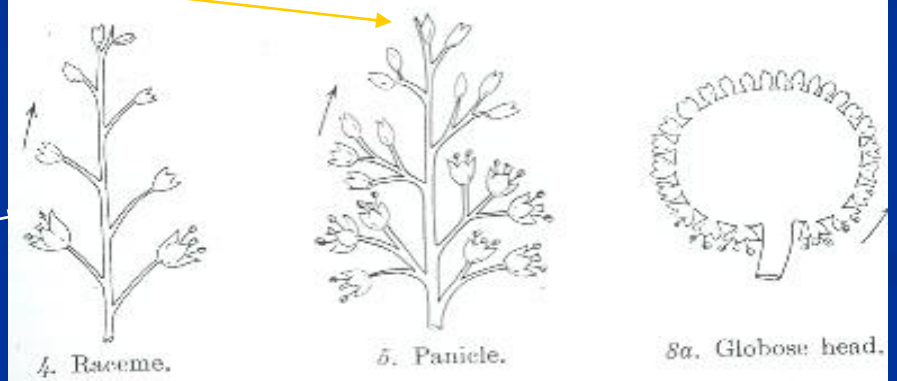
Corymb



1a. Cylindrical cyme. 1b. Flat-topped cyme. 2. Spike. 3. Catkin or ament

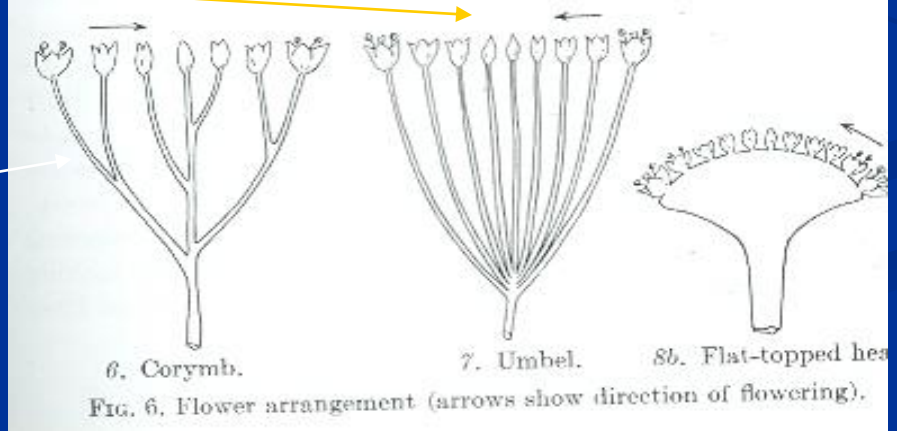
Spike

Catkin



4. Raceme. 5. Panicle. 8a. Globose head.

Globose head



6. Corymb. 7. Umbel. 8b. Flat-topped hea

Fig. 6. Flower arrangement (arrows show direction of flowering).

Flat-topped head

Fruits & Seeds

Simple Fruits — From single ovary in a flower

- Dry, Indehiscent — Achene, Samara, Nut
- Dry, Dehiscent — Legume, Follicle, Capsule
- Fleshy — Pome, Drupe, Berry

Compound Fruits — From several separate ovaries

- Aggregate — Cluster of simple fruits from separate pistils of a single flower
- Multiple — Cluster of simple fruits from separate flowers in a compact inflorescence

Angiosperm Fruit

Achene

Double Sumara

Nut

Acorn

Capsule

Pome

Single sumara

Legume

Drupe

Berry

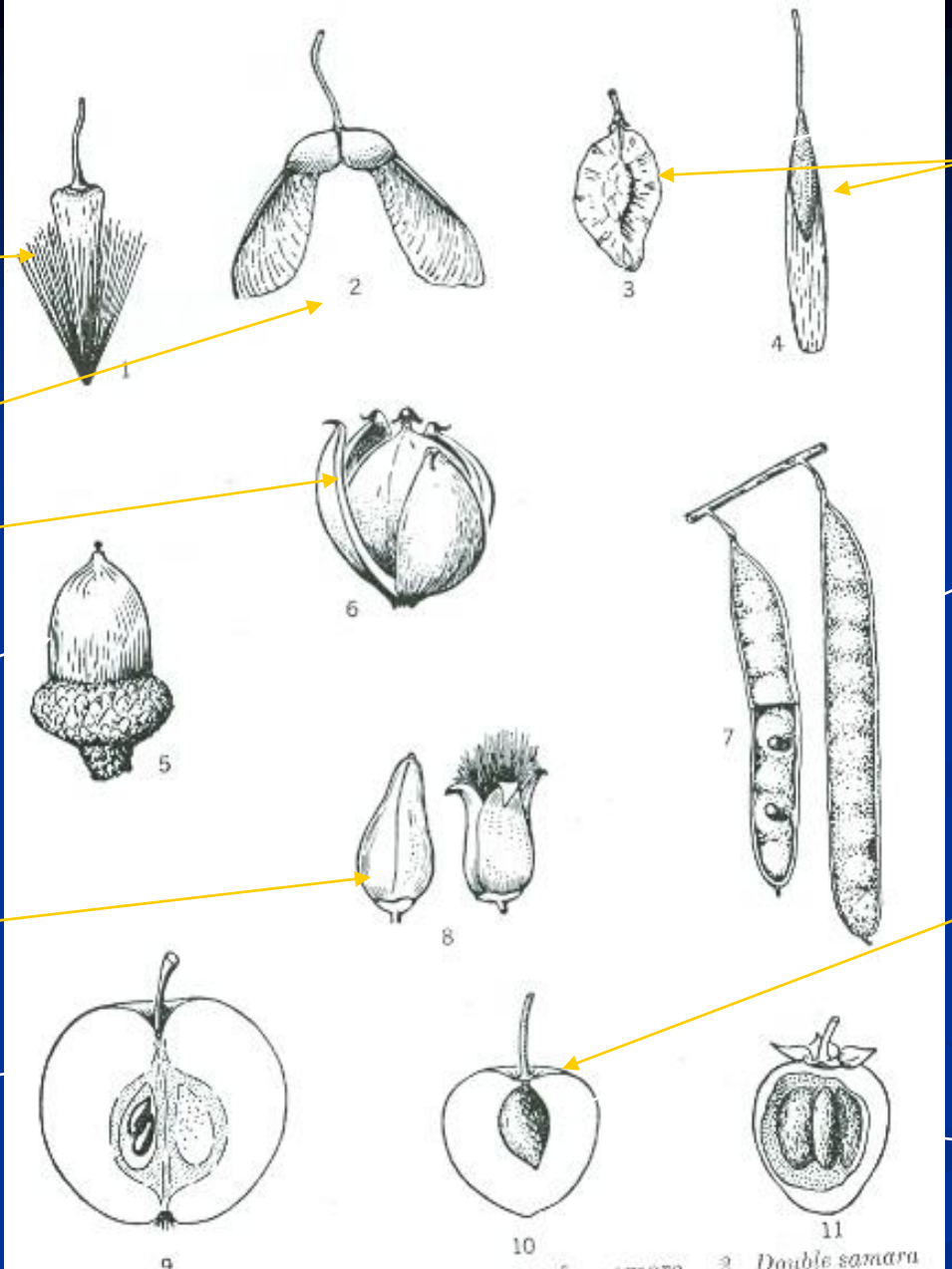
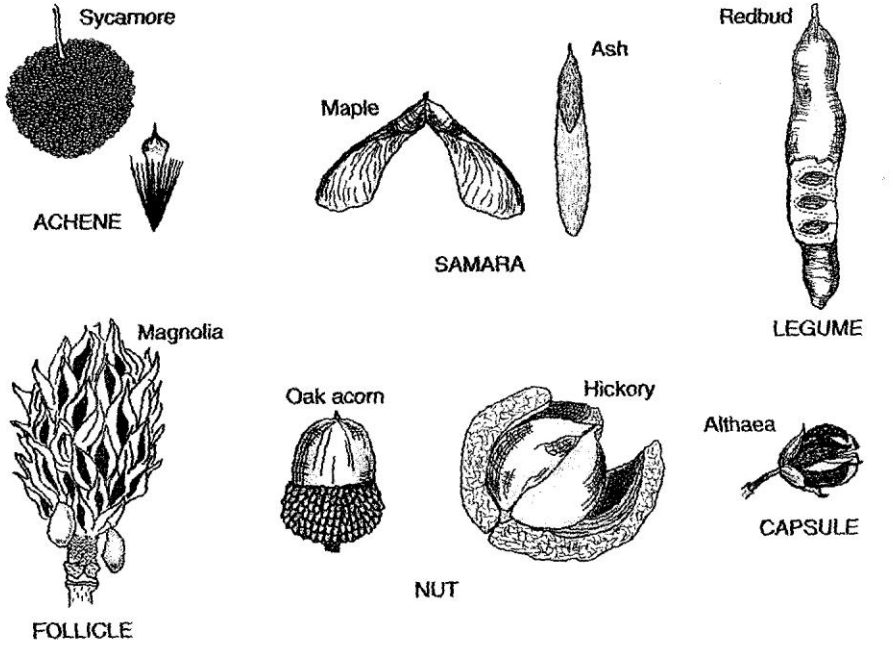
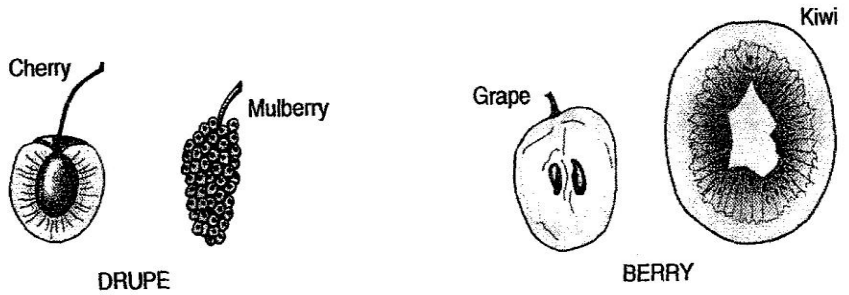
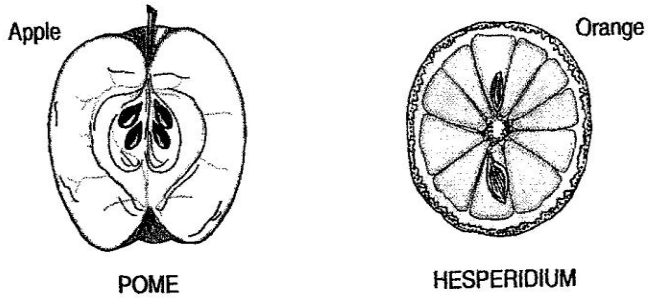


Fig. 7. Some angiosperm fruits. 1. *Achene* of sycamore. 2. *Double samara* of maple. 3. *Single samara* of elm. 4. *Single samara* of ash. 5. *Acorn* (*nut*) of oak. 6. *Nut* of hickory. 7. *Legume* of black locust. 8. *Capsule* of poplar. 9. *Pome* of apple. 10. *Drupe* of cherry. 11. *Berry* of persimmon.

Fruits & Seeds







FRUITS

GYMNOSPERMS

Cone

(Pine)

seed on scale

(Yew)

fleshy

(Torreya)

ANGIOSPERMS

Examples of simple and compound fruits

Multiple of Achenes

(Sycamore)

Capsule

(Poplar)

Drupe

(Cherry)

Aggregate of Samaras

(Yellow-popla

Samara

(Elm)

Legume

(Locust)

Pome

(Apple)

Multiple of Drupes

(Mulberry)

Nut

(Hickory)

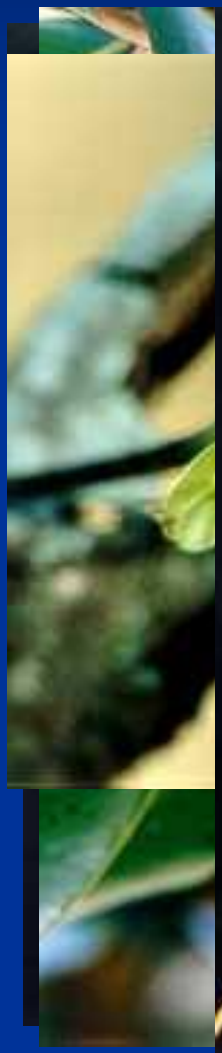
Aggregate of Follicles

(Magnolia)

Berry

(Persimmon)

Fruits & Seeds



Cones

Seed Dispersal

- Gravity
- Animals
- Wind
- Water

Vegetative Morphology

What does the term “Habit” refer to?

- growth form: a tree, a shrub, a vine
- “typical” size at maturity on a “typical” site
- “typical shape” at maturity for open-grown specimens
- These conditions vary with site characteristics

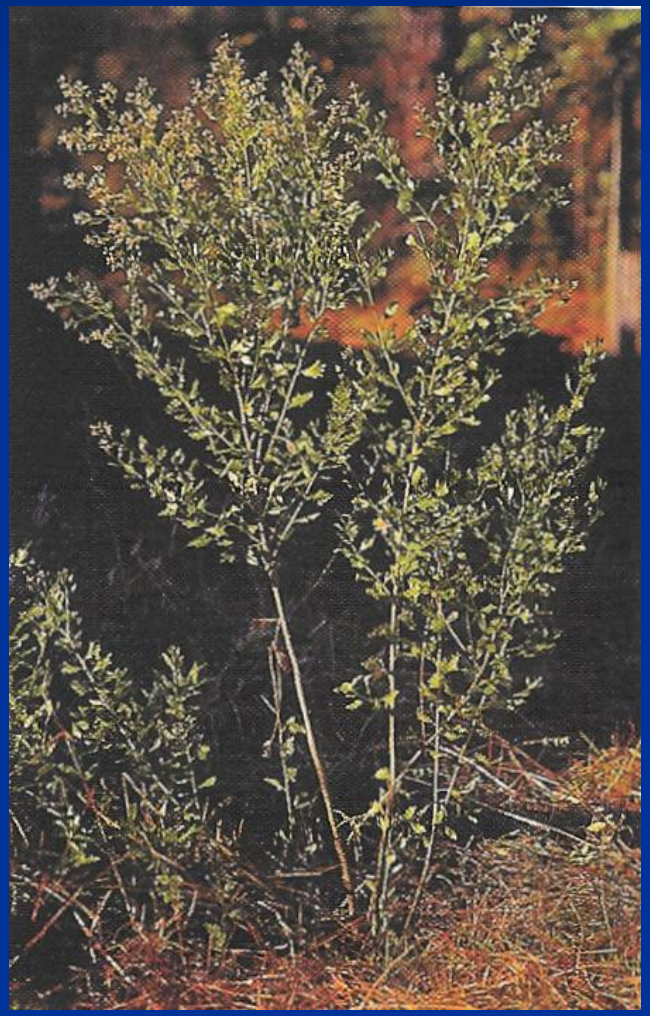
In SFR 107, I use “Size and Form” as a synonym for “Habit”

Tree: a woody plant that <u>at maturity</u> generally :

- **has a single unbranched stem for several feet above the ground**
- **attains a minimum height of 15-20 feet**
- **attains a minimum of 3 inches diameter breast height**

Size and Form: The General Sherman tree in Sequoia National Park averages 32 feet in diameter at its base and is 17.5 feet in diameter at 60 feet above the ground.

Shrub: a woody plant that at maturity has



T. Bodner

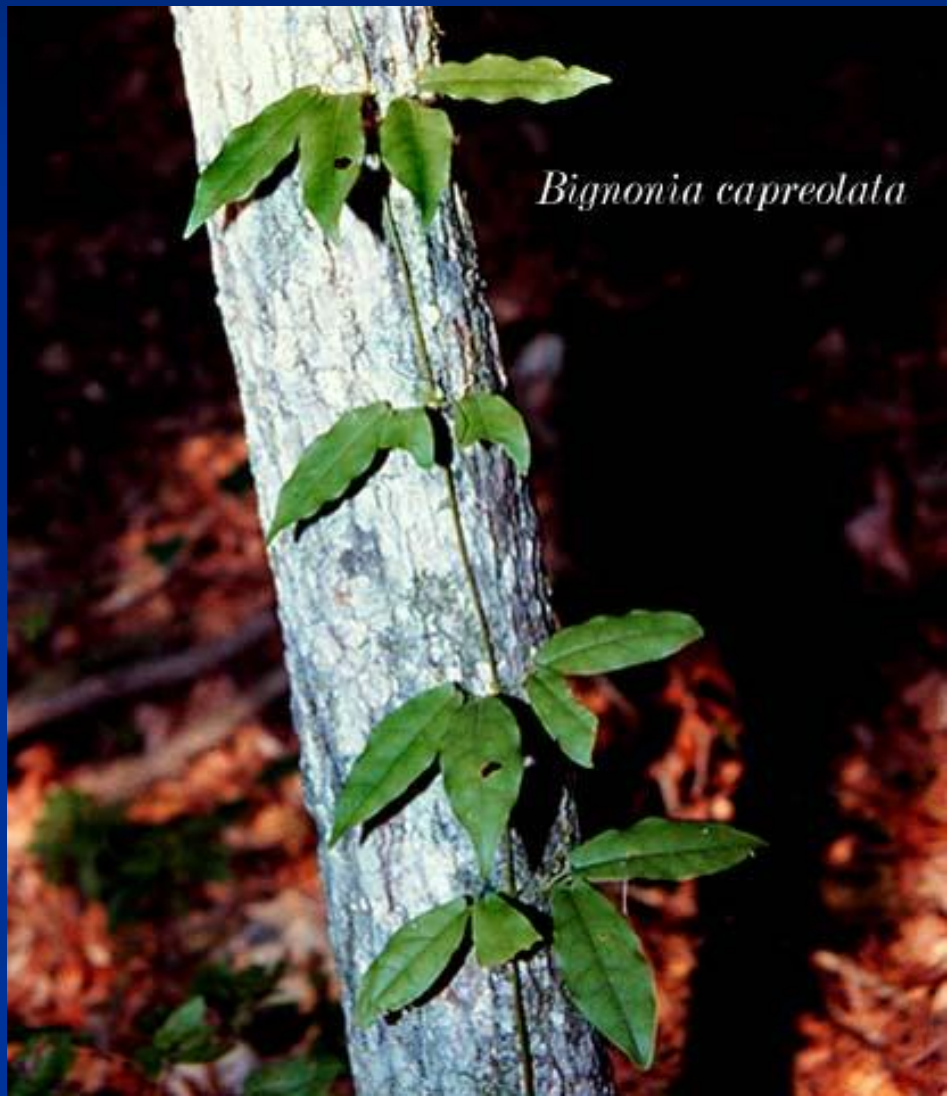
- several erect, spreading, or prostrate stems arising from a central location; bushy in appearance
- attains a maximum height of 15-20 feet; therefore smaller than a tree

Baccharis halimifolia, eastern baccharis

Vine or liana: a woody plant that at maturity climbs on a host plant by:

- twining around its host
- utilizing aerial roots to climb
- utilizing tendrils to climb

Normally do not have a stand-alone upright stem.



Primary Habits: (Branching Patterns)

Excurrent	Central dominant stem. Narrow symmetrical crown.
Decurrent	Repeatedly forking stem. Spreading crown.
Palm-like	Unbranched trunk. Leaves in rosette at top.
Yucca-type	Basal rosette of stiff leaves, or irregularly branched.

Picea engelmannii

Engelmann spruce

Excurrent habit

Quercus virginiana

Tree characteristically forms a broad spreading crown (Decurrent habit).