

Laboratory work 7

Features of the morphological structure of the
shoot

Modifications of shoot.

Material:

live and herbaric specimens of shoots of lycopodium (*Lycopodium* sp.), spruce (*Picea* sp.), cherries (*Cerasus* sp.), plums (*Prunus domestica* L.), linden (*Tilia cordata* Mill.), Lilac (*Syringa vulgaris* L.), horse chestnut (*Aesculus hyppocastanum* L.), apple (*Malus* sp.), Birch (*Betula pendula* Roth), grapes (*Vitis* sp.), hop (*Humulus lupulus* L.), Loosestrife (*Lysimachia nummularia* L.), Clover (*Trifolium* sp.), belousa (*Nardus stricta* L.), bluegrass (*Poa annua* L.), wheatgrass (*Elytrigia repens* (L.) Nevski.), maple (*Acer* sp.), willow (*Salix* sp.), Aristolichias (*Aristolochia* sp.), Wolf bast (*Daphne mezereum* L.).

Modified underground stems: bulbs, stem tubers,

Modified aerial stems: succulent stem, shoot tendril, thorns, stolons or runners.

Objective:

to investigate the morphological differences in the structure of the shoots the above plants.

Tasks of work:

To familiarize yourself with the external structure of the shoots; to show the difference of stems by the mode of growth, position in space, type branching, arrangement of leaves and buds.

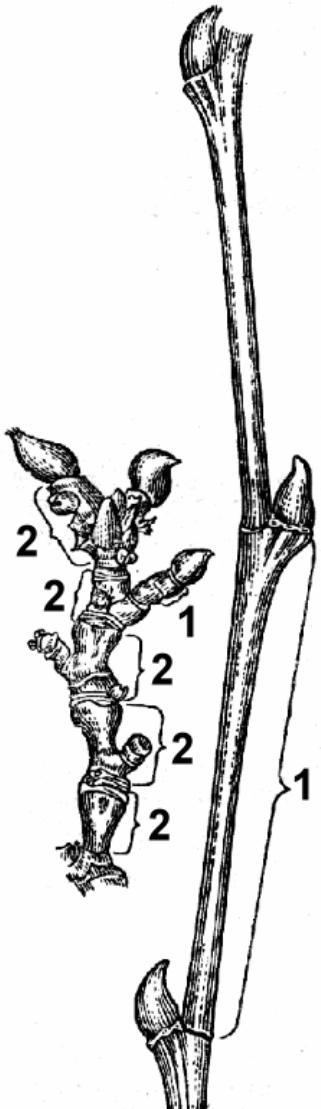
Draw shoot with buds, label nodes, internodes, buds. To analyze the types of buds and branching.

The order of execution:

1. On the example of wood, grass and indoor plants to study the morphological part of the shoots, select metamer, elongated and short shoots. Draw the morphological structure of the shoot.
2. To consider the herbaric samples of the shoots of various plants and draw them by location in space (erect, ascending, creeping, clinging, climbing, and so on).
3. To consider the shoots of various plants and determine the type of branching; draw the branching patterns of these plants (lycopodium, spruce, cherry, linden, lilac and so on).
4. To familiarize yourself with the features of branching bluegrass by example bluegrass, wheat grass; draw a tillering area and make notation.
5. Examine the leaf location on the shoots. Find the spiral, opposite, whorled arrangement of leaves. Draw them.
6. To consider the appearance and internal structure of the horse chestnut bud. Draw a longitudinal section of the bud and identify its parts.
7. To consider the buds on the shoots of various plants: horse chestnut, maple, willow, aristolochia, wolfberry, plum. Describe their features and classify.
8. To consider modified underground and aerial stems, draw it.

By the direction and mode of growth, the stems are often erect, less often - ascending (red clover), creeping (creeping clover, wild strawberries), creeping (cucumber, zucchini), curly (bindweed) clinging (hops), climbing (with tendrils), such as peas, floating (duckweed), emerging pop-up (waterlily), submerged (elodea), etc.

In botany, shoots consist of stems including their appendages, the leaves and lateral buds, flowering stems and flower buds. The new growth from seed germination that grows upward is a shoot where leaves will develop. In the spring, perennial plant shoots are the new growth that grows from the ground in herbaceous plants or the new stem or flower growth that grows on woody plants.



Vegetative shoot consists of a stem with leaves and buds. A node is the area of the stem from which the leaf (or leaves) grows. The section of the stem between two adjacent nodes is called the internodes.

Long shoots - shoots with long internodes. **Short shoots** - shoots with short internodes (spurs apple, pear).

A bud is an embryonic plant shoot. Most buds are classified according to several different criteria such as location and function. Generally most buds are formed on the tips of stems or at the base of leaves. Buds can develop into flowers or small shoots, and can also contribute to general shoot growth.

Buds are often useful in the identification of plants, especially for woody plants in winter when leaves have fallen.^[4] Buds may be classified and described according to different criteria: location, status, morphology, and function.

Botanists commonly use the following terms:

for location:

terminal, when located at the tip of a stem (**apical** is equivalent but rather reserved for the one at the top of the plant);

axillary, when located in the axil of a leaf (**lateral** is the equivalent but some adventitious buds may be lateral too);

adventitious, when occurring elsewhere, for example on trunk or on roots (some adventitious buds may be former axillary ones reduced and hidden under the bark, other adventitious buds are completely new formed ones).

for status:

accessory, for secondary buds formed besides a principal bud (axillary or terminal);

resting, for buds that form at the end of a growth season, which will lie dormant until onset of the next growth season;

dormant or **latent**, for buds whose growth has been delayed for a rather long time. The term is usable as a synonym of *resting*, but is better employed for buds waiting undeveloped for years, for example **epicormic buds**;

pseudoterminal, for an axillary bud taking over the function of a terminal bud (characteristic of species whose growth is **sympodial**: terminal bud dies and is replaced by the closer axillary bud, for examples **beech**, **persimmon**, **Platanus** have sympodial growth).

or function: **vegetative**, if only containing vegetative pieces: embryonic shoot with leaves (a **leaf bud** is the same);

reproductive, if containing embryonic flower(s) (a **flower bud** is the same);

mixed, if containing both embryonic leaves and flowers.

Arrangement of leaves on a stem is called as Phyllotaxy. There are several methods that plants use to arrange leaves on their stem. It is basically 4 ways as;

Alternate

In this arrangement, leaves are arranged alternatively on the stem with one leaf per node in a straight line. **Opposite**

Here, two leaves arise from a single node in opposite fashion

Spiral

Only one leaf is present per node as in alternate arrangement. But, the leaves are arranged as a spiral which would be visible if you look down at the apex of the stem.

Whorled

Multiple leaves arise from a single node and each nodes are separated by huge internodes.

Common Leaf Arrangements



Alternate

Opposite

Whorled

Monopodial
Branching

growth of main axis
causes increase
in height

Sympodial
Branching

growth of lateral branches
causes increase
in height

Dichotomous
Branching

growth of all branches
causes increase
in height

The Shoot

- Shoot- the above ground portion of the plant, consisting of stem and leaves.
 - Stem- the above ground axis of vascular plants.
 - Leaf- the principle lateral appendage of the stem.
 - Foliage leaf- photosynthetic organ.
- Node- the part of the stem where one or more leaves are attached.
- Internode- the region of the stem between two successive nodes.
- Bud- an embryonic shoot protected by young leaves.

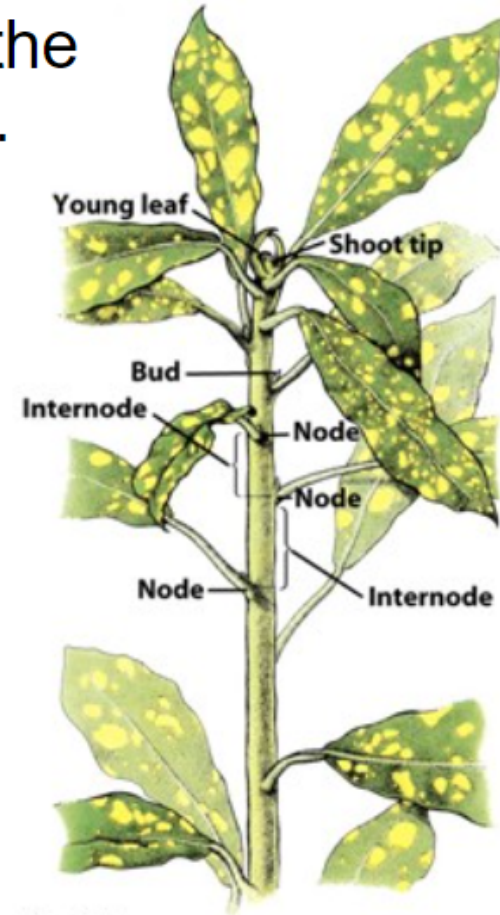
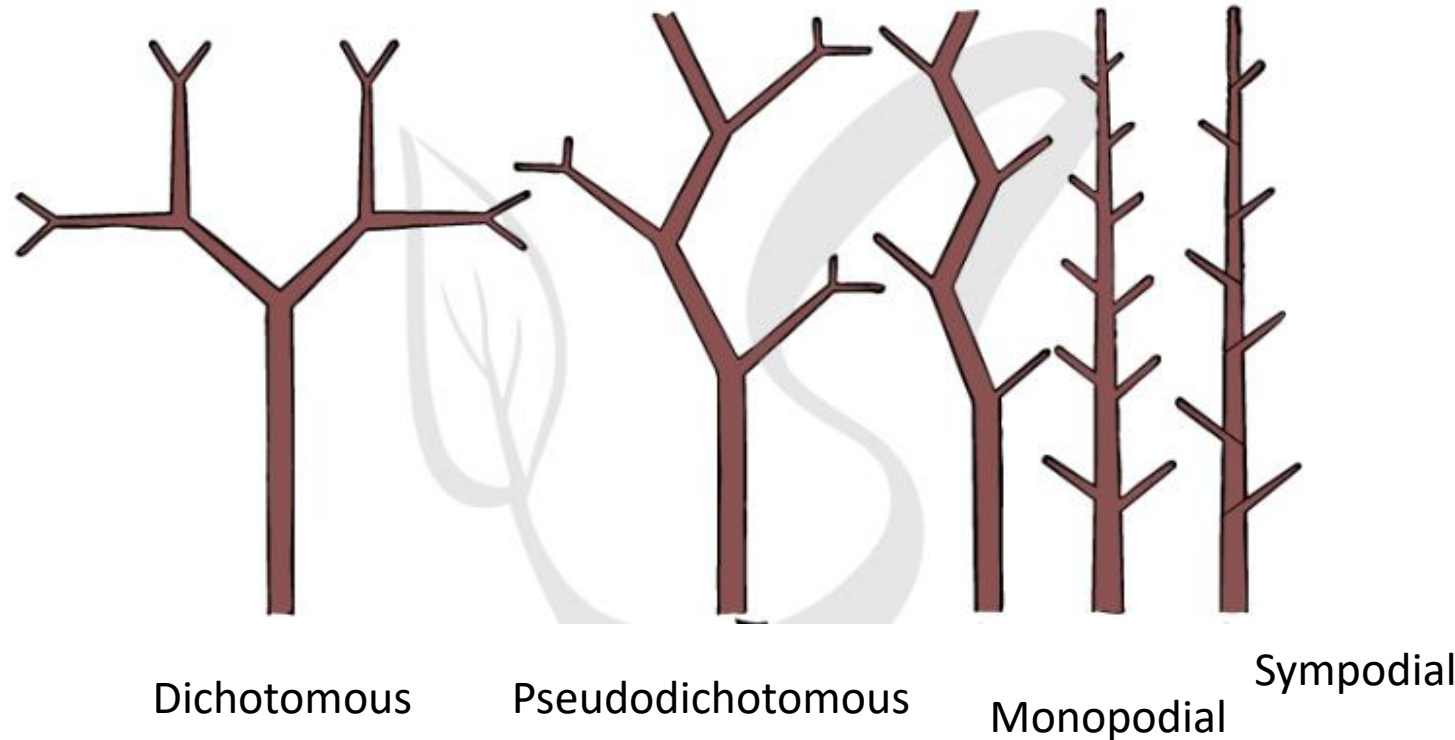


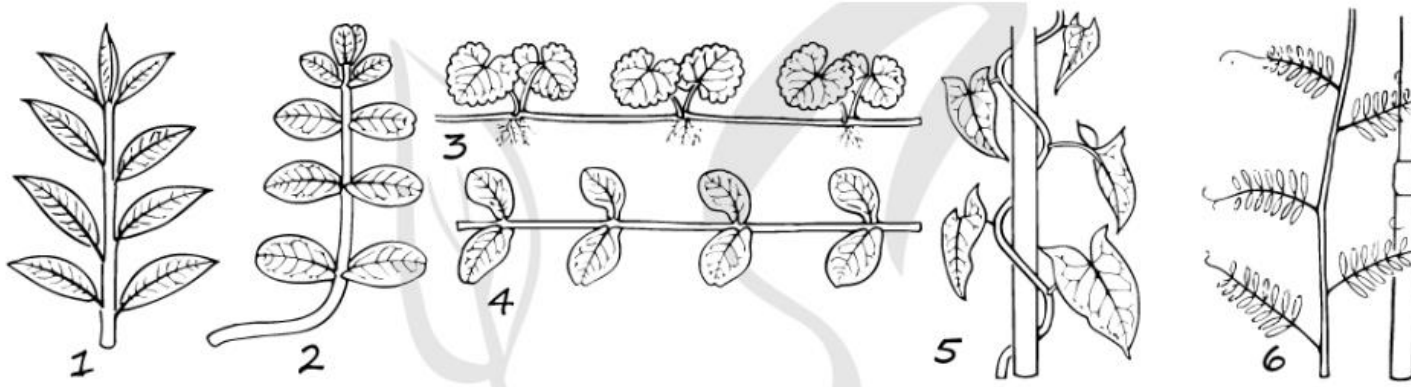
Figure 25-1
Biology of Plants, Seventh Edition
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Shoot branching



- Monopodial – growth of the main axis causes increases in height (Angiosperms: pear, plum, apple tree)
- Sympodial – growth of the lateral branches causes increases in height (Gymnosperm plants: pine, spruce)
- Dichotomous – growth of the all branches causes increases in height (higher spore plants, moses)
- Pseudodichotomous - the apical bud dies, and two oppositely located lateral buds form two apical shoots (lilacs, horse chestnuts)

Types of the localization of the shoot



1. Erect Shoot (Sunflower)
2. Ascending Stem (Clover)
3. Creeping Shoot (Strawberries)
4. Procumbent Shoot (Watermelon, Melon)
5. Hopbind Shoot (Bindweed)
6. Climbing Stem (Peas)