

**MINISTRY OF HEALTH OF UKRAINE
BOGOMOLET'S NATIONAL MEDICAL
UNIVERSITY**

**Sample test questions with explanations for preparation
for the licensed exam USQE-1
(PHARMACEUTICAL BOTANY)**

a manual for students of higher pharmaceutical educational
institutions of the III-IV accreditation levels

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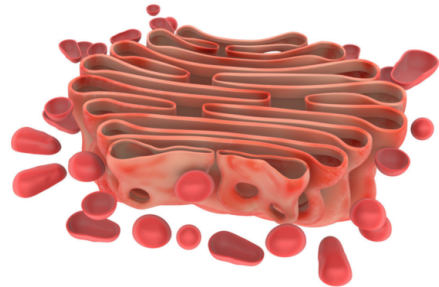
- 1. Plant cell**
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Gymnosperms.**
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Plant cell

1. During examination of a plant cell under the electron microscope some structures in form of a **stack of flattened membrane cisterns and vesicles** were found. What organelles are these?

- A. **Golgi apparatus**
- B. Endoplasmic reticulum
- C. Plastids
- D. Mitochondrions
- E. Microbodies

The **Golgi apparatus** or **Golgi complex** contains cisterns and vesicles. Golgi complex is responsible for secretory processes, accumulation and excretion off different substances from cells, formation of endoplasmic reticulum (ER) and the cell membrane.



2. It is known that in plants the synthesis of secondary reserve starch occurs in:

- A. **Amyloplasts**
- B. Proteinoplasts
- C. Elaioplasts
- D. Chloroplasts
- E. Chromoplasts

Leucoplasts are the plastids without pigments. They divided in **amyloplasts** that form reserve *starch*, proteoplasts – form reserve proteins, oleoplasts – accumulate fatty oils.

3. Microscopic examination of a **potato tuber** showed some cell inclusions that become **blue-violet** as affected by **Lugol's iodine solution**. These inclusions are:

- A. **Starch granules**
- B. Insulin crystals
- C. Aleurone grains
- D. Drops of fatty oil
- E. Calcium oxalate crystals

Starch ($C_6H_{10}O_5$)_n – is the most widely spread substance in the plant world. According to the method of forming starch is divided in **primary** and secondary. **Primary** is formed in the process of *photosynthesis* with the help of *chloroplasts*. **Secondary** is divided in **transient (transitional)**, **reserve**, **defensive**. **Transient** forms and breaks on the ways of glucose solutions transportation. **Reserve** starch accumulates in amyloplasts of storage tissues of *rhizomes*, *tubers*, *seeds* and other parts of the plant in the form of *starch grains (granules)*. **Defensive (statocyte)** accumulates in the *root cap (tip)*, influencing on positive geotropism, and endoderm of the stem, influencing on negative geotropism.

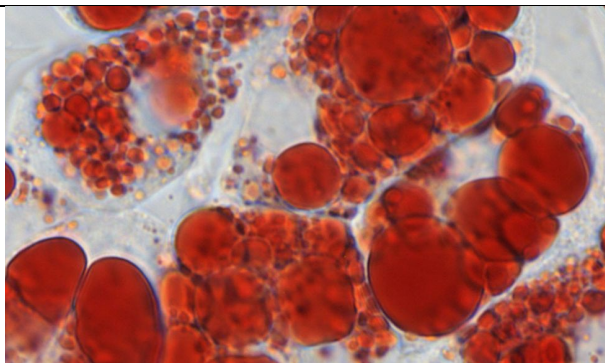
4. When a root tip was processed with **Lugol's solution**, the following was revealed in the root cap:

- A. **Statocyte starch**
- B. Compound proteins
- C. Glycogen
- D. Fatty oils
- E. Inulin

	<p>Under the action of iodine-containing reagent (Lugol's iodine solution) starch grains are colored in dark-purple.</p>
<p>5. The end product of starch hydrolysis is: A. D-glucose B. D-fructose C. Saccharose D. Maltose E. D-galactose</p>	<p>Under the action of hydrolytic enzymes (<i>amylase and diastase</i>) starch is broken down into <i>glucose</i> and intermediary products <i>dextrins</i>.</p>
<p>6. During photosynthesis within plant cell chloroplasts there is short-term retained starch being produced, which rapidly hydrolyzes into glucose. This starch is called: A. Primary B. Secondary C. Transitory D. Resistant E. Reserve</p>	<p>According to the method of forming starch is divided in primary and secondary. Primary is formed in the process of <i>photosynthesis</i> with the help of <i>chloroplasts</i>. Under the action of enzyme <i>diastase</i> it hydrolyzes and diffuses into other parts of the plant.</p>
<p>7. The section of a sunflower seed has been treated with Sudan III solution that caused pink-and-orange staining. This is the evidence of presence of: A. Fatty oil B. Protein C. Starch D. Inulin E. Cellulose</p>	<p>Lipids (fatty oils) are the basic product for storage, which is formed by oleoplasts. Fatty oils are concentrated in the seeds. They are very power-consuming storage substances. Under the action of Sudan III fatty oils are colored in pink-and-orange.</p>
<p>8. Microscopic study of soybean seeds</p>	

stained with **Sudan III** revealed **droplets** of various sizes. These droplets are:

- A. **Lipids**
- B. Proteins
- C. Starch
- D. Inulin
- E. Glycogen



9. It is known that depending on *pH* of cellular fluid **petal coloration** can vary **from blue-and-violet to pink and light pink**. This is caused by presence of:

- A. **Anthocyanins**
- B. Carotins
- C. Xanthophylls
- D. Phycobilins
- E. Chlorophylls

Anthocyanins — blue, red and purple pigments, that are found in many plant cells. Anthocyanins cause the color of flowers, fruits, stems, leaves. Depending on the *pH* of the cell juice, **anthocyanins** can acquire different shades (in acidic medium - red, in neutral - purple, in alkaline - yellow-green).

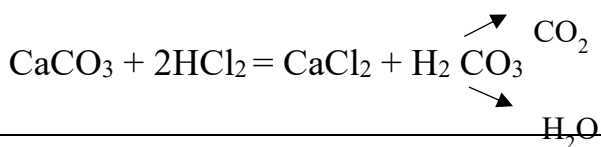
10. It is known that **bluish purple petal coloration** of a plant under examination varies up **to pink or light pink** according to *pH* of cellular fluid of vacuole. It is caused by presence of:

- A. **Anthocyanins**
- B. Carotins
- C. Xanthophylls
- D. Phycobilins
- E. Chlorophylls

11. Racemose **clusters of calcium carbonate crystals** are detected among the waste products of a protoplast. These crystals are:

- A. **Cystoliths**
- B. Raphides
- C. Isolated crystals
- D. Styloid crystals
- E. Crystal druses

Cystolith — internal growth of cell membrane where the salt of calcium carbonate are layered. It has an appearance of hilly body roundish or elongated form and consists of body and stalk connected with a plasma membrane.



12. Microscopic examination of a ficus

leaf revealed in some cells of its epidermis a **protrusion of the cell membrane with an accumulation of crystals** that dissolve in the **hydrochloric acid and release carbonic acid gas**. This structure is called:

- A. Cystolith
- B. Raphide
- C. Druse
- D. Single crystal
- E. Styloid

13. Morphologically the herbaceous plant being studied can be identified as **Convallaria majalis**. To confirm this conclusion additionally, a leaf of this plant was examined under the microscope and a search for the following crystalline inclusions was conducted:

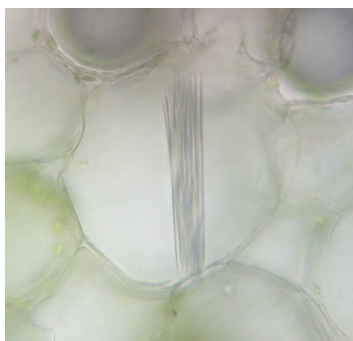
- A. Raphides
- B. Styloid crystals
- C. Single crystals
- D. Druse crystals
- E. Crystal sand

14. In monocotyledonous plants metabolism end-products are often represented by multiple needle crystals of calcium oxalate arranged in clusters. Name this structures:

- A. Raphides
- B. Crystalline sand
- C. Druses
- D. Twinned crystals
- E. Styloids

15. **Styloids** are big single elongate-

Raphids — are acicular crystals. Usually they are situated in the form of a bunch and fall out of the cell when it is damaged. Raphids occur more often in monocotyledon, rarely in dicotyledon.



Styloids – are elongate-prismatic needle-like crystals of calcium oxalate

<p>prismatic needle-like crystals. They are mostly typical for the following plants:</p> <p>A.Monocotyledonous B.Dicotyledonous C.Gymnospermous D.Lycopodiophyta E.Equisetophyta</p>	<p>with sharp edges. Styloids as well as raphids occur more often in monocotyledon.</p>
<p>16. In the course of plant cells treatment with phloroglucinol with concentrated sulfuric acid their cell walls became crimson-red, which means:</p> <p>A. Lignification B. Suberization C. Mucification D. Cutinization E. Mineralization</p>	<p>Lignification – impregnation of the cell wall by lignin. Qualitative reactions to lignification: 1. yellow-green coloring of walls with aniline sulphate solution. 2. crimson-red coloring of walls with phloroglucinol together with concentrated sulfuric and hydrochloric acid.</p>
<p>17. After a plant microslide had been processed with phloroglucinol together with concentrated hydrochloric acid, the cell membranes turned crimson-red. This indicates presence of:</p> <p>A.Lignin B.Pectin C.Cellulose D.Hemicellulose E.Suberin</p>	
<p>18. Name the process of cell membrane saturation with a fat-like substance – suberin:</p> <p>A. Suberization B. Cutinization C. Mucification D. Lignification E. Mineralization</p>	<p>Suberization (cork formation) - impregnation of the cell wall by suberin (lipoid). Qualitative reaction to suberization: 1. pink coloring of walls with Sudan III</p>
<p>19. Name the process of cell membrane saturation with a fat-like</p>	

substance – **suberin**:

A. Cork formation

B. Lignification

C. Sliming

D. Mineralization

E. Cutinization

20. As a result of staining of a plant microslide with *Sudan III* solution the cell membranes turned **pink**. This indicates the presence of:

A.Suberin

B.Cellulose

C.Lignin

D.Pectin

E.Hemicellulose

21.A vegetational microspecimen was treated with **Sudan III solution**. As a result of it cell membranes turned **pink** that means they contain:

A. Suberin

B. Cellulose

C. Lignin

D. Pectin

E. Hemicellulose

22. **Cork formation** occurs in cell membranes because they accumulate:

A. Suberin

B. Cutin

C. Cellulose

D. Mineral salts

E. Lignin

<p>23. After application of chlorine-zinc-iodine to the thick colourless cell membranes of collenchyme they became violet. That means the membranes are:</p> <p>A.Cellulose B.Lignificated C.Cutinized D.Mineralized E. Suberinized</p>	<p>The cell wall consists of cellulose, hemicelluloses and pectin substances. under the action of chlorine-zinc-iodine reagent cellulose is dyed in violet color.</p>
<p>24. Flax seeds are used in medicine as coating agents, due to the following ability of their secondary membranes:</p> <p>A.Sliming B.Suberization C.Gummosis D.Lignification E.Mineralization</p>	<p>Sliming – the intramolecular modification in the cell wall that results in formation of mucus. Qualitative reaction to sliming: 1. blue coloring of walls under the action of methylene blue.</p>
<p>25. Connection between plant cell protoplasts and their metabolic function is provided by thin cytoplasmic threads that pass through pores in the cell walls. Name these threads:</p> <p>A. Plasmodesma B. Microtubules C. Microfilaments D. Fibrils E.Cytoskeleton</p>	<p>There are thin parts (pores) in cell walls across which tubules (threads) of the cytoplasmic reticulum pass. They join neighboring cells. These tubules are called plasmodesma.</p>

Plant tissues

<p>26. Stem thickening occurs due to functioning of the following structures:</p> <ul style="list-style-type: none">A. Lateral meristemB. Apical meristemC. EndodermD. Wound meristemE. Intercalary meristem	<p>Meristems or meristematic tissues form all permanent tissues in the plant, provide growth of organs. Meristem cells are parenchymatous, alive, tightly closed with thin walls. They have large nucleus, thick cytoplasmic fluid and numerous ribosomes and with tiny vacuoles or no vacuoles at all. Chloroplasts and chromoplasts are absent; there are proplastids and leucoplasts. Meristems are divided according to the location in the plant (apical, intercalary, lateral, traumatic meristems) and origin (primary and secondary). Lateral meristems are located along all organs and cause their thickening. Primary lateral meristems include procambium and pericycle and secondary – cambium and phellogen or cork cambium.</p>
<p>27. While determining the type and characteristics of conducting bundles of axial organs one should take into account the positional relation between phloem and xylem and . . .</p> <ul style="list-style-type: none">A. CambiumB. ProcambiumC. CollenchymeD. PericycleE. Phellogen	<p>Cambium is situated between <i>xylem</i> and <i>phloem</i>. It is formed from procambium or cells of basic tissue. It is present in vegetative organs (except of leaf) of <i>dicots</i> and <i>gymnosperms</i> and provides their thickening.</p>
<p>28. Microscopy of monocotyledon leaf epidermis revealed that stomatal complex has four accessory cells. That means stomatal apparatus belongs to the following type:</p>	<p>According to the number of subsidiary (accessory) cells and their position relative to the stomatic cleft allows us to distinguish several types of <i>stomatal apparatus</i>. Tetracytic type of stomatal</p>

A. Tetracytic

B. Diacytic

C. Anisocytic

D. Anomocytic

E. Paracytic

29. Microscopy of a leaf epidermis of *Convallaria majalis* showed that the stomata had four accessory cells. Two of them were lateral, and two other were polar. What type of stomatal mechanism is it?

A. Tetracytic

B. Diacytic

C. Anisocytic

D. Anomocytic

E. Paracytic

apparatus is the type where the stoma with four subsidiary (accessory) cells, two of them are lateral and another two are polar (It is typical for monocots class).



30. Microscopy of leaf epidermis of *Lamiaceae (Labiatae)* family plants revealed that both accessory cells are perpendicular to a stoma. Such stomata are called:

A. Diacytic

B. Paracytic

C. Anisocytic

D. Anomocytic

E. Tetracytic

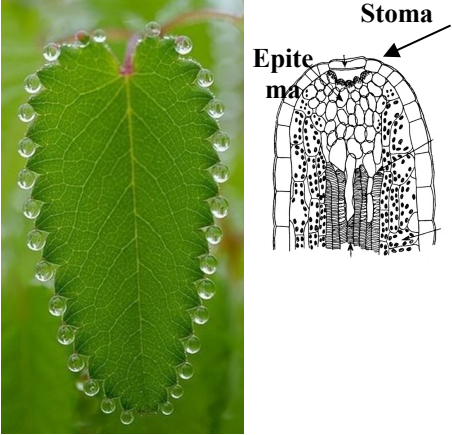
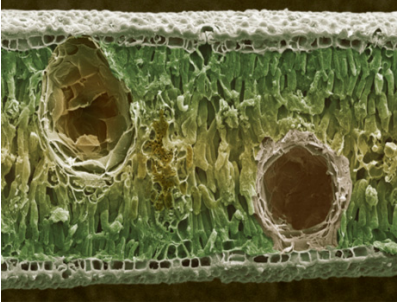
Diacytic type of stomatal apparatus is the type where two subsidiary (accessory) cells are perpendicular to the stomatic cleft (It is typical for *Lamiaceae*, *Caryophyllaceae* Families, *Dryopteris filix-mas*).

31. Examination of a root revealed a tissue that has root fibrils and doesn't have stomata and cuticle. What tissue is it?

Epiblema, or rhizoderma is primary covering (investing) single-layer root tissue. Cells of epiblema are thin-walled, deprived of cuticle. Stomas are

<p>A. Epiblema B. Epiderm C. Periderm D. Endoderm E. Exoderm</p>	<p>absent in this tissue. Each cell of epiblema is potentially capable of forming root hair (root fibrils).</p>
<p>32. Microscopical examination of transverse section of a root revealed investing tissue consisting of thin-walled, closely joining cells with root fibrilla. This tissue is called:</p> <p>A. Epiblema B. Root cap (pileorhiza) C. Periderm D. Endoderm E. Epiderma</p>	
<p>33. What tissue can be characterized by permeable cells located within the root of the primary structure?</p> <p>A. Endodermis B. Central axial cylinder C. Exodermis D. Mesodermis E. Pericycle</p>	<p>Endodermis is inner, usually one-lined layer of the primery cortex. It borders on the central cylinder. The cell sides of the endoderm have lens like thickening – Casparian strips (for Diocots) or they have the U- shaped thickening of the cell wall, become corked and die off (for Monocots).</p>
<p>34. A sample section of an axial body shows a complex consisting of phellogen and its derivatives - cork and phelloderm. This tissue is called:</p> <p>A. Periderm B. Colenchyma C. Sclerenchyma D. Epiblema E. Epidermis</p>	<p>Periderm is the secondary covering complex tissue, which is formed in the perennial dicots and gymnosperms plants by the end of the first year of living as the result of phellogen's activity. It consists of cork (or phellem), phellogen (cork cambium) and phelloderm.</p>
<p>35. A sample section of an arial body shows a complex consisting</p>	

<p>of phellogen and its derivatives - cork and phelloderm. Name this tissue:</p> <p>A. Periderm B. Epiblema C. Epidermis D. Colenchyma E. Sclerenchyma</p>	
<p>36. Microscopic examination of a perennial stem revealed the secondary integumentary tissue that was formed as a result of cell division of:</p> <p>A. Phellogen B. Procambium C. Cambium D. Pericycle E. Protoderma</p>	<p>Phellogen is formed from cells of basic tissue which is located under epidermis and keeps weak meristematic activity. In the process of periderm (secondary covering (integumentary) tissue) formation cells of phellogen divide and form the cork and phelloderm (parts of periderm).</p>
<p>37. Microscopic examination of ground tissue of a small branch revealed cork and phelloderm. These are the derivatives of:</p> <p>A. Phellogen B. Cambium C. Procambium D. Protoderm E. Pericycle</p>	
<p>38. Microscopic examination of a stem of a perennial plant revealed integumentary tissue of secondary origin that was formed as a result of activity of:</p> <p>A. Phellogen B. Procambium C. Cambium D. Pericycle</p>	

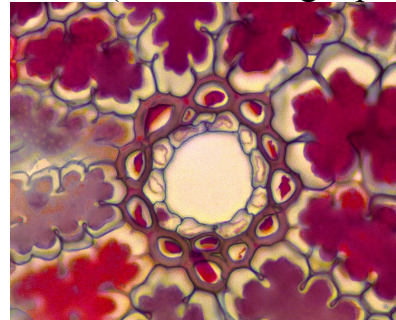
<p>E. Protoderm</p>	
<p>39. Microscopic examination of leaf serration revealed secretory structures secreting some liquid. What are these structures called?</p> <p>A. Hydatodes B. Nectaries C. Stomata D. Glandules E. Osmophores</p>	<p>Hydatodes (or water stomata) are complex excretory structures that provide excretion of water with mineral salts. They are same to stomas but their guard cells have no live contents, fixed and constantly open. With excessive absorption of water by plants, with a weakening of transpiration due to the increase in humidity, with the help of a hydatode there is a guttation - active excretion of water droplets. Hydatodes are usually placed along the 'of leaves (Stachys, Fragaria, etc.).</p>
<p>40. Microscopical examination of a leaf revealed water stomata on its serration. These stomata are for exudation of liquid- drop moisture. This process is called:</p> <p>A. Guttation B. Gas exchange C. Internal secretion D. Transpiration E. Photosynthesis</p>	
<p>41. It is known that rhizome and roots of <i>Inula helenium</i> have cavities without distinct inner boundaries filled with essential oils. They are called:</p> <p>A. Lysigenous receptacles B. Schizogenous receptacles C. Resin ducts D. Segmented laticifers E. Nonsegmented laticifers</p> <p>! incorrect answer</p>	<p>Lysigenous conceptacles (receptacles) are formed after destruction of secretory cells. That is why the conceptacle that accumulates essential oils does not have distinct inner boundaries.</p> 
<p>42. It is known that the leaves of <i>Eucalyptus globulus</i> have cavities</p>	<p>Schizogenous conceptacles (cavities) – intercellular or tubular structures which</p>

with well-defined internal boundaries and filled with essential oils. They are called:

A. Schizogenous cavities

- B. Non-articulated laticifers
- C. Schizolysigenous cavities
- D. Articulated laticifers
- E. Lysigenous cavities

are covered by living secretory cells that produce secretion into the intercellular space, which gradually increases in size. Most **schizogenous cavities** contain mucus, essential oils, resins (for example: galipot).



43. Within folded parenchyma of a fir needle there are cavernous structures filled with galipot and lined with live thin-walled secretory cells. Name these structures:

A. Resin ducts

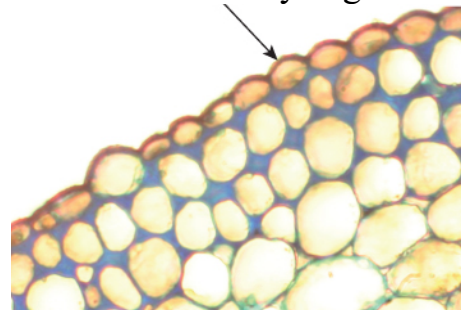
- B. Glandules
- C. Nectar glands
- D. Laticifers
- E. Hydatodes

44. Characteristic peculiarity of mechanic plant tissues is that they consist mainly of dead cells, but there is one type of mechanic tissues consisting of living cells. Which of the listed mechanic tissues contains the living protoplast?

A. Collenchyme

- B. Scleroids
- C. Libriform
- D. Perivascular fibers
- E. Phloem fibers

Collenchyme – is a mechanical tissue which consists of living cells. According to the character of walls thickening and density of cells location there are **angular**, **lamellar** and **lacunar** collenchyme. The cells of the **angular collenchyme** are tightly joined, walls are thickened by angles.



In **lamellar collenchyme** tangent sides are thickened. **Lacunar collenchyme** differs from other types of collenchyme by the presence of intercellular spaces.

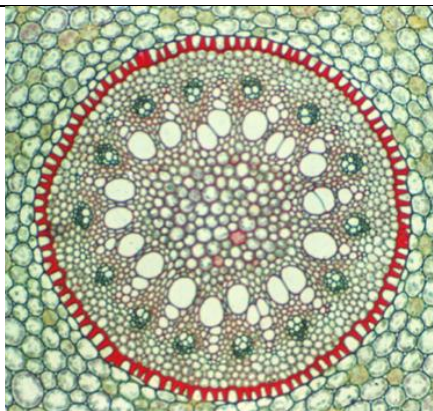
45. A substance performs mechanical

Sclerenchima – is a mechanical tissue

<p>function; its cells are covered with uniformly thick lignified membranes. This substance is:</p> <p>A. Sclerenchyma B. Collenchyme C. Periderm D. Cambium E. Sieve tubes</p>	<p>which consists of dead cells with thickened usually lignified walls. It is divided into sclereids (or stone cells) and fibers.</p>
<p>46. Old radish roots are less juicy, their storage xylem becomes porous and hard due to significant proliferation and lignification of:</p> <p>A. Vessels B. Parenchyma C. Bast fibers D. Companion cells E. Sieve tubes</p>	<p>Xylem (wood) is a complex tissue which consists of conductive tissue – <i>vessels and tracheids</i>, the mechanical tissue – <i>libriform (wood fiber)</i>, the storage tissue – <i>storage parenchyma</i></p>
<p>47. Analysis of the plant parts detected fragments of rhizomes. Their microscopy revealed periphloematic vascular bundles on section, the presence of which indicates that these samples belong to:</p> <p>A. Monocotyledons B. Dicotyledons C. Polypodiophyta D. Algae E. Gymnosperms</p>	<p>Periphloematic (centrophloem) vascular bundle is a type of conductive bundle which consists of phloem and xylem that surrounds the phloem. This type of bundle is typical to <i>monocotyledons</i>.</p>
<p>48. What type of conducting bundles is characteristic of all root zones of one-seeded plants?</p> <p>A. Radical B. Central phloem (Amphivasal) C. Central xylem (Amphicribal) D. Bilateral E. Collateral ! incorrect translation</p>	<p>Radial (radical) bundles (beams) are closed. Phloem and xylem interchange by the radius. Between the rays of xylem the parts of phloem are situated. Radial bundles are typical for the roots' absorption zone and are preserved in the roots' conductive zone of monocots (single-seeded plants, one-seeded plants).</p>
<p>49. When root is studied under microscope, one leading bundle is</p>	

detected in its maturation zone, where xylem and phloem areas interchange radially. It can be concluded that this bundle type is:

- A. Radial
- B. Collateral
- C. Bicollateral
- D. Amphicribal
- E. Amphivasal



50. Each root site performs a certain function due to the special cells that forms tissues. Zones allow growing of the earth, sucking substances out of the soil and carrin them to all other parts. Which of the following types of conducting beams are inherent in all root zones of single-seeded plants?

- A. Radical
- B. Central phloem (Amphivasal)
- C. Central xylem (Amphicribal)
- D. Bilateral
- E. Collateral ! incorrect translation

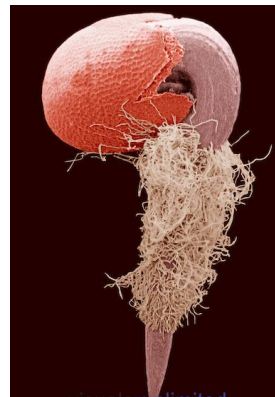
Vegetative organ

51. The study of the main root ontogenesis shows that it has developed from:

- A. Radicle
- B. Apical meristem
- C. Pericycle
- D. Lateral meristem
- E. Intercalary meristem

! incorrect translation

In all seed plants in the structure of the embryo the following parts are distinguished: embrionic rootlet (**radicle**), embrionic stem (hypocotyl), embrionic bud, one or two cotyledons (embrionic leaves).



52. While examining structure of a root the students payed attention to an area where the superficial cells formed

The **suction (absorption) zone**, or zone of root hair, is a system of root hairs (root fibrils) and other epibel cells (superficial

<p>root fibrils. What root zone is it?</p> <p>A. Suction B. Cell division C. Extension D. Conduction E. Pileorhiza</p>	<p>cells) of approximately 1.5-2 mm in length. A large number of root hairs provide a significant absorption surface.</p>
<p>53. Section of <i>Helianthus annuus</i> root has a secondary fascicular formation, it means that the section was made in the zone of:</p> <p>A. Fortification and conduction B. Growth and elongation C. Absorption D. Fissionable cells E. Root cap</p>	<p>The zone of anchoring and conduction (fortification and conduction, fixation and conduction) is the largest zone of the root. Root hairs in this area die off, the surface contains a covering tissue, the conductive elements are already fully formed (secondary fascicular formation). In this area the root branches, forming numerous lateral roots, and water with mineral salts obtained by root hairs from the soil moves from the root up the stem to the leaves.</p>
<p>54. On the root section of <i>Helianthus annuus</i> a secondary fascicular structure was found. This means that the section was made in the zone of:</p> <p>A. Fixation and conduction B. Growth and distension C. Absorption D. Dividing cells E. Root cap (pileorhiza)</p>	<p>Epiblema, or rhizoderma, is a single-layered, tightly closed cells, that provide suction function.</p> <p>The absorption of mineral solutions from the soil is carried out by all cells of the epiblema, but primarily by root hairs.</p>
<p>55. When root was being studied under microscope, root hairs were detected, which are cell growths of:</p> <p>A. Epiblema B. Epidermis C. Endoderm D. Exoderm E. Mesoderm</p>	<p>The mesoderm, or parenchyma of the primary cortex is multi-lined, consists of living cells that perform predominantly storage function and filled up with starch grains (starch granules, amyloid granules). The cells of mesoderm are alive, large, often roundish, with intercellular spaces. In the parenchyma of</p>
<p>56. Microscopic examination of a root cortex in the absorbing zone revealed that it consists mainly of multilayer living loose parenchyma with starch granules. This is:</p> <p>A. Mesoderm B. Endoderm C. Exoderm</p>	

<p>D. Collenchyme E. Phellogen</p>	<p>the bark the necessary substances for plants are synthesized, starch is deposited in the form of grains, calcium crystals of oxalate of various shapes and the like.</p>
<p>57. Microscopic examination of primary cortex of a root in its absorption zone revealed that it consisted mainly of multilayer loose living parenchyma with amyloid granules. It is called: A. Mesoderm B. Endoderm C. Exoderm D. Collenchyme E. Phellogene</p>	<p>Root is the underground radially-symmetric axial organ with unlimited growth and positive geotropism. The root executes the following functions: absorbs water and mineral substances from the soil, strenthens plants in the soil, accumulates nutritives, synthesizes some oorganic compounds, provides vegetative renewal (propagation, reproduction), links the plants with other organisms of the soil.</p>
<p>59. A student analyses plant organ with radial symmetry, unlimited growth and positive geotropism, which provides nourishment, vegetative reproduction and plant fastening in soil. This organ is: A. Root B. Stem C. Leaf D. Rhizome E. Seed</p>	

60. A student had to analyze an axial plant organ characterized by radial symmetry, unlimited growth, positive geotropism. It provided nutrition, vegetative propagation, anchorage of plant in the soil. This organ was identified as . . .

- A. **Root**
- B. Stem
- C. Leaf
- D. Rhizome
- E. Seed

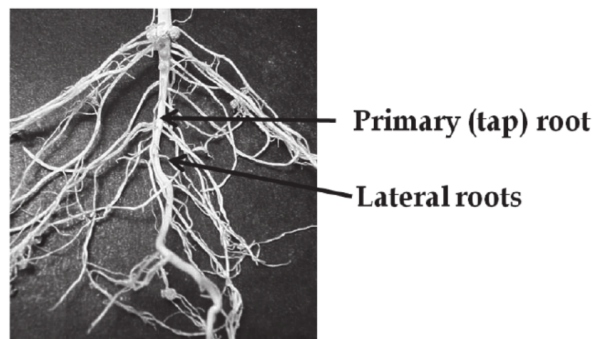
61. The student is studying a plant organ with *radial symmetry*, unlimited growth and *positive geotropism*. It provides nourishment, vegetative reproduction and plant fastening in the soil. Which of the following is described?

- A. **Root**
- B. Stem
- C. Leaf
- D. Rhizome
- E. Seed

62. Comparison of the underground organs of herbaceous plants revealed that in the bipartite annuals the following organ prevails:

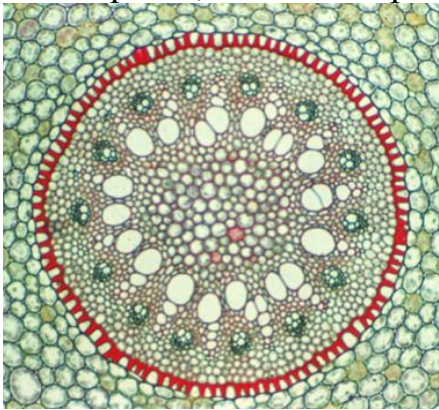
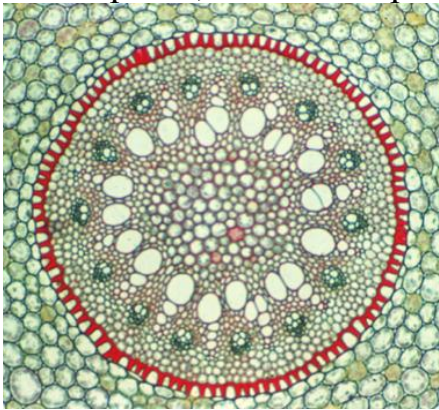
- A. **Main root system**
- B. Adventitious root system
- C. Rhizome
- D. Bulb
- E. Corm


Tap root system (main root system) is found in dicotyledonous (bipartite) and gymnospermous plants.



63. Microscopic analysis of a root revealed the following features: primary structure, endodermal cells with horseshoe-shaped areas, radial fascicle of the central cylinder, more than six xylem rays. Such root

Radial bundles are typical to the roots' absorption zone and are preserved in the roots' conductive zone of monocots. **Monocots** have the multiradiate bundle with more than 6 rays of xylem, and **dicots** can have at the most 6 rays of xylem.

<p>structure is typical for the following plants:</p> <p>A. Angiosperms, monocotyledons B. Angiosperms, dicotyledons C. Gymnosperms, conifers D. Gymnosperms, gnetales E. Pteridosperms</p>	
<p>64. What type of conducting bundles is characteristic of all root zones in one-seeded plants?</p> <p>A. Radial B. Amphivasal (Leptocentric) C. Amphicribal (Heterocentric) D. Bilateral E. Collateral</p> <p>! incorrect translation</p>	<p>Radial (radial) bundles (beams) are closed. Phloem and xylem interchange by the radius. Between the rays of xylem the parts of phloem are situated. Radial bundles are typical for the roots' absorption zone (where the primary anatomical structure is formed) and are preserved in the roots' conductive zone of monocots (single-seeded plants, one-seeded plants).</p> 
<p>65. What type of conducting bundle is characteristic of the primary anatomical structure of a root?</p> <p>A. Radial B. Bicollateral C. Concentric D. Closed collateral E. Open collateral</p>	
<p>66. On the photomicrograph of a herbaceous plant stem the bicollateral vascular bundles are clearly visible. The microspecimen represents the stem of the following plant:</p> <p>A. Pumpkin B. Rye C. Flax D. Corn E. Solomon's seal</p>	<p>The primary structure of Dicots stem changes into the secondary one. This happens due to the formation and function of the cambium and as a result the formation of open collateral (clover) and bicollateral bundles (pumpkin).</p>
<p>67. In root transverse section laying and formation from pericycle of the following organs can be seen in maturation zone:</p> <p>A. Lateral roots</p>	<p>Depending on the origin, the following types of roots are distinguished: main root, lateral roots and adventitious roots. The main root always develops from the</p>

<p>B. Trichome C. Additional roots D. Root hairs E. Root cap</p>	<p>embryonic rootlet. adventitious roots originate from any other organ of the plant: stems, leaves, tubers, bulbs, etc. The lateral roots form from the pericycle on the main and adventitious roots. Lateral roots are present in zone of anchoring and conduction (fortification and conduction, fixation and conduction, conducting zone).</p>
<p>68. Cross section of a root conducting zone shows pericycle that gives rise to: A. Lateral roots B. Trichomes C. Adventitious roots D. Root fibrilla E. Root cap</p>	<p>Haustorial (or parasitic) roots are metamorphosis of the root that is specific for parasite and semiparasite. Such kind of roots provide nutrition of parasite and semiparasite due to taking the necessary nutrients from tissues of higher plants.</p> 
<p>69. When studying <i>white mistletoe</i>, - perennial medicinal semiparasite plant, - it was revealed that its embryonic root buries into higher plant stem tissue and reaches vascular tissue system. This type of roots is called: A. Haustorial roots B. Photosynthetic roots C. Aerating roots D. Contractile roots E. Aerial roots</p>	<p>In the edible roots such as carrot, garden radish, beetroot has cambium formed by ring. Apart from carrot and garden radish that have one ring of cambium (monocambial structure), beetroot includes several rings of cambium (polycambial structure). Any way the presence of cambium determines belonging to the secondary anatomical structure.</p>
<p>70. A section of beet root has several layers of cambium that form additional conducting bundles. What is the structure of the given root? A. Secondary, polycambial B. Secondary monocambial C. Primary, polycambial D. Primary, monocambial E. Transitional, monocambial</p>	

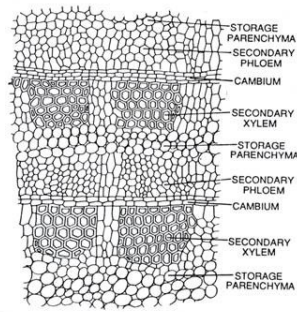


Fig. 42.41. The root. The root of *Betula*

71. A taproot plant develops a crown of basal leaves in the first year of its life and blooms and produces fruits in the second year of its life, after which it dies. Therefore, this plant is:

- A. **Biennial herbaceous**
- B. Annual herbaceous
- C. Perennial herbaceous
- D. Perennial shrub
- E. Perennial prostrate shrub

Biennial herbs during the first year of life form the leaf radical rosette and storage organs. During its second year the plants blossom and fructify.

72. Species character of *Thymus serpyllum* includes: apical inflorescences (flower heads), dark punctate glands on the inferior surface of a leaf, long hairs along the edge of leaf base, and:

- A. **Creeping stems**
- B. Thorns
- C. Climbing stems
- D. Short decumbent stems
- E. Stems with prickles

The shoot usually grows vertically upwards, but can grow horizontally. Vertical shoots are called orthotropic (upright), and horizontal - plagiotropic (**creeping**).

73. Name the above-ground sprout modifications that develop from lateral buds, are situated in leaf angles or inflorescences, and take part in vegetative reproduction:

- A. **Bulbils**
- B. Above-ground tubers
- C. Cladodes
- D. Tendrils
- E. Thorns

Bulbil also called bulblet, tiny secondary bulb that forms in the angle between a leaf and stem or on place of flowers on certain plants. Bulbils fall or are removed and planted to produce new plants.

74. Saffron propagates vegetatively - via corms which are a modification

Corm (or bulbotuber) is **underground metamorphosis (modification)** of shoot.

of . . . f

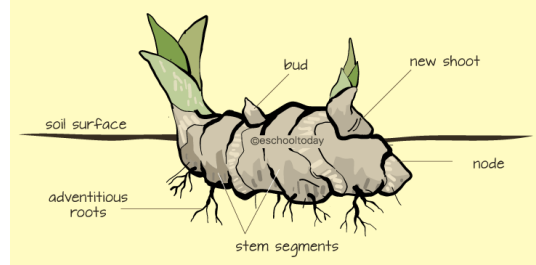
- A. **Underground** shoot
- B. Main root
- C. Above-ground shoot
- D. Lateral roots
- E. Additional roots

It is bulb with well-developed tuber-like stem, which is covered by filmy leaves. It provides vegetative propagation (reproduction).

75. Examination of a medicinal plant revealed that its underground organ had nodes, internodes, cataphylls, gemmae and secondary roots. Therefore, this underground organ is:

- A. **Rhizome**
- B. Storage root
- C. Root bulb
- D. Stolon
- E. Tuber

Rhizome is an underground metamorphosis of the shoot, that is proved by presence of nodes, internodes, cataphylls, adventitious (secondary) roots and apical and lateral buds (gemmae).



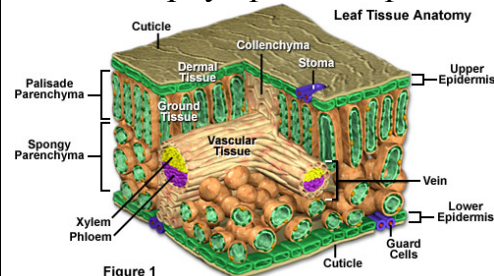
76. Examination of an underground organ of *Poligonatum odoratum* shows that it is horizontally oriented, uniformly thick and has nodes, internodes, round indentations, and an apical bud. Therefore, it is a:

- A. **Rhizome**
- B. Underground stolon
- C. Main root
- D. Root crop
- E. Root tuber

77. In a sample studied under a microscope the multilayer palisade (columnar) parenchyma can be clearly seen. Such structure is typical for:

- A. **Leaf**
- B. Root
- C. Dicotyledon stem
- D. Rhizomes of ferns
- E. Adventitious roots

Anatomical structure of a **leaf** is divided in three types: dorsiventral, isolateral, radial. The fierst two types include in their mesophyll *palisade parenchyma*.



78. Leaves of a plant under examination have a distinct main nerve

According to position of veins there are following types of venation (nervation):

in the middle with regularly diverging side nerves. What type of nervation is it?

- A. **Pinnate**
- B. Digitate
- C. Arcwise
- D. Parallel
- E. Dichotomic

79. Morphological analysis of leaves revealed that each vein runs along the lamina separately and the veins join together only at the top of the lamina. This kind of venation is called:

- A. **Arcuate**
- B. Pinnate
- C. Dichotomous
- D. Palmate
- E. Pinnate-reticulate

80. During morphological analysis of lily-of-the-valley (*Convallaria majalis*) leaf it was noted that lamina has wide elliptic shape and numerous veins are parallel to leaf margin and merge only at the leaf point. What is this venation type called?

- A. **Arcuate**
- B. Parallel
- C. Palmate
- D. Pinnate-reticulate
- E. Dichotomous

81. *Quercus robur* leaves have the following type of lamina shape and division:

- A. **Pinnatilobate**
- B. Trilobate
- C. Pinnatipartite
- D. Palmatilobate
- E. Palmatipartite

a) **pinnate** - only one conductive bundle penetrates leaf blade - the main vein (main nerve) is expressed legibly and passes along the leaf blade in the centre, the lateral veins (side nerves) are evenly distributed by both sides from the main vein;

b) dichotomous - each vein branches into two lateral equivalents;

d) **arcuate** - veins are equivalent, situated parallel to the leaf blade (margin) and joined at the leaf apex.


e) parallel - the leaf blade from the base to the apex penetrates several identical parallel unbranched veins



The simple leaves have only one blade, that can be entire or divided. Divided leaves are distinguished as:

1. **Pinnate** - free parts of leaf blade are on both sides of the main vein
2. **Ternate** and **palmate** - free parts of leaf blade are situated radially

<p>82. A simple leaf is being analyzed. Its lamina is divided and the incisions are deep enough to reach its base. Therefore, this leaf is:</p> <p>A. Pinnatisect or palmatisect B. Digitate C. Partite D. Lobate E. Ternate</p>	<p>As for degree of the blade irregularity leaves are subdivided into:</p> <ol style="list-style-type: none"> 1. Lobed – irregularity is more than 1/3 but less than 1/2 of the semi-blade 2. Partite – the free parts are equal 1/2-2/3 of the semi-blade 3. Dissected – cut up to the main vein of the leaf blade or to the base. <p>Compound leaves consist of a few petiole or sessile leaflets. The leaflets (folioles) attach to the apex of the petiole in the tricomound and palmately compound leaves. Among pinnate leaves there are paripinnately and odd-pinnately leaves. If the rachis is branching, leaves become bipinnately compound.</p>
<p>83. Leaves of <i>Aesculus hippocastanum</i> are composed of 5-7 assidenous folioles that are oblong-ovovate shaped with dentate-serrated margin, are attached to petiole (leaf rachis), and therefore are:</p> <p>A. Palmately compound B. Pinnately compound C. Pinnatisected D. Palmatisected E. Palmatilobed</p>	
<p>84. Each stem node of white deadnettle (<i>Lamium album</i>) has two leaves which grow perpendicularly to the leaves of the previous node. Such leaf arrangement is called:</p> <p>A. Cross-opposite B. Spiral C. Verticillate D. Rosette E. Leaf mosaic</p>	<p>Location of leaves on stem (or leaf arrangement) can be alternate (one leaf/node), opposite (two leaves/node placed on opposite side of the stem), crosswise-opposite (cross-opposite or opposite decussate leaf) arrangement (two leaves/node placed on opposite side of the stem which grow perpendicularly to the leaves of the previous node), whorled (two and more leaves/node).</p>
<p>85. The representatives of <i>Lamiaceae</i> Family have a leaf arrangement, where the pairs of leaves growing from two neighboring nodes on a stem are situated in two mutually opposite planes. What type of leaf arrangement is it?</p> <p>A. Opposite decussate leaf arrangement</p>	<p>Cross-opposite or opposite decussate leaf arrangement is typical to <i>Lamiaceae</i> family representatives.</p>

<p>B. Opposite leaf arrangement C. Spiral leaf arrangement D. Whorled leaf arrangement E. Rosette leaf arrangement</p>	
<p>86. During practical field session students have detected plant with diversity of leaves that differ by their placement on stem, parts development, size, shape, lamina division. This phenomenon is called:</p> <p>A. Heterophylly B. Phyllotaxy C. Metamorphosis D. Leaf mosaic E. Trichomes</p>	<p>Heterophyllous (heterophylly), or diversity, is the difference in the shape, size, structure and degree of irregularity of leaves of one plant.</p>  <p><i>Eucalyptus cinerea</i></p>
<p>87. During a morphological description of <i>Salvia sclarea</i>, students noticed its bright bracts. They serve to attract pollinating insects and are a modification of a:</p> <p>A. Leaf B. Pedicel C. Receptacle D. Androecium E. Shoot</p>	<p>Bracts (floral leaves) are brought coloured leaves, which carry out the function of perianth that is attracting insects.</p>
<p>88. Pulp of a needle leaf consists of living tissue with internal ansiform outgrowths of membrane. Along these outgrowths the chloroplasts are placed. Name the type of this leaf's parenchyma:</p> <p>A. Folded B. Spongy C. Palisade D. Storage E. Aeriferous</p>	<p>Anatomical structure of a leaf is divided in three types: dorsiventral, isolateral, radial. The fierst two types include in their mesophyll palisade parenchyma. The third which is typical <i>for needle-shaped leaves</i> consists of folded (plicate) parenchyma.</p>

89. Pulp of a needle leaf consists of living tissue with inner ansiform protuberances of membrane and chloroplasts along them. What is type of this leaf's parenchyma?

A. **Plicate**
 B. Spongioid
 C. Palisade
 D. Storage
 E. Aeriferous

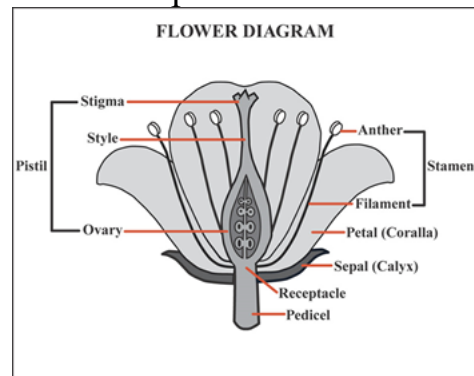
Generative organ

Fower

90. Colored or white component of double perianth, which consists of petals, is a:

A. **Corolla**
 B. Gynoecium
 C. Androecium
 D. Perigonium
 E. Flower cup

Corolla is a sterile usually bright or white part of flower that has leaf origion and consists of petals.



91. Actinomorphic corolla include: apopetalous

A. **Cruciform**
 B. Ligulate
 C. Funnelform
 D. Tubular
 E. Campanulate

Actinomorphic (actinomorphous) corolla has a few axis of symmetry. *Actinomorphic apopetalous (choripetalous) corolla* can be carnation-shaped, stellar and **cruciform** (is formed by four polar opposite petals, unguis is short, the limb is wide)

92. Representatives of *Asteraceae* family have various types of flowers except for:

A. **Bilabiate**
 B. Tubular
 C. Funnelform
 D. Ligulate
 E. Pseudoligulate

Bilabiate type of flowers belongs to zygomorphous ones. It consists of tube and bilobate upper and trilobite lower lips (limbs) and is typical for *Lamiaceae* family representatives (*Origanum vulgare*, *Salvia officinalis* and others)

93. Corolla of the origanum flower is

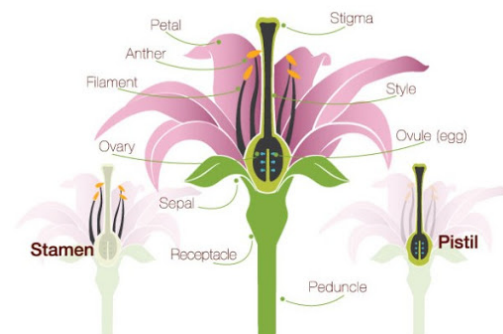
zygomorphic, sympetalous and consists of a tube and two limbs. The upper limb is bilobate and the lower is trilobate. Such corolla is called:

- A. **Bilabiate**
- B. Unilabiate
- C. Lingulate
- D. Thimble-like
- E. Tubular

94. Students should identify the following to determine the sex of a flower:

- A. **Stamens and pistils**
- B. Flower cup and corolla
- C. Pedicle and receptacle
- D. Symmetry
- E. Color and type of indumentum

Stamens and pistils belong to the fertile part of flower.



95. . A flower has the androecium consisting of two long and two short stamens. Therefore the flower's androecium is:

- A. **Didynamous**
- B. Tetradynameous
- C. Diadelphous
- D. Tetradelphous
- E. Polyadelphous

Didynamous (didymous) androecium has four stamens two of which have longer stamen filaments.

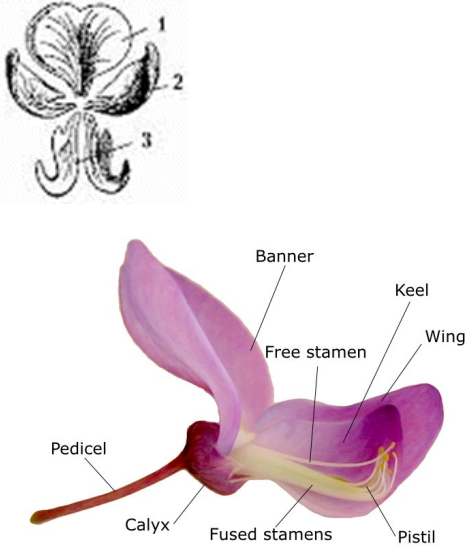
96. Androecium of *Brassica oleracea* flower has six stamens, with four stamens of inner circle longer than two stamens of outer circle. What is this type of androecium called?

- A. **Tetradynamous**
- B. Didynamous
- C. Diadelphous
- D. Monadelpheous
- E. Polydelphous

Tetradynamous (tetradymous) androecium has six stamens two of which have short filaments and four stamens have long filaments. It is typical for Brassicaceae family representatives (*Brassica oleracea* and others).

97. Upon examination of a flower it is determined to have **one pistil** made up of a **single free carpel**. Therefore, this gynoecium can be identified as:

A gynoecium is an aggregate of the carpels forming one or several pistils. **Monocarpous** gynoecium is represented by one carpel which forms

<p>A. Monocarpous B. Paracarpous C. Syncarpous D. Lusycarpous E. Apocarpous</p>	<p>one pistil, apocarpous consists of few or many free pistils with one carpel, and cenocarpous is represented by two or more pistils, that form one compound pistil</p>
<p>98. Corolla of a zygomorphic bisexual flower consists of 5 petals: the largest one is called banner, two lateral - wings, and two fused together - keel. This corolla is characteristic of <i>Fabacea</i> family and is called:</p> <p>A. Papilionaceous B. Lingulate C. Rotate D. Funnelform E. Tubular</p>	<p>Petals of papilionaceous flower of <i>Fabaceae</i> (<i>Leguminosae</i>) family plants (<i>Melilotus officinalis</i>, <i>Glycyrrhiza glabra</i>, <i>Glycine max</i>, <i>Pisum sativum</i> and others):</p> <p>1 – vexillum or standar or banner (1 petals) 2 - wings (2 petals) 3 – slipcover or keel (2 petals)</p>
<p>99. Corolla of a zygomorphic hermaphroditic flower consists of 5 petals: the largest one is called the banner, the two lateral petals are called the wings, and the two fused petals forming the keel. Such corolla is characteristic of medicinal plants of Leguminosae family. Name the type of corolla:</p> <p>A. Papilionaceous B. Labiate C. Saucer-shaped D. Funnelform E. Tubular</p>	
<p>100. One of the plants under examination has a zygomorphic flower and papilionaceous corolla. This plant is called:</p> <p>A. <i>Melilotus officinalis</i> B. <i>Mentha piperita</i> C. <i>Valeriana officinalis</i> D. <i>Urtica dioica</i> E. <i>Rosa canina</i></p>	

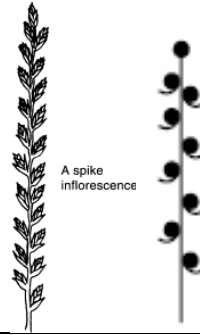
Inflorescence

101. <i>Plantago major</i> inflorescence	A spike – the main axis is lengthened,
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grows at the apex, its rachis is long, with sessile flowers. Name this type of inflorescence:

- A. **Spike**
- B. Panicle
- C. Capitulum
- D. Thyrsse
- E. Spadix

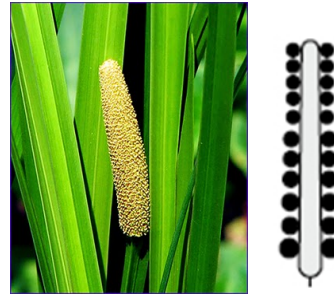
the flowers are sessile, alternate.



102. Examination of an inflorescence of sweet flag *Acorus calamus L.* revealed that it was encircled with a covering leaf (spathe) and small sessile flowers grew compactly on the thickened pulpy axis. Such inflorescence is called:

- A. **Ear**
- B. Glomus
- C. Spike
- D. Umbel
- E. Corymb

Inflorescences **spadix (ear)** of *Acorus calamus* - the main axis is elongated, thick, fleshy, densely covered with sessile flowers.



103. Cherry (*Prunus cerasus*) inflorescence has short floral axis and approximately same length pedicels emerging from one point. It is characteristic of the following inflorescence organisation:

- A. **Umbel**
- B. Corymb
- C. Raceme
- D. Spike
- E. Head

Scheme of **umbel** inflorescence



Prunus cerasus



Ledum palustre

104. Inflorescence of *Ledum palustre* has a significantly shortened rachis, connivent nodes, pedicels of the quite similar length. This inflorescence is called:

- A. **Umbel**
- B. Glomus
- C. Bostryx
- D. Spike
- E. Ament

105. A sour cherry has shortened principal axis of inflorescence, pedicels have nearly equal length and emerge like from the same point. It is typical for the following type of inflorescence:

- A. **Umbel**
- B. Corymb
- C. Truss
- D. Ear
- E. Anthodium

106. Morphological analysis of an inflorescence revealed that its flowers were attached to the same axis at different levels but due to the various length of peduncle they grew in the same plane. Such inflorescence is called:

- A. **Corymb**
- B. Anthodium
- C. Glomus
- D. Umbel
- E. Spike

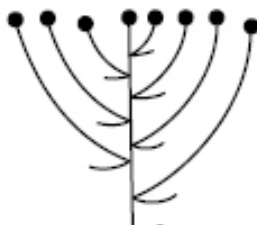
107. Morphological analysis of poplar inflorescence showed that it is a simple monopodial inflorescence: main axis is drooping, the flowers are sessile, unisexual. Specify the type of inflorescence:

- A. **Catkin**
- B. Head
- C. Capitulum
- D. Cyme
- E. Panicle

108. The birch has compound inflorescences with drooping main axis bearing dichasia composed of unisexual cells. Therefore, this inflorescence is called:

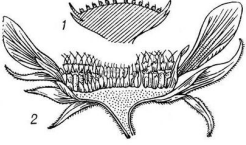







- A. **Ament**
- B. Raceme
- C. Spadix
- D. Spike

Scheme of **corymb** inflorescence



Scheme of **catkin (ament)** inflorescence



<p>E. Glomus</p> <p>109. <i>Calendula officinalis</i> as a representative of <i>Asteraceae</i> family can be characterized by the following type of inflorescence:</p> <p>A. Anthodium</p> <p>B. Catkin</p> <p>C. Umbel</p> <p>D. Capitulum</p> <p>E. Corymb</p>	<p>Inflorescence anthodium (flowerhead) - the main axis is horizontally grown into a common receptacle, surrounded by involucre from bracts, the flowers are small, sessile. Such inflorescence is typical for <i>Asteraceae</i> family.</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p style="text-align: center;">scheme of anthodium (flowerhead) inflorescence</p>
<p>110. <i>Calendula officinalis</i> which a representative of the <i>asteraceae</i> family is characterized by the following inflorescence type:</p> <p>A. Flowerhead</p> <p>B. Umbel</p> <p>C. Catkin</p> <p>D. Glome</p> <p>E. Cyme</p>	<p>Inflorescence capitulum (head, glome) - the main axis shortened and thickened, the flowers sessile or nearly sessile.</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div>
<p>111. <i>Astragalus dasyanthus</i> has sessile flowers gathered into inflorescences with a short thick axis. This kind of inflorescence is called:</p> <p>A. Capitulum</p> <p>B. Cyme</p> <p>C. Raceme</p> <p>D. Head</p> <p>E. Calathidium</p>	<p>Inflorescence dichasium (dichasial cymes) – cymose inflorescence in which two lateral axes of the second and following orders are located opposite each other.</p> <p>Scheme of dichasial inflorescence of <i>Tilia cordata</i></p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div>
<p>112. Diaphoretic herbal tea includes dichasial cymes with light-yellow, oblong, wing-like, squamelliferous perianth. The flowers are fragrant, yellowish. These inflorescences belong to:</p> <p>A. <i>Tilia cordata</i></p> <p>B. <i>Viburnum opulus</i></p> <p>C. <i>Robinia pseudoacacia</i></p> <p>D. <i>Mentha piperita</i></p> <p>E. <i>Padus avium</i></p>	<p>Inflorescence dichasium (dichasial cymes) – cymose inflorescence in which two lateral axes of the second and following orders are located opposite each other.</p> <p>Scheme of dichasial inflorescence of <i>Tilia cordata</i></p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div>

Seed

113. What forms from an ovule after fertilization of flowering plants?

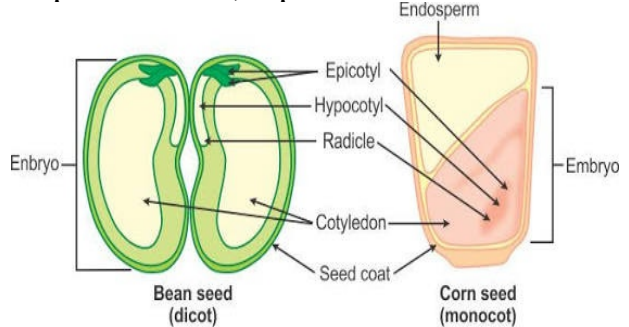
- A. Seed
- B. Gametophyte
- C. Sporophyte
- D. Fruit
- E. Endosperm

Seed forms from ovules situated in loci of the pistil ovary of flowering plants.

114. Seeds of rye, corn, and other crops have small corymb-shaped cotyledon and accumulate nutrients in the:

- A. Endosperm
- B. Gemmule
- C. Embryo root
- D. Perisperm
- E. Shell

Reserve nutritives are accumulated in the endosperm, sometimes in the perisperm, endosperm and perisperm or cotyledons of the embryo. Seeds with endosperm are typical for Poaceae family (rye, corn and others), Solanaceae, Ranunculaceae, Euphorbiaceae, Apiaceae and so on.

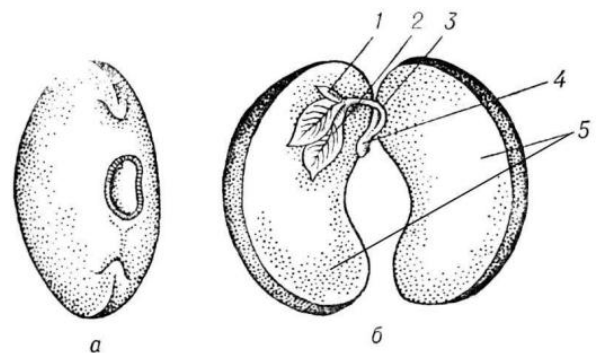


Monocot and Dicot seeds

115. It is known that a seed without endosperm and perisperm has its nutrients accumulated in:

- A. Embryo cotyledons
- B. Embryo root
- C. Embryo stalk
- D. Gemma
- E. Seed coat

Phaseolus vulgaris (common beans) belongs to the class of Dicotyledons, and therefore the seed has two cotyledons, in which nutritives are accumulated.



Structure of seed without endosperm:

a – general view of bean seeds; b – embryo without endosperm: 1 – embryonic bud; 2 – embryonic leaves; 3 – embryonic stem; 4 –

Fruits

116. Fruits of the *Apiaceae* family can be identified on the basis of a set of morphological features and presence of the following formation in the pericarp:

- A. **Essential oil tubules**
- B. Resin ducts
- C. Articulated laticifers
- D. Non-articulated laticifers
- E. Wax strips with stomata

The fruit of the *Apiaceae* family is cremocarp. It is cenocarpous, dry, dehiscent. The fruit has gum conceptacles with essence (**or essential oil tubules**).

117. You need to specify a monocarpous one-seeded fruit with hard scleroid endocarp and soft mesocarp. This fruit is:

- A. **Drupe**
- B. Legume
- C. Silique
- D. Capsule
- E. Bacca

The **drupe** is a one-seeded, monocarpous fruit, indehiscence. It consists of thin lather-like exocarp (peel), fleshy soft mesocarp and scleroid endocarp (stone).



Drupe fruits of representatives of the subfamily Prunoidae: apricot, plum, cherry.



118. The fruit of black locust is dry, formed of a single carpel, dehisces by the ventral and dorsal sutures on two sides, the. Such fruit is called:

- A. **Legume**
- B. Siliqua
- C. Follicle
- D. Capsule
- E. Silicula

The **legume** is formed from monocarpous gynoecium, which consists of one carpel. Legume is dry, open by two sutures. Seeds are attached to the ventral suture of valves.



119. Dry many-seeded monocarp fruit

Follicle – is dry, open along its ventral

opens along its ventral suture. It can be identified as:

- A. Follicle
- B. Legume
- C. Nutlet
- D. Drupe
- E. Capsule

120. Select the fruit that meets the description: monocarpic, dry, polyspermous, can be split apart only in the ventral suture. The seeds are located along the ventral suture:

- A. Follicle
- B. Coccus
- C. Fleshy stone fruit
- D. Dry stone fruit
- E. Follicetum

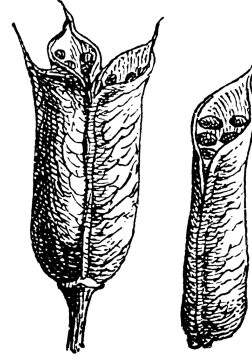
121. Many species of wild rose are a source of vitamins, fatty oils and herbal material. Specify the juicy pseudocarps that are procured as herbal raw material:

- A. Rose hips
- B. Coenobia
- C. Hesperides
- D. Aggregate-accessory fruits
- E. Cenocarp stone-fruits

122. Which of the following plants has pome fruit?

- A. *Sorbus aucuparia*
- B. *Prunus domestica* L.
- C. *Amygdalus communis*
- D. *Rosa majalis*
- E. *Prunus padus*

suture. It is man many-seeded.



Apocarpous fruit **cynarodium (rose hips)** belongs to false fruits (pseudocarps), as it is formed with the participation of juicy hypantiup, in which the nuts are situated. Cynarodium (**rose hips**) is used as plant raw material as it is a source of vitamins and fatty oils as well.



The subfamily Maloidea includes plants from the family Rosaceae, which have an apple fruit (*Malus domestica*, *Pyrus communis*, *Cydonia oblonga*, ***Sorbus aucuparia***, *Arónia melanocarpa*, *Crategus* species)



123. During field practice a student was tasked with making a morphological collection of coenocarpous fruits. What type of fruit belongs to this group?

- A. **Hesperidium**
- B. Drupe
- C. Cynarodium
- D. Aggregate-accessory fruit
- E. Fragaria

Cenocarpous fruits are formed from cenocarpous gynoecium, which consists of two or more carpels.

Hesperidium, or citrus - is the fruit of citrus genus representatives (lemon, orange, tangerine, lime, etc.) which belongs to cenocarpous fruits. It has a colored leathery exocarp containing essential oil, white, spongy mesocarp and fleshy (jucy) endocarp consisting of large juicy sac-cells.

124. One of the examined soft fruits is characterized by essential-oil exocarp, spongioid mesocarp and overgrown endocarp that consists of juice saccules. What fruit was under examination?

- A. **Hesperidium**
- B. Pepo
- C. Multicoccus
- D. Drupe
- E. Bacca



125. A citrus fruit is characterized by the glandular exocarp, spongiouse mesocarp and overgrown endocarp consisting of juice sacs. Such fruit is called:

- A. **Hesperidium**
- B. Legume
- C. Pod
- D. Drupe
- E. Bacca

126. One of fleshy fruits under examination is characterized by essential oil exocarp, spongy mesocarp and overgrown endocarp consisting of

juice sacs. What fruit was examined?

- A. **Hesperidium**
- B. Pepo
- C. Cinarodium
- D. Drupe
- E. Bacca

127. What type of fruit has a **juicy pericarp**, is many seeded, indehiscent, and forms from **coenocarpous gynoecium**?

- A. **Hesperidium**
- B. Silique
- C. Coenobium
- D. Fraga
- E. Cynarrhodium

128. A fruit under examination is pseudomonocarpic, with woody pericarp and one seed. The seed cuticle remains unfused with the pericarp. Such fruit is called:

- A. **Nut**
- B. Cremocarp
- C. Achenocarp
- D. Caryopsis
- E. Pseudomonocarpic drupe

Nut is a dry, indehiscent pseudomonocarpous (it is formed from cenocarpous gynoecium, but only one seed-bud is developed in the ovary after semination) fruit with a hard shell, with one or (rarely) two seeds. Hard woody pericarp of the nut does not grow together with the seed coat (cuticle). Examples of nuts are hazelnuts and walnuts, chestnuts, acorns.




129. During determination of fruit type *Hypericum perforatum* it was found that: the fruit is coebocarpous, dry, opens with valves and contains a big number of seeds. Therefore the fruit of *Hypericum perforatum* is:

- A. **Fruitcase**
- B. Multifollicle
- C. Follicle
- D. Coenobium
- E. Aggregate achene

The fruit of *Hypericum perforatum* is formed from cenocarpous gynoecium (**capsule or fruitcase**).



<p>130. During identification of fruits of <i>Datura</i> family they were determined to be a:</p> <p>A. Thorned quadrivalve capsule B. Berry in an orange cup C. Urceolate capsule with a lid D. Juicy globular cynarodium E. Glossy black berry</p>	<p>The structure of <i>Datura</i> fruit – capsule (or fruitcase).</p> 
<p>131. <i>Datura stramonium</i> has dry many-seeded fruits formed by syncarpous gynoecium that dehisce when the valves are broken off. Specify the fruit type:</p> <p>A. Capsule B. Follicle C. Siliqua D. Coenobium E. Hesperidium</p>	

Fungi. Highest spore bearing plants. Gymnosperms.

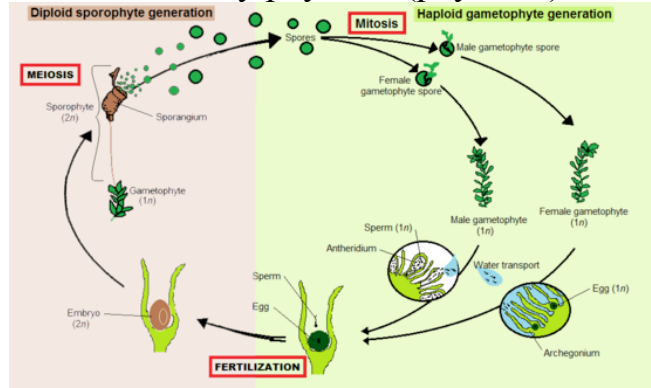
<p>132. Antibiotics produced by fungi belonging to <i>Penicillium</i> and <i>Aspergillus</i> genera are widely used in medicine. What class do these genera belong to?</p> <p>A. Deuteromycetes B. Basidiomycetes C. Zygomycetes D. Ascomycetes E. Chytridiomycetes</p>	<p>The <i>deuteromycetes</i>, commonly called molds, are “second-class” fungi that have no known sexual state in their life cycle, and thus reproduce only by producing spores via mitosis. The deuteromycetes are of particular use to humans as sources of medicinally important compounds, such as antibiotics. <i>Penicillium</i> species producing antibiotics for treating bacterial infectious diseases are examples of <i>deuteromycetes</i>. Many <i>deuteromycetes</i> are pathogens of animals, humans and plants.</p>
<p>133. Mycothallus of the fungus under study consists of a stipe, pileus, lamellar hymenophore. This fungus belongs in the class:</p> <p>A. Basidiomycetes B. Ascomycetes C. Zygomycetes D. Deuteromycetes E. Oomycetes</p>	<p>Basidiomycota (Basidiomycetes) are filamentous fungi composed of hyphae (except for basidiomycota-yeast) and reproduces sexually via the formation of specialized club-shaped end cells called basidia that normally bear external meiospores (usually four). These specialized spores are called basidiospores. However, some <i>Basidiomycota</i> are obligate asexual reproducers. <i>Basidiomycota</i> that reproduce asexually can typically be</p>

<p>134. Microscopy shows that basidia with basidiospores are formed on the hymenium. What division do these fungi belong to?</p> <p>A. Basidiomycota B. Ascomycota C. Chytridiomycota D. Zygomycota E. Lichenophyta</p>	<p>recognized as members of this division by gross similarity to others, by the formation of a distinctive anatomical feature: <i>stipe, pileus, lamellar hymenophore.</i></p>
<p>135. It is known that cells of <i>Chlorophyta</i> division representatives have chromatophores of various shapes. We can observe ribbon-like chromatophores in the species of the following genus:</p> <p>A. <i>Spyrogyra</i> B. <i>Volvox</i> C. <i>Clorella</i> D. <i>Chlamidomonas</i> E. <i>Spirulina</i></p>	<p>Genus <i>Spyrogyra</i> counts 300 species and belongs to Chlorophyta division. Representatives of such a genus consists of identical cylindrical cells capable of growth and division. There are haploid nucleus with a nucleole in the center of the cell. The chromatophores are green, ribbon-like located in the cytoplasm. The cell membrane is composed of cellulose and pectic substances.</p>
<p>136. A big brown alga has a stipe, rhizoids and laminae rich in alginates and iodine. It belongs to the following genus:</p> <p>A. <i>Laminaria</i> B. <i>Chlorella</i> C. <i>Chlamydomonas</i> D. <i>Spirogira</i> E. <i>Ulothrix</i></p>	<p><i>Laminaria</i> is a genus that counts 31 species of brown algae (Phaeophyta Division). This economically important genus is characterized by long, leathery laminae and relatively large size. <i>Laminaria</i> form a habitat for many fish and invertebrates. Various species of <i>Laminaria</i> have been used for food purposes since ancient times wherever humans have encountered them. The greater proportion of commercial cultivation is for algin, iodine, and mannitol.</p>
<p>137. Representatives of this division propagate vegetatively by special formations: isidia, soredia, lobules. Name this division.</p> <p>A. <i>Lichenes</i> B. <i>Basidiomycota</i> C. <i>Equisetophyta</i> D. <i>Lycopodiophyta</i> E. <i>Polypodiophyta</i></p>	<p><i>Lichenes</i> are composite organisms that arise from algae or cyanobacteria living among filaments of multiple fungi species in a mutualistic relationship. Vegetative reproduction (propagation) are provided by special formations: <i>isidia, soredia and lobules.</i></p>

138. A higher avascular plant shows clear alternation of generations with the dominant sexual (gametophyte) and reduced asexual (sporophyte) generation. This indicates that the plant relates to the:

- A. *Bryophyta*
- B. *Lycopodiophyta*
- C. *Equisetophyta*
- D. *Pteroid*
- E. *Gymnosperms*

Bryophytes is higher non-vascular plants in the life cycle of which sexual generation (gametophyte) dominates. The bryophytes lack the true conductive tissues of the phloem and xylem, as well as the roots, and the suction function is performed by the rhizoids. The shoot is divided into a stem of radial structure and leafy phylloids (phyllidia).



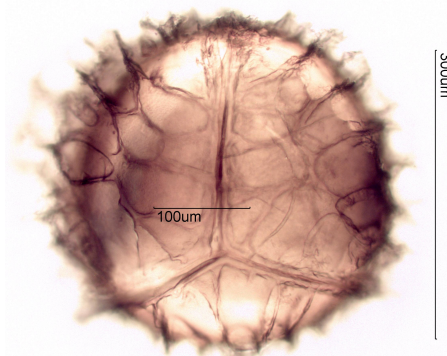
139. A higher nonvascular plant has distinct alternation of dominant sexual (gametophyte) and reduced asexual (sporophyte) generations. This indicates that the plant belongs to the following division:

- A. **Bryophyta**
- B. Lycoposida
- C. Equisetophyta
- D. Pteridophyta
- E. Gymnospermae

140. Spore and pollen analysis revealed tetrahedral spores with a semicircular base and reticular surface in the pollen. It is the spore of:

- A. *Lycopodiophyta*
- B. *Equisetophyta*
- C. *Bryophyta*
- D. *Polypodiophyta*
- E. *Pinophyta*

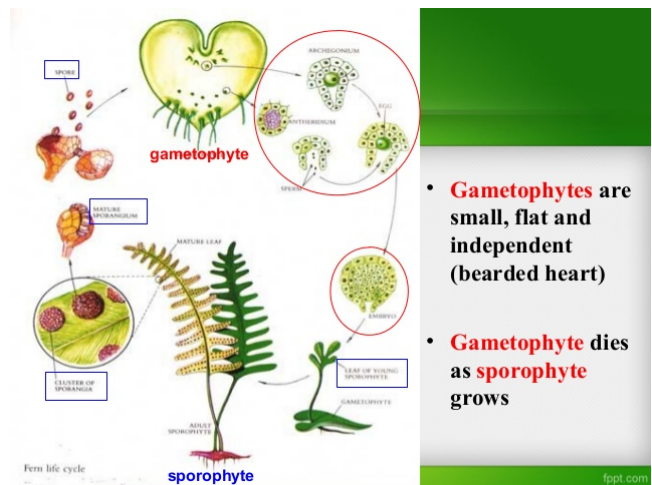
Structure of spore of *Lycopodiophyta* division. Spores are small, tetrahedral, pale yellow, not wetted with water, greasy and velvety to the touch



141. A plant under examination has a rhizome, big pinnatisected leaves with sori and sporangia on their undersurface. According to this data the plant should be related to one of the following divisions:

- A. *Polypodiophyta*
- B. *Pinophyta*
- C. *Magnoliophyta*
- D. *Equisetophyta*
- E. *Lycopodiophyta*

Polypodiophyta division in its development cycle has the dominant generation sporophyte, which is differ from other sporophytes by presence of big pinnatisected leaves and absence of cones. Their sporangia are gathered in sori on the underside (undersurface) of leaves and protected by indusium. Underground organ of representatives of Polypodiophyta division is rhizome.



142. Every year in autumn, a coniferous gymnosperm exhibits a fall of soft needles that grow on its short shoots. It is characteristic of the following genus:

- A. *Larix*
- B. *Pinus*
- C. *Cedrus*
- D. *Abies*
- E. *Picea*

Larix is the only genus among conifers, represented by deciduous trees. It belongs to *Pinophyta* division, *Pinopsida* class and *Pinaceae* family. The leaves are soft, slightly green, arranged on the short shoots by 20-40, and on the long shoots – alternate. The cones are not big, egg-shaped or long oval, skinny.



143. A common species of the *Pinaceae* family is a tall, evergreen, shade-enduring tree. The needles are solid, prickly, quadrangular in cross-section, spirally arranged. This tree is:

- A. *Picea abies*
- B. *Larix sibirica*
- C. *Pinus sylvestris*
- D. *Juniperus communis*
- E. *Ephedra equisetina*

Picea abies is an evergreen shady tree that belongs to *Pynophyta* division, *Pinopsida* class and *Pinaceae* family. Needles are short, tetrahedral (quadrangular), sharp (prickly), arranged spirally and only on long shoots. The female cones hanging down.

144. It is known that leaves of most gymnosperm species are represented by needles. Which one of the species listed below has macropodous leathery leaves with solid flabellate lamina, dichotomous venation and one or several notches along the upper margin?

- A. *Ginkgo biloba*
- B. *Cedrus libani*
- C. *Juniperus communis*
- D. *Picea abies*
- E. *Abies sibirica*


Ginkgo biloba is a deciduous tree belonging to the *Pynophyta* division, the *Ginkgopsida* class and the *Gingaceae* family. It differs from other gymnosperms by the presence of long petiolar, fan-shaped (flabellate) with dichotomous nervation (venation) of leaves.



145. It is known that in most species of the gymnosperms the leaves are in the form of needles. However, a certain gymnosperm species has leathery leaves with long petioles, individuated **fan-shaped lamina, dichotomous venation**, and one or several sinuses along the upper edge. These leaves belong to:

- A. *Ginkgo biloba*
- B. *Juniperus communis*
- C. *Picea abies*
- D. *Cedrus libani*
- E. *Abies sibirika*

Flowering plants

<p>146. A medicinal herb under examination has the capsule fruit with laticifers and small openings. This herb is called:</p> <p>A. <i>Papaver somniferum</i> B. <i>Chelidonium majus</i> C. <i>Zea mays</i> D. <i>Mentha piperita</i> E. <i>Sanquisorba officinalis</i></p>	<p><i>Papaver somniferum</i> is an annual herbaceous plant belonging to the <i>Papaveraceae</i> family. All parts of the plant contain laticifers with poisonous, white milky juice (latex). Stem, leaves and sepals pubescent with long emergences. Leaves are stem-shaped, broad-lanceolate. The flowers are single, large, on long peduncles, with cenocarpous gynoecium (pistil formed by a big number of carpels). Fruit-capsule (fruitcase), which opens with small openings (orifices).</p>
<p>147. A medicinal plant under examination has a pistil formed by a big number of carpels, and a fruitcase that opens with small orifices. This is:</p> <p>A. <i>Papaver somniferum</i> B. <i>Chelidonium majus</i> C. <i>Zea mays</i> D. <i>Mentha piperita</i> E. <i>Sanquisorba officinalis</i></p>	 <p>The image contains two botanical illustrations. On the left is a detailed scientific illustration of <i>Papaver somniferum</i>, showing a red flower, a white flower, and a capsule with a lobed top. On the right is a photograph of a purple capsule with a golden-brown, lobed top, which is a characteristic feature of the opium poppy.</p>
<p>148. During identification of a perennial herb of <i>Ranunculaceae</i> family it was found to have: apical flowers of regular form up to 6 cm in diameter; 5 downy violet- and-green calyx lobes of irregular serrate form; up to 20 bright yellow glossy petals without nectarostigma. What plant is it?</p> <p>A. <i>Adonis vernalis</i> B. <i>Helleborus purpurascens</i> C. <i>Ranunculus acris</i> D. <i>Delphinium elatum</i> E. <i>Aconitum napellus</i></p>	<p><i>Adonis vernalis</i> is a perennial herbaceous plant belonging to the <i>Ranunculaceae</i> family. Flower has a compound perianth that is golden yellow and consists of 6-20 free petals without nectaries (<i>nectarostigma</i>), the fruit is polynutlet.</p>
<p>149. <i>Quercus robur</i> leaves have the following type of lamina shape and division:</p> <p>A. Pinnatilobate B. Trilobate C. Pinnatipartite</p>	<p>Oak (<i>Quercus robur</i>) is a monoecious tree belonging to the <i>Fagaceae</i> family. Leaves alternate, short petioled, pinnatilobate. Male flowers are gathered in ament-shaped thyrses. Female flowers are gathered in 2-5 in the axils of the upper leaves. Fruit is acorn.</p>

- D. Palmatilobate
- A. Palmatipartite



150. Gastric herbal tea contains oval brown lignified “cones” up to 1,5 cm long, which are:

- A. *Alnus infructescences*
- B. *Larix* cones
- C. *Cupressus* cones
- D. *Platyclusus orientalis* cones
- E. *Juniperus galbuli*

Alnus glutinosa has the hard fruits are ovoid to nearly globose and measure 1.2-2.5 cm long and 1-1.5 cm wide. They are called “collective fruits” or “cone”. “Collective fruits” or “cone”, which are the plant composition, have: gastric, sudorific, antiulcer.



151. To make diaphoretic herbal tea the following inflorescences are used: 3-15 corymbose dichasia with light-yellow oblong wing-shaped membranous recaulescent squamella that fuses halfway with floral axis. Flowers are fragrant, yellowish. These inflorescences belong to:

- A. *Tilia cordata*
- B. *Viburnum opulus*
- C. *Robinia pseudoacacia*
- D. *Mentha piperita*
- E. *Padus avium*

Scheme of dichasial inflorescence of *Tilia cordata*



152. A herbaceous plant has upright stems, branching in their upper part. The leaves and flowers contain dark cavities. The

Hypericum perforatum – is a perennial herbal plant of the *Clusiaceae* family. Presense of cavities with dark secret is typical of this plant. The leaves are opposite, sessile, with

inflorescence is an apical corymb with yellow flowers. The fruit is a trihedral capsule. This description is characteristic of:

- A. *Hypericum perforatum*
- B. *Althaea officinalis*
- C. *Capsella bursa-pastoris*
- D. *Thea sinensis*
- E. *Ledum palustre*

numerous light and dark glandulas. The inflorescence is corymb-lice thyrses. Flowers are yellow, consist of 5 petals with glandulas on them. The fruit is a trihedral red-brown capsule.



153. A leaf of a plant under examination has a membranous ochrea wrapped around the internode base. Presence of such modified stipules is the diagnostic feature of the following family:

- A. ***Polygonaceae***
- B. *Gramineae*
- C. *Rosaceae*
- D. *Legumes*
- E. *Solanaceae*

Polygonaceae family is presented mostly by perennial herbaceous plants. The leaves are simple and arranged alternately on the stems. Each leaf has a peculiar pair of fused, sheathing stipules known as an *ochrea*. The flowers are normally bisexual, small, and actinomorphic, with a perianth of three to six sepals. The fruit is nutlet.



154. A plant under study has stipules fused together and thus forming a tight tube - ochrea, that is a diagnostic feature of the following family:

- A. ***Polygonaceae***
- B. *Gramineae*
- C. *Rosaceae*
- D. *Papaveraceae*
- E. *Clusiaceae*

155. A leaf has glumaceous ochrea. It clasps bottom of internode and is a modified stipule. This is diagnostic sign of

the following family:

- A. *Polygonaceae*
- B. *Gramineae*
- C. *Rosaceae*
- D. *Legumes*
- E. *Solanaceae*

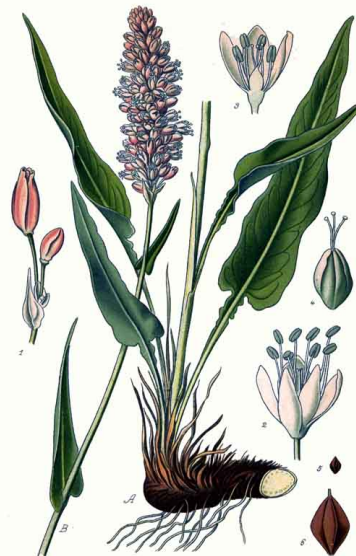
156. When studying a herbarium specimen of *Persicaria maculosa*, the following diagnostic sign, characteristic of all *Polygonaceae* family representatives, was noted:

- A. **Ochrea**
- B. Essential oil glands
- C. Legume fruits
- D. No petioles
- E. Compound leaves

157. A certain perennial plant of *Polygonaceae* family was harvested on a water meadow. The plant has a thick horizontal **serpentine rhizome** and apical **spicate inflorescences** consisting of small pink flowers. What plant was harvested?

- A. ***Polygonum bistorta***
- B. *Polygonum hydropiper*
- C. *Rumex acetosa*
- D. *Polygonum persicaria*
- E. *Polygonum aviculare*

***Polygonum bistorta* (serpent grass)** is a wild perennial plant of *Polygonaceae* family, which grows on wet soil, forest edges, meadows, on the banks of rivers. It has thick serpentine rhizome, upright stem, brown ocreas, small pink flowers in spicate inflorescence.



Pl. 279. Renouée Bistorte. *Polygonum Bistorta* L.

158. A food plant of *Polygonaceae* family is being studied. The plant has reddish stalk, cordate-sagittate leaves, its fruit is a trihedral nutlet. Name

Fagopyrum esculentum is an annual, herbaceous, honey plant belonging to the *Polygonaceae* family. Leaves triangular-cordate. The flowers are collected in inflorescences corymbose panicle. They are

this plant:

- A. *Fagopyrum esculentum*
- B. *Rumex confertus*
- C. *Polygonum aviculare*
- D. *Persicaria hydropiper*
- E. *Persicaria bistorta*

characterized by a variety of stamens and pistils (heterostyles). The fruit is triangular (trihedral) nutlet.



159. A herb under analysis relates to the Malvaceae family and is used as an expectorant and coating agent. The stem is erect, with simple palmate three to five lobed leaves, large pink flowers growing in short panicles. The herb has schizocarpic fruit - a capsule. Identify the plant:

- A. *Althaea officinalis*
- B. *Fragaria vesca*
- C. *Potentilla erecta*
- D. *Tussilago farfara*
- E. *Thymus serpyllum*

Althaea officinalis, or marsh-mallow, is a perennial species that belongs to the *Malvaceae* family. The stems is upright (erect), typically grow 0.91-1.22 m, but can reach 2.0 m. The leaves are shortly petioled, roundish, palmatilobate. They are soft and velvety on both sides due to a dense covering of stellate hairs. The flowers are large, faintly pink in short panicles and form interrupted racemose inflorescence. *A. officinalis* has dry fruits, such as cenocarpous capsule. The leaves, flowers and the root of *A. officinalis* have been used in traditional herbal medicine as relief for irritation of mucous membranes and as an expectorant.



160. What inflorescences are characteristic of *Cruciferae* (*Brassicaceae*) family?

- A. Raceme or panicle
- B. Capitulum or corymb
- C. Corymb or spike
- D. Spadix or panicle
- E. Capitulum or umbel

Raceme inflorescence – the main axis is lengthened, flowers on the pedicels. Panicle – abundantly branching axis of the following orders, bearing flowers, racemes or corymbs on a protractedly growing main axis. These two types of inflorescences are typical for *Brassicaceae* family.

161. A species of Ericaceae family is characterized by the following type of leaves: alternate leaf arrangement, short footstalk, leathery, elliptic or obovate with retuse tip, downturned edges; upper surface is dark-green, lower surface is light-green with punctate glandules. Name this species:

- A. *Vaccinium vitis-idaea*
- B. *Arctostaphylos uva-ursi*
- C. *Vaccinium oxycoccus*
- D. *Vaccinium myrtillus*
- E. *Ledum palustre*



Vaccinium vitis-idaea is evergreen subshrub from *Ericaceae* family. The leaves are skinny (leathery), elliptical, short-petiolar (footstalk) with declinate edges (downturned edges). They dark-green from above and light-green with dark glandular spots (glandules) from below. The flowers are white-pink, bell-like gathered in racemes. The fruit is berry.

162. *Arctostaphylos uva-ursi*, *Vaccinium vitis-idaea*, *Vaccinium myrtillus* life forms can be defined as:

- A. Small shrub (fruticulus)
- B. Vine

Arctostaphylos uva-ursi, *Vaccinium myrtillus* and *Vaccinium vitis-idaea* are representatives of Ericaceae family. They are subshrubs (small shrub, fruticulus) according to their life form.

- C. Grass
- D. Shrub (frutex)
- E. Subshrub (s)



163. During excursion into a conifer forest the students noticed that bilberry (*Vaccinium myrtillus*) stems are lignified only partially in their lower part, the upper part of the stem retains the form of caulis. Therefore, this plant can be classified as:

- A. Suffrutex
- B. Tree
- C. Liana
- D. Annual grass
- E. Perennial grass

Vaccinium myrtillus is deciduous subshrub (suffrutex) from *Ericaceae* family. The leaves are deciduous, short-petioled and oval with thin leaf blade and serrated edge. The flowers are single, drooping. The fruit is blue-black berry.



164. Which representative of the *Rosaceae* family has spring bloom in form of white, fragrant flowers gathered in pendulous racemes at the ends of short shoots?

- A. *Padus racemosa* (Pavia)
- B. *Potentilla erecta*
- C. *Sorbus aucuparia*
- D. *Cerasus vulgaris*
- E. *Crataegus sanguinea*

Padus avium (*racemosa*) is a tree of the *Rosaceae* family, *Prunoideae* subfamily, has simple elliptic leaves. The flowers are odorous, white, in drooping (pendulous) racemes. Fruit is drupe, spherical, black, shiny with a greenish flesh.



165. Herbarium specimens of medicinal plants are being studied. Which one of them belongs to *Rosaceae* family?

Crataegus sanguinea is a tree or shrub of the *Rosaceae* family, *Maloidae* subfamily. It has two types of shoots: elongated and shortened, which usually turn into spines. The leaves are

- A. *Crataegus sanguinea*
- B. *Melilotus officinalis*
- C. *Conium maculatum*
- D. *Copsella bursa-pastoris*
- E. *Polygonum persicaria*

simple (on short shoots) and obovate (on elongated ones). The flowers are collected in compound corymb inflorescences. The fruit is pome.



166. A fruit tree of Rosaceae family has short thorny shoots: the fruit is a distinctively-shaped pome with stone cells in its pulp. Name this plant:

- A. *Pyrus communis*
- B. *Prunus armeniaca*
- C. *Cerasus vulgaris*
- D. *Prunus spinosa*
- E. *Malus sylvestris*

Pyrus communis is a tree from the *Rosaceae* family, *Maloideae* subfamily that has simple oblong-ovate leaves. The flowers are gathered in the corymb inflorescence. Fruit is pome, which pulp contains stony cells.



167. The analyzed plant has hollow ribbed stems, compound umbel inflorescence, schizocarpic fruit (cremocarp) and is rich in essential oils, which is a characteristic of:

- A. *Apiaceae*
- B. *Fabaceae*
- C. *Ericaceae*
- D. *Brassicaceae*
- E. *Asteraceae*

The *Apiaceae* family counts about 3000 species of annual and biennial herbaceous plants. Storage roots are characteristic for biennial plants. Stems ribbed, hollow. Leaves without stipules, with a broad filmy vagina and a pinnate blade, dissected to varying degrees. The lower leaves form rosette, stem leaves have alternate arrangement, petiolate or sessile. The flowers are small, collected in compound umbel inflorescence. Fruit is cremocarp. The fruit has a gum conceptacles with essential oil.



Pimpinella anisum

Daucus carota

Conium maculatum

Anethum graveolens

168. A plant has ribbed and hollow stems, sheathing pinnatisect leaves; compound umbel inflorescence; fruit with essential oil tubules. These features are typical for the representatives of the following family:

- A. *Apiaceae*
- B. *Solanaceae*
- C. *Fabaceae*
- D. *Brassicaceae*
- E. *Scrophulariaceae*

Anethum graveolens is a representative of the *Apiaceae* family, for which compound umbel inflorescence is typical.



169. A plant under examination has a storage root; its stems are ribbed and channelled, hollow; leaves are many times pinnatisect, leafstalk has a boot; inflorescence is the compound umbel; fruit is the cremocarp with essential oil canaliculi in the

<p>pericarp. Such characteristics are typical for the plants of the following family:</p> <p>A. <i>Apiaceae</i> B. <i>Solanaceae</i> C. <i>Fabaceae</i> D. <i>Brassicaceae</i> E. <i>Scrophulariaceae</i></p>	
<p>170. A plant under investigation has compound uniform monopodium inflorescence - compound umbel. What plant is it characteristic of?</p> <p>A. <i>Anethum graveolens</i> B. <i>Sorbus aucuparia</i> C. <i>Allium cepa</i> D. <i>Rosa canina</i> E. <i>Centaurea cyanus</i></p>	
<p>171. Some medicinal plants need to be harvested very carefully, because they are poisonous. One such plant is a representative of Umbelliferae family. Name this plant:</p> <p>A. <i>Cicuta virosa</i> B. <i>Arctium lappa</i> C. <i>Viburnum opulus</i> D. <i>Plantago major</i> E. <i>Valeriana officinalis</i></p>	<p><i>Cicute virosa</i> - is one of <i>Apiaceae (Umbelliferae)</i> family repreaentative.</p>
<p>172.A plant under examination has papilionaceous flowers. This plant belongs to the following family:</p> <p>A. <i>Fabaceae</i> B. <i>Scrofulariaceae</i> C. <i>Ranunculaceae</i> D. <i>Lamiaceae</i> E. <i>Asteraceae</i></p>	<p>The <i>Fabaceae (Legume) family</i> counts about 17000 species with different life forms, but herbacious plants preveal. Leaves are alternate, compound, sometimes simple with stipules. Sometimes the parts of the leaf modified into thorns or tendrils. Flowers usually collected in inflorescences raceme, glome (head), umbel or spike. Flowers zygomorphic, papilionaceous with double perianth. Fruit is legume, dry or juicy, one- or multi-seeded.</p>



173. Both scientific and folk medicine uses medicinal plant *Glycyrrhiza glabra* L. What part of the plant is harvested?

- A. **Roots and rhizomes**
- B. Foliage
- C. Inflorescence
- D. Grass
- E. Seeds

Glycyrrhiza glabra is a perennial herbaceous plant of the bean family *Fabaceae* (*Legume family*). It has odd-pinnately compound leaves. The flowers are papilionaceous, purple, compose panicle inflorescence. The fruit is legume. The roots and rhizomes are used in medicine as expectorant and antiinflammatory agent. These underground organs are yellow and tastes sweets.

174. Examination of five herbarium specimens of medicinal plants showed that one of them belonged to the *legume* family, namely:

- A. ***Glycyrrhiza glabra***
- B. *Atropa belladonna*
- C. *Hyoscyamus niger*
- D. *Datura stramonium*
- E. *Solanum dulcamara*



175. A tea for cough relief contains comminuted roots of a plant. The roots are bright yellow and sweet. The were identified as the roots of:

- A. ***Glycyrrhiza glabra***

<p>B. <i>Valeriana officinalis</i> C. <i>Sanguisorba officinalis</i> D. <i>Acorus calamus</i> E. <i>Althaea officinalis</i></p>	
<p>176. When studying five herbarium specimen of medicinal plants, it was determined that one of them belongs to <i>Fabaceae</i> family. Which one is it? A. <i>Ononis arvensis</i> B. <i>Atropa belladonna</i> C. <i>Hyoscyamus niger</i> D. <i>Datura stramonium</i> E. <i>Solanum dulcamara</i></p>	<p><i>Ononis arvensis</i> is a perennial herb of <i>Fabaceae (Legume) family</i>. The stems are ascending, straight, pubescent, leaves are tricompond. The flowers are papilionaceous in raceme inflorescence, the fruit is legume.</p>
<p>177. A fruit is a capsule with oblate light brown smooth glossy seeds that mucify when moistened. This fruit belongs to: A. <i>Linum usitatissimum</i> B. <i>Linaria vulgaris</i> C. <i>Digitalis putrpurea</i> D. <i>Ledum palustre</i> E. <i>Hypericum perforatum</i></p>	<p><i>Linum usitatissimum</i>, an annual herb of the <i>Linaceae family</i>. Leaves alternate, sessile, linear, entire. Flowers are collected in panicles. Fruit is ovoid capsule. Seeds are flat, brown, smooth a box. The seeds are small, smooth, shiny, light brown in color. Contains a lot of mucus that is released when moisturized. This property is used in medicine.</p>
<p>178. A certain dioecious plant commonly grows at the forest edge. It is shrub with thorned spreuts. Its fruit is round black coenocarpous drupe (pyrenarium) with 3-4 seeds. Name this plant: A. <i>Rhamnus cathartica</i> B. <i>Rosa canina</i> C. <i>Sambucus nigra</i> D. <i>Hippophae rhamnoides</i> E. <i>Crataegus sanguine</i></p>	<p><i>Rhamnus cathartica</i> is a dioecious shrub of <i>Ramnaceae family</i> which grows in steppe and forest zones. Shoots (spreuts) end with thorns. The leaves are in bunches on the shortened shoots, opposite, petiolar. The flowers are unisexual, four-membered, collected 10-15 in the axils of the leaves. Fruit - spherical, black, coenocarpous drupe (pyrenarium).</p>



179. Bark of a thornless xylophyte of the *Rhamnaceae* family has laxative effect. Name this plant:

- A. *Frangula alnus*
- B. *Hippophae' rhamnoides*
- C. *Rubus idaeus*
- D. *Aronia melanocarpa*
- E. *Crataegus sanguinea*

Frangula alnus is a diclinous shrub of *Ramnaceae* family which grows in steppe and forest zones. Shoots (spreuts) are without thorns. The leaves are opposite, petiolar with deciduous stipules.. The flowers are bisexual, collected 2-7 in bunches. Fruit – red-violet coenocarpous drupe (pyrenarium). The bark and medicines from it are used as laxative.

180. A perennial herbaceous plant has ascending **quadrangular stem** and **oppositely arranged leaves**. The flowers with **bilabiate corolla** are zygomorphic, bisexual, arranged in whorls in the leaf axils. The fruit type is **coenobium**. The described medicinal plant relates to the following botanic family:

- A. *Lamiaceae*
- B. *Asteraceae*
- C. *Poaceae*
- D. *Brassicaceae*
- E. *Rosaceae*

The *Lamiaceae* family counts about 3500 species. The life forms are herbs, subshrubs or shrubs. The stems are upright, ascending, branchy and densely pubescent with glandules with essential oils, square in cross-section. Leaves are simple with cross-opposite leaf arrangement. Flowers with bilabiate corolla, in inflorescences whorls and false whorls, head, spike, corymb-like panicles, or situated in angles of leaves. Gynoecium is cenocarpous. Fruits are dry schizocarp dehiscent into 4 nutlets and called coenobium.



181. If aromatic secretory-downy plant has square in cross section stem, spike inflorescence made up from whorled dichasia, bilabiate corolla and its fruit consists of four nutlets, it probably belongs to the following family:

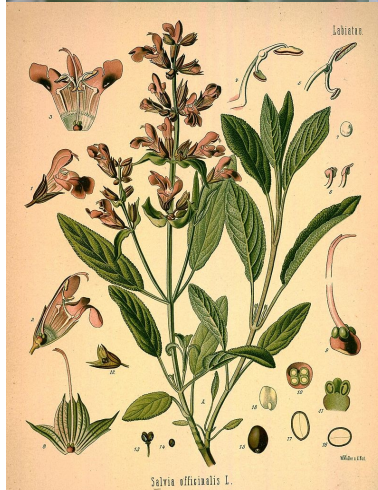
- A. *Lamiaceae*
- B. *Scrophulariaceae*
- C. *Brassicaceae*
- D. *Apiaceae*
- E. *Solanaceae*

Salvia officinalis is representative of *Lamiaceae* family widely cultivated in tropics, subtropics, and in the temperate climate including Ukraine. Its homeland I Mediterranean and Minor Asia. This is subshrub that has pubescent stem with glandules with essential oils. Leaves are simple. Flowers have bilabiate corolla. The fruit is coenobium.




182. An essential oil plant has a tetraquetrous stem, flowers with bilabiate corolla, its fruit is coenobium. These signs are typical for the following family:

- A. *Lamiaceae*
- B. *Papaveraceae*
- C. *Polygonaceae*
- D. *Solanaceae*
- F. *Scrophulariaceae*



183. A plant producing essential oil has square stem, bilabiate corolla, coenobium fruit. These features are characteristic of:

- A. *Lamiaceae*
- B. *Scrophulariaceae*
- C. *Solanaceae*
- D. *Polygonaceae*

<p>E. <i>Papaveraceae</i></p> <p>184. Crop production includes cultivation of medicinal essential oil plants that don't grow in Ukraine widely, namely <i>Mentha piperita</i>, <i>Ortosiphon stamineus</i>, and also:</p> <p>A. <i>Salvia officinalis</i> B. <i>Origanum vulgare</i> C. <i>Leonurus cardiaca</i> D. <i>Thymus serpyllum</i> E. <i>Leonurus quinquelobatus</i></p>	
<p>185. Choose a plant whose apical sprouts are used in medical practice for sedative drug production:</p> <p>A. <i>Leonurus cardiaca</i> B. <i>Glycyrrhiza glabra</i> C. <i>Digitalis purpurea</i> D. <i>Ledum palustre</i> E. <i>Fagopyrum sagittatum</i></p>	<p><i>Leonurus cardiaca</i> is a perennial plant of <i>Lamiaceae</i> family with tetragonal and pubescent stem. Leaves are simple, ovoid. The flowers are small, sessile, form a leafed intermittent spicate inflorescence from whorles. Corolla is bilabiate, pink. The fruit is coenobium. The herb and medicines from it are used as spasmolytic, sedative, hypotensive medicine.</p> 
<p>186. Folk medicine uses the flowers of white dead-nettle (<i>Lamium album</i>) to treat pancreatic diseases, catarrh of the upper respiratory tract, etc. This plant belongs to the following family:</p> <p>A. Labiatae</p>	<p><i>White dead-nettle (Lamium album)</i> is representative of <i>Lamiaceae (Labiatae)</i> family</p>

- B. Solanaceae
- C. Fabaceae
- D. Scrophulariaceae
- E. Asteraceae

187. Some medicinal plants are poisonous. Select a poisonous plant from the list below:

- A. *Digitalis purpurea*
- B. *Thymus serpyllum*
- C. *Origanum vulgare*
- D. *Salvia officinalis*
- E. *Thymus vulgaris*

Digitalis purpurea is annual or perennial plant of *Scrophulariaceae* family. The leaves are covered with soft hairs, dark green on the upper side and pubescent grayish-green with a dense network of protruding veins on the lower side. Flowers on short pedicels, drooping, collected in one-sided raceme. Fruit is capsule. The plant is poisonous as contains cardiac glycosides.



188. The figwort family *Scrophulariaceae* includes a biennial plant up to 1,5 m high, with golden-yellow flowers gathered in spiked inflorescences. The flowers have five stamens. Specify this plant:

- A. *Verbascum flomoides*
- B. *Digitalis purpurea*
- C. *Digitalis grandiflora*
- D. *Digitalis lanata*
- E. *Digitalis Ferruginea*

Verbascum flomoides is a biennial herbaceous plant of *Scrophulariaceae* family. At the first year it gives a leaf rosette and at the second year the stem with flowers grow. Leaves are simple entire petiolar and sessile. Flowers are yellow on short pedicel zygomorphous with double perianth and five stamens. Flowers are in spiked thyrus inflorescences. The fruit is fruitcase.

189. Bacca fruit is typical for the following representative of *Solanaceae* family:

Atropa belladonna is a perennial poisonous plant of *Solanaceae* family. Leaves lanceolate, entire, pubescent along the veins. Flowers

- A. *Atropa belladonna*
- B. *Hyoscyamus niger*
- C. *Datura stramonium*
- D. *Nicotiana tabacum*
- E. *Datura innoxia*

190. What type of fruit is characteristic of *Atropa belladonna*?

- A. **Berry**
- B. Legume
- C. Capsule
- D. Silique
- E. Hesperidium

axillary, single, large, drooping, on pubescent peduncles. The fruit is black berry (bacca).



191. A cultivated plant has green berrylike fruit and underground sprout modifications - tubers. The described plant is:

- A. ***Solanum tuberosum***
- B. *Convalaria majalis*
- C. *Polygonatum odoratum*
- D. *Atropa belladonna*
- E. *Solanum lycopersicum*

Solanum tuberosum is *Solanaceae* family representative cultivated in countries with temperate climate. This is an annual plant with underground tubers. The stem is ascending, leaves are pinnatiseted. Flowers are white or pink, form terminal double bostryx. Berries are green. They are poisonous.





192. The fruit is a thorned many-seeded capsule that opens into four flaps when ripe. It is characteristic of:

- A. *Datura stramonium*
- B. *Papaver somniferum*
- C. *Hyoscyamus niger*
- D. *Digitalis purpurea*
- E. *Linum usitatissimum*

Datura stramonium an annual herbaceous poisonous plant of the *Solanaceae* family. Leaves are alternate, ovoid, acute. The flowers are large, white, single, sessile, have a tubular funnellform. Fruit – is thorny capsule dehiscent by valves. The numerous seeds are small and black.



193. Analysis of a plant revealed essential- oil glands with several layers of cells arranged in pairs. This allows for the possibility that the plant relates to the family:

- A. *Asteraceae*
- B. *Scrofulariaceae*
- C. *Solanaceae*
- D. *Apiaceae*
- E. *Lamiaceae*

The Asteraceae family counts about 20000 species. Life forms are herbs, shrubs, subshrubs rarely trees. Leaves simple, occasionally - compound, without stipules, rosette, alternate, sometimes opposite. Representatives of the family are characterized by specific 8-cell essential oil glandules with biseriate stalk. The flowers are aggregated into *anthodium* (*calathium*, *capitulum*). The fruit is *achene* (or *cypsela*).



194. Essential oil glandules that consist of 8 secretory cells placed in 2 lines and 4 tiers are typical for most plants of the following family:

- A. *Asteraceae*
- B. *Apiaceae*
- C. *Lamiaceae*
- D. *Rosaceae*
- E. *Scrophulariaceae*

Arnica montana is a perennial herb of the *Asteraceae* family. It is mountain and forest species of the Ukrainian Carpathians that introduced into “Red Book of Ukraine”. Stem is ascending. Stem leaves are opposite, sessile, lanceolate, leaves in leaf rosette are oblong-oval. Anthodiums are single formed by yellow-orange legulate and tubular flowers. Fruit is a cypsela without coma.

195. The presence of **essential oil glandules, achene fruits, and capitulum inflorescences** are the tcharacteristic diagnostic characters of the following plant family:

- A. *Asteraceae*
- B. *Lamiaceae*
- C. *Rosaceae*
- D. *Solanaceae*
- F. *Scrophulariaceae*



196. A certain herbaceous plant grows on the meadows of the

Carpathian Mountains. It has orange anthodium inflorescences, upright stem, and a rosette of basal leaves.

Name this plant:

- A. *Arnica montana*
- B. *Calendula officinalis*
- C. *Cychorium intybus*
- D. *Centaurea cyanus*
- E. *Echinacea purpurea*

197. In terms of numbers of species the Asteraceae family is the largest among the Magnoliophyta. Some species of this family that are used in medicine were entered into the “Red Book of Ukraine” and need protection. Name one such species:

- A. *Arnica Montana*
- B. *Centaurea cyanus*
- C. *Helianthus annuus*
- D. *Artemisia vulgaris*
- E. *Taraxacum officinale*

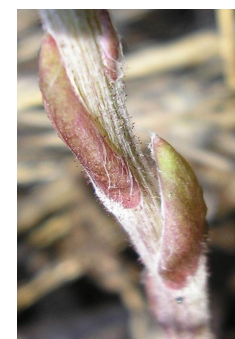
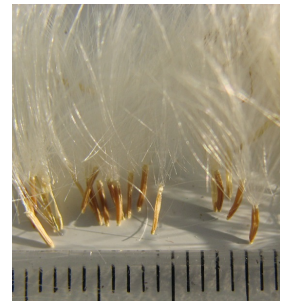
198. In spring a perennial plant of Asteraceae family produces floral shoots with **golden-yellow flowers**. After blossom-fall shoots with **large leaves** appear. Name this plant:

- A. *Tussilago farfara*
- R. *Petroselinum crispum*
- C. *Datura stramonium*
- D. *Hipericum perforatum*
- E. *Potentilla erecta*

199. Rhizome of an *Asteraceae* family species is polycephalous, succulent, has lysigenous cavities, accumulates inulin. Such underground organ is characteristic of:

- A. *Inula helenium*

Tussilago farfara is a perennial herb of the *Asteraceae* family. Stem leaves alternate, ovate-lanceolate. After flowering (blossom), large broad-ovate, long petiolate leaves in rosette appear. Anthodiums are single. Flowers are yellow, consists of false-legulate and tubular flowers. Fruit is cypsela with coma.



Inula helenium is a perennial herb of *Asteraceae* family with thick rhizome and long additional roots. The stems are upright pubescent. The leaves are large and petiolar. The lower leaves form leaf rosette. The large anthodiums form the apical corymbose inflorescence. Flowers are yellow, false-

- B. *Helianthus annuus*
- C. *Digitalis grandiflora*
- D. *Sorbus aucuparia*
- E. *Hyoscyamus niger*

200. Rhizome of an *Asteraceae* family species is polycephalous, succulent, has lysigenous cavities, accumulates inulin. Such underground organ is characteristic of:

- A. *Inula helenium*
- B. *Hyoscyamus niger*
- C. *Helianthus annuus*
- D. *Digitalis grandiflora*
- E. *Sorbus aucuparia*

legulate and tubular. The achene has pappus. The rhizomes with roots contain inulin.



201. A perennial plant has white flower heads grouped in compound corymbs and bipinnatisected or tripinnatisected leaves. Name this plant:

- A. *Achillea millefolium*
- B. *Phaseolus vulgaris*
- C. *Taraxacum officinale*
- D. *Potentilla erecta*
- E. *Melilotus officinalis*

Achillea millefolium is a perennial herb of *Asteraceae* with creeping rhizome. The stems are pubescent. The lower leaves form rosette, the stem leaves are sessile, lanceolate, pinnatisected. The anthodiums are white small, form apical corymbs. The achene has no outgrowth.



202. You are studying the silvery downy plant *Asteraceae* family, which is rich with essential oils and bitters. Harvested are apical sprouts with panicle of small round flower heads. This plant is:

- A. *Artemisia absintium*
- B. *Arcticum lappa*
- C. *Chamomilla recutita*

Artemisia absintium is a silver and grey downy perennial herb of *Asteraceae* with a rhizome. The stems end with inflorescens. The anthodium is small, drooping and rounded.

- D. *Calendula officinalis*
- E. *Bidens tripartita*



203. In the practice of harvesting herbal raw material of *Asteraceae* family the term "flowers" means both individual flowers and inflorescences. However, the notion of "flowers" is botanically correct only for:

- A. *Centaurea cyanus*
- B. *Gnaphalium uliginosum*
- C. *Arnica montana*
- D. *Echinops ritro*
- E. *Bidens tripartita*

Centaurea cyanus is annual or biannual herb of *Asteraceae* family. The stem is upright, pubescent. The leaves are elongated lanceolate. The anthodiums are large, single and apical, consists of funnel-shaped and tubular flowers. The achene has outgrowth. In spite of other representatives of *Asteraceae* family *Centaurea cyanus* raw material includes only marginal flowers – funnel-shaped, not all inflorescence.



204. One of the herbarium specimens of medicinal plants relates to the *Asteraceae* family. This plant is:

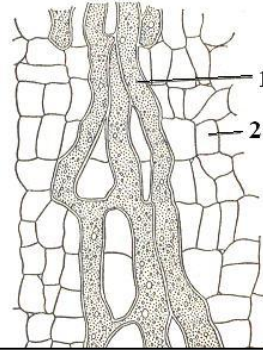
- A. *Arctica lappa*
- B. *Atropa belladonna*
- C. *Cassia acutifolia*
- D. *Urtica dioica*
- E. *Rubus idaeus*

Arctica lappa is a biannual herb of *Asteraceae* family. The stem is upright, brenchy. The lower leaves are very large petiolar widely egg-shapede. The anthodiums are aggregated into corymbose and racemose inflorescences. The flowers are tubular. The achene has easily falling pappus.

205. A herbaceous plant under examination has segmented laticifers with anastomoses filled with white latex. This is typical for:

- A. *Taraxacum officinale*
- B. *Urtica dioica*
- C. *Chelidonium majus*
- D. *Anethum graveolens*
- E. *Thymus vulgaris*

Taraxacum officinale is a perennial herbal plant of the *Asteraceae* family. The whole plant has articulate laticifers. The leaves form a leaf rosette. Hollow flower arrows carry single baskets. The flower stalk are coreless ended by single anthodiums. Flowers are yellow legulate. yellow. Fruit is an achenes with outgrowth.

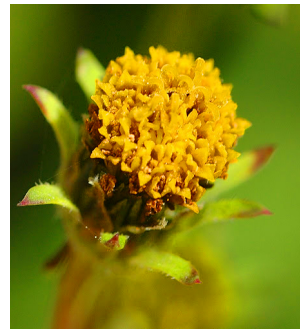


articulate laticifers

206. Microscopy of subterranean organs of an *Asteraceae* family plant shows articulated laticifers with anastomoses filled with white latex. It is characteristic of the following plant:

- A. *Taraxacum officinale*
- B. *Helianthus annuus*
- C. *Achillea millefolium*
- D. *Bidens tripartita*
- E. *Artemisia absinthium*

Bidens tripartita, an annual herbaceous plant of the *Asteraceae* family. Leaves are opposite, short-petioled, tripartite or trisected. Flowers are small, yellowish and only tubular (disk). It has a fruit - a seedling with 2-3 spines on the apex. The fruits are achenes with two or three sharp emergences (aristae, bristly serratures).





207. *Asteraceae* family has only disk flowers in the flowerhead?

- A. Three-part beggarticks (*Bidens tripartita*)
- B. Dandelion (*Taraxacum officinale*)
- C. *Echinacea purpurea*
- D. Cornflower (*Centaurea cyanus*)
- E. Common yarrow (*Achillea millefolium*)

208. An annual plant of the

Ambrosia artemisiifolia is species of

<p><i>Asteraceae</i> family has tripartite leaves, apical anthodia with tubular flowers, flat achenocarps that are tenent due to 2-3 bristly serratures. This plant is:</p> <p>A. <i>Bidens tripartita</i> B. <i>Chamomilia recutita</i> C. <i>Centaurea cyanus</i> D. <i>Echinacea purpurea</i> E. <i>Artemisia vulgaris</i></p>	<p>poisonous annual herbaceous plants of the <i>Asteraceae family</i>. It is a monoecious plant, having unisexual male flowers, gathered in spike-like inflorescences at the tops of branches and female flowers in anthodiums that are placed in the axils of the upper leaves. During the flowering period the flower pollen causes an allergic disease in the population.</p> 
<p>209. Weeds can be harmful for populace's wellbeing. Particularly, allergic reactions are often caused by the following plant in its period of blossoming:</p> <p>A. <i>Ambrosia artemisiifolia</i> B. <i>Equisetum arvense</i> C. <i>Stellaria media</i> D. <i>Erigeron canadensis</i> E. <i>Taraxacum officinale</i></p>	
<p>210. Elongated narrow prismatic crystals with sharpened points were detected during microscopic investigation of <i>Convallaria majalis mesophile</i>. These crystals are:</p> <p>A. Styloids B. Druses C. Crystalline sand D. Cystoliths E. Perigonium</p>	<p><i>Convallaria majalis</i> perennial herbaceous plant of the <i>Convallariaceae family</i>, that belong to Monocotyledon (monocot). The floral shoot is triquetrous and ends with one-sided raceme. The flowers are white, bell-shaped. The fruit is red berry.</p> <p>Styloids – are elongate-prismatic needle-like crystals of calcium oxalate with sharp edges. Styloids as well as raphids occur more often in monocotyledon (monocot).</p>
<p>211. Plant pathogens are represented by various microorganisms: bacteria, fungi, actinomycetales, viruses. Name the main location of plant pathogens in the natural environment:</p> <p>A. Soil B. Water C. Air D. Plant parts</p>	<p>Soil is the basic place for plant pathogens in the natural environment</p>

E. Plant vascular system	
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