

ODESSA NATIONAL MEDICAL UNIVERSITY
Department of General and Clinical Pharmacology and Pharmacognosy

METHODOLOGICAL DEVELOPMENT
Course: "Pharmacognosy"

practical lesson for students on the topic:

"Lignans. Xanthoni. LR and LRS containing lignans and xanthones. Chinese lemongrass, prickly eleutherococcus, milk thistle. Species of yarrow, St. John's wort.

Course: 3rd Faculty: Medical and Pharmaceutical

**Approved on methodical
meeting of the department
"30" 08.2024
Protocol № 1
Head department
MD, prof. JV Rozhkovsky**



Odessa - 2024

1. Topic of the lesson: "Lignans. Xanthoni. LR and LRS containing lignans and xanthonnes. Chinese lemongrass, prickly eleutherococcus, milk thistle. Species of yarrow, St. John's wort. - 4 years.

2. Relevance of the topic.

Lignans are dimeric phenolic compounds derived from phenylpropane (C₆-C₂) n. They accumulate in all plant organs, but mostly in seeds, roots, stems. Fragments of lignans can be part of molecules of more complex phenolic compounds - lignoids (flavolignans, xantholignans, coumarinolignans). Lignans have a wide range of pharmacological activity, have antitumor, stimulating and adaptogenic, antihemorrhagic, antimicrobial, hepatoprotective effect.

Xanthonnes are a group of biologically active substances of phenolic nature with the general formula C₆-C₁-C₆, which are based on dibenzo-g-pyrone. The most common in nature xanthone 3-glycoside mangiferin, isolated from mango fruits. Currently, more than 300 xanthonnes have been identified from plants of the yarrow, St. John's wort, and legume families. Xanthonnes have a wide range of biological effects: antiviral, antifungal, antitumor. Mangiferin stimulates the nervous system, has cardiogenic, diuretic, anti-inflammatory and bactericidal activity. The range of drugs based on LRS, containing lignans and xanthonnes, is constantly replenished, which makes it especially important to study this topic both for the practical activities of the pharmacist and for scientific research of possible raw materials.

3. Objectives of the lesson:

3.1. General goals: To study medicinal plants containing lignans and xanthonnes, as well as to perform work on macroscopic analysis of raw materials (Chinese lemongrass, prickly eleutherococcus, milk thistle, yarrow, St. John's wort).

3.2. Educational goals: formation of a professionally significant substructure of personality with relevant aspects of deontological, ecological, legal, psychological, patriotic, professional responsibility.

3.3. Specific goals:

- know (level of assimilation according to Bezpalk - II):

1. Definition of "lignans", "xanthonnes".
2. Distribution of lignans and xanthonnes in the plant world and resources of natural raw materials.
3. External signs of the studied species of LR and LRS.
4. Terms and methods of rational procurement of the relevant LRS.
5. Preparations containing lignans and xanthonnes, their use in medicine.
6. The main methods of detection and isolation of lignans and xanthonnes in LRS.

Based on theoretical knowledge and practical work:

- master the techniques (be able to) (level of assimilation according to Bezpalk - III):

1. Recognize the external features of the plant (Chinese lemongrass, prickly eleutherococcus, milk thistle, yarrow, St. John's wort);
2. To determine the identity and good quality of raw materials containing lignans and xanthonnes, by external signs.

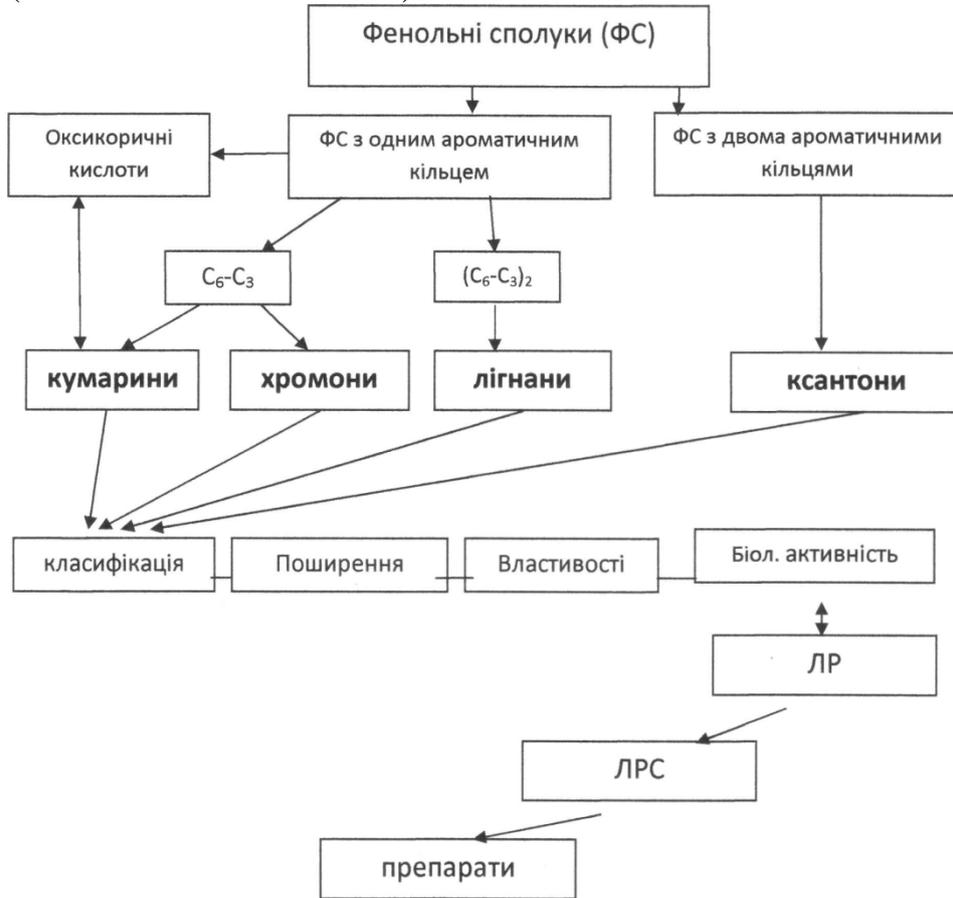
4. Interdisciplinary integration

№ p.p.	discipline	know	be able
1	2	3	4
1.	<p>Previous disciplines:</p> <p>1. Botany</p> <p>2. Organic chemistry</p> <p>3. Analytical chemistry</p>	<p>Characteristic features of the families of the studied plants. Morphology of stem, bark, leaves, flower, fruit, root and rhizome. Anatomical structure of the leaf, bark, fruit, root, rhizome.</p> <p>Physical and chemical properties of polysaccharides, glycosides, terpenoids, aromatic derivatives, heterocycles.</p> <p>Methods of acid-base titration (neutralization) and permanganatometry</p>	<p>Use a microscope, prepare surface preparations and cross-sections.</p> <p>Carry out qualitative reactions; purification of organic compounds.</p> <p>Work with analytical scales, measuring vessels, photoelectrocolorimeter, use methods of chromatography on paper and in a thin layer of sorbent.</p>
2.	<p>The following disciplines:</p> <p>1. Physical and colloid chemistry</p>	<p>Solubility of solids and liquids in liquids. Distillation. Raoul's law. Konovalov's law. Vapor pressure and composition over mutually insoluble liquids. Buffer solutions. Polarography. Potentiometric titration. Adsorption. Ion exchange adsorption. Chromatography: paper, column, in a thin layer of sorbent, gel chromatography.</p> <p>Methods of measuring mass and volume. Preparation of powders or liquid drugs for internal and</p>	

	<p>2. Pharmacy technology of drugs</p> <p>3. Industrial technology of medicines</p> <p>4. Clinical pharmacology</p> <p>5. Pharmaceutical chemistry</p> <p>6. Organization and economics of pharmacy</p>	<p>external use. Analysis of prepared liquid drugs using a burette system.</p> <p>Conditions of industrial preparation of medicines. Principles of organization of pharmaceutical production of various dosage forms: liquid, solid, soft, injectable solutions, etc. Machines, devices, equipment for the production of medicines.</p> <p>Pharmacodynamics and pharmacokinetics of drugs. The pattern of action of drugs on the human body and its corresponding reactions. Basic principles of treatment in terms of drug selection, evaluation of their effectiveness and safety.</p> <p>Methods of qualitative and quantitative study of drugs.</p> <p>Pharmaceutical service management. Storage of medicines. Control and analytical service, organization of its work. Accounting for inventory and cash. Economic analysis of the pharmacy.</p> <p>Management and entrepreneurship. Organization as an object of management. Connecting processes in management. Human Resource Management Pharmaceutical Marketing Management. Pharmaceutical market research. International marketing.</p>	
--	---	--	--

	7. Management and marketing in pharmacy		
--	--	--	--

5. Content of the topic (text and thesis), graphological structure of the lesson.
(See the text of the lecture)



6. Plan and organizational structure of the lesson.

№№ p.p.	The main stages of the lesson, their functions and content.	Learning objectives in the levels of mastery.	Means of training and control.	Materials on methodical forensuring the visibility of the lesson, control the knowledge of those who teachis.	Term (in minutes or in%) of the total class time.
1	2	3	4	5	6
1	<i>Preparatory stage</i> Organization of classes Setting learning goals Homework check	II	Oral interview on the topic	Methodical works for students, album	1% 2% 25%
2	<i>The main stage</i> Conducting a practical lesson	III	Herbariums of medicinal plants, LRS, reagents		50%
3	<i>The final stage</i> Testing and assessment of practical skills Checking the final level of knowledge Providing homework with a reference to the literature	II- III II- III	Herbariums of medicinal plants, LRS, reagents	Methodical works for students, album Tests and situational tasks	5% 15% 3%

7. Materials on methodological support of the lesson.

7.1. Control materials for the preparatory stage of the lesson: questions, tasks, tests.

Tests:

1. From the fruits of milk thistle produce a number of domestic and foreign drugs of hepatoprotective activity. The good quality of this raw material is determined by the content:

- A flavolignans
- B coumarins
- C alkaloids
- D vitamins
- E terpenoids

2. Herbal drug Silibor is used as a hepatoprotective agent. The source for obtaining this drug is:

- A thistle seed
- B cornflower flowers
- C tansy flower ordinary
- D hawthorn flower
- E grass horsetail

3. Medicinal plants are part of many drugs for the treatment of the digestive system. Indicate what is the source of the hepatoprotective drug "Hepabene":

- A milk thistle extract
- B chamomile extract
- C calendula extract
- D licorice extract
- E capsicum extract

4. The pharmacist asked the pharmacist to recommend a hepatoprotective agent of plant origin. Name the medicinal plant raw material that contains silibin and has a hepatoprotective effect.

- A thistle fruit.
- B flax seeds.
- C magnolia seeds.
- D fennel fruit.
- E pumpkin seeds.

5. Rhizomes and roots of *Eleutherococcus* are used as an adaptogenic agent. What active substances does this raw material contain?

- A lignans
- B cardiosteroids
- C polysaccharides
- D sesquiterpenes
- E flavonoids

6. In the absence of tonic drugs from ginseng roots in the pharmacy they can be replaced with drugs from:

- A *Eleutherococcus senticosus*
- B *Orthosiphon stamineus*
- C *Glycyrrhiza glabra*
- D *Polygala senega*
- E *Astragalus dasyanthus*

7. Preparations of ginseng roots show tonic, adaptogenic properties, improve mental and physical performance. In the absence of ginseng tincture in the pharmacy, it can be replaced by drugs similar in action from raw materials:

- A radices *Eleutherococci*
- B radices *Valerianae*
- C radices *Inulae*

D radices Ononidis
E radices Rhei

8. The drug condyline NSA contains lignin. To obtain the substance of these BAS use:

- A rhizome with podophyllum roots
- B rhizomes with angelica roots
- C rhizome with valerian root
- D herb St. John's wort spotted
- E grass horsetail

9. The herb St. John's wort is processed into a number of drugs. In addition to this species, the official species are also:

- A Hypericum maculatum
- B Hypericum hirsutum
- C Hypericum elegans
- D Hypericum montanum
- E Hypericum linariodes

10. The drug "Alpizarin" is used in the form of ointments and tablets for the treatment of herpes and other viral diseases. It is obtained on the basis of xanthone from the alpine kopeck piece

- A magniferin
- B anchovine
- C tovofelina
- D tovoltezin
- E vysnadin

11. Xanthenes with substitution in positions 1,3,5,8 have antiviral properties (mangiferin and its derivatives). Specify a drug with this BAR group:

- A alpizarin
- B legal
- With Alor
- D marelin
- E flacumin

Question:

1. Definition of "lignans", "xanthenes".
2. Distribution of lignans and xanthenes in the plant world and resources of natural raw materials.
3. External signs of the studied species of LR and LRS.
4. Terms and methods of rational procurement, respectively, LRS.
5. Preparations containing lignans and xanthenes, their use in medicine.
6. The main methods of detection and isolation of lignans and xanthenes in LRS.

7.2. Materials of methodical support of the main stage of employment: professional algorithms, orientation maps for formation of practical abilities and skills, educational tasks.

The list of educational practical tasks that must be performed during the practical laboratory lesson:

Task 1. Study Chinese magnolia and analyze the raw materials for AND (external signs).

1. Examine the appearance of Chinese magnolia on a herbarium sample. Write down the Latin and Russian names of the raw materials that produce plants and families, draw. (Scheme 1).

Scheme 1:

DEFINITIONS OF PRODUCING PLANTS By external SIGNS

- Life form (herbaceous plant, shrub, tree).
- Type of underground organs (root, rhizome, tuber, etc.)
- Stem structure (shape, nature of branching, pubescence, diameter, etc.)
- Sheet placement (regular, opposite, whorled)
- Leaves (simple or complex. The shape of the leaf blade or leaves, edge, veining, color, size).
- Flowers (single or inflorescences, flower structure, color, size, etc.)
- Fruit (type, shape, color, size).
- Bark (in woody species), (color, presence, shape and color of the ureters, thorns, etc.).

Write the Latin and Russian names of raw materials, plants and families (give synonyms).

2. Carry out a comparative morphological analysis of the rhizomes of male fern, female fern and ostrich (Scheme 2).

Scheme 2:

ANALYSIS OF RAW MATERIALS "UNDERGROUND ORGANS" By external signs

- Commodity type of raw material (unharvested, cut, cleaned or uncleaned, etc.)
- Type of underground organs (roots, rhizomes with roots, rhizomes, tubers, bulbs, bulbs, etc.)
- Shape (cylindrical, conical, lumpy, double curved, etc.)
- dimensions
- Surface (smooth or wrinkled, the presence of longitudinal or transverse folds, scars from leaves, stems, traces of lateral roots, etc.)
- Color on the outside, at the break.
- The nature of the fracture (granular, fibrous, smooth, rolling, bristly, etc.)
- The presence of the core
- Type of structure of the conductive system (beam, beamless).
- Odor when scraping or wetting with water.
- Taste (in non-toxic objects).
- Prepare a cross section of the leaf petiole of the male fern.

Draw a diagram of the structure of the sprout under a magnifying glass. to study a micropreparation at low and high magnification (Scheme 3).

Scheme 3:

Microscopic analysis of RAW MATERIALS "UNDERGROUND ORGANS"

- Structure: primary, secondary; (Beam, beamless type).
- Integumentary tissue (plug, epidermis).
- Elements of xylem, phloem (histological composition, location).
- The shape and structure of the core rays.
- The main parenchyma (dense, loose, aerenchyma, etc.)
- Containers, milk vessels, secretory passages, etc.
- Crystalline inclusions
- Spare nutrients (starch, inulin)

Draw and mark diagnostic signs:

- Partially destroyed epidermis;
- Hypoderm, consisting of 5-8 rows of strongly thickened brown cells;
- The main parenchyma, consisting of thin, loose cells, forming large intercellular spaces, and filled with starch grains 4-6 μm in size.
- In the intercellular spaces are spherical or oval glands on a thin stalk with a yellowish-green content;
- Conducting bundles centroxylem, consisting of tracheids and sieve tubes. They are separated from the main tissue by the endoderm.

- Carry out a comparative morphological study of the scales covering the base of the leaf petioles of male fern, female fern and ostrich.

- Prepare micropreparations of male fern scales, female fern and ostrich scales.

Examine the structure of the edge of the scales.

Draw and mark the characteristic features:

- Double teeth formed by the protruding ends of adjacent cells (male fern);
- The edge is whole, the teeth are missing (female fern);
- The edge is solid, no teeth (ostrich);
- Carry out histochemical reactions:
- Apply a drop of Sudan III solution to the cross section of a fern leaf petiole.

Observations: the contents of the glands turn orange-red;

- On the cross section of the fern petiole apply a drop of 1% alcohol solution of vanillin with concentrated sulfuric acid. Observations: the contents of the glands turn red (floroglucin derivatives).

- Note the compliance of the sample of raw materials (by external signs, microscopy and qualitative reactions) to the requirements of DF.

Task 2. To study a violet tricolor and field, to carry out the analysis of raw materials on AND (sections: external signs, microscopy).

1. To study the appearance of violet tricolor, violet field on herbarium specimens (see scheme 1 above).

2. Write down the Latin and Russian names of raw materials, plants and family (give synonyms).
3. Describe the appearance of violet grass tricolor on the example of samples of raw materials (Scheme 4).

Scheme 4:

ANALYSIS OF RAW MATERIALS "GRASS" On external signs

- "Commodity type" of raw materials (unharvested, cut, threshed)
- Stem structure (shape, branching, pubescence, color, size, specific features).
- The nature of the leaf arrangement (alternate, opposite, whorled).
- Leaves
- The location of the flowers on the stem.
- Flowers
- Fruits and seeds
- Sizes of stems, leaves, flowers.
- Coloring.
- Запах when rubbing.
- Taste (in non-toxic objects).

4. Note the compliance of the sample of raw materials (on external grounds) to the requirements of GF XI, Article 62.

Task 3. To study rhodiola rosea and to carry out the analysis of raw materials on AND (section: external signs).

1. Examine the appearance of Rhodiola rosea by herbarium sample (Scheme 1). Write down the Latin and Russian names of the raw materials that produce plants and families (give synonyms).
2. Describe the appearance of the rhizome with the roots of Rhodiola rosea on the example of a sample of raw materials (Scheme 2)
3. Note the compliance of the sample of raw materials (on external grounds) to the requirements of GF XI, Article 75.

Task 4. To study the common oyster mushroom and to analyze the raw materials according to the AND (all sections except "numerical indicators").

1. To study oyster mushroom on a herbarium sample (scheme 1). Write down the Latin and Russian names of the raw materials that produce plants and families (give synonyms).
2. Describe the appearance of bearberry shoots on the example of a sample of raw materials. Carry out a comparative morphological analysis of bearberry leaf and possible impurities - cranberry leaf, blueberry, blueberry. Draw the appearance of a bearberry leaf.
3. Prepare a micropreparation of bearberry leaf from the surface, study it at low and high magnification (Scheme 5).

Scheme 5:

Microscopic analysis of RAW MATERIALS "LEAVES"

- Structure (dorsiventral, isolateral)
- Mesophile (nature of palisade and spongy tissues).

- Inclusions are crystalline (single crystals, crystalline coating, friends, Rafida, crystalline sand, cystolites); secretory (containers, milk vessels, canals).
- The epidermis of the upper and lower sides of the sheet (shape and contour of the cells: isodiametric, rectangular, tortuous;
- Type of trichomes: hairs, glands.
- Cuticle: thin, thick, straight, folded, warty.

Draw and mark diagnostic signs:

- Polygonal cells of the epidermis with straight, thick walls;
- The stomata are located on the underside of the leaf, they are large with 8 (5-9) periosteal cells;
- On the edge of the young leaves and on the central vein are 1-2-3 cell hairs with a short, thick-walled cell at the base and a longer, curved terminal cell;
- Large veins are accompanied by prismatic crystals of calcium oxalate.

4. Carry out qualitative reactions for the presence of arbutin and tannins in raw materials:

take a portion of crushed raw materials - 0.5 g;

place in a flask and add 10 ml of water;

boil for 2-3 minutes;

after cooling filter;

To 1 ml of filtrate add a crystal of ferrous sulfate.

Observations: the liquid turns purple, then dark purple, and finally a dark purple precipitate (arbutin) is formed.

To 1 ml of filtrate (in a porcelain cup) add 4 ml of a solution of ammonia and 1 ml of a 10% solution of sodium phosphorus-molybdate in hydrochloric acid.

Observations: there is a blue color (arbutin).

Add 2-3 drops of iron-ammonium alum solution to 2-3 ml of filtrate.

Observations: there is a black and blue color (tannins).

Record the results of observations in a laboratory journal.

5. Determine the content of arbutin.

1. Extraction.

- grind raw materials to 1 mm

-take an exact portion of about 0.5 g

-Put in a conical flask of 100 ml

-add 50 ml of water and boil for 30 minutes

-filtered into a 100 ml volumetric flask so that the raw material did not fall on the filter

-again pour the raw material 25 ml of water and boil for 20 minutes

-filtered into the same volumetric flask

-wash the filter residue twice with 10 ml of hot water

2. Cleaning.

-to the filtrate add 3 ml of lead acetate solution, mix and bring to the mark with water

-Place the flask in a boiling water bath and heat until completely settled

-Filter the hot liquid into a dry flask with a section, covering the funnel with glass

-after cooling to the filtrate add 1 ml of concentrated sulfuric acid

- weigh the flask
- heat with a refrigerator for 1.5 hours in a water bath
- after cooling, weigh and bring to the initial mass with water
- filter into a dry flask
- add to the filtrate 0.1 g of zinc dust
- shake 5 minutes
- Add sodium bicarbonate to a neutral reaction to litmus
- Add another 2 g of sodium bicarbonate
- after dissolving, filter into a dry flask

3. Own quantitative definition

Dilute 50 ml of filtrate with 200 ml of water

titrate from the microburette with 0.1 N iodine solution until the blue color disappears within 7 minutes. The indicator is starch. 1 ml of 0.1 N iodine solution corresponds to 0.01361 g of arbutin.

4. Calculation.

The content of arbutin is calculated by the formula

$$X = \frac{V \times 0.01361 \times 2 \times 100}{b \times (100 - c)} \times 100$$

where

V - volume of 0.1 N iodine solution spent on titration, ml

b - attachment of raw materials, g

c - moisture, %

Carry out statistical processing of the results of at least three experiments.

5. Assessment of the quality of raw materials.

On the basis of the conducted analysis to make a conclusion on conformity of the investigated sample of raw materials to requirements of NTD.

Task 5. To study cranberries and to analyze raw materials according to AND (sections: external signs, qualitative reactions).

1. To study the appearance of cranberries on herbarium specimens (Scheme 1).

Write down the Latin and Russian names of the raw materials that produce plants and families.

2. Describe the appearance of a cranberry leaf on the example of a sample of raw materials (Scheme 6).

Scheme 6

ANALYSIS OF RAW MATERIALS "LEAVES" According to external signs

- Type of leaf and dissection of the leaf blade: (simple: palmately- or palmately- or peristomolobed, peristomolobed, three- or five-lobed; complex: even or imparipinnate).
- Stem stem or sessile.
- Shape (round, elliptical, ovoid, lanceolate, linear).
- The edge of the leaf (solid, serrated, toothed, crenate, etc.)
- The nature of veining (arcuate, reticular, finger, pinnate, parallel).
- pubescence
- Color of the upper and lower sides
- The size of the sheet and leaves
- Odor when rubbing the object or wetting with water.

- Taste (for non-toxic objects)
 - Specific features.
3. Prepare a micropreparation of cranberry leaf from the surface and study it at low and high magnification (Scheme 5).
Draw and mark diagnostic signs:
 - The cells of the epidermis are slightly tortuous
 - Small stomata with two accompanying cells located parallel to the stomatal slit
 - On the underside of the leaf there are glands with a multicellular stalk and an oval multicellular head with brown contents
 - On the vein there are unicellular straight or curved thick-walled hairs with a smooth or warty surface
 - The mesophyll contains prismatic crystals.
 4. Carry out qualitative reactions to arbutin and tannins.
 5. Determine the content of arbutin.
 6. Note the compliance of the test sample of raw materials to the requirements of NTD.

Instructional materials for mastering professional skills, abilities:

Methods of work performance, stages of performance:

- a) get the necessary ARS
- b) to study and describe the appearance of the obtained ARS, to draw ARS
- c) to conduct ARS training
- d) to study ARS on herbarium specimens
- e) to study the anatomical and diagnostic features of the leaves
- f) to study the anatomical and diagnostic signs of roots and rhizomes
- g) draw observations and record them in a laboratory journal
- h) to analyze the violet grass on the basis of external signs

7.3. Control materials for the final stage of the lesson: tasks, tasks, tests, etc.

Question:

1. What plants contain phenolglycosides (their Russian and Latin names)?
2. What are the morphological features of bearberry leaves?
3. What may be the impurities in the leaves of okra? The main signs of their differences?
4. How to react to the presence of tannins in the leaves of bearberry? What are the results of this reaction?
5. How to open arbutin in medicinal raw materials (for example, bearberry leaves, cranberries)?
6. What are the external characteristics of a cranberry leaf?
7. What is the characteristic surface of the cranberry leaf blade?
8. What types of violets are used to obtain medicinal raw materials?
9. Do flowers always have a tricolor color in the grass of tricolor violets?
10. What are the external signs of raw tricolor violets?
11. What part of the plant is used as a raw material in *Rhodiola rosea*?
12. What are the external signs of raw *rhodiola rosea*?
13. Why is the raw material of *Rhodiola rosea* called "golden root"?

14. What is characteristic of the anatomical structure of the rhizome of *Rhodiola rosea*?

15. Name the Latin names of raw materials that produce plants and families of *Rhodiola rosea*.

Tests:

1. Which plant is used as an adaptogen:

- A. *Rhodiola rosea*
- B. common bearberry
- B. thyme
- G. mother-and-stepmother
- D. *althaea medicinal*

2. Tincture of the fruits and seeds of this plant, containing lignans, increases performance "gently" without noticeable disturbance, has a general strengthening effect on the human body, increases body weight, muscle strength.

- A. Chinese lemongrass
- B. mountain ash is common
- B. dried marsh flowers
- G. corn
- D. series three-part

3. Specify the pharmacologically active substances of the group of podophyllin, carried out carcinolytic action:

- A. lignans
- B. fatty oils
- B. lipoids
- G. monosaccharides
- D. polysaccharides

4. Specify biologically active substances that have in their structure aromatic rings with a hydroxyl group and their functional derivatives

- A. phenolic compounds
- B. monosaccharides
- B. polysaccharides
- G. fatty oils
- D. lipoids

5. From the rhizome of which medicinal plants receive "raw filitsin", meaning the amount of floroglucid:

- A. male fern
- B. blueberry
- V. *lapchatka erect*
- Sumy Hemisphere
- D. *Dublusitan*

6. Name a plant containing phenolic compounds, which is characterized by the following macroscopic features: rhizome oblique, powerful with numerous cordate roots. At the upper end of the rhizome are snail-shaped rolled leaf buds, densely covered with rusty-brown membranous scales.

- A. male fern
- B. calendula
- B. Immortelle is sandy
- G. common bearberry
- D. horsetail

7. Name the plant in the procurement of which ostrich and female fern are unacceptable impurities

- A. thyroid gland male
- B. mountain ash is common
- V. dried marsh
- G. corn
- Д. чередатрехраздельная

8. Name the plant in the glands of which (mucilage cells) are mucopolysaccharides:

- A. male fern
- B. common bearberry
- B. thyme
- G. mother-and-stepmother
- D. althaea medicinal

9. At the stages of harvesting any of these plants as impurities may be the leaves of cranberries, blueberries, blueberries. The leaves of this plant are used in the form of decoctions for diseases of the genitourinary tract.

- A. toloknyanka ordinary
- B. blueberries
- V. lapchatka erect
- Sumy Hemisphere
- D. Lusitanian oak

10. The main active substances in the rhizome of this plant - phenolic alcohols and their glycosides, flavonoids and tannins. The taste is bitter and tart, the smell of fresh fracture resembles the smell of a rose

- A. Rhodiola rosea
- B. calendula
- B. Immortelle is sandy
- G. common bearberry
- D. horsetail

8. Literature for the teacher.

1. Фармакогнозія: підручник (I—III р. а.) / І.А. Бобкова, Л.В. Варлахова. – 3-є видання Всеукраїнське спеціалізоване видавництво «Медицина» 2018, 504с.
2. Фармакогнозія: базовий підручн. для студ. вищ. фармац. навч. закл.(фармац. ф-тів) IV рівня акредитації / В.С. Кисличенко, І.О. Журавель, С.М. Марчишин та ін.; за ред. В.С. Кисличенко. – Харків: НФаУ: Золоті сторінки, 2015. - 736 с.
3. Навчальний посібник з дисципліни «Фармакогнозія» / Я. В. Рожковський, Б. В. Приступа, І. А. Бойко, Н. В. Герасимюк, В. В. Черногорюк -: Методична розробка кафедри фармакогнозії ОНМедУ. – Одеса: ОНМедУ, 2019 – 51 с.
4. Державна Фармакопея України: в 3 т. / Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Харків: Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1500 с.

Додаткова література:

- 1 Державна Фармакопея України: в 3 т. / Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Харків: Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
2. Сербін А.Г., Сіра Л.М., Слободянюк Т.О. Фармацевтична ботаніка. Підручник. – Вінниця: НОВА КНИГА, 2007. – 488 с.
3. Практикум з ідентифікації лікарської рослинної сировини: навч. посіб. / [В. М. Ковальов, С. М. Марчишин, О. П. Хворост та ін.] ; за ред. В. М. Ковальова, С. М. Марчишин. – Тернопіль: ТДМУ, 2014. – 250 с.

10. The topic of the next lesson:

Flavonoids. Methods of qualitative and quantitative determination. LR and LRS containing flavonoids: Sophora japonica, dog nettle species, pepper bitter, marsh dried flower, sand cumin, wolfberry, hawthorn species, blue cornflower, chokeberry, three-part herd, two-bladed ginkgo, black elderberry.

Methodical recommendations were made by



associate professor Boyko IA