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

METHODOLOGICAL DEVELOPMENT

Course: “Pharmacognosy”

practical lesson for students on the topic:

"Alkaloids. Proto- and pseudoalkaloids. General characteristics Methods of qualitative and quantitative determination. LR and LRS, which contain proto- and pseudoalkaloids: lobelia hellebore, annual capsicum, horsetail ephedra, late-flowering species. "

Course: 3rd Faculty: Medical and Pharmaceutical

Approved on methodical meeting of the department
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Protocol № 1
Head department
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Odessa – 2024

1. Topic: "Alkaloids. Proto- and pseudoalkaloids. General characteristics Methods of qualitative and quantitative determination. LR and LRS, which contain proto- and pseudoalkaloids: lobelia hellebore, annual capsicum, horsetail ephedra, late-flowering species. " - 4 years.

2. Relevance of the topic.

Among the natural pharmacologically active substances, alkaloids are the main group from which modern medicine derives the largest number of highly effective drugs.

The medical use of alkaloids and their preparations is very diverse, as each alkaloid has its own specific action, often very valuable and sometimes irreplaceable.

For therapeutic purposes, alkaloid-bearing raw materials are used in the form of powders, infusions, fees, in the form of galenic and novogalenic preparations, or pure alkaloids and their salts are obtained from it. The pharmacist must know medicinal plants and raw materials containing alkaloids and the rules of work with them, be able to determine the authenticity and good quality of raw materials, taking precautions, because alkaloids are poisonous substances.

3. Objectives of the lesson:

*3.1. General goals:*to study LR containing alkaloids without heterocycle in the molecule, derivatives of pyrrolizidine, quinolizidine and tropane, and to master the methods of macro- and microscopic analysis of LRS of this topic.

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:

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

1. Definition of "Alkaloids", their classification.
2. Distribution of alkaloids in the plant world and their localization.
3. Terms and methods of collecting LRS containing alkaloids.
4. Morphological characteristics of plants, their habitats (cultivation areas), places of growth.
5. Rational use of wild medicinal plants containing alkaloids and measures for their protection.
6. Latin and Ukrainian names of raw materials, producing plants and families of all objects of the researched topic.
7. Characteristics of external signs of the studied species of LRS.
8. Possible impurities in raw materials and their main differences.
9. The main anatomical diagnostic features of belladonna leaf, blackberry, datura, thermopsis lanceolate.
10. Features of harvesting, drying and storage of raw materials containing alkaloids.
11. Formulas: ephedrine, platyphylline, pachycarpine, cytisine, atropine, scopolamine.
12. Chemical composition, uses and medical application of medicinal plant raw materials containing alkaloids of this group.

On the basis of theoretical knowledge and practical work

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

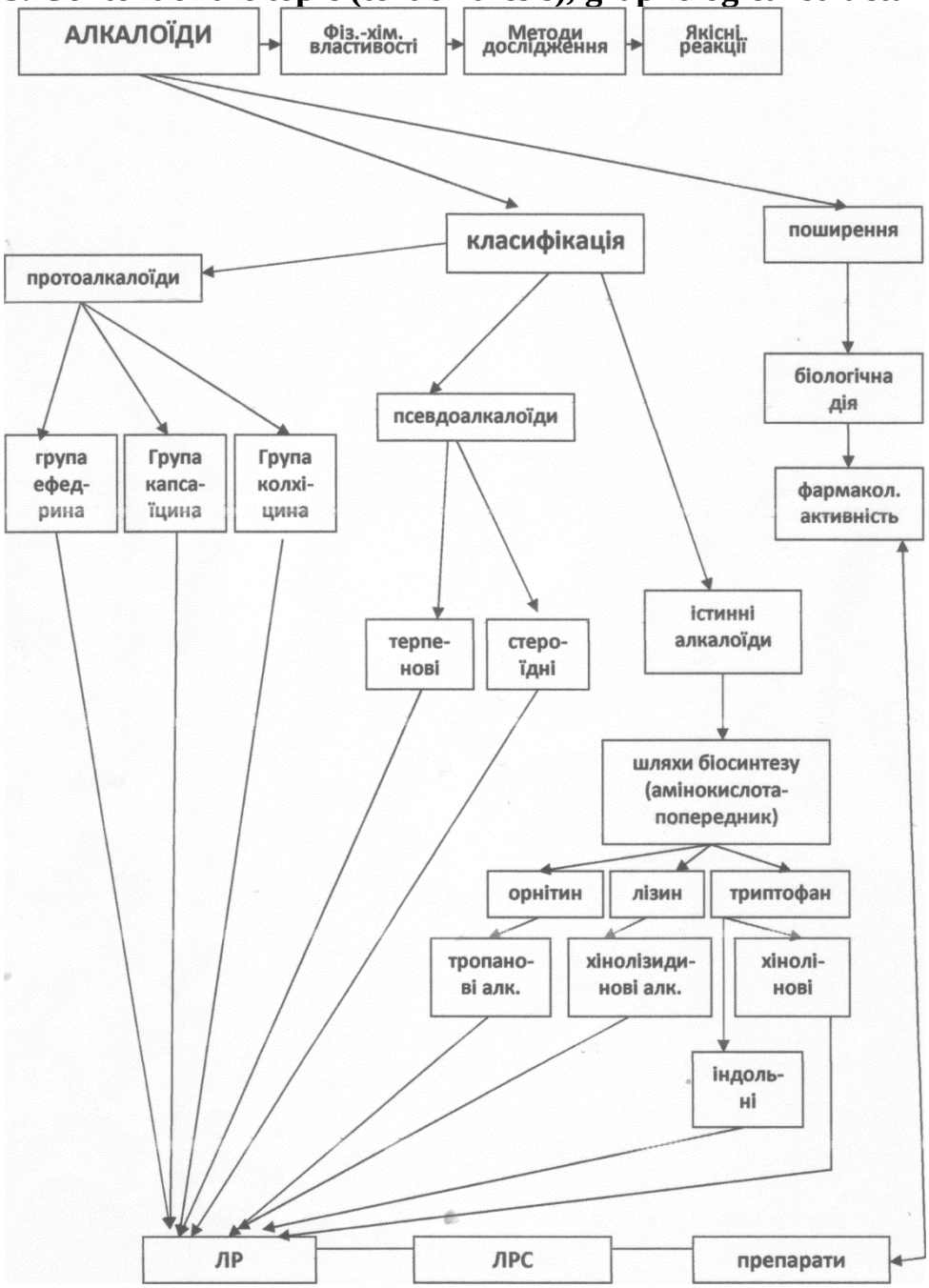
- Recognize the external features of the plant (annual pepper, horsetail ephedra and medium, yellow-leaved yellow, thermopsis lanceolate and alternate, jugs yellow, lamb, belladonna, black fever, datura) and distinguish them from possible to;
- Determine the identity and good quality of raw materials by external features, anatomical structure and qualitative reactions.

4. Interdisciplinary integration

№ p.p.	discipline	know	be able
1	2	3	4
1.	Previous disciplines: 1. Botany	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.	Use a microscope, prepare surface preparations and cross-sections.
	2. Organic chemistry	Physical and chemical properties of polysaccharides, glycosides, terpenoids, aromatic derivatives, heterocycles.	Carry out qualitative reactions; purification of organic compounds.
	3. Analytical chemistry	Methods of acid-base titration (neutralization) and permanganatometry	Work with analytical scales, measuring vessels, photoelectro-colorimeter, use methods of chromatography on paper and in a thin layer of sorbent.
2.	The following disciplines: 1. Physical and colloid chemistry	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.	

	2. Pharmacy technology of drugs	Methods of measuring mass and volume. Preparation of powders or liquid drugs for internal and external use. Analysis of prepared liquid drugs using a burette system.	
	3. Industrial technology of medicines	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.	
	4. Clinical pharmacology	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.	
	5. Pharmaceutical chemistry	Methods of qualitative and quantitative study of drugs.	
	6. Organization and economics of pharmacy	Pharmaceutical service management. Storage of medicines. Control and analytical service, organization of its work. Accounting for inventory and cash. Economic analysis of the pharmacy.	
	7. Management and marketing in pharmacy	Management and entrepreneurship. Organization as an object of management. Connecting processes in management. Human Resource Management Pharmaceutical Marketing Management. Pharmaceutical market research. International marketing.	

5. Content of the topic (text or thesis), graphological structure of the lesson.



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	*Preparatory stage*				1%

	Organization of classes Staging trainingtheir goals Homework check	II	Oral interview on the topic	Methodical works for students, album	2% 25%
2	*The main stage* Conducting a practical lesson	III	Herbariums of medicinal plants, LRS, reagents		50%
3	*The final stage* 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. Datura leaf contains tropan alkaloids and is a poisonous impurity to other leaves. This impurity primicrodiagnostics can be determined by the following anatomical features:
A. many friends
B. cells with mucus
V.cells from Rafid
G. cells with needle crystals
D. cells are filled with calcium oxalate sand

2. Belladonna leaf contains tropan alkaloids and is a poisonous impurity to other leaves. This impurity primicrodiagnostics can be determined by the following anatomical features:
A. cells filled with calcium oxalate sand
B. cells containing essential oil
B. cells containing fatty oil
G. cells are filled with spherocrystals
D.cells filled with prismatic crystals

3. Black leaf contains tropane alkaloids and is a poisonous impurity to other leaves. This impurity primicrodiagnostics can be determined by the following anatomical features:
A. cells filled with prismatic crystals

B. cells filled with calcium oxalate sand
B. cells containing essential oil
G. cells containing fatty oil
D. cells filled with spherocrystals

4. A characteristic micro-diagnostic feature of medicinal plant raw materials - datura leaves is the presence of multicellular warty hairs, as well as the inclusion of calcium oxalate, called
A. friends
B. rafidami
B. cystoliths
G. microcrystalline sand
D. needle crystals

5. A characteristic microdiagnostic feature of the leaf blekoty is the presence of multicellular head hairs, as well as inclusions of calcium oxalate, called:
A. prismatic crystals
B. friends
B. cystoliths
G. needle crystals
D. raffids

6. Late-flowering bulbs contain alkaloids and are used to treat skin cancer. This raw material should be stored in the warehouse:
A. on list A
B. according to list B
V. on the general list
R. on the list "Scented"
D.separate from other types of raw materials
7. Black leaf contains tropane alkaloids and is used to treat bronchial asthma. This raw material should be stored in the warehouse:
A. on list A
B. according to list B
V. on the general list
R. on the list "Scented"
D. according to the list "Dyes"

8. Unacceptable impurity in any vegetable raw materials is a toxic impurity tropan-containing raw materials. Which of the following types of raw materials may contain tropane alkaloids:
A. dope leaf
B. letter of Stephanie
V. thyme leaf
G. leaf of sumac
D. sheet of sumac

9. Complex organic nitrogen-containing compounds of basic nature, plant, rarely animal origin, most of which have a strong specific physiological effect on the body. it:
A. alkaloids
B. polysaccharides
B.fatty oils
G. essential oils
D. saponins

10. In connection with the presence of BAV drugs thermopsis lanceolate have antitussive effect:
A. alkaloids
B. polysaccharides
V. flavonoids
G. iridoidov
D. tannins

Question:
1. Definition of "alkaloids".
2. Plants rich in alkaloids.
3. Features of harvesting, drying and storage of raw materials containing alkaloids.
4. Formulas: ephedrine, platyphyllin, pachycarpine, cytisine, atropine, scopolamine.
5. Latin and Ukrainian names of raw materials, producing plants and families of all objects of the researched topic.
6. Morphological characteristics of plants, their habitats (areas of cultivation), habitats.
7. External signs of the studied types of medicinal plant raw materials.
8. Possible impurities to the raw material (sagebrush, black leaves, rhizomes of yellow cuckoo, clownfish) and their main differences.
9. Chemical composition, uses and medical use of medicinal plant raw materials containing alkaloids.

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 lesson:

Task 1. To study belladonna ordinary and to carry out the analysis of raw materials on AND (sections: external signs, microscopy).

1. Examine the appearance of belladonna ordinary herbarium specimens (Scheme 1.).

Scheme 1.

DETERMINATION OF THE PRODUCING PLANT ACCORDING TO EXTERNAL SIGNS

- life form (herbaceous plant, shrub, shrub, tree).
- type of underground organs (root, rhizome, tuber, etc.)
- stem structure (shape, nature of branching, pubescence, diameter, etc.)

- leaf 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 lentils, thorns, etc.).

Write down the Latin and Russian names of raw materials produced by plants and families.

2. Describe the appearance of a belladonna leaf on the example of a sample of raw materials

(scheme 2)

Scheme 2.

ANALYSIS OF RAW MATERIALS "LEAVES" ON EXTERNAL SIGNS "

- type of leaf and dissection of the leaf blade: (simple: palchatorassechennaya, palchato- or pinnate, peristolopastnye, three- or five-lobed; complex: even or imparipinnate.
- leaf stem or sessile.
- shape (round, elliptical, ovoid, lanceolate, linear).
- leaf edge (solid, serrated, toothed, crenate, etc.)
- nature of veining (arcuate, reticular, finger, pinnate, parallel).
- pubescence
- color of the upper and lower sides
- sheet and leaf sizes
- odor when rubbing the object or wetting with water.
- taste (for non-toxic objects)
- specific features.

Conduct a macroscopic analysis of the grass and describe its appearance (Figure 3).

Scheme 3

ANALYSIS OF RAW MATERIALS "GRASS" BY EXTERNAL SIGNS

- "Commodity type" of raw materials (whole, cut, threshed)
- Stem structure (shape, branching, lowering, color, size, specific features).
- The nature of the leaf arrangement (alternate, opposite, whorled).
- Leaf.
- The location of the flowers on the stem.
- Flowers.
- Fruits and seeds.
- Sizes of stems, leaves, flowers.
- Color.
- 3apah when rubbing.
- Taste (in non-toxic objects).

3. Prepare a micropreparation of belladonna leaf from the surface, study it at low and high magnification (Scheme 4).

Scheme 4

MICROSCOPIC ANALYSIS OF RAW MATERIALS

- structure (Dorsoventral, isolateral)
- mesophile (nature of palisade and spongy tissues).
- inclusions crystalline (single crystals, crystal-bearing coating, friends, Rafida, crystalline sand, cystolites); secretory (containers, milk vessels, canals).
- epidermis of the upper and lower sides of the sheet (shape and contour of cells: isodiametric, erect, convoluted; stomatal type: diacytic, parasitic, anisocytic, anocytic; number and location of periosteal cells.
- type of trichomes: hairs, glands.
- cuticle: thin, thick, straight, folded, warty.

Draw and mark diagnostic signs:

- tortuous cells of the epidermis on both sides of the sheet;
- numerous large stomata, surrounded by 3 cells of the epidermis;
- cuticle folding;
- three types of hairs:
    1. *simple* multicellular, thin-walled, often with dormant joints;
    2. *head* - with a multicellular oval head consisting of 2-11 cells on a unicellular (sometimes two-celled) stalk and with a spherical, rarely oval unicellular head on a multicellular stalk;
    3. *in the spongy parenchyma* large oval cells filled with fine crystalline sand of calcium oxalate.

4. Note the compliance of the investigated sample of raw materials (by external signs, microscopy) to the requirements of GF XI, Article 13.

Task 2. To study black blacks and to carry out the analysis of raw materials on AND (sections: external signs and microscopy).

1. Examine the appearance of black spot on the herbarium sample (Scheme 1). Write down the Latin and Russian names of raw materials produced by plants and families.
2. Carry out a macroscopic analysis of the blackberry leaf on the example of a sample of raw materials and describe its appearance (Scheme 2).
3. Prepare a micropreparation of blackberry leaf on the example of a sample of raw materials and describe its appearance (Scheme 4).

Draw and mark diagnostic signs:

- stomata surrounded by three cells of the epidermis ;;
- simple hairs: small, three-four-celled with the expanded basis; large, with long cells;
- glandular hairs with a multicellular (2-4 cells) stalk and multicellular (occasionally unicellular oval) head.

1. Note the compliance of the sample of raw materials (by external signs, microscopy and histochemical reaction) to the requirements of GF XI, Article 17.

Task 3. Examine the common dope and analyze the raw materials for AND (sections: external signs and microscopy).

1. Examine the appearance of dope ordinary by herbarium pattern (Scheme 1). Write down the Latin and Russian names of raw materials, plants and families.
2. Conduct a macroscopic analysis of datura sheet on the example of a sample of raw materials and describe its appearance (Scheme 2).
3. Prepare the leaf micropreparation from the surface. To study it at low and high magnification according to scheme 4.

Draw and mark diagnostic signs:

1. cells of the upper epidermis with more straight walls, the lower - with tortuous;
2. stomata rounded, surrounded by three cells of the epidermis, one of which is slightly smaller than the others;
3. two types of hairs:
    - *simple* thin-walled 2-3 (rarely 4-5) -cellular with a roughly warty surface
    - *glandular* with unicellular curved leg and oval multicellular head;
4. friends of calcium oxalate.

4. Note the compliance of the investigated sample of raw materials (by external signs, microscopy) to the requirements of GF XI, Article 24.

WITHavdannya 4. To study the lanceolate and alternate thermopsis and to analyze the raw materials according to the AND (sections: external signs and microscopy).

1. To study the appearance of thermopsis lanceolate and alternate-flowered herbarium specimens (Scheme 1). Write the Latin and Russian names of raw materials, plants and families (give synonyms).
2. Conduct a macroscopic analysis of thermopsis grass and describe its appearance on the example of a sample of raw materials (Scheme 3).
3. Prepare a micropreparation of thermopsis leaf from the surface. Examine it at low and high magnification (Scheme 4).

Draw and mark diagnostic signs:

- upper epidermis, consisting of large polygonal cells.
- cells of the epidermis of the lower side of the leaf with tortuous contours.
- numerous stomata on both sides of the oval leaf, surrounded, for the most part, by 4-5 cells of the epidermis.
- bicellular hairs, consisting of a short cell at the base (basal) or long end (terminal) cell.
- epidermal cells around the place of attachment of hairs form a rosette.
- yellowish-brown spherical crystals.

4. Note the compliance of the investigated sample of raw materials (on external grounds) to the requirements of GF XI, Article 59.

Task 5. To carry out the analysis of fruits of red pepper on AND (section: external signs).

Task 6. To carry out the analysis of a grass of an ephedra horsetail on AND (section: external signs)

Task 7. To carry out the analysis of a grass of a yellow-leaved yellow-grass on AND (section: external signs).

Task 8. To carry out the analysis of rhizomes of jugs of yellow on AND (section: external signs).

Task 9. To carry out the analysis of a grass of a plaun of a lamb on AND (section: external signs).

For each of the objects specified in tasks 5-9:

1. Examine the appearance of the plant on herbarium specimens and tables. Write down the Latin and Russian names of the raw materials that produce plants and families.
2. Describe the appearance of the object on a sample of raw materials, using diagrams.
3. Note the compliance of raw materials (on external grounds) with the requirements of the AND.

Instructional materials for mastering professional skills:
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 the anatomical and diagnostic features of roots and rhizomes
e) to study the anatomical and diagnostic features of fruits and leaves
f) record the observations in a laboratory journal

7.3. Control materials for the final stage of the lesson: tasks, tasks, tests, etc.
Question:
1) What parts of the plant consists of raw grass thermopsis lanceolate?
2) What Russian synonym indicates GF XI for thermopsis?
3) What is indicated in GF XI on the content of immature fruits in the grass thermopsis? Why do they pay attention to this?
4) Why thermopsis grass is grayish-green? Are both surfaces of the sheet the same color?
5) What types of hairs are found in the preparation of thermopsis leaf; than they are characteristic?
6) How to prepare a micropreparation of thermopsis leaf to see thermopsilanthin crystals; in what fabric are they?
7) What types of raw belladonna are used in medicine?
8) What produce plants adopted GF XI as a source of raw belladonna?

9) Why do raw belladonna leaves differ so much in size?
10) Is it important that the raw belladonna leaves were with petioles?
11) Indicate the microscopic features of the belladonna leaf in the micropreparation.
12) What external signs determine the authenticity of the belladonna root?
13) What parts of the plant consists of raw materials - belladonna grass?
14) Which diagnostic feature is very important for determining the authenticity of belladonna root?
15) On what external basis can be determined by a letter of blackberry, what to look for?
16) Blackthorn leaf has calcium oxalate crystals of different shapes; which of them are characteristic in the diagnosis of raw materials?
17) On what external grounds can distinguish the leaf of datura ordinary from the leaf of blackberry?
18) What type of hairs, crystals is peculiar only to the leaves of datura?
19) What is the name of the raw yellow cup; what are its external and microscopic signs?
20) Why the rhizome of the yellow cup is presented in raw materials in thin pieces?
21) What is the raw material of the clown Barantz, what are its external features?

Tests:

1. In the procurement of vegetable raw materials by students there were cases of poisoning. It is not recommended to involve children in the collection of any raw materials:
A. dope is common
B. dioecious nettle
B. sea buckthorn buckthorn
G. gray alder
D. plantain is large

2. In the identification of raw materials containing alkaloids, a large number of druses, a head hair with a multicellular head, a unicellular stalk and a simple warty hair were found. These morphological features are characteristic of:
A. Folium Daturae
B. Folium Belladonnae
B. Folium Vincae minor
G. Folium Hyoscyami
D. Folium Theae

3. In the microdiagnostic analysis of grass containing alkaloids, were found stomata of anocytic type, numerous bicellular hairs with a short basal and long terminal cell and large-bumpy surface, spherocrystals of phenolic glycoside, which is a characteristic feature:
A.Nerba Thermopsidis
B.Herba Belladonnae
B.Herba Chelidonii
G.Herba Delphinii
D.Herba Ephedrae

4. Vegetable raw materials containing alkaloids are stored according to list B. Particularly toxic types of vegetable raw materials, which are stored according to list A, include:
A. timeless tubers
B. the fruits of capsicum
C. passionflower grass
G. tobacco leaf
D. nightshade grass

5. To establish the benignity of the leaf of black blackberry conduct a quantitative analysis of the content of alkaloids in terms of atropine. To do this, use the method:
A. back titration
B. biological standardization
B. distillation with water vapor
G. gravimetric analysis
D. chromatographic analysis

6. To establish the benignity of datura leaf conduct a quantitative analysis of the content of alkaloids in terms of atropine. To do this, use the method:
A. back titration
B. biological standardization
B. distillation with water vapor
G. gravimetric analysis
D. chromatographic analysis

7. To establish the benignity of belladonna leaves conduct a quantitative analysis of the content of alkaloids in terms of atropine. To do this, use the method:
A. back titration
B. biological standardization
B. distillation with water vapor
G. gravimetric analysis
D. chromatographic analysis

8. Belladonna leaves are used to obtain tinctures, thick and dry extracts. To detect hyoscyamine in belladonna leaves should use the reaction:
A. with Dragendorf's reagent
B. azo combination reaction
B. with a solution of ferric chloride
G. Keller-Killian reaction
D. the reaction is legal

9. Blackberry leaves are used in the manufacture of anti-asthmatic drugs. To detect hyoscyamine in the leaves of blackberries should use the reaction:
A. with Dragendorf's reagent
B. Reazole azo combination

B. with a solution of ferric chloride
G. Keller-Killian reaction
D. the reaction is legal

10. From which alkaloid-bearing ARS get tincture, and on its basis produce combined drugs "Capsitrin", "Capsin", ointment "Espol", liniment "Camfocin":
A. annual peppers
B. sweet naked
B. chamomile G. linden heart-shaped
D. kendir Konoplyova

11. In contrast to phenolic compounds and terpenoids, these biologically active substances are combined into one group of secondary metabolism not on biogenetic principles, but on chemical grounds - the presence of nitrogen molecules in them. Most of these substances are formed by their amino acids, others - by mevalonate. These are:
A. alkaloids
B. iridoids
B. anthracene derivatives
G. fatty oils
D. cardiosteroids

8. Literature for the teacher.

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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:
Alkaloids. True alkaloids. Medicinal plants and raw materials that contain alkaloids: belladonna, black black, dope, thermopsis, opium poppy, yellow cat, celandine, barberry, hornbeam, chilli, species of Rauwolfia, catharanthus pink, periwinkle.

Methodical recommendations were made by

associate professor Boyko IA