

MINISTRY OF HEALTH OF UKRAINE
ODESSA NATIONAL MEDICAL UNIVERSITY
Department of General and Clinical Pharmacology and Pharmacognosy

APPROVE

Vice-Rector for Scientific and Pedagogical Work
_____ Edward BURYACHKIVSKY

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**METHODOLOGICAL RECOMMENDATIONS TO PRACTICAL
CLASSES
FROM THE ACADEMIC DISCIPLINE
PRODUCTION PRACTICES WITH
PHARMACOGNOSIS**

Level higher Education : second (master's)

Branch knowledge : 22 « Security health »

Specialty : 226 " Pharmacy , industrial" pharmacy »

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Odessa National Medical University

Protocol No. 1 dated “ 30 ” August 2024

Head of the Department



(Yaroslav ROZHKOVSKY)

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No. p.p	Topic of practical classes	Number of hours
1	Familiarization with the calendar, the practice base, the content of the main works, the time and conditions of their implementation; with the organization of work, tasks and internal regulations of the practice base, the content of the practice report. Instruction on safety precautions during the practice. Geobotanical classification of LR, belonging to a certain phytocenosis, morphological characteristics of plants. Geobotanical description of LR according to the received individual tasks.	8
2	Types of plant communities, their ecological characteristics, species composition of protected areas and plants. Species composition and ecological and morphological features of forest phytocenoses. Forest stratification. Medicinal plants of steppes and meadows. Aquatic and coastal plants. Synanthropic vegetation. Types of weeds.	8
3	Diagnosis of official medicinal plants and possible impurities in them, distinctive features. Vegetation phases. Herbalization of medicinal plants. Terms of harvesting medicinal plants of wild medicinal plants.	6
4	Introduction to the biological characteristics of LR, methods and techniques of their cultivation. Selection of sites, soil preparation. Methods of LR propagation. Planting material: seed categories, varietal control. Types of fertilizers, fertilizer application.	8
5	Sowing, crop care, soil cultivation . Harvesting, technical means, care of cultivated LR using good cultivation practices (GACP). Agrotechnical conditions for growing LR cultivated on the basis of practice.	8
6	Organization of LRS harvesting. Mastering techniques for rational collection of LRS of different morphological groups.	8
7	Mastering the methods of primary processing, drying of LRS. The importance of primary processing for obtaining good-quality LRS. Methods of primary processing of LRS of different morphological groups. Drying of LRS of different chemical and morphological groups. Methods of drying LRS - natural and artificial	8
8	Bringing LRS to a standard state. Packaging and labeling, transportation of LRS. Familiarization with the storage conditions of LRS. Preparation of premises for storage of LRS. Rules for storing LRS of different morphological and chemical groups. Quality control of LRS during storage.	8
9	Detection of LR thickets . Periodicity of exploitation of LR thickets . Requirements for rational collection and periodicity of LRS harvesting in a specific thicket	8
10	Rare, endangered species of LR. Red and Green Books of Ukraine. System of measures for the protection, rational use of nature and reproduction of LR stocks in the region.	8
	Diff credit	2
	Total:	80

TOPIC 1. Familiarization with the calendar, the practice base, the content of the main works, the time and conditions of their implementation; with the organization of work, tasks and internal regulations of the practice base, the content of the practice report. Instruction on safety precautions during practice. Geobotanical classification of LR, belonging to a certain phytocenosis, morphological characteristics of plants. Geobotanical description of LR according to the received individual tasks.

Practical training is an integral part of the training of specialists in the field of pharmacognosy and botany. It is aimed at consolidating theoretical knowledge, developing professional skills and practical abilities in working with medicinal plants.

The first practice session aims to familiarize students with the work schedule, organization of the practice base, internal regulations, tasks, and reporting.

Special attention is paid to safety precautions when working on the sites, mastering the skills of geobotanical description of medicinal plants, determining their belonging to certain phytocenoses and morphological characteristics.

Such familiarization provides a basis for further effective implementation of individual and collective practice tasks.

Goal:

- To familiarize students with the calendar and organization of work based on practice.
- Provide skills in reporting on the completed practice.
- Provide knowledge of safety techniques during practical work.
- To introduce the geobotanical classification of medicinal plants (MP), their phytocenosis and morphological features.
- To teach how to conduct a geobotanical description of the landscape according to individual tasks.

Basic concepts (list of questions):

1. Practice calendar: structure and content.
2. Practice base: work organization, internal procedures, tasks.
3. Practice reporting forms.
4. Safety rules during work in practice.
5. Geobotanical classification of medicinal plants.
6. Main phytocenoses and the affiliation of LR to them.
7. Morphological characteristics of plants: root, stem, leaves, flower, fruit.
8. Methodology for conducting geobotanical plant description.

Practical lesson plan

1. Control of the reference level of knowledge

1. Oral survey on theoretical material: calendar plan, practice base, safety techniques.
2. Test tasks on basic concepts of geobotany and morphology of the LR.

2. Discussion of theoretical questions to test basic knowledge on the topic

1. Analysis of calendar tasks and their sequence of execution.
2. Reporting rules.
3. Basic principles of individual practice-based tasks.
4. Overview of geobotanical classifications and phytocenoses, examples of medicinal plants.

3. Formation of professional skills and practical abilities

1. Conducting practical safety training.
2. Carrying out a geobotanical description of the LR according to an individual task (including morphological features and phytocenosis).
3. Compiling the first part of the practice report: information about the sites visited, plants, observations and analysis of the phytocenosis.
4. Consultations on the preparation of observations and recommendations for further work in practice.

4. Summing up:

After completing the practical session, students should:

- Clearly navigate the calendar and work organization based on practice;
- Follow safety rules during field and laboratory work;
- Be able to correctly report on the practice performed;
- Identify medicinal plants by geobotanical classification and phytocenosis;
- Describe the morphological characteristics of plants and conduct a geobotanical description according to the individual task.
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Thus, the first practical lesson lays the foundation for the successful completion of subsequent work, forms professional skills, and prepares students for independent research of medicinal plants in natural conditions.

List of recommended literature:

Main:

1. Pharmacognosy: textbook (I–III grades) / I.A. Bobkova , L.V. Varlakhova . – 3rd edition All-Ukrainian Specialized Publishing House “Medicine” 2018, 504p.

2. Pharmacognosy: basic manual for students of higher pharmaceutical schools (pharmaceutical faculties) of the IV level of accreditation / V.S. Kyslychenko , I.O. Zhuravel, S.M. Marchyshyn and others ; edited by V.S. Kyslychenko . - Kharkiv: National University of Pharmacy : Golden Pages, 2015. - 736 p.

3. Textbook on the discipline "Pharmacognosy" / Ya. V. Rozhkovsky , B.V. Prystyupa , I.A. Boyko, N.V. Gerasymyuk , V.V. Chernogoryuk -: Methodological development of the Department of Pharmacognosy of ONMedU . – Odessa: ONMedU , 2019 – 51 p.

4. State Pharmacopoeia of Ukraine: in 3 volumes / State Enterprise “Ukrainian Scientific Pharmacopoeial Center for the Quality of Medicinal Products”. – 2nd ed. – Kharkiv: State Enterprise “Ukrainian Scientific Pharmacopoeial Center for the Quality of Medicinal Products”, 2015. – Vol. 1. – 1500 p.

Additional:

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3. Solodovnichenko N.M., Zhuravlev M.S., Kovalev V.M. Medicinal plant raw materials and phytopreparations. - Kharkiv: Publishing house of the National Academy of Agricultural Sciences "Golden Pages", 2001. - 407 p.

4. Workshop on the identification of medicinal plant raw materials: teaching aids . / [V. M. Kovalev, S. M. Marchyshyn , O. P. Khvorost and others]; ed. V. M. Kovalev, S. M. Marchyshyn . – Ternopil: TSMU, 2014. – 250 p.

TOPIC 2. Types of plant communities, their ecological characteristics, species composition of protected areas and plants. Species composition and ecological and morphological features of forest phytocenoses. Forest stratification. Medicinal plants of steppes and meadows. Aquatic and coastal plants. Synanthropic vegetation. Types of weeds

The study of plant community types and their ecological characteristics is the basis for understanding the relationships between plants and the environment. The practical lesson focuses on determining the species components of medicinal plants and rare, protected species, studying the stratification of forest phytocenoses, as well as familiarizing with the specifics of plants of steppes, meadows, wetlands and synanthropic ecosystems. Special attention is paid to weeds and their role in agrocenoses and natural communities. This lesson allows students to consolidate theoretical knowledge and develop practical skills in observing, describing and analyzing plant communities in natural conditions.

Goal:

- To introduce students to the types of plant communities and their ecological features.
- Provide knowledge about the species composition of medicinal plants, rare and protected species.
- Develop skills in determining the stratification of forest phytocenoses and morphological features of plants.
- To develop the ability to describe the vegetation of steppes, meadows, wetlands, and synanthropic groups.
- To teach how to identify weeds and analyze their role in plant ecosystems.

Basic concepts (list of questions):

1. What are medicinal plants and how are they different from other plants?
2. Name the main morphological parts of a plant used in pharmacognosy.
3. What is phytocenosis and what are its components?
4. Name the main types of plant communities.
5. What is meant by forest layering?
6. What ecological conditions determine the type of plant community?
7. Give examples of medicinal plants of the steppes.
8. Give examples of medicinal plants of meadows.
9. What aquatic coastal plants are known to you as medicinal?
10. What is synanthropic vegetation?
11. What types of weeds are most common in anthropogenic communities?
12. What is a rare or protected plant species?
13. What methods of field plant description are used in practice?
14. Name the main criteria for geobotanical description of plants.
15. What information must be recorded in the internship report?

Practical lesson plan

1. Control of the reference level of knowledge

1. Types of plant communities: forest, steppe, meadow, wetland, synanthropic.
2. Ecological characteristics of communities.
3. Species composition of medicinal plants and rare species.
4. The stratification of forest phytocenoses.
5. Ecological and morphological features of plants of different groups.
6. Weed species and their role in natural and anthropogenic communities.
7. Methods of field observation and description of plant communities.

2. Discussion of theoretical questions to test basic knowledge on the topic.

1. What are the main types of plant communities found in nature?
2. What are the ecological characteristics of forest communities?
3. How is the species composition of forest phytocenoses determined?
4. Give examples of medicinal plants from each forest layer.
5. What is stratification and what strata are distinguished in a forest?
6. How to distinguish steppe groups from meadows by species composition?
7. What morphological features of medicinal plants are important for their description?
8. What wetland plants are used in medicine?
9. What is synanthropic vegetation and how does it differ from natural vegetation?
10. What environmental factors influence the spread of weeds?
11. Give examples of protected medicinal plants in the region.
12. How is the ratio of medicinal and undesirable species in a community assessed?
13. What field observation methods allow us to determine species diversity?
14. Why is it important to consider the ecological conditions of plant growth during geobotanical description?
15. What role do weeds and synanthropic vegetation play in shaping the ecosystem?

3. Formation of professional skills and practical abilities

1. Field definition of grouping type

- Students are tasked with observing and determining the type of plant community: forest, steppe, meadow, wetland, or synanthropic.
- Observations are made of plant species, the number of medicinal and protected species.

2. Determining forest layering

- Identification of tree, shrub, and herbaceous layers in the forest.

- Fixation of representatives of each tier with a brief description of morphological features.
- 3. Geobotanical description of medicinal plants**
 - Identification of species using floristic keys or herbarium specimens.
 - Description of morphology (root, stem, leaves, flower, fruit).
 - Indication of phytocenosis and ecological growth conditions.
- 4. Observation of aquatic, coastal and meadow plants**
 - Study of the characteristic features of plant communities.
 - Recording location features and species relationships.
- 5. Identification of synanthropic vegetation and weeds**
 - Identification of common weeds and their impact on communities.
 - Analysis of the ratio of cultural and undesirable species in the environment.
- 6. Compiling field notes and reports**
 - Students record observations in the form of tables or descriptions.
 - All types of medicinal plants, rare species, synanthropic plants and weeds are recorded.
 - A brief analysis of ecological conditions and the structural composition of communities is provided.

Expected results

After completing the practical tasks, the student must:

- Be able to distinguish types of plant communities and determine their ecological characteristics.
- Distinguish between forest, steppe, meadow, wetland, and synanthropic plants.
- Conduct a geobotanical description of medicinal plants and rare species.
- Identify the stratification of forest phytocenoses and morphological characteristics of species.
- Format field notes in the form of tables, diagrams, and descriptions for further reporting.

4. Summing up:

- Students must clearly identify types of plant communities and their ecological features.
- Be able to analyze forest stratification and describe the species composition of communities.
- Have the skills to observe, describe, and record the morphological and ecological characteristics of plants.
- Understand the role of protected species and weeds in shaping the ecosystem.
- The skills developed lay the foundation for independent field research of medicinal plants in nature.

List of recommended literature:

Main:

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TOPIC 3. Diagnosis of official medicinal plants and possible impurities in them, distinctive features. Vegetation phases. Herbalization of medicinal plants. Terms of harvesting medicinal plants of wild medicinal plants.

Diagnostics of medicinal plants is a key stage in pharmacognostic practice, since the correct determination of the species ensures the effectiveness and safety of the use of medicinal plant raw materials. Of particular importance is the ability to distinguish officinal plants from possible impurities that can reduce the quality of the raw materials or be dangerous to health. An important aspect is also knowledge of the phases of plant vegetation, which determine the optimal terms for harvesting raw materials. Mastering the methods of herbarization allows you to store plant samples for further study and identification. This practical lesson is aimed at developing professional skills in recognizing, harvesting and documenting medicinal plants in students.

GOAL :

- To introduce students to the principles of diagnosis of official medicinal plants.
- Teach how to distinguish medicinal plants from possible impurities.
- To form knowledge about the phases of plant vegetation and their importance for harvesting.
- To introduce the rules for herbalization of medicinal plants.
- Develop skills in determining the optimal timing for harvesting medicinal plant raw materials.

Basic concepts (list of questions):

1. Official medicinal plants.
2. Impurities in medicinal plant raw materials.
3. Morphological diagnostics of plants.
4. Distinctive features of medicinal plants.
5. Plant vegetation phases.
6. Biologically active substances and their accumulation.
7. Herbarium and its importance.
8. Methods of plant herbarization.
9. Medicinal plant raw materials (MPR).
10. Terms of harvesting wild medicinal plants.

Practical lesson plan

1. Control of the reference level of knowledge

1. What is medicinal plant raw material?

2. What plants are called official?
3. What are morphological characteristics of plants?
4. Name the main organs of a plant.
5. What is phytocenosis?
6. What factors affect plant growth and development?
7. What is a herbarium?
8. What is the importance of herbalization?
9. What are the rules for collecting plants in nature?
10. What is the growing season?
11. What are the phases of plant development?
12. What parts of plants are most often used as LRS?
13. What environmental factors influence the accumulation of BAS?
14. What are the main requirements for the quality of medicinal plant raw materials?
15. What are impurities in LRS?

2. Discussion of theoretical questions to test basic knowledge on the topic

1. Which plants are considered officinal and why?
2. What are the impurities in medicinal plant raw materials?
3. What morphological characteristics are used for plant diagnosis?
4. How to distinguish a medicinal plant from a morphologically similar impurity?
5. What phases of vegetation are distinguished in plants?
6. How does the content of biologically active substances change in different phases?
7. What are the rules for collecting medicinal plants in natural conditions?
8. What are the terms for harvesting different parts of plants (roots, leaves, flowers)?
9. What is herbalization and what are its main stages?
10. What errors can occur during herbarization?
11. How to properly dry medicinal plant materials?
12. What are the signs that indicate the benign nature of LRS?
13. What are the dangers of misidentifying plants?
14. How do growing conditions affect the quality of LDS?
15. What is the importance of correct plant identification in medicine?

3. Formation of professional skills and practical abilities

Practical activities of students:

1. **Diagnostics of medicinal plants**
 - Identification of officinal plants from herbarium specimens or natural objects.
 - Identification of characteristic morphological features.
2. **Detection of impurities**

- Comparison of medicinal plants with possible impurities.
- Establishing distinctive diagnostic features.
- 3. Determining the phases of vegetation**
 - Analysis of the stage of plant development (vegetation, budding, flowering, fruiting).
 - Establishing the optimal collection period.
- 4. Herbarium of plants**
 - Collection of plant material.
 - Proper pressing, drying, and presentation of a herbarium specimen.
 - Herbarium signature (name, place of collection, date, growing conditions).
- 5. Determining the terms of procurement of LRS**
 - Justification of the choice of the period for collecting different plant parts.
 - Analysis of the relationship between the developmental phase and the accumulation of BAS.

4. Summing up:

After the class, students should:

- Be able to recognize official medicinal plants and their impurities.
- Identify morphological features that have diagnostic significance.
- To understand the phases of plant growth and their importance for harvesting.
- Master the method of plant herbarization.
- Determine the optimal timing for harvesting medicinal plant raw materials.

Thus, the acquired knowledge and skills provide the basis for the correct identification of medicinal plants, their rational use and procurement, which is an important stage in the training of future pharmaceutical specialists.

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Main:

1. Pharmacognosy: textbook (I–III grades) / I.A. Bobkova , L.V. Varlakhova . – 3rd edition All-Ukrainian Specialized Publishing House “Medicine” 2018, 504p.
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TOPIC 4. Familiarization with the biological features of LR, with the methods and techniques of their cultivation. Selection of plots, soil preparation. Methods of LR propagation. Planting material: seed categories, varietal control. Types of fertilizers, fertilizer application.

Rational cultivation of medicinal plants is an important stage in obtaining high-quality medicinal plant raw materials. The biological characteristics of plants determine their requirements for environmental conditions, methods of reproduction and agrotechnical techniques. Knowledge of the principles of site selection, soil preparation, the use of high-quality planting material and fertilizers allows you to ensure high yields and accumulation of biologically active substances. The practical lesson is aimed at developing students' skills in planning and organizing the process of growing medicinal plants, taking into account their biological and environmental characteristics.

GOAL :

- To introduce students to the biological characteristics of medicinal plants.
- To teach the basic principles of growing medicinal plants.
- To develop knowledge about site selection and soil preparation.
- To introduce methods of propagation of medicinal plants.
- Provide knowledge about planting material, seed categories, and varietal control.
- Develop skills in using fertilizers and planning their application.

Basic concepts (list of questions):

1. Biological features of medicinal plants.
2. Agricultural techniques for growing medicinal plants.
3. Choosing a site for cultivation.
4. Soil preparation.
5. Soil fertility.
6. Methods of plant reproduction (seed, vegetative).
7. Planting material.
8. Seed categories.
9. Varietal control.
10. Organic and mineral fertilizers.
11. Fertilizer system.
12. The impact of agrotechnical measures on the quality of LRS.

Practical lesson plan

1. Control of the reference level of knowledge

1. What are medicinal plants?
2. What factors affect plant growth and development?
3. What is soil and what are its main properties?
4. What types of soils do you know?
5. What is soil fertility?
6. What are the main methods of plant reproduction?
7. What are seeds?
8. What conditions are necessary for seed germination?
9. What is vegetative propagation?
10. What organs do plants use for vegetative reproduction?
11. What are fertilizers?
12. What types of fertilizers are there?
13. What is the importance of minerals for plants?
14. What are the stages involved in growing plants?
15. What is agricultural technology?

2. Discussion of theoretical questions to test basic knowledge on the topic

1. What biological features of medicinal plants influence their cultivation?
2. How to choose the right area for growing medicinal plants?
3. What are the soil requirements of plants?
4. What are the stages of soil preparation before sowing?
5. What is the difference between seed and vegetative propagation?
6. What are the advantages and disadvantages of different methods of reproduction?
7. What categories of seeds exist and how do they differ?
8. What is variety control and what is its importance?
9. What types of fertilizers are used in growing medicinal plants?
10. How to determine the need for fertilizers for plants?
11. What are the rules for applying organic and mineral fertilizers?
12. How does agricultural technology affect the quality of medicinal plant raw materials?
13. What environmental factors should be considered when growing LR?
14. What mistakes can occur when growing medicinal plants?
15. What modern approaches are used in the cultivation of medicinal plants?

3. Formation of professional skills and practical abilities

Practical activities of students:

1. **Assessment of the plot for growing LR**
 - Analysis of conditions: lighting, humidity, soil type.
 - Choosing the optimal location for specific types of medicinal plants.

2. **Soil preparation**
 - Determining the structure and condition of the soil.
 - Planning activities: plowing, loosening, leveling.
3. **Choosing a method of reproduction**
 - Justification of the seed or vegetative method.
 - Selection of material for propagation (seeds, rhizomes, cuttings).
4. **Evaluation of planting material**
 - Determination of seed quality (germination, purity, category).
 - Introduction to the principles of varietal control.
5. **Fertilizer system planning**
 - Determining the type of fertilizer depending on the crop and soil.
 - Development of a fertilizer application scheme.
6. **Drawing up an agrotechnical cultivation plan**
 - Students develop a brief plan for growing a specific medicinal plant (stages, timing, care).

4. Summing up:

After the class, students should:

- Know the biological characteristics of medicinal plants and their requirements for growing conditions.
- Be able to choose a site and prepare the soil for cultivation.
- Distinguish between methods of reproduction and justify their use.
- Assess the quality of planting material and understand the importance of varietal control.
- Plan a fertilization system and agrotechnical measures.

Thus, the acquired knowledge and practical skills allow students to effectively organize the process of growing medicinal plants, which is important for obtaining high-quality medicinal plant raw materials and their further use in medical practice.

List of recommended literature:

Main:

1. Pharmacognosy: textbook (I–III grades) / I.A. Bobkova , L.V. Varlakhova . – 3rd edition All-Ukrainian Specialized Publishing House “Medicine” 2018, 504p.
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4. Workshop on the identification of medicinal plant raw materials: teaching aids . / [V. M. Kovalev, S. M. Marchyshyn , O. P. Khvorost and others]; ed. V. M. Kovalev, S. M. Marchyshyn . – Ternopil: TSMU, 2014. – 250 p.

TOPIC 5. Sowing, crop care, soil cultivation . Harvesting, technical means, care of cultivated LR using good cultivation practices (GACP). Agrotechnical conditions for growing LR cultivated on the basis of practice.

Effective cultivation of medicinal plants requires compliance with a complex of agrotechnical measures, including proper sowing, crop care, soil cultivation and timely harvesting. An important role is played by the use of modern technical means and the implementation of the principles of good cultivation and harvesting practices (GACP), which guarantees the quality and safety of medicinal plant raw materials. The practical lesson is aimed at developing in students a systematic understanding of the process of cultivating medicinal plants and acquiring practical skills in organizing agrotechnical measures in real conditions of the practice base.

GOAL :

- To introduce students to the technology of sowing medicinal plants.
- To develop knowledge about crop care and soil cultivation.
- To teach the basics of harvesting medicinal plants.
- To introduce the technical means used in growing LR.
- Explain the principles of Good Cultivation Practices (GACP).
- To develop skills in analyzing agrotechnical conditions for growing medicinal plants.

Basic concepts (list of questions):

1. Sowing medicinal plants.
2. Seeding rates.
3. Sowing methods (row, wide-row, etc.).
4. Crop care.
5. Soil cultivation.
6. Weed control.
7. Harvesting.
8. Technical means in growing LR.
9. Mechanization of agricultural processes.
10. Good Cultivation and Collection Practices for Medicinal Plants (GACP).
11. Quality of medicinal plant raw materials.
12. Agrotechnical growing conditions.

Practical lesson plan

1. Control of the reference level of knowledge

1. What is plant sowing?
2. What sowing methods do you know?
3. What is the seeding rate?

4. What factors affect seed germination?
5. What is crop care?
6. What are the main agrotechnical measures used after sowing?
7. What is soil cultivation?
8. What is the purpose of loosening the soil?
9. What are the ways to combat weeds?
10. What is a harvest?
11. What factors affect plant yield?
12. What parts of plants are harvested as medicinal raw materials?
13. What is mechanization in agriculture?
14. What technical means are used for soil cultivation?
15. What is the quality of medicinal plant raw materials?

2. Discussion of theoretical questions to test basic knowledge on the topic

1. What methods of sowing medicinal plants are the most effective?
2. How is the optimal seeding rate determined?
3. What are the features of caring for medicinal plant crops?
4. What types of soil cultivation are used?
5. How does soil cultivation affect plant growth?
6. What weed control methods are the most effective?
7. When are medicinal plants harvested?
8. What are the requirements for collecting different types of medicinal raw materials?
9. What technical means are used in growing LR?
10. What are the principles of GACP?
11. How does GACP affect the quality of medicinal plant raw materials?
12. What agrotechnical conditions are necessary for growing LR based on practice?
13. What mistakes can occur when sowing and caring for plants?
14. How do weather conditions affect cultivation and yield?
15. What modern technologies are used in the cultivation of medicinal plants?

3. Formation of professional skills and practical abilities

Practical activities of students:

1. **Sowing medicinal plants**
 - Choosing a sowing method depending on the crop.
 - Calculation of seeding rate.
2. **Crop care**
 - Soil loosening.
 - Weed removal and assessment of their impact.
3. **Soil cultivation**

- Introduction to methods of mechanical tillage.
- Analysis of soil condition after cultivation.
- 4. **Familiarization with technical means**
 - Study of equipment for sowing, cultivating, and harvesting plants.
 - Analysis of the effectiveness of their use.
- 5. **Collection of medicinal plant raw materials**
 - Determining the optimal collection period.
 - Practical collection of plants or their parts.
- 6. **Analysis of GACP principles**
 - Assessment of growing conditions based on practices in accordance with GACP.
 - Identification of shortcomings and suggestions for their elimination.
- 7. **Preparation of agrotechnical characteristics**
 - Description of the conditions for growing a specific medicinal plant based on practice.
 - Assessment of the quality of grown raw materials.

4. Summing up:

After the class, students should:

- Have knowledge about the technology of sowing and caring for medicinal plants.
- Be able to carry out basic agrotechnical measures and evaluate their effectiveness.
- Be familiar with the principles of Good Cultivation Practices (GACP).
- Know the features of collecting medicinal plant raw materials.
- Analyze the agrotechnical conditions for growing medicinal plants based on practice.

Thus, the acquired knowledge and practical skills provide a comprehensive approach to the cultivation of medicinal plants, contribute to the production of high-quality raw materials, and meet the modern requirements of the pharmaceutical industry.

List of recommended literature:

Main:

1. Pharmacognosy: textbook (I–III grades) / I.A. Bobkova , L.V. Varlakhova . – 3rd edition All-Ukrainian Specialized Publishing House “Medicine” 2018, 504p.
2. Pharmacognosy: basic manual for students of higher pharmaceutical schools (pharmaceutical faculties) of the IV level of accreditation / V.S. Kyslychenko , I.O. Zhuravel, S.M. Marchyshyn and others ; edited by V.S. Kyslychenko . - Kharkiv: National University of Pharmacy : Golden Pages, 2015. - 736 p.

3. Textbook on the discipline "Pharmacognosy" / Ya. V. Rozhkovsky , B.V. Prystyupa , I.A. Boyko, N.V. Gerasymyuk , V.V. Chernogoryuk -: Methodological development of the Department of Pharmacognosy of ONMedU . – Odessa: ONMedU , 2019 – 51 p.

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Additional:

1. State Pharmacopoeia of Ukraine (State Enterprise “Scientific and Expert Pharmacopoeial Center”. – 1st ed. – Kharkiv: RIREG, 2001. – Supplement 1. – 2004. – 520 p.

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TOPIC 6. Organization of LRS harvesting. Mastering the techniques of rational collection of LRS of different morphological groups.

The collection of medicinal plant raw materials is a crucial stage in pharmacognostic practice, which directly affects the quality, effectiveness and safety of herbal medicines. Rational collection involves not only the correct identification of plants and terms of collection, but also compliance with the ecological principles of preserving natural resources. It is important to take into account the morphological features of plants, which determine the specifics of the collection of various types of raw materials (roots, leaves, flowers, fruits, etc.). The practical lesson is aimed at developing in students the skills of organizing the collection of medicinal plant raw materials and mastering the techniques of rational collection taking into account modern requirements.

GOAL :

- To familiarize students with the principles of organizing the procurement of medicinal plant raw materials.
- To form knowledge about the rational use of natural resources of medicinal plants.
- To teach methods for collecting LRS of different morphological groups.
- Develop skills in determining optimal conditions and timing of harvesting.
- To foster environmental responsibility when collecting medicinal plants.

Basic concepts (list of questions):

1. Medicinal plant raw materials (MPR).
2. LRS procurement.
3. Rational collection of medicinal plants.
4. Morphological groups of LRS (roots, rhizomes, leaves, flowers, fruits, bark).
5. Procurement terms.
6. Primary processing of raw materials.
7. Drying of medicinal plant raw materials.
8. Storage of LRS.
9. Ecological principles of harvesting.
10. Restoration of natural resources of medicinal plants.
11. Quality of LRS.
12. Standardization of medicinal plant raw materials.

Practical lesson plan

1. Control of the reference level of knowledge

1. What is medicinal plant raw material?
2. What parts of plants are used as LRS?
3. What are morphological groups of plants?

4. What factors affect the accumulation of biologically active substances?
5. What is the growing season of plants?
6. What phases of plant development do you know?
7. What is a herbarium?
8. What are the rules for collecting medicinal plants?
9. What is the quality of medicinal raw materials?
10. What conditions are necessary for drying plants?
11. What are impurities in LRS?
12. What factors affect the preservation of raw materials?
13. What is ecological balance?
14. What plants need protection?
15. What is the importance of proper preparation of LRS?

2. Discussion of theoretical questions to test basic knowledge on the topic

1. What are the principles of organizing the procurement of medicinal plant raw materials?
2. What does rational collection of medicinal plants mean?
3. What are the features of collecting different morphological groups of LRS?
4. When are roots and rhizomes harvested?
5. What are the rules for collecting leaves and flowers?
6. How to properly harvest fruits and seeds?
7. What are the requirements for collecting bark?
8. How does the harvesting time affect the quality of LRS?
9. What are the methods of primary processing of medicinal raw materials?
10. What are the drying conditions for different types of LRS?
11. How to properly store medicinal plant raw materials?
12. What environmental principles should be followed during harvesting?
13. How is the restoration of medicinal plant populations carried out?
14. What errors can occur when preparing LRS?
15. What are the requirements for the quality and standardization of medicinal raw materials?

3. Formation of professional skills and practical abilities

Practical activities of students:

1. **Organization of the LRS procurement process**
 - Planning the collection of medicinal plants.
 - Determining optimal harvesting times.
2. **Rational collection of different morphological groups**
 - Collection of leaves, flowers, fruits, roots, bark.
 - Compliance with the rules for preserving plant populations.
3. **Primary processing of raw materials**
 - Purification of impurities.

- Sorting and preparation for drying.
- 4. **Drying of medicinal plant raw materials**
 - The choice of drying method depends on the type of raw material.
 - Control of conditions (temperature, ventilation).
- 5. **LRS quality assessment**
 - Determining the external signs of good quality raw materials.
 - Detection of defects and impurities.
- 6. **Compliance with environmental principles**
 - Assessment of the impact of harvesting on natural communities.
 - Development of recommendations for resource conservation.

4. Summing up:

After the class, students should:

- Understand the principles of organizing the procurement of medicinal plant raw materials.
- Be able to carry out rational collection of LRS of different morphological groups.
- Know the rules for primary processing, drying, and storage of raw materials.
- Assess the quality of medicinal plant raw materials.
- Follow ecological principles when harvesting medicinal plants.

Thus, the acquired knowledge and practical skills ensure the proper organization of the procurement of medicinal plant raw materials, contribute to the conservation of natural resources, and meet the modern requirements of pharmaceutical practice.

List of recommended literature:

Main:

1. Pharmacognosy: textbook (I–III grades) / I.A. Bobkova , L.V. Varlakhova . – 3rd edition All-Ukrainian Specialized Publishing House “Medicine” 2018, 504p.
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TOPIC 7. Mastering the methods of primary processing, drying of LRS. The importance of primary processing for obtaining good-quality LRS. Methods of primary processing of LRS of different morphological groups. Drying of LRS of different chemical and morphological groups. Methods of drying LRS - natural and artificial

Primary processing and drying of medicinal plant raw materials are key stages that determine its quality, stability and suitability for further use in pharmaceutical practice. Incorrect processing or violation of drying conditions can lead to the loss of biologically active substances, the development of microflora and spoilage of raw materials. It is important to take into account the morphological and chemical characteristics of plants, which determine the optimal methods of processing and drying. The practical lesson is aimed at developing practical skills in primary processing and drying of medicinal plant raw materials in compliance with modern quality requirements.

GOAL :

- To introduce students to the importance of primary processing of medicinal plant raw materials.
- To teach methods of primary processing of LRS of different morphological groups.
- To develop knowledge about methods of drying LRS.
- To introduce natural and artificial drying methods.
- Develop skills in controlling the quality of raw materials after processing and drying.

Basic concepts (list of questions):

1. Primary processing of medicinal plant raw materials.
2. Benignity of LRS.
3. Morphological groups of LRS.
4. Chemical groups of biologically active substances.
5. Drying of medicinal plant materials.
6. Seasoning.
7. Artificial drying.
8. Drying temperature.
9. Raw material moisture.
10. Ventilation during drying.
11. Preservation of biologically active substances.
12. Signs of properly dried raw materials.

Practical lesson plan

1. Control of the reference level of knowledge

1. What is medicinal plant raw material?
2. What morphological groups of LRS do you know?
3. What parts of plants are used as raw materials?
4. What is the harvesting of medicinal plants?
5. What factors affect the quality of LRS?
6. What is primary processing of raw materials?
7. What impurities can be in LRS?
8. What is plant drying?
9. What drying methods do you know?
10. What conditions are necessary for drying plants?
11. What is the moisture content of raw materials?
12. What factors affect drying speed?
13. What are biologically active substances?
14. How does improper drying affect the quality of raw materials?
15. What are the signs of benign LRS?

2. Discussion of theoretical questions to test basic knowledge on the topic

1. What is the importance of primary treatment of LRS?
2. What are the main stages of primary processing of medicinal raw materials?
3. How does the processing of different morphological groups (roots, leaves, flowers) differ?
4. What are the methods of cleaning raw materials from impurities?
5. What are the features of processing succulent and dry plant organs?
6. What are the methods of drying LRS?
7. What is the difference between natural and artificial drying?
8. What temperature regimes are used for different groups of LRS?
9. How do biologically active substances influence the choice of drying method?
10. What conditions are necessary for proper drying?
11. What are the signs of properly dried medicinal raw materials?
12. What errors can occur during drying?
13. How to prevent spoilage of raw materials?
14. What modern drying technologies are used?
15. How is the quality of LRS assessed after drying?

3. Formation of professional skills and practical abilities

Practical activities of students:

1. **Primary processing of medicinal plant raw materials**
 - Cleaning raw materials from mechanical impurities.
 - Sorting by morphological features.
 - Preparation for drying (grinding, washing if necessary).
2. **Processing of different morphological groups**
 - Working with roots, leaves, flowers, fruits.

- Selecting appropriate processing methods for each group.
- 3. Drying of LRS**
 - Organization of natural drying (in the air, in the shade, under a canopy).
 - Introduction to artificial drying (dryers, heat chambers).
- 4. Control of drying conditions**
 - Determination of temperature, humidity, ventilation.
 - Observation of the drying process.
- 5. Assessment of the quality of dried raw materials**
 - Determination of color, odor, and brittleness.
 - Detection of defects (mold, darkening, drying out).
- 6. Comparative analysis of drying methods**
 - Identify the advantages and disadvantages of natural and artificial drying.
 - Justification of the choice of method for different types of LRS.

4. Summing up:

After the class, students should:

- Understand the importance of primary processing for the quality of medicinal plant raw materials.
- Be able to perform primary processing of LRS of different morphological groups.
- Know drying methods and justify their choice depending on the type of raw material.
- Control drying conditions and assess the quality of dried raw materials.
- Identify defects and prevent damage to the LRS.

Thus, the acquired knowledge and practical skills ensure the production of high-quality medicinal plant raw materials that meet the requirements of the pharmacopoeia and modern pharmaceutical practice.

List of recommended literature:

Main:

1. Pharmacognosy: textbook (I–III grades) / I.A. Bobkova , L.V. Varlakhova . – 3rd edition All-Ukrainian Specialized Publishing House “Medicine” 2018, 504p.
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TOPIC 8. Bringing LRS to a standard state. Packaging and labeling, transportation of LRS. Familiarization with the storage conditions of LRS. Preparation of premises for storage of LRS. Rules for storing LRS of different morphological and chemical groups. Quality control of LRS during storage.

After harvesting and drying, medicinal plant raw materials need to be brought to a standard state, which ensures their compliance with quality and safety requirements. Important stages are proper packaging, labeling, transportation and organization of storage conditions. Failure to comply with these requirements can lead to the loss of biologically active substances, spoilage of raw materials or the appearance of impurities. Of particular importance is the quality control of medicinal plant raw materials during storage and compliance with conditions for various morphological and chemical groups. The practical lesson is aimed at developing in students a systematic approach to post-harvest processing and storage of medicinal plant raw materials.

GOAL :

- To familiarize students with the requirements for bringing the LRS to a standard state.
- Teach the rules for packaging, labeling, and transporting PPE.
- To develop knowledge about the storage conditions of medicinal plant raw materials.
- To introduce the preparation of warehouse facilities.
- Develop skills in quality control of LRS during storage.

Basic concepts (list of questions):

1. Standard condition of medicinal plant raw materials.
2. Sorting and calibration of LRS.
3. Packaging of medicinal plant raw materials.
4. LRS marking.
5. Transportation of medicinal raw materials.
6. Storage conditions of LRS.
7. Humidity and storage temperature.
8. Ventilation of warehouses.
9. Morphological groups of LRS.
10. Chemical groups of biologically active substances.
11. Expiration date of LRS.
12. Quality control of medicinal plant raw materials.

Practical lesson plan

1. Control of the reference level of knowledge

1. What is medicinal plant raw material?

2. What are the stages of processing LRS after collection?
3. What is primary processing of raw materials?
4. What methods of drying LRS do you know?
5. What is the quality of medicinal raw materials?
6. What factors affect the quality of LRS?
7. What is product packaging?
8. What materials are used for packaging?
9. What is labeling?
10. What conditions are necessary for storing plant raw materials?
11. What is humidity and how does it affect LRS?
12. What factors cause spoilage of raw materials?
13. What is an expiration date?
14. What are the signs of poor-quality LRS?
15. What is the importance of quality control?

2. Discussion of theoretical questions to test basic knowledge on the topic

1. What does it mean to bring the LRS to a standard state?
2. What operations does this process include?
3. What are the requirements for packaging medicinal plant raw materials?
4. What information should the labeling contain?
5. What are the rules for transporting LRS?
6. What conditions are necessary for the storage of different morphological groups?
7. How do temperature and humidity affect the quality of LRS?
8. What are the features of storing essential oil raw materials?
9. How to store raw materials containing alkaloids or glycosides?
10. What are the requirements for warehouse space?
11. How are storage facilities prepared?
12. What are the methods of quality control of LRS during storage?
13. What changes can occur in LRS if stored improperly?
14. How to determine the expiration date of LRS?
15. What modern approaches are used for storing medicinal raw materials?

3. Formation of professional skills and practical abilities

Practical activities of students:

1. **Bringing the LRS to the standard state**
 - Sorting and cleaning of raw materials.
 - Removal of impurities and defective parts.
2. **Packaging of medicinal raw materials**
 - Selection of appropriate packaging material (bags, boxes, paper bags).
 - Formation of batches of raw materials.
3. **LRS marking**

- Label design (name, part of the plant, date of collection, place of collection).
- Checking the correctness of labeling.
- 4. **Familiarization with transportation conditions**
 - Analysis of requirements for the transportation of LRS.
 - Assessment of possible risks during transportation.
- 5. **Evaluation of storage conditions**
 - Analysis of temperature, humidity, ventilation.
 - Determining compliance with the requirements for different groups of LRS.
- 6. **Preparation of warehouse premises**
 - Cleaning, ventilation, pest control.
 - Organization of raw material placement.
- 7. **Quality control during storage**
 - Evaluation of external signs (color, smell, structure).
 - Detection of signs of deterioration (mold, moisture, pests).

4. Summing up:

After the class, students should:

- Understand the principles of bringing the LRS to a standard state.
- Be able to properly package, label, and transport medicinal raw materials.
- Know the requirements for storage conditions of different types of LDVs.
- Assess the condition of warehouses and preparation for storage.
- Conduct quality control of medicinal plant raw materials during storage.

Thus, the acquired knowledge and skills ensure the preservation of the quality of medicinal plant raw materials at all stages of post-harvest processing and meet the modern requirements of pharmaceutical practice.

List of recommended literature:

Main:

1. Pharmacognosy: textbook (I–III grades) / I.A. Bobkova , L.V. Varlakhova . – 3rd edition All-Ukrainian Specialized Publishing House “Medicine” 2018, 504p.

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TOPIC 9. Detection of LR thickets . Periodicity of exploitation of LR thickets . Requirements for rational collection and periodicity of LRS harvesting in a specific thicket

Rational use of natural resources of medicinal plants involves not only their correct identification and harvesting, but also the identification of natural thickets and assessment of the possibility of their exploitation. Excessive or improper collection can lead to depletion of populations and extinction of species. Therefore, it is important to know the principles of identifying thickets, assessing their productivity and establishing the periodicity of harvesting. The practical lesson is aimed at forming in students an environmentally sound approach to the use of natural resources of medicinal plants and the skills of planning their rational exploitation.

GOAL :

- To introduce students to methods for identifying thickets of medicinal plants.
- To develop knowledge on the assessment of LRS stocks in nature.
- Teach how to determine the frequency of exploitation of thickets.
- Develop skills in planning rational collection of LRS.
- To foster an environmentally responsible attitude towards natural resources

Basic concepts (list of questions):

1. Thickets of medicinal plants.
2. Natural resources of the Republic of Lithuania.
3. Productivity of thickets.
4. Exploitation of plant resources.
5. Periodicity of preparation.
6. Rational collection of LRS.
7. Restoration of plant populations.
8. Ecological balance.
9. Estimation of LRS reserves.
10. Monitoring the condition of thickets.
11. Protection of medicinal plants.
12. Sustainable (balanced) nature management.

Practical lesson plan

1. Control of the reference level of knowledge

1. What are medicinal plants?
2. What is medicinal plant raw material?
3. What parts of plants are used as LRS?
4. What is phytocenosis?
5. What factors affect plant growth?

6. What is the harvesting of medicinal plants?
7. What are the rules for collecting medicinal plants?
8. What is ecological balance?
9. What plants need protection?
10. What is plant productivity?
11. What factors affect yield?
12. What is the rational use of natural resources?
13. What are the consequences of over-harvesting plants?
14. What is plant resource restoration?
15. What is the importance of protecting medicinal plants?

2. Discussion of theoretical questions to test basic knowledge on the topic

1. What are medicinal plant thickets and how are they detected?
2. What methods are used to estimate LRS reserves?
3. What is thicket productivity and how is it determined?
4. What factors influence the condition of thickets?
5. What does the frequency of exploitation of thickets mean?
6. How to determine the allowable volume of workpiece?
7. What are the principles of rational collection of medicinal plants?
8. How to ensure the recovery of populations after harvesting?
9. What environmental requirements must be taken into account during harvesting?
10. What types of medicinal plants are subject to protection?
11. How is the condition of thickets monitored?
12. What errors can occur when estimating resources?
13. What are the consequences of violating the periodicity of harvesting?
14. How do climatic conditions affect the condition of thickets?
15. What modern approaches are used for the rational use of natural resources?

3. Formation of professional skills and practical abilities

□ Detection of medicinal plant thickets

- Survey of the territory and identification of places where LR grows.
- Fixation of the boundaries of thickets and their area.

□ Assessment of the condition and productivity of thickets

- Determining plant density.
- Estimation of biomass and potential harvest volume.

□ Determining the periodicity of procurement

- Analysis of the ability of plants to regenerate.

- Calculation of intervals between meetings.
- **Development of a rational collection plan**
- Establishing the allowable collection volume.
 - Determination of areas for alternating workpieces.
- **Assessment of the environmental impact of the collection**
- Identifying possible risks to the ecosystem.
 - Proposals for the conservation of natural resources.
- **Compiling field notes and reports**
- Registration of data on thickets, their condition and use.
 - Analysis of the results obtained.

4. Summing up:

After the class, students should:

- Be able to identify thickets of medicinal plants and assess their condition.
- Know the principles of determining the productivity and reserves of LRS.
- Understand the need to maintain periodicity of harvesting.
- Be able to plan the rational collection of medicinal plant raw materials.
- Adhere to environmental principles of preserving natural resources.

Thus, the acquired knowledge and practical skills ensure scientifically sound and environmentally safe use of natural resources of medicinal plants, which is an important component of the professional training of pharmaceutical specialists.

List of recommended literature:

Main:

1. Pharmacognosy: textbook (I–III grades) / I.A. Bobkova , L.V. Varlakhova . – 3rd edition All-Ukrainian Specialized Publishing House “Medicine” 2018, 504p.
2. Pharmacognosy: basic manual for students of higher pharmaceutical schools (pharmaceutical faculties) of the IV level of accreditation / V.S. Kyslychenko , I.O. Zhuravel, S.M. Marchyshyn and others ; edited by V.S. Kyslychenko . - Kharkiv: National University of Pharmacy : Golden Pages, 2015. - 736 p.
3. Textbook on the discipline "Pharmacognosy" / Ya. V. Rozhkovsky , B.V. Prystyupa , I.A. Boyko, N.V. Gerasymyuk , V.V. Chernogoryuk -: Methodological development of the Department of Pharmacognosy of ONMedU . – Odessa: ONMedU , 2019 – 51 p.
4. State Pharmacopoeia of Ukraine: in 3 volumes / State Enterprise “Ukrainian Scientific Pharmacopoeial Center for the Quality of Medicinal Products”. – 2nd ed.

– Kharkiv: State Enterprise “Ukrainian Scientific Pharmacopoeial Center for the Quality of Medicinal Products”, 2015. – Vol. 1. – 1500 p.

Additional:

1. State Pharmacopoeia of Ukraine (State Enterprise “Scientific and Expert Pharmacopoeial Center”. – 1st ed. – Kharkiv: RIREG, 2001. – Supplement 1. – 2004. – 520 p.

2. State Pharmacopoeia of Ukraine: in 3 volumes / State Enterprise “Ukrainian Scientific Pharmacopoeial Center for the Quality of Medicinal Products”. – 2nd ed. – Kharkiv: State Enterprise “Ukrainian Scientific Pharmacopoeial Center for the Quality of Medicinal Products”, 2014. – Vol. 3. – 732 p.

3. Solodovnichenko N.M., Zhuravlev M.S., Kovalev V.M. Medicinal plant raw materials and phytopreparations. - Kharkiv: Publishing house of the National Academy of Agricultural Sciences "Golden Pages", 2001. - 407 p.

4. Workshop on the identification of medicinal plant raw materials: teaching aids . / [V. M. Kovalev, S. M. Marchyshyn , O. P. Khvorost and others]; ed. V. M. Kovalev, S. M. Marchyshyn . – Ternopil: TSMU, 2014. – 250 p.

TOPIC 10. Rare, endangered species of LR. Red and Green Books of Ukraine. System of measures for the protection, rational use of nature and reproduction of LR stocks in the region.

Preservation of the biodiversity of medicinal plants is an important component of environmental safety and sustainable development of society. A significant part of medicinal plants is negatively affected by anthropogenic factors, which leads to a decrease in their populations and even the disappearance of individual species. Of particular importance is the study of rare and endangered species listed in the Red Book of Ukraine, as well as plant groups protected in accordance with the Green Book of Ukraine. The practical lesson is aimed at forming in students environmental awareness, knowledge about the system of protection of medicinal plants and skills of rational use of nature.

GOAL :

- To introduce students to rare and endangered species of medicinal plants.
- To form knowledge about the Red and Green Books of Ukraine.
- To teach how to identify species that are subject to protection.
- To introduce the main measures for the protection of medicinal plants.
- Develop skills in rational use of nature and reproduction of plant resources.

Basic concepts (list of questions):

1. Rare plant species.
2. Endangered plant species.
3. Red Book of Ukraine.
4. Green Book of Ukraine.
5. Protection of medicinal plants.
6. Biodiversity.
7. Anthropogenic impact.
8. Rational use of nature.
9. Reproduction of plant resources.
10. Protected areas.
11. Monitoring the condition of plants.
12. Environmental responsibility.

Practical lesson plan

1. Control of the reference level of knowledge

1. What are medicinal plants?
2. What is medicinal plant raw material?
3. What parts of plants are used in medicine?
4. What is phytocenosis?
5. What factors influence the spread of plants?

6. What is ecological balance?
7. What plants are called rare?
8. What does endangered species mean?
9. What is biodiversity?
10. What are the reasons for the decline in plant numbers?
11. What is anthropogenic impact?
12. What nature conservation measures do you know?
13. What are protected areas?
14. What is the importance of plant protection?
15. What is sustainable environmental management?

2. Discussion of theoretical questions to test basic knowledge on the topic

1. What plants are listed in the Red Book of Ukraine?
2. What categories of rare species are distinguished?
3. What is the Green Book of Ukraine and what objects does it protect?
4. Which medicinal plants in the region are rare or endangered?
5. What are the main reasons for the disappearance of medicinal plants?
6. What measures are used to protect rare species?
7. What is the introduction and cultivation of rare plants?
8. What are the principles of sustainable environmental management?
9. How is the restoration of medicinal plant populations carried out?
10. What functions do nature reserves and national parks perform?
11. What methods of plant condition monitoring are used?
12. What are the legal aspects of protecting medicinal plants in Ukraine?
13. What is the role of pharmacists in preserving plant resources?
14. What are the consequences of violating environmental protection requirements?
15. What are modern approaches to biodiversity conservation?

3. Formation of professional skills and practical abilities

Practical activities of students:

- 1. Introduction to rare species of LR**
 - Study of herbarium specimens or illustrations of rare plants.
 - Determination of their morphological features.
- 2. Working with the Red and Green Books of Ukraine**
 - Analysis of information on protected species and groups.
 - Definition of plant rarity categories.
- 3. Assessment of the state of plant populations**
 - Analysis of factors affecting species abundance.
 - Identifying threats to plant communities.
- 4. Development of security measures**

- Proposals for the preservation and restoration of medicinal plants.
 - Planning for the rational use of resources.
- 5. Modeling environmentally safe collection**
- Defining rules for collecting without harming populations.
 - Justification of the need for procurement restrictions.
- 6. Drafting a report and recommendations**
- Presentation of research results.
 - Formation of conclusions regarding the protection of medicinal plants in the region.

4. Summing up:

After the class, students should:

- Know rare and endangered species of medicinal plants.
- Navigate in the Red and Green Books of Ukraine.
- Understand the reasons for the decline in plant populations and ways to preserve them.
- Be able to propose measures for the protection and reproduction of plant resources.
- Adhere to the principles of sustainable environmental management in professional activities.

Thus, the acquired knowledge and practical skills contribute to the training of specialists capable of ensuring the preservation of medicinal plants and their resources, which is an important task of modern pharmacy and ecology.

List of recommended literature:

Main:

1. Pharmacognosy: textbook (I–III grades) / I.A. Bobkova , L.V. Varlakhova . – 3rd edition All-Ukrainian Specialized Publishing House “Medicine” 2018, 504p.

2. Pharmacognosy: basic manual for students of higher pharmaceutical schools (pharmaceutical faculties) of the IV level of accreditation / V.S. Kyslychenko , I.O. Zhuravel, S.M. Marchyshyn and others ; edited by V.S. Kyslychenko . - Kharkiv: National University of Pharmacy : Golden Pages, 2015. - 736 p.

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