

MINISTRY OF HEALTH OF UKRAINE
BOGOMOLETS NATIONAL MEDICAL UNIVERSITY
DEPARTMENT OF PHARMACOGNOSY AND BOTANY

HANDBOOK ON PHARMACOGNOSY
for auditory and independent students work
Laboratory handbook
PART II

Discipline: Pharmacognosy

Direction: second (master's) level of higher education

Specialty: 226 "Pharmacy, industrial pharmacy"

Department: Pharmacognosy and botany

Name

Course

Group

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Reviewers:

Zhuravel I.O. professor, doctor of pharmaceutical sciences, professor of Pharmacognosy and Nitriciology Department of National Pharmaceutucal University

Hala L.O. professor, doctor of pharmaceutical sciences, professor of Organization and Economy of Pharmacy Department of Bogomolets National Medical University

This handbook covers the established methodologies for morphological, anatomical, and chemical analysis of medicinal plants that can successfully teach the theoretical and practical course of pharmacognosy in accordance with the "Program of Pharmacognosy."

For students of higher educational establishments of level III-IV pharmaceutical accreditation full-time and part-time training in the specialty "Pharmacy."

Minarchenko V. M., Karpiuk U. V., Cholak I. S., Kovalska N. P., Makhynia L. M., Pidchenko V.T., Dvirna T. S., Robinson D. K. 2024

INTRODUCTION

The educational discipline "Pharmacognosy" is a profile for students majoring in "226 Pharmacy, industrial pharmacy". According to the training plan for specialists in this specialty of teaching the educational discipline, pharmacognosy is conducted in 5-6 semesters of the III year for a total of 240 hours, of which 30 hours are lectures, 120 hours are practical classes, and 90 hours are independent work of students.

The purpose of teaching pharmacognosy is to teach students: to find and identify medicinal plants in natural habitats; to know the periods, terms and rational methods of harvesting, primary processing, drying conditions and storage rules of medicinal plant raw materials (LPR); to carry out commodity analysis, macroscopic, microscopic, phytochemical analysis of LRS, its processing products and raw materials of animal origin, which is necessary in the future professional activity of a pharmacist.

The practical part of the educational discipline involves the development and assimilation of skills and abilities to identify medicinal plants in the natural environment and herbarium state; harvesting, drying, storage of LRS, its identification based on macroscopic and microscopic analysis; thin-layer chromatography methods, establishing its benign quality by determining the qualitative composition and quantitative content of active substances (BAR groups) and basic numerical indicators (moisture, ash content, presence of impurities, etc.).

In the study guide, the structure of each practical lesson is developed in detail, diagrams, the content of the tasks are given, and the methodology of their implementation is outlined. In order to study theoretical questions, acquire practical abilities and skills, provided by the program of the academic discipline, at each practical session, the student must have not only the recommended educational - methodical and reference literature, but also a completed work journal. By checking the class protocols filled out by the students in the work journals, the teacher assesses the readiness of each of them for the class, independent extracurricular work, and the quality of practical tasks. The presence of this work journal and its neat filling during homework and at each practical session is mandatory for students and is a guarantee of mastering the program requirements of the discipline and, as a result, successful completion of the final control in pharmacognosy.

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Notation conventions

MP – medicinal plant

MPM – medicinal plant material

BAS – biologically active substances

SPhU – State Pharmacopoeia of Ukraine

PhEur – European Pharmacopoeia

QCM – Quality Control Methods

TLC – thin-layer chromatography

PC – paper chromatography

SAMPLE OF FILLING OUT THE HANDBOOK

Sample 1. Marshmallow root

	Latin name	English name
MPM	Althaeae radices	Marshmallow root
MP	Althaea officinalis L.	Marshmallow
Family	Malvaceae	

Dissemination of MP	It grows throughout the territory of Ukraine (except the mountainous regions of the Carpathians and the Crimea), Europe and South America
Harvesting time	Raw materials are harvested in early spring or autumn, after the above-ground part has died
Drying conditions	Raw materials are dried at a temperature of 45-50°C
Storage conditions	According to the general list
Basic group of BAS, %	Polysaccharides (mucilage, starch, pectin substances, sugars)
Other substances	Fatty oil, tannins, steroids, betaine, mineral salts
Standardization by content of BAS	The content of polysaccharides in terms of dry raw materials is not less than 14%

Macroscopic analysis of marshmallow root:

whole, cut, ground, or pulverized	Unrefined whole raw material
shape	Cylindrical, somewhat twisted
surface	With deep longitudinal grooves and numerous scars from the roots
characteristic of fracture	Fracture is fibrous on the outside, rough and granular on the inside
presence of core	-
colour of fracture surface	Fracture is white or yellowish-white
colour of external surface	The cleaned raw material has a grayish-white fine-fibrous outer surface
odour	Not specific
taste	Mucilaginous, sweet

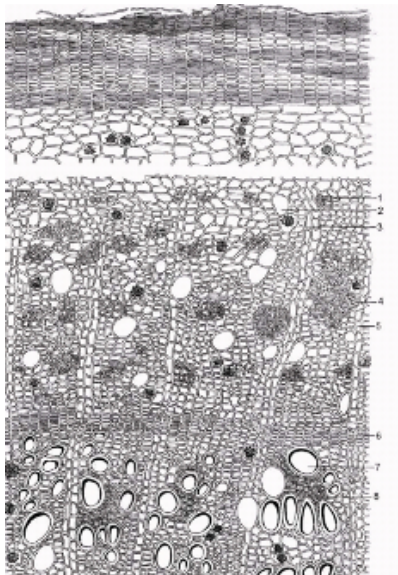
Adulteration (English and Latin names):

1. *Lavatera thuringiaca*
2. *Malva sylvestris*

Histochemical reactions:

Name of reaction	Methods	Observation
Reaction for mucilage	Add a drop of 5% sodium hydroxide solution on a fracture of marshmallow root.	A yellow color appears
Conclusions: this reaction indicates the presence of mucilage		
Reaction for starch	Add a drop of Lugol's solution on a fracture of marshmallow root.	Starch grains are colored blue (blue-violet).
Conclusions: this reaction indicates the presence of starch		
The reaction for lignin (Wiesner test)	Place a cut of pre-softened root on a glass slide with 1% alcohol phloroglucinol solution, and add 1 drop of concentrated hydrochloric acid. After 1 min remove the excess reagent with filter paper and add 1 drop of chloral hydrate, cover with a glass-slide cover, and examine under a microscope at magnification 100.	Lignified cell membranes acquire a crimson or cherry color
Conclusions: this reaction indicates the presence of lignin		
Dual-colour reaction	Place a cut of root on a glass slide in a solution of iron (III) chloride for 20 min. Remove reagent with filter paper, add a drop of methylene blue, then wash with water and cover with a glass-slide cover; examine under a microscope at magnification 100.	Cells with mucilage are colored yellow; bast fibers - in blue color; wood vessels - green
Conclusions: this reaction indicates the presence of mucilage		

Microscopic analysis of marshmallow root

	<p>The main diagnostic microscopic features of MPM:</p> <ol style="list-style-type: none"> 1. thin-walled parenchyma with starch grains; 2. cells with mucilage in the parenchyma of bark and wood; 3. calcium oxalate druses; 4. groups of bast fibers, mostly non-woody with thickened walls; 5. core rays single-rowed, rarely double-rowed; 6. cambium; 7. xylem vessels; 8. tracheids
---	--

Use in medicine Expectorant, enveloping, anti-inflammatory action in acute and chronic respiratory diseases;

TOPIC: SIMPLE PHENOLS AND THEIR DERIVATIVES

Aim: to establish the identity of MPM containing simple phenols and their derivatives according to macroscopic and microscopic characteristics, and to determine the qualitative composition and quantitative content of BAS using methods of phytochemical analysis.

Objects for laboratory work: bearberry, cowberry, willow, rhodiola, echinacea roots and herb, wild pancy, fern.

Objects for independent study: bilberry, vanilla, turmeric, chicory, artichoke, hemp, cotton plant bark of roots.

Structural formulas of main BAS: arbutin, methylarbutin, phloroglucin, thyrosol, salidroside, salicylic acid, methylsalicylate, caffeic acid, chlorogenic acid, tetrahydrocannabinol, cannabidiol

I. Phytochemical analysis of MPM containing simple phenols and their derivatives

Task 1. Fill an Appendix 2 on the topic of the lesson.

Task 2. Prepare extract of MPM and make the qualitative reactions for arbutin and tannin. On the basis of reactions make a conclusion about the chemical composition of MPM.

Method. 0.5 grams of powdered herbal drug is boiled with 10 ml of water for 2-3 minutes. Hoods hot filtered through a paper filter. The filtrate was used for qualitative reactions, monitor results and make conclusions.

Name of reaction	Methods	Observation
Reaction with ferrous (II) sulfate	Add a crystal of ferrous (II) sulfate to 1 ml of filtrate.	
Reaction with phosphorous molybdate sodium solution	Add 4 ml of ammonia and 1 ml 10% phosphorous molybdate sodium to 1 ml of filtrate in porcelain dish.	
Reaction with alum solution	Add 4 drops of 1% alum solution to 2 ml of filtrate in porcelain dish.	
Conclusions:		

Task 3. Do the chromatographic analysis of simple phenols by TLC method for the bearberry or cowberry leaves in accordance with the SPhU monograph (2.0 Vol.3) " Uvae ursi folium ".

Test solution. 5 ml of a mixture of equal volumes of methanol and water is added to 0.5 g of raw material crushed into powder and heated under reflux for 10 min. The resulting hot solution is filtered, the flask and the filter are rinsed with a mixture of equal volumes of methanol and water and brought to a volume of 5 ml with the same mixture of solvents.

Comparison solution.

50 mg of arbutin and 25 mg of gallic acid are dissolved in methanol and the volume of the solution is brought up to 20 ml with the same solvent.

Plate: TLC plate with a layer of silica gel.

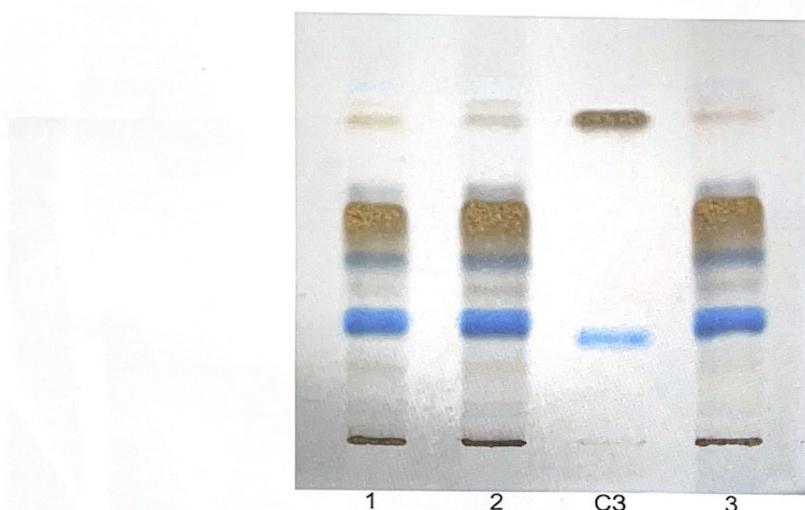
Mobile phase: anhydrous formic acid - water - ethyl acetate (6:6:88).

Sample volume: 10 μ l (or 2 μ l), in strips of 15 mm (or 8 mm). Distance to be covered by the moving phase: about 15 cm (or 6 cm) from the starting line.

Drying: at a temperature of (105-110°C) until the removal of solvents (mobile phase).

Detection: treat with a solution of 10 g/l of dichloroquinone chloride in methanol, then with a solution of 20 g/l of anhydrous sodium carbonate.

Results: Below is the sequence of zones on the chromatograms of the reference solution and the test solution. Other blue or brown zones may also appear on the chromatogram of the tested solution. The upper part of the plate is gallic acid (brown zone). The lower part of the plate is arbutin (blue zone).



1-3 – the bearberry or cowberry leaves series; C3 – arbutin (lower zone) + gallic acid (upper zone)

Conclusions: _____

Task 4. Make a scheme of quantitative determination of arbutin in *Folia Uvae ursi*. (SPhU 2.0, Vol.3)

The starting solution. 50 ml of water is added to 0.400 g of raw materials crushed into powder and boiled in a water bath with a reflux condenser for 30 minutes. After cooling, the mixture is quantitatively transferred with 50 ml of water into a volumetric flask with a capacity of 250 ml, brought up to the mark with water and mixed. They are kept until the particles settle and the supernatant liquid is used.

Test solution. Place 5.0 ml of the original solution in a separatory funnel, add 45 ml of water, 1 ml of a 2% (w/v) aminopyrazolone solution, 0.5 ml of diluted ammonia solution and 1 ml of a 8% (w/v) potassium ferricyanide solution, mixing thoroughly after each addition. Keep for 5 minutes, shake the resulting aqueous layer at least with 3 portions, 25 ml each, of chloroform, filter the chloroform layer each time through a pre-washed filter with chloroform into a volumetric flask with a capacity of 100 ml, bring the volume of the solution up to the mark with chloroform and mix.

Comparison solution. Dissolve 0.015 g (exact weight) of FSZ DFU arbutin in 50 ml of water and bring the volume of the solution up to 100 ml with the same solvent. 5.0 ml of the resulting solution is placed in a dividing funnel and then proceed as described in the preparation of the tested solution, starting with the words "...and add 45 ml of water ...". The optical density of the test solution is measured at a wavelength of 455 nm, using chloroform as a compensating liquid. In parallel, the optical density of the comparison solution is measured.

The content of hydroquinone derivatives, in terms of arbutin, in percent, is calculated according to the formula:

$$X = A \times m_0 \times 2,5 \times P / A_0 \times m,$$

A - is the optical density of the tested solution at a wavelength of 455 nm,

A₀ - is the optical density of the reference solution at a wavelength of 455 nm,

m₀ - is the weight of the arbutin, in grams,

P - is the content of anhydrous arbutin in FSZ DFU of arbutin, in percent,

m - is the weight of the tested raw material, in grams.

Conclusions: _____

II. Macro- and microscopic analysis of MPM containing simple phenols and their derivatives

Sample 1. *Uvae ursi folium* (bearberry leaves)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>arbutin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Uvae ursi folium*

occurrence, fracture of drug		venation	
------------------------------	--	----------	--

form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Microscopic analysis of *Uvae ursi folium*:

<p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p>	<p>Sign anatomic diagnostic features of <i>Uvae ursi folium</i>:</p> <p>A –</p> <p>B –</p> <p>C –</p> <p>D –</p> <p>E –</p> <p>1.</p> <p>2.</p> <p>3.</p> <p>4.</p> <p>5.</p>
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Biological effects and application of *Uvae ursi folium*:

Sample 2. *Vitis idaeae* folium (cowberry leaves)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>methylarbutin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Vitis idaeae* folium

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Microscopic analysis of *Vitis idaeae* folium:

	<p>Sign anatomic diagnostic features of <i>Vitis idaeae folium</i>:</p> <ol style="list-style-type: none"> 1. 2. 3. 4.
--	--

Biological effects and application of *Vitis idaeae folium*:

Sample 3. Salicis cortex (willow bark)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>salicylic acid</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Salicis cortex*

occurrence, fracture of drug		outer surface colour	
------------------------------	--	----------------------	--

shape		inner surface colour	
surface characters		odour after grinding	
section fracture, internal appearance		taste	
sizes		other diagnostic characters	

Biological effects and application of *Salicis cortex*:

Sample 4. *Rhodiolae roseae rhizoma et radices* (rhodiola rhizome et roots)

	Latin name	English name
MPM		
MP		
Family		

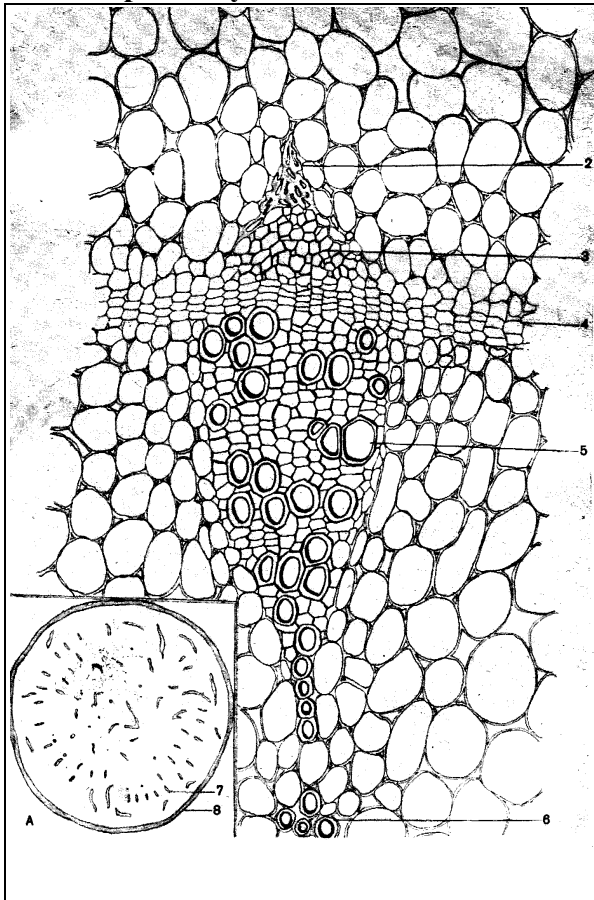
Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		
		<i>salidroside</i>

Macroscopic analysis of *Rhodiolae roseae rhizoma et radices*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic	

		characters	
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Microscopic analysis of *Rhodiolae roseae rhizoma et radices*



Sign anatomic diagnostic features of *Rhodiolae roseae rhizoma et radices*

A –
 B –
 2.
 3.
 4.
 5.
 6.
 7.
 8.

Biological effects and application of *Rhodiolae roseae rhizoma et radices*:

Sample 5. Echinaceae radix (echinacea roots)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		

Other substances		
Standardization by the content of BAS		<i>caffeic acid</i>

Macroscopic analysis of *Echinaceae radix*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Biological effects and application of *Echinaceae radix*:

Sample 6. *Violae herba* (wild pansy herb)

	Latin name	English name
MPM		
MP		
Family		
Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Violae herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Microscopic analysis of *Violae herba*

	<p>Sign anatomic diagnostic features of <i>Violae herba</i></p> <p>A –</p> <p>B –</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5.
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Biological effects and application of *Violae herba* :

Sample 7. *Filicis maris rhizoma* (male fern rhizome)

	Latin name	English name
MPM		
MP		
Family		

Biological effects and application of *Filicis maris rhizoma*:

Signature of the teacher _____

INDEPENDENT STUDENTS WORK

Sample 1. Folia Vaccinii myrtilli (bilberry leaves)

	Latin name	English name
MPM		
MP		
Family		

		Structural formula
Dissemination of MP		
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Folia*:

Sample 2. Vanillae fructus (vanilla fruits)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Vanillae fructus*:

Sample 3. *Curcumae rhizoma* (turmeric rhizome)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Curcumae rhizoma*:

Sample 4. *Folia et anthodia Cynarae* (artichoke leaves and inflorescences)

	Latin name	English name
MPM		
MP		

Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Folia et anthodia Cynarae*:

Sample 5. Cannabis flores (hemp flowers)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Cannabis flores*:

Sample 6. Gossypii radices cortex (cotton plant bark of roots)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		<i>gossypol</i>
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Gossypii radices cortex*:

Signature of the teacher _____

TOPIC: COUMARINS AND CHROMONES

Aim: to establish the identity of MPM containing coumarins and chromones according to macroscopic and microscopic characteristics, and to determine the qualitative composition and quantitative content of BAS using methods of phytochemical analysis.

Objects for laboratory work: melilot, ammi, parsnip, fig tree leaf, angelica, khella.

Objects for independent study: horse chestnut, rue, dill, carrot wild.

Structural formulas of main BAS: coumarin, phurocoumarin, pyranocoumarin, chromone, phuranochromone and their derivatives: umbelliferone, aesculetine, hydroxycoumarin, 3,4-dihydrocoumarin, psoralen, bergaptene, xanthoxine, isopimpinelline, visnagine, visnagine dihydrosamidin, khellin.

I. Phytochemical analysis of MPM containing coumarins and chromones

Task 1. Fill an Appendix 2 on the topic of the lesson.

Task 2. Prepare extract from MPM, containing coumarins, and to detect them by qualitative reactions.

Method. Put 1.0 g powdered MPM into a 100 ml glass-stoper flask and add 15 ml 96% ethanol solution. Attach a reflux condenser and heat on a water bath for 15 min. Filter the hot alcoholic extract through a cotton and detect coumarins. Add 2-5 drops of 5% alcoholic sodium hydroxide solution to 5 ml of extract, heat on a water bath for 5 min. Describe the changes and explain them. Use alkalined extract for the following reactions:

Name of reaction	Methods	Observation
Lactone reaction	Add for 1 ml of alkalined extract 4 ml of water. Neutralize the mixture with 20% sulphuric acid solution (litmus in an indicator).	
Write the scheme of chemical equation:		
Nitrodye formation	1) to 1 ml of alkalined extract, add 3-5 drops of freshly prepared dinitro- π -nitroaniline solution (add 1 ml of 5% sodium nitrite solution to 1 ml of 0.1N HCl solution; 0.5 ml of mixture add for 1 ml of 0.5% π -nitroaniline solution). Solution develops reddish-orange colour, indicating the presence of coumarins. 2) to 1 ml of alkalined extract add 3-5 drops of freshly prepared dinitrosulphanilic acid solution (add 1 ml of 5% sodium nitrite solution to 1 ml of 0.1N HCl solution; add 0.5 ml of mixture to 10 ml of 0.1% sulfanilic acid solution). Mixture develops reddish-orange colour, indicating the presence of coumarins. Fix the change.	
Write the scheme of chemical equation:		
Conclusions:		

Task 3. Obtain an extract of MPM, containing chromones, and carry out qualitative detection. Add 5 ml of 96% ethanol solution to 1.0 g of powdered MPM, place in glass - stoppered flask, attach a reflux condenser and heat on a water bath for 15 min. Filter the hot alcoholic extract in a porcelain dish, evaporate the filtrate on a water bath up to dryness. Place 2 grains of KOH (carefully in a dish melt, mixing with a rod). Development of purplish-red colour indicates the presence of chromones in the extract.

Task 4. To carry out chromatographical detection of coumarins (SPhU 2.0 Vol.3 *Meliloti herba*).

Test solution. 3 ml of methanol is added to 0.3 g of raw material crushed into powder, heated in a water bath at a temperature of 100°C for 1 min and filtered.

Comparison solution. 50 mg of FSZ coumarin and 20 mg of o-coumaric acid are dissolved in 50 ml of methanol.

Plate: TLC plate with a layer of silica gel (5-40 μm) (or TLC plate with a layer of silica gel (2-10 μm)).

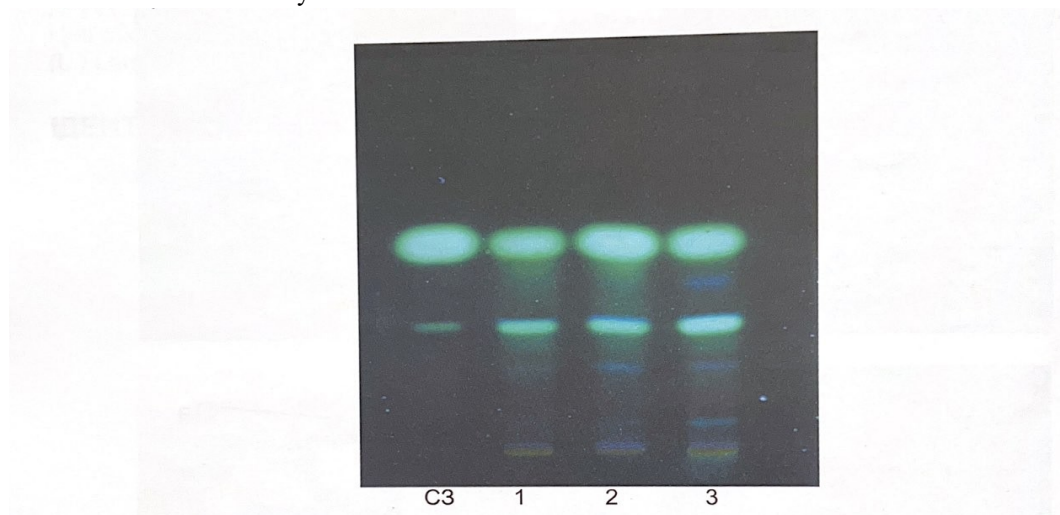
Mobile phase: upper layer of the mixture: dilute acetic acid R - ether R - toluene R (10:50:50).

Sample volume. 25 μl (or 3 μl), in 10 mm (or 8 mm) strips. The distance to be covered by the moving phase: 12 cm (or 6 cm) from the starting line.

Drying: in the air.

Detection: spray potassium hydroxide with a 2 M alcohol solution R. View in UV light at a wavelength of 365 nm.

Results: Below is the sequence of zones on the chromatograms of the reference solution and the test solution. The chromatogram of the tested solution may reveal other weak zones of different colors.



1-3 - *Meliloti herba* series; C3 – coumarin (upper zone)+o-coumaric acid (lower zone)

Conclusions: _____

II. Macro- and microscopic analysis of MPM containing coumarins and chromones

Sample 1. *Meliloti herba* (melilot herb)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>3,4-dihydrocoumarin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Meliloti herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Biological effects and application of *Meliloti herba*:

Sample 2. *Ammi majoris fructus* (ammi fruits)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>Isopimpinelin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

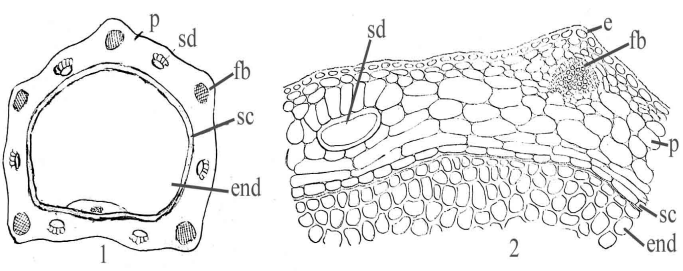
Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Ammi majoris fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Microscopic analysis of *Ammi majoris fructus*

	<p>Sign anatomic diagnostic features of <i>Ammi majoris fructus</i>:</p> <ol style="list-style-type: none"> 1. p. sd. fb. sc. end. 2. sd. e. fb. p. sc. end.
---	--

Biological effects and application of *Ammi majoris fructus*:

Sample 3. *Pastinacae sativae fructus* (parsnip fruit)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		<i>Isopimpinelin</i>
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Pastinacae sativae fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Biological effects and application of *Pastinacae sativae fructus*:

Sample 4. *Ficusi caricae folia* (fig tree leaves)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>Bergaptene</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Ficusi caricae folia*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Biological effects and application of *Ficusi caricae folia*

Sample 5. Angelicae radices (angelica root)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		

Other substances		<i>Angelicin</i>
Standardization by the content of BAS		

Macroscopic analysis of *Angelicae radices*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Biological effects and application of *Angelicae radices*:

Sample 6. *Visnagae daucoides* (*Ammi visnagae*) fructus (khella fruit)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Khellin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Visnagae daucoides fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Biological effects and application of *Visnagae daucoides fructus*:

INDEPENDENT STUDENTS WORK

Sample 1. Hippocastani semina (horse chestnut semen)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>esculetine</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of Hippocastani semina:

Sample 2. Rutae herba (rue herb)

	Latin name	English name
MPM		

MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of Rutae herba:

Sample 3. Anethi graveolentis fructus (dill fruits)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of Anethi graveolentis fructus:

Sample 4. Dauci carotae fructus (wild carrot fruits)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>8-methoxypsoralen</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of Dauci carotae fructus:

Signature of the teacher _____

TOPIC: LIGNANS AND XANTHONES

Aim: to establish the identity of MPM containing lignans and xanthenes according to macroscopic and microscopic characteristics.

Objects for laboratory work: centaury genus, Lemongrass Chinese, Eleutherococcus senticosus, Milk thistle.

Objects for independent study: gentian, podofil, species Hypericum

Structural formulas of main BAS: schizandrine, syringoresinol, podophyllotoxin, silybin, 1,6,8-trihydroxy-3,5,7-trimethoxyxanthone, glucomangiferin

Sample 1. *Schizandrae fructus et semina (Schizandra fruit and seed)*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		<i>Schizandrine</i>
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Schizandrae fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Macroscopic analysis of *Schizandrae semina*

occurrence, fracture of drug		size	
shape		odour after grinding	
surface		taste	
colour		other diagnostic characters	
characters of ridges, their number			

Biological effects and application of *Schizandrae fructus et semina*:

Sample 2. *Eleutherococci rhizomata et radices* (*Eleutherococcus rhizome and roots*)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Eleutherococci rhizomata et radices*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	

section fracture		taste	
sizes		other diagnostic characters	

Biological effects and application of *Eleutherococci rhizomata et radices*:

Sample 3. *Silybi fructus* (Milk-thistle fruit)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Silybin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Structural formula

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Silybi semina*

occurrence, fracture of drug		size	
shape		odour after grinding	
surface		taste	
colour		other diagnostic characters	
characters of ridges, their number			

Biological effects and application of *Silybi semina*:

INDEPENDENT STUDENTS WORK

Sample 1. *Podophylli rhizoma* (Mayapple rhizome)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>Podophyllotoxin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Podophylli rhizoma*:

Signature of the teacher _____

**ANALYSIS OF MEDICINAL PLANT MATERIALS
CONTAINING XANTHONES AND THEIR DERIVATIVES**

Sample 1. *Centaurii herba* (centaury herb)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>1,6,8-trihydroxy-3,5,7-trimethoxyxanthon</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

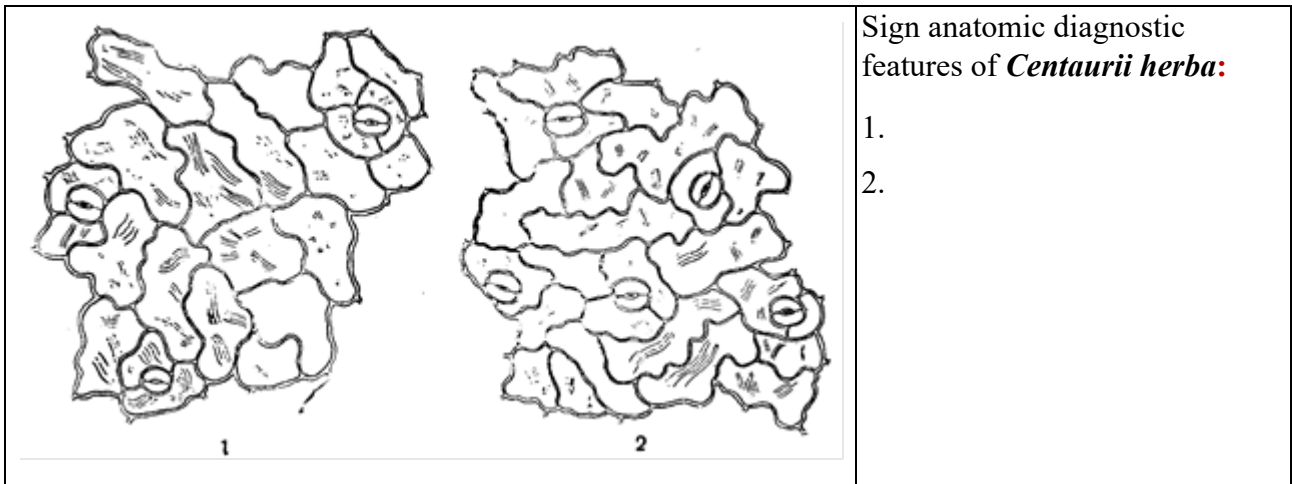
Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Centaurii herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Microscopic analysis of *Centaurii herba*



Sign anatomic diagnostic features of *Centaurii herba*:

- 1.
- 2.

Biological effects and application of *Centaurii herba*:

Sample 2. *Hedysari herba (hedysarum herb)*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>Glucomangiferin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Hedysari herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Biological effects and application of *Hedysari herba*:

INDEPENDENT STUDENTS WORK

Sample 1. *Gentianae radices* (gentian root)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Gentianae radices*:

Sample 2. *Hyperici maculati herba* (St. John`s wort herb)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>1,3,6,7-tetrahydroxyxanthone</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Hyperici maculati herba*:

Signature of the teacher _____

TOPIC: FLAVONOIDS

Aim: to establish the identity of MPM containing flavonoids according to macroscopic and microscopic characteristics, and to determine the qualitative composition and quantitative content of BAS using methods of phytochemical analysis.

Objects for laboratory work: Scholar-tree (pagoda-tree) buds and fruit, cornflower, chokeberry, lemon buckwheat, green tea, motherwort water piper, southwestern persicaria, knotweed, gnaphalia, tickseed, sandy, tansy, hawthorn, sandy everlasting, elder black, equisetum, glycyrrhiza, restharrow.

Objects for independent study: pansy, hibiscus, calendulas, st-john's-wort, ginkgo, neckmould.

Structural formulas of main BAS: flavan, catechin, anthocyanin, leucoanthocyanidine, flavanone, flavanol, flavon, flavonol, chalkon, dihydrochalcone, auron, quercetin, routine, hyperosid.

I. Phytochemical analysis of MPM containing flavonoids

Task 1. Fill an Appendix 2 on the topic of the lesson.

Task 2. Prepare extract of MPM and make the qualitative reactions for flavonoids. On the basis of reactions make a conclusion about the chemical composition of MPM.

Stages of carrying out

1. Accurate weighting of MPM sample.
2. Extraction of MPM with 80% ethanol solution.
3. Evaporation of alcoholic extract.
4. Purification of aqueous portion.
5. Obtaining of aqueous extract for detection of flavonoids.

Method. Place 2 g of MPM in 250 ml glass bulb and add 50 ml 80% ethanol solution. Attach a reflux condenser and heat on a water bath for 30 min. Filter a hot alcoholic extract, evaporate the filtrate on a water bath and concentrate to about 3-4 ml. Add to a residue 15 -20 ml hot distilled water, mix by a glass rod, continue to heat till has been completed alcohol evaporation (absence of odour). Filter the aqueous extract through a filter paper, bring the extract into separatory funnel and shake with 15 ml chloroform. After separation, investigate the presence of flavonoids in purified aqueous extract (upper layer) chromatographically (15 ml of extract) and by qualitative reactions.

Task 3. To detect flavonoids by means of qualitative reactions. As an example of comparison, use a 0.1% alcohol rutine solution. Record the results of the reaction in the table and draw conclusions.

Name of reaction	Methods	Observation	
		Investigated extract	Solution of rutine
1. Cyanidin reaction	Into 2 ml of extract, add 0,5 ml ethanol with 5-6 drops concentrated hydrochloric acid. Boil the mixture on a water bath for 4-5 minutes, then add 10-15 mg metalline magnesium or zinc. Fix the result of reaction in 3-5 minutes		
2. Cyanidin reaction by Briant	To the colored product of the cyanidin reaction add 1/3 of the volume of butanol, dilute with water to the distribution of layers, shake.		
3. Reaction with 10% alkaline	To 1 ml of the extract add 1-2 drops of 10% alcohol-aqueous solution of potassium or sodium hydroxide		

4. Reaction with 3% aluminium chloride	To 1 ml of the extract, add 1 ml of 3% alcohol solution of aluminum chloride.		
5. Reaction with 2% ferric chloride.	To 1 ml of the extract add 2-3 drops of 1% alcohol solution of ferrum chloride.		
6. Wilson`s reaction	To the 2 ml extract, add 1 ml of a 2% solution of boric acid and 1 ml of a 2% alcoholic solution of citric acid (or oxalic acid).		
7. Reaction with vanillin in concentrated hydrochloric acid	To 1 ml add a few drops of 1% solution of vanillin in concentrated hydrochloric acid.		
8. Reaction with 2% lead acetate solutions	To 1 ml of the extract, add 1 ml of 2% lead acetate solutions.		
Conclusions:			

Task 4. To analyze flavonoids chromatographically (SPhU, 2.0 Vol.3 *Hyperici herba*).

Test solution. 0.5 g of raw materials crushed into powder is mixed with 10 ml of methanol in a water bath at a temperature of 60°C for 10 minutes and filtered.

Comparison solution. 5 mg of rutin and 5 mg of hyperoside are dissolved in methanol and the volume of the solution is brought up to 5 ml with the same solvent.

Plate. TLC plate with a layer of silica gel.

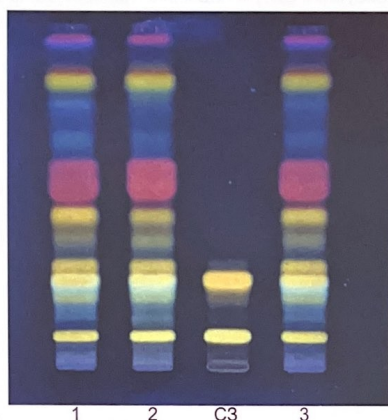
Mobile phase: anhydrous formic acid - water - ethyl acetate (6:9:90).

Sample volume. 10 µl of the test solution and 5 µl of the reference solution, in strips of 10 mm. The distance to be covered by the moving phase: 10 cm from the starting line.

Drying: at a temperature of (100-105)°C for 10 minutes.

Detection: treated with a solution of 10 g/l of diphenylboronic acid aminoethyl ether in methanol, then with a solution of 50 g/l of macrogol 400 in methanol, and after 30 minutes viewed in UV light at a wavelength of 365 nm.

Results: should be detected: in the lower third — the zone of rutin, above it — the zone of hyperoside, both with yellow-orange fluorescence.



1-3 - *Hyperici herba* series; C3 – rutin (lower zone)+hyperoside (upper zone)

Conclusions: _____

Task 5. To determine quantitative content of flavonoids in MPM (SPhU, 2.0 Vol.3 *Hyperici herba*).

Method. *The starting solution.* Place 0.300 g of raw materials crushed into powder in a round-bottom flask with a capacity of 100 ml, add 1 ml of a solution of 5 g/l hexamethylenetetramine, 20 ml of acetone and 2 ml of hydrochloric acid, boil under reflux for 30 minutes and filter through a cotton swab into the flask with a capacity of 100 ml. A cotton swab is added to the residue in a round-bottomed flask and extracted with 2 portions, 20 ml each, of acetone, boiling under reflux for 10 min each time, cooled to room temperature, and each extract is filtered through a cotton swab into the flask. The obtained cooled combined acetone extracts are filtered through a paper filter into a volumetric flask, the volume of the solution is brought up to 100 ml with acetone, rinsing the flask and the paper filter. Place 20.0 ml of the obtained solution in a separatory funnel, add 20 ml of water and shake the mixture with 15 ml of ethyl acetate, and then with 3 portions of 10 ml each of ethyl acetate. The obtained ethyl acetate extracts are combined in a separatory funnel, washed with 2 portions, 50 ml each, of water, filtered over 10 g of anhydrous sodium sulfate in a volumetric flask, and the volume of the solution is adjusted to 50.0 ml with ethyl acetate.

Test solution. 1 ml of aluminum chloride reagent is added to 10.0 ml of the initial solution and brought to a volume of 25.0 ml with a solution of 5% (v/v) glacial acetic acid in methanol.

Compensation solution. 10.0 ml of the original solution is brought up to a volume of 25.0 ml with a solution of 5% (v/v) glacial acetic acid in methanol.

The optical density of the test solution is measured 30 minutes after preparation at a wavelength of 425 nm relative to the compensating solution.

The content of flavonoids, in terms of hyperoside, in percent, is calculated according to the formula:

$$X = A \times 1,25 / m$$

where A - is the optical density of the tested solution at a wavelength of 425 nm;

m - is the weight of the tested raw material, in grams.

The specific absorption index of hyperoside equal to 500 is used.

Conclusions: _____

II. Macro- and microscopic analysis of MPM containing flavonoids and their derivatives

Sample 1. *Sophorae japonicae fructus* (Pagoda-tree fruit)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Quercetin-3-rutinoside

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Sophorae japonicae fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Biological effects and application of *Sophorae japonicae fructus et alabastrae*:

Sample 2. *Sophorae japonicae alabastrae* (Pagoda-tree buds)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Rutin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Sophorae japonicae alabastra*

occurrence, fracture of drug		base of rachis	
colour		odour after grinding	
shape, size		taste	
surface		other diagnostic characters	

Biological effects and application of *Sophorae japonicae alabastrae*:

Sample 3. *Theae folium*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		
		<i>Catechin</i>

Macroscopic analysis of *Theae folium*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	

leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Biological effects and application of *Theae folium*:

Sample 4. *Citri exocarpium*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Hesperidin

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Citri exocarpium*

occurrence, fracture of drug		oil reservoirs	
colour		odour after grinding	
shape, size		taste	
surface		other diagnostic characters	

Biological effects and application of *Citri exocarpium*:

Sample 5. *Centaureae cyani flores*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> Cyanidine
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Centaureae cyani flores*

occurrence, fracture of drug		corolla	
type of inflorescence		size	
symmetry		colour of flower parts	
receptacle		odour after grinding	
involucre, bracts		taste	
florets		other diagnostic characters	
calyx			

Biological effects and application of *Centaureae cyani flores*:

Sample 6. *Aroniae melanocarpae fructus recentes*

	Latin name	English name
MPM		

MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		
		<i>Cyanidine</i>

Macroscopic analysis of *Aroniae melanocarpae fructus recentes*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Biological effects and application of *Aroniae melanocarpae fructus recentes*:

Sample 7. *Leonuri herba*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		

Storage conditions		<i>Quercitrin</i>
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

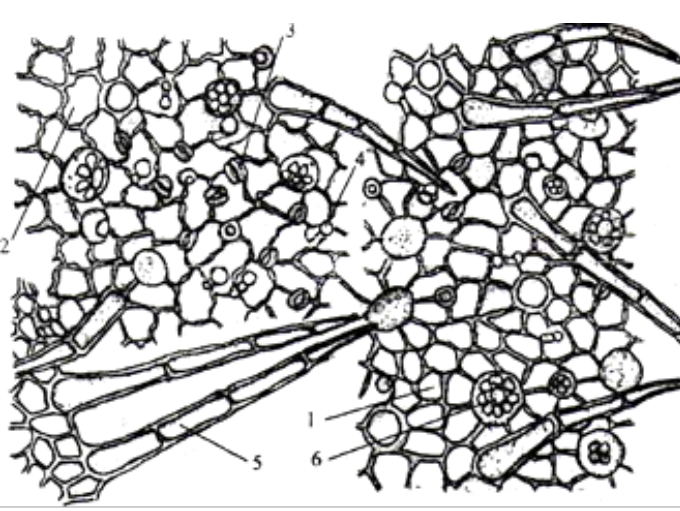
Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Leonuri herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Microscopic analysis of *Leonuri herba*

	Sign anatomic diagnostic features of <i>Leonuri herba</i> : <ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6.
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Biological effects and application of *Leonuri herba*:

Sample 8. *Polygoni hydropiperis herba*

	Latin name	English name
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MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

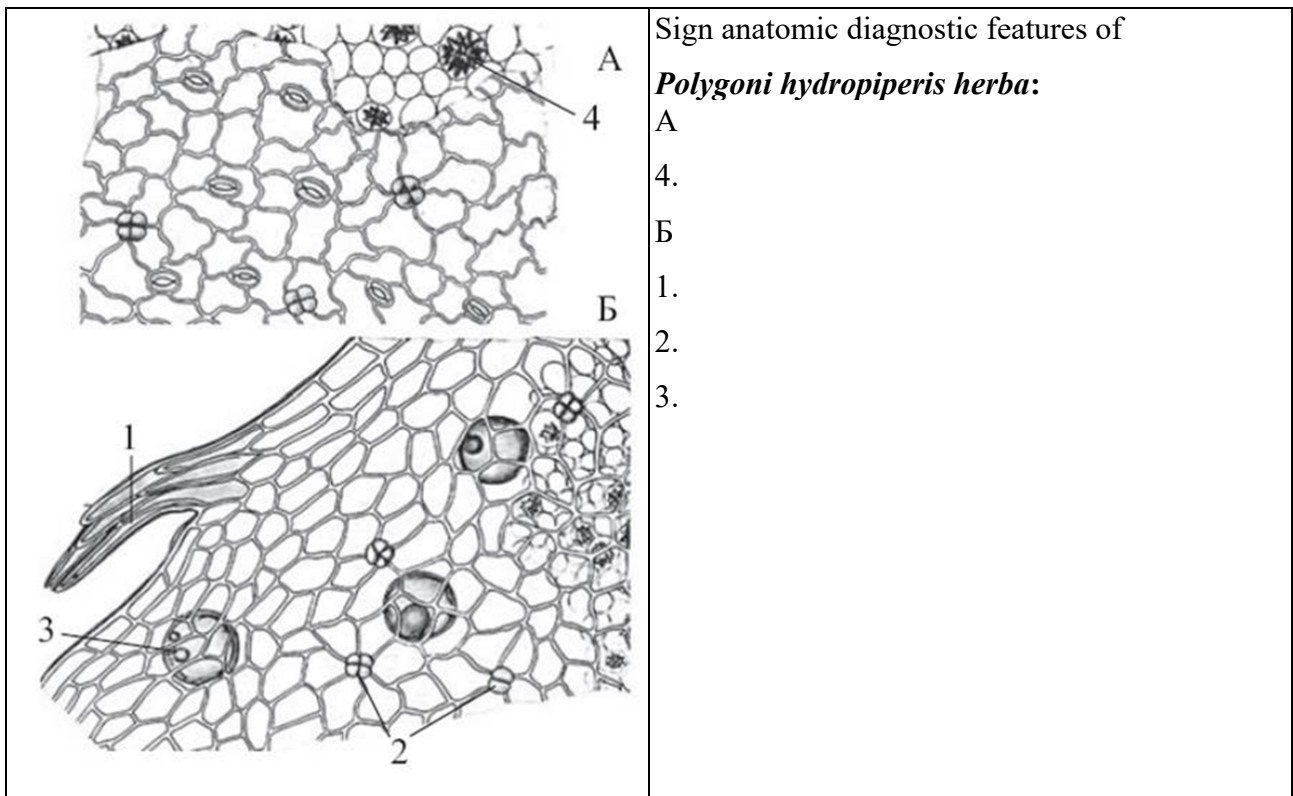
Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Polygoni hydropiperis herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Microscopic analysis of *Polygoni hydropiperis herba*



Sign anatomic diagnostic features of *Polygoni hydropiperis herba*:

- A
4.
B
1.
2.
3.

Biological effects and application of *Polygoni hydropiperis herba*:

Sample 9. *Polygoni persicariae herba*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Hyperoside

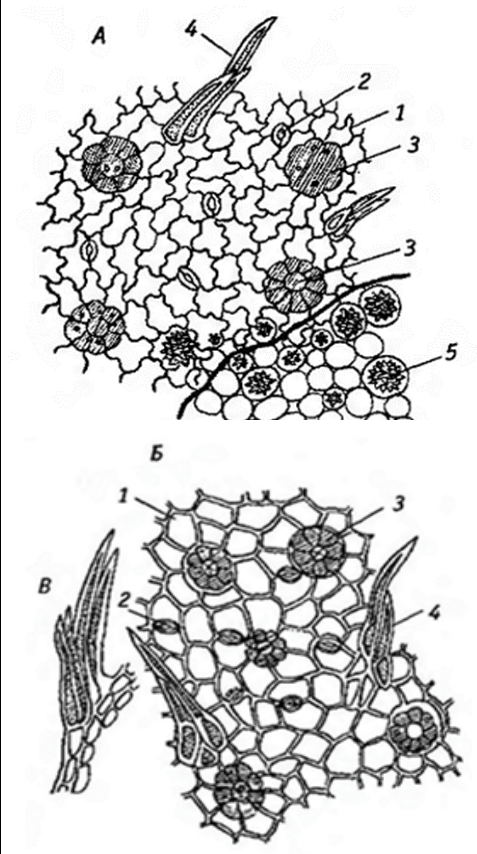
Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Polygoni persicariae herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Microscopic analysis of *Polygoni persicariae herba*

 <p>Diagram A: Microscopic view of the leaf cross-section. Labels: 1 - upper epidermis, 2 - palisade mesophyll, 3 - spongy mesophyll, 4 - vascular bundle, 5 - lower epidermis with stomata.</p> <p>Diagram B: Microscopic view of the stem cross-section. Labels: 1 - cortex, 2 - vascular bundle, 3 - pith, 4 - vascular bundle.</p>	<p>Sign anatomic diagnostic features of <i>Polygoni persicariae herba</i>:</p> <p>A-</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5. <p>B -</p> <ol style="list-style-type: none"> 1. 2. 3. 4.
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Biological effects and application of *Polygoni persicariae herba*:

Sample 10. *Polygoni avicularis herba*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Avicularin

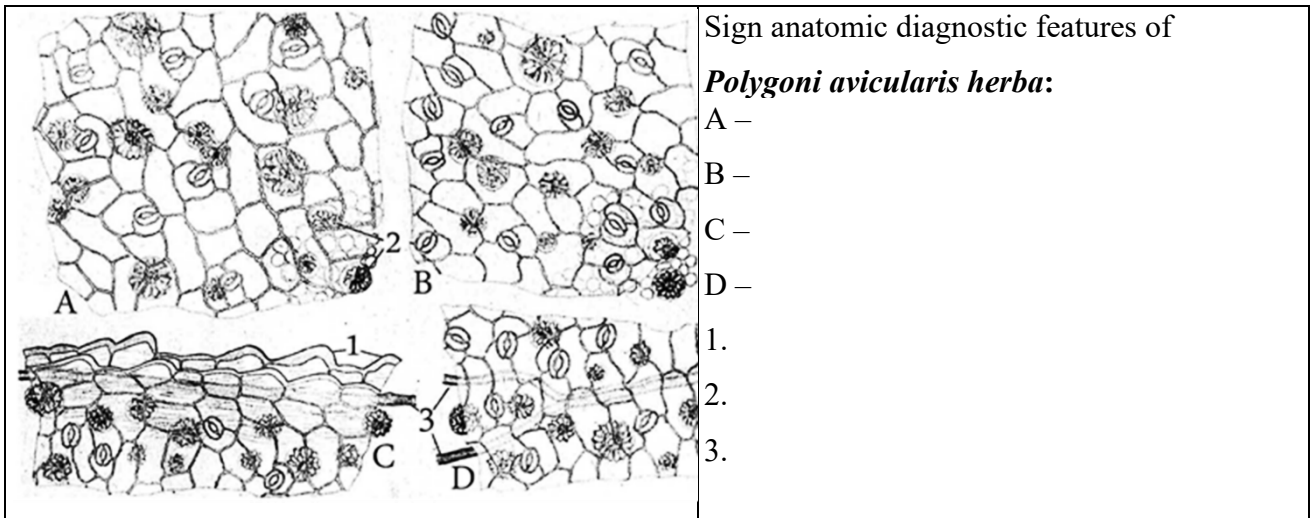
Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Polygoni avicularis herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Microscopic analysis of *Polygoni avicularis herba*



Biological effects and application of *Polygoni avicularis herba*:

Sample 11. *Helichrysi arenarii flores*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>Naringenin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Helichrysi arenarii flores*

occurrence, fracture of drug		corolla	
type of inflorescence		size	

symmetry		colour of flower parts	
receptacle		odour after grinding	
involucre, bracts		taste	
florets		other diagnostic characters	
calyx			

Biological effects and application of *Helichrysi arenarii* flores:

Sample 12. *Crataegi flores*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Vitexin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Crataegi flores*

occurrence, fracture of drug		corolla	
type of inflorescence		size	
symmetry		colour of flower parts	
receptacle		odour after grinding	
involucre, bracts		taste	

florets		other characters	diagnostic	
calyx				

Biological effects and application of *Crataegi flores*:

Sample 13. *Crataegi fructus*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Crataegi fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other characters	diagnostic

Biological effects and application of *Crataegi fructus*:

Sample 14. *Glycyrrhizae radices*

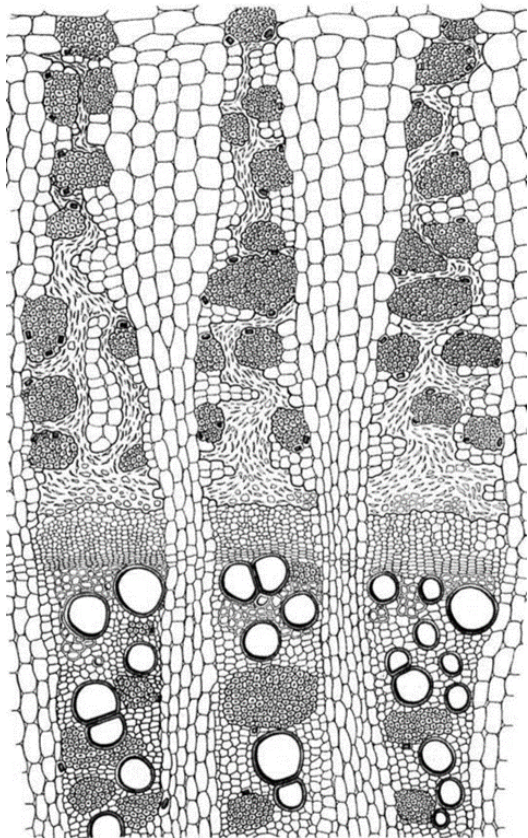
	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		
		<i>Dihydrochalcone</i>

Macroscopic analysis of *Glycyrrhizae radices*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Microscopic analysis of *Glycyrrhizae radices*

	<p>Sign anatomic diagnostic features of <i>Glycyrrhizae radices</i></p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6. 7. 8.
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Biological effects and application of *Glycyrrhizae radices*:

Sample 15. *Ononidis radices*

	Latin name	English name
MPM		
MP		
Family		

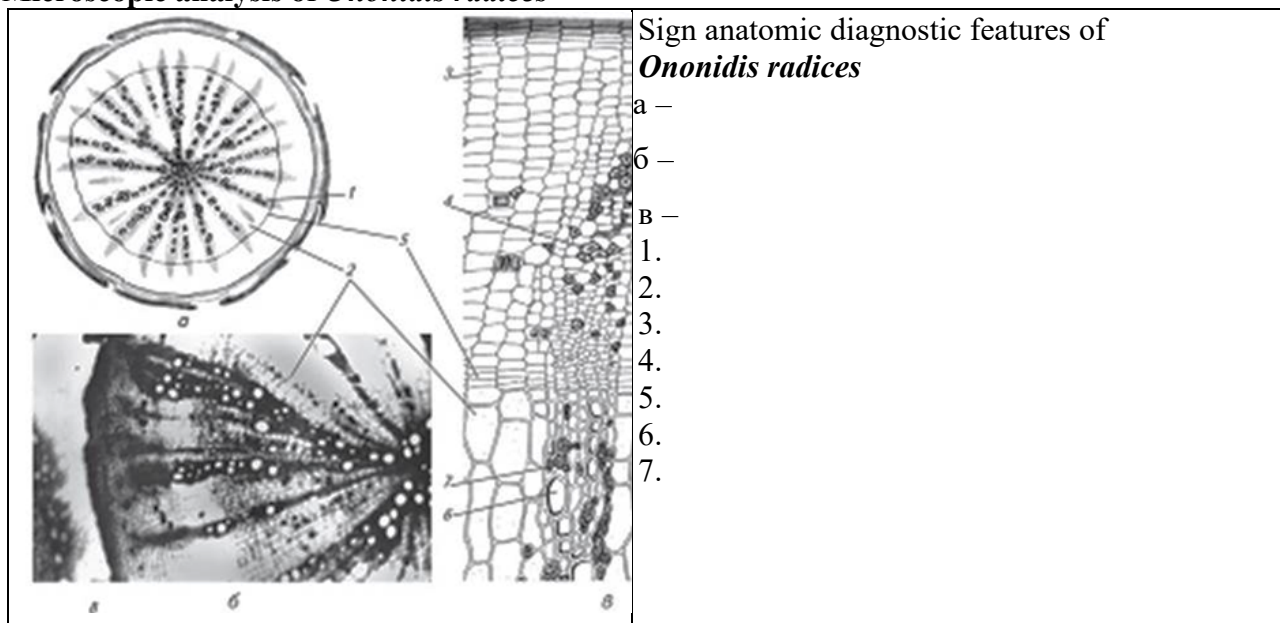
Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		

Standardization by the content of BAS		<i>Ononin</i>
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Macroscopic analysis of *Ononidis radices*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Microscopic analysis of *Ononidis radices*



Biological effects and application of *Ononidis radices*:

Sample 16. *Vitis viniferae fructus*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
---------------------	--	---------------------------

Harvesting time		<i>Cyanidin</i>
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Vitis viniferae fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Biological effects and application of *Vitis viniferae fructus*:

INDEPENDENT STUDENTS WORK

Sample 1. *Violae herba* (wild pansy herb)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		

Other substances		<i>rutin</i>
Standardization by the content of BAS		

Biological effects and application of *Violae herba*:

Sample 2. *Calendulae flores* (*calendula flowers*)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Calendulae flores*:

Sample 3. *Hyperici herba* (*st-john's-wort herb*)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Hyperici herba*:

Sample 4. *Ginkgo folium* (ginkgo leaf)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Ginkgo folium*:

Signature of the teacher _____

TOPIC: ANTHRAQUINONE DERIVATIVES

Aim: to establish the identity of MPM containing anthraquinone derivatives according to macroscopic and microscopic characteristics, and to determine the qualitative composition and quantitative content of BAS using methods of phytochemical analysis.

Objects for laboratory work: buckthorn, rhineberry, rhubarb, horse sorrel, senna, aloe, dyer's-madder, st-john's-wort.

Objects for an independent study: ubiquinone, walnut.

Structural formulas of main BAS: anthrone, anthranol, anthraquinone, alizarine, aloe-emodin, glucorhein, rheochrisine, rheum-emodin, chrysacine, chrysophanol, hypericine, sennoside, frangularoside, ruberithrinic acid.

I. Phytochemical analysis of MPM containing anthraquinone derivatives

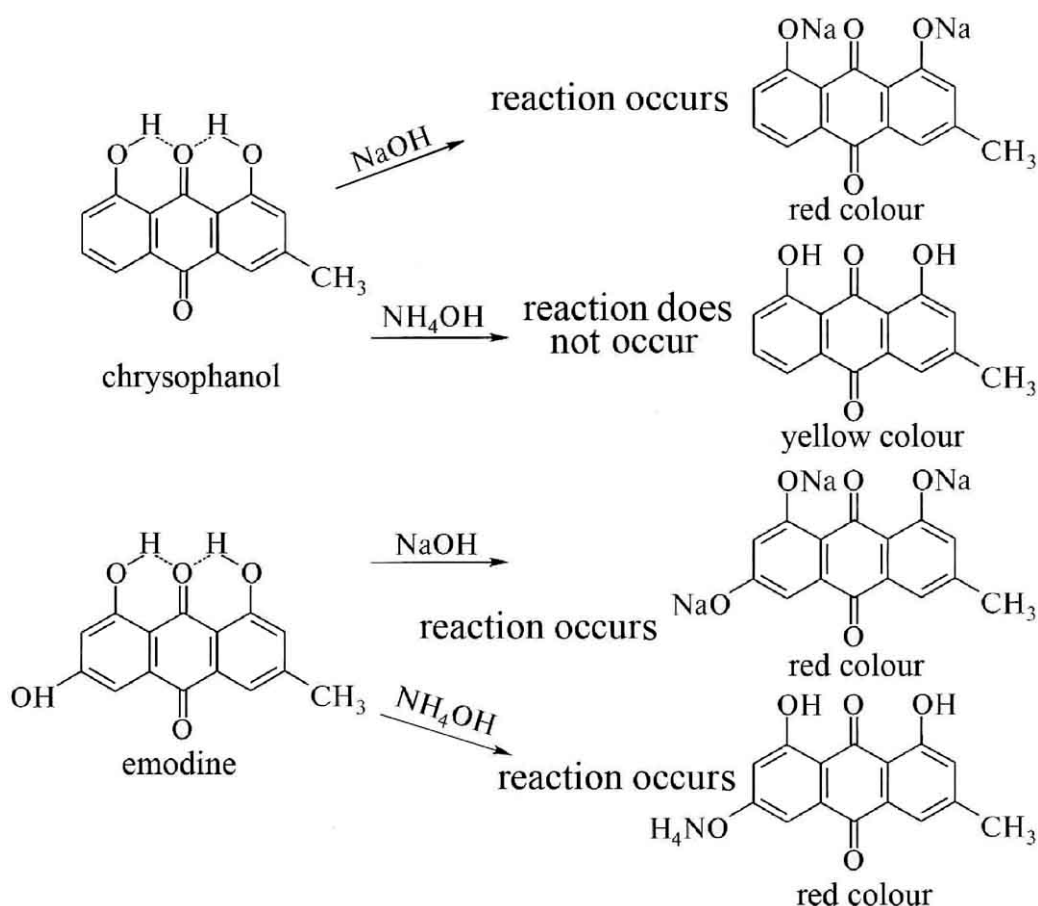
Task 1. Fill an Appendix 2 on the topic of the lesson.

Task 2. Detect anthraquinones by qualitative reactions.

Name of reaction	Methods	Observation
1. Reaction of microsublimation	Put in a dry test tube 0.1-0.3 g powdered MPM and heat at flame level. Anthraquinones are sublimated and precipitated on the walls of a test tube as yellow crystals, coloured with 5% alcoholic ammonia solution. Note a produced colour.	
2. Tchirch's reaction	Add 5ml of distilled water for 0.5g powdered MPM. Boil for 5 min and filter into a test tube. Add 5% alcoholic sodium hydroxide solution to the filtrate. At the presence of emodines or chrysophane acid cherrish-red colour is obtained, of alizarins - violet.	
3. Borntrager's reaction.	Place 1.0 g powdered MPM into a flask, add 10 ml of 10% sodium hydroxide solution, boil for a few minutes and filter in a test tube. Cool, adjust the acidity, adding 10% hydrochloric acid, to a weak acid reaction (according to the universal indicator). Place in a separatory funnel and extract with 10ml of chloroform. Allow to stand. Chloroform layer gives yellow colour (anthraquinone derivatives). Shake 5 ml of chloroform extract in a test tube with an equal volume of 5% alcoholic ammonia solution. Cherrish-red colour of ammonia solution layer indicates the presence of emodines, blue colour - presence of alizarines, yellow constant colour of chloroform solution indicates chrysophanic acid. Note a produced colour.	
4. Reaction with magnesium acetate.	5 ml of anthraquinones containing extract, obtained after Borntrager's reaction, place in a porcelain dish, evaporate to a dry surplus and dissolve it in 2ml of ethanol. For 1ml of obtained solution, add 1ml of 1% magnesium acetate solution in methanol. Extracted compounds with hydroxylic groups in o-position give red colour, in m-position-orange; blue	

	or violet colour indicates the presence of hydroxylic groups in o- or p-position of anthraquinone system. Note a produced colour.	
5. Histochemical reaction to determine of anthraquinone derivatives	In a Petri dish, a few drops of 5% NaOH solution are applied to a piece of LRC. Observe the formation of color.	
Conclusions:		

Borntrager's reaction



Task 3. To analyze anthraquinone derivatives chromatographically by thin layer chromatography.

Test solution. 5 ml of ethanol (70%, v/v) is added to 0.5 g of the raw material crushed into powder, heated to boiling, cooled and centrifuged. The supernatant solution is immediately decanted and used within the next 30 minutes.

Comparison solution. 10 mg of FSZ DFU of franguloemodin is dissolved in ethanol (70%, v/v) and the volume of the solution is brought up to 10 ml with the same solvent.

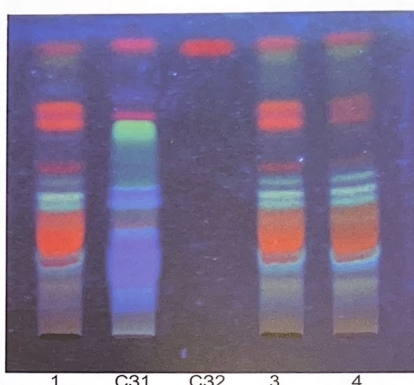
Plates: TLC plates with a layer of silica gel.

Mobile phase: water - methanol - ethyl acetate (13:17:100).

Sample volume: 10 µl, in strips. The distance to be covered by the moving phase: 10 cm from the starting line.

Drying: in the air for 5 minutes.

Detection: spray with a solution of 50 g/l of potassium hydroxide in ethanol (50%), heat at a temperature of (100-105)°C for 15 minutes and view in UV light at a wavelength of 365 nm.



1-4 – *Frangulae cortex* series; C31 – *Rhamnus cathartica* sample C32 – franguloemodin

Conclusions: _____

Task 4. To determine a quantitative content of anthraquinone derivatives in the analyzed MPM (according to the SPhU 2 ed., Vol.3 *Frangulae cortex*).

1. Extraction. Weigh 0.250 g of powdered raw material into a pre-weighed round-bottomed flask with a ground glass stopper. Add 25.0 ml of a 70% (v/v) methanol solution to the flask; mix, weigh, heat in a reflux water bath for 15 min, cool, weigh and adjust with a solution of 70% (v/v) methanol to the starting mass and filter.

2. Purification. Transfer 5.0 ml of the obtained filtrate to a separatory funnel, add 50 ml of water and 0.1 ml of hydrochloric acid, shake with 5 portions, 20 ml each, of petroleum ether, wait until separation and transfer the aqueous layer to a volumetric flask with a capacity of 100 ml. The ether layers are combined and washed with 2 portions, 15 ml each, of water. The washing liquid is used to wash the dividing funnel and added to the aqueous solution in the volumetric flask. Add 5 ml of a solution of 50 g/l sodium carbonate, bring the volume of the solution to 100.0 ml with water. The petroleum ether layer is discarded. 40.0 ml of the aqueous solution is transferred to a round-bottomed flask with a ground glass stopper with a capacity of 200 ml, 20 ml of a solution of 200 g/l of iron (III) chloride is added and heated under reflux in a water bath with a water level higher than the level of the liquid in the flask for 20 minutes. Add 2 ml of hydrochloric acid and continue heating for another 20 minutes with vigorous shaking until the precipitate dissolves. The resulting mixture is cooled, transferred to a separatory funnel and shaken with 3 portions, 25 ml each, of the ether previously used for washing the round-bottomed flask. The ether extracts are combined and washed with 2 portions, 15 ml each, of water. The ether layer is transferred to a volumetric flask and made up to a volume of 100.0 ml with ether. 20.0 ml of the solution is carefully evaporated to dryness and the residue is dissolved in 10.0 ml of a solution of 5 g/l magnesium acetate in methanol.

3. Determination of optical density. The optical density of the test solution is measured at a wavelength of 515 nm, using methanol as a compensating liquid.

4. Calculation. The content of glucofrangulins, in percent, in terms of glucofrangulin A, is calculated according to the formula:

$$X = A \times 3,06 / m;$$

A - is the optical density of the tested solution at a wavelength of 515 nm,

m - is the weight of the tested raw material, in grams

II. Macro- and microscopic analysis of MPM containing anthraquinone derivatives

Sample 1. *Frangulae cortex* (alder buckthorn bark)

	Latin name	English name
MPM		

MP		
Family		

Dissemination of MP		<i>Frangulin A</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

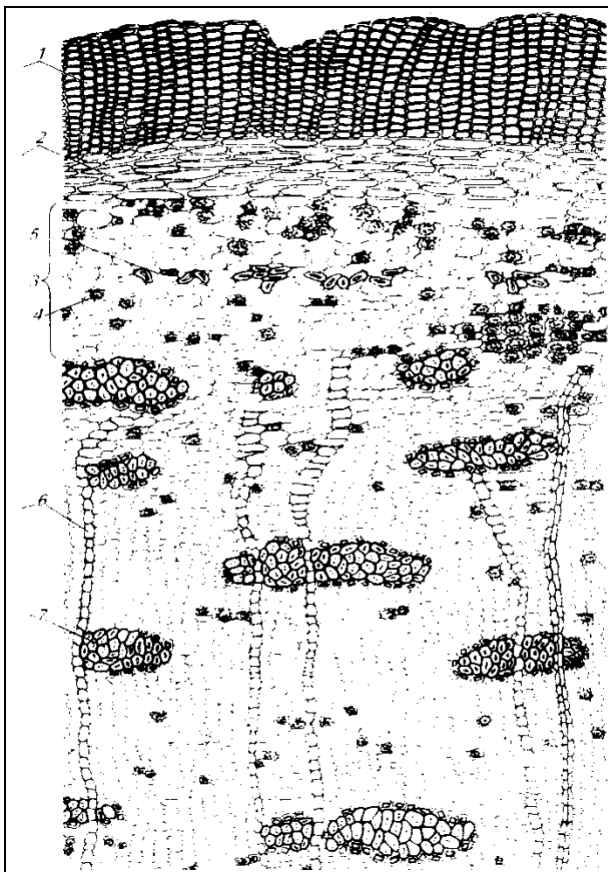
Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Frangulae cortex*

occurrence, fracture of drug		outer surface colour	
shape		inner surface colour	
surface characters		odour after grinding	
section fracture, internal appearance		taste	
sizes		other diagnostic characters	

Microscopic analysis of *Frangulae cortex*



Sign anatomic diagnostic features of *Frangulae cortex*

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

Biological effects and application of *Frangulae cortex*:

Sample 2. *Rhamni purshianae cortex (cascara bark)*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		

Standardization by the content of BAS		<i>Cascaroside A</i>
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Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Rhamni purshianae cortex*

occurrence, fracture of drug		outer surface colour	
shape		inner surface colour	
surface characters		odour after grinding	
section fracture, internal appearance		taste	
sizes		other diagnostic characters	

Biological effects and application of *Rhamni purshianae cortex*:

Sample 3. *Rhamni catharticae fructus* (common buckthorn fruit)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Rhamnocatharinin</i> (<i>glucofranguline</i>)
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

3. _____
 4. _____

Macroscopic analysis of *Rhamni catharticae fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Biological effects and application of *Rhamni catharticae fructus*:

Sample 4. *Rhei radices* (rhubarb root)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

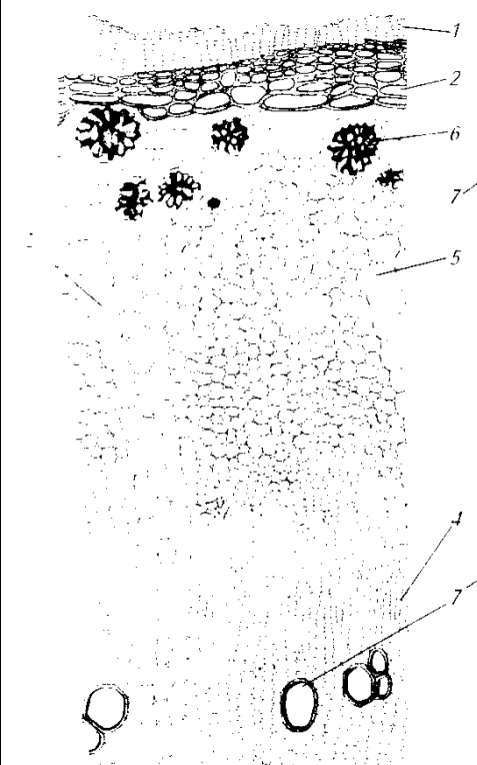
1. _____
 2. _____

Macroscopic analysis of *Rhei radices*

occurrence, fracture		outer surface colour	
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of drug			
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Microscopic analysis of *Rhei radices*

	<p>Sign anatomic diagnostic features of <i>Rhei radices</i></p> <p>2.</p> <p>3.</p> <p>4.</p> <p>5.</p> <p>6.</p> <p>7.</p>
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Biological effects and application of *Rhei radices*:

Sample 5. *Rumicis radices* (horse sorrel root)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>phycion</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Rumicis radices*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Biological effects and application of *Rumicis radices*:

Sample 6. *Aloes arborescentis folia recentes* (aloe leaf)

	Latin name	English name
MPM		
MP		
Family		

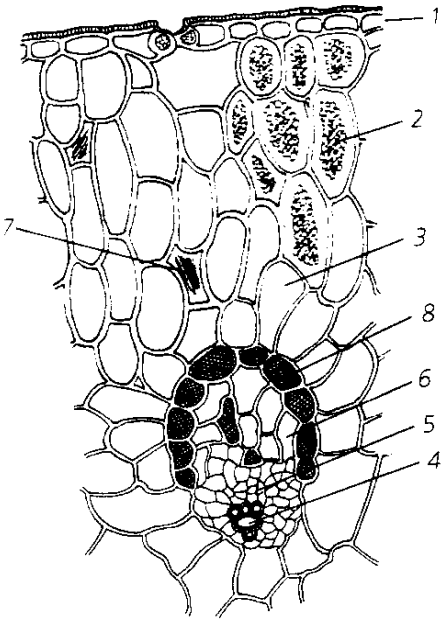
Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		

Other substances		<i>Aloe-emodin</i>
Standardization by the content of BAS		

Macroscopic analysis of *Aloes arborescentis folia recentes*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Microscopic analysis of *Aloes arborescentis folia recentes*

	<p>Sign anatomic diagnostic features of <i>Aloes folium</i>:</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6.
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Biological effects and application of *Aloes arborescentis folia recentes*:

Sample 7. *Sennae folia* (cassia leaf)

	Latin name	English name
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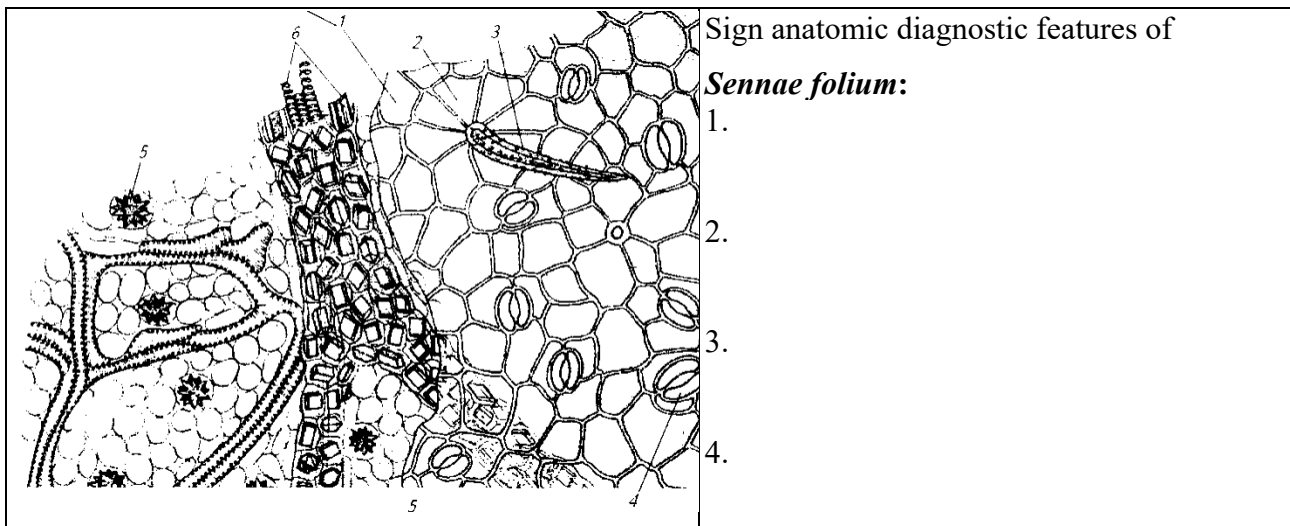
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Sennae folia*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Microscopic analysis of *Sennae folia*



Sign anatomic diagnostic features of *Sennae folium*:

- 1.
- 2.
- 3.
- 4.

Biological effects and application of *Sennae folia*:

Sample 8. *Hyperici herba* (St. John`s wort herb)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Hipericin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Hyperici herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	

leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Biological effects and application of *Hyperici herba*:

Sample 9. *Rubiae rhizomata et radices* (common madder rhizome and roots)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Rubiae rhizomats et radices*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Microscopic analysis of *Rubiae rhizoma et radices*

	<p>Sign anatomic diagnostic features of <i>Rubiae rhizoma et radices</i></p> <ol style="list-style-type: none"> 2. 3. 4. 5. 6.
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Biological effects and application of *Rubiae rhizomata et radices*:

INDEPENDENT STUDENTS WORK

Sample 1. *Juglandis folium* (walnut leaf)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
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Harvesting time		<i>juglon</i>
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Juglandis folium*:

Signature of the teacher _____

TOPIC: TANNINS

Aim: to establish the identity of MPM containing tannins according to macroscopic and microscopic characteristics, and to determine the qualitative composition and quantitative content of BAS using methods of phytochemical analysis.

Objects for laboratory work: witch hazel bark, witch hazel leaves, sumach leaves, smoke tree leaves, bistort rhizome, Greater burnet rhizome and roots, bergenia rhizome, alder fruit, American chestnut leaves, oak bark, common tormentil rhizome, bilberry fruit, bird cherry fruit, pomegranate.

Objects for an independent study: turkish nutgall, chinese nutgall, pistachio nutgall, fustic, sumachs.

Structural formulas of main BAS: catechine, anthocyanidine, leucoanthocyanidine, structure of gallotannin, gallic acid, ellagic acid, theogalline, proanthocyanidine.

I. Phytochemical analysis of MPM containing tannins

Task 1. Fill an Appendix 2 on the topic of the lesson.

Task 2. Obtain an extract of MPM.

Place 3g of MPM in 250 ml flask and add 250 ml of water, heat on a water bath for 15 min. Cool and filter the hot extract through cotton.

Task 3. Detect tannins by qualitative reactions.

Name of reaction	Methods	Observation
1. Interaction with ferric salts after the reaction with formic aldehyde and HCl.	For 50 ml of extract add 5 ml of concentrated hydrochloric acid and 15 ml of 40% formic aldehyde solution. Attach a reflux condenser and heat on a water bath for 30 min. Condensed tannins precipitating. Filter the formed precipitate. For 2 ml of filtrate, add 10 drops of 1% alum and 1g of crystalline formic acid sodium. Hydrolyzed tannins give bluish-violet colors. Note and explain the results of reaction, determine the group of tannins, contained in the analyzed MPM.	
2. Reaction with gelatine solution.	For 2 ml of analyzed extract add a few drops of gelatine. Cloudiness is formed, and disappears after addition of gelatine surplus.	
3. Reaction with alkaloids.	For 2 ml of examined extract, add a few drops of 1% chinine hydrochloride solution or papaverine hydrochloride solution. Amorphous precipitate is produced.	
4. Reaction with ferric salts.	For 2 ml of analyzed extract, add 4 or 5 drops of 1% alum solution. Hydrolyzed tannins give bluish-black colour, condensed ones - greenish- brown.	
5. Reaction with lead acetate.	For 2 ml of analyzed extract, add 4 ml of 10% acetic acid solution, 1-2 ml of 10% lead acetate solution. Filter the precipitate. Add a few drops of 1% alum solution for filtrate. Condensed tannins produce a greenish-brown colour.	
5. Histochemical reaction to determine of tannins	In a Petri dish, a few drops of 1% alum solution are applied to a piece of MPM. Observe the formation of color.	
Conclusions:		

Task 4. Carry out the chromatographic determination of catechins in MPM by the method of thin-layer chromatography in accordance with the monograph of the SPhU (2.0 Vol.3) "Oak Bark".

Test solution. 10 ml of water P is added to 1.0 g of raw materials crushed into powder, shaken for 10 min and filtered. The filtrate is shaken with 2 portions, 10 ml each, of ethyl acetate P, the combined upper layers are filtered over 6 g of anhydrous sodium sulfate P, the filtrate is evaporated to dryness under reduced pressure. The obtained residue is dissolved in 1.0 ml of ethyl acetate R.

Comparison solution. Add 0.2 ml of ethyl acetate R to the contents of the ampoule oak extract and shake until dissolved.

Plate: TLC plate with a layer of silica gel R.

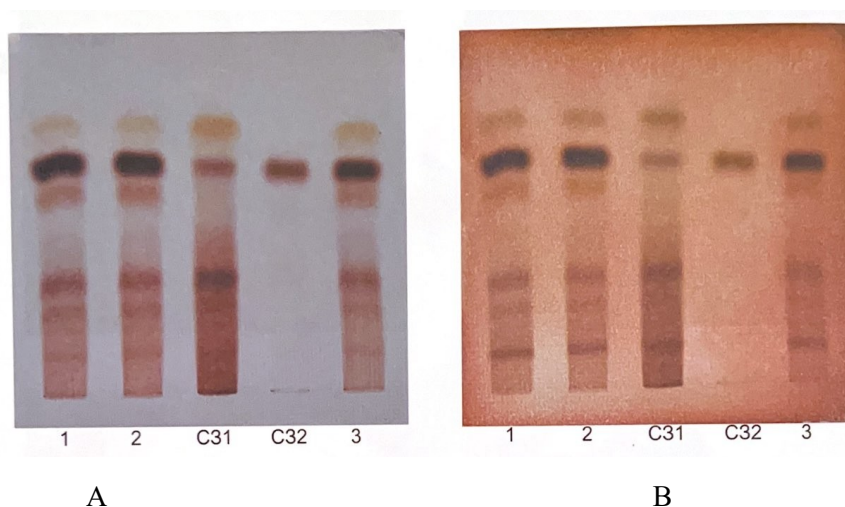
Mobile phase: glacial acetic acid R - ether R-hexane R - ethyl acetate R (20:20:20:40).

Sample volume: 20 µl, in strips.

The distance to be covered by the moving phase: 10 cm from the starting line. Drying, in the air for (10-15) minutes.

Detection: spray with a freshly prepared solution of 5 g/l strong blue B, salt P; reddish areas appear. The plate is kept in ammonia vapor; zones become more intense, reddish-brown. Viewed in daylight.

Results: Below is the sequence of zones on the chromatograms of the reference solution and the test solution. Other weak zones can also be detected on the chromatogram of the tested solution



1-3 – oak bark series, C31 – oak bark extract, C32 – catechin

II. Macro- and microscopic analysis of MPM containing tannins

Sample 1. *Hamamelidis cortex* (witch hazel bark)

	Latin name	English name
MPM		
MP		

Family		
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Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Hamamelidis cortex*

occurrence, fracture of drug		outer surface colour	
shape		inner surface colour	
surface characters		odour after grinding	
section fracture, internal appearance		taste	
sizes		other diagnostic characters	

Biological effects and application of *Hamamelidis cortex*:

Sample 2. *Hamamelidis folia* (witch hazel leaves)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		

Basic group of BAS, %		<i>Gallic acid</i>
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Hamamelidis folia*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Biological effects and application of *Hamamelidis folia*:

Sample 3. *Cotini coggygriae folia* (smoke tree leaves)

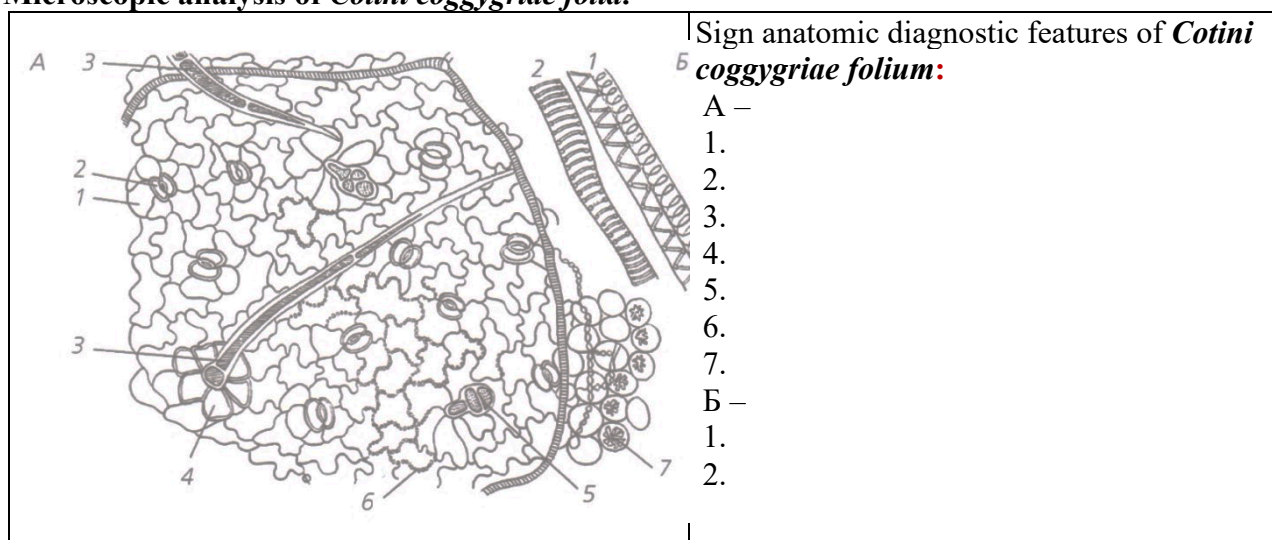
	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Methylgallate</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Cotini coggygriae folia*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Microscopic analysis of *Cotini coggygriae folia*:



Biological effects and application of *Cotini coggygriae folia*:

Sample 4. *Bistortae rhizomata* (bistort rhizome)

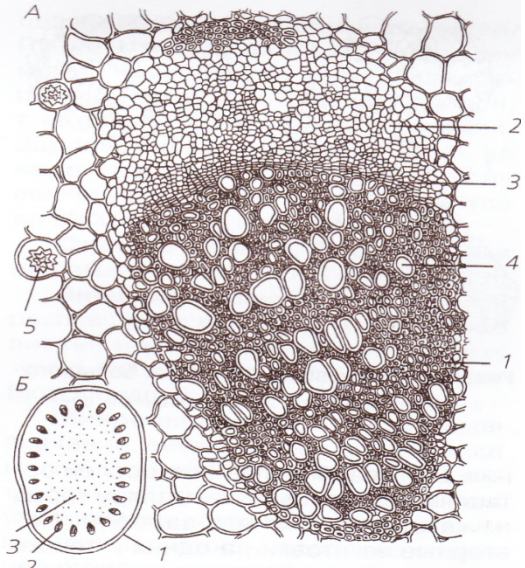
	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>Ellagic acid</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Bistortae rhizomata*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Microscopic analysis of *Bistortae rhizomata*:

	<p>Sign anatomic diagnostic features of <i>Bistortae rhizoma</i></p> <p>A – B – 1. 2. 3. 4. 5.</p>
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Biological effects and application of *Bistortae rhizomata*:

Sample 5. *Sanguisorbae rhizomata et radices* (Greater burnet rhizome and roots)

	Latin name	English name
MPM		
MP		

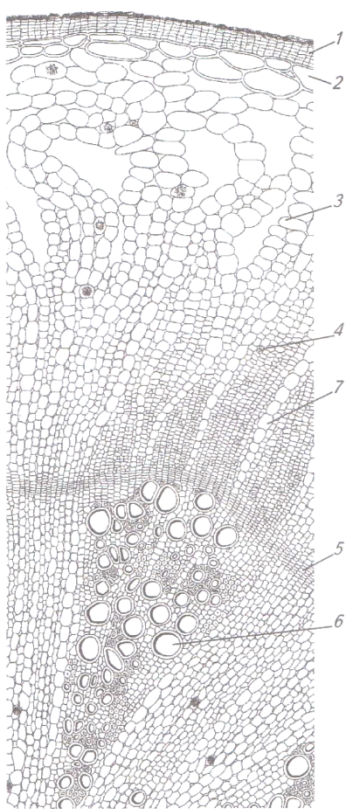
Family		
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Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Sanguisorbae rhizomata et radices*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Microscopic analysis of *Sanguisorbae rhizomata et radices*:

	<p>Sign anatomic diagnostic features of <i>Sanguisorbae rhizoma et radices</i></p> <p>A –</p> <p>Б –</p> <p>2.</p> <p>3.</p> <p>4.</p> <p>5.</p> <p>6.</p> <p>7.</p>
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Biological effects and application of *Sanguisorbae rhizomata et radices*:

Sample 6. *Bergeniae rhizomata* (*Bergenia rhizome*)

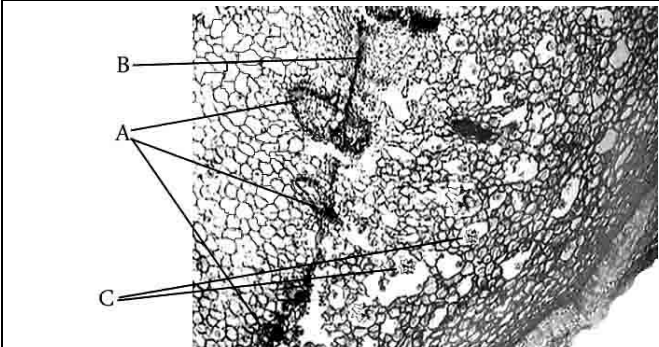
	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Bergeniae rhizomata*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Microscopic analysis of *Bergeniae rhizomata*:

	Sign anatomic diagnostic features of <i>Bergeniae rhizoma</i> A- B- C-
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Biological effects and application of *Bergeniae rhizomata*:

Sample 7. *Alni fructus* (Alder fruit)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Alni fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Biological effects and application of *Alni fructus*:

Sample 8. *Castaneae dentatae folia* (American chestnut leaves)

	Latin name	English name
MPM		
MP		
Family		

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Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Castaneae dentatae folia*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Biological effects and application of *Castaneae dentatae folia*:

Sample 9. *Quercus cortex* (oak bark)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		

Basic group of BAS, %		<i>Catechin</i>
Other substances		
Standardization by the content of BAS		

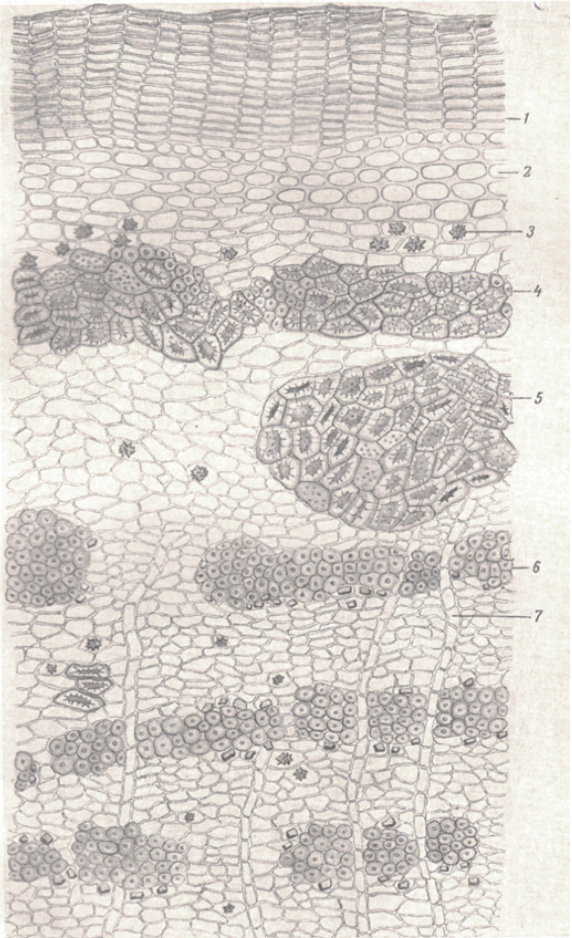
Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Quercus cortex*

occurrence, fracture of drug		outer surface colour	
shape		inner surface colour	
surface characters		odour after grinding	
section fracture, internal appearance		taste	
sizes		other diagnostic characters	

Microscopic analysis of *Quercus cortex*

	<p>Sign anatomic diagnostic features of <i>Quercus cortex</i></p> <p>A –</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6. 7.
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Biological effects and application of *Quercus cortex*:

Sample 10. *Tormentillae rhizomata* (Common tormentil rhizome)

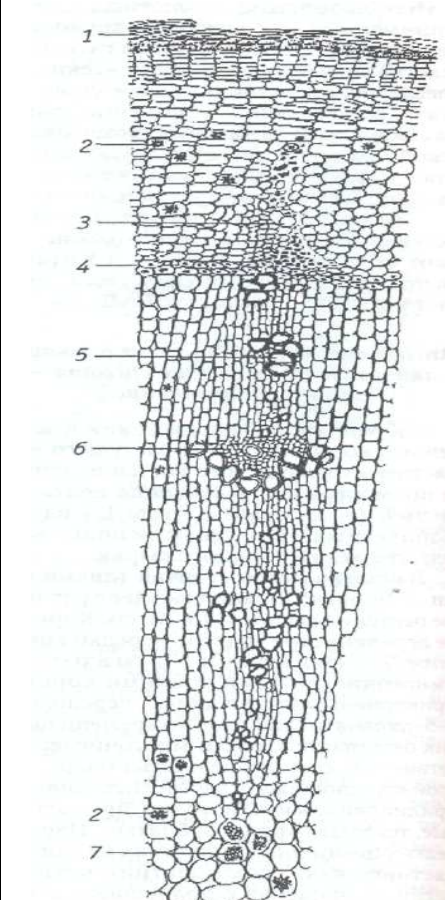
	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Tormentillae rhizomata*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Microscopic analysis of *Tormentillae rhizomata*:

	<p>Sign anatomic diagnostic features of <i>Tormentillae rhizoma</i></p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6. 7.
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Biological effects and application of *Tormentillae rhizomata*:

Sample 11. *Myrtilli fructus* (bilberry fruit)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		

Other substances		<i>Myrtillin</i>
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Myrtilli fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Biological effects and application of *Myrtilli fructus*:

Sample 12. *Padi fructus* (bird cherry fruit)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Amygdalin</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____
4. _____
5. _____

Macroscopic analysis of *Padi fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Biological effects and application of *Padi fructus*:

INDEPENDENT STUDENTS WORK

Sample 1. *Gallae turcicae*, *Gallae chinensis* (turkish galls, chinese galls)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> Tannin
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Gallae turcicae*, *Gallae chinensis*:

Sample 2. *Rhois coriariae folia* (sumach leaves)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Biological effects and application of *Rhois coriariae folia*:

Signature of the teacher _____

TOPIC: ALKALOIDS

Aim: to establish the identity of MPM containing alkaloids according to macroscopic and microscopic characteristics, and to determine the qualitative composition and quantitative content of BAS using methods of phytochemical analysis.

Objects for laboratory work: capsicum, ephedra, belladonna, stramonium, henbane, bush pea, celandine, tulip poppy, barberry, passionflower, snakeweed, periwinkle, catharanthus, ergot, hatched-vetch.

Structural formulas of main BAS: capsaicine, ephedrine, colchamine, plathyfilline, atropine, hyoscyamine, scopolamine, cytizin, papaverine, glaucine, morphine, garmine, vincamine, reserpine, vincristine, ergotamine, caffeine, theophylline, theobromine.

I. Phytochemical analysis of MPM containing alkaloids

Task 1. Fill an Appendix 2 on the topic of the lesson.

Task 2. Prepare an extract from MPM by one of the methods.

Alkaloids as bases. Transfer approximately 5g of powdered MPM in a 250-ml glass-stoppered flask, moisten with 5ml of ammonia solution, mix and pour 70 ml of chloroform. Close the flask with a stopper, mix in apparatus for shaking (ABY-1) for 40 min (open obligatory flask stopper periodically). Filter an extract through cotton into a flask, covering the funnel with a watch glass. Adjust the solvent volume of obtained chloroform extract to 1-2 ml, transfer residue in flask into a porcelain dish and evaporate to dryness on a water bath. Dissolve the dry residue in 5 ml of hydrochloric acid and carry out qualitative reactions and chromatography.

Alkaloids as salts. Weigh 3g of powdered MPM, transfer it into a glass-stoppered flask, and pour 40 ml of 1% hydrochloric acid. To carry out an extraction of alkaloids, attach a reflux condenser and heat on a water bath for 20 min. Cool, filter an extract, alkalinize to pH 10-12 with sodium hydroxide solution. Extract alkaloid bases with 10-30 ml of organic solvent (chloroform, dichlorethane), mixing in a separatory funnel for 5-10 min. Separate organic fractures from aqueous ones and transfer into a porcelain dish. Evaporate organic solvent to dryness on a water bath, dry the residue, dissolve in 5ml of hydrochloric acid solution, and carry out qualitative reactions on alkaloids and chromatography.

Task 3. Detect alkaloids in an extract by general reactions for precipitation of alkaloids.

"General reactions for alkaloids". Apply separate drops of analyzed extract on a glass slide. Near each drop, apply two drops of each reagent. By means of the glass rod, mix a drop of extract with a drop of reagent. Notice cloudiness or precipitation that confirms presence of alkaloids in the extract.

Describe the results of reactions in the table.

Reagent	Reagent constituents	Results of reactions
Buchard's or Vagner's	iodine in potassium iodine solution	
Mayer's	mercuric chloride in potassium iodine solution	
Dragendorff's	bismuth nitrate and potassium iodine in acetic acid	
Sonnenstain's	phosphorous molybdate acid solution	
Marmae's	cadmium iodine in potassium iodine	
Shabler's	phosphorous wolframic acid solution	

Godfrua's or Berthrane's	siliceous wolframic acid	
	10% tannin solution	
	1% picric acid solution	
	5% mercuric chloride solution	
	5% platinous hydrochloric acid solution	

Task 4. Isolate purified totality of alkaloids form *Belladonnae folium* and carry out qualitative reaction, in accordance to the *Eur.Ph.* method for the analyzed MPM. Describe the result and make conclusion on occurrence of tropane alkaloids.

Shake 1 g of powdered drug (180) (2.9.12) with 10 ml of 0.05 M sulphuric acid for 2 min. Filter and add to the filtrate 1 ml of concentrated ammonia R and 5 ml of water R. Shake cautiously with 15 ml of ether R, avoiding formation of an emulsion. Separate the ether layer and dry over anhydrous sodium sulphate R. Filter and evaporate the ether in a porcelain dish. Add 0.5 ml of fuming nitric acid R and evaporate to dryness on a water-bath. Add 10 ml of acetone R and, dropwise, a 30 g/l solution of potassium hydroxide R in ethanol (96 per cent) R. A deep violet colour develops.

The Vitali – Morin reaction may be carried out by the following modification: Evaporate to dryness 2 ml of analyzed extract in a porcelain dish. Dissolve a dry residue in 1 ml of concentrated nitric acid. Evaporate the solution to dryness on a water bath; add a few drops of acetone and 1-2 drops of 0.5n alcoholic potassium hydroxide solution.

Task 5. Carry out chromatographic examination of *Folia Belladonnae* in accordance to the *Eur.Ph.* method for the analyzed MPM. Draw a scheme of chromatogram and determine R_f values of standard samples and alkaloids in an extract.

Thin-layer chromatography (2.2.27).

Test solution. To 0.6 g of powdered drug (180) (2.9.12) add 15 ml of 0.05 M sulphuric acid, shake for 15 min and filter. Wash the filter with 0.05 M sulphuric acid until 20 ml of filtrate is obtained. To the filtrate add 1 ml of concentrated ammonia R and shake with 2 quantities, each of 10 ml, of peroxide-free ether R. If necessary, separate by centrifugation. Dry the combined ether layers over anhydrous sodium sulphate R, filter and evaporate to dryness on a water-bath. Dissolve the residue in 0.5 ml of methanol R.

Reference solution. Dissolve 50 mg of hyoscyamine sulphate R in 9 ml of methanol R. Dissolve 15 mg of hyoscyne hydrobromide R in 10 ml of methanol R. Mix 1.8 ml of the hyoscyne hydrobromide solution and 8 ml of the hyoscyamine sulphate solution.

Plate: TLC silica gel G plate R.

Mobile phase: concentrated ammonia R, water R, acetone R (3:7:90 V/V/V).

Application: 10 µl and 20 µl, as bands of 20 mm by 3 mm leaving 1 cm between the bands.

Development: over a path of 10 cm.

Drying: at 100-105 °C for 15min, allow to cool.

Detection A: spray with potassium iodobismuthate solution R2, using about 10 ml for a plate 200 mm square, until the orange or brown zones become visible against a yellow background.

Results A: the zones in the chromatograms obtained with the test solution are similar in position (hyoscyamine in the lower third, hyoscyne in the upper third of the chromatogram) and colour to the bands in the chromatograms obtained with the reference solution. The zones in the chromatograms obtained with the test solution are at least equal in size to the corresponding zones in the chromatogram obtained with the same volume of the reference solution. Faint secondary zones may appear, particularly in the middle of the chromatogram obtained with 20 µl of the test solution or near the starting point in the chromatogram obtained with 10 µl of the test solution.

Detection B: spray with *sodium nitrite solution R* until the coating is transparent and examine after 15 min.

Results B: the zones due to hyoscyamine in the chromatograms obtained with the test solution and the reference solution change from brown to reddish-brown but not to greyish-blue (atropine) and any secondary zones disappear.

Task 6. Determine quantitative content of tropane alkaloids in MPM of the Solanaceae according to the SPhU 2.0 ed. Vol.3 *Belladonnae folium* and conclude on compliance of the analyzed sample to the QCM requirements.

Weigh approximately 5 g of powdered MPM accurately and transfer into a 250 ml glass-stoppered flask, moisten with 5 ml of ammonia solution, mix thoroughly and pour 70 ml of chloroform. Close the flask with a stopper, mix in apparatus for shaking (ABY-1) for 40 min (the flask stopper must be opened periodically). Filter the extract through a cotton piece in a flask, covering a funnel with a watch glass.

Transfer 50 ml of obtained extract in a separatory funnel. Wash volumetric cylinder twice with 5ml of chloroform each time, attaching to an extract. Extract alkaloids consequently with 15, 10, 5 ml of 1% hydrochloric acid solution. Filter acidic extract through moistened in water filter, that should be washed twice with 5 ml of 1% hydrochloric acid solution each time, adding obtained water to the extract. Add ammonia solution to the extract until the reaction is alkaline (phenolphthaleine or universal indicator), extract alkaloids consequently with 10, 10, 5ml of chloroform, shaking for 3 min each time. Filter the chloroform extract through a paper filter with anhydrous sodium sulphate, moistened in chloroform. Wash the filter with chloroform twice with 5 ml each time, add it to the whole volume of chloroform extract.

Evaporate a solvent from obtained extract on a water bath, adjusting a volume to 1-2ml. Dry chloroform residue in a flask, blowing the air until the odour is absent. Dissolve dry residue in 15 ml of hydrochloric acid solution (0.22mol/l), heat on a water bath, add 2 drops of methylene red and 1 drop of methylene blue; titrate surplus of hydrochloric acid with sodium hydroxide solution (0.02 mol/l) until a green colour is produced.

Calculate total content of alkaloid, expressed as hyoscyamine in absolutely dried MPM, %:

$$X = \frac{(15 - V) \times 0.005780 \times 100 \times 100}{m \times (100 - W)} \%$$

0.005780 - amount of alkaloids, expressed as hyoscyamine, equal to 1ml of hydrochloric acid solution (0.02mol/l), g;

V - volume of sodium hydroxide (0.02mol/l), used for titration, ml;

m - mass of drug used in grams;

W - loss on drying of MPM, %.

II. Macro- and microscopic analysis of MPM containing alkaloids

MPM containing protoalkaloids

Sample 1. *Capsici fructus (capsicum fruit)*

	Latin name	English name
MPM		
MP		

Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Capsici fructus*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Biological effects and application of *Capsici fructus*:

Sample 2. *Ephedrae herba (ephedra herb)*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		

Standardization by the content of BAS		<i>Ephedrine</i>
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Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Ephedrae herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Microscopic analysis of *Ephedrae herba*

	<p>Sign anatomic diagnostic features of <i>Ephedrae herba</i>:</p> <ol style="list-style-type: none"> 1. 2. a. b. c. d. e. g. j. i. l. 3.
--	---

Biological effects and application of *Ephedrae herba*:

Sample 3. *Colchici bulbotubera recens (colchicum corm)*

	Latin name	English name
MPM		

MP		
Family		

Dissemination of MP		<i>Colchicine</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____
3. _____

Macroscopic analysis of *Colchici bulbotubera recens*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Biological effects and application of *Colchici bulbotubera recens*:

MPM containing purine alkaloids

Sample 4. *Theae folium* (tea leaf)

	Latin name	English name
MPM		
MP		

Family		
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Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Theae folium*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Biological effects and application of *Theae folium*:

Sample 5. *Coffeae semina (coffee bean)*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		

Drying conditions		<i>Caffeine</i>
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Coffeae semina*

occurrence, fracture of drug		size	
shape		odour after grinding	
surface		taste	
colour		other diagnostic characters	
characters of ridges, their number			

Biological effects and application of *Coffeae semina*:

MPM containing tropane alkaloids

Sample 6. *Belladonnae folium* (belladonna leaf)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Atropine</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

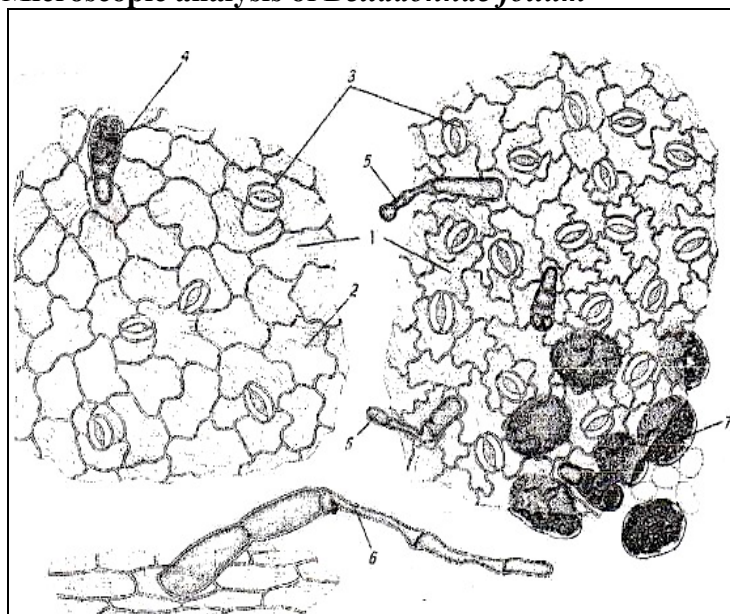
Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Belladonnae folium*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Microscopic analysis of *Belladonnae folium*



Sign anatomic diagnostic features of *Belladonnae folium*:

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

Biological effects and application of *Belladonnae folium*:

Sample 7. *Belladonnae herba* (belladonna herb)

	Latin name	English name
MPM		
MP		

Family		

Dissemination of MP		<i>Structural formula</i> <i>Hyoscyamine</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Belladonnae herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Biological effects and application of *Belladonnae herba*:

Sample 8. *Belladonnae radices* (belladonna root)

	Latin name	English name
MPM		
MP		
Family		

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Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Macroscopic analysis of *Belladonnae radices*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Biological effects and application of *Belladonnae radices*:

Sample 9. *Hyoscyami folium* (henbane leaf)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

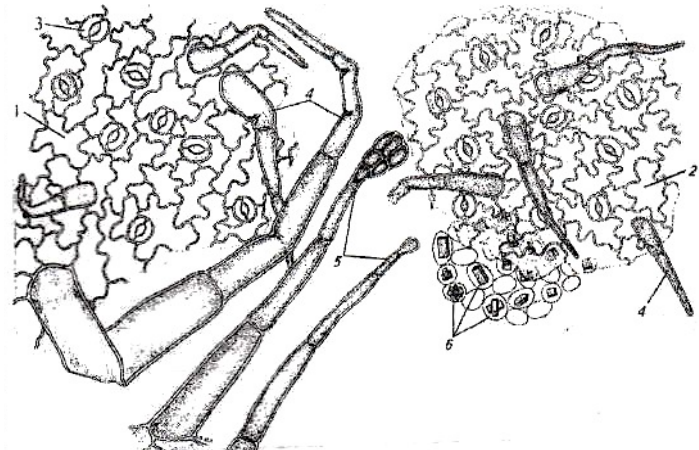
Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Hyoscyami folium*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Microscopic analysis of *Hyoscyami folium*

	Sign anatomic diagnostic features of <i>Hyoscyami folium</i> : 1. 2. 3. 4. 5.
--	--

Biological effects and application of *Hyoscyami folium*:

Sample 10. *Stramonii folium* (stramonium leaf)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		Structural formula
---------------------	--	--------------------

Harvesting time		<i>Hyoscyamine</i>
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

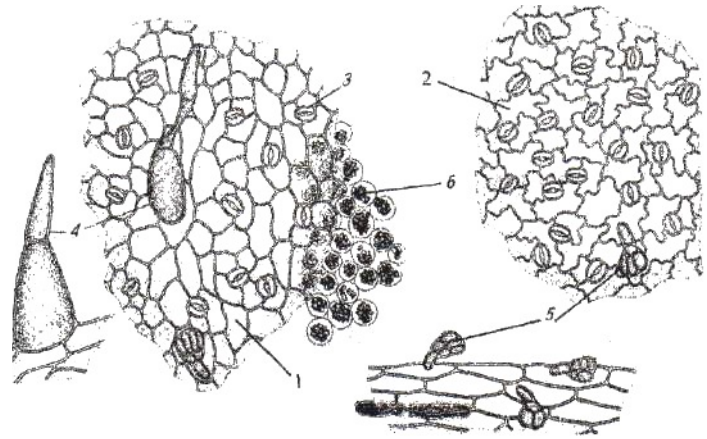
Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Stramonii folium*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Microscopic analysis of *Stramonii folium*

	<p>Sign anatomic diagnostic features of <i>Stramonii folium</i>:</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6.
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Biological effects and application of *Stramonii folium*:

Sample 11. *Daturae innoxiae semen* (datura seed)

	Latin name	English name
--	-------------------	---------------------

MPM		
MP		
Family		

Dissemination of MP		<i>Scopolamine</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Daturae innoxiae semen*

occurrence, fracture of drug		size	
shape		odour after grinding	
surface		taste	
colour		other diagnostic characters	
characters of ridges, their number			

Biological effects and application of *Daturae innoxiae semen*:

MPM containing pyrrolizidine alkaloids

Sample 12. *Senecionis platyphylloides rhizoma et radices* (senecio rhizome and root)

	Latin name	English name
MPM		
MP		

Family		

Dissemination of MP		<i>Platyphylline</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Senecionis platyphylloides rhizoma et radices*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Biological effects and application of *Senecionis platyphylloides rhizoma et radices*:

Sample 13. *Senecionis platyphylloides herba (senecio herb)*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		

Drying conditions		<i>Senecifilline</i>
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Senecionis platyphylloides herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Biological effects and application of *Senecionis platyphylloides herba*:

MPM containing quinolizidine alkaloids

Sample 14. *Thermopsis herba (thermopsis herb)*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		

Storage conditions		<i>Thermopsis</i>
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

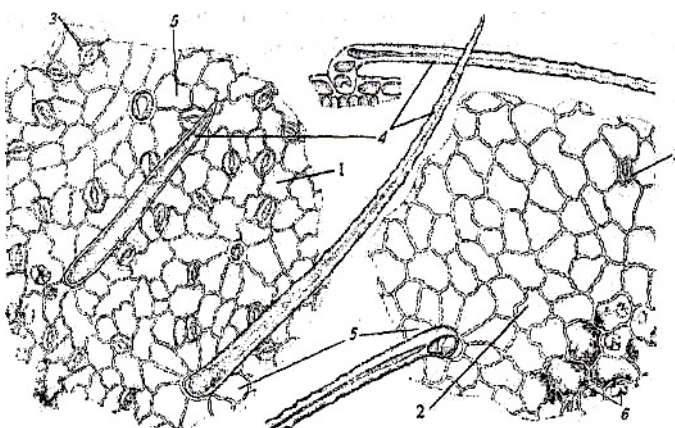
Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Thermopsis herba*

occurrence, fracture of drug		leaf size	
Stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Microscopic analysis of *Thermopsis herba*

	<p>Sign anatomic diagnostic features of <i>Thermopsis herba</i>:</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6.
---	---

Biological effects and application of *Thermopsis herba*:

Sample 15. *Thermopsis semina* (thermopsis seeds)

	Latin name	English name
MPM		

MP		
Family		

Dissemination of MP		<i>Cytisine</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Thermopsisidis semina*

occurrence, fracture of drug		size	
shape		odour after grinding	
surface		taste	
colour		other diagnostic characters	
characters of ridges, their number			

Biological effects and application of *Thermopsisidis semina*:

MPM containing isoquinoline alkaloids

Sample 16. *Papaveris capitata* (poppy capsules)

	Latin name	English name
MPM		
MP		

Family		

Dissemination of MP		<i>Morphine</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Papaveris capitata*

occurrence, fracture of drug		characters of ridges, their number	
fruit type		colour	
shape, size		odour after grinding	
surface		taste	
number of seeds		other diagnostic characters	

Biological effects and application of *Papaveris capitata*:

Sample 17. *Glaucii flavi herba (tulip poppy herb)*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>Glaucine</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Glaucii flavi herba*

occurrence, fracture of drug		leaf size	
stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Biological effects and application of *Glaucii flavi herba*:

Sample 18. *Chelidonii herba* (celandine herb)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		

Storage conditions		<i>Chelidonium</i>
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Chelidonii herba*

occurrence, fracture of drug		leaf size	
stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Microscopic analysis of *Chelidonii herba*

	<p>Sign anatomic diagnostic features of <i>Chelidonii herba</i>:</p> <p>A.</p> <p>B.</p> <p>C.</p> <p>1.</p> <p>2.</p> <p>3.</p>
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Biological effects and application of *Chelidonii herba*:

Sample 19. *Berberidis folium* (barberry leaf)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		Structural formula
Harvesting time		<i>Berberine</i>
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Berberidis folium*

occurrence, fracture of drug		venation	
form of leaf		pubescence	
division of lamina		size of leaf blade and petiole	
leaf attachment to the stem, occurrence of petiole		colour of upper leaf surface	
leaf base		colour of lower leaf surface	
leaf apex		odour after grinding	
leaf margin		taste	

Biological effects and application of *Berberidis folium*:

Sample 20. *Berberidis radix* (barberry root)

	Latin name	English name
MPM		

MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Berberidis radix*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Biological effects and application of *Berberidis radix*:

MPM containing indole alkaloids

Sample 21. *Rauwolfiae radix* (rauwolfia root)

	Latin name	English name
MPM		
MP		

Family		
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Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Rauwolfiae radix*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Biological effects and application of *Rauwolfiae radix*:

Sample 22. *Vincae minoris herba* (periwinkle herb)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		

Storage conditions		<i>Vincamine</i>
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Vincae minoris herba*

occurrence, fracture of drug		leaf size	
stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Biological effects and application of *Vincae minoris herba*:

Sample 23. *Catharanthi herba* (*catharanthus herb*)

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		

Other substances		<i>Vinblastine</i>
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Catharanthi herba*

occurrence, fracture of drug		leaf size	
stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Biological effects and application of *Catharanthi herba*:

Sample 24. *Secale cornutum (ergot)*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		

Standardization by the content of BAS		<i>Ergometrine</i>
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Biological effects and application of *Secalis cornuti cornua stam ergotamini (ergotoxini)*:

Sample 25. *Passiflorae herba (passionflower herb)*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Structural formula</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Passiflorae herba*

occurrence, fracture of drug		leaf size	
stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Biological effects and application of *Passiflorae herba*:

MPM containing pseudoalkaloids**Sample 26. *Aconiti tubera* (aconite root)**

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		Structural formula
Harvesting time		<i>Aconotine</i>
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Aconiti tubera*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Biological effects and application of *Aconiti tubera*:

Sample 27. *Delphinii herba (delphinium herb)*

	Latin name	English name
MPM		
MP		
Family		

Dissemination of MP		<i>Delphinine</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Delphinii herba*

occurrence, fracture of drug		leaf size	
stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Biological effects and application of *Delphinii herba*:

Sample 28. *Solani laciniati herba (kangaroo apple herb)*

	Latin name	English name
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MPM		
MP		
Family		

Dissemination of MP		<i>Solanine</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Solani laciniati herba*

occurrence, fracture of drug		leaf size	
stem shape at transverse section		colour of leaf	
leaf attachment to the stem, occurrence of petiole		allocation of flowers on the stem	
colour of stem		flower size	
leaf shape		colour of flower	
size of stem		pubescence	
leaf margin		odour after grinding	
venation type		taste	

Biological effects and application of *Solani laciniati herba*:

Sample 29. *Veratri rhizoma cum radicibus* (*veratrum rhizome with radicibus*)

	Latin name	English name
MPM		

MP		
Family		

Dissemination of MP		<i>Structural formula</i> <i>Jervine</i>
Harvesting time		
Drying conditions		
Storage conditions		
Basic group of BAS, %		
Other substances		
Standardization by the content of BAS		

Possible adulterants (Latin and common names):

1. _____
2. _____

Macroscopic analysis of *Veratri rhizoma cum radicibus*: *Veratri rhizoma cum radicibus*

occurrence, fracture of drug		outer surface colour	
shape		internal surface colour	
surface characters		odour after grinding	
section fracture		taste	
sizes		other diagnostic characters	

Biological effects and application of *Veratri rhizoma cum radicibus*:

Signature of the teacher _____

TOPIC: BATCH QUALITY ANALYSIS

Aim: to learn to accept the MPM and sampling for batch quality analysis, to determine the identity, purity and quality of the investigated party MPM, which arrived at the analysis.

Task 1. To sample the medicinal plant material.

A batch of medicinal plant material is a quantity of medicinal plant material with the weight no less 50 kilos of the same official name, homogeneous according to all characters, which have one document of quality. Each unit is examined for detection of damage and accordance of packaging and labelling according to the requirement of the Pharmacopoeia monograph.

For verification of accordance of the MPM quality to the requirements of Pharmacopoeia monograph an excerption from different parts of not damaged packages should be taken. In the case of damaged packages each unit is opened.

Carry out the sampling of medicinal plant materials according to the scheme (see below).

Take 3 samples of approximately equal quantity from the top, the middle and the bottom of a package. Combine them together. Mix and quarter, 2 of the diagonal quarters reject, the remaining 2 quarters combine and carefully mix and again quarter in the same way until the required quantity, to within $\pm 10\%$ is obtained.

Take analytical sample No 1.

Task 2. To identify the medicinal plant material.

Prepare a cross section after studying macroscopic signs of the medicinal plant material. Put pieces of the material in boiling water for 10 minutes. After this procedure material becomes soft. Prepare a cross section with the help of a sharp knife or scalpel.

A protocol pattern (tasks 1-2)

Date

Part used	
The form and size	
The colour of outer surface	
Fracture	
Odour	
Taste	
Drawing :	Microscopic characters:
Histochemical reactions	
Conclusion	The examined sample is...

Task 3. To determine degree of contamination of the medicinal plant material by drug-eating insects. Determine contamination of medicinal plant material by drug-eating insects either by visual inspection and using magnifying lens.

Put the sample of medicinal plant material in the sieve with diameter of pores 0,5 mm. Calculate quantity of mites in medicinal plant material that passed through sieve pores. Calculate quantity of moth, its larva, pupa and imago and other drug-eating insects in medicinal plant material that didn't pass through sieve pores. Evaluate the quantity of insects per 1 kilogram of medicinal plant material and determine degree of contamination. If you found less than 20 mites per 1 kilogram, medicinal plant material is of the 1st degree of contamination; if more than 20 of mites, medicinal plant material is of the 2nd degree of contamination; more, than 50 mites, 3rd degree of contamination. The results of analysis write down in the protocol.

Task 4. To determine degree of fragmentation of the medicinal plant material according to the State Pharmacopoeia, XI-ed, and the State Standard (ГОСТ 24027.1-80).

The samples of medicinal plant material are sifted through the sieve with diameter of pores specified in Pharmacopoeia monograph. Calculate quantity of small non-standard fragments that passed through the sieve. Weigh small non - standard fragments and calculate content (%).

Task 5. To determine contents of contamination in the medicinal plant material.

Determine contents of contamination in the part, which remained after sifting. Weigh separately each kind of contamination and calculate its content (in %) using formula:

$$X = \frac{m_1 \times 100\%}{m_2}$$

where: m_1 - mass of contamination in grams, m_2 - mass of analytical sample.

Task 6. To determine contents of moisture in the medicinal plant material.

Determination of contents of moisture is carried out according to the State Pharmacopoeia, XI ed. (p. 285) and the State Standard (ГОСТ 24027.2-80).

Cut medicinal plant material (in analytical sample) with a knife or scissors to pieces about 10 mm in diameter, mix them and take 2 samples, weigh them with precision $\pm 0,01$ g. Put each sample in a previously weighed laboratory kettle with a cover then put it in a drying oven, heated to $+100$ - $+105^\circ$ C. Dry to the constant weight.

The weight may be accepted as constant if the difference between two successive weight measures after 30 min of drying in a drying oven does not exceed $\pm 0,01$ g. Carry out the first weight measure of roots, fruits and barks after 3 hour, flowers and herbs after 2 hour. Chill the laboratory kettle and weigh. Calculate moisture of medicinal plant material by formula (in %):

$$X = \frac{(m - m_1) \times 100\%}{m}$$

where: m - mass of medicinal plant material before drying;
 m_1 - mass of medicinal plant material after drying;

Task 7. To determine total ash contents in the medicinal plant material (according to the State Standard (ГОСТ 24027.2-80).

Put a 1-3 gram - sample of medicinal plant material, weighed accurately, in a previously dried to the constant weight porcelain crucible for determination of common ash. Analogically, put 5 grams, weighed accurately, for determination of ash insoluble in 10 % HCl.

Burn down medicinal plant material carefully in a weak flame of a burner, then put the porcelain crucible into a laboratory high-temperature oven and heat at $+550$ - 600° C to constant weight. Weigh the porcelain crucible with common ash after 2 hours of cooling.

For determination of insoluble in 10 % HCl ash, add 15 ml 10 % HCl to porcelain crucible with common ash and boil for 10 min, then filtrate solution through a filter paper. Dry the filter paper in a drying oven and carefully burn down in the porcelain crucible.

Calculate contents of total ash (%) in absolutely dry medicinal plant material by formula:
 where: m_1 - mass of ash (in grams) m_2 - mass of medicinal plant material (in grams)

$$X_1 = \frac{m_1 \times 100 \times 100}{m_2 \times (100 - W)}$$

W - loss of weight after drying (in %).

Contents of insoluble in 10 % HCl ash, can be calculated by formula:

$$X_2 = \frac{(m_1 - m) \times 100 \times 100}{m_2 \times (100 - W)}$$

where: m - mass of an ash filter paper (if its mass is more than 0,002 g),
 m_1 - mass of ash (in grams), m_2 - mass of medicinal plant material (in grams),
 W - loss of weight after drying (in %).

Task 8. To determine contents of extractive matter in the medicinal plant material (according to the State Standard (ГОСТ 24027.2-80).

Put a sample of previously weighed medicinal plant material (mass according to the correspondent Pharmacopoeia monograph or State Standard) in a glass – stopper conical flask, add 50 ml of solvent (according the correspondent Pharmacopoeia monograph or State Standard).

Attach the reflux condenser to the flask and heat to the temperature of boiling and boil gently for 2 hours. Weigh the flask after cooling. Add the solvent if a weight loss occurs. Shake flask contents and filter through the filter paper into a dry retort (V= 150-200 ml). Take 25 ml of a obtained solution and transfer it in a porcelain dish (d=7-9 cm), previously weighed in analytical balances. Evaporate the content on a water bath. Dry in a drying oven (t=+100-105° C). Weigh the porcelain cup with the residuum of extractive substances after 30 min cooling.

Calculate the content of extractive matter (%) in absolutely air – dried medicinal plant material by formula:

$$X_1 = \frac{m \times 200 \times 100}{m_1 \times (100 - W)}$$

where: m - mass of dry residuum in the dish (grams);
 m_1 - mass of medicinal plant material;
 w - loss of weight after drying (in %).

A protocol pattern (tasks 3-8)

1. Weigh of a sample _____
2. MPM Latin name _____
3. Pharmacopoeia monograph or State Standard _____

Results of analysis

No	The names of characteristics	Found		The standard values for MPM	
		Grams	%	whole	cut
1	Small non-standard fragments being sifted through the sieve with diameter of pores _____ mm				
2	Contamination: - mineral (soil, sand) - organic: - of darkened and brown parts of a plant - of foreign organic matter				
3	Moisture				
4	Common ash				
5	Acid-insoluble ash				
6	Extractive matter				

Conclusion: (valuation of quality of medicinal plant material and recommendation on processing and uses in medicine)

TOPIC: ANALYSIS OF ASSEMBLIES AND TEAS

Aim: to learn to determine the composition of assemblies and teas for medicinal plant raw materials; to determine the identity of various forms of cutted MPM on macroscopic and microscopic features according the methods of control quality.

Task 1. Conduct an analysis of the collection of MPM according the State Pharmacopea. Identify the components that are part of the collection using determinants of whole and cut raw materials. Analyze each component according to the scheme shown.

- I. Collection number _____ (name of the tea for use in medicine)
- II. Number of components in the collection _____
- III. Characteristics of each component:

Component number 1

Calculate the content of the component in the percentage collection by the formula:

$$X = \frac{m_1 \times 100}{m_2} = \text{-----} = \text{-----} \%$$

where m_1 - component mass, g; m_2 - mass of the analyzed sample, g

Describe the macroscopic diagnostic features of the researched MPM:

Draw a schematic section of the microprepared substance of the researched MPM:

	Sign anatomic diagnostic features of MPM: 1. 2. 3. 4. 5. 6.
--	---

Describe the results of the conducted qualitative and histochemical reactions:

	Latin name	English name
MPM		
MP		
Family		

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Indicate the pharmacological effect of the researched MPM:

Component number 2

Calculate the content of the component in the percentage collection by the formula:

$$X = \frac{m_1 \times 100}{m_2} = \text{-----} = \text{-----} \%$$

where m_1 - component mass, g; m_2 - mass of the analyzed sample, g

Describe the macroscopic diagnostic features of the researched MPM:

Draw a schematic section of the microprepared substance of the researched MPM:

	Sign anatomic diagnostic features of MPM: 1. 2. 3. 4. 5. 6.
--	---

Describe the results of the conducted qualitative and histochemical reactions:

	Latin name	English name
MPM		
MP		
Family		

Indicate the pharmacological effect of the researched MPM:

Component number 3

Calculate the content of the component in the percentage collection by the formula:

$$X = \frac{m_1 \times 100}{m_2} = \text{-----} = \text{-----} \%$$

where m_1 - component mass, g; m_2 - mass of the analyzed sample, g

Describe the macroscopic diagnostic features of the researched MPM:

Draw a schematic section of the microprepared substance of the researched MPM:

	Sign anatomic diagnostic features of MPM: 1. 2. 3. 4. 5. 6.
--	---

Describe the results of the conducted qualitative and histochemical reactions:

	Latin name	English name
MPM		
MP		
Family		

Indicate the pharmacological effect of the researched MPM:

Component number 4

Calculate the content of the component in the percentage collection by the formula:

$$X = \frac{m_1 \times 100}{m_2} = \text{-----} = \text{-----} \%$$

where m_1 - component mass, g; m_2 - mass of the analyzed sample, g

Describe the macroscopic diagnostic features of the researched MPM:

Draw a schematic section of the microprepared substance of the researched MPM:

	Sign anatomic diagnostic features of MPM: 1. 2. 3. 4. 5. 6.
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Describe the results of the conducted qualitative and histochemical reactions:

	Latin name	English name
MPM		
MP		
Family		

Indicate the pharmacological effect of the researched MPM:

Component number 5

Calculate the content of the component in the percentage collection by the formula:

$$X = \frac{m_1 \times 100}{m_2} = \text{-----} = \text{-----} \%$$

where m_1 - component mass, g; m_2 - mass of the analyzed sample, g

Describe the macroscopic diagnostic features of the researched MPM:

Draw a schematic section of the microprepared substance of the researched MPM:

	Sign anatomic diagnostic features of MPM: 1. 2. 3. 4. 5. 6.
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Describe the results of the conducted qualitative and histochemical reactions:

	Latin name	English name
MPM		
MP		
Family		

Indicate the pharmacological effect of the researched MPM:

INDEPENDENT STUDENTS WORK

1. Read the composition of the main assemblies, write the main BAS of all components of the teas and their pharmacological action.

№ 3/II	Name of the assemblies	Composition of the assemblies		BAS of all component of the assembly	Pharmacological action of the assembly
1.	<i>Species vitaminicae №1</i>	Rosae fructus	50,0		
		Ribes nigri fructus	50,0		
2.	<i>Species vitaminicae №2</i>	Rosae fructus	50,0		
		Sorbi fructus	50,0		

3.	<i>Species carminative</i> ФC 42-1027-75	Menthae piperitae folia Foeniculi fructus Valerianae rhizomata cum radicibus	33,3 33,3 33,3		
4.	<i>Species pectorales</i> №1 ФC 42-1030-75	Althaeae radices Farfarae folia Origani herba	40,0 40,0 20,0		
5.	<i>Species pectorales</i> №2 ФC 42 Y-18-438-99	Farfarae folia Plantaginis majoris folia Glycyrrhizae radices	40,0 30,0 30,0		
6.	<i>Species pectorales</i> №3 ФC 42-1219-78	Pini gemmae Althaeae radices Glycyrrhizae radices Anisi fructus Salviae folia	14,4 28,8 28,8 14,4 14,4		
7.	<i>Species amarae</i> ФC 42-1017-75	Absinthii herba Millefolii herba	80,0 20,0		
8.	<i>Species cholagogae</i> ФC 42-1029-75	Helichrysi flores Menyanthidis trifoliatae folia Menthae piperitae folia Coriandri fructus	40,0 30,0 20,0 10,0		
9.	<i>Species cholagogae</i> БФC 42-639-77	Helichrysi flores Millefolii herba Menthae piperitae folia Coriandri fructus	40,0 20,0 20,0 20,0		
10.	<i>Species cholagogae</i> TY Y 22165380.002-99	Glycyrrhizae radices Chelidonii herba Origani herba Chamomillae flores Menthae piperitae folia	10,0 10,0 10,0 20,0 20,0		
11.	<i>Species sedative</i> ФC 42-1026-75	Menthae piperitae folia Menyanthidis trifoliatae folia Valerianae rhizomata cum radicibus Lupulus strobuli	33,3 33,3 16,7 16,7		
12.	<i>Species sedative</i> ФC 42 Y 18-293-98	Menthae piperitae folia Leonuri herba Valerianae rhizomata cum radicibus Lupulus strobuli Glycyrrhizae radices	15 40 15 20 10		
13.	<i>Species sedative</i> TY Y 22165380.004-99	Menthae piperitae folia Leonuri herba Valerianae rhizomata cum radicibus	20 40 20		

		Lupulus strobuli	20		
14.	<i>Species vitaminice</i>	Urticae dioicae folia Sorbi fructus	30,0 70,0		
15.	<i>Species sudoriphicae</i> №1 ΦC 42-1025-75	Rubi idaei fructus Tiliae flores	50,0 50,0		
16.	<i>Species sudoriphicae</i> №2 ΦC 42-1018-75	Rubi idaei fructus Farfarae folia Origani herba	40,0 40,0 20,0		
17.	<i>Species purgative</i> №1	Frangulae cortex Urticae dioicae folia Millefolii herba	30,0 20,0 10,0		
18.	<i>Species purgative</i> №2 ΦC 42-1348-79	Sennae folia Rhamni fructus Frangulae cortex Anisi fructus Glycyrrhizae radices	30,0 20,0 20,0 10,0 10,0		
19.	<i>Species nephricae</i> TY Y 22165380.001-99	Phaseolus exocarpii Myrtilli cornus Millefolii herba Equiseti herba Hyperici herba	15 15 15 30 25		
20.	Asthmatinum	Stramonii folia Hyoscyami folia Sodium nitritis	0,86 0,22 0,12		
21.	<i>Species antihemoroidales</i> ΦC 42-1203-78	Sennae folia Millefolii herba Frangulae cortex Coriandri fructus Glycyrrhizae radices	20,0 20,0 20,0 20,0 20,0		
22.	<i>Species antidiabetes</i> <i>Arphasetinum</i> ΦC 42-1511-86	Myrtilli cornus Phaseolus exocarpii Araliae radices Rosae fructus Equiseti herba Hyperici herba Chamomillae flores	20,0 20,0 15,0 15,0 10,0 10,0 10,0		
23.	<i>Species diuretice №1</i> ΦC 42-1027-75	Uvae ursi folia Centaureae cyani flores Glycyrrhizae radices	30,0 10,0 10,0		
24.	2 <i>Species diuretice №2</i> ΦC 42-1028-75	Uvae ursi folia Glycyrrhizae radices Juniperi fructus	40,0 20,0 40,0		

25.	<i>Species stomachicae</i> ΦC 42-1043-76	Frangulae cortex Urticae dioicae folia Menthae piperitae folia Valerianae rhizomata cum radicibus Calami rhizomata	30,0 30,0 10,0 10,0 10,0		
26.	<i>Species antisepticae</i> Species “Aeilecasolum” ΦC 42 Y-18-356-98	Bidentis herba Chamomillae flores Glycyrrhizae radices Salviae folia Eucalypti folia Calendulae flores	10 10 20 20 20 20		

2. Give examples of types of MPM that can be part of the tea with the following pharmacological properties: immunostimulative, sedative, anti-ulcer, anti-hemorrhoidal, anti-sclerotic, antiallergic, diuretic, hypoglycemic, choleric, hemostatic, anti-inflammatory, appetite, laxative, hypoazotemic, antihypertensive, anticoagulant, litholytic, expectorant, astringent, hepatoprotective, as well as for the treatment of cystitis, heart failure, cholelithiasis do, pyelonephritis, avitaminosis, angina pectoris, chronic colitis in the form of a table according to the scheme:

Pharmacological and pharmacotherapeutic properties of the assemblies	Latin and Ukrainian names of MPM, MP, families	Biological active substances of MPM	Qualitative or hystochemical reactions identification of MPM
1	2	3	4

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Signature of the teacher _____

Structural formulas of biologically active substances

TOPIC: SIMPLE PHENOLS

arbutin	methyларbutin	hydroquinone	thyrosol
phloroglucin	salicylic acid	methyلسalicylate	salidroside
caffeic acid		chlorogenic acid	

TOPIC: CUMARINS AND CHROMONS

coumarin	dicoumarin
aesculetine	psoralen
xanthoxine	bergaptene
isopimpinelline	visnagine

khellin	visnadine
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TOPIC: LIGNANS AND XANTHONS

schizandrine	syringoresinol
silybin	podophyllotoxin
1,6,8-trihydroxy-3,5,7-trimethoxyxanthon	glucomangiferin

TOPIC: FLAVONOIDS

flavan	catechin
anthocyanidine	leucoanthocyanidine
flavanone	flavanonole
flavone	flavonole
chalkon	dihydrochalcone

auron	quercetine
routine	hyperoside

TOPIC: ANTHRAQUINONE DERIVATIVES

anthracene	anthraquinone
anthrone	anthranol

emodine	chrysophanol
rheum-emodine	aloe-emodine
alizarine	ruberithrinic acid

sennoside

hypericine

TOPIC: TANNINS

catechine	anthocyanidine
leucoanthocyanidine	gallic acid
theogalline	ellagic acid
structure of gallotannin	

TOPIC: ALKALOIDS

capsaicine	ephedrine
colchamine	plathyfilline
atropine	scopolamine
papaverine	cytizin
glaucine	morphine

garmin

ergotamine

vincristine

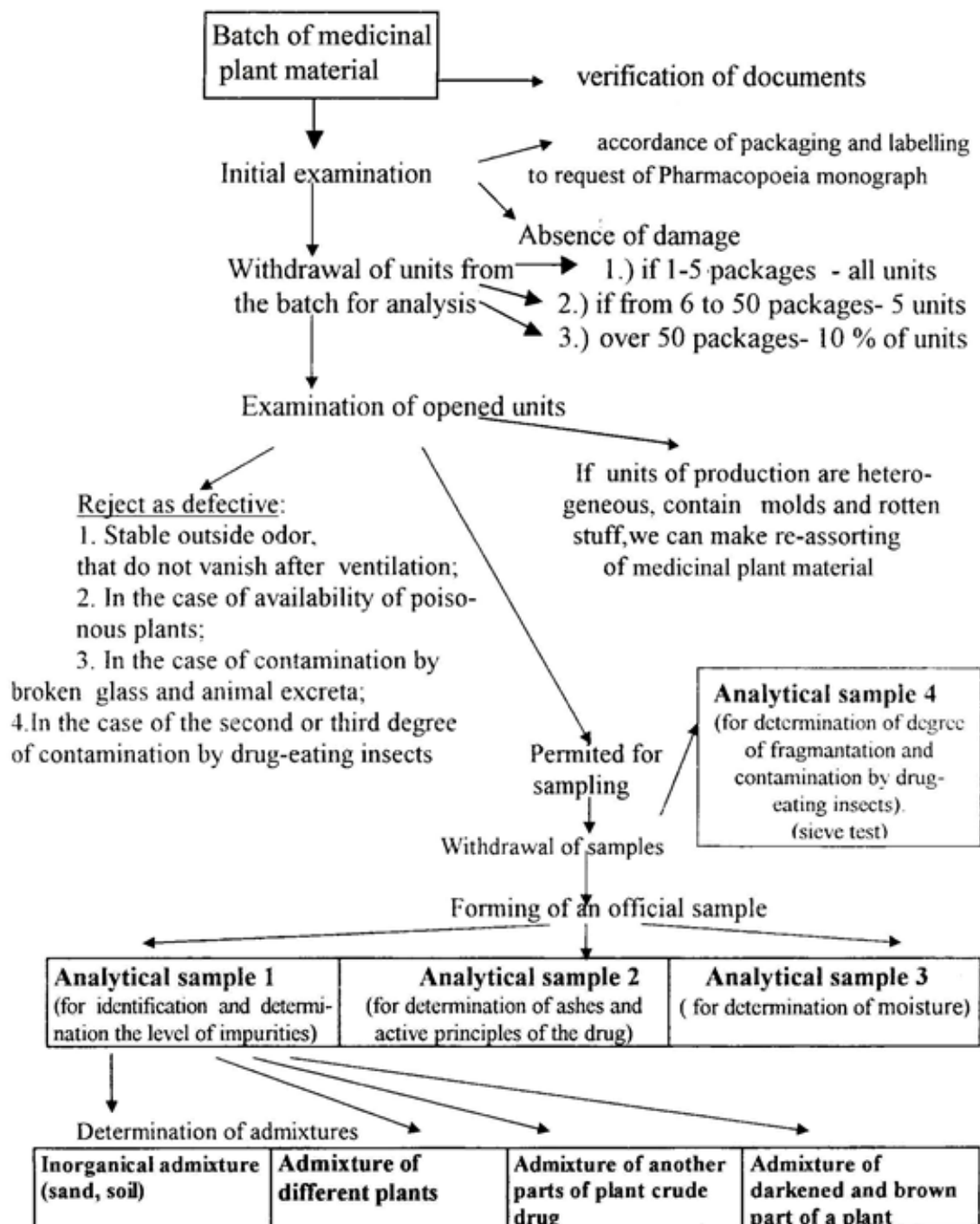
vincamine

caffeine

theophylline

SCHEME

for sampling of medicinal plant material and selected samples



Weight average and analytical samples of MPM for batch quality analysis

Name of crude drugs	State Standards	Numerical index								
		moisture	total ash	Acid insoluble ash	foreign organic matter	Inorganic matter	Darke- ned parts	other plant parts	non- Standat d parts	active principles
		no more than.... %								
1	2	3	4	5	6	7	8	9	10	11
<i>Folia Menthae piperitae</i>	St.Pharmacopoeia	14	14		1	1	5	10	5	
<i>Folia Salviae officinalis</i>	-” “-	14	12		0,5	0,5	5	10	3	
<i>Folium Urticae dioicae</i>	-” “-	14			2	1		5	10	
<i>Herba Hyperici</i>	-” “-	13	8		1	1	1		10	
<i>Herba Equiseti arvensis</i>	State St.	13	24		4			10		
<i>Herba Absinthii</i>	State St.	13	13		2	1,5	3		5	
<i>Rhizomata et radices Valerianae</i>	St.Pharmacopoeia	16	14							
<i>Folia Tussilago farfarae</i>	State St.	13	20		1	3		3		
<i>Herba Chelidonii</i>	St.Pharmacopoeia	14	15		1	0,5	3			
<i>Radices Belladonnae</i>	State St.	13	6		0,5	1	3	3	3	
<i>Radices Rhei</i>	St.Pharmacopoeia	12	8		0,5	0,5	5		5	
<i>Cortex Quercus</i>	-” “-	15	8		1	1	5		3	
<i>Cortex Frangulae</i>	-” “-	15	5		0,5	0,5		1		

SAFETY PRECAUTIONS

Execution of educational and scientific experimental work at the Department of Pharmacognosy and Botany in educational and research laboratories associated with various chemicals (organic solvents, acids, alkalis), plant materials using, different chemical utensils, equipment and devices. Therefore, in the laboratory spaces there are continuously possible dangerous and harmful factors which can effect on students. These factors can lead to work-related injury and fire hazards.

Students are admitted to practical training in chemical lab only after a detailed briefing on safety and fire precautions.

Each student works in the laboratory must know the location of fire fighting and be able to know where the first aid kit and know how to provide first aid for various injuries.

Experimental part begins only after a thorough acquaintance with chemical dishes, technique experiments, properties, purpose reagents and solvents used, and the rules of work with devices. The workplace should only has necessary reagents, instruments and a notebook to record results.

Before using glass and porcelain tableware check its purity and integrity. Do not work with the dishes that have chips, cracks, deep scratches.

All transactions with flammable liquids, concentrated acids and alkalis, experiments with the formation of gases and work with metallic sodium should be performed only in a fume hood, if necessary, should use personal protective equipment (masks, goggles, mask, gloves, etc.). Smell of substance in a test tube or flask determine carefully directing couples to himself flick of the wrist. Mixing and dilution of chemicals, accompanied by heat, spend with heatproof bowl and porcelain.

Do not allow heat flasks with inflammable liquids over an open fire, avoid getting water on the heated external surface of glass vessels, gently and carefully to treat laboratory glassware and equipment.

Acids and bases to dial in using only the dropper rubber pear, forbidden to absorb acid and alkali liquid in the pipette mouth, because it can cause burns and poisoning.

Heating of substances in hermetically sealed vessels (safety explosion!) is strictly forbidden. To prevent the release of liquid from the reaction vessel should be carried out uniformly heating the to put to the bottom of the vessel 2-3 boiling stones (pieces of porous inorganic material).

Heating tubes of substances should be carried out at periodic shaking, vent tubes should be directed away from yourself and others that work.

Take and carry glass with substances should, covering them with hand from side, not the neck.

Do not leave without supervision laboratory installation, operating and equipment included.

It is strictly forbidden to drink water from the chemical dishes, eat, smoke at the laboratory.

After work should be thoroughly washed and put to dry dishes, cups and place shtanhlasy on their location, wipe the work surface of the table, close the gas and water valves, turn off appliances and exhaust ventilation.

In case of pouring concentrated acid, it must first fill with sand so that it is absorbed acid. Sand collect in the container and make out of room to place waste collection. Polluted place pouring rinse with water and wipe dry.

In case of pouring concentrated and ammonia - they can fill as sand and sawdust. Pouring place by weak solution of acetic acid after collecting sand or sawdust.

In case of fire in a laboratory situation should turn off gas appliances, exhaust ventilation and remove all flammable material from the fire area. Shouting loudly advertise on fire people working together and in neighboring areas.

It is necessary to take urgent measures to eliminate the fire using fire extinguishers or sand. Do not fill the flames with water that in many cases this leads to expansion of the fire. Only water-soluble substances (alcohol, acetone, etc.) quenched with water. In case of fire clothes should not run, you need to throw the victim's robe located in a prominent and accessible place.

Provision for first aid is the duty of everyone! In providing assistance priority should be to eliminate the cause of the injury, turn off the power grid, extinguish the flame, remove from the wound

pieces of glass or substance that causes burns, etc. ; the victim must create conditions for the most comfortable position and provide first aid.

If *cuts* must be removed with tweezers glass pieces of glass and wash the wound 3% solution of hydrogen peroxide. The skin around the wound grease 5% solution of iodine and apply a sterile bandage. In severe bleeding tourniquet and attach a note with precisely specified time imposing and send poterpitsloho doctor.

When I degree *thermal burns* (redness) burnt areas should be cool running water, while more severe burns to the provision of skilled care - apply dry aseptic bandage. Do not remove the skin from the burnt remains of clothes that burned.

Burns by concentrated acids affected skin should be washed with plenty of water for 10-15 minutes and then process the 2% solution of sodium bicarbonate and again rinsed with water.

Burns by concentrated alkalis affected area should be washed with plenty of water, and then - a 1% solution of acetic acid.

When *hit acids or alkalis to the eyes*, they should immediately wash with water for 10-15 minutes, then, if getting acid - 2% solution of sodium bicarbonate, and when it enters the meadow - isotonic sodium chloride solution for 30-60 minutes. After thorough rinsing eyes should consult a doctor.

After *burns by phenol* rub the affected area till restore the natural skin colour.

If poisoning by *gas substances* bring the victim to fresh air and create him complete rest and call a doctor.

When *electric shock* turn off power and, using a wooden or plastic objects poterpioho release from contact with electric wire. It is necessary to ensure the victim calm and bring it to life.

If *breathing or heartbeat stops* it's necessary to carry out artificial respiration and chest compressions and do not stop these operations to full functional recovery or the arrival of the medical workers.

Safety precautions at work, harvesting, drying, processing and storage of plant material that contains toxic and potent substances (alkaloids, cardiac glycosides, etc.):

1. Teenagers, students are allowed to collect only under the supervision of the responsible team leader or instructor. By collecting MP, which contain these substances, it is better to include the adult population to collect datura, henbane, hellebore teenagers do not allow!

2. During the assembly should not touch your eyes, the face, not to eat. After collecting wash hands thoroughly with soap and water.

3. During the processing, drying, sorting, packaging protecting mouth and nose with a respirator, wet gauze, eye - protective glasses. Do not take food or smoke.

4. After thoroughly shake out of clothes, wash clothes, wash the face with soap and water, wipe with a dust mask, goggles, gauze.

5. When the need to have a first aid kit.

6. To work with the potent and poisonous MP not allowed zhinkm pregnant and lactating.

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