

**MINISTRY OF HEALTH OF THE REPUBLIC OF MOLDOVA
“NICOLAE TESTEMITANU” STATE UNIVERSITY
OF MEDICINE AND PHARMACY
FACULTY OF PHARMACY**

CENTER FOR DRUG DEVELOPMENT

**THE COLLECTION
OF THE SCIENTIFIC
AND PRACTICAL CENTER
FOR MEDICINAL PLANTS**

GUIDE



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Chișinău, 2025

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PREFACE

Medicinal plants have long represented an important source of raw material for harvesting vegetal products and obtaining increasingly complex extractive and phytotherapeutic preparations. The implementation of World Health Organization directives aimed at meeting population needs for plant-derived products through the use of local raw material resources can only be achieved through thorough knowledge of medicinal plants and their active principles.

To fulfill this objective, the study of medicinal plants by students of the Faculty of Pharmacy of “Nicolae Testemitanu” State University of Medicine and Pharmacy (SUMPh) as well as by specialists, begins with the scientific understanding of medicinal plants—species distribution, identification of vegetal products, chemical composition, pharmacological actions and indications, viewed through the prism of their active principles. In this context, the training of pharmacists in the identification and understanding of medicinal plants and vegetal products represents an important social necessity in ensuring the safety of phytotherapeutic products.

The methodological guide “**The Scientific and Practical Center for Medicinal Plants**” serves as a reference tool for researchers, students and specialists, facilitating their orientation and acquisition of knowledge about medicinal plants from the flora of the Republic of Moldova and species introduced into cultivation. The guide presents a wide diversity of herbal products, phytochemical analysis methods and pharmacological actions. For easier comprehension, the plants are grouped according to active principles (polysaccharides, vitamins, volatile oils, bitter and resinous substances, heterosides, saponosides, lignans, alkaloids, phenolic compounds including coumarins and chromones, anthracene derivatives, flavonoids, tannins and various active principles).

The evaluation of the chemical composition of herbal products offers a new perspective in pharmacognostic research by correlating the pharmacotherapeutic activity of plants with their chemical composition and structure of active principles—research that forms the basis of pharmacological action.

The species are also classified according to pharmacological action (analgesic, antioxidant, antihypertensive, anti-inflammatory, antirheumatic, antitumoral, antitussive, antiviral, antiseptic, antibacterial, aphrodisiac, cardiosedative, cicatrizing, carminative, choleric, diuretic, emollient, expectorant, hepatoprotective, hypoglycemic, immunomodulatory, laxative, spasmolytic, stomachic, sedative, vitaminizing). Plants are distributed by families (Asteraceae, Apiaceae, Lamiaceae, Papaveraceae, Rosaceae, Tiliaceae, Apocynaceae, Araceae, Aristolochiaceae, Asparagaceae, Berberidaceae, Brassicaceae, Caprifoliaceae, Fagaceae, Plantaginaceae, Poaceae, Polygonaceae, Scrophulariaceae), with species names indicated in Latin, English, Romanian and Russian. The guide also includes species with toxic and allergenic potential.

The guide further presents results of research projects conducted at the Scientific and Practical Center for Medicinal Plants (SPCMP) of “Nicolae Testemitanu” SUMPh, including qualitative and quantitative determinations of active principles in selected species with antioxidant, antibacterial, anti-inflammatory and hepatoprotective activity, with the aim of disseminating scientific findings related to the medicinal plants in the collection. It is intended for researchers, students, residents, pharmacists, physicians and all specialists involved in the field of medicinal plants and scientific research. It is also useful for students of the Faculty of Pharmacy during their practical training in the disciplines of Pharmaceutical Botany and Pharmacognosy, contributing to the preparation of future specialists and to achieving educational objectives related to the study of medicinal plants.

The first attempts to protect vegetation in the Republic of Moldova were undertaken in the 19th century. Out of approx. 1550 plant species, 46 are listed in the **Red Book of the Republic of Moldova (3rd edition, 2015)** and 224 are protected by the state. Thus, the SPCMP of “Nicolae Testemitanu” SUMPh contributes to the bioconservation of medicinal plants from the spontaneous flora, including rare and endangered species, through their introduction into cultivation. Creating plant collections is essential both for preventing the disappearance of species and for supporting restoration of natural populations. Among the species in the collection are plants with various levels of vulnerability such as *Ephedra distachya* L., *Scopolia carniolica* Jacq., *Crataegus pentagyna* Waldst. et Kit., *Galanthus nivalis* L., *Nymphaea alba* L., *Padus avium* Mill.

The SPCMP serves as an educational platform for students of the Faculty of Pharmacy and other institutions with medical, pharmaceutical and biological profiles, promoting scientific knowledge, rational use of medicinal plants, and providing a research base for collaboration and exchange of experience. The medicinal plants from the collection may also serve as raw material for the national pharmaceutical industry for the development of new phytotherapeutic preparations.

I. THE SCIENTIFIC AND PRACTICAL CENTER FOR MEDICINAL PLANTS

1.1. CENTER INFRASTRUCTURE

The Scientific and Practical Center for Medicinal Plants (SPCMP) of State University of Medicine and Pharmacy “Nicolae Testemitanu” was founded based on the Government Decision of the Republic of Moldova No. 1071 from August 15, 2002, “Regarding the allocation, change of land destination, and authorization of certain design works”. The Center was granted 2.5 hectares of land in the outskirts of Bardar village, Ialoveni district, located 4 km northeast of the village, for the creation of a medicinal plant collection, construction of an administrative building, a teaching hall, and a drying facility. The project also included the construction of an irrigation network, an artesian well, the acquisition of agricultural machinery, laboratory equipment, and reagents. Currently, the SPCMP occupies a total area of 11 hectares and is organizationally a component of the Drug Development Center, part of the National Institute for Research in Medicine and Health of “Nicolae Testemitanu” SUMPh.

The plant collection



Administrative building



Field study hall for students



Storage facility



Drying facility



Drip irrigation system



Practical activities with students



1.2. HUMAN RESOURCES

The management of a plant collection involves several employees at different managerial levels, including personnel with expertise in the care and cultivation of medicinal plants.

Medicinal plants serve as study material for improving research projects and techniques as new theories, methods and practices emerge. The SPCMP establishes new collaborations between professors, scientific researchers, students, residents and PhD candidates to evaluate the biological, phytochemical and pharmacological potential of the collection.

Currently, the SPCMP employs specialists in biology and cultivation technologies of medicinal plants, as well as pharmacists specializing in pharmacognosy, phytochemistry of medicinal plants, pharmaceutical technology, and biotechnology.



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1.3. RESEARCH DIRECTIONS

The Republic of Moldova possesses a rich natural environment in terms of landscape diversity, situated across three major European eco-regions: Central European mixed forests, Pontic steppe, and East European forest-steppe. The country's flora comprises approximately 1550 species, belonging to 550 genera and 101 families. The most important strategy for conserving natural biodiversity and ensuring sustainable use of plant resources focuses on establishing protected natural ecosystems.

A component of the natural ecosystem is the plant collection of the SPCMP of “Nicolae Testemitanu” SUMPh, which includes approximately 160 taxa of plants grouped into 14 categories of active principles with various pharmacotherapeutic actions. Scientific research is conducted within institutional projects funded by the state budget, as well as initiative research performed by students, residents, master's students and PhD candidates.

At the same time, the SPCMP hosts practical training for students of the Faculty of Pharmacy in the disciplines “Medicinal Plants” and “Pharmacognosy”, as well as continuous education programs.

Main research directions of the SPCMP include:

- Biological study of medicinal plants from spontaneous and cultivated flora of the Republic of Moldova
- Phytochemical research of medicinal plants and vegetal products collected from the Center's collection
- Introduction into cultivation of medicinal plants from local spontaneous flora and from other floristic regions
- Study of growth conditions and development of cultivation technologies for medicinal plants
- Establishment of a scientific foundation for producing medicinal plant seeds and planting material

1.4. RESEARCH METHODOLOGY

Research regarding the introduction into cultivation of medicinal plants from the spontaneous and cultivated flora includes determining optimal cultivation parameters and identifying environmental factors influencing growth and development of species, such as: edaphic and orographic conditions, soil cultivation timing, water regime, sowing time and plant density per unit area.

Biological study of plants includes biometric assessment and morpho-anatomical analysis of vegetal products through pharmacognostic examination. Research methods are applied in collaboration with the Department of Pharmacognosy and Pharmaceutical Botany, the Department of Drug Technology, the Department of Microbiology, Virology and Immunology, the laboratories form the Center for Drug Development at “Nicolae Testemitanu” SUMPh; Moldovan Academy of Science within the Institute of Chemistry, the Institute of Genetics, Physiology and Plant Protection; Moldovan State University with the National Botanical Garden (Institute) “Alexandru Ciubotaru”. The Center also has international collaborations with research laboratories from Romania (Cluj-Napoca, Bucharest, Iași, Arad), Italy (Bologna, Chieti – Pescara) and Spain (Santiago de Compostela).

Within research projects, phytochemical studies are carried out, including optimization of methods for obtaining fluid and dry extracts, and biological studies such as determining antioxidant activity (DPPH, FRAP, ABTS), *in vitro* antimicrobial activity, anti-inflammatory activity (induced paw edema in rats), and *in vivo* hepatoprotective activity.

RESEARCH PROJECTS IMPLEMENTED (2006–2026)

No.	Project Title	Type	Funding Body	Implementation Period
1.	Complex study of autochthonous phytopreparations with hepatoprotective and antimicrobial activity	Institutional 06.420.038 A	Academy of Sciences of Moldova	2006–2010
2.	Biological and phytochemical study of medicinal plants with hepatoprotective and antimicrobial activity	Institutional 11.817.09.14A	Academy of Sciences of Moldova	2011–2014
3.	Biological and phytochemical study of medicinal plants with antioxidant, anti-inflammatory and hepatoprotective activity	Institutional 15.817.04.35A	Academy of Sciences of Moldova	2015–2019
4.	Biological and phytochemical study of medicinal plants with antioxidant, antimicrobial and hepatoprotective activity	State Program 20.80009.8007.24	National Agency for Research and Development	2020–2023
5.	Development of new pharmaceutical products from local raw materials	Institutional 080301	Ministry of Health	2024–2027
6.	Impact of different habitats and abiotic stress factors on plant metabolites of the genera <i>Galium</i> and <i>Helichrysum</i>	Bilateral research project in partnership with Romania (Aurel Vlaicu University of Arad) PN-IV-P8-8.3-ROMD-2023-0022	Romania	2024–2026

7.	<i>In vivo</i> evaluation of the anti-inflammatory activity of polyphenolic extracts from <i>Hypericum perforatum</i> L. and <i>Agrimonia eupatoria</i> L., obtained from local raw materials	25.80012.8007.04SE	National Agency for Research and Development	2025–2026
8.	Optimization of extraction methods for phenolic compounds from plant products with evaluation of antimicrobial and antioxidant activity	25.80012.8007.05SE	National Agency for Research and Development	2025–2026
9.	Development and characterization of topical pharmaceutical forms based on polysaccharides containing extracts from medicinal plants with antibacterial activity	25.80012.8007.06TC	National Agency for Research and Development	2025–2026

II. PLANTS FROM THE COLLECTION OF THE CENTER ACCORDING TO THE ACTIVE PRINCIPLES

Recent studies have shown that the chemical content of plants depends on both internal factors (the plant's genotype) and external factors (the environment, harvesting, and storage of herbal products). Knowledge of the chemical composition of plants and the dynamics of secondary metabolite accumulation in organs is of particular interest for the application of extraction or isolation techniques for active ingredients and the assessment of therapeutic values, in accordance with the Analytical Standardization Documentation.

The medicinal plants in the SPCMP collection of “Nicolae Testemitanu” State University of Medicine and Pharmacy (SUMPh) were evaluated according to the composition of the active ingredients presented in the diagram (Figure 1). Thus, the highest proportion is attributed to essential oils (29%), consisting of multiple mixtures of aliphatic, aromatic, and hydroaromatic hydrocarbons belonging to the terpenoid class; alkaloids occupy second place (14%), followed by tannins (12%), bitter substances (12%), and flavonoids (11%). Coumarins are in the minority, accounting for only 5%.

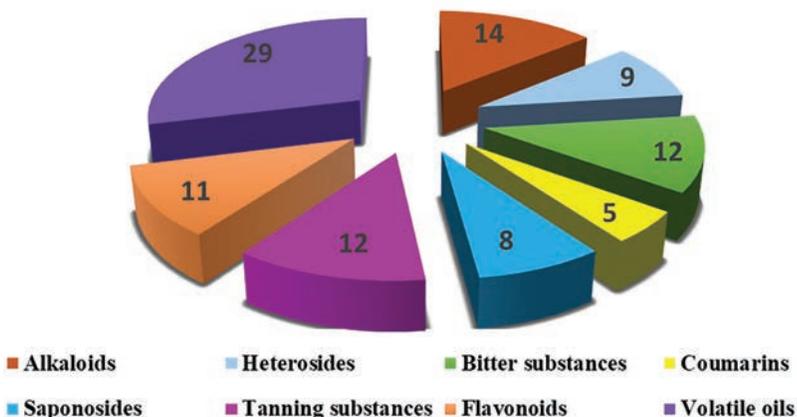


Figure 1. Diagram showing the distribution of plants in the collection according to chemical compounds

2.1. PLANTS CONTAINING ALKALOIDS

ALKALOIDS are products of secondary metabolism, which are nitrogenous heterocyclic organic substances of plant origin, with basic properties, which in certain doses have a physiological effect on the body, but at large doses are toxic. Alkaloids act on the central nervous system as stimulants and depressants; on the vegetative nervous system and receptors (adrenergic, dopaminergic, or serotonergic) as well as on malignant cells, exhibiting cytostatic action.

1. *Aristolochia clematitis* L.
2. *Atropa belladonna* L.
3. *Berberis vulgaris* L.
4. *Chelidonium majus* L.
5. *Datura stramonium* L.
6. *Echinops ritro* L.
7. *Ephedra distachya* Bunge
8. *Fumaria officinalis* L.
9. *Glaucium flavum* Crantz.
10. *Macleaya microcarpa* (Maxim.)
11. *Nuphar luteum* L.
12. *Nymphaea alba* L.
13. *Papaver rhoeas* L.
14. *Papaver somniferum* L.
15. *Symphytum officinale* L.
16. *Vinca minor* L.



Macleaya microcarpa (Maxim.)



Nymphaea alba L.

2.2. PLANTS CONTAINING COUMARINS

COUMARINS – natural phenolic compounds, spread in the plant kingdom, based on a benzo- α -pyron nucleus, frequently found in nature as derivatives of coumarin and furocoumarin, with stomachic, carminative, photosensitizing, anticoagulant, and spasmolytic effects.

1. *Anethum graveolens* L.
2. *Levisticum officinale* Koch.
3. *Melilotus officinalis* (L.) Pall.
4. *Pastinaca sativa* L.
5. *Petroselinum crispum* (Mill.) Fuss



Pastinaca sativa L.

2.3. PLANTS CONTAINING ANTHRACENS

ANTHRACENE DERIVATIVES – glycosides of phenolic derivatives of anthracene, a complex of heterosides with varying degrees of oxidation, which in plants occur as a mixture of different isomers, with laxative or purgative action depending on the dose, as well as anti-inflammatory, cholagogue, and healing properties.

1. *Hypericum perforatum* L.
2. *Rhamnus cathartica* L.
3. *Rumex acetosa* L.
4. *Senna occidentalis* L. (*syn. Cassia*)



Cassia occidentalis L.



Hypericum perforatum L.

2.4. PLANTS CONTAINING FLAVONOIDES

FLAVONOIDS – group of plant pigments with a polyphenolic structure, widespread in the plant kingdom, found in the form of heterosides whose aglycones are derivatives of phenyl-benzo- γ -pyrones (C6-C3-C6). Flavonoids are given attention due to their antioxidant, diuretic, antiviral, anticancer, anti-inflammatory, and antihistamine properties, have low toxicity and are well-tolerated by the human body.



Helichrysum italicum
(Roth) G. Don

1. *Aronia melanocarpa* (Michx.) Elliott
2. *Buddleja davidii* Franch.
3. *Centaurea cyanus* L.
4. *Cercis siliquastrum* L.
5. *Crataegus monogyna* Jacq.
6. *Cynara scolymus* L.
7. *Galium verum* L.
8. *Galium aparine*
9. *Ginkgo biloba* L.
10. *Helichrysum arenarium* (L) Moench
11. *Helichrysum italicum* (Roth) G.Don
12. *Leonurus cardiaca* L.
13. *Polygonum aviculare* L.
14. *Robinia pseudoacacia* L.
15. *Silybum marianum* L.
16. *Sophora japonica* L.



Cynara scolymus L.



Cercis siliquastrum L.

2.5. PLANTS CONTAINING HETEROSIDES

HETEROSIDES – plant compounds resulting from the combination of a carbohydrate fraction with a non-carbohydrate substance (aglycone or genin), which, through hydrolysis, release the carbohydrate part (consisting of one or more sugars) and the non-carbohydrate part with a varied chemical structure and a broad therapeutic spectrum, including on the heart (cardiotonic heterosides).

1. *Adonis vernalis* L.
2. *Amygdalus communis* L.
3. *Convallaria majalis* L.
4. *Digitalis lanata* Ehrh.
5. *Digitalis purpurea* L.

6. *Elytrigia repens* (L) Nevski
7. *Prunus amigdalus* Stokes
8. *Sambucus nigra* L.
9. *Salix alba* L.
10. *Salix babylonica* L.



Convallaria majalis L.

2.6. PLANTS CONTAINING POLYHOLOSIDES

POLYHOLOSIDES – essential substances, composed of C, H, O, resulting from the secondary metabolism of plants, with expectorant, anti-inflammatory, emollient, healing, laxative, astringent, and hemostatic properties.

1. *Althaea officinalis* L.
2. *Echinacea purpurea* (L.) Moench.
3. *Linum usitatissimum* L.
4. *Plantago lanceolatata* L.
5. *Plantago major* L.
6. *Tilia cordata* Mill.
7. *Tilia platyphyllos* Scop
8. *Tilia tomentosa* Moench.
9. *Tussilago farfara* L.
10. *Verbascum phlomoides* L.



Echinacea purpurea (L.)
Moench.

2.7. PLANTS CONTAINING SAPONOSIDES

SAPONINS – vegetal macromolecular compounds, with hetroside characteristics, which possess a range of specific properties (when treated with water, they produce abundant and persistent foam and have the property of hemolyzing erythrocytes).

Saponosides exhibit expectorant, adaptogenic, sedative, vasoconstrictive, and hypolipidemic effects.

1. *Aesculus hippocastanum* L.
2. *Aralia mandshurica* Rupr. et Maxim.
3. *Eryngium planum* L.
4. *Glycyrrhiza glabra* L.
5. *Gypsophila paniculata* L.
6. *Phytolacca americana* L.
7. *Saponaria officinalis* L.
8. *Solidago canadensis* L.
9. *Solidago virgaurea* L.



Solidago virgaurea L.

2.8. PLANTS CONTAINING BITTER SUBSTANCES

BITTER SUBSTANCES – are terpenic compounds from the plant kingdom, very bitter (due to the presence of unsaturated lactone) that stimulate digestive functions: increase secretion and gastric and motility (stomach stimulants, tonics-appetizer), bile secretion (choleric) and increase appetite.

1. *Achillea millefolium* L.
2. *Artemisia absinthium* L.
3. *Artemisia vulgaris* L.
4. *Cichorium inthybus* L.
5. *Marrubium vulgare* L.
6. *Taraxacum officinale* (L.) Weber



Cichorium inthybus L.

2.9. PLANTS CONTAINING TANNINS

TANNINS – groups of complex substances of different molecular weights (consisting of polyphenols, tannins, and flavophene), with the property of tanning the skin and precipitating proteins. They have astringent, anti-inflammatory, hemostatic, and antiseptic properties.

1. *Agrimonia eupatoria* L.
2. *Bergenia crassifolia* L.
3. *Cornus mas* L.
4. *Fragaria vesca* L.
5. *Junglans regia* L.
6. *Padus racemosa* Gilib.
7. *Potentilla anserina* L.
8. *Potentilla erecta* (L.) Hampe
9. *Prunus padus* L.
10. *Prunus spinosa* L.
11. *Quercus robur* L.
12. *Sanguisorba officinalis* L.



Agrimonia eupatoria L.

2.10. PLANTS CONTAINING ESSENTIAL OILS

ESSENTIAL OILS – represent a complex of substances consisting of multiple mixtures of aliphatic, aromatic, and hydroaromatic hydrocarbons belonging to the terpenoid class. They are used as antiseptics, anti-inflammatories, carminatives, and to correct the odor of medicinal and cosmetic products.

1. *Abies nordmanniana* (Steven) Spach
2. *Acorus calamus* L.
3. *Aristolochia clematitis* L.
4. *Artemisia dracunculus* L.
5. *Betula verrucosa* L.
6. *Carum carvi* L.
7. *Chamomilla recutita* L.
8. *Coriandrum sativum* L.
9. *Dracocephalum moldavica* L.
10. *Foeniculum vulgare* Mill.
11. *Hyssopus officinalis* L.
12. *Inula helenium* L.
13. *Iris germanica* L.
14. *Iris pseudacorus* L.
15. *Lavandula angustifolia* Mill.
16. *Lavandula x intermedia*
17. *Juniperus communis* L.
18. *Magnolia kobus* DC.



Lavandula angustifolia
Mill.

19. *Matricaria chamomilla* L.
20. *Melissa officinalis* L.
21. *Mentha piperita* L.
22. *Nepeta cataria* L.
23. *Ocimum basilicum* L.
24. *Origanum vulgare* L.
25. *Picea abies* L.
26. *Pinus sylvestris* L.
27. *Populus nigra* L.
28. *Pyrethrum cinerariaefolium* Tver.
29. *Rosa damascena* Mill.
30. *Rosmarinus officinalis* L.
31. *Salvia officinalis* L.
32. *Salvia sclarea* L.
33. *Santolina chamaecyparissus* L.
34. *Ruta graveolens* L.
35. *Tanacetum vulgare* L.
36. *Thymus serpyllum* L.
37. *Thymus vulgaris* L.
38. *Valeriana officinalis* L.



Ocimum basilicum L.

2.11. PLANTS CONTAINING VITAMINS

VITAMINS – biologically active substances, catalysts of metabolic processes, that are part of all the fermentative systems, in the metabolism of lipids, carbohydrates, proteins, necessary for the functioning of vital processes in the organism. The medicinal plants from the collection are mostly rich in vitamins: C, E, K, P, carotenoids.

1. *Calendula officinalis* L.
2. *Capsella bursa pastoris* (L.) Medic.
3. *Corylus avellana* L.
4. *Daucus carota* L., var. *Sativa*
5. *Hippophae rhamnoides* L.
6. *Petroselinum crispum* (Mill.) Fuss
7. *Rosa canina* L.
8. *Ribes nigrum* L.
9. *Ribes uva-crispa* L.



Calendula officinalis L.

10. *Sorbus aucuparia* L.
11. *Viburnum opulus* L.
12. *Urtica dioica* L.
13. *Zea mays* L.

2.12. PLANTS WITH VARIOUS ACTIVE PRINCIPLES

VARIOUS ACTIVE PRINCIPLES – in addition to the compounds mentioned in the center's collection, there are also plants that contain other various active ingredients, such as lignans, phytosterols, resins, iridoids, and secoiridoids.

1. *Arctium lappa* L.
2. *Armoracia rusticana* Gaertn., Mey. et Scherb.
3. *Asparagus officinalis* L.
4. *Chaenomeles japonica* L.
5. *Filipendula ulmaria* L. Maxim.
6. *Forsythia x intermedia* Zabel.
7. *Fraxinus excelsior* L.
8. *Galega officinalis* L.
9. *Humulus lupulus* L.
10. *Lamium album* L.
11. *Mahonia aquifolium* (Pursh) Nutt.
12. *Miscanthus sinensis* Anderson
13. *Ricinus communis* L.
14. *Rubus idaeus* L.
15. *Rubus fruticosus* L.
16. *Trifolium pratense* L.
17. *Vitis vinifera* L.



Rubus fruticosus L.

III. CLASSIFICATION OF MEDICINAL PLANTS ACCORDING TO THEIR PHARMACOLOGICAL ACTION

The medicinal plants in the SPCMP collection were evaluated according to their pharmacological actions and classified according to systems: nervous, digestive, respiratory, cardiovascular, excretory, metabolic processes, including medicinal plants with antimicrobial, antiviral, and antiparasitic properties, mostly products that are being studied in research projects carried out at the Center.

Plants affecting the central nervous system

Analgesic: *Amygdalus communis* L., *Atropabelladonna* L., *Chelidonium majus* L., *Macleaya microcarpa* (Maxim.), *Papaver somniferum* L.

Sedative: *Ginkgo biloba* L., *Humulus lupulus* L., *Melissa officinalis* L., *Mentha piperita* L., *Valeriana officinalis* L.

Antiparkinsonian: *Datura stramonium* L.

Plants affecting the digestive system

Cholagogue: *Berberis vulgaris* L., *Betula verrucosa* L., *Calendula officinalis* L., *Chelidonium majus* L., *Centaurea cyanus* L., *Cynara scolymus* L., *Dracocephalum moldavica* L., *Fraxinus excelsior* L., *Fumaria officinalis* L., *Gypsophila paniculata* L., *Helichrysum arenarium* (L.) Moench., *Helichrysum italicum* L., *Hypericum perforatum* L., *Mentha piperita* L., *Rosmarinus officinalis* L., *Silybum marianum* (L.) Gaertner, *Tanacetum vulgare* L., *Taraxacum officinale* (L.) Weber, *Rosa canina* L.

Carminative: *Anethum graveolens* L., *Carum carvi* L., *Coriandrum sativum* L., *Foeniculum vulgare* Mill., *Fumaria officinalis* L., *Levisticum officinale* Koch., *Ocimum basilicum* L., *Nepeta cataria* L.

Laxatives, purgatives: *Armoracia rusticana* Gaertn., Mey. et Scherb., *Linum usitatissimum* L., *Ricinus communis* L.

Stomachic: *Achillea millefolium* L., *Acorus calamus* L., *Anethum graveolens* L., *Artemisia dracunculus* L., *Artemisia vulgaris* L., *Carum carvi* L., *Cichorium inthybus* L., *Coriandrum sativum* L., *Hippophae rhamnoides* L., *Inula helenium* L., *Levisticum officinale* Koch. *Ocimum basilicum* L., *Rumex acetosa* L., *Symphytum officinale* L., *Taraxacum officinale* (L.) Weber.

Hepatoprotective: *Agrimonia eupatoria* L., *Chelidonium majus* L., *Cichorium inthybus* L., *Cynara scolymus* L., *Helichrysum arenarium* (L.) Moench., *Melilotus officinalis* (L.) Pall., *Silybum marianum* (L.) Gaertner, *Symphytum officinale* L., *Potentilla anserina* L.

Galactagogues: *Carum carvi* L., *Foeniculum vulgare* Mill., *Galega officinalis* L.

Plants affecting the the respiratory system

Antitussives: *Amygdalus communis* L., *Glaucium flavum* Crantz., *Papaver rhoeas* L., *Papaver somniferum* L., *Thymus serpyllum* L., *Thymus vulgaris* L.

Expectorants: *Althaea officinalis* L., *Armoracia rusticana*., *Eryngium planum* L., *Hyssopus officinalis* L., *Inula helenium* L., *Iris germanica* L., *Glycyrrhiza glabra* L., *Gypsophila paniculata* L., *Marrubium vulgare* L., *Ocimum basilicum* L., *Origanum vulgare* L., *Saponaria officinalis* L., *Tussilago farfara* L., *Verbascum phlomoides* L.

Plants affecting the cardiovascular system

Antihypertensive: *Aronia melanocarpa* (Michx.) Elliott, *Aesculus hippocastanum* L., *Viburnum opulus* L.

Cardiotonics: *Adonis vernalis* L., *Aronia melanocarpa* (Michx.) Elliott, *Convallaria majalis* L., *Crataegus monogyna* Jacq., *Digitalis lanata* Ehrh., *Digitalis purpurea* L., *Leonurus cardiaca* L.

Plants affecting the excretory system

Diuretics: *Berberis vulgaris* L., *Betula verrucosa* L., *Centaurea cyanus* L., *Elytrigia repens* (L) Nevski, *Filipendula ulmaria* L. Maxim., *Fraxinus excelsior* L., *Galium verum* L., *Juniperus communis* L., *Iris germanica* L., *Lamium album* L., *Levisticum officinale* Koch., *Ocimum basilicum* L., *Padus racemosa* Gilib., *Petroselinum crispum* (Mill.) Fuss., *Polygonum aviculare* L., *Populus nigra* L., *Prunus padus* L., *Prunus spinosa* L., *Robinia pseudoacacia* L., *Saponaria officinalis* L., *Solidago canadensis* L., *Solidago virgaurea* L., *Thymus serpyllum* L., *Tilia cordata* Mill., *Tilia platyphyllos* Scop, *Tilia tomentosa* Moench., *Trifolium pratense* L., *Urtica dioica* L., *Viburnum opulus* L., *Zea mays* L.

In kidney stones: *Acorus calamus* L., *Corylus avellana* L., *Robinia pseudoacacia* L., *Zea mays* L.

Plants affecting the metabolic processes

Anti-inflammatory: *Althaea officinalis* L., *Bergenia crassifolia* (L.), *Calendula officinalis* L., *Chaenomeles japonica* L., *Echinacea purpurea* (L.) Moench., *Elytrigia repens* (L) Nevski, *Filipendula ulmaria* L. Maxim., *Fraxinus excelsior* L., *Galium verum* L., *Glycyrrhiza glabra* L., *Hypericum perforatum* L., *Hippophae rhamnoides* L., *Macleaya microcarpa* (Maxim.) *Matricaria chamomilla* L.

Vitamins: *Aronia melanocarpa* (Michx.) Elliott., *Chaenomeles japonica* L., *Calendula officinalis* L., *Capsella bursa pastoris* (L.) Medic., *Daucus carota* L., var. *Sativa*, *Fragaria vesca* L., *Viburnum opulus* L., *Hippophae rhamnoides* L., *Pastinaca sativa* L., *Petroselinum crispum* (Mill.) Fuss, *Ribes nigrum* L., *Rosa canina* L., *Rubus fruticosus* L., *Rubus idaeus* L., *Sorbus aucuparia* L., *Zea mays* L.

Anti-allergic: *Matricaria chamomilla* L., *Verbascum phlomoides* L.

Hypoglycemic: *Cichorium inthybus* L., *Elytrigia repens* (L) Nevski, *Galega officinalis* L., *Junglans regia* L., *Salvia officinalis* L., *Sorbus aucuparia* L., *Urtica dioica* L.

Medicinal plants with antibacterial, antifungal, antiviral and anthelmintic properties

Antibacterial: *Aristolochia clematitis* L., *Bergenia crassifolia* (L.), *Coriandrum sativum* L., *Cornus mas* L., *Ginkgo biloba* L., *Hypericum perforatum* L., *Macleaya microcarpa* (Maxim.), *Nepeta cataria* L., *Thymus vulgaris* L.

Antifungal: *Hippophae rhamnoides* L., *Rosa damascena* Mill.

Antiviral: *Tilia cordata* Mill., *Tilia platyphyllos* Scop., *Tilia tomentosa* Moench., *Rosa canina* L.

Anthelmintic: *Achillea millefolium* L., *Artemisia absinthium* L., *Artemisia vulgaris* L., *Cornus mas* L., *Inula helenium* L., *Ruta graveolens* L., *Tanacetum vulgare* L.

IV. MEDICINAL PLANTS WITH HIGHLY ACTIVE AND POTENTIALLY TOXIC COMPOUNDS

Of the total number of species in the collection, 22 are considered potentially toxic (0.11%), due to their content of chemical compounds, the overdosage of which can cause intoxication and death. These are mostly plants containing alkaloids, cardiotonic and cyanogenic heterosides, saponosides, furocoumarins, anthracene derivatives, resins and volatile oils. Potentially toxic plants are classified according to their toxicity:

– **extremely hazardous plants:** considered plants that cause intoxication at doses of 5 mg or less per kg body weight, this group includes: *Atropa belladonna*, *Hyoscyamus niger*, *Datura stramonium*, *Scopolia carniolica*, *Ricinus communis*, *Digitalis purpurea*, *Conium maculatum*, *Juniperus sabina*;

– **highly hazardous plants:** plants that cause poisoning from 5 to 50 mg/kg of body weight. In the collection, this group includes: *Chelidonium majus*, *Convallaria majalis*, *Adonis vernalis*, *Buxus sempervirens*, *Solanum dulcamara*;

– **moderately hazardous plants:** plants that cause signs of poisoning when ingested from 50 to 500 mg/kg body weight, such as: *Ranunculus sceleratus*, *Cynoglossum officinale*, *Aristolohia clematitidis*, *Hedera helix*, *Tanacetum vulgare*.

The mechanisms of action of toxic plants are diverse and depend on the group of chemical compounds involved, their physicochemical properties, and their concentration in plant organs. Neuroreceptors are the main targets for many active principles that have chemical structures similar to endogenous neurotransmitters such as acetylcholine, dopamine, noradrenaline, serotonin, adrenaline, and GABA. These neuroactive substances can act either as agonists, overstimulating neuroreceptors, or as antagonists, blocking specific neuroreceptors, which results in excitation, hallucinations, and general disturbances of the central nervous system, effects that are most often caused by alkaloids.

Potentially toxic plants, classified according to their chemical compounds (alkaloids, cardiotoxic heterosides, saponosides, anthracenosides, coumarins, resins, lectins, and volatile oils), are presented below, with an indication of the poisonous parts, active principles, modes of action, and symptoms of poisoning.

ALKALOIDS



***Atropa belladonna* L. (Deadly nightshade)**

Hazardous plant parts: all parts.

Active principles: hyoscyamine (90%), scopolamine (2–5%) and other tropane alkaloids.

Mode of action: muscarinic acetylcholine receptor (mAChR) antagonist with parasympatholytic properties; hallucinogenic and aphrodisiac effects.

Symptoms of intoxication: mydriasis, hyperthermia, inhibition of salivation, and potentially death due to respiratory arrest.



***Hyoscyamus niger* L. (Black henbane)**

Hazardous plant parts: all parts, seeds.

Active principles: hyoscyamine (50%), scopolamine (50%).

Mode of action: muscarinic acetylcholine receptor (mAChR) antagonist with parasympatholytic properties.

Symptoms of intoxication: dry mouth, thirst, slurred speech, difficulty speaking, dysphagia, warm flushed skin, pyrexia, nausea, vomiting, headache, blurred vision, photophobia, urinary retention, drowsiness, hyperreflexia, auditory, visual, or tactile hallucinations, confusion, disorientation, delirium, aggressiveness, mydriasis, tachycardia, arrhythmia, agitation, convulsions, and coma.



***Datura stramonium* L. (Thornapple)**

Hazardous plant parts: all parts, seeds.

Active principles: hyoscyamine (75%), scopolamine (25%), atropine.

Mode of action: tropane alkaloids inhibit muscarinic acetylcholine receptors (mAChR) and exhibit parasympatholytic properties, leading to strong hallucinations. *Datura stramonium* has been used as a hallucinogen and aphrodisiac

Symptoms of intoxication: dry mouth, intense thirst, blurred vision with pronounced mydriasis, tachycardia, hallucinations, delirium, loss of motor coordination, and potentially death due to respiratory failure.



***Ricinus communis* L. (Castor bean)**

Hazardous plant parts: seeds.

Active principles: ricin (lectin) and ricinine (pyridine alkaloid).

Mode of action and symptoms: ricin is a highly toxic lectin that inhibits protein biosynthesis. Parenteral exposure can cause life-threatening multisystem organ failure, while ingestion leads to nausea, bloody vomiting, bloody diarrhea, nephritis, liver damage, convulsions, tachycardia, and circulatory arrest. tachycardia, circulatory arrest.



***Chelidonium majus* L. (Celandine)**

Hazardous plant parts: all parts, reddish latex.

Active principles: chelidonine, chelerythrine, sanguinarine, berberine and other isoquinoline alkaloids.

Mode of action and symptoms: burning sensation in mouth and throat, nausea, vomiting, bloody diarrhoea, central sedative, spasmolytic and narcotic, low pulse, hypotension, cardiac arrest, chelidonine inhibits mitosis and is therefore cytotoxic.



***Papaver somniferum* L. (Opium poppy)**

Hazardous plant parts: all parts, especially latex.

Active principles: morphine, codeine, papaverine, thebaine, noscapine, and narcotine.

Mode of action and symptoms: intoxication with opioids may cause bradycardia, coma, decreased gastrointestinal motility, depressed mental state, respiratory depression, hypotension, hypothermia, and miosis. Opioid withdrawal may present with agitation, diarrhea,

diaphoresis, hypertension, cramps, mydriasis, piloerection, tachycardia, tachypnea, and vomiting.



***Nuphar luteum* L. (Yellow water-lily)**

Hazardous plant parts: all parts.

Active principles: nupharine, desoxynupharidine, and other simple quinolizidine alkaloids.

Mode of action: the alkaloids may affect acetylcholine receptors, leading to psychoactive effects similar to atropine and papaverine. They also exhibit spasmolytic and hypotensive properties and have a local anesthetic effect similar to curare.

Symptoms of intoxication: poisoning from fresh rhizomes, particularly in children, may cause vomiting, diarrhea, and prolonged sleep.



***Ephedra distachya* L. (Joint-pine)**

Hazardous plant parts: all parts.

Active principles: L-ephedrine, D pseudoephedrine, L, D-norephedrine, D-nopseudoephedrine (0.5-3.3%).

Mode of action: sympathomimetic; exhibits amphetamine-like activities, acting as a stimulant, euphoric agent, and reducing fatigue while suppressing appetite.

Symptoms of intoxication: at higher doses, may cause heavy perspiration, increased respiratory and muscle activity, insomnia, mydriasis, constipation, hypertension, arrhythmia, and potentially death.



***Symphytum officinale* L. (Comfrey)**

Hazardous plant parts: all parts, roots.

Active principles: symphytine, echimidine and other pyrrolizidine alkaloids, allantoin.

Mode of action: pyrrolizidine alkaloids alkylate DNA; they are hepatotoxic, mutagenic, and carcinogenic, and can inhibit peripheral nerves. They are also significant toxins in animals.

Symptoms of intoxication: abdominal pain, vomiting, and ascites (fluid accumulation in the abdomen), which may progress to liver failure and cirrhosis.



***Aristolochia clematitis* L. (Birthwort)**

Hazardous plant parts: aerial parts, the most toxic being the seeds and rhizomes.

Active principles: rhizomes contain alkaloids (aristolochine, magnoflorine), aristolochic acid; leaves and seeds - aristolochine, aristolochic acid.

Mode of action: aristolochic acid exhibits mutagenic and carcinogenic properties.

Symptoms of intoxication: ingestion may induce vomiting, gastrointestinal disturbances, tachycardia, hypotension, and respiratory arrest.

CARDIOTONIC HETEROZIDES



***Digitalis lanata* Ehrh., Woolly foxglove**

Hazardous plant parts: all parts.

Active principles: cardioactive steroid glycosides (cardenolides) (0,5 to 1.5%): aglycone digitoxigenin; lanatoside A (0.05 to 0.25%), aglycone gitoxigenin: lanatoside B (0.01 to 0.15%), lanatoside C and digoxin; lanatoside D, diginatin, digitoxigenin gitaloside; lanatoside E and gitaloxin. Steroid saponins: lanagitosides I and II, tigonin,

tigogenin, digalogenin, digitogenin and gitogenin.

Mode of action: cardiac glycosides inhibit Na^+/K^+ -ATPase, leading to typical effects of cardiac glycoside intoxication.

Symptoms of intoxication: vomiting, diarrhea, gastroenteritis, severe headache, irregular heartbeat and pulse, convulsions, central nervous system disturbances, cardiac arrest, and potentially sudden death.



***Digitalis purpurea* L. (Foxglove)**

Hazardous plant parts: all parts, especially the leaves during flowering.

Active principles: cardioactive steroid glycosides (cardenolides, 0.5–1.5%), including purpurea glycoside A, digitoxin, gitoxigenin, purpurea glycoside B, gitoxin; aglycones such as gitaloxigenin; glucoverodoxin, glucogitaloxin, gitaloxin; steroid saponins, including desgalactotigonin, digitonin, and purpureagitoside.

Mode of action: cardiac glycosides inhibit Na⁺, K⁺ - ATPase, typical cardiac glycoside intoxication.

Symptoms of intoxication: vomiting, diarrhoea, gastroenteritis, severe headache, irregular heartbeat and pulse, convulsions, CNS disturbance, cardiac arrest, sudden death. Saponins, which accompany the heterosides, cause epithelial irritation, hypersalivation, vomiting, colic and diarrhea.



***Convallaria majalis* L. (Lily-of-the-valley)**

Hazardous plant parts: all parts, fruits.

Active principles: convallatoxin, convalloside, convallatoxol, desglucocheirotoxin, lokundjoxide, saponins.

Mode of action, symptoms: cardiac glycosides inhibit Na⁺, K⁺ - ATPase.

Symptoms of intoxication: include nausea, gastrointestinal disturbances, diarrhoea, dizziness, hypertension, arrhythmia, coma, and cardiac arrest.

SAPONOZIDES



***Saponaria officinalis* L. (Soapwort)**

Hazardous plant parts: all parts, especially the roots.

Active principles: triterpene saponins (gypsogenol heterozides).

Mode of action: saponins disrupt cell membrane fluidity and are cytotoxic. At higher doses, they may cause nephritis and gastrointestinal disturbances. After ingestion, there is a characteristic sweet taste, which is followed by a strong burning sensation in the mouth and pharynx.

Symptoms of intoxication: nausea, vomiting, stomach pain, central nervous system excitation, convulsions, respiratory arrest.



***Phytolacca americana* L. (Pokeweed)**

Hazardous plant parts: roots, leaves.

Active principles: lectins, phytolaccatoxin (triterpene saponins).

Mode of action and symptoms: saponins disturb membrane fluidity and are cytotoxic, symptoms include vomiting, diarrhoea, stomach cramps, weakened pulse, in severe cases breathing difficulty, convulsions, death.

ANTHRACENE DERIVATIVES



***Hypericum perforatum* L., St. John's wort**

Hazardous plant parts: all parts.

Active principles: hypericin, protohypericin, pseudohypericin .

Mode of action and symptoms: inflammation occurs on sun-exposed skin, edema, exudate, pruritus, painful erythema up to necrosis; psychomotor excitations, general restlessness, confusion, depression, mania, hyperactivity, painful erythema up to necrosis; psychomotor

excitations, general restlessness, confusion, depression, mania, hyperactivity.

COUMARINS



***Ruta graveolens* L., Rue**

Hazardous plant parts: all parts.

Active principles: bergapten, psoralen (furanocoumarins), kokusa-genine, skimmianine, rutamine dictamine (quinoline alkaloids).

Mode of action and symptoms: furanocoumarins and alkaloids intercalate and alkylate DNA, strong skin irritant, blister formation, itching, internally: salivation, gastroenteritis, irritation of GI tract, narcotic, abortifacient, haematuria, visual distortion.

RESINS

***Humulus lupulus L., Hop***

Hazardous plant parts: strobiles (female flowers).

Active principles: phytoestrogens (8-prenylnaringenin), bitter resinous substances (humulone, lupulone).

Mode of action and symptoms: nervous system inhibition, dermatitis, nausea, vomiting, stomach pain, dizziness, drowsiness. Symptoms of „hop-pickers” may occur when harvesting the plant product: drowsiness, sweating, restlessness, fear, fever, pain in the heart area, shortness of breath and eczema.

LECTINS

***Robinia pseudoacacia L., Black locust***

Hazardous plant parts: all parts, especially roots, bark, fruits.

Active principle: robin (a lectin), tannins.

Mode of action, symptoms: the lectin has agglutinating properties

and is cytotoxic, nausea, vomiting, diarrhoea, sleepiness, mydriasis,

seizures, abdominal pain, parenteral application

can cause life- threatening multisystem organ failure.

VOLATILE OILS

***Tanacetum vulgare L., Tansy***

Hazardous plant parts: aerial parts, especially flowers.

Active principle: thujone and other monoterpenes.

Mode of action, symptoms: thujone is neurotoxic and cytotoxic, at higher doses the essential oil causes strong spasms, vomiting, gastroenteritis, convulsions, arrhythmia, mydriasis, uterine bleeding, miscarriage (abortifacient), kidney and liver disturbance, death through cardiac and respiratory arrest.

***Artemisia absinthium* L., Wormwood**

Hazardous plant parts: aerial parts at flowering stage.

Active principle: (-) α - thujone, (+) β - thujone, isothujone.

Mode of action, symptoms: agitation, mental disturbance, memory loss, nausea, vomiting, diarrhea, abdominal epigastric pain, tremor, urinary retention, hallucinations, seizures, loss of awareness.

4.1. PLANTS WITH ALLERGIC POLLEN

Pollinosis or pollen allergy is a disease caused by an allergic reaction to the different types of pollen present in the atmosphere, which penetrate the body through the mucous membranes exposed to the air, producing respiratory processes such as rhinitis and asthma. Pollinosis is defined as the appearance of respiratory symptoms (rhinoconjunctivitis and/or asthma) as a result of the inhalation of pollen to which the individual is sensitized. It is well known that allergic rhinitis and asthma are very common in the general population, the estimated prevalence being 15-25%, though the figures may vary according to patient age and geographical distribution.

Pollen allergy is considered a major public health problem that causes morbidity and subsequently affects a patient's quality of life. Pollen due to their large size cannot enter the thoracic regions of the respiratory tract but can affect the nasopharyngeal mucous membrane. At the same time, the submicronic-pollen particles can act as respirable particles reaching deeper into the upper airways leading to exacerbation of asthma, chronic obstructive pulmonary disease and other allergic reactions. Based on the existing literature, expanding evidence shows that climate change and air pollutants could affect the pollen number, morphology, season, allergen content, and distribution pattern. Hence, this will influence the prevalence and occurrence of allergies linked to pollen exposure.

In Europe, the severity of ragweed pollinosis varies according to geographical region. Positive results of skin prick test or positive RAST reactions to ragweed allergens in pollen allergic patients reached the following values: Hungary, more than 80%, northern Italy, nearly 70%, France, 30%, Czech Republic, about 35%, Austria, about 30%, and southern Switzerland, 17%. The high frequency of sensitization might be caused by the apparent high degree of cross-reactivity with various other members of the family Asteraceae, and the families Poaceae and Betulaceae.

Climate change and anthropogenic environmental factors significantly alter and prolong pollen emission seasons and production rates. Due to global warming, warmer temperature has been constantly observed over the past decades. The increase in temperature has shifted the start of pollen seasons by 3-22 days in advance for spring-flowering taxa and delayed by 27 days for late-flowering taxa, therefore extending the duration of pollen seasons.

A total of 34 species with allergenic potential were identified in the SPCMP collection, including 27 tree and shrub species and 7 herbaceous species. Among these, one species exhibits low allergenicity, 16 show moderate allergenicity, and 17 are characterized by a high degree of allergenicity.

SOURCES OF ALLERGENIC POLLEN AND POLLEN CALENDAR

No	Latin name	Family	Flowering period	Allergen rate
TREES AND SHRUBS				
1.	<i>Corylus avellana</i> L.	Corylaceae	II-III	High
2.	<i>Berberis vulgaris</i> L.	Berberidaceae	III-IV	High
3.	<i>Betula pendula</i> L.	Betulaceae	III-IV	High
4.	<i>Juniperus sabina</i> L.	Cupressaceae	III-IV	High
5.	<i>Mahonia aquifolium</i> (Pursh) Nutt.	berberidaceae	III-IV	High
6.	<i>Salix babylonica</i> L.	Salicaceae	III-IV	High
7.	<i>Salix caprea</i> L.	Salicaceae	III-IV	High
8.	<i>Fraxinus excelsior</i> L.	Oleaceae	III-IV	High
9.	<i>Aesculus hippocastanum</i> L.	Sapindaceae	IV-V	Moderate
10.	<i>Cercis siliquastrum</i> L.	Fabaceae	IV-V	Low
11.	<i>Fagus sylvatica</i> L.	Fagaceae	IV-V	Moderate
12.	<i>Juglans regia</i> L.	Juglandaceae	IV-V	High
13.	<i>Morus alba</i> L.	Moraceae	IV-V	High
14.	<i>Populus alba</i> L.	Salicaceae	IV-V	High
15.	<i>Populus nigra</i> L.	Salicaceae	IV-V	High
16.	<i>Syringa vulgaris</i> L.	Oleaceae	IV-V	Moderate
17.	<i>Quercus robur</i> L.	Fagaceae	IV-V	High
18.	<i>Viburnum opulus</i> L.	Caprifoliaceae	IV-V	Moderate
19.	<i>Robinia pseudoacacia</i> L.	Fabaceae	V-VI	Moderate
20.	<i>Ginkgo biloba</i> L.	Ginkgoaceae	V-VI	Moderate
21.	<i>Pinus sylvestris</i> L.	Pinaceae	V-VI	Moderate
22.	<i>Pinus nigra</i> J.F.Arnold	Pinaceae	V-VI	Moderate
23.	<i>Thuja occidentalis</i> L.	Cupressaceae	V-VI	High
24.	<i>Lonicera caprifolium</i> L.	Caprifoliaceae	V-VI	Moderate
25.	<i>Tilia tomentosa</i> Moench	Tiliaceae	VI-VII	Moderate
26.	<i>Ligustrum vulgare</i> L.	Oleaceae	VI-VII	High
27.	<i>Symphoricarpos orbiculatus</i> Moench	Caprifoliaceae	VI-VII	Moderate

HERBACEOUS MEDICAL PLANTS AND WEED

28.	<i>Phleum pratense</i>	Graminaceae	V-VIII	High
29.	<i>Plantago lanceolata</i> L.	Plantaginaceae	V-VIII	Moderate
30.	<i>Plantago major</i> L.	Plantaginaceae	V-VIII	Moderate
31.	<i>Chenopodium album</i> L.	Chenopodiaceae	VI-IX	Moderate
32.	<i>Solidago canadensis</i> L.	Asteraceae	VII-VIII	Moderate
33.	<i>Ambrosia artemisiifolia</i> L.	Asteraceae	VII-IX	High
34.	<i>Artemisia vulgaris</i> L.	Asteraceae	VII-X	Moderate



***Ambrosia artemisiifolia* L.**

Ambrosia artemisiifolia L. (Ragweed) is one of the most dangerous and invasive species to agricultural crops, human health and local biodiversity, native to North America, which has been present in Europe since 1860. In the last 20 years, the species has experienced an accelerated spread, mainly due to the severe allergies it causes during flowering. Pollen, produced during the ragweed's flowering period in July-September, is considered a strong allergen. A mature ragweed plant can release up to 8 billion microscopic pollen grains, 20 microns in diameter. The species affects both children and adults, mainly through rhinoconjunctivitis, manifested by frequent sneezing, itching of the nose, itching of the eyes, stuffy nose, profuse nasal discharge, red eyes (conjunctival hyperemia), asthma attacks, coughing, shortness of breath; itching of the skin (urticaria), eczema, anaphylactic shock - the most severe allergic reaction, with sudden onset, which can lead to death, requiring urgent medical intervention. Measures to prevent and eradicate ragweed include both legislative and informational measures for the population to identify the species, eradicate it and avoid contact with it during the flowering period.

V. METHODS OF PHYSICO-CHEMICAL AND BIOLOGICAL ANALYSIS

5.1. CONDITIONS FOR HARVESTING VEGETAL PRODUCTS

The plant raw material used in the pharmaceutical industry is represented by medicinal plant products, which, due to the particularities of their chemical compounds, after biosynthesis, accumulate active principles with various pharmacotherapeutic properties. The harvesting of plant products is an important stage in the complex of work involved in ensuring their conditioning and quality in strict compliance with pharmacopoeial requirements.

Harvesting of plant products is carried out only from well-developed plants that are not affected by insects or microorganisms.

The leaf buds are harvested during the resting period of the plant: from late winter or early spring (January to March), when the plants are intensifying their vegetative activity and the buds are swollen but have not yet started to grow.

The bark is the totality of the tissues between the suber and cambium. It is harvested in spring, until the first leaves begin to form, when it is slightly detached from the woody part (April - the beginning of May).

The leaves are harvested when fully developed, mostly in spring until the beginning of flowering, when the leaves reach maturity. Leaves shall be harvested with or without petiole, depending on the requirements of the Analytical Standards Documentation. Sometimes, the aerial parts are mown and the leaves are removed after wilting (nettle) or after drying (peppermint).

Flowers are harvested from the time of budding and throughout the flowering period. They are harvested by hand or cut (hawthorn), special harvesting machines are used in plantations (chamomile). The product name refers to whole inflorescences and solitary, fully developed flowers. The flower buds are harvest-

ed before flowering (japanese pagoda tree).

The aerial parts refer to the entire above-ground portion of the herbaceous plant, consisting of the stem with leaves and flowers, and sometimes also with fruits. They are harvested during the flowering period some at the beginning of flowering (wormwood, three-lobe beggarticks, motherwort, lily of the valley), others at the end of flowering, before the fruits fall (spring pheasant's eye). In some plants, the entire above-ground part is cut, while in others only the tips or side branches are collected (wormwood, three-lobe beggar ticks, sweet yellow clover).

The fruits and seeds are harvested when fully ripe, less often when 60–70% of the fruits are browned (coriander, castor bean, flax, mustard greens). When harvesting dry fruits, the aerial parts are mowed, dried in sheaves, and threshed (fennel, cumin, flax). Fruits or seeds that fall easily are harvested early in the morning. Juicy fruits are picked by hand, without peduncles, fleshy ones – when fully developed (blueberry, juniper).

Underground organs of plant roots, rhizomes, tubers, and bulbs are usually harvested in autumn, rarely in spring, before the start of vegetation, when the active ingredients are concentrated in the plant products. Underground organs are removed with shovels, in plantations - with plows, potato diggers. Then the aerial part is separated and cleaned of soil.

The harvest periods of plant products from plants grown at SPCMP are presented in the Annex 4.

5.2. OPTIMIZATION OF EXTRACTION METHODS FOR ACTIVE COMPOUNDS

A fundamental requirement for ensuring a maximum concentration of active compounds in extractive products is the optimization of extraction methods. Dry extracts are obtained using various techniques such as a reflux water bath, ultrasonic bath, magnetic stirrer, and Soxhlet extractor. The extraction conditions

for phenolic compounds from the aerial parts of *Hyperici herba*, *Agrimoniae herba*, and *Cichorii herba* have been optimized, achieving optimal extraction of polyphenols and flavonoids using 50–70% ethyl alcohol as the solvent. Through the process of fractionated extraction and the spectral characterization of extractive fractions from the flowers of *Centaurea cyanus*, the necessity of successive extraction with chloroform and ethyl alcohol to remove chlorophyll was demonstrated.

Currently, experimental design methods are widely used in comparative studies of extraction techniques. The use of a fractional D-optimal experimental design with three factors and two levels demonstrated that the maximum content of active compounds in *Cynarae folium* is obtained through ultrasound-assisted extraction. Employing a fractional experimental design of resolution V+ with five factors and two levels (2^{5-2}), the optimal working conditions were identified as follows: extraction temperature of 80°C, extraction time of 30 minutes, solvent concentration of 70% ethyl alcohol, and an amplitude of 100 kHz.

5.3. IDENTIFICATION AND QUANTITATIVE DETERMINATION OF ACTIVE PRINCIPLES

In the chemical analysis of plant products, a variety of analytical methods are used, including identification, precipitation, and color reactions, as well as titrimetric and gravimetric techniques. However, the current trend is shaped by the use of physico-chemical methods such as spectral, electrochemical, and chromatographic analysis. By applying specific qualitative reactions, the presence of flavonoids, hydroxycinnamic acids, tannins, saponosides, and anthracene derivatives was highlighted in the plant materials *Cynarae folium*, *Hyperici herba*, *Agrimoniae herba*, *Cichorii herba*, *Centaureae flos*, and *Rubi fruticosi fructus*. Thin-layer chromatography further revealed the presence of

polyphenolic constituents such as rutin, isoquercitrin, apigenin, biapigenin, catechin, epicatechin, quercetin, pyrogallol, caffeic acid, chlorogenic acid, and gallic acid.

Using UV–VIS spectrophotometry, the total polyphenol content (mg GAE/g) was quantified with the Folin–Ciocalteu reagent, and the flavonoid content (mg RU/g) was determined using aluminum chloride in plant products from the center's collection. The results indicate higher concentrations in St. John's wort flowers (*Hyperici flos*) and agrimony (*Agrimoniae herba*), followed by the aerial parts of chicory (*Cichorii herba*), artichoke leaves (*Cynarae folium*), and hyssop flowers (*Hyssopi flos*) (figure 2).

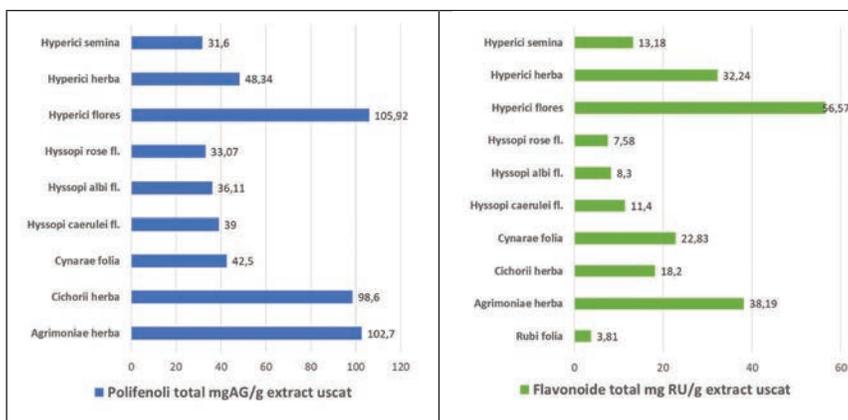


Figure 2. Total polyphenols (mg AG/g) and total flavonoids (mg RU/g) in herbal products from the SPCMP collection

Using complementary methods, the quantification of hydroxycinnamic acids was carried out as follows: the content recalculated as caffeic acid equivalent using the Arnou reagent in plant materials, according to the European Pharmacopoeia, which showed the highest levels in *Hyperici herba* and *Hyperici flos*, followed by *Agrimoniae herba* and *Hyssopi flos* (white-flowered form).

A method performed on extractive solutions obtained with 30% ethyl alcohol, in which the hydroxycinnamic acids were expressed as chlorogenic acid equivalent (%), with the highest content observed in *Cichorii herba*.

A method performed on extractive solutions obtained with 20% ethyl alcohol from the examined products, recalculated as caffeic acid, according to the requirements of the Belarusian Pharmacopoeia, where *Cichorii herba* again showed the highest levels.

RESULTS OF HYDROXYCINNAMIC ACID DOSAGE BY COMPLEMENTARY METHODS

	Extractive Product	With Arnow reagent; expressed in mg caffeic acid/g	With ethyl alcohol 30%; in recalculation to chlorogenic acid, (%)	With ethyl alcohol 20%; in recalculation to caffeic acid, (%)
1.	<i>Agrimoniae herba</i>	3.67±0.011	3.78±0.251	3.107±0.014
2.	<i>Cichorii herba</i>	1.48±0.024	13.22±0.114	10.938±1.115
3.	<i>Cynarae folium</i>	1.3±0.187	2.75±1.025	1.968±0.452
4.	<i>Rubi fruticosi folium</i> (Arapaho)	2.01±0.014	2.65±0.874	2.031± 0.072
5.	<i>Rubi fruticosi folium</i> (Triple Crown)	1.97 ± 0.101	2.38± 0.115	1.968±1.014
6.	<i>Hyssopi herba</i> (with blue flowers)	2.851±0.014	3.472±0.014	2.222±0.118
7.	<i>Hyssopi herba</i> (with white flowers)	3.014±0.023	3.217±0.052	2.092±0.011
8.	<i>Hyssopi herba</i> (with pink flowers)	2.915±0.157	3.089±0.411	1.998±0.134
9.	<i>Hyperici herba</i>	3.80±0.012	3.51±0.088	1.721±1.005
10.	<i>Hyperici flos</i>	3.48±0.081	3.023±0.011	1.721±0.514

HPLC analysis of artichoke leaves identified seven compounds in decreasing order of abundance: chlorogenic acid, caffeic acid, apigenin, luteolin, ferulic acid, p-coumaric acid, and

gentisic acid. In the inflorescences, only four compounds were identified and quantified: chlorogenic acid, apigenin, luteolin, and caffeic acid. HPLC screening of the aerial parts of *Centaurea cyanus* revealed the presence of phenylpropanoic acids, flavones, and flavonols, and enabled the quantitative determination of hyperoside, apigenin, and chlorogenic acid.

HPLC analysis performed on a Shimadzu LC-20AD chromatograph equipped with an SPD-20A UV detector, using a Zorbax Eclipse Plus C18 stationary phase and two mobile phases—(I) methanol: water (40:60) with gradient elution, and (II) 0.5% orthophosphoric acid:acetonitrile (80:20) with isocratic elution—at detection wavelengths of 280, 325, and 360 nm, showed that *A. eupatoria* is richer in tannins (epicatechin), while *C. intybus* contains higher levels of hydroxycinnamic acids (cichoric, chlorogenic, caffeic acids). Flavonoids were identified in the extracts of agrimony and chicory, including rutin, quercetin, apigenin, and luteolin.

The direction of phytochemical and phytotherapeutic research is based on demonstrating the efficacy of volatile-oil constituents as antimicrobial agents. A major challenge in studying volatile oils lies in the complexity of extraction and separation technologies. It was shown that the volatile-oil content in the fresh aerial parts of St. John's wort collected from the wild is 0.303%, while samples from the SPCMP collection contain 0.204%. Gas chromatography–mass spectrometry of the volatile oil from *Hyperici herba* harvested from natural flora identified 97 components, 33 of which account for 82.26% of the total composition. The major constituents were β -caryophyllene, germacrene D, β -pinene, and β -cis-ocimene. In contrast, the volatile oil of *Hyperici herba* from the SPCMP collection is dominated by germacrene, β -caryophyllene, and bicyclogermacrene. These results demonstrate that the content and chemical composition of the volatile oil from the aerial parts of *H. perforatum* are influenced by environmental growth conditions.

The assessment of habitat effects on the antioxidant capacity of plant extracts and the evaluation of abiotic stress on photosynthesis and CO₂ emissions in species of *Galium* and *Helichrysum* is being conducted through a bilateral research project in partnership with Romania: The impact of different habitats and abiotic stress factors on plant metabolites in the genera *Galium* and *Helichrysum*, project no. PN-IV-P8-8.3-ROMD-2023-0022.

5.4. DETERMINATION OF ANTIOXIDANT ACTION

The high content of plant compounds with antioxidant properties capable of scavenging free radicals has stimulated interest in their use in both preventive and therapeutic phytotherapy. In recent years, considerable attention has been devoted to antioxidants and their association with multiple health benefits, with many studies focusing on polyphenolic compounds. Antioxidants have the ability to inhibit the harmful action of free radicals - molecules containing an unpaired electron on their outer orbital - thereby protecting the human body from their damaging effects. They inhibit oxidative chain reactions by acting as hydrogen donors or free-radical acceptors, generating more stable radical species.

Antioxidants, most of which possess phenolic structures, interact through a variety of mechanisms, including metal ion binding, scavenging reactive oxygen species, converting hydroperoxides into non-radical species, absorbing UV radiation, or deactivating singlet oxygen. So far, various chemical assays combined with sensitive detection technologies have been used to evaluate antioxidant activity through specialized methods such as radical scavenging assays targeting different types of free radicals, reducing power tests, and metal-chelating assays.

To determine the antioxidant activity of plant extracts obtained from materials collected from the SPCMP collection, complementary techniques were applied: DPPH, ABTS, and iron-chelating assays.

The DPPH test indicates pronounced antioxidant activity for the extract from *H. perforatum*, followed by *H. officinale*, *A. eupatoria* and *R. fruticosus*. Using the ABTS radical-neutralization method, *A. eupatoria* shows strong antioxidant activity, ranking highest among the extracts, followed by *C. scolyumus* and *C. intybus*. The iron-chelating capacity, assessed in comparison with EDTA, shows the highest activity in the extract of *A. eupatoria*, followed by *C. intybus*, *C. scolyumus*, *H. perforatum*, *H. officinalis* and *R. fruticosus*.

RESULTS OF DETERMINING ANTIOXIDANT ACTIVITY IN PLANT EXTRACTS

Nr.	Species	dry extract	$\mu\text{M TEAC /g}$	DPPH, $\text{IC}_{50} \mu\text{g/ml}$	Iron chelating capacity, %
1.	<i>Agrimonia eupatoria</i>	aerial parts	59.18 \pm 0.30	45.55 \pm 0.01	88.07 \pm 0.74
2.	<i>Cynara scolyumus</i>	leaves	57.15 \pm 0.05	92.27 \pm 0.1	48.5 \pm 0.6
3.	<i>Cichorium intybus</i>	aerial parts	31.29 \pm 0.25	90.79 \pm 0.04	45.7 \pm 1.12
4.	<i>Hyssopus officinale</i>	aerial parts	29.72 \pm 0.11	34.77 \pm 1.2	33.1 \pm 0.33
5.	<i>Hypericum perforatum</i>	aerial parts	22.74 \pm 0.01	19.08 \pm 0.64	45.7 \pm 1.12
6.	<i>Rubus fruticosus</i>	fruits	14.41 \pm 0.1	215.44 \pm 0.1	27.32 \pm 0.9
		leaves	10.5 \pm 0.78	45.39 \pm 0.1	31.3 \pm 1.1
7.	<i>Standard</i>			Trolox 5.25	EDTA 99.03 \pm 1.2

It was found that extracts from plant products harvested from the SPCMP collection can prevent the oxidative action of free radicals by capturing or inhibiting them, as follows, in decreasing antioxidant potential: *A. eupatoria* > *C. inthybus* > *R. frucicosus* > *H. perforatum* > *C. scolyumus*, the data being correlated with the content of polyphenolic compounds.

5.5. EVALUATION OF ANTI-INFLAMMATORY ACTIVITY

To evaluate anti-inflammatory activity, technical *in vitro* and *in vivo* methods were applied using laboratory animals. Paw edema was induced in rats for extracts obtained from the aerial parts of *C. cyanus* and from the aerial parts and flowers of *H. perforatum*. In addition, the inhibitory activity on the production of pro-inflammatory cytokines—interleukin-1 β , interleukin-8, and tumor necrosis factor- α —was determined *in vitro* for the extract obtained from *C. scolymus* leaves. These studies represent a preliminary stage prior to clinical testing.

The anti-inflammatory activity of the polyphenolic extracts from the aerial parts of *C. cyanus* was assessed *in vivo* by inducing hind-paw edema in rats. Both extracts demonstrated efficacy under conditions of acute inflammation. The polyphenolic extract exhibited a pronounced anti-inflammatory effect, comparable to that of sodium diclofenac, a nonsteroidal anti-inflammatory drug used as a standard. Administration of the tested extracts in induced inflammation produced a positive influence on hematological parameters.

The anti-inflammatory activity of dry extracts from *Hyperici flos* and *Hyperici herba* was also evaluated *in vivo*. The dry extracts were administered intraperitoneally at doses of 50–200 mg/kg. It was demonstrated that the extract from the aerial parts produced stronger inhibition of inflammation compared with the extract from the flowers.

The inhibitory activity of *C. scolymus* from the SPCMP collection on the production of pro-inflammatory cytokines - interleukin-1 β , interleukin-8, and tumor necrosis factor- α (TNF- α) was determined using an *in vitro* model of human neutrophils stimulated with lipopolysaccharides. Initially, the influence on cell viability was assessed, using dexamethasone as the control. Secretion of IL-1 β was significantly inhibited at doses of 10 μ g/mL and 20 μ g/mL. A similar trend was observed for TNF- α . Moreover, the inhibitory effects on IL-8 production were superior to those

of the positive control dexamethasone at the same concentration (IL-8 levels of $28.41 \pm 5.17\%$ relative to LPS-stimulated cells).

5.6. EVALUATION OF BACTERIOSTATIC, BACTERICIDAL, AND ANTIFUNGAL EFFECTS

The use of natural antimicrobial compounds has gained significant attention in the pharmaceutical industry, largely due to the growing problem of antibiotic resistance. Several medicinal plants from the SPCMP collection have demonstrated the ability to suppress the growth and development of a wide range of microorganisms, including strains with high levels of resistance to tetracyclines, aminoglycosides, erythromycin, chloramphenicol, and others.

Antimicrobial activity was evaluated using the serial dilution method, determining the minimum inhibitory concentration (MIC, mg/mL) and minimum bactericidal concentration (MBC, mg/mL). The concentrations tested were 0.078, 0.156, 0.312, 0.625, 1.25, 2.5, and 5 mg/mL (table 3). The extracts obtained by maceration from *Agrimoniae herba*, *Cichorii herba*, *Cynarae folium*, *Hyperici flos*, *Hyperici herba*, *Galii veri herba*, and *Rubi fruticosi folium* were dissolved in physiological saline (10 mg/mL).

The following reference strains were used: *Staphylococcus aureus* (ATCC 25923), *Enterococcus faecalis* (ATCC 19433), *Escherichia coli* (ATCC 25922), *Proteus mirabilis* (ATCC 3177), *Pseudomonas aeruginosa* (ATCC 27853), *Bacillus cereus* (ATCC 11778) and *Acinetobacter baumannii* (ATCC 17978).

The antimicrobial activity of the tested extracts was determined by the serial dilution method, which allowed establishing the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC). The results demonstrate antimicrobial activity against *S. aureus*, with MIC values ranging from 0.156 mg/mL for *A. eupatoria* to 2.5 mg/mL for *C. intybus*. Corresponding MBC values ranged from 0.625 to 5.0 mg/mL.

Against *B. cereus*, the most active extract was from the aerial parts of *H. perforatum* (MIC 0.07 mg/mL; MBC 0.156 mg/mL). For *A. baumannii*, antibacterial activity was observed for *A. eupatoria* extract (MIC 2.5 mg/mL; MBC 5 mg/mL) and for *R. fruticosus* leaves (MIC 5 mg/mL).

Antifungal activity against *Candida albicans* (ATCC 10231) was exhibited only by the extract from *C. scolyumus* (MIC 5 mg/mL; MBC 5 mg/mL).

It is noteworthy that the plant extracts studied did not show antibacterial activity against *E.coli*, a Gram-negative strain, and were generally more active against Gram-positive strains (*S. aureus*, *B. cereus*).

ANTIBACTERIAL AND ANTIFUNGAL ACTIVITY OF ETHANOLIC EXTRACTS

Herbal product	<i>E. coli</i>		<i>S. aureus</i>		<i>B.cereus</i>		<i>A.bau-mannii</i>		<i>C. albicans</i>	
	MIC	MBC	MIC	MBC	MIC	MBC	MIC	MBC	MIC	MBC
1. Agri-moniae herba	-	-	0.156	0.625	0.312	0.625	2.5	5	-	-
2. Cichorii herba	-	-	2.5	5	2.5	5	-	-	-	-
3. Cynarae folium	-	-	0.312	1.25	0,156	0.312	-	-	5	5
4. Hyperici flos	-	-	0.625	1.25	0.156	0.312	-	-	-	-
5. Hyperici herba	-	-	0.312	2.5	0.07	0.156	-	-	-	-
6. Galii veri herba	-	-	-	-	2.5	5	-	-	-	-
7. Rubi fruticosi folium	-	-	0.625	2.5	0.312	0.625	5	-	-	-

Note: MIC – Minimum inhibitory concentration;
MBC – Minimum bactericidal concentration

The antibacterial activity of plant extracts rich in phenolic compounds may be attributed to their high permeability through the bacterial cell wall. In addition, phenolic compounds are known to inhibit the activity of protease enzymes that degrade the bacterial cell wall and plasma membrane.

The antibacterial action of plant extracts against *S. aureus* also helps explain the beneficial effects of plant-based extracts in the treatment of psoriasis and eczema. Furthermore, evaluation of scientific data, together with our own findings, indicates that antibacterial activity depends on the plant part used, the nature of the extractive compounds, and the solvent. Studies show that ethanolic plant extracts are generally more effective against Gram-positive bacteria.

Another antibacterial investigation demonstrated that volatile oil of *H. perforatum* L. exhibits strong bacteriostatic activity against Gram-positive microorganisms, with a concentration of 0.0009% for *S. aureus* (209-P) and 0.125% for *E. faecalis*. The bactericidal activity against *S. aureus* (209-P) is 0.0037%, and against *E. faecalis* is 0.25%. For Gram-negative microorganisms - *E. coli* (ATCC 25922), *P. vulgaris* (HX 19222), and *P. aeruginosa* (ATCC 27853) - the bacteriostatic and bactericidal concentrations of the volatile oil exceed 0.5%. Thus, the volatile oil from *Hyperici herba* demonstrated antifungal properties against all tested fungi at concentrations up to 0.5%.

5.7. EVALUATION OF VIABILITY AND CYTOTOXICITY ON ISOLATED HEPATOCYTES USING THE MTT TECHNIQUE

In the extracts obtained from aerial parts of *A. eupatoria* and *C. intybus* considered practically non-toxic both for enteral and parenteral administration: (LD25% = 4412 mg/kg for the extract from *Agrimoniae herba*); (LD50% >5000 mg/kg for the extracts from *Agrimoniae herba* and *Cichorii herba*), according to the TG 423 method (Acute Toxic Class Method) which characterized the

extracts as practically inoffensive: toxicity class 5, the viability and cellular cytotoxicity of hepatocytes were determined *in vitro*. Hepatocytes isolated from rats, in two stages according to the protocol, were treated with the MTT reagent (3-(4,5-dimethylthiazole)-2,5-diphenyl-2H-tetrazolium bromide), then with extracts of *Agrimoniae herba* and *Cichorii herba* in concentrations of 100 mg, 200 mg, 600 mg, 1000 mg, with subsequent measurement of absorbance and calculations. The method was based on the ability of succinate dehydrogenase from hepatocyte mitochondria in isolated cells to reduce the soluble tetrazolium salts to insoluble formazan with the formation of a red-violet colour.

The cell viability of hepatocytes treated with extract of *Agrimoniae herba* and *Cichorii herba* in doses of 100 mg and 200 mg are similar and constitute 92% and 76% respectively compared to the control group; the dose of 600 mg presents 77.1% for *Agrimoniae herba* and 57.2% for *Cichorii herba* respectively. The lowest cell viability was attested at the concentration of 1000 mg, being 41.6% for *Cichorii herba* and 49.9% for *Agrimoniae herba*, a dose considered with high cytotoxic action. Thus, doses of 100-600 mg obtained from aerial parts of *A. eupatoria* and *C. intybus* manifest cell viability and do not affect liver cells, respectively, they can be used in further studies. A review of the literature suggests that herbal medicines with anti-oxidant potential may protect the liver from CCl₄ - induced injury, a condition that induces toxic hepatotoxicity in laboratory animal models. One of the main mechanisms underlying this hepatitis model is lipid peroxidation, which plays a crucial role in liver damage.

5.8. BIOCHEMICAL AND HISTOPATHOLOGICAL EVALUATION OF PLANT EXTRACTS

The liver is an essential organ of the body, the most complex factory, which performs multiple functions indispensable for the daily life of the human body, playing a significant role in the

metabolism of carbohydrates, proteins, fats, steroids and drugs, as well as in the detoxification of exogenous and endogenous metabolites. Liver damage can be caused by oxidative stress induced by free radicals, drugs and the infiltration of pathogens such as viruses and bacteria. Therefore, any impairment of its function has serious implications for the health of the affected person. Acute and chronic hepatitis remain significant global health challenges, and this underlines the urgent need to explore and evaluate potential treatments. Investigating medicinal plants from collections and the spontaneous flora that may provide hepatoprotective benefits is a promising avenue. Such research is not only important from a medical and social perspective, due to its potential to improve the well-being of individuals and communities, but also from an economic perspective, given its potential to lead to the development of cost-effective and accessible treatments.

From the plant and extractive products from the SPCMP collection, the study of the hepatoprotective activity of extracts obtained from aerial parts of *A. eupatoria* and *C. intybus* was carried out, administered by gavage, in doses of: 100 mg/kg; 200 mg/kg; 400 mg/kg body, on a model of toxic hepatitis, induced with an oily solution of carbon tetrachloride (CCL₄) in laboratory animals (rats), with subcutaneous administration at a dose of 0.4g/100 g per kg body, for 7 consecutive days with the determination of:

- *Indices of protein metabolism* (alanine aminotransferase (ALT), aspartate aminotransferase (AST), total protein (TP), albumin, creatinine, urea and gamma-glutamyl transferase (γ -GTP),
- *Mineral metabolism indices*: calcium, phosphorus, alkaline phosphatase.
- *Carbohydrate and thiodisulfide metabolism indices*: glucose, thiol SH-groups.
- *Lipid metabolism and lipid peroxidation indices*: cholesterol, triglycerides.

For histological analysis, organs harvested from white rats (liver, heart, spleen, kidneys, brain, lungs) were weighed and sampled. Staining was performed with hematoxylin-eosin, and the samples were visualized by optical microscopy (H-Ex90).

Severe necrotic liver lesions induced by CCl_4 were significantly reduced by the administration of *Agrimoniae herba* and *Cichorii herba* extracts at doses of 100, 200 and 400 mg/kg. Thus, the medication of toxic hepatitis with *Agrimoniae herba* and *Cichorii herba* extracts contributes to the reduction and normalization of biochemical and histopathological indices, through interactions between the studied extracts and cell membranes at an important frontier of cell biology, at doses of 100, 200 and 400 mg/kg body weight.

ANNEX 1

**IMPLEMENTATION OF THE RESULTS
SCIENTIFIC IMPACT AND RECOGNITION**

Based on the experimental results obtained, the pharmacopoeial monograph „Aerial parts of Cornflowers *Cyani herba*, plant product 50g” and the pharmacopoeial monograph „Artichoke leaf, 50 g” were developed and approved, implemented at the local pharmaceutical enterprise, drug manufacturer „Medfarma” LLC; the pharmacopoeial monograph and technological regulations for production „Artichoke tablets, 5 mg”, implemented at the local pharmaceutical enterprise „RNP Pharmaceuticals”.

Based on the experimental results obtained, the draft pharmacopoeial monographs for the plant product *Hyperici perforati flos* and for the dry extract *Hyperici perforati flos extractum sicum* were developed. The results of the study were implemented: in the didactic and instructional process within the Department of Pharmacognosy and Pharmaceutical Botany; in the scientific and practical process within the Center for Drug Development and within the SPCMP of the “Nicolae Testemitanu” SUMPh.

PATENTS AND OTHER INTELLECTUAL PROPERTY OBJECTS

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2. Balan V., Dodica D., Pompuș I., Șarban V., Guci I. Patent of invention. ***Blackberry branching process***: short-term MD patent no. 1442. Filing no.: s 2019 0126. Publ. date: 31.07. 2020. In: BOPI no. 7/2020.
3. Benea A., Dizdari A., Sava V. Innovator’s Certificate No. 519. For the innovation entitled: ***Essential oil from Hypericum***

- perforatum with antistaphylococcal effect*, registered on 19.02.2013 USMF „Nicolae Testemițanu”.
4. Benea A., Parii S. ***Pharmacological research of dry extracts and volatile oil from Hypericum perforatum L.*** Series O, no. 6918. of 02.06.21.
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 8. Hovanet M., Anghel A., Nicolescu, T., Cojocaru-Toma M., Calalb T. ***Process for obtaining an extract of plant origin for the treatment of neuropathic pain associated with chemotherapy.*** RO. (11) 131712 A0 (51) A61K 36/81 (2006.01) (21) a 2016 00489 (22) 05/07/2016 (41) 30/03/2017//3/2017.71). Published in BOPI-inventions section, no. 9/2021 dated 30.09.2021.
 9. Melnic V., Peleah E. ***Patent application. Plant variety Helihrisum italicum (Imortela) Auriu 21***, No. V 2021 0008 dated 2021.02.26.
 10. Melnic V., Peleah E. Patent for plant variety no. 337. ***Mentha piperita L., variety Victoria***, granted by the State Agency for Intellectual Property, 31.03.2020.
 11. Melnic V., Peleah E. ***Plant variety patent no. 340, Mentha longifolia L., variety Speranța-2017***, granted by the State Agency for Intellectual Property, 31.03.2020.

*ANNEX 2***WORKSHOPS AND PRACTICAL ACTIVITIES****Workshops organized within the SPCMP**

Workshop organized within the framework of the 10th International Congress for students, doctoral candidates and young doctors “MedEspera” in the Center’s collection: “Medicinal plants containing volatile oils in phytotherapy from the SPCMP collection of the “Nicolae Testemitanu” SUMPh, during the period, April 24-27, 2024.

Workshop organized within the anniversary Congress of “Nicolae Testemitanu” SUMPh “80 years of innovation in health and medical education”, with the theme: “Complementary treatment of cardiovascular diseases with native phytotherapeutic products”, during the period, October 20-22, 2025.

Practical activities within the Workshop



Visit of collaborators from the University of North Carolina, Eshelman School of Pharmacy in Chapel Hill, USA



ANNEX 3

LATIN, ENGLISH, ROMANIAN AND RUSSIAN NAMES OF THE PLANTS FROM THE COLLECTION

Nr.	Species names				Family
	Latin	English	Romanian	Russian	
1.	<i>Abies nordmanniana</i> (Steven) Spach	Nordmann fir	Brad nordic	Пихта Нёрдманна	Pinaceae
2.	<i>Achillea millefolium</i> L.	Milfoil	Coada-șoricelului	Тысячелистник обыкновенный	Asteraceae
3.	<i>Acorus calamus</i> L.	Calamus	Obligeană	Аир обыкновенный	Araceae
4.	<i>Adonis vernalis</i> L.	Spring pheasant's eye	Rușcuță-de-primăvară	Горицвет весенний	Ranunculaceae
5.	<i>Aesculus hippocastanum</i> L.	Horse chestnut	Castan	Конский каштан	Sapindaceae
6.	<i>Aesculus carnea</i> Hayne	Red horse chestnut	Castan roșu	Конский каштан мясо-красный	Sapindaceae
7.	<i>Agrimonia eupatoria</i> L.	Stickwort	Turiță-mare	Репешок обыкновенный	Rosaceae
8.	<i>Althaea officinalis</i> L.	Marsh-mallow	Nalbă-mare	Алтей лекарственный	Malvaceae
9.	<i>Ambrosia artemisiifolia</i> L.	Common ragweed	Ambrozie	Амброзия полыннолистная	Asteraceae
10.	<i>Amygdalus communis</i> L.	Almond	Migdal	Миндаль обыкновенный	Rosaceae
11.	<i>Anethum graveolens</i> L.	Dill	Mărar	Укроп огородный	Apiaceae
12.	<i>Aralia mandshurica</i> Rupr. et Maxim.	Aralia	Aralie	Аралия маньчжурская	Araliaceae
13.	<i>Arctium lappa</i> L.	Greater burdock	Brusture	Лопух большой	Asteraceae
14.	<i>Aristolochia clematitidis</i> L.	Birthwort	Cucurbețică	Кирказон обыкновенный	Aristolochiaceae
15.	<i>Armoracia rusticana</i> Gaertn., Mey., Scherb.	Horseradish	Hrean	Хрен обыкновенный	Brassicaceae
16.	<i>Aronia melanocarpa</i> (Michx.) Elliott.	Black chokeberry	Aronie	Арония Черноплодная	Rosaceae

17.	<i>Artemisia absinthium</i> L.	Wormwood	Pelin-alb	Полынь Горькая	Asteraceae
18.	<i>Artemisia dracunculus</i> L.	Tarragon	Tarhon	Эстрагон	Asteraceae
19.	<i>Artemisia vulgaris</i> L.	Common mugwort	Pelin-negru	Чернобыльник	Asteraceae
20.	<i>Asparagus officinalis</i> L.	Garden asparagus	Sparanghel	Спаржа лекарственная	Asparagaceae
21.	<i>Atropa belladonna</i> L.	Banewort	Mătrăgună	Красавка обыкновенная	Solanaceae
22.	<i>Berberis vulgaris</i> L.	Barberry	Dracilă	Барбарис обыкновенный	Berberidaceae
23.	<i>Bergenia crassifolia</i> L.	Heart-leaf bergenia	Crăciuniță	Бадан толстолистный	Saxifragaceae
24.	<i>Betula pendula</i> Roth.	Birch	Mesteacăn	Береза повислая	Betulaceae
25.	<i>Buddleja davidii</i> Franch.	Summer lilac	Liliac de vară	Буддлея Давида	Scrophulariaceae
26.	<i>Calendula officinalis</i> L.	Pot marigold	Gălbenele	Ноготки лекарственные	Asteraceae
27.	<i>Capsella bursa pastoris</i> (L.) Medic.	Shepherd's purse	Traista-cioabanului	Пастушья сумка обыкновенная	Brassicaceae
28.	<i>Carum carvi</i> L.	Caraway	Chimion	Тмин обыкновенный	Apiaceae
29.	<i>Senna occidentalis</i> L.	Coffee senna	Simeniche	Сенна западная	Fabaceae
30.	<i>Centaurea cyanus</i> L.	Cornflower	Albăstriță	Василек синий	Asteraceae
31.	<i>Cercis siliquastrum</i> L.	Judas tree	Arborele lui Iuda	Иудино дерево	Fabaceae
32.	<i>Chamomilla recutita</i> L.	Chamomile	Mușețel	Ромашка аптечная	Asteraceae
33.	<i>Chaenomeles japonica</i> L.	Maule's quince	Gutui-japonez	Айва японская	Rosaceae
34.	<i>Chelidonium majus</i> L.	Greater celandine	Rostopască	Чистотел большой	Papaveraceae
35.	<i>Cichorium inthybus</i> L.	Common chicory	Cicoare	Цикорий обыкновенный	Asteraceae
36.	<i>Convallaria majalis</i> L.	Lily of the valley	Lăcrămioară	Ландыш майский	Asparagaceae
37.	<i>Coriandrum sativum</i> L.	Coriander	Coriandru	Кориандр посевной	Apiaceae
38.	<i>Cornus mas</i> L.	Cornelian cherry	Corn	Кизил	Cornaceae

39.	<i>Corylus avellana</i> L.	Haselnut tree	Alun	Лещина обыкновенная	Betulaceae
40.	<i>Crataegus monogyna</i> Jacq.	Hawthorn	Păducel	Боярышник однопестичный	Rosaceae
41.	<i>Cynara scolymus</i> L.	Artichoke	Anghinare	Артишок	Asteraceae
42.	<i>Datura stramonium</i> L.	Jimson weed	Ciumăfaie	Дурман обыкновенный	Solanaceae
43.	<i>Daucus carota</i> L.	Wild carrot	Morcov-sălbatic	Морковь дикая	Apiaceae
44.	<i>Digitalis lanata</i> Ehrh.	Woolly fox-glove	Degețel-lănos	Наперстянка шерстистая	Scrophulariaceae
45.	<i>Digitalis purpurea</i> L.	Purple fox-glove	Degețel-roșu	Наперстянка пурпурная	Scrophulariaceae
46.	<i>Dracocephalum moldavica</i> L.	Turkish mel-lisse	Mătăciune	Змееголовник молдавский	Lamiaceae
47.	<i>Echinacea purpurea</i> (L.) Moench.	Purple cone-flower	Echinacee	Эхинацея пурпурная	Asteraceae
48.	<i>Echinops ritro</i> L.	Southern globe thistle	Tătărnică	Мордовник обыкновенный	Asteraceae
49.	<i>Eryngium planum</i> L.	Blue eryngo	Scai-vânăt	Синеголовник плосколистный	Apiaceae)
50.	<i>Elytrigia repens</i> (L.) Nevskisyn.	Couch grass	Pir	Пырей ползучий	Poaceae
51.	<i>Ephedra distachya</i> L.	Ephedra	Cârcel	Эфедра двухколосковая	Ephedraceae
52.	<i>Filipendula ulmaria</i> L. Maxim	Meadowsweet	Crețușcă	Лабазник вязолистный	Rosaceae
53.	<i>Foeniculum vulgare</i> Mill.	Common fennel	Fenicul	Фенхель обыкновенный	Apiaceae
54.	<i>Forsythia × intermedia</i> Zabel.	Border forsythia	Forsiția sau ploaia de aur	Форзиция средняя	Oleaceae
55.	<i>Fragaria vesca</i> L.	Wild strawberry	Frag-de pădure	Земляника лесная	Rosaceae
56.	<i>Fraxinus excelsior</i> L.	Common ash	Frasin	Ясень	Oleaceae
57.	<i>Fumaria officinalis</i> L.	Fumitory	Fumăriță	Дымянка лекарственная	Papaveraceae
58.	<i>Galega officinalis</i> L.	Goat's-rue	Ciumărea	Козлятник лекарственный	Fabaceae
59.	<i>Galium verum</i> L.	Lady's bed-straw	Sânzie-ne-galbene	Подмаренник жёлтый	Rubiaceae

60.	<i>Galium aparine</i> L.	Cleavers	Lipicioasă	Подмаренник цепкий	Rubiaceae
61.	<i>Ginkgo biloba</i> L.	Ginkgo	Gingo	Гинкго двулопастный	Ginkgoaceae
62.	<i>Glaucium flavum</i> Crantz.	Yellow horn poppy	Mac-galben	Мачок жёлтый	Papaveraceae
63.	<i>Glycyrrhiza glabra</i> L.	Liquorice	Lemn-dulce	Солодка голая	Fabaceae
64.	<i>Glycyrrhiza echinata</i> L.	Wild liquorice	Reglisă- echinata	Солодка щетиная	Fabaceae
65.	<i>Gypsophila paniculata</i> L.	Baby's breath	Ipcărige	Качим метельчатый	Caryophyllaceae
66.	<i>Helichrysum arenarium</i> (L.) Moench	Dwarf everlast	Siminoc	Бессмертник песчаный	Asteraceae
67.	<i>Helichrysum italicum</i> (Roth) G.Don	Curry Plant	Imortelă	Цмин итальянский	Asteraceae
68.	<i>Hippophae rhamnoides</i> L.	Buckthorn	Cătină-albă	Облепиха крушиновидная	Elaeagnaceae
69.	<i>Humulus lupulus</i> L.	Common hop	Hamei	Хмель обыкновенный	Cannabaceae
70.	<i>Hypericum perforatum</i> L.	Saint John's wort	Sunătoare	Зверобой продырявленный	Hypericaceae
71.	<i>Hyssopus officinalis</i> L.	Hyssop	Isop	Иссоп лекарственный	Lamiaceae
72.	<i>Inula helenium</i> L.	Elecampane	Iarbă-mare	Девясил высоки	Asteraceae
73.	<i>Iris germanica</i> L.	German bearded iris	StânjeneI	Касатик германский	Iridaceae
74.	<i>Iris pseudacorus</i> L.	Yellow flag	StânjeneI de baltă	Ирис ложноирисовый	Iridaceae
75.	<i>Junglans regia</i> L.	Persian walnut	Nuc	Орех грецкий	Juglandaceae
76.	<i>Juniperus communis</i> L.	Juniper	Ienupăr	Можжевельник обыкновенный	Cupressaceae
77.	<i>Lamium album</i> L.	Dead nettle	Urzică – moartă	Глухая крапива	Lamiaceae
78.	<i>Lavandula angustifolia</i> Mill.	Lavender	Levănțică	Лаванда узколистная	Lamiaceae
79.	<i>Lavandula x intermedia</i>	Lavandin	Lavandin	Лавандин, Лаванда средняя	Lamiaceae
80.	<i>Leonurus cardiaca</i> L.	Motherwort	Talpa-gâștei	Пустырник сердечный	Lamiaceae

81.	<i>Levisticum officinale</i> Koch.	Lovage	Leuștean	Любисток лекарственный	Apiaceae
82.	<i>Linum usitatissimum</i> L.	Flax	In-de-cultură	Лен обыкновенный	Linaceae
83.	<i>Macleaya microcarpa</i> (Maxim.) Fedde	Plume poppy	Macleia	Маклея мелкоплодная	Papaveraceae
84.	<i>Magnolia kobus</i> DC.	Kobus magnolia	Magnolie	Магнолия кобус	Magnoliaceae
85.	<i>Mahonia aquifolium</i> (Pursh) Nutt.	Holly-leaved barberry	Mahonie	Магония падуболистная	Berberidaceae
86.	<i>Malva thuringiaca</i> (L.) Vis.	Garden tree-mallow	Nalbă, ru-jă-de-deal	Хатьма тюрингская	Malvaceae
87.	<i>Marrubium vulgare</i> L.	Horehound	Unguraș	Шандра обыкновенная	Lamiaceae
88.	<i>Melilotus officinalis</i> (L.) Pall.	Melilot	Sulfină	Донник лекарственный	Fabaceae
89.	<i>Melissa officinalis</i> L.	Lemon balm	Roiniță	Мелисса лекарственная	Lamiaceae
90.	<i>Mentha piperita</i> L.	Mint	Izmă-bună	Мята перечная	Lamiaceae
91.	<i>Miscanthus sinensis</i> Andersson	Chinese silver grass	Iarba elefantului	Мискантус китайский	Poaceae
92.	<i>Monarda fistulosa</i> L.	Wild bergamot	Monardă-tubulară	Монарда дудчатая	Lamiaceae
93.	<i>Nepeta cataria</i> L.	Catmint	Cătușnică	Котовник кошачий	Lamiaceae
94.	<i>Nepeta transcaucasica</i> L.	Transcaucasian catmint	Cătușnică	Котовник закавказский	Lamiaceae
95.	<i>Nymphaea alba</i> L.	European white water lily	Nufăr-alb	Кувшинка белая	Nymphaeaceae
96.	<i>Nuphar luteum</i> L.	Yellow water-lily	Nufăr-galben	Кубышка желтая	Nymphaeaceae
97.	<i>Ocimum basilicum</i> L.	Basil	Busuioc	Бasilik обыкновенный	Lamiaceae
98.	<i>Origanum vulgare</i> ssp. <i>hirtum</i> (Link) Hetswaart	Oregano	Sovârv	Душица	Lamiaceae
99.	<i>Origanum vulgare</i> L.	Oregano	Sovârv	Душица обыкновенная	Lamiaceae
100.	<i>Papaver rhoeas</i> L.	Corn poppy	Mac-roșu	Мак самосейка	Papaveraceae

101.	<i>Papaver somniferum</i> L.	Opium poppy	Mac-de-grădină	Мак снотворный	Papaveraceae
102.	<i>Pastinaca sativa</i> L.	Parsnip	Păstârnac	Пастернак полевой	Apiaceae
103.	<i>Petroselinum crispum</i> (Mill.)	Parsley	Pătrunjel	Петрушка курчавая	Apiaceae
104.	<i>Phytolacca americana</i> L.	American pokeweed	Cârmăz	Лаконос американский	Phytolaccaceae
105.	<i>Picea abies</i> L.	Norway spruce	Molid	Ель обыкновенная	Pinaceae
106.	<i>Pinus sylvestris</i> L.	Pine	Pin-de-pădure	Сосна обыкновенная	Pinaceae
107.	<i>Pinus nigra</i> J.EArnold	Black pine	Pin-negru	Сосна чёрная	Pinaceae
108.	<i>Plantago lanceolata</i> L.	Ribwort Plantain	Pătlagină-în-gustă	Подорожник ланцетолистный	Plantaginaceae
109.	<i>Plantago major</i> L.	Broadleaf plantain	Pătlagină-mare	Подорожник большой	Plantaginaceae
110.	<i>Polygonum aviculare</i> L.	Knot grasses	Troscot	Горец птичий	Polygonaceae
111.	<i>Populus nigra</i> L.	Poplar	Plop-negru	Тополь чёрный	Salicaceae
112.	<i>Potentilla alba</i> L.	White cinquefoil	Scrîntitoare-albă	Лапчатка белая	Rosaceae
113.	<i>Potentilla anserina</i> L.	Silverweed	Coada-racului	Лапчатка гусиная	Rosaceae
114.	<i>Potentilla erecta</i> (L.) Hampe	Tormpentil	Sclipeți	Лапчатка прямостоячая	Rosaceae
115.	<i>Prunus padus</i> L.	Hackberry	Mălin	Черемуха обыкновенная	Rosaceae
116.	<i>Prunus spinosa</i> L.	Black thorn	Porumbar	Терновник	Rosaceae
117.	<i>Pyrethrum cinerariifolium</i> Trev.	Pyrethrum daisy	Piretru	Ромашка далматская	Asteraceae
118.	<i>Quercus robur</i> L.	Oak	Stejar	Дуб черешчатый	Fagaceae
119.	<i>Rhamnus cathartica</i> L.	Common Buckthorn	Verigariu	Крушина слабительная	Rhamnaceae
120.	<i>Ribes nigrum</i> L.	Blackcurrant	Coacăz-negru	Смородина чёрная	Grossulariaceae
121.	<i>Ribes uva-crispa</i> , sin. <i>Ribes grossularia</i>	Gooseberry	Agriș	Крыжовник	Grossulariaceae

122.	<i>Ricinus communis</i> L.	Castor bean	Ricin	Клещевина обыкновенная	Euphorbiaceae
123.	<i>Robinia pseudoacacia</i> L.	Robinie	Salcâm	Акация белая	Fabaceae
124.	<i>Rosa canina</i> L.	Dog rose	Măceș	Шиповник собачий	Rosaceae
125.	<i>Rosa damascena</i> Mill.	Damask rose	Trandafir	Роза дамасская	Rosaceae
126.	<i>Rubus fruticosus</i> L.	Blackberry	Mur	Ежевика	Rosaceae
127.	<i>Rubus idaeus</i> L.	Raspberry	Zmeur	Малина обыкновенная	Rosaceae
128.	<i>Rumex acetosa</i> L.	Sorrel	Măcriș	Щавель кислый	Polygonaceae
129.	<i>Ruta graveolens</i> L.	Rue	Vârnaț	Рута душистая	Rutaceae
130.	<i>Salix alba</i> L.	Golden willow	Salcie-albă	Ива белая	Salicaceae
131.	<i>Salix babylonica</i> L.	Babylon weeping	Salcie- plângătoare	Ива плакучая	Salicaceae
132.	<i>Salix caprea</i> L.	Goat willow	Salcie-căprească	Ива козья	Salicaceae
133.	<i>Salvia officinalis</i> L.	Shap sage	Jaleș-de-grădină	Шалфей лекарственный	Lamiaceae
134.	<i>Salvia sclarea</i> L.	Sage	Șerlai	Шалфей мускатный	Lamiaceae
135.	<i>Sambucus nigra</i> L.	Black elder	Soc-negru	Бузина черная	Caprifoliaceae
136.	<i>Sanguisorba officinalis</i> L.	Great burnet	Sorbestrea	Кровохлебка лекарственная	Rosaceae
137.	<i>Santolina chamaecyparissus</i> L.	Cotton lavender or lavender-cotton	Lemnul Maicii Domnului	Сантолина кипарисовидная	Asteraceae
138.	<i>Saponaria officinalis</i> L.	Soapwort	Săpunăriță	Мыльнянка лекарственная	Caryophyllaceae
139.	<i>Satureja montana</i> L.	Mountain savory	Cimbru-de-munte	Чабер горный	Lamiaceae
140.	<i>Silybum marianum</i> (L.) Gaertner.	Milk thistle	Armurariu	Расторопша пятнистая	Asteraceae
141.	<i>Symphytum officinale</i> L.	Comfrey	Tătăneasă	Окопник лекарственный	Boraginaceae
142.	<i>Solidago canadensis</i> L.	Canadian goldenrod	Sânziene-de-grădină	Золотарник канадский	Asteraceae
143.	<i>Solidago virgaurea</i>	European goldenrod	Varga de aur	Золотарник	Asteraceae

144.	<i>Sophora japonica</i> L. <i>Styphnolobium japonicum</i> (L.) Schott	Japanese pagoda tree	Salcâm japonez	Софора японская	Fabaceae
145.	<i>Sorbus aucuparia</i> L.	Rowan	Scoruș	Рябина обыкновенная	Rosaceae
146.	<i>Sorbus intermedia</i> (Ehrh.) Pers.	Swedish whitebeam	Sorbus	Рябина промежуточная	Rosaceae
147.	<i>Tanacetum vulgare</i> L.	Tansy	Vetrice	Пижма обыкновенная	Asteraceae
148.	<i>Taraxacum officinale</i> (L.) Weber.	Dandelion	Păpădie	Одуванчик лекарственный	Asteraceae
149.	<i>Tilia cordata</i> Mill.	Small-leaved lime	Tei-roșu	Липа сердцевидная	Tiliaceae
150.	<i>Tilia platyphyllos</i> Scop.	Large leaf linden	Tei-mare	Липа крупнолистная	Tiliaceae
151.	<i>Tilia tomentosa</i> Moench.	Silver linden	Tei-argintiu	Липа серебристая	Tiliaceae
152.	<i>Thymus serpyllum</i> L.	Wild thyme	Cimbrișor-de-câmp	Чабрец ползучий	Lamiaceae
153.	<i>Thymus vulgaris</i> L.	Garden thyme	Cimbrișor-de-grădina	Тимьян обыкновенный	Lamiaceae
154.	<i>Trifolium pratense</i> L.	Red clover	Trifoi-roșu	Клевер луговой	Fabaceae
155.	<i>Tussilago farfara</i> L.	Coltsfoot	Podbal	Мать-и-мачеха	Asteraceae
156.	<i>Urtica dioica</i> L.	Stinging nettle	Urzică –mare	Крапива двудомная	Urticaceae
157.	<i>Valeriana officinalis</i> L.	Valerian	Odolean	Валерьяна лекарственная	Valerianaceae
158.	<i>Verbascum phlomoides</i> L.	Mullein	Lumânărică	Коровяк лекарственный	Scrophulariaceae
159.	<i>Viburnum opulus</i> L.	Snowberry	Călin	Калина обыкновенная	Caprifoliaceae
160.	<i>Vinca minor</i> L.	Perwinkle	Saschiu	Барвинок малый	Apocynaceae
161.	<i>Vitis vinifera</i> L.	Grape vine	Vița-de-vie	Виноградная лоза	Vitaceae
162.	<i>Zea mays</i> L.	Maize	Porumb	Кукуруза обыкновенная	Poaceae

ANNEX 4

HARVESTING PERIOD FOR HERBAL PRODUCTS

Abbreviations used in the table indicate the plant parts harvested during the cultivation period, according to traditional Latin terminology, as follows:

- Gem.** – *Gemma* (bud) 
Fol. – *Folium* (leave) 
Flos – *Flos* (flower) 
Rhiz. – *Rhizoma* (rhizome) 
Herb. – *Herba* (aerial part) 
Cort. – *Cortex* (bark) 
Sem. – *Semen* (seed) 
Rad. – *Radix* (root) 
Fruct. – *Fructus* (fruit) 
Stigm. – *Stigmata* (stigma) 

Nr.	The Latin name of the plant.	MONTH											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1.	<i>Abies nordmanniana</i> (Steven) Spach	Gem. 	Gem. 	Gem. 	Fol. 	Fol. 	Fol. 	Fol. 	Fol. 	Fol. 			
2.	<i>Achillea millefolium</i> L.					Herb. 	Herb. 	Herb. 	Herb. 	Herb. 			
3.	<i>Acorus calamus</i> L.	Rhiz. 	Rhiz. 								Rhiz. 	Rhiz. 	Rhiz. 
4.	<i>Adonis vernalis</i> L.			Herb. 	Herb. 	Herb. 							
5.	<i>Aesculus hippocastanum</i> L.			Cort. 	Cort. 	Flos 					Sem. 	Sem. 	
6.	<i>Aesculus carnea</i> Hayne					Flos 	Flos 						
7.	<i>Agrimonia eupatoria</i> L.					Herb. 	Herb. 	Herb. 	Herb. 	Herb. 			
8.	<i>Althaea officinalis</i> L.	Rad. 	Rad. 			Fol. 	Fol. 	Fol. 	Fol. 	Rad. 	Rad. 		
9.	<i>Amygdalus communis</i> L.								Sem. 	Sem. 	Sem. 		
10.	<i>Anethum graveolens</i> L.					Herb. 	Herb. 	Fruct. 	Fruct. 	Fruct. 			
11.	<i>Aralia mandshurica</i> Rupr. et Maxim.	Rad. 	Rad. 								Rad. 	Rad. 	

12.	<i>Arctium lappa</i> L.	Rad. 	Rad. 							Rad. 	Rad. 	Rad. 	
13.	<i>Aristolochia clematitis</i> L.				Herb. 	Herb. 	Herb. 						
14.	<i>Armoracia rusticana</i> Gaertn., Mey., Scherb.			Rad. 	Rad. 								
15.	<i>Aronia melanocarpa</i> (Michx.) Elliott.							Fruct. 	Fruct. 	Fruct. 			
16.	<i>Artemisia absinthium</i> L.				Herb. 	Herb. 	Herb. 						
17.	<i>Artemisia dracunculus</i> L.			Herb. 	Herb. 	Herb. 							
18.	<i>Artemisia vulgaris</i> L.				Herb. 	Herb. 	Herb. 						
19.	<i>Asparagus officinalis</i> L.		Gem. 	Gem. 	Gem. 						Rad. 	Rad. 	
20.	<i>Atropa belladonna</i> L.			Fol. 	Fol. 	Fol. 							
21.	<i>Berberis vulgaris</i> L.			Cort. 	Cort. 		Fruct. 	Fruct. 	Fruct. 	Rad. 	Rad. 		
22.	<i>Bergenia crassifolia</i> L.								Fol. 	Fol. 	Fol. 		
23.	<i>Betula pendula</i> Roth.	Gem. 	Gem. 	Gem. 	Fol. 	Fol. 							
24.	<i>Buddleja davidii</i> Franch.				Flos 	Flos 	Flos 						
25.	<i>Calendula officinalis</i> L.				Flos 	Flos 	Flos 	Flos 	Flos 				
26.	<i>Capsella bursa pastoris</i> (L.) Medic.		Herb. 	Herb. 	Herb. 								
27.	<i>Carum carvi</i> L.						Fruct. 	Fruct. 					
28.	<i>Cassia occidentalis</i> L.			Fol. 	Fol. 	Fol. 	Fol. 	Fol. 	Sem. 	Sem. 			
29.	<i>Centaurea cyanus</i> L.					Flos 	Flos 	Flos 					
30.	<i>Cercis siliquastrum</i> L.			Flos 	Flos 	Flos 	Flos 	Flos 					
31.	<i>Chamomilla recutita</i> L.				Flos 	Flos 	Flos 						
32.	<i>Chaenomeles japonica</i> L.								Fruct. 	Fruct. 			
33.	<i>Chelidonium majus</i> L.				Herb. 	Herb. 	Herb. 						
34.	<i>Cichorium inthybus</i> L.					Herb. 	Herb. 	Herb. 	Rad. 	Rad. 			
35.	<i>Convallaria majalis</i> L.				Fol. 	Fol. 							
36.	<i>Coriandrum sativum</i> L.						Fruct. 	Fruct. 					
37.	<i>Cornus mas</i> L.						Fruct. 	Fruct. 	Fruct. 				
38.	<i>Corylus avellana</i> L.					Fol. 	Fol. 	Fruct. 	Fruct. 				
39.	<i>Crataegus monogyna</i> Jacq.				Flos 	Flos 				Fruct. 	Fruct. 		

40.	<i>Cynara scolymus</i> L.					Fol.	Fol.	Fol.							
41.	<i>Datura stramonium</i> L.						Fol.	Fol.	Fol.	Sem.	Sem.				
42.	<i>Daucus carota</i> L.									Sem.	Sem.				
43.	<i>Digitalis lanata</i> Ehrh.					Fol.	Fol.								
44.	<i>Digitalis purpurea</i> L.					Fol.	Fol.								
45.	<i>Dracocephalum moldavica</i> L.						Herb.	Herb.							
46.	<i>Echinacea purpurea</i> (L.) Moench.						Herb.	Herb.				Rad.	Rad.		
47.	<i>Echinops ritro</i> L.							Flos	Flos						
48.	<i>Eryngium planum</i> L.							Herb.	Herb.			Rad.	Rad.		
49.	<i>Elytrigia repens</i> (L.) Nevskisyn.											Rhiz.	Rhiz.		
50.	<i>Ephedra distachya</i> L.					Herb.	Herb.								
51.	<i>Filipendula ulmaria</i> L. Maxim						Flos	Flos							
52.	<i>Foeniculum vulgare</i> Mill.									Fruct.	Fruct.				
53.	<i>Forsythia × intermedia</i> Zabel.		Flos	Flos											
54.	<i>Fragaria vesca</i> L.						Fol.	Fol.	Fruct.	Fruct.					
55.	<i>Fraxinus excelsior</i> L.					Fol.	Fol.								
56.	<i>Fumaria officinalis</i> L.					Herb.	Herb.								
57.	<i>Galega officinalis</i> L.						Herb.	Herb.							
58.	<i>Galium verum</i> L.						Herb.	Herb.							
59.	<i>Galium aparine</i> L.			Herb	Herb.										
60.	<i>Ginkgo biloba</i> L.						Fol.	Fol.	Fol.						
61.	<i>Glaucium flavum</i> Crantz.						Herb.	Herb.							
62.	<i>Glycyrrhiza glabra</i> L.											Rad.	Rad.	Rad.	
63.	<i>Glycyrrhiza echinata</i> L.											Rad.	Rad.	Rad.	
64.	<i>Gypsophila paniculata</i> L.											Rad.	Rad.	Rad.	
65.	<i>Helichrysum arenarium</i> (L.) Moench					Flos	Flos	Flos							
66.	<i>Helichrysum italicum</i> (Roth) G. Don					Flos	Flos	Flos	Flos						
67.	<i>Hippophae rhamnoides</i> L.									Fruct.	Fruct.	Fruct.			

68.	<i>Humulus lupulus</i> L.							Flos	Flos				
69.	<i>Hypericum perforatum</i> L.				Herb.	Herb.	Herb.						
70.	<i>Hyssopus officinalis</i> L.				Herb.	Herb.	Herb.						
71.	<i>Inula helenium</i> L.									Rad.	Rad.	Rad.	
72.	<i>Iris germanica</i> L.									Rhiz.	Rhiz.	Rhiz.	
73.	<i>Iris pseudacorus</i> L.									Rhiz.	Rhiz.	Rhiz.	
74.	<i>Junglans regia</i> L.				Fol.	Fol.	Fol.			Fruct.	Fruct.		
75.	<i>Juniperus communis</i> L.									Fruct.	Fruct.	Fruct.	
76.	<i>Lamium album</i> L.				Flos	Flos	Flos	Flos					
77.	<i>Lavandula angustifolia</i> Mill.				Flos	Flos	Flos						
78.	<i>Lavandula x intermedia</i>				Flos	Flos	Flos						
79.	<i>Leonurus cardiaca</i> L.				Herb.	Herb.	Herb.						
80.	<i>Levisticum officinale</i> Koch.				Fol.	Fol.					Rad.	Rad.	
81.	<i>Linum usitatissimum</i> L.							Sem.	Sem.	Sem.			
82.	<i>Macleaya microcarpa</i> (Maxim.) Fedde				Herb.	Herb.	Herb.						
83.	<i>Magnolia kobus</i> DC.	Gem.	Gem.										
84.	<i>Mahonia aquifolium</i> (Pursh) Nutt.				Fol.	Fol.					Rad.	Rad.	
85.	<i>Malva thuringiaca</i> (L.) Vis.				Flos.	Flos.	Flos.						
86.	<i>Marrubium vulgare</i> L.				Herb.	Herb.	Herb.						
87.	<i>Melilotus officinalis</i> (L.) Pall.				Herb.	Herb.	Herb.						
88.	<i>Melissa officinalis</i> L.				Herb.	Herb.	Herb.						
89.	<i>Mentha piperita</i> L.				Herb.	Herb.	Herb.						
90.	<i>Miscanthus sinensis</i> Andersson				Herb.	Herb.	Herb.						
91.	<i>Monarda fistulosa</i> L.				Herb.	Herb.	Herb.						
92.	<i>Nepeta cataria</i> L.				Herb.	Herb.	Herb.						
93.	<i>Nepeta transcaucasica</i> L.				Herb.	Herb.	Herb.						
94.	<i>Nymphaea alba</i> L.										Rhiz.	Rhiz.	
95.	<i>Nuphar luteum</i> L.										Rhiz.	Rhiz.	

96.	<i>Ocimum basilicum</i> L.					Herb.	Herb.	Herb.	Herb.				
97.	<i>Origanum vulgare</i> ssp. <i>hirtum</i> (Link) Hetswaart					Herb.	Herb.	Herb.	Herb.	Herb.			
98.	<i>Origanum vulgare</i> L.					Herb.	Herb.	Herb.	Herb.	Herb.			
99.	<i>Papaver somniferum</i> L.							Sem.	Sem.	Sem.			
100.	<i>Pastinaca sativa</i> L.									Rad.	Rad.	Rad.	
101.	<i>Petroselinum crispum</i> (Mill.)					Fol.	Fol.	Fol.	Fol.	Rad.	Rad.	Rad.	
102.	<i>Phytolacca americana</i> L.							Herb. Rad.	Herb. Rad.	Rad.			
103.	<i>Picea abies</i> L.		Gem.	Gem.									
104.	<i>Pinus sylvestris</i> L.		Gem.	Gem.									
105.	<i>Pinus nigra</i> J.F. Arnold		Gem.	Gem.									
106.	<i>Plantago lanceolata</i> L.					Herb.	Herb.	Herb.	Herb.				
107.	<i>Plantago major</i> L.					Herb.	Herb.	Herb.	Herb.				
108.	<i>Polygonum aviculare</i> L.					Herb.	Herb.	Herb.	Herb.				
109.	<i>Populus nigra</i> L.		Gem. Cort.	Gem. Cort.									
110.	<i>Potentilla alba</i> L.					Herb. Flos	Flos	Flos					
111.	<i>Potentilla anserina</i> L.					Herb.	Herb.	Herb.	Herb.				
112.	<i>Potentilla erecta</i> (L.) Hampe										Rhiz. Rad.	Rhiz. Rad.	
113.	<i>Prunus padus</i> L.					Flos	Fruct.						
114.	<i>Prunus spinosa</i> L.					Flos				Fruct.	Fruct.		
115.	<i>Pyrethrum cinerariifolium</i> Trev.					Flos	Flos	Flos					
116.	<i>Quercus robur</i> L.		Cort.	Cort.									
117.	<i>Rhamnus cathartica</i> L.		Cort.	Cort.						Fruct.	Fruct.		
118.	<i>Ribes nigrum</i> L.	Gem.	Gem.		Fol.	Fol.	Fol.			Fruct.	Fruct.		
119.	<i>Ribes uva-crispa</i> , sin. <i>Ribes grossularia</i>				Fol.	Fol.				Fruct.	Fruct.		
120.	<i>Ricinus communis</i> L.							Sem.	Sem.	Sem.			
121.	<i>Robinia pseudoacacia</i> L.					Flos	Flos						
122.	<i>Rosa canina</i> L.									Fruct.	Fruct.	Fruct.	

123.	<i>Rosa damascena</i> Mill.					Flos 	Flos 						
124.	<i>Rubus fruticosus</i> L.				Fol. 	Fol. 			Fruct. 	Fruct. 			
125.	<i>Rubus idaeus</i> L.				Fol. 	Fol. 			Fruct. 	Fruct. 			
126.	<i>Rumex acetosa</i> L.				Fol. 	Fol. 	Fol. 						
127.	<i>Ruta graveolens</i> L.					Herb. 	Herb. 	Herb. 					
128.	<i>Salix alba</i> L.	Cort. 	Cort. 	Cort. 									
129.	<i>Salix babylonica</i> L.	Cort. 	Cort. 	Cort. 									
130.	<i>Salix caprea</i> L.	Cort. 	Cort. 	Cort. 									
131.	<i>Salvia officinalis</i> L.				Fol. 	Fol. 	Fol. 	Fol. 					
132.	<i>Savia sclarea</i> L.					Herb. 	Herb. 	Herb. 					
133.	<i>Sambucus nigra</i> L.					Flos 	Flos 		Fruct. 	Fruct. 			
134.	<i>Sanguisorba officinalis</i> L.					Herb. 	Herb. 	Herb. 			Rad. 	Rad. 	
135.	<i>Santolina chamaecyparissus</i> L.						Herb. 	Herb. 	Herb. 				
136.	<i>Saponaria officinalis</i> L.									Rad. 	Rad. 	Rad. 	
137.	<i>Satureja montana</i> L.						Herb. 	Herb. 	Herb. 				
138.	<i>Silybum marianum</i> (L.) Gaertner.								Fruct. 	Fruct. 			
139.	<i>Symphytum officinale</i> L.									Rad. 	Rad. 	Rad. 	
140.	<i>Solidago canadensis</i> L.						Herb. 	Herb. 	Herb. 				
141.	<i>Solidago virgaurea</i>						Herb. 	Herb. 	Herb. 				
142.	<i>Sophora japonica</i> L.					Flos 	Flos 			Fruct. 	Fruct. 		
143.	<i>Styphnolobium japonicum</i> (L.) Schott					Flos 	Flos 			Fruct. 	Fruct. 		
144.	<i>Sorbus aucuparia</i> L.					Flos 				Fruct. 	Fruct. 		
145.	<i>Sorbus intermedia</i> (Ehrh.) Pers.					Flos 				Fruct. 	Fruct. 		
146.	<i>Tanacetum vulgare</i> L.						Flos 	Flos 	Flos 				
147.	<i>Taraxacum officinale</i> (L.) Weber.		Fol. 	Fol. 	Herb. 	Herb. 				Rad. 	Rad. 	Rad. 	
148.	<i>Tilia cordata</i> Mill.					Flos 	Flos 						

149.	<i>Tilia platyphyllos Scop.</i>					Flos 	Flos 						
150.	<i>Tilia tomentosa Moench.</i>					Flos 	Flos 						
151.	<i>Thymus serpyllum L.</i>					Herb. 	Herb. 	Herb. 					
152.	<i>Thymus vulgaris L.</i>					Herb. 	Herb. 	Herb. 					
153.	<i>Trifolium pratense L.</i>					Flos 	Flos 						
154.	<i>Tussilago farfara L.</i>	Flos 	Flos 	Fol. 	Fol. 	Fol. 							
155.	<i>Urtica dioica L.</i>				Herb. 	Herb. 	Herb. 			Sem. 			
156.	<i>Valeriana officinalis L.</i>									Rad. 	Rad. 	Rad. 	
157.	<i>Verbascum phlomoides L.</i>					Flos 	Flos 	Flos 					
158.	<i>Viburnum opulus L.</i>	Cort. 	Cort. 		Flos. 	Flos 				Fruct. 	Fruct. 		
159.	<i>Vinca minor L.</i>				Herb. 	Herb. 							
160.	<i>Vitis vinifera L.</i>				Fol. 	Fol. 				Fruct. 	Fruct. 		
161.	<i>Zea mays L.</i>								Stigm. 	Stigm. 			

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