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Chemistry of Plant Substances

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ACTUAL PROBLEMS OF THE CHEMISTRY OF NATURAL COMPOUNDS

SCIENTIFIC AND PRACTICAL CONFERENCE
OF YOUNG SCIENTISTS

ABSTRACTS

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CONFERENCE TOPICS

1. Chemistry, biology, pharmacology, technology and biotechnology of natural compounds, organic chemistry;
2. Successes and problems of creation of new drugs.

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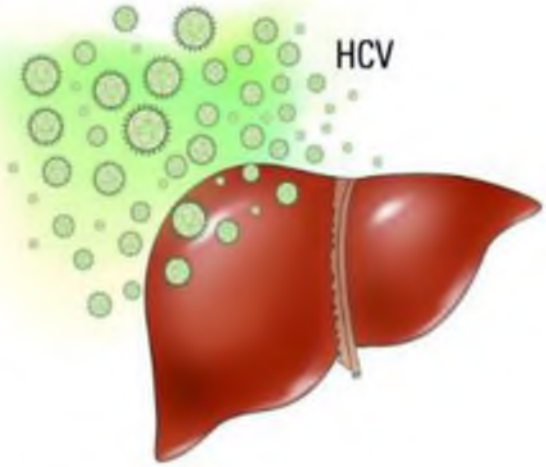
ORAL PRESENTATIONS

SOFOSBUVIR SUBSTANSIYASI

Virusli gepatit C ni davolash uchun yangi avlod virusga qarshi preparati

Sofosbuvir – "Sovaldi" original preparatining sintetik analogi. Katta yoshdagi bemorlarda virusga qarshi davolashning bir qismi sifatida surunkali gepatit C (SGC) ni davolash uchun qo'llaniladi.
Afzalliklari: Amalda 100% li natija, minimal miqdordagi nojo'ya ta'sirlar, davolash davomiyligining 2-4 marotaba qisqaligi.
Chiqarilish shakli: tabletkalar 400 mg



СУБСТАНЦИЯ СОФОСБУВИР

Противовирусный препарат нового поколения для лечения вирусного гепатита С

Софосбувир – синтетический аналог оригинального препарата «Sovaldi». В составе антивирусной терапии применяется для лечения хронического гепатита С (ХГС) у взрослых пациентов.
Преимущества: Практически 100% результат, минимальное количество побочных эффектови в 2-4 раза более короткая длительность терапии.
Форма выпуска: Таблетки 400 мг

SOFOSBUVIR SUBSTANCE

New generation antiviral drug for the treatment of viral hepatitis C

Sofosbuviris a synthetic analogue of the original Sovaldi drug. As part of antiviral therapy, it is used to treat chronic hepatitis C (CHC) in adult patients.
Advantages: Almost 100% result, minimal side effects and 2-4 times shorter duration of therapy.
Release form: Tablets of 0.4 g.

NEW FUSED OXABICYCLIC BISABOLANES CHARACTERIZED BY A C-2–O–C$_{SC}$ BRIDGE FROM *Artemisia persica*

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Bisabolane-type sesquiterpenoids are secondary metabolites synthesized by plants, marine organisms, and fungi, characterized by their six-membered carbon ring and a side chain. The biosynthesis of these sesquiterpenoids is produced from farnesyl pyrophosphate (FPP) through a series of enzymatic reactions, leading to the formation of a monocyclic sesquiterpene structure. Bisabolanes and their derivatives have a wide range of biological activities [1]. In this study, we present examples of bisabolanes containing an intramolecular ether bond (C-2–O–C$_{SC}$) observed between the C-2 carbon in the parent 6-membered ring and any carbon atom in the side chain (C$_{SC}$) and report their new derivatives isolated from *Artemisia persica*.

In fused oxabicyclic bisabolanes, the side chain carbons can form possible 4- to 9-membered oxacyclic rings by connecting to C-2 through an ether bond. The literature reveals that only bisabolanes containing a 5- or 6-membered oxacyclic ring, 2,8-epoxy and 2,9-epoxy bisabolanes, respectively, have been isolated and identified from natural sources [1,2].

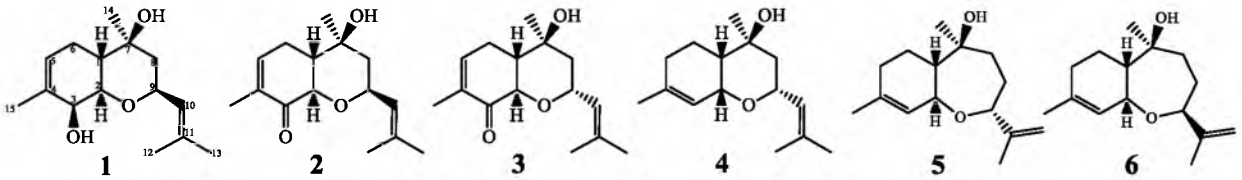

Figure 1. The chemical structures of new bisabolane-type sesquiterpenoids from *A. persica*

During our research, we isolated six new fused oxabicyclic bisabolanes from *A. persica,* including four 2,9-epoxy (**1-4**) and two previously unobserved 2,10-epoxy bisabolanes with a 7-membered oxasacyclic ring (**5-6**) (Fig. 1). The chemical structures of these new compounds were determined by 1D, 2D NMR spectroscopic and HR-ESI-MS data, electronic circular dichroism (ECD), and single crystal X-ray diffraction analysis. Novel bisabolane-type sesquiterpenoids were semi-systematic named as (1*S*,2*R*,3*S*,7*S*,9*S*)-3,7-dihydroxy-2,9-epoxybisabola-4,10-diene (**1**), (1*S*,2*R*,7*S*,9*S*)-3,7-dihydroxy-2,9-epoxybisabola-4,10-diene-3-one (**2**), (1*S*,2*R*,7*S*,9*R*)-3,7-dihydroxy-2,9-epoxybisabola-4,10-diene-3-one (**3**), (1*S*,2*R*,7*S*,9*R*)-7-hydroxy-2,9-epoxybisabola-3,10-diene (**4**), (1*S*,2*S*,7*S*,10*R*)-7-hydroxy-2,10-epoxybisabola-3,11(13)-diene (**5**), and (1*S*,2*S*,7*S*,10*S*)-7-hydroxy-2,10-epoxybisabola-3,11(13)-diene (**6**). The predominance of bisabolane-type structures in *A. persica* is particularly noteworthy, as this is an uncommon feature within the *Artemisia* genus.

The work was supported by the Budgetary Program for Basic Scientific Research, Academy of Sciences, Republic of Uzbekistan.

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STUDY OF THE COMPOSITION OF WATERY AND ETHANOL EXTRACTS OF THE PLANT *Capparis spinosa* L. USING THE LC-ESI-MS METHOD

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The plant *Capparis spinosa L.* (*Capparidaceae*) is widespread in Southern Europe, North Africa, the Mediterranean region, Western and Central Asia. *C. spinosa* has strong adaptive characteristics to abiotic and biotic influences in regions with changing climatic conditions. This plant species is considered resistant to drought tolerant, a fire resistant and saline soil regions.

Today, scientific research on the adaptation of the promising plant C.spinosa, distributed in various regions of our republic, in particular on the dried bottom of the Aral Sea, to the conditions of saline soils, is insufficient. Taking this into account, scientists of the Institute of Bioorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan are conducting research to determine the biochemical changes occurring in the population of the plant C. spinosa, distributed in the territory of the Southern Aralkum, by comparing its chemical composition with the population of other regions. In particular, to date, the content of free amino acids, total and water-soluble proteins, polyphenolic compounds, alkaloids, fatty acids, water-soluble vitamins, and carbohydrates of this species has been studied.At the same time, research is being conducted on the introduction of *C. spinosa* plant seeds into in vitro, adaptation of the obtained primary micro-seedlings to saline nutrient media, as well as the development of an optimal method for obtaining salt-tolerant micro-seedlings and obtaining them in ex vitro.

In this study, the chemical composition of watery and ethanol alcohol extracts obtained using 70% and 96% solvents was studied using the *Liquid Chromatography-Electrospray Ionization-Mass Spectrometry* LC/MS/MS Q-TOF 6420B was carried out under the following conditions: ionization source: ESI-, gas flow rate: 7 l/min, gas temperature: 300°C, voltage: 20V in the skimmer cone, 125V in the fragment, mass range: in MS 100 mode - 2000 m/s, and in MS/MS 50 mode - 2000 m/s. Collision energy - 20, 30 eV. Ionization method: negative method to determine the biologically active substances involved in the manifestation of the pharmacological properties of the *C. spinosa* plant. Based on the LC/MS/MS spectra of the chemical substances contained in the extracts of the plant *C. spinosa*, the spectra in the massbank.eu database and references data were identified. Based on the obtained results, the presence of substances such as glucocapparin ($C_8H_{15}NO_9S_2$), quinic acid ($C_7H_{12}O_6$), circiliol ($C_{17}H_{14}O_7$), calystegin B2 ($C_7H_{13}NO_4$), kaempferol 3-O-alpha-L-arabinoside ($C_{20}H_{18}O_{10}$), sakuranetin ($C_{16}H_{14}O_5$), quercetin 3-O-ramonoside ($C_{21}H_{20}O_{11}$), capparispine ($C_{25}H_{29}N_3O_4$), isorhamnetin 3-galactoside ($C_{22}H_{22}O_{12}$), syringic acid ($C_9H_{10}O_5$), rutin ($C_{27}H_{30}O_{16}$), flazin ($C_{17}H_{12}N_2O_4$), kaempferol 3-(2G-glucosylrutinoside) ($C_{33}H_{40}O_{20}$), caffeic acid ($C_9H_8O_4$), spionoside A ($C_{19}H_{30}O_9$) stachydrine ($C_7H_{13}NO_2$), Cappariz ($C_{26}H_{31}N_3O_5$) and capparine A ($C_{12}H_{12}N_2O_2S_2$) was established.

In conclusion, it can be said that the glucosinolates, phlavonoids, phenolic acids, and alkaloids identified in the watery and ethanol extracts of the *C. spinosa* plant population of the Southern Aralkum region are cited in the references as the main substances ensuring its medicinal properties.

NEW DITERPENOID ALKALOIDS FROM *Delphinium iliense*

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Four new C_{19}-diterpenoid alkaloids, sinchianidines A-D (**1-4**), together with eight known diterpenoid alkaloids (**5-12**), were isolated from the whole plant of *Delphinium iliense*. Their structures were established by extensive spectroscopic analyses, while the absolute configurations of sinchianidine A (**1**) and sinchianidine C (**3**) were determined by experimental electronic circular dichroism (ECD) spectra comparison. Biological activity evaluations revealed that sinchianidines C and D (**3-4**) demonstrated significant pain inhibition (78.16% and 72.54%, respectively) in acetic acid-induced writhing tests of mice at a dose of 5 mg/kg. Compounds **1-4** showed no significant inhibitory activity on hERG (Human Ether-à-go-go-related gene) and CaV3.1 (T-type calcium) channels. Additionally, all isolates showed no significant cytotoxicity against Hela, HCT8 and MCF7 human cancer cells in *vitro*.

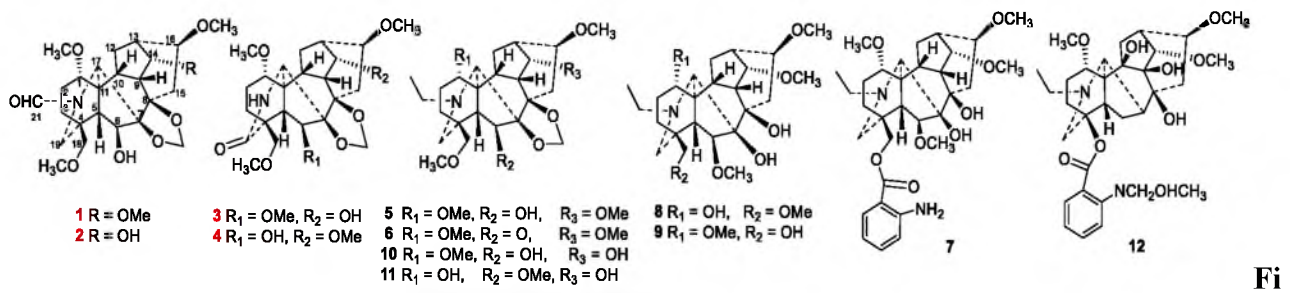

Fig. 1 Structures of new diterpenoid alkaloids

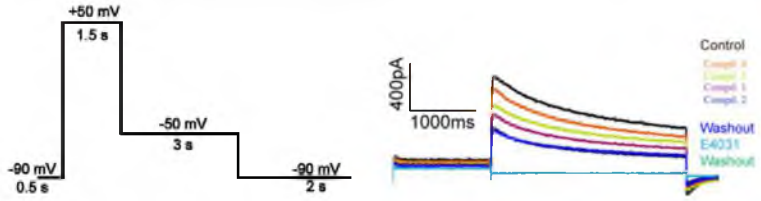

Fig. 2 Voltage clamp parameter setting diagram(L) and Typical graph of compounds **1-4** inhibition effect on hERG current (R)

ACKNOWLEDGEMENTS

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A FACILE METHOD FOR OBTAINING POTENTIALLY ACTIVE SULFONAMIDES IN THE BICYCLIC QUINAZOLONES SERIES

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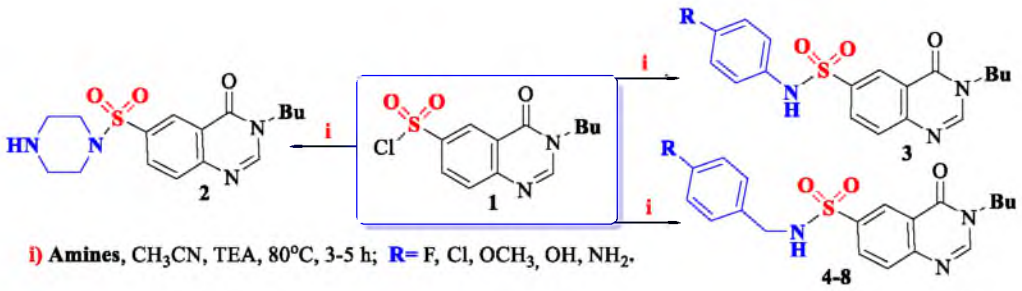
More than 90 years ago, sulfonamides changed modern medicine. These were some of the first widely used antibiotics. While penicillin soon overshadowed them as an antibiotic, sulfonamides are still very commonly used today to treat dozens of different conditions. In the U.S., there are over 40 sulfonamide drugs still approved for use.

Sulfonamides (SN) or sulfanilamides belong to an important class of synthetic antimicrobial drugs that are pharmacologically used as broad spectrum for the treatment of human and animal bacterial infections. Although sulfonamides have now been replaced by many other agents, they still have considerable value in the treatment of certain types of infections, such as urinary tract infections, eye and ear infections, and bronchitis. Compounds with pharmacological activity have been found among sulfonamide analogues containing secondary, aliphatic, and aromatic amine moieties [1-2].

On this basis, we modified 3-butyl-4-oxo-3,4-dihydroquinazoline-6-sulfonyl chloride (**1**) in the presence of secondary and aromatic amines, piperazine (**2**), 4-fluoroaniline (**3**) and electron-donating aliphatic amines 4-fluorobenzyl (**4**), 4-methoxybenzyl (**5**), 4-chlorobenzyl (**6**), 4-hydroxybenzyl (**7**) and 2-aminobenzyl (**8**) amines and synthesized the corresponding sulfonamides (**2-8**).



Since the above reactions facilitate nucleophilic substitution in a polar solvent, our reactions were carried out in the presence of TEA using a polar aprotic solvent - acetonitrile. The processes were carried out by heating the solution at boiling point for 3–5 hours. The structure of the obtained compounds was fully confirmed based on the results of IR, ^{1}H, ^{13}C NMR spectroscopy.

Acknowledgments: The authors were awarded a scholarship from the Academy of Sciences of the Republic of Uzbekistan for the project "Creation of scientific foundations for targeted synthesis of new, highly biologically active synthetic and natural compounds for the needs of agriculture and medicine using modern methods of organic synthesis." expresses its gratitude for the financial support provided within the framework of the research program.

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THE INFLUENCE OF SUPRAMOLECULAR COMPLEXES ON THE GERMINATION OF *Atriplex pratovii* SUKHOR. SEEDS DISTRIBUTED IN THE SOUTHERN ARAL SEA REGION

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In recent years, the level of desertification and salinization, which are one of the global environmental problems, has been sharply increasing in the world. This, in turn, causes an increase in the scale of a number of problems for humanity, especially in the plant world and various sectors of agriculture. Therefore, the identification of plant species adapted to growing in arid and highly saline regions and the development of biotechnological methods for their propagation are of great importance.

The study of seed germination processes is important not only for phytomelioration, but also for solving practical problems in conditions of severe drought. This, in turn, requires the application of many methods and the use of various stimulants to increase seed germination.

In this study, for the first time, the influence of supramolecular complexes on seed germination of *Atriplex pratovii* Sukhor. distributed in the Southern Aral Sea, was studied. For this, the seeds were first soaked in distilled water (control), gibberellin (Gibb) and glycyrrhizic acid (GA) solutions of the complexes GA:Gibb (4:1, 5:1, 9:1), GlA:IAA (4:1) and GlA:Gibb (4:1) at concentrations of 10^{-5}, 10^{-7}, 10^{-9} M for 24 hours and grown on filter paper. The experiments were conducted in a thermostat with an air temperature range of 26±20°C.

From the obtained results, it was found that the lowest germination was 38.35±0.95% in GA:Gibb 9:1 samples 10^{-5} M, and 38.82±1.39% in the control, and these indicators were practically the same. When comparing the complexes, the percentage of germination decreased with increasing concentration of the phytohormone Gibb, and the best germination was 58.06±0.73% in a solution with a concentration of 10^{-9}M.

Among the supramolecular complexes, in the experiment using the GlA:Gibb (4:1) stimulant, the percentage of germination increased with increasing concentration and amounted to 58.85±0.60% at 10^{-5} M, showing practically the same result as with a 10^{-9} M Gibb solution. Based on the biological characteristics of all tested supramolecular complexes, *A. pratovii* did not adversely affect seed germination and showed germination of more than 50%. In particular, GA:Gibb (5:1) at 10^{-9} M was 52.38±1.34%, GA:Gibb (9:1) at 10^{-9} M 57.07±0.75%, GlA:Gibb (4:1) at 10^{-5} M 58.85±0.60% and GlA:IAA (4:1) at 10^{-5} M 56.70±0.82%, the highest germination was observed at GA:Gibb (4:1) at 10^{-7} M 67.75±1.32%.

The results of the study showed that the treatment of *A. pratovii* seeds with the GA:Gibb (4:1) stimulant had a positive effect compared to other studied samples, and it was found that the use of a 10^{-7} M solution of the GA:Gibb (4:1) stimulant in the future is effective. This stimulant not only improved the germination rate, but also significantly increased the growth of the first germinated microphores and the development of the root system, and the highest result was achieved with treatment with GA:Gibb (4:1).

COMPONENTS OF STAMENS FROM *Crocus sativus*

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Crocus sativus L. is an annual cormous plant up to 25 cm tall, belonging to the *Iridaceae* family. Two wild species occur in the flora of Uzbekistan: *C. alatavicus* and *C. korolkowii*. However, these species are not used in the food and pharmaceutical industries due to the small amount of aromatic (safranal and isophorone) and flavor-imparting (crocin and picrocrocin) secondary metabolites they produce. Therefore, in global practice, *C. sativus* is used with a high content of target products. However, *C. sativus* does not occur in the wild, so this species is cultivated in many countries in Europe, Asia, and Australia. Currently, based on the special value and widespread use of *C. sativus*, work has begun for the first time on its introduction into the Republic of Uzbekistan.

The flowers of *C. sativus* contain three yellow stamens, six purple petals, and a filamentous white style, which eventually forms three red stigmas. In the preparation of 1 kg of stigmas, approximately 63 kg of floral by-products are obtained (53 kg of petals, 9 kg of stamens, and 1 kg of styles). Additionally, 1500 kg of saffron leaves are discarded as waste. Therefore, utilizing the bio-waste from saffron flowers for the large-scale extraction of secondary metabolites is a promising strategy for the disposal of valuable by-products [1].

The aim of this work is to conduct a phytochemical study of the secondary metabolites of the stamens of cultivated saffron introduced in the Jizzakh region of the Republic of Uzbekistan, and to evaluate the hepatoprotective activity of the sum of flavonoids obtained from the stamens.

For the isolation of phenolic compounds, the stamens of *C. sativus* flowers were collected during the flowering period in the late first decade of November 2022 in the Bakhmal district of the Jizzakh region of Uzbekistan. Dried and ground flower stamens (8 kg) were extracted with 70% ethanol at room temperature five times for 8 hours each. The combined extracts were evaporated to dryness and the resulting sum (4.12 kg) was diluted with hot water, then successively shaken with extraction gasoline, chloroform, ethyl acetate, and n-butanol, obtaining 226.05 g, 38.81 g, 78.6 g, and 300 g of the sum of extractive substances, respectively.

When separating the ethyl acetate fraction (50 g) of the alcoholic extract on a chromatographic column with silica gel and eluting with chloroform and a chloroform-methanol system in various ratios, seven subfractions (Crs.s,e-1; Crs.s,e-7) were obtained.

Rechromatographing the subfraction Crs.s,e-1 on a Sephadex LH-20 (GE Health Care) column in methanol yielded quercetin (**1**) and isorhamnetin (**2**), from Crs.s,e-2, phlazin (**3**) and cyanidanol (**4**), from Crs.s,e-3, astragalin (**5**) and tiliroside (**7**), and from rechromatographing the subfraction Crs.s,e-6, isoquercitrin (**6**), isorhamnetin-3-*O*-neohesperidoside (**8**), helichryzoside (**9**), and kaempferol-3-*O*-sophoroside (**10**) were isolated. The study of the remaining subfractions continues. The identification of the isolated compounds **1-10** was carried out by studying their spectral data (UV, IR, ^{1}H and ^{13}C NMR, as well as HSQC, HMBC) followed by comparison with the literature data for these compounds.

All isolated components were isolated from the stamen part of the cultivated saffron flower for the first time.

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SYNTHESIS OF NOVEL THIOUREA DERIVATIVES OF 6-AMINOBENZOPYRIMIDIN-4-ONES

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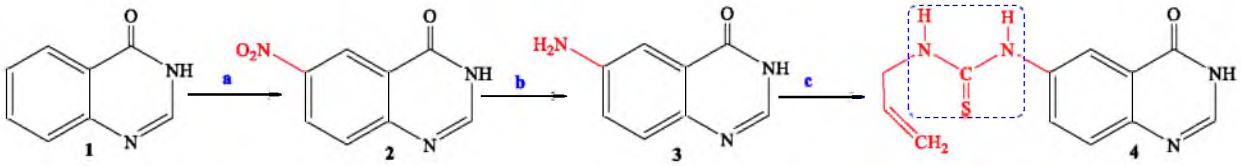
Today, drugs based on benzopyrimidine derivatives are widely used in medicine. Benzopyrimidine derivatives are widely used against colds, viruses, fungi, microbes, and cancer, and as plant stimulants [1]. In recent years, prozosin, bunazosin, dacomitinib and gefitinib have been used against tuberculosis and cancer. Despite the widespread use of pharmaceuticals in medicine, there is a growing demand for less toxic but highly effective drugs [2]. Based on these considerations, we set ourselves the goal of studying the substitution reactions in the aromatic ring for the synthesis of analogues of benzopyrimidine derivatives used in agriculture and medicine, the synthesis and modification of various biologically active representatives, and the determination of their structure using physical research methods.

During the research, benzopyrimidin-4-one **(1)** was synthesized. The resulting substance was treated with HNO_3+H_2SO_4 to produce 6-nitrobenzopyrimidin-4-one (**2**) in 95% yield. Then, the nitro compound was reacted with tin(II) chloride dihydrate ($SnCl_2 \cdot 2H_2O$) and conc. HCl (36%) to synthesize the corresponding 6-aminobenzopyrimidin-4-one (**3**, 65%). The synthesized substance was dissolved in DMF and reacted with allyl isothiocyanate under alkaline conditions to obtain 1-allyl-3-(4-oxo-3,4-dihydroquinazolin-6-yl)thiourea (**4,** 87%).



a) H_2SO_4/HNO_3, 40-45°C, 2 h; **b)** $SnCl_2$ $2H_2O$, HCl, C_2H_5OH, 4 h; **c)** DMF, K_2CO_3, 24 h.

An improved method for high-yield synthesis was used, using a heterocyclization reaction involving formamide and o-aminobenzoic acid, followed by nitration and reduction. The resulting substance was synthesized by reacting the amino group with allyl isothiocyanate to form a thiourea derivative (**4**), with high reactive potential. The structure of the synthesized substances was determined and proven using physical research methods: IR, and ^1H, ^{13}C NMR spectra.

Acknowledgments: The authors were awarded a scholarship from the Academy of Sciences of the Republic of Uzbekistan for the project "Creation of scientific foundations for targeted synthesis of new, highly biologically active synthetic and natural compounds for the needs of agriculture and medicine using modern methods of organic synthesis." expresses its gratitude for the financial support provided within the framework of the research program.

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A NEW WITHANOLIDE FROM *Saponaria officinalis*

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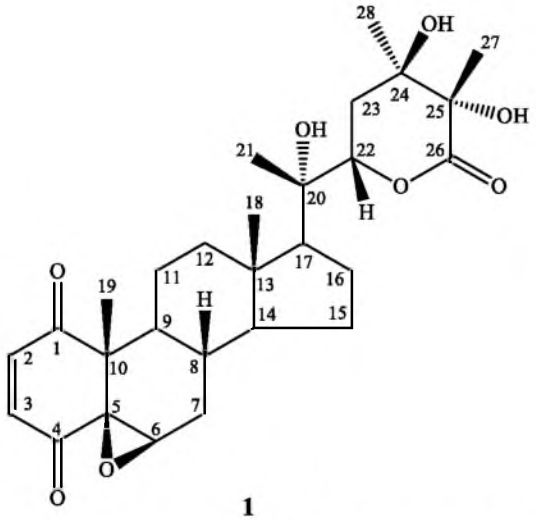
Saponaria officinalis L., commonly referred to as common soapwort or wormwood herb, is a widely recognized perennial species belonging to the *Caryophyllaceae* family. It grows naturally from Europe to Central Asia in various habitats, usually along roads, in hedgerows, and near water sources.

The composition of *S. officinalis* includes triterpene glycosides. Its leaves contain alkaloids, ascorbic acid, and flavonoids such as vitexin, saponarin, and saponaretin. As an herbal medicinal product, it is used as an expectorant for bronchitis, topically for skin diseases, and in the treatment of rheumatic disorders.

By performing rechromatography on intermediate eluates from butanol subfractions, we successfully isolated a novel withanolide (1). The yield of new compound **1** was determined to be 0.004% relative to the air-dry plant material.

A new compound **1** was isolated as a yellowish crystalline substance with a melting point of 185–187°C. The UV spectrum showed an absorption band at 223 nm, characteristic of withanolides. While the IR spectrum exhibited absorption bands corresponding to the hydroxyl group vibrations (3523 cm^{-1}), CH_2 group vibrations (2971 cm^{-1}), carbonyl group of the lactone ring (1741 cm^{-1}), carbonyl group (1687 cm^{-1}), and C–O stretching (1078 cm^{-1}). The molecular formula $C_{28}H_{38}O_8$ was determined by HR-ESI-MS positive ion at *m/z* 502.2674 $[M]^+$ (calculated for 502.2562, $C_{28}H_{38}O_8$). The chemical structure and relative configuration of the new withanolide were established based on 1D (^1H and ^{13}C) and 2D (HSQC, HMBC, COSY, and ROESY) NMR spectra data.



1

The chemical structure of new withanolide 1

Based on the presented data, the chemical structure of the new isolated compound **1** was determined to be 5β,6β-epoxy-20α,24β,25α-trihydroxy-1,3-dioxowitha-2-enolide, a previously unreported withanolide in the scientific literature.

ANTIRHEUMATOID ACTIVITY OF TWO 1H-1,2,3-TRIAZOLES DERIVATIVES IN A COLLAGEN-INDUCED RHEUMATOID ARTHRITIS MODEL

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Rheumatoid arthritis affects about 1% of the world's population. This is a chronic autoimmune, systemic disease characterized by damage to the synovial membrane of the joints, its hyperplasia and rapid increasing the volume of synovial tissue with progressive destruction of cartilage and bone tissue. The collagen-induced arthritis (CIA) model is based on the ability of type II bovine collagen, the main protein of articular cartilage, to stimulate the production of antibodies against bone and cartilage tissue in animals.

Using the CIA model in rats, we studied the antirheumatoid activity of two 1H-1,2,3-triazole derivatives (TB-59 and TB-88), previously identified in a screening model of formalin arthritis as the most active of 30 derivatives of this series. The activity of the substances was compared with the drugs Ketonal forte and Dicloberl Retard.

The results of an X-ray study of rats with CIA showed signs of destructive changes in the articular surfaces of the hip joint, narrowing of the joint spaces, erosion of bone tissue, as well as the presence of soft tissue edema around the affected joints. Radiographs study in the groups taking the investigated substances and comparison drugs, noted an improvement in the joint structure, a decrease in soft tissue inflammation and stabilization of bone tissue.

Biochemical markers of inflammation, such as the main interleukins, C-reactive protein, leukocyte elastase, showed that the studied substances increase the level of interleukin-4, decrease the levels of interleukin-6, TNF-α, CRP and leukocyte elastase, not inferior to the comparison drugs. Both the studied substances and the comparison drugs normalize the level of peripheral blood leukocytes, which was increased by 3 times compared to the control group in the CIA model, bringing this indicator to a value close to that in intact animals group. These data indicate inhibition of the inflammatory process.

Financing. This work was carried out using budgetary funds of ICPS the Academy of Sciences of the Republic of Uzbekistan.

We thank the Academy of Science of the Republic of Uzbekistan for supporting this study.

RESULTS OF BIOCHEMICAL, BIOLOGICAL AND BIOTECHNOLOGICAL STUDIES OF *Nitraria schoberi* L. PLANT DISTRIBUTED IN THE SOUTHERN ARAL SEA REGION

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As a result of the drying up of the Aral Sea, the increasing processes of desertification and salinization in large areas of the Aral Sea region lead to a change in natural geographical conditions, a worsening of the social situation, a decrease in vegetation cover, and the disappearance of some rare and endemic species. In such conditions, the identification of highly saline plant species distributed in areas free from seawater and the development of biotechnological methods for their propagation are of great importance.

No special studies have been conducted on the biochemical, biological, and biotechnological study of the Shoberi whiteflies *(Nitraria schoberi L.),* distributed in the dried-up southern regions of the Aral Sea. Therefore, the study of this plant and its effective use as a promising species will help to solve the above-mentioned problems.

For the first time, the *Nitraria schoberi* L. plant, distributed in the Southern Aral Sea region, was studied using biochemical, biological, and biotechnological methods. As a result, the natural geographical location of the Southern Aral Sea regions where the *N. schoberi* plant is distributed was studied, and a map reflecting the distribution of populations of this species was created. In addition, as a result of biochemical analysis of the aboveground parts of the *N. schoberi* plant, the total protein content ranged from 6.74% to 27.41%, the total content of free amino acids ranged from 18.28 mg/g to 39.35 mg/g, of which the highest amount of non-essential amino acids was in the leaves (23.08 mg/g), and it was found to be a rich source of C, PP, and B group vitamins, as well as carbohydrates such as glucose, fructose, and sucrose.

A sum of polyphenols was isolated from the aboveground part of the plant, and 19 different polyphenol compounds were identified using HPLC and chromatography-mass-spectrometry methods. Among them, substances such as 3,6-bis-O-galloyl-1,2,4-tri-O-galloyl-β-D-glucose, 2-bis-O-galloyl-1,3,4,6-tetra-O-galloyl-β-D-glucose, and 1,2,3,6-tetra-O-galloyl-β-D-glucose, which have antiviral activity, were proven to be present. Also, it was determined that the sum of polyphenols has antiradical, antibacterial, and antifungal properties.

The germination of *N. schoberi* seeds was studied under laboratory, field, and *in vitro* conditions. Seed germination in laboratory conditions was 83%, and in field conditions, it was 69.6%. Germination *in vitro* was increased to 96% by sowing seeds in a nutrient medium with DKW + 2 g/l activated carbon after 21 days of cold stratification at -20°C. For the first time, in a hormonal medium of DKW+6-BAP+NAA+GA_3 (0.5; 0.5; 1 mg/l), more than 15 new shoots were formed in each 30-day-old microshoot, and up to 40-45 cuttings were obtained from them. This developed an effective method for multiplying *N. schoberi* microshoots *in vitro*.

A technology for obtaining primary microshoots was developed by adding salts isolated from the Aralkum soils (T-7 moderately saline and T-11 strongly saline) to the optimized nutrient medium. The adaptability indicators of these microshoots to *ex vitro* (natural) conditions were 70% for T-7 and 61.3% for T-11, and seedling biomaterials adapted to growth in the Aral Sea region were created. As a result of the conducted research, it was possible to form a huge vegetation cover on the dried bottom of the Aral Sea by cultivating a promising species of *N.schoberi* with phytomeliorant and medicinal properties *in vitro* using callus clusters in a saline environment.

CLONING OF THE HBsAg GENE INTO A PLASMID VECTOR FOR *IN VITRO* TRANSCRIPTION

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Messenger RNA (mRNA) vaccines offer a rapid and effective approach to disease prevention by producing protective proteins. Their accelerated development timeline was demonstrated during the COVID-19 pandemic, with the Pfizer-BioNTech vaccine achieving 95% efficacy in just seven months and the Moderna vaccine reaching 94.1% efficacy within eight months. These vaccines stimulate both humoral and cellular immunity, providing robust and durable protection. With hepatitis B virus (HBV) responsible for an estimated 820,000 to 1 million deaths annually, the development of an mRNA-based HBV antigen vaccine is a critical step toward reducing the global burden of HBV-related disease.

This study focuses on the cloning of the HBsAg gene into the pcDNA 3.1 plasmid containing a T7 RNA polymerase promoter to facilitate *in vitro* mRNA transcription. The HBsAg gene was isolated from human blood infected with the Hepatitis B virus using the ENKOR kit (ICPS AS, Uzbekistan). Polymerase chain reaction (PCR) amplification was performed with primers incorporating *EcoRI* and *NotI* restriction sites, and the product was confirmed via agarose gel electrophoresis. The amplified gene and the T7 promoter-containing plasmid (pcDNA 3.1(+)) were digested with *EcoRI* and *NotI*, purified, and ligated using T4 DNA ligase at 37°C for 30 minutes. The recombinant plasmid (pcDNA 3.1(+)-HBsAg) was transformed into *E. coli* by electroporation, and transformants were selected on LB agar supplemented with ampicillin (Amp^+). Positive colonies were cultured, and the recombinant plasmid DNA was isolated. The presence of the HBsAg insert was verified through restriction digestion and gel electrophoresis (Fig. 1).

In this study, the HBsAg gene was successfully cloned into a T7 promoter-containing plasmid pcDNA 3.1+, enabling *in vitro* transcription studies for further vaccine development and therapeutic research.

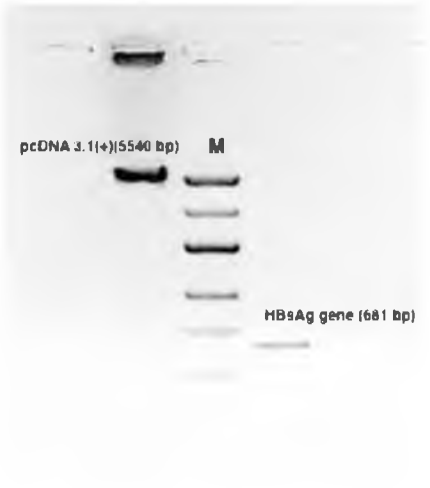

Fig 1. Gel electrophoresis after restriction digestion of recombinant plasmid pcDNA 3.1(+)-HBsAg

FLAVONOIDS FROM THE *Dracocephalum diversifolium*

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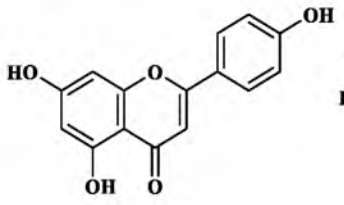
Plants of the genus *Dracocephalum* (family *Lamiaceae*) are known for their rich chemical composition and biological activity. The genus *Dracocephalum*, numbering about 70 species, is widespread in the temperate and subtropical regions of Eurasia. In Uzbekistan grows 16 species of this genus. Many of its representatives are used in folk medicine due to their pronounced antioxidant, anti-inflammatory, antimicrobial and antitumor properties [1].

We have investigated aerial art of *D. diversifolium* collected (August, 2020) in Djizak Region of the Uzbekistan. Air-dried raw material was extracted exhaustively with EtOH (96 %) at room temperature. The ethyl acetate fraction was chromatographed over a column of silica gel with elution by CH_3 : MeOH (50:1 – 1:1). Three flavonoids **1-3** were isolated from the ethyl acetate fraction of plant.

Investigation of NMR spectral 1D (^1H, ^{13}C) and 2D (HSQC, HMBC, COSY) data of compounds and their comparison with the literature and direct comparison with authentic samples the isolated compounds were identified as apigenin (**1**), tilianin (**2**). Crystals of salvigenin (**3**) were identified by X-ray diffraction.



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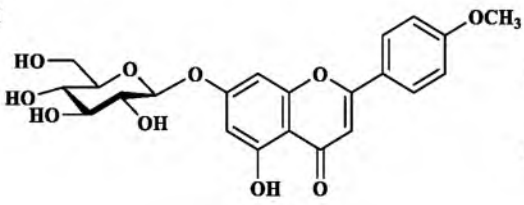

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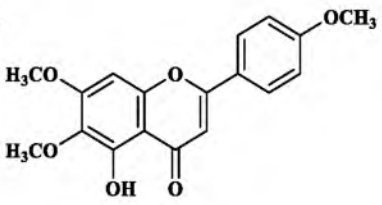

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CYTOTOXICITY OF ALKYL DERIVATIVES OF SOME 1,2,3,4-TETRAHYDROISOQUINOLINES ON NORMAL CELLS

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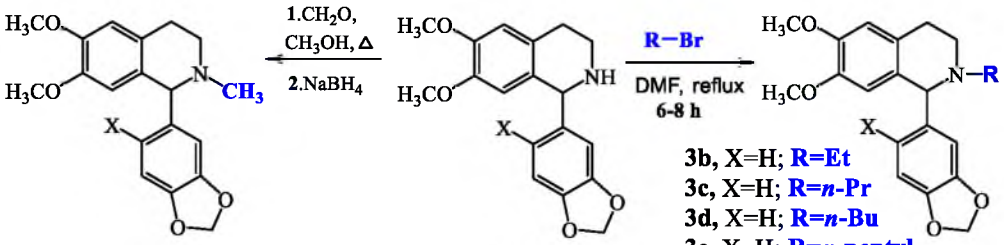
Cytotoxicity of twenty alkyl derivatives of tetrahydroisoquinolines on normal cells (blood mononuclear cells, hepatocytes, Vero B) was studied. The compounds have a similar chemical structure and differ in the length of the methylene chain at the nitrogen atom. Ten compounds contain a Br atom, 10 compounds are without bromine. These derivatives have previously been shown to exhibit cytotoxicity against cancer cell lines and are represented by the general formula as follows:



3a: X=H
4a: X=Br

1: X=H
2: X=Br

3b, X=H; **R=Et**
3c, X=H; **R=*n*-Pr**
3d, X=H; **R=*n*-Bu**
3e, X=H; **R=*n*-pentyl**
3f, X=H; **R=*i*-pentyl**
3g, X=H; **R=*n*-hexyl**
3h, X=H; **R=*n*-heptyl**
3i, X=H; **R=*n*-octyl**
3j, X=H; **R=*n*-nonyl**
3k, X=H; **R=*n*-decyl**

4b, X=Br; **R=Et**
4c, X=Br; **R=*n*-Pr**
4d, X=Br; **R=*n*-Bu**
4e, X=Br; **R=*n*-pentyl**
4f, X=Br; **R=*i*-pentyl**
4g, X=Br; **R=*n*-hexyl**
4h, X=Br; **R=*n*-heptyl**
4i, X=Br; **R=*n*-octyl**
4j, X=Br; **R=*n*-nonyl**
4k, X=Br; **R=*n*-decyl**

The cytotoxicity of compounds was studied by the MTT *in vitro* [1]. The test substances were added at concentrations of 100 μM. A well-known antitumor drug Cisplatin (NAPROD, India) was used as a reference drug in the same dose.

It was found that the length of the methylene chain of the tetrahydroisoquinoline molecule does not affect the increase in their cytotoxicity. Overall, 1-(3,4-methylenedioxy)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinolines lacking a bromine atom were found to be more toxic to healthy cells than bromine-containing derivatives (up to 66.2% and 34.4% cell growth inhibition, respectively). Blood cells were found to be the most sensitive to the action of 1,2,3,4-tetrahydroisoquinolines, while Vero B kidney cells were less sensitive.

Unlike healthy cells, bromine derivatives are more active against cancer cells than non-bromine molecules.

LIPIDS OF *Datisca cannabina*

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Relevance. *Datisca cannabina* L. (hemp datisca, family Datiscaceae) is a subshrub plant similar in general morphology to hemp (Cannabis sativa L.). The aboveground part of D. cannabina contains flavonoids, triterpenoids, steroids, alkaloids, tannins. Based on the sum of flavonoids, the drug "Datiscan" with diuretic, antipyretic and expectorant action was created. The lipids of the plant have not been studied.

The aim of the work was to study the composition of neutral and polar lipids of D. cannabina seeds collected in the Bostanlyk district of the Tashkent region in October 2024.

Materials and methods. The moisture content of grounded seeds was determined by the standard method. Neutral lipids (NL) were isolated by extracting the grounded raw material with hexane in a Soxhlet apparatus, polar lipids (glycolipids, GL, phospholipids, PhL) were extracted after defatted of lipids with a mixture of chloroform and methanol (2:1). The composition of three lipid groups was determined by TLC on silica gel in known solvent systems.

Obtained results. The D. cannabina seeds had a moisture content of 5.60% and contained: 34.81% NL, 2.9% GL, and 0.44% PhL. The main components of the NL seeds were triacylglycerides, accompanied by hydrocarbons, carotenoids, fatty acid (FA) esters with aliphatic and cyclic alcohols, free triterpenols, and phytosterols. The composition of FA lipids in the form of methyl esters was determined by GC on an Agilent 8860 GC gas chromatograph (table).

TABLE. Fatty acid content of lipids Datisca cannabina seeds, GC, % by weight of acids

Acid	NL	GL	PhL	Acid	NL	GL	PhL
10:0, 12:0	Trace	1,64	0,35	18:3n3	39,96	7,20	8,89
14:0	0,07	3,08	0,83	20:0	0,20	0,62	0,89
15:0	0,03	1,34	0,41	20:1n13	0,20	6,01	6,42
16:0	7,55	29,95	21,40	20:4n6	0,99	-	-
16:1	0,06	Trace	0,23	22:0	0,03	1,16	1,17
17:0	0,08	0,62	0,23	22:1n15	-	1,76	1,04
18:0	3,72	8,16	4,87	24:0	0,02	0,89	-
18:1n9	12,58	25,38	29,72	$\Sigma_{sat.\ FA}$	11,70	47,46	30,15
18:2n6	34,51	12,19	23,58	$\Sigma_{unsat.\ FA}$	88,30	52,54	69,85

Thus, this study was novel in reporting that the seeds of Datisca cannabina growing in Uzbekistan contain 34.81% NL and 3.34% PL. In lipids, 15 FA were found with the predominance of the sum of unsaturated FA (88.30%). The presence of fatty acids with increased biological activity (18:3n3, α-linolenic, 39.96% and 20:4n6; arachidonic, 0.1%) was noted.

QUANTITATIVE CONTENT OF GLYCYRRHETINIC ACID IN THE RESIDUE OF *Glycyrrhiza glabra* ROOTS FORMED AFTER WATER EXTRACTION

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In global practice, including in Uzbekistan, water (50-60%) is primarily used to obtain biologically active substances from the roots of *Glycyrrhiza glabra*. Water extraction mainly yields hydrophilic compounds. After their extraction, the roots of *Glycyrrhiza glabra* are often discarded as industrial waste. However, considering that many hydrophobic compounds in the roots, such as lipids, flavonoids with aglycones (glabridin), and some triterpene saponins, are poorly soluble in water, these substances remain in the secondary products of plant raw material processing. To standardize the resulting industrial waste, i.e., the secondary product, we conducted research on drying methods and factors affecting the drying process. As a result, optimal drying conditions were recommended: the thickness of the raw material layer in the drying apparatus – 15 cm, the speed of hot air – 15 m/s, the process temperature – 60°C, and the process time – 12 hours. Under these conditions, raw material with a standard moisture content of 10-12% was obtained.

The content of glycyrrhetinic acid in the standardized sample of raw material was determined using high-performance liquid chromatography (Shimadzu, Japan, model "LC-20"), with two pumps (model – P2000), an autosampler (model – AS3000), and a UV detector (model – UV 1000). The data collection and analysis were performed using ChromQuest software version 4.1. The analysis was conducted on a "Supelco" column (150×4.6 mm) with a stationary phase of SiO2 (C18) particles, 5 μm in size. The column temperature was 25°C, the detector wavelength was 254 nm, the injector volume was 20 μL, and the mobile phase flow rate was 2.0 μL/min. The mobile phase consisted of a mixture of 2.0 g sodium heptanesulfonate, 730 mL methanol, 270 mL purified water, and 120 mL glacial acetic acid. Glycyrrhetinic acid with 99.5% purity (Sigma-Aldrich) was used as the standard.

The formula for calculation:

$$X = \frac{S_1 \cdot a_0 \cdot P}{S_0 \cdot a_1 \cdot}$$

where:

X – glycyrrhetinic acid content in the raw material, %;

S_1 – peak area of glabridin on the chromatogram of the test solution;

S_0 – peak area of glycyrrhetinic acid on the chromatogram of the standard solution;

P – glycyrrhetinic acid content in the standard solution, %;

a_0 – mass of the standard substance, g;

a_1 – mass of the raw material, g.

The analysis results showed that the glycyrrhetinic acid content in the samples of standardized raw material (5 batches) ranged from 0.25% to 0.30%. Based on this, it was established that the glycyrrhetinic acid content in the residues of *Glycyrrhiza glabra* roots should be at least 0.25%.

Currently, work is continuing on high-tech extraction of glycyrrhetinic acid from the raw material with high purity.

ISOLATION OF STEROID SAPONIN FROM AERIAL PARTS OF *Silene tomentella*

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Steroid saponins are a class of widely distributed natural products with diverse biological activities. These compounds, found in various plant species, play significant roles in plant defense and have potential pharmacological applications.

Silene tomentella is a species of the *Silene* genus, which comprises numerous species distributed across diverse ecological regions. Due to its reported biological activities, a phytochemical investigation of *Silene tomentella* was conducted. The plant was collected from Bukhara region in June, 2021, and its botanical identification was confirmed at the Institute of the Chemistry of Plant Substances (ICPS), Uzbekistan.

A methanol extract of the aerial parts of *Silene tomentella* was suspended in H_2O and partitioned with hexane and n-BuOH. The BuOH-soluble extract (15.7 g) was subjected to column chromatography (SiO_2, solvent gradient AcOEt/MeOH 100:0 to 0:100), yielding multiple fractions (Frs. A–G). Fraction G (0.110 g) was subjected to CC, eluting with $CHCl_3$-EtOAc-CH_3OH (30:2:1), and $CHCl_3$ –EtOAc-CH_3OH (20:1:0.05), (15:1:0.05) to obtain lokundjoside (Fig.1) (0.0048 g). The structure of the compound was determined by spectroscopic methods, including 1D and 2D NMR.

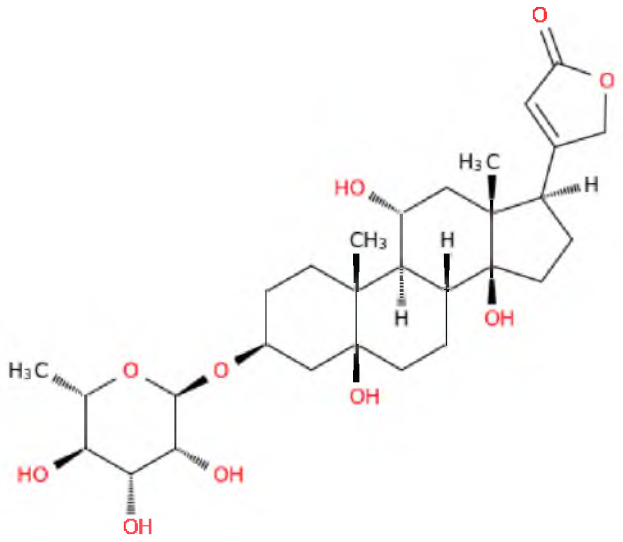

Fig.1. Lokundjoside

This compound (**1**), belonging to the steroid saponin, was isolated for the first time from the aerial parts of *Silene tomentella*.

CARBOHYDRATE COMPOSITION OF THE ABOVE-GROUND PART OF *Artemisia juncea* PLANT

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Artemisia juncea Kar. et Kir. (commonly known as rush-like wormwood) is a perennial semi-shrub (family *Asteraceae*) growing in Central Asia. The plant contains carotene, ascorbic acid, saponins, tannins, tannins, alkaloids, essential oil, as well as coumarin derivatives: coumarin, umbelliferon, esculetin, scopoletin and others, flavonoids, but there is little information on the carbohydrate composition of the above-ground part of *A.juncea*. We isolated the carbohydrate complex: alcohol-soluble sugars (ASPs), water-soluble polysaccharides (WSPs), pectin substances (PSs), hemicelluloses (HMCs) and determined their monosaccharide composition according to the known method [1,2] (Table 1). The isolated polysaccharides are amorphous powders of light brown color. WSP and PS are completely soluble in water and have a relative viscosity (η) of 1.83 and 3.4, respectively. HMCs are soluble in alkaline solutions. Infrared (IR) spectroscopy of the samples revealed absorption bands characteristic of polysaccharides. Glucose and fructose were detected in the composition of ASPs in paper chromatography (n-butanol-pyridine-water system 6:4:3, developing agents: acidic aniline phthalate and 5% urea solution). The monosaccharide composition of polysaccharides was determined by total acid hydrolysis. Hydrolysis was carried out with 1N H2SO4 at 100°C for 8 h for WSP, PS and HMC - with 1N H2SO4 at 100°C for 18 h. The qualitative and quantitative composition of the monosaccharides was analyzed using paper chromatography and high-performance liquid chromatography (HPLC) (Table 1).

Table 1.Content and monosaccharide composition of polysaccharides of the above-ground parts of *A. juncea*

Type of Polysaccharides	yield, %	Monosaccharide Composition (mg/mL)				
		Gal	*Glu*	*Ara*	*Xyl*	*UAc*
WSP	6	0,279	0,563	0,397	1,262	+
PS	4,3	0,181	-	0,180	1,813	+
HMC	8,5	0,352	0,188	1,186	0,983	+

As can be seen from the table, the dominant polysaccharides are water-soluble polysaccharides and hemicellulose. The isolated polysaccharides differ in monosaccharide composition. The presence of xylose and uronic acids is observed in all the polysaccharides. The polysaccharides are acidic polymers according to their monosaccharide composition. According to titrometric analysis, PS belongs to highly esterified pectins, where the degree of esterification (DE) is 64.1%.

Thus, from the above-ground part of *A. juncea* carbohydrate complexes were isolated and their physicochemical characteristics and monosaccharide composition were studied.

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FLAVONOIDS AND PHENYLPROPANOIDS OF THE AERIAL PARTS OF *Salvia sarawschanica*

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Salvia (sage) is one of the largest genera of the *Lamiaceae* family and is represented by more than 1000 species, widespread in various regions of the world, 25 species of plants of this genus grow on the territory of Uzbekistan [1]. Many species of sage are used to create herbal remedies, as well as in folk and traditional medicine of various countries. Substances isolated from representatives of the genus *Salvia* are characterized by significant cytotoxic, anti-inflammatory, antimicrobial, antiviral, antiplasmodial, antiplatelet-aggregation, growth inhibitory and repellent activity [2].

Salvia sarawschanica Regel et Schmalh - grows in dry riverbeds, rocks, stony, gravelly and fine-earth slopes of the lower and middle belts of the Pamir and Pamir-Alai mountains in Central Asia and Kazakhstan. The infusion is used in traditional medicine of Tajikistan for heart diseases, the extract has antiprotozoal and fungistatic properties [3].

In order to search for biologically active compounds, the crushed air-dried above-ground part of *S. sarawschanica*, harvested during the fruiting period in the Navoi region, was extracted at room temperature six times with methanol. From various fractions of the methanol extract, 16 individual compounds were isolated by column chromatography on silica gel and Sephadex LH-20. Based on the study of UV, ^{1}H and ^{13}C NMR spectral data, as well as HSQC and HMBC experiments, followed by comparison with literature data for these compounds, the isolated substances were identified with apigenin (**1**), genkwanin (**2**), acacetin (**3**), 7,4′-di-O-methylapigenin (**4**), salvigenin (**5**), eupatorin (**6**), cyrsiliol (**7**), luteolin (**8**), cynaroside (**9**), luteolin-3'-O-β-D-glucuronide (**10**), caffeic acid (**11**), rosmarinic acid (**12**), D-pinitol (**13**), β-sitosterol (**14**), stigmasterol (**15**) and daucosterol (**16**).

Compounds **1-7** and **10-16** from *S. sarawschanica* were isolated for the first time.

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COMPOSITIONS OF POLYSACCHARIDES WITH BIOLOGICALLY ACTIVE SYNTHETIC COMPOUNDS TO IMPROVE THEIR SOLUBILITY AND BIOAVAILABILITY

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In recent years, polysaccharides have found increasingly widespread use in the production of biologically active systems to improve the solubility of drugs. The object of the study is quinazoline compounds: 6-sulfonamide-3-butylquinozolin-4-one, (**Sc+AC-8**), 6-aminoquinazolin-4-one, 6-amino-2-methylquinazolin-4-one (**Sc+6A2MX4**), synthesized in the department of Organic synthesis of ICPS AS RUz.

The aim of this study is to create a polysaccharide-biologically active insoluble substance composition. To improve their solubility and bioavailability, we have developed compositions based on water-soluble polysaccharides (WSPS) isolated from the above-ground parts of S. *adenostegia* and *S.comosa*. The WSPS of monosaccharide composition of *S. adenostegia* is represented by galactose (14.0%), glucose (5.6%), arabinose (31%), xylose (4.4%), and uronic acids (43.6%), and in the case of WSPS *S.comosa*, the WSPS consists of galactose residues (15%), glucose (3.9%), arabinose (38%), rhamnose (6.9%), and uronic acids (36.2%).

To prepare polysaccharide-synthetic compound compositions, a method of mixing components in the liquid phase was used, with the participation of a solvent-water, and the chemical interaction of the system components was activated using an ultrasonic device. The compositions were created based on two types of WSPS *Scutellaria* and quinazoline compounds in different ratios. The optimal ratio of polysaccharide to synthetic compounds is 1:0.5. The obtained composites were studied by IR spectroscopy and ^{1}H and ^{13}C NMR spectroscopy. In the IR spectrum of **Sc+AC-8** there is no absorption band of the OH groups of the polysaccharide (3256 cm^{-1}). The absorption bands at 1583 and 1440 cm^{-1} are attributed to quinazolines, and the absorption bands in the region of 1712-1657 cm^{-1} are attributed to sulfate groups. The signals of ketone groups (C=O) appear in the region of 1712 cm^{-1}, the absorption bands of the NH_2 group overlap in the region of 1657-1440 cm^{-1}. The absorption band for amino groups is characteristic at 1657 cm^{-1}. In the ^{1}H NMR spectrum of the sample, chemical shifts of 8.33 (1H, s, H-5), 8.11 (1H, dd, J_1=2.19, J_2=8.6, H-7), 7.98 (1H, H-8), 7.54 (2H, s, NH_2), 3.50 (3H, s, CH_3) were identified. The chemical shift (CS) at δ 7.55 ppm appeared as a singlet and was attributed to the NH_2 protons. The spectrum also contained chemical shift signals at 4.67-4.29 ppm (H1), weak signals at 3.62-4.29 ppm, related to the anomeric region of arabinogalactan residues →6)-β-Galp-(1→ and →3)-β-Galp-1. In the IR spectrum of the composition **Sc+6A2MX4**, a change in the absorption band in the region of 3426 cm^{-1} is observed (characteristic of OH groups). In the spectrum, this band shifts downfield and a less intense band is observed at 3174 cm^{-1}, characteristic of the NH_2 group of 6-amino-2-methylquinozolin-4-one. Additionally, absorption bands appear in the region of 1668-1677 cm^{-1}, which corresponds to the stretching vibrations of C-NH groups, and changes are observed in the region of 1142 cm^{-1}. Probably, the combination of 6-sulfonamide-3-butylquinazolin-4-one with water-soluble polysaccharides of *Scutellaria* forms a salt due to the carboxyl groups of the uronic acid of the polysaccharide.

Thus, water-soluble compounds with reduced toxicity and increased bioavailability were obtained.

COMPOSITION OF THE ABOVEGROUND PART OF *Perovskia botschantzevii*

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The genus *Perovskia* Kar., belonging to the family Lamiacaeae, includes nine species of plants with ethnobotanical value and medicinal potential. In Uzbekistan, there are 4 species of plants of this genus, the phytocenoses of which occupy large areas. *Perovskia botschantzevii* Kovalevsk. & Koczk is a semi-shrub growing in the Samarkand, Jizzakh, and Navoi regions of Uzbekistan. The component composition of the essential oil of the above-ground part was previously studied.

In order to search for biologically active terpenoids and phenolic compounds, the chemical composition of the above-ground part of *P.botschantzevii*, harvested during the flowering period in the Farish district of the Jizzakh region, was studied. Ten individual compounds (**1-10**) were isolated from various fractions of the methanol extract using column chromatography on silica gel and Sephadex LH-20.

The identification of the isolated compounds was carried out by studying their UV, ^{1}H and ^{13}C NMR spectral data, as well as HSQC, HMBC, COSY experiments, followed by comparison with those of the literature data for these compounds, as well as direct comparison with authentic samples of substances **2–9.**

As a result, it was established that the substances we obtained are the diterpenoid carnosol (**1**), flavonoids luteolin (**2**), cyrsiliol (**3**), kaempferol (**4**), quercetin (**5**), taxifolin (dihydro- quercetin, **6**), phenylpropanoids caffeic (**7**) and rosmarinic (**8**) acids, as well as triterpenoids oleanolic (**9**) and ursolic (**10**) acids.

A modified agar diffusion method was used to study the antibacterial and antifungal properties of caffeic and rosmarinic acids. The results of in vitro tests showed that rosmarinic acid exhibits significant antibacterial activity against gram-positive bacteria *Bacillus subtilis* and *Staphylococcus aureus* with inhibition zone diameters of 18.04±0.10 and 18.08±0.12 mm, respectively. The studied samples were inactive against *Escherichia coli* and *Candida albicans.*

As a result of pharmacological studies, high anti-inflammatory activity of rosmarinic acid was established. Carnazole has antioxidant, antitumor, anti-inflammatory properties and protects the skin from cancer and joints from inflammation.

Compounds **1-10** were first isolated from *P.botschantzevii*, substances **1**,**3**,**6-10** were previously found in other plant species of the genus *Perovskia.*

STUDYING OF CARBOHYDRATE AND MONOSACCHARIDE COMPOSITION OF *Crotalaria juncea* SEEDS

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The study of high-molecular carbohydrate compounds from plants is advancing rapidly, aiding the development of effective medicines. Water-soluble polysaccharides, particularly galactomannans, have broad applications in the food, pharmaceutical, and textile industries. *Fabaceae* seeds, widely found in Uzbekistan, are a rich source of these non-toxic and non-allergenic compounds.

However, the polysaccharides of some *Fabaceae* species, including introduced ones, remain understudied. *Crotalaria* species, introduced in Karakalpakstan for fiber production, soil fertility improvement, and beekeeping, are of particular interest. The lack of data on their polysaccharide composition underscores the need for further research.

We isolated high-molecular compounds from the seeds of three *Crotalaria juncea* plants growing in different geographical areas. The yield of water-soluble polysaccharide extracts in cold (WSPS-c) and hot (WSPS-h) extracts, pectic substances (PS), and hemicellulose (HC) was determined. For seeds matured in Tashkent: WSPS-c – 6.7%; WSPS-h – 19.2%; PS – 1.6%; HC – 8.4%. For seeds matured in the Khorezm region: WSPS-c – 6.8%; WSPS-h – 4.6%; PS – 7.7%; HC – 7.9%. For seeds matured in Karakalpakstan: WSPS-c – 12%; WSPS-h – 8.3%; PS – 1%; HC – 8%. To determine the monosaccharide composition, they were subjected to acid hydrolysis. The qualitative composition of each polymer compound was determined using paper chromatography (PC). Since high-performance liquid chromatography (HPLC) is a powerful method for analyzing complex mixtures, it was used to quantify the monosaccharide composition of each high-molecular compound. When developing methods and determining the monosaccharide composition, sugars were derivitized with 2,4 dinitrophenylhydrazine.

Thus, the relevance of this study in the application of HPLC is related to the development of a method for determining the monosaccharide composition of polysaccharides, hemicellulose, and pectic substances in *Crotalaria juncea* plants growing in Tashkent, the Khorezm region, and Karakalpakstan. Experimental studies were carried out on a "Milichrome A-02" chromatograph, ProntoSil 120-5 C18 AQ column, Ø2x75 mm, with UV detector.

The monosaccharide compositions of each extract were determined. Monosaccharide composition of seeds matured in Tashkent. WSPS-c contained 13.4% *Gal* and 16.5% *Man*, WSPS-h contained 8.3% *Gal* and 24.9% *Man*, PS contained 17.5% *Gal* and 37.8% *Man*, HC contained 8.6% *Gal*, 32.5% *Man*, and 26.7% *Xyl*. Monosaccharide composition of seeds matured in the Khorezm region. WSPS-c contained 32.8% *Gal* and 63.3% *Man*, WSPS-h contained 19.5% *Gal* and 52.3% *Man*, PS contained 29.9% *Gal* and 65.6% *Man*, HC contained 11.1% *Gal*, 23.1% *Man* and 1.5% *Xyl*. Monosaccharide composition of seeds matured in Karakalpakstan. WSPS-c contained 7.0% *Gal* and 14.8% *Man*, WSPS-h contained 2.8% *Gal* and 5.8% *Man*, PS contained 2.8% *Gal* and 6.5% *Man*, HC contained 4.9% *Gal*, 8.0% *Man* and 1.5% *Xyl*.

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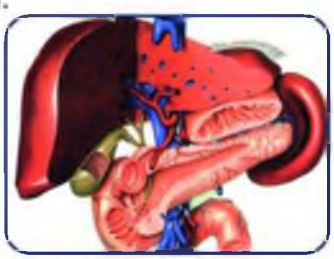

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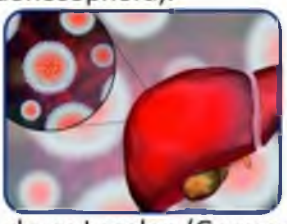

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CHEMICAL COMPONENTS OF *Perovskia scrophulariifolia* ROOTS

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Four species of plants of the genus *Perovskia* (family *Lamiaceae*) grow in Uzbekistan, and the species *P. angustifolia* and *P. scrophulariifolia*, which are taxonomically close, are quite widespread and form significant phytocenoses. In folk medicine, a decoction of the above-ground part of *P. scrophulariifolia* is used for scabies in humans and animals, as well as for healing sunburn and treating skin diseases. Dried flowers are brewed and consumed as tea to relieve gastrointestinal diseases and abdominal pain. In some countries of the Asian region, *P. scrophulariifolia* is used to remove intestinal parasites from the body. To search for biologically active compounds, we studied the chemical composition of the roots of *P. scrophulariifolia,* collected in the Samarkand region of the Republic of Uzbekistan in November 2023. Crushed dry roots were extracted six times with methanol at room temperature. Five individual compounds were isolated from various fractions of the methanol extract by column chromatography on silica gel and Sephadex LH-20. Based on the study of UV, ^{1}H and ^{13}C NMR spectra, as well as HSQC and HMBC experiments, followed by comparison with literature data for these compounds, the isolated substances were identified with the nor-ditepenoid cryptotanshinone, caffeic and rosmarinic acids, D-pinitol and β-stigmasterol.

Cryptotanshinone has a variety of pharmacological properties, including anticancer, anti-inflammatory, immunomodulatory, neuroprotective and antifibrotic activities. Rosmarinic acid is characterized by immunomodulatory, anti-inflammatory, antibacterial, antioxidant, neuro-protective and antidiabetic effects. D-Pinitol has antidiabetic and antioxidant properties.

A modified agar diffusion method was used to study the antibacterial and antifungal properties of cryptotanshinone and rosmarinic acid. The test results showed that rosmarinic acid has a pronounced antibacterial effect on *Bacillus subtilis* (18.04±0.10 mm), *Staphylococcus aureus* (18.08±0.12 mm) and *Pseudomonas aeruginosa* (12.04±0.10 mm) bacterial strains. The antibacterial activity of cryptotanshinone against bacterial strains *B. subtilis, S. aureus, P. aeruginosa* was 18.04±0.10 mm, 18.08±0.12 mm and 12.04±0.10 mm, respectively.

Compounds **1-5** from *P. scrophulariifolia* were isolated for the first time.

DEVELOPMENT OF UV-SPECTROPHOTOMETRIC ANALYSIS METHODS FOR TORASEMIDE

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Relevance: Torasemide is a diuretic drug, when it is used incorrectly, there is an increase in water and electrolyte imbalances in the cardiovascular system: hypovolemia, hypokalemia, hyponatremia. Torasemide is a loop diuretic administered in low doses. At higher doses, torasemide induces potent diuresis, characterized by a maximal effect. Overdose can lead to intensified diuresis with the risk of fluid and electrolyte loss, resulting in headache, weakness, drowsiness, arterial hypotension, and vascular insufficiency. Gastrointestinal tract disorders are possible. Patients with impaired liver function exhibit an increased plasma concentration of torasemide, attributed to decreased hepatic metabolism. In patients with cardiac or hepatic insufficiency, the half-life of torasemide and its M5 metabolite is slightly prolonged.

Aim: To develop a UV-spectrophotometric method for the analysis of torasemide.

Methods: The UV-spectrophotometric analysis of the torasemide standard was performed using Agilent Technologies 8453E Spectroscopy System. For this purpose, 0.02 g of the torasemide standard was weighed, transferred into a 100 mL volumetric flask, dissolved in 0.1 N hydrochloric acid, and diluted to the mark. The solution was thoroughly mixed and filtered through a 0.45 μm filter (Solution A). Working standard solutions (Solution B) containing 2-20 μg/mL of torasemide were prepared from Solution A. Analysis was performed in a 10 mm path length cuvette, within a 200 to 400 nm wavelength range, using 0.1 N hydrochloric acid as the reference.

Results: It was confirmed that the 0.1 N hydrochloric acid solution of torasemide exhibits a maximum absorbance at a wavelength of 287 nm.

Conclusion: The UV-spectrophotometric analysis of torasemide was studied. It was determined that the 0.1 N hydrochloric acid solution of torasemide has a maximum absorbance at 287 nm. The linearity, accuracy, and repeatability of the method were evaluated. The specific and molar absorptivity of torasemide were found to be 34.54 and 1263, respectively. The quantitative analysis of torasemide using the UV-spectrophotometric method was calculated through the constructed calibration curve, with an average content of 100.23%. The average relative error was found to be E_{ave}=0,486. The obtained results indicate the potential applicability of this method for determining torasemide isolated from biological objects and biological fluids.

DEVELOPMENT OF A UV-SPECTROPHOTOMETRIC METHOD FOR THE ANALYSIS OF MEPHEDRONE

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Relevance: Mephedrone has been included in the list of narcotic substances approved by the Cabinet of Ministers of the Republic of Uzbekistan in its resolution No. 85 dated February 14, 2020, regarding the "Regulations on the Control of Narcotic Drugs, Psychotropic Substances, Their Analogues, and Precursors." It is a substance that exhibits psycho-stimulant properties based on its pharmacological effects. In recent years, synthetic drugs have become increasingly popular among the population, with a large portion of them being phenylethylamine derivatives or amphetamines. Studies are being conducted using the UV-spectrophotometry method to identify and quantify mephedrone in various objects. This method has gained recognition among modern instrumental methods due to its low cost, convenience, and accuracy.

The objective of the work is to develop a UV-spectrophotometric method for the analysis of mephedrone.

Methods and materials: the UV-spectrophotometric analysis method for mephedrone was developed using the "Agilent Technologies" 8453E Spectroscopy System spectrophotometer. For this, 0.01 g of a standard mephedrone sample was weighed and placed into a 100 ml volumetric flask, dissolved in 50 ml of purified water, and made up to the mark with solvent. The solution was thoroughly mixed and filtered through a 0.45-micron filter (Solution A). From Solution A, working solutions (Solution B) containing 1-10 µg/ml mephedrone were prepared. The spectra of these solutions were recorded in a 10 mm thick cuvette in the wavelength range of 200-400 nm. Purified water was used as the reference solution. Using the obtained results, the specific and molar absorbance values of the mephedrone solution were calculated. Furthermore, a calibration graph was created for quantitative analysis, and the method's accuracy and reproducibility were studied.

Results: it was determined that the mephedrone aqueous solution has a high absorbance at a wavelength of 265 nm, which was confirmed by comparing it with the spectrum in the literature. The specific and molar absorbance values of the mephedrone solution were found to be 25.15 and 445.74, respectively. Using this method, mephedrone can be quantitatively determined in model solutions with a recovery rate of 100.23% and an average relative error of 0.12%.

Conclusion: a UV-spectrophotometric method for the analysis of mephedrone has been developed. The linearity, accuracy, and reproducibility of the method were studied. The quantitative analysis of mephedrone using the UV-spectrophotometric method is achievable through the calibration graph, with the relative error being within the required limits.

STABILITY OF THE COMPLEX OBTAINED FROM QUARSETIN WITH MONOAMMONIUM SALT OF GLYCYRRHIZINIC ACID

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The field of supramolecular chemistry, which is one of the relatively young directions, has created opportunities for creating methods for molecular encapsulation of a number of drugs, as well as for studying the structure of the obtained complexes and determining their stability.

Here we can take glycyrrhizic acid (GA), which is one of the biologically active triterpene acids. One of the remarkable properties of GA is the formation of molecular and supramolecular structures, structurally organized and functionally integrated chemical systems in solutions[1,2].

Of course, before us, complexes of MASGA with quercetin were obtained, their spectral analysis (UV-, IR-spectroscopy) was carried out, and the stability of the complexes (phosphate buffer Na_2HPO_4-NaH_2PO_4, pH 7.2) was determined [3,4].

However, we determined the stability of these complexes in the buffer medium PBS- (NaCl 137 mM, KCl 2.7 mM, Na_2HPO_4 10 mM, KH_2PO_4 1.76 mM, pH 7.4), as well as PBS+ (NaCl 137 mM, KCl 2.7 mM, Na_2HPO_4 8.1 mM, KH_2PO_4 1.47 mM, $CaCl_2$ 0.9 mM, $MgCl_2*6H_2O$ 0.5 mM, pH 7.4), corresponding to the concentration of ions in the human body.

The obtained results showed that the stability constant in a simple phosphate buffer medium in the MASGA:Que complex is practically the same as in PBS- and PBS+ buffers. It was also observed that the values of Gibbs free energy are practically the same in three different buffer media.

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STUDY OF THE "SADARAYKHON" VARIATY OF *Ocimum basilicum* L. CULTIVATED IN UZBEKISTAN

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Ocimum basilicum L. (Lamiaceae family), commonly known as basil, is an aromatic plant native to the Asian region, but it has been introduced worldwide. Basil is cultivated in America, Europe, East Asia, and other countries mainly for essential oil production. There are different varieties of *O. basilicum* with green and dark purple leaves and flowers [1]. The people of Uzbekistan distinguished them as "ashraykhan" (sweet basil), "kararaykhon" (black basil), and "sadaraykhon" (simple basil). The botanical differences between varieties of basil are plenty. Sadaraykhon is smaller in size and more compact than sweet basil. The aerial part of the sadaraykhon variety of basil, widely cultivated in Uzbekistan, were studied in terms of the volatile and fixed oils by using extraction, UV spectroscopy, TLC and GC-MS techniques. Volatile components of hexane extract and fatty acid methyl esters were analyzed on an Agilent 7890A GC/5975C Inert MSD instrument (Agilent Technologies, USA) equipped with a polar HP-Innowax column (30.0 m × 250.0 μm × 0.25 μm as described in [1]. UV-spectrum was acquired on a spectrophotometer Lambda 1050 (Perkin Elmer, Switzerland) in ethanol.

An ethanol extract of the aerial part of sadaraykhan was obtained with a yield of 6.9% of the air dried mass. The extract contains more than 5% fixed oil. The analysis of fixed oil by TLC indicates that it contains biologically active substances, such as unsaturated fatty acids, their esters with glycerol, as well as lipophilic components (phytosterols, pigments, essential oil components). The oil contains 1.1% pigments, consisting of chlorophyll "a', chlorophyll "b" and carotenoids.

A comparison of the fatty acid compositions of fixed oils from sadaraykhon and previously studied ashraykhan varieties of basil [2] shows that the unsaturated components, including the amounts of essential (*Z,Z*)-octadeca-9,12-dienoic (linoleic) and (*Z,Z,Z*)-octadeca-9,12,15-trienoic (linolenic) acids, are more in both basil varieties. Sadaraykhon, like the ashraykhan variety, produces volatile substances with a high content of oxygenated monoterpenes, the major constituent of which is linalool.

Thus, our results indicate the content essential fatty acids, phytosterols, volatiles, carotenoid and chlorophyll pigments are of great interest as bioactive additive in herbal medicine.

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COMPOSITION AND ANTIMICROBIAL ACTIVITY OF *Perovskia kudrjaschevii* ESSENTIAL OIL

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Plants of the genus *Perovskia* Kar. (family Lamiacaeae) are represented by 9 species of semi-shrubs growing in mountainous regions in Southwest and Central Asia. Representatives of the genus are almost not affected by pests and diseases due to the presence of essential oil in the above-ground mass, which has phytoncidal and insecticidal properties.

Perovskia kudrjaschevii Gorschk. & Pjataeva - grows on the rocky slopes of the mountains of Uzbekistan, Tajikistan and Kyrgyzstan. The chemical composition of this species has not been previously studied. In order to search for biologically active compounds, we studied the composition of the essential oil and hexane extract of the above-ground part of *P. kudrjaschevii,* collected during the flowering period in the Bostandyk district of the Tashkent region. The essential oil was isolated from the crushed air-dried aboveground parts by hydrodistillation at atmospheric pressure for 3 hours. The qualitative and quantitative compositions of the essential oil and hexane extract were determined on an Agilent 5975C Inert MSD/7890A GC chromatograph mass spectrometer with an Agilent HP-INNOWax quartz capillary column (30 m × 250 μm × 0.25 μm).

Using the GC-MS method, 67 compounds were identified in the essential oil, and 12 substances were found in the hexane extract, which amounted to 93.1 and 75.7% of the total amount of essential oil and extract, respectively. Monoterpenes (38.1%) and oxidized monoterpenes (26.4%) predominate in the essential oil. The main component of the essential oil is 1,8-cineole, the content of which was 14.24%. The essential oil also contains camphor (11.5%), cyclofenchene (6.6%), β-caryophyllene (6.3%), alloaromadendrene (4.9%), endo-borneol (4.9%), camphene (4.0%), β-myrcene (3.6%), humulene (3.6%), β-caryophyllene oxide (3.1%), p-cymene (2.7%), β-bisabolene (2.6%), etc. The major components of the hexane extract are cyclododecane (14.2%), 1,8-cineole (11.2%), 1-decene (8.3%), α-cedrene (8.2%), (2E)-tetradecene (6.3%), 9-epi-β-caryophyllene (5.7%), camphor (4.6%), (9Z)-octadecenal (4.17%), β-caryophyllene (3.8%).

The main component of the essential oil of the above-ground part 1,8-cineole (eucalyptol) belongs to bicyclic monoterpenoids and has moderately expressed antiexudative and cytotoxic activity, as well as significant analgesic and antitumor properties.

To study the antibacterial and antifungal properties of the essential oil and hexane extract from the above-ground part of *P. kudrjaschevii,* a modified agar diffusion method was used, and gram-positive bacteria *Bacillus subtilis, Staphylococcus aureus;* gram-negative bacteria *Pseudomonas aeruginosa, Escherichia coli* and the fungal strain *Candida albicans* were used as test cultures. The hexane extract showed a significant antibacterial effect against the bacterial strains *B. subtilis* and *S. aureus* with inhibition zone diameters of 14.04±0.10 and 17.04±0.10, respectively, as well as against *P. aeruginosa* (inhibition zone diameter of 17.04±0.10 mm).

The antimicrobial activity of the essential oil may be due to the presence of 1,8-cineole in its composition.

(1S)-LAUDANIDINE ALKALOIDE FROM *Lindelofia macrostyla*

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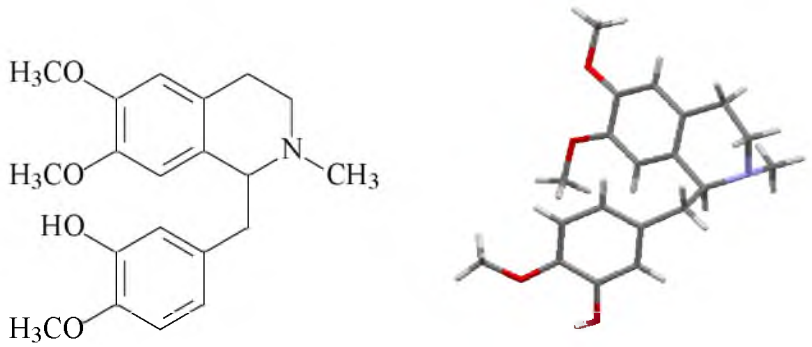
Research material and metods: As a research material, a sample of *Lindelofia macrostyla* plant collected from Chimyon foothills of Tashkent region was taken. The crushed plant sample was cooled with 10% ammonia solution. The aqueous portion was separated and filtered and extracted with dichloromethane. 2/3 of dichloromethane was removed and the remainder was extracted with 5% sulfuric acid solution. Alkaloids salted with sulfuric acid were basified with 5% ammonia solution and extracted with chloroform. In this way, a collection of chloroform alkaloids purified from non-polar molecules was isolated. The total alkaloids were analyzed on Aluminum TLC plate F254 and 6 distinct spots were found. By comparison with reference substances by the HPLC method, 2 of them were identified as lindelofin and N-oxide lindelofin [1], which were previously isolated from this plant. One alkaloid was isolated from the total of alkaloids using the preparative HPLC method [2]. The isolated alkaloid was determined to be (1S)-laudanidine alkaloid according to the results of X-Ray analysis. (1S)-Laudanidine alkaloid earlier isolated from the plant *Roemeria retracta* DC. (Papaveraceae family)n[3].



Scructure of (1S)-laudanidine alkaloid in the crystal

Conclusion: (1S)-Laudanidine – isoquinoline alkaloid was isolated for the first time from *Lindelofia macrostyla.*

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VITAMIN COMPOSITION OF SOME TYPES OF PLANTS OF THE BORAGINACEAE FAMILY

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For the first time, the quantitative content of the most common water-soluble vitamins in 3 plant species: *Rindera oblongifolia* M. Pop., *Rindera cyclodonta* (Bge) M. Pop. and *Lindelofia macrostyla* (Bge) M. Pop., belonging to the Boraginaceae family, was studied and their comparative analysis was carried out. The main component of *R. cyclodonta* is vitamin B1, and for *R. oblongifolia* it is vitamin B2. The *Lindelofia macrostyla* sample contains a predominant amount of all seven defined vitamins (including vitamins B9 and C, which are generally absent in representatives of the genus *Rindera*), compared with samples of 2 other plant species (*R. cyclodonta* and *R. oblongifolia*).

The content of water-soluble vitamins in the samples of the above 3 plant species was determined using the HPLC method. The results of the analysis of the studied plants are shown in the table.

Table. **Content of water-soluble vitamins in 3 plant species of the genera *Rindera* and *Lindelofia***

	Sample name	Quantitative content mg/100 g						
		B1	B6	B9	PP	C	B2	B12
1	*Rindera cyclodonta*	27,20	12,75	-	0,49	-	2,53	2,35
2	*Rindera oblongofolia*	-	32,58	-	6,14	-	46,34	12,52
3	*Lindelofia macrostyla*	14,15	20,27	2,987	40,99	172,14	49,74	26,53

R. cyclodonta contains 5 water-soluble B vitamins, but lacks vitamins C and B9. The sample has a high content of vitamin B1, which is involved in the metabolic processes of the human body, controls and improves its immunity. In the absence of vitamin B1 in *R. oblongifolia*, its content in *R. cyclodonta* is 2 times higher than in *L. macrostyla*. The data obtained lead to the conclusion that the vitamin composition of *R. cyclodonta* consists mainly of water-soluble vitamins B1 and B6.

Conclusions: For the first time, the content of the most common water-soluble vitamins in three plant species of the Boraginaceae family, growing in Uzbekistan, has been determined.

FLAVONOID COMPOSITION OF SOME TYPES OF PLANTS OF THE BORAGINACEAE FAMILY

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For the first time, the quantitative content of the most common flavonoids in three plant species *Rindera oblongifolia* M. Pop., *Rindera cyclodonta* M. Pop. and *Lindelofia macrostyla* M. Pop., belonging to the Boraginaceae family, was studied and their comparative analysis was carried out.

The analysis of flavonoids was carried out by HPLC method using the isocritical elution mode and a diode-array detector (DAD). Acetonitrile and a buffer solution were used as the mobile phase. Spectral data were studied in the spectral range from 200 to 400 nm.

The presente of four compounds (robinin, rutin, gyperazide and gallic acid) in the studied plants was shown for the first time, and the flavonoids apigenin, hypolaetin, isorham-netin and hypolaetin 7-O-D-glycoside were absent in all three samples. The species *L. macrostyla* significantly exceeds the other two species in flavonoid content (table).

Table. **Content of flavonoids in 3 types of plants of the genera Rindera and Lindelofia**

Sample name	**Quantitative content mg/100 g**							
	Robinin	**Hypolaetin**	**Rutin**	**Hypolaetin-7-O-D-glycoside**	**Isorhamnetin**	**Gallic acid**	**Hyperozide**	**Apigenin**
Rindera oblongifolia	5,29	-	92,36	-	-	84,73	0,46	-
Rindera cyclodonta	5,23	-	297,26	-	-	123,45	0,99	-
Lindelofia macrostyla	5,89	-	393,63	-	-	125,88	5,57	-

Conclusion: The obtained data indicate that the studied plants contain a large number of flavonoids useful for a living organism.

THE ACTOPROTECTIVE EFFECT OF A DRY EXTRACT FROM THE AERIAL PART OF *Cistanche salsa*

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Cistanche salsa, the *Orobanchaceae* family, contains a complex of biologically active substances aerial part of: phenolic compounds, including flavonoids, tannins, as well as various carbohydrates, minerals, organic acids, etc.

We studied the actoprotective effect of a dry extract from *Cistanche salsa* (CS). The experiments were carried out on male mice weighing 18-20 g. CS extract was administered orally at a dose of 100 mg/kg. The control animals received an equi-volumetric amount of water. The effect of the test substance as a means of potential actoprotective action was considered in comparison with the effect of the well–known actoprotector, bemitil, which was administered at a dose of 50 mg/kg to mice.

To assess the effect of the studied substances on physical performance, a test of mice swimming to complete fatigue was used.

It was found that with single and repeated administration of CS extract, the duration of swimming of animals (with a load of 5% of body weight) increased by 38.3 and 53.7%, respectively, in compare to the control group, and bemitil, taken for comparison, increased the swimming time of mice by 17.4 and 28.6%. It is important to note that the effect of bemitil in both cases was significantly lower than the effect of CS extract.

In an experiment with prolonged swimming of mice without a load until complete fatigue, with a single injection of CS extract, the duration of swimming of animals increased by 26.5% in compare to the control, the reference drug bemitil increased the swimming time of mice by 15.7%.

In another experiment, CS extract and bemitil were administered after the first swim of the mice and then the mice swam again after an hour. In the control after 1 hour of rest the duration of swimming of the animals was 35.7% of the initial value assumed to be 100%. Against the background of the action of CS extract and bemitil, the efficiency increases by 63.6 and 28.8%, respectively, in animals of the control group.

Thus, the results of the conducted studies show that the dry extract from *Cistanche salsa* has significant actoprotective activity higher than those of the drug bemitil.

LOLIOLIDE LACTONE ISOLATED FROM *Rindera cyclodonta* PLANT

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The study of the production of biologically active compounds by living organisms has led to the discovery of numerous compounds with varying degrees of structural complexity [1]. One of the simplest molecules is monoterpenoid lactones, among which loliolide is the most common. Loliolide has been identified in animals (insects) and plants (flowers, shrubs, trees), as well as in terrestrial and marine organisms, such as algae (photosynthetic aquatic organisms with simple structures, which may or may not have a cell nucleus) and corals. Long-term research has demonstrated that loliolide exhibits anticancer, antibacterial, and antifungal biological properties [2].

The plant was collected during its flowering period from the Forish district of Jizzakh region. The aerial part of the plant was dried and ground using a mill. The plant sample was extracted eight times with 80% ethanol. The alkaloid fraction was isolated from the extract, and the chloroform alkaloid fraction was subjected to column chromatography using silica gel (0.063–0.100 nm). During column chromatography, chloroform-methanol mixtures with different ratios (from 200:1 to 1:1) were used as eluents. From the initial 14–20 fractions, 20 mg of loliolide monoterpenoid lactone was obtained in its pure form. The structure of the isolated lactone was confirmed by X-ray structural analysis.

This is the first time loliolide lactone has been isolated from the *Rindera cyclodonta* plant. The molecular formula was determined as $C_{11}H_{16}O_3$, with a melting point of 153–155°C.

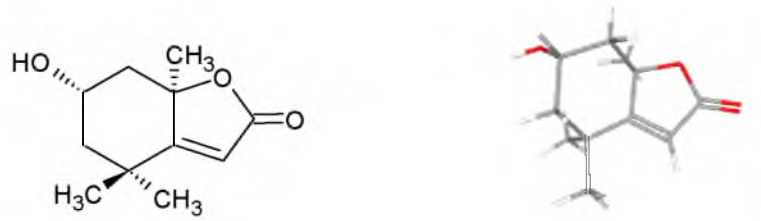

Fig.1. Structural formula and spatial (RTT) structure of loliolide lactone.

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INVESTIGATION OF CATALYTIC PROPERTIES OF RECOMBINANT URIDINE (UP) AND THYMIDINE PHOSPHORYLASES (TP) EXPRESSED IN PICHIA

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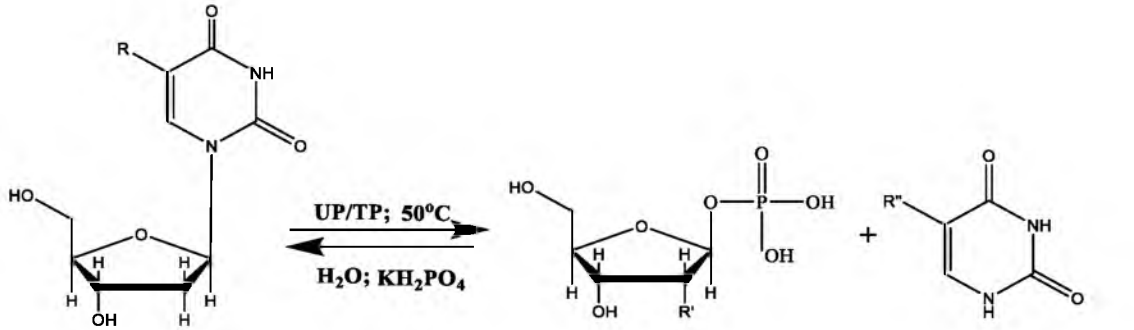
Pyrimidine nucleoside phosphorylases, including Uridine - (UP, EC 2.4.2.3) and Thymidine phosphorylase (TP, EC 2.4.2.4) are key enzymes in the pyrimidine salvage pathway, catalyzing the reversible phosphorolysis (transglycosylation) of uridine/thymidine to pyrimidine bases and ribose-/or deoxyribose-1-phosphate [1]. Recombinant UP and TP are widely applied for the biocatalytic synthesis of modified nucleosides, which have used as potential antiviral (Sofosbuvir, Telbuvidine, etc.), anticancer (Fludarabine, Cytarabine) and antibacterial (Gemcitabine, Floxuridine) drugs. Many preparations based on modified nucleosides are obtained by methods of multi-stage chemical synthesis, which has a number of significant drawbacks. The "One-Pot" enzymatic synthesis of modified nucleosides using recombinant nucleoside phosphorylases may serve as a highly cost-effective alternative [2].

We have cloned recombinant plasmids pPICZαA-UdP and pPICZαA-TP for expressing of UP and TP's in the *Pichia pastoris* cells, as an efficient expression system for large-scale biotechnological production of recombinant proteins. The substrate specificity of the obtained recombinant enzymes were analyzed by observing the hydrolysis of uridine and thymidine into uracil/thymine and ribose- or /2-deoxy-D-ribose-1-phosphate (scheme 1).



Scheme 1. Enzymatic hydrolysis of pyrimidine nucleosides by UP/TP.

HPLC analysis of the reaction mixtures showed that recombinant UP (~ 29 kDa) and TP (~ 49 kDa) produced in *Pichia pastoris* GS115 cells lead to hydrolysis of pyrimidine nucleosides within 1 hour by more than 50% under our experimental conditions, exhibiting high hydrolytic activity, indicating their potential for enzymatic transglycosylation of modified nucleosides.

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OBTAINING SUPRAMOLECULAR COMPLEXES OF THE MONOAMMONIUM SALT OF GLYCYRRHIZIC ACID WITH SOME ANTIBIOTICS

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Antibiotics play an important role in organ transplantation and other operations, as well as in diseases caused by bacteria (pneumonia, sepsis, meningitis, acute tonsillitis (angina), tuberculosis, etc.). Currently, as a result of the widespread use of antibiotics, the level of resistance in microorganisms is increasing. As a result, the creation of potent and effective drugs for the treatment of bacterial infections is becoming increasingly important. Supramolecular complexes between triterpenic acids and antibiotics can help increase their effectiveness against microorganisms.

Glycyrrhizic acid and its aglycone-glycyrrhetinic acid which belong to the class of triterpene acids, are considered safe and low-toxicity agents because they are derived from natural sources (*Glycyrrhiza glabra L.*). At the same time, glycyrrhizic acid is a substance with a wide range of effects, exhibiting anti-inflammatory, anti-cancer, anti-arthritic, antiviral, antioxidant, immunomodulatory, hepatoprotective, and neuroprotective properties [1]. Due to its hydrophobic and hydrophilic properties, it enhances the ability of antibiotics to penetrate the body, thereby increasing their efficiency while allowing for a reduced antibiotic dosage. Such natural additives are very important in modern pharmacology for the creation of safe and effective drugs.

Taking into account the aforementioned properties, supramolecular complexes of cephalosporin-class antibiotics (first-generation Cefazolin, second-generation Cefuroxime, third-generation Ceftriaxone, and fourth-generation Cefepime) with the monoammonium salt of glycyrrhizic acid were obtained in 2:1 and 4:1 molar ratios. The physico-chemical properties of the obtained compounds were analyzed, and spectral studies, including IR and UV spectroscopy, were performed. Currently, research is ongoing to evaluate the antibacterial activity of these complexes in collaboration with workers of the Institute of Microbiology of the Academy of Sciences of the Republic of Uzbekistan.

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VOLATILE COMPOUNDS OF THE AERIAL PART OF *Tragopogon graminifolius*

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Tragopogon graminifolius DC. is a perennial plant belonging to the Asteraceae family. It is distributed across Europe, the Caucasus, Afghanistan, Iran, and the Central Asian republics, including Uzbekistan. In traditional medicine, it is used to treat gastrointestinal diseases and liver conditions [1].

This plant species has been scarcely studied. Therefore, we investigated the volatile compounds of the aboveground part of *Tragopogon graminifolius* collected during the flowering period in Chirchik, Tashkent region.

The composition of the essential oil obtained by hydrodistillation was determined using an Agilent 5975C Inert MSD/7890A GC-MS (Agilent Technologies, USA). The GC-MS analytical conditions were analogous to those described in the literature [2]. Constituents were identified by comparing mass spectral characteristics with data in electronic libraries. Retention indices (RI) of the compounds were determined from the ratio of retention times of a mixture of *n*-alkanes (C9–C30) and by comparing their mass spectral fragmentation with published data [3].

In the essential oil, 25 out of 33 detected compounds were identified. The following compounds were identified: 1-pentadecene (0.98%), cis-2-nonene (0.83%), heneicosane (26.75%), methyl-cyclooctane (0.74%), 2,3-dihydro-benzofuran (0.52%), carbonic acid, prop-1-en-2-yltetradecyl ester (3.06%), 2-decene (1.00%), carbonic acid, decylundecyl ester (0.80%), 1,2-benzenedicarboxylic acid, bis(2-methylpropyl) ester (12.47%), cyclododecane (1.03%), 2-chloropropionic acid, pentadecylester (0.71%), *Z,Z*-6,13-octadecadien-1-ol acetate (0.42%), 1-dodecene (2.27%), aromadendrene (0.94%), trichlorodocosylsilane (0.57%), n-hexadecanoic acid (20.05%), 8-oxabicyclo[5.1.0]octane (1.76%), cyclopentadecane (1.65%), (*Z,Z*)-9,12-octadecadienoic acid (8.66%), 1-tetradecene (2.53%), and (*Z,Z,Z*)-9,12,15-octadecatrienoic acid (5.18%).

The identified compounds account for 92.92% of the total oil composition. According to the GC-MS analysis, the main components include the hydrocarbon heneicosane, fatty acids, and their esters: *n*-hexadecanoic acid, 1,2-benzenedicarboxylic acid bis(2-methylpropyl) ester, (*Z,Z*)-9,12-octadecadienoic acid, and (*Z,Z,Z*)-9,12,15-octadecatrienoic acid.

All the identified compounds have been reported for the first time in the essential oil of *Tragopogon graminifolius*.

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VOLATILE COMPONENTS OF *Handelia trichophylla*

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The study aimed to investigate the aerial part of *Handelia trichophylla* (Schrenk ex Fisch. & C.A. Mey) Heimerl., collected in the Jizzakh region (Uzbekistan) near the village of Bobur (16.05.2024) during the flowering period.

The gas chromatography-mass spectrometry (GC-MS) analysis was used to examine the petroleum fraction of the ethanol extract of *Handelia trichophylla*. Out of 42 identified compounds (99.45%), 27 compounds were determined, accounting for 80.51% of the total petroleum fraction of the ethanol extract composition. Among them, monoterpenoids make up 22.87%, sesquiterpenoids – 41.89%, diterpenoids – 0.32%, alcohol – 4.79%, hydrocarbons – 6.16%, ketone – 0.67%, organic acid esters – 2.86%, fatty acids – 0.95%.

The major components of Handelia trichophylla flower essential oil are: *trans*-β-caryophyllene (18.73%), isobornyl acetate (12.09%), *cis*-β-caryophyllene (6.70%), *cis*-muurola-4(15),5-diene (4.88%), isoamyl alcohol (4.79%), (+)-limonene (3.53%), 2,4,5,6,7,7a-hexahydro-4,7-methano-1H-indene (3.02%), humulene (α-caryophyllene) (2.75%), α-amorphene (2.59%), cadin-1,4-diene (2.47%), 1,8-cineole (2.46%).

The petroleum fraction of the ethanol extract of *H. trichophylla* was examined for antibacterial and antifungal activity. The antibacterial and antifungal activity was evaluated using the modified agar diffusion method, with a test sample concentration of 20 μL per disk [1,2]. Disks impregnated with antibiotics Ampicillin, Ceftriaxone, and Fluconazole (Himedia Laboratories Pvt. Limited) were used as positive controls, and DMSO was used as a negative control. The following microorganism strains were used as test cultures: *Bacillus subtilis* (RKMUz - 5), *Staphylococcus aureus* (ATCC 25923), *Pseudomonas aeruginosa* (ATCC 27879), *Escherichia coli* (RKMUz - 221) and the fungal strain *Candida albicans* (RKMUz - 247). The RKMUz strains were obtained from the collection of the Institute of Microbiology of the Academy of Sciences of the Republic of Uzbekistan.

The *in vitro* screening results demonstrated that the petroleum fraction exhibited notable antibacterial and antifungal activity against all tested microbial strains. Among them, the most sensitive strain to the petroleum fraction of the ethanol extract of *Handelia trichophylla* was *Pseudomonas aeruginosa* (18.04 ± 0.10 mm).

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SECONDARY METABOLITES OF *Handelia trichophylla*

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Handelia trichophylla (Schrenk ex Fisch. & C.A. Mey) Heimerl. - a perennial plant of the family. Asteraceae, growing in the plains of Central Asia (Uzbekistan, Kazakhstan, Tajikistan) up to the middle belt of mountains [1].

Previous studies have shown that Handelia trichophylla is a source of sesquiterpene lactones [2]. However, other classes of secondary metabolites have not been studied. Continuing the study of the above-ground part of Handelia trichophylla collected in Jizzakh region (Uzbekistan) in the vicinity of Bobur settlement (16.05.2024) during its flowering period [3], sesquiterpene lactone Cumambrin A (**1**), flavonoids 5,7-dihydroxy-6,4'-dimethoxyflavone (**2**), and eupatillin (**3**) were isolated from the chloroform fraction of the ethanol extract. The structure of the compounds was confirmed using spectral analysis methods.

Cumambrin A (**1**) - colorless cubic crystals with m.p. 190-191°C (ethanol). ^{1}H NMR (600 MHz, $CDCl_3$, δ, ppm, J/Hz): 1.25 (3H, s, H-14), 1.70 (1H, br s, 10-OH), 1.87 (1H, d, J = 6.8, H-9α), 1.91 (3H, s, H-15), 2.09 (1H, tdd, J = 1.9, 4.2, 13.0, H-9β), 2.17 (3H, s, -OCOC$\underline{H}_3$), 2.23 (1H, dddd, J = 1.5, 2.9, 7.7, 15.5, H-2β), 2.32 (1H, dd, J = 5.9, 16.7, H-2α), 2.57 (1H, dddd, J = 0.8, 6.6, 7.8, 10.9, H-1), 2.77 (1H, br t, J = 8.3, H-5), 3.90 (1H, m, H-7), 3.99 (1H, dd, J = 9.3, 10.6, H-6), 5.17 (1H, ddd, J = 1.4, 5.8, 9.6, H-8), 5.51 (1H, m, H-3), 5.52 (1H, d, J = 3.1, H-13a), 6.19 (1H, d, J = 3.5, H-13b). ^{13}C NMR (150 MHz, $CDCl_3$, δ, ppm): 54.32 (C-1), 33.62 (C-2), 125.56 (C-3), 143.8 (C-4), 54.44 (C-5), 80.37 (C-6), 46.52 (C-7), 73.48 (C-8), 38.89 (C-9), 73.80 (C-10), 138.54 (C-11), 169.59 (C-12), 121.44 (C-13), 33.61 (C-14), 17.95 (C-15), 170.26 (-O$\underline{C}$O-CH$_3$), 21.53 (-OCO-$\underline{C}$H$_3$).

5,7-dihydroxy-6,4'-dimethoxyflavone (**2**) – light yellow crystals with m.p. 224-225 °C (ethanol). ^{1}H NMR (600 MHz, $CDCl_3$, δ, ppm, J/Hz): 3.89 (6H, s, 2 x O$\underline{C}$H$_3$), 6.58 (1H, s, H-8), 6.60 (1H, s, H-3), 7.03 (2H, d, J = 8.9, H-2',6'), 7.84 (2H, J = 8.9, H-3', 5'), 12.08 (1H, br s, 5-OH). ^{13}C NMR (150 MHz, $CDCl_3$, δ, ppm): 55.61 (4'-O$\underline{C}$H$_3$), 60.94 (6'-O$\underline{C}$H$_3$), 93.47 (C-8), 103.80 (C-3), 106.77 (C-10), 114.59 (C-3', 5'), 123.60 (C-1'), 128.14 (C-2',6'), 130.43 (C-6), 152.23 (C-5), 153.21 (C-9), 155.12 (C-7), 162.70 (C-4'), 164.24 (C-2), 183.02 (C-4).

Eupatilin (5,7-Dihydroxy-3',4',6-trimethoxyflavone) (3) - yellow crystals with a melting point of 239-240°C (MeOH). The spectral data are similar to the literature data [4] and the substance was reliably identified by comparison with the standard sample.

Compounds **2** and **3** from this plant were isolated for the first time. Compounds **2** and **3** belong to methoxylated flavones with antioxidant activity.

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ULTRASONIC EXTRACTION OF SESQUITERPENE LACTONES FROM *Inula grandis* ROOTS

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Extraction of biologically active compounds from plant raw materials is a key process in the development of natural medicinal products. *Inula grandis* L. (great elecampane) contains sesquiterpene lactones, which exhibit anti-inflammatory, antioxidant, and anticancer properties. The root extract of *I. grandis* is included in the anthelmintic formulation "Helmintabs" [1]. To enhance the efficiency of extracting these compounds, ultrasonic extraction (UAE) is widely used, as it accelerates the process through cavitation and improves the solubility of active components in the solvent [2]. Based on this, we have initiated a study on the extraction process of *Inula grandis* roots using ultrasound.

Several factors influencing the extraction process were determined, including raw material particle size and the selection of an optimal solvent. Ultrasonic extraction was performed for 20 minutes at a frequency of 20–25 kHz and a power of 350 W/L, with a temperature range of 45–50°C.

The experiments revealed that the optimal particle size for extraction was 0.2 cm, at which the highest mass of extractable substances was obtained.

To determine the best solvent, the following extraction agents were used: chloroform, ethyl acetate, ethanol at various concentrations (60%, 80%, 95%), methanol, water, and hot water (80°C). The lowest extraction yield was observed with chloroform, while the highest was obtained using hot water. However, the total mass of extractable substances was not the sole determining factor. Infrared (IR) spectra of the extracts were analyzed to confirm the presence of carbonyl groups in the γ-lactone ring and to quantify the biologically active sesquiterpene lactones, based on the absorption band area.

IR spectroscopy showed that the highest yield of sesquiterpene lactones was achieved with ethyl acetate, followed closely by chloroform. The use of 80% and 96% ethanol showed promising results, but full extraction was not achieved in a single process. Methanol provided moderate extraction efficiency; whereas 60% ethanol and water increased the total extract mass by co-extracting additional compounds, reducing the relative concentration of lactones.

Thus, extraction can be effectively conducted using chloroform, ethyl acetate, and 96% ethanol. However, chloroform is an expensive and toxic solvent compared to ethyl acetate and ethanol. Therefore, ethyl acetate is considered the optimal extraction solvent. Its application in combination with ultrasound allows for a faster extraction process and a higher yield of biologically active sesquiterpene lactones.

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DETERMINATION OF MICROBIOLOGICAL PURITY OF THE ABOVE-GROUND PARTS OF *Carthamus tinctorius*

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Relevance. Considering current trends in harmonizing quality requirements and testing methods for herbal medicinal products, as stipulated by regulatory documents of various countries,the State Pharmacopoeia of the Republic of Uzbekistan, and general technical regulations on the safety of medicinal products, the need to determine the microbiological purity of plant raw materials is indicated among the parameters that regulate their quality and safety.

The purpose of the study. Medicinal products, including those of plant origin, which are not sterilized during the production process, may be contaminated with microorganisms. A study on the microbiological purity of *Carthamus tinctorius L.,* recommended for use against diabetes mellitus, was conducted.

Materials and methods. The object of the study is a sample of the above-ground part *of Carthamus tinctorius* L. The microbiological purity test included quantitative determination of viable bacteria and fungi, as well as identification of certain types of microorganisms that are unacceptable in non-sterile medicinal products.

Test for microbiological purity were conducted using the official two-layer agar methods in Petri dishes. A 10 g sample of raw material was suspended in a phosphate buffer solution (pH 7.0) to achieve a final suspension volume of 100 ml. The prepared sample suspension was then added to each of two test tubes containing 4 ml of medium No. 1, which had been melted and cooled to a temperature between 45°C and 50°C. The contents of the test tubes were quickly mixed and transferred to Petri dishes containing 15-20 ml of the corresponding nutrient medium. The top layer of agar was evenly distributed by rapidly swirling the Petri dishes. After the medium solidified, the plates were inverted and incubated for 5 days at 35°C. The number of bacterial colonies on two plates was counted after 48 hours and again after 5 days. The average value was calculated and multiplied by the dilution factor to determine the number of microorganisms per 1 g of sample. The total fungal count was determined using the aforementioned agar method with Sabouraud medium. Detection and identification of bacteria from the Enterobacteriaceae family, as well as Pseudomonas aeruginosa and Staphylococcus aureus, were carried out in accordance with the requirements of the State Pharmacopoeia of the Republic of Uzbekistan.

Results and conclusions. Table 1 presents the results of determining the microbiological purity of the studied raw materials.

Table 1. **Indicators of microbiological purity of the above-ground part *Carthamus tinctorius***

Indicators	Requirements of regulatory documents	Results of the analysis	Compliance with regulatory requirements
Aerobic bacteria 1 g count (per sample)	No more than 10^7	140 CFU	Corresponds
Total number of yeast and mold fungi (in 1 g samples)	No more than 10^5	10 CFU	Corresponds
Group Enterobacteriaceae (Escherichia coli, Salmonella), Pseudomonas aeruginosa and Staphylococcus aureus)	Should be absent	None	Corresponds

As can be seen from the data provided, the above-ground part *of Carthamus tinctorius* L. fully complies with the requirements for medicinal plant materials in terms of microbiological purity.

STUDY OF ESSENTIAL OILS OF THE SEEDS OF *Isatis tinctoria*

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Relevance: Woad (Ísatis tinctória) is a member of cruciferous family (Brassicaceae), which has long been used in the treatment of various diseases in folk and traditional medicine of many countries. In Europe, research is being conducted on Isatis tinctoria to obtain preparations for the treatment of tumours. The biological properties of the raw material are known from traditional Chinese medicine. It is known from the literature that the plant contains many valuable biologically active compounds, including several alkaloids (tryptantrine, indirubin, indolinone), phenolic compounds (flavonoids) and polysaccharides, vitamins, as well as glucosinolates, carotenoids, volatile components and fatty acids.

In Uzbekistan, Isatis tinctoria is not a pharmacopoeial plant and is not listed in the register of medicines. Recent scientific studies have shown its promising use as an antiviral, antibacterial and antimicrobial agent, and proved its anti-inflammatory, antioxidant and anticoagulant effects.

The aim of the study is to identify essential oils (EO) of Isatis tinctoria L. seeds.

Materials and methods: Plant samples were collected in Parkent district of Tashkent region of the Republic of Uzbekistan in September, after full maturation of seeds. The objects of the study were dried seeds, which were dried in a well-ventilated space at room temperature in the shade.

Essential oil from crushed seeds was extracted by hydrodistillation for 4 h using a glass flask and a Clevenger nozzle. The obtained EM was a pale yellow mobile liquid with a specific odour. The obtained sample was stored in a refrigerator at 0 °C until gas chromatography-mass spectral (GC-MS) analysis.

GC-MS analysis. The components of the obtained sample were analysed on an Agilent 7890AGC gas chromatograph with an Agilent 5975C inert MSD quadrupole mass spectrometer as a detector. Components were identified based on comparison of mass spectra characteristics with data from electronic libraries.

Results: The GC-MS method was used to identify 55 components in the EO composition of Isatis tinctoria L. seeds. The main dominant components of the essential oil of the seeds of the studied plant were (-)-borneol (15.79%), 1,8-cineol (12.42%), linalyl isovalerate (11.78%), 4-isopropyl benzaldehyde (3.68%), palmitic acid (3.39%), 3-methyl-2-butenenitrile (3.16%), 4-isopropyl-2-cyclohexenone (3.15%), p-vinyl guaiacol (3.02%) and phenylacetaldehyde (2.02%).

Conclusions: Borneol has antiviral and antispasmodic properties. It is indispensable as a natural remedy for headaches. When used topically, it exhibits anti-inflammatory, antibacterial, anteseptic, analgesic action, improves blood microcirculation. Cineol has mucolytic, bronchodilator and anti-inflammatory properties and provides symptomatic relief in patients suffering from asthma and rhinosinusitis.

The results of the research show that the seeds of Isatis tinctoria L. can be used to produce oil with medicinal properties and introduced into domestic pharmaceutical practice. It is also possible to use seeds and oil obtained from seeds for the development of biologically active additives.

As a result, documentation for the introduction of a biologically active additive based on Isatis tinctoria seeds oil – "Istinol" was developed.

STUDY OF WATER-SOLUBLE VITAMINS OF THE *Inonotus hispidus* BASIDIOMYCETES

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Relevance: Shaggy bracket (*Inonotus hispidus*) is a member of the family of Hymenochetaceae, which has long been used in the treatment of various diseases in folk and traditional medicine of many countries. The biological properties of the raw material are known from traditional Chinese medicine. It is known from the literature that the basidiomycetes contain many valuable biologically active compounds, including phenolic compounds (flavonoids) and polysaccharides, vitamins, as well as glucosinolates, carotenoids, volatile components and microelements.

The aim of the study is to identify water-soluble vitamins in the dry exstract isolated from *Inonotus hispidus* basidiomycetes.

Materials and methods: Basidiomycetes of *Inonotus hispidus,* collected from mulberry trees growing in the mulberry plantation of the Tashkent Sericulture Research Institute located in Tashkent city, were used as the raw material for obtaining the dry extract in which water-soluble vitamins were to be determined. The basidiomycetes consist entirely of brown, oval-shaped fruiting bodies with a diameter of 8-10 cm. During the process, a dry extract was isolated from the raw material.

Water-soluble vitamins in the sample were determined using the highly effective liquid chromatography method. 5-10 grams are weighed on analytical scales and placed in a 300 ml flat flask. Add 50 ml of a 40% ethanol solution. The mixture is equipped with a magnetic stirrer, a reverse cooler, boiled with intensive stirring for 1 hour, and then stirred at room temperature for 2 hours. The mixture is settled and filtered. The remaining part was re-extracted 2 times with 25 ml of 40% ethanol. The filtrates were combined and placed in a 100 ml volumetric flask and filled with 40% ethanol (5-10%) up to the line. The resulting solution is rotated in a centrifuge at a speed of 7000 rpm for 10 minutes. The resulting solution was taken from the surface for analysis.

Chromatography conditions:

- Agilent-1200 chromatograph (equipped with an autosampler)
- Column Eclipse XDB C18 (reversed-phase), 5 μm, 4.6 x 250 mm
- Diode array detector (DAD), identification at 250 nm
- Flow rate 0.8 ml/min
- Eluent acetate buffer: acetonitrile:

0-5 min 96:4,
6-8 min 90:10,
9-15 min 80:20,
15-17 min 96:4,
thermostat temperature 25°C, 5 μl injection volume

Initially, working standard solutions were introduced into the chromatograph, followed by the prepared working solutions.

Results: As a result of the study, the following water-soluble vitamins were identified in the raw material: vitamin C - 0, vitamin B2 - 14.7 mg/g, vitamin B9 - 4.01 mg/g, vitamin B3-8.62 mg/g, vitamin B6 - 4.94 mg/g.

Conclusions: The research results show that the fruit body of Inonotus hispidus contains water-soluble B vitamins, which will serve as a basis for a deeper study of the composition of the raw material in the future.

THE STUDY OF PROTEINS IN THE CREATION OF PROMISING SUNFLOWER VARIETIES

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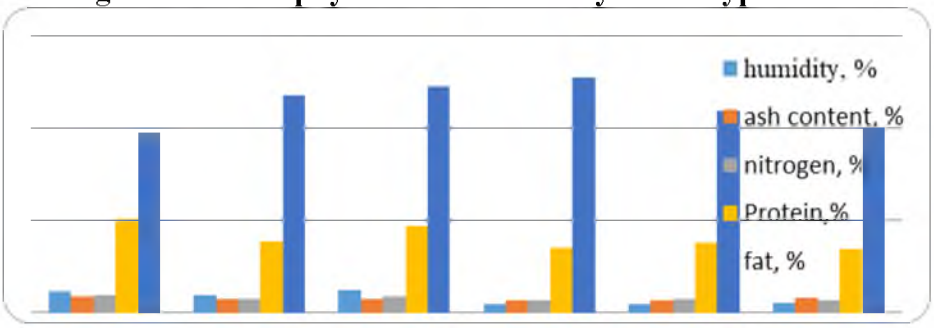
Sunflower seeds are the fruits of the annual sunflower (*Helianthus annuus*), which is one of the most powerful natural sources of nutrients. The purpose of our work is to determine the basic chemical compositions of the seeds of 6 sunflower samples grown in the soil and climatic conditions of Karakalpakstan. The breeders used a simple and complex hybridization method based on many years of scientific fertilization. The research work is to create new promising varieties and recommend a state variety for testing. The quantitative protein content of 6 samples KK-29, KK-33, KK-35, KK-44, KK-52, and KK-60 was determined using the Kjeldahl method on an automatic Hanon K1100F analyzer, which includes mineralization, distillation, and titration to measure nitrogen content, and then converted to protein content using a coefficient recalculation. It was found that the relatively high protein content in the KK-29 sample was 19.5%. The protein content varies from 14-19%. The oil content of sunflower depends on the variety and the conditions of its cultivation. The oil content in 6 samples was determined by the standard method of exhaustive acetone extraction. The relatively high fat content was 51.02% in the KK-44 sample. The fat content varies from 40-55%. The results are shown below in Fig. 1. In addition, the functional groups of isolated proteins from 6 types of the studied samples were determined. IR spectra of proteins were taken on a Perkin-Elmer system 2000 IR Fourier spectrophotometer in KBr tablets.

Fig.1. Results of physico-chemical analysis of 6 types of sunflower



Thus, the KK - 44 sample is a relatively high-oil sample, has a relatively low humidity, ash content and low protein content, which makes it possible to recommend this sample for the solution of obtaining high-quality sunflower oil.

The work was carried out under the project "Creation of new promising early-ripening, high-yielding, high-oil sunflower varieties from simple and complex hybrids suitable for the soil and climatic conditions of Karakalpakstan" by the Institute of Agriculture and Agrotechnologies of Karakalpakstan

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STUDY OF THE LIPID-PROTEIN COMPLEX OF ELITE SESAME SEEDS OF THE KARSHIGA VARIETY IN THE SOIL AND CLIMATIC CONDITIONS OF KARAKALPAKSTAN

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Sesame is one of the most common foods in the East. The literature data on the nutritional value of sesame seeds (Sesamum indicum L.) are presented. According to the literature, sesame seeds contain up to 55% oil and up to 20% protein. Sesame proteins are lysine-limited, but rich in tryptophan and methionine. Sesame oil is characterized by a high content of linoleic and oleic acids, the predominance of gamma-tocopherol over other isomers of vitamin E, as well as a high content of fat-soluble lignans (sesamine and sesamoline). Sesame oil has a hypocholesterolemic antiatherogenic effect [1]. The comprehensive use of sesame seeds as a source of not only edible oil, but also dietary protein, will make it possible to create complete, protein-enriched foods that are significantly cheaper than products made from expensive animal protein. The prospects of such a solution are indisputable - the resources of plant raw materials, as replenished, are practically unlimited. The purpose of our work is to determine the basic chemical compositions of 6 samples of elite Karshiga sesame seeds in the soil and climatic conditions of Karakalpakstan for propagation and application. The quantitative protein content of 6 samples of Karshyg samples 1, sample 2, samples 3 and Karshyg IO1, IO2, IO3 was determined using the Kjeldahl method on an automatic analyzer Hanon K1100F. It was found that the relatively high protein content in the Karshyg sample was 2-20.52%. The oil content of sesame depends on the variety and conditions of its cultivation. The oil content in 6 samples was determined by the standard method of exhaustive acetone extraction. The comparatively high fat content was 51.05% in the Karshyg sample of samples 1. The fat content varies from 35-51%. The results are shown below in fig. 1.

Fig.1. Results of physico-chemical analysis of 6 types of sesame seeds

In addition, the functional groups of isolated proteins from 6 types of the studied samples were determined. IR spectra of proteins were taken on a Perkin-Elmer system 2000 IR Fourier spectrophotometer in KBr tablets.

The work was carried out under the project "Propagation and application of elite seeds of the sesame Karshiga variety in the soil and climatic conditions of Karakalpakstan using an improved new method" of the Institute of Agriculture and Agrotechnologies of Karakalpakstan.

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DETERMINATION OF THE AMOUNT OF ACETAMIZOLE IN THE MODIFIED PECATSETIN COMPOSITION

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With purpose of obtaining of new anthelmintic agents, which have high biological activity and low toxicity a technology for producing polymer compositions of acetamizole with pectin in the has been studied, the formation of which is established by IR spectrometry [1,2].

The low-frequency shift of the absorption bands of the stretching vibrations of the C = O (about 20 -25 cm^{-1}) of pectin in the complex compared to the original pectin shows a part of the group in the intermolecular H-bond. Furthermore, there is a change in the IR spectrum at 3150 -3550 cm^{-1} region of complex relative to the starting compounds.

The aim of our work was developing an analysis method for the modification of acitamizole with pectin. Quantitative determination of acetamizole in the preparation carried out by spectrophotometric method by SF- 46 instrument.

A mixture of 0.2 mol/l acetic acid and ethyl alcohol is used as a comparison solution.

In parallel, the optical density of the standard acetamizole solution is measured. Measurement of the optical density of the standard and the test samples is carried out at a wavelength of 295 nm.

The weight fraction of the major substance (X,%) on acetamizole was calculated according to the formula:

$$X = \frac{D_1 * a_0 * b}{D_0 * a_1} \text{ where}$$

D_0 - the optical density of the standard sample of acetamizole;

D_1- the optical density of the test solution;

a_0- the weight of the standard sample of acetamizole, g

a_1- the weight of preparation, g

b-content of the standard sample of acetamizole.

Thus, the quantity determination method of the major substance in the preparation modified with acetamizole and pectin was developed.

Financing. This work was carried out using budgetary funds of ICPS the Academy of Sciences of the Republic of Uzbekistan.

We thank the Academy of Sciences of the Republic of Uzbekistan for supporting this study

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ABOUT THE ANTIARRHYTHMINE (N–DESACETYLLAPPACONITE HYDROBROMIDE) SUBSTANCE

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Currently, the medicinal substance Allapinin, which has antiarrhythmic properties, has been created based on alkaloids from the roots and rhizomes of *Aconitum septentrionale, Aconitum lycoctonum* L., and this medicinal substance has been produced serially in large quantities for many years. An antiarrhythmic drug with new antiarrhythmic properties was created from a by-product of production (recrystallization residue), and was approved for clinical trials by the Pharmacology Committee under the Ministry of Health. Our scientific research has shown that N-desacetyllappaconite hydrobromide is formed during the production of the allapinin substance by the removal of the acetyl group from the lappaconitine alkaloid as a result of hydrolysis under the influence of certain factors (temperature, solution environment - pH, etc.). In the development of processes for the production of an antiarrhythmic drug substance from a raw material - a secondary product, when the substance was obtained by extracting the N-desacetyllappaconite hydrobromide salt in the main state, its instability - a change in color during storage - was discovered.

A technology has been developed to obtain an antiarrhythmic substance (N-desacetyllappaconite hydrobromide), which does not change its quality during storage, in its salt form, that is, in its native state, from a secondary production product and from the substance lappaconite hydrobromide. The stability of the obtained substance and its solution when stored at room temperature was studied. Currently, work is underway to prepare the finished dosage forms of the drug for clinical trials in the form of a 1% solution of 1 ml and 10 mg tablets.

MULTI-COMPONENT SYNTHESIS OF PYRANOPYRAZOLE DERIVATIVES IN A MICROWAVE REACTOR

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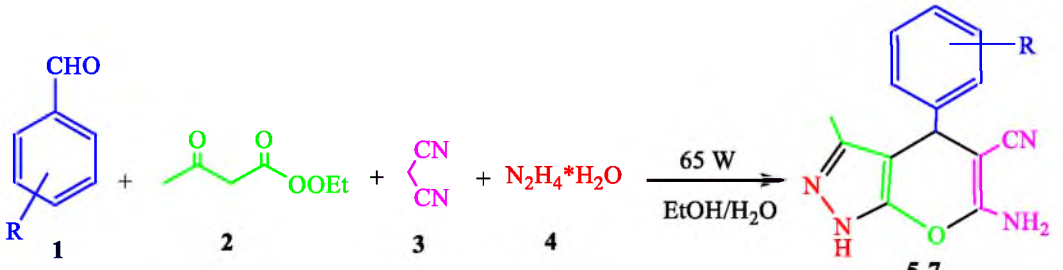
Heterocyclic compounds have high activity in medicine and agriculture, and the biologically active compounds currently studied are of great interest to researchers interested in creating new synthetic products based on their derivatives. In particular, pyranopyrazoles are used as anti-inflammatory, anticancer, antimicrobial, anti-inflammatory and analgesic agents. Based on this, targeted synthesis and chemical modification of pyranopyrazole derivatives, determination of their physical, chemical, biological and pharmacological properties, as well as the creation of new drugs based on selected candidate compounds have become a motivating factor in the literature [1,2].

In the course of our studies, we succeeded in obtaining the products in a short time using a microwave reactor, without using catalysts for multicomponent reactions. Initially, aldehyde (**1**), ethyl acetoacetone (**2**), malononitrile, (**3**) and hydrazine hydrate (**4**) were mixed in a ratio of 1:1:1:1 in a solvent of ethanol:water (1:1, v:v). Then the mixture was transferred to a microwave reactor with a power of 65 W for 2 minutes. The mixture was cooled and the precipitate was washed with water and recrystallized from DMF. The targeted 6-amino-3-methyl-4-phenyl-1,4-dihydropyrano[2,3-c]pyrazole-5-carbonitriles (**5-7**) was synthesized in high (80-88%) yields:



R= 4-NO_2, 4-OCH_3, 2-OH;

The reaction was carried out according to the principles of "green chemistry" conditions, without catalysts. The chemical structure of the obtained substances was confirmed by IR, ^1H, ^{13}C NMR spectroscopy, including X-ray structural analysis.

It should be noted that multicomponent reactions have high productivity, are more effective in a short time and without additives compared to classical methods.

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DESIGN OF SPECIFIC OLIGONUCLEOTIDES FOR HPV 11 DETECTION

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Human papillomavirus (HPV) is among the most prevalent sexually transmitted infections. HPV 11, in particular, is associated with conditions such as epithelial dysplasia and respiratory papillomatosis, highlighting the need for its early detection, disease progression monitoring, and molecular characterization. These aspects are decisive for both clinical diagnostics and epidemiological studies.

Among HPV genes, E6, E7, L1 and L2 are of particular interest, with the E7 gene being highly conserved. This makes it an ideal target for designing specific oligonucleotides, enhancing the accuracy of HPV 11 detection, and enabling molecular-level investigations.

For this study, the E7 gene was selected as the target region. Oligonucleotides were designed using Primer3Plus and IDT DNA Primer Design tools, with specific criteria set duringthe design process:

- oligonucleotide length ranging from 19 to 23 bp, with a GC content of 40–60%;
- melting temperature (Tm) maintained between 55–65°C;
- minimal potential for dimer formation and self-annealing.

Table 1. Specific oligonucleotide design

Direction	IDT DNA Primer Design tool (Amplicon length - 136 bp)	Primer3Plus tool (Amplicon length - 223 bp)
Forward 5` - 3`	XXXXXXXAGGTGGAXXXXXXX* (21 bp, 52% GC, Tm: 56–58°C)	XXXXXXXCCTGCAXXXXXXX* (20 bp, 55% GC, Tm: 56–59°C)
Reverse 5` - 3`	XXXXXXXAGACATCXXXXXXX* (21 bp, 52% GC, Tm: 56–58°C)	XXXXXXXTTTTGCXXXXXXX* (20 bp, 55% GC, Tm: 58–60°C)

** The full sequence is not disclosed due to patent protection, with hidden nucleotides represented by "X".*

A comparative assessment of these tools revealed that the IDT DNA Primer Design tool offers a rapid and optimized approach, generating accurate primer sequences efficiently. On the other hand, Primer3Plus provides greater customization, enabling retrieval of additional sequence data. The shorter 136 bp amplicon is particularly suited for clinical diagnostics, while the 223 bp product is more appropriate for further molecular studies, including sequencing.

The final selection of primers will be validated experimentally under laboratory conditions to determine their suitability for HPV 11 detection.

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Adonis turkestanica (KORSH.) ADOLF – A PROMISING MEDICINAL PLANT

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Adonis turkestanica is a valuable medicinal plant native to Central Asia, endemic to the Pamir-Alai region. It is widespread in juniper forests and permanent thickets at altitudes of 2000–3500 meters above sea level.

In ancient folk medicine, the aerial parts of *A. turkestanica* were used to treat fever, chills, shortness of breath, hypertension, and burns. According to literature, the plant contains coumarins, saponins, more than 20 cardiac glycosides, alkaloids, and other bioactive compounds. From a related species, *A. vernalius*, the drug adoniside was developed, which is used to treat heart disease.

As part of research aimed at assessing the raw material base of *A. turkestanica*, geobotanical studies were conducted in the mountainous regions of the Kashkadarya region. These studies determined the plant's role in vegetation communities, its ecological structure, and floristic composition.

The plant was found to be associated with the following species: *Adonis turkestanica - Juniperus seravchanica - Ferula kuhistanica - Prangos pabularia + Koenigia coriaria + Rosa kokanica*. This association was identified on May 28, 2024, near the Maidanak Observatory and the village of Chit in the Kamashinsky district, Kashkadarya region, on a northeast-facing slope with a steepness of 45°, covered with grassy calcareous soil (N38.675960 E66.910496).

The vegetation cover of the association consisted of: *Adonis turkestanica*- 12%, *Juniperus seravchanica*-5%, *Ferula kuhistanica*-2%, *Prangos pabularia*-3%, *Koenigia coriaria*-2%, *Rosa kokanica*-1%. The plant community included: 3-tree species, 4-shrub species, 5-subshrub species, 27-perennial herb species, 18-annual herb species. The total area of the association is 125 hectares, with a yield of 120 c/ha. Vegetation covered 64% of the soil surface.

A. turkestanica is harvested with a sickle, leaving several shoots per m^2. Drying of plants is carried out under a canopy in a cool, shady place, laying it out in a thin layer 5-6 cm thick. During the drying process, the raw material *A. turkestanica* loses 80-85% of the moisture from the original weight. For storage, the plant is packed in bags or cardboard boxes. The shelf life is 3-4 years in a dry, well-ventilated room. The dried plant should be green, have astringent properties, and its moisture content should not exceed 8-10%.

A total of 1 kg of dried aerial parts of *A. turkestanica* was extracted using methanol and separated into chloroform, ethyl acetate, and n-butanol fractions based on polarity. High-performance liquid chromatography (HPLC) analysis revealed the presence of adonitoxigenin in the chloroform fraction, convallotoxol in the ethyl acetate fraction, and the cardiac glycoside convalloside in the n-butanol fraction. Additionally, three flavonoids—kaempferol, quercetin, and kaempferol-7-rhamnoside—were identified.

These studies confirm the significant availability of *A. turkestanica* in the Kashkadarya region. Its valuable chemical composition makes it a promising resource for the pharmaceutical industry.

SYNTHESIS OF AZOMETHINES AND AMIDES IN THE SERIES OF 1,3,4-OXADIAZOLES

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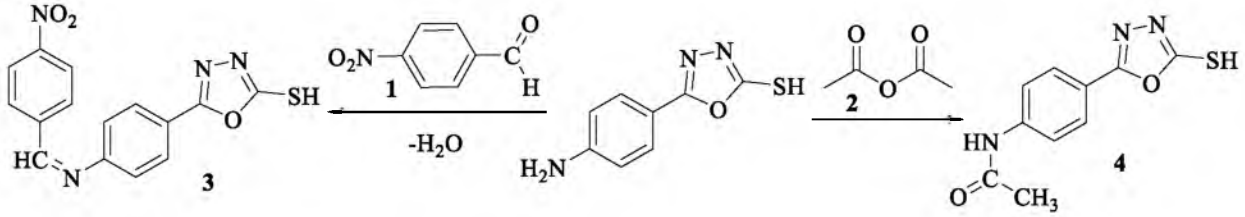
Cancer is the first or second leading cause of premature death in 134 countries in the world. 1,3,4-Oxadiazoles are five membered heterocyclic rings containing nitrogen (two atoms) and oxygen (one atom). They show better thermal stability, metabolic stability, aqueous solubility, and lower lipophilicity than the other isomeric oxadiazoles. They are important class of heterocycles present in many drug structures like raltegravir, nesapidil and zibotentan. In this study, to obtain new derivatives of oxadiazoles, we carried out the reaction of 5-(4-aminophenyl)-1,3,4-oxadiazol-2-thiol with acetic anhydride and 4-nitrobenzaldehyde. Several 1,3,4-oxadiazoles are prepared and reported as anticancer agents by numerous scientists worldwide [1,2].

Reaction of 5-(4-(aminophenyl)-1,3,4-oxadiazol-2-thiol) with 4-nitrobenzaldehyde (**1**) (in a 1:1.1 ratio) was carried out by heating of the reaction mixture in ethanol (solvent) and reaction mixture was left at room temperature for 24 hours. As a result, a dark orange crystalline Schiff base precipitated. The product was filtered, dried, and purified using the recrystallization method. It was observed that when the starting materials were used in a 1:1 ratio, the product yield was low. The reaction was monitored using thin-layer chromatography (TLC). The structure of 5-(4-((4-nitrobenzylidene)-amino)phenyl)-1,3,4-oxadiazol-2-thiol (**3**) was studied using ^{1}H NMR spectroscopy:



Reaction of 5-(4-aminophenyl)-1,3,4-oxadiazol-2-thiol with acetic anhydride (**2**). The reaction was conducted under continuous stirring using a magnetic stirrer at 30°C for 12 hours. After that, distilled water was added to the reaction mixture and stirred for an additional 1 hour. The resulting precipitate was filtered, washed with water, and dried. The product was purified by recrystallization from 50% ethanol. As a result, a 52.5% yield of pure product was obtained. The structure of acetamide (**4**) was studied using ^{1}H NMR spectroscopy.

Financing. This work was carried out using budgetary funds of ICPS from the Academy of Sciences of the Republic of Uzbekistan.

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QUANTITATIVE DETERMINATION OF FLAVONES FROM THE AERIAL PART OF *Artemisia juncea*

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The genus *Artemisia* L. (wormwood) is one of the largest in the family Asteraceae - the phylogenetically most advanced family from the class of dicotyledonous flowering plants Magnoliopsida. One of the widespread species of wormwood in our republic is *Artemisia juncea* Kar et Kir. - wormwood rush. This species grows on gravelly-sandy deposits of plains, clayey, gravelly, rocky slopes in dry riverbeds, on pebbles, outcrops of variegated flowers, in river valleys, up to the middle mountain belt.

As a result of phytochemical studies, it was established that *Artemisia juncea* produces biologically active guaianolides and flavonoids.

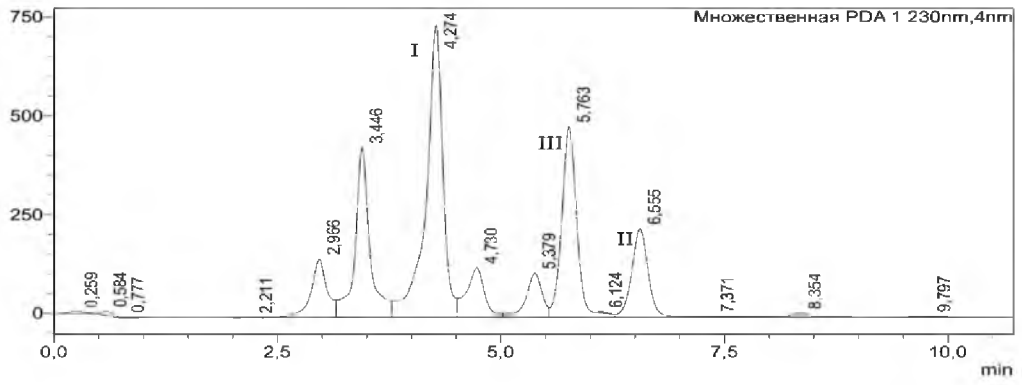
On this basic, the aim of this work was to determine the content of flavones eupatilin (**I**), jaceosidin (**II**) and circineol (**III**) by high-performance liquid chromatography (HPLC) from *Artemisia juncea* growing in Uzbekistan.

For the analysis, 10 g (accurately weighed) of crushed raw material was placed in a filter paper cartridge and extracted in a Soxhlet apparatus with 95% ethyl alcohol for 8 hours. The resulting extract was diluted with water and successively fractionated with petrol and chloroform. The combined chloroform fraction was dissolved in ethanol and filtered through a membrane filter with a pore size of 0.22 μm into specialized vials for HPLC analysis.

Working standard samples (WSS) of eupatilin (**I**), jaceosidin (**II**) and circineol (**III**) of appropriate purity, confirmed by spectral methods, were used.

The analysis was performed on a Shimadzu LC-20AD chromatograph (Japan), SPD-M20A variable wavelength detector, Shim-pack GIST C18 4.6x250 mm column, with a particle size of 5 μm. Elution was carried out in a gradient mode using two mobile phases (MP): MP A: 0.5% orthophosphoric acid in deionized water and MP B: acetonitrile.

Chromatographic analysis showed the presence of peaks of the studied sample of the chloroform fraction of the alcohol extract of *Artemisia juncea*, similar in retention time to the peaks of the WSS samples.



As a result, the total content of compounds **I-III** in the aerial part of *A. juncea* was 0.34, 0.10 and 0.19% (from the weight of air-dried raw materials), respectively.

The work was supported by the Budget Program for Fundamental Scientific Research of the Institute of Chemistry of Plant Substances of the Academy of Sciences of the Republic of Uzbekistan.

SYNTHESIS OF CYANOALKYL CONTAINING DERIVATIVES OF 5-(2,3,4-PYRIDYL)-1,3,4-OXADIAZOL-2-THIONE

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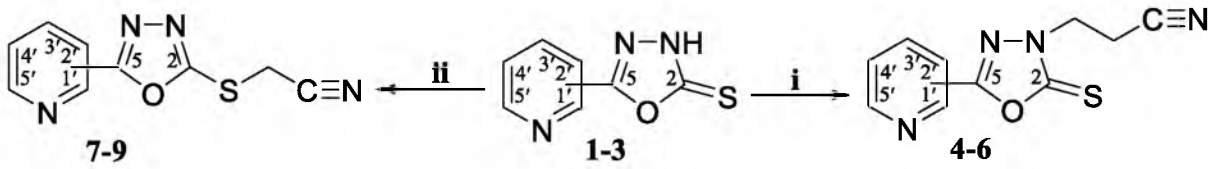
It is well known that compounds containing the nitrile (C≡N) group exhibit biological activity and can also be used as synthons for obtaining new derivatives. In order to obtain such compounds, we carried out the reactions of 5-(2,3,4-pyridyl)-1,3,4-oxadiazol-2-thiones **1-3** with acrylonitrile (AN) and chloroacetonitrile:



i=CH_2CHCN, C_2H_5OH, TEA, 78°C.
ii=$ClCH_2CN$, CH_3OH, NaOH, 45-50°C.

When equimolar amounts of 5-(2,3,4-pyridyl)-1,3,4-oxadiazol-2-thiones and acrylonitrile were refluxed in ethanol in the presence of triethylamine (TEA), only N(3)-substituted derivatives - 3-cyanoethyl-5-(2,3,4-pyridyl)-1,3,4-oxadiazol-2-thiones **4-6** were obtained in high yields (85-90%). The reaction of chloroacetonitrile with **1-3** thiones in a 1:1 molar ratio in methanol in the presence of NaOH at 40-42°C led to the formation of S-substituted derivatives-2-((5-(2,3,4-pyridyl)-1,3,4-oxadiazol-2-yl)thio)acetonitriles **7-9** in relatively lower yields (40-42%). Conducting this reaction in a 1:2 molar ratio under the same conditions increased the yield of the obtained compounds to 70-72%. The structures of the synthesized compounds were fully confirmed by the appearance of characteristic absorption maxima in the UV spectra at 310-315 nm and 272-275 nm for the N- and S-derivatives, respectively, as well as by IR, ^1H, and ^{13}C NMR spectral data.

Acknowledgment

Authors would like to thank Academy of Sciences of the Republic of Uzbekistan for financial support.

BETA-2-MICROGLOBULIN (B2M) BASED PCR ASSAY INTERNAL CONTROL SYSTEM

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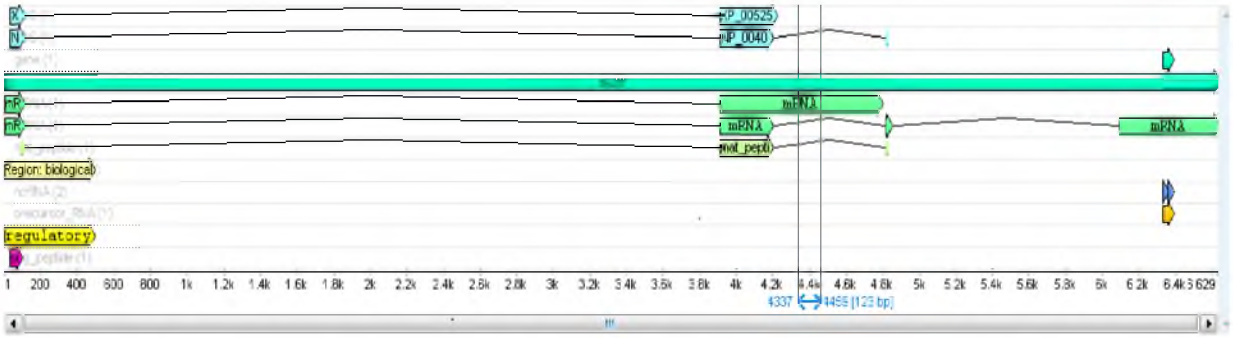
Polymerase chain reaction (PCR) diagnostics allows for the rapid and sensitive detection of nucleic acids, and this method is widely used in molecular biology and biotechnology.In PCR diagnostics, the internal control system confirms the quality and quantity of nucleic acid, identifies potential inhibitors, and provides a basis for quantitative determination.Beta-2-Microglobulin (β2M) is a molecular component of the major histocompatibility complex (MHC) class I and may be a candidate for an internal control sample.This gene is located on chromosome 15 and can be reliably detected in blood and tissue biopsies in various samples.In the PCR analysis, β2M was amplified together with the target gene using specific primers, and the PCR reaction was confirmed to be complete and pure using a positive control sample.This is important in clinical diagnostics, in the detection of pathogenic viruses such as HBV, HCV, and HIV, genetic mutations, and biomarkers.



Forthis purpose, the nucleotide sequences of the β2M subspecies genes were retrieved from the NCBI database, and they were compared using the UGENE software tool.Primer design was performed for selected regions of the gene.In this case, the primers were designed to have a length of 20-25 nucleotides, a G/C content of 50-60%, and melting points close to 60°C. In addition, the thermodynamic properties of the primers were examined using the Oligo Analyzer software tool, which is an example of the formation of secondary structures.The design resulted in 11 pairs of primers. The synthesis of these oligonucleotide primers was performed using the phosphoramidite method on an ASM-800 DNA/RNA synthesizer.

Financing. This work was carried out using budgetary funds of ICPS from the Academy of sciences of the Republic of Uzbekistan.

POLAR LIPIDS OF *Achillea filipendulina* SEEDS WITH BRACTS

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Introduction. *Achillea filipendulina* (yarrow, family Asteraceae) is a perennial halophyte plant found in saline soils of Central Asia, the Caucasus, and Iran. This plant (locally known as "buymodaron") grows to a height of 80-120 cm and blooms from June to August. It has been used in traditional medicine since ancient times to treat various ailments. Infusions of the above-ground part of *A. filipendulina* are used for the treatment of sciatica, gout, arthritis, gastrointestinal disorders, congestion, cardiovascular diseases, and malaria. The lipids of the plant have not been studied.

The aim of the study was to investigate the polar lipids (PL), glycolipids (GL), and phospholipids (PL) of the seeds with bracts of the plant *A. filipendulina*, collected in the Kashkadarya region in October 2024.

Materials and methods. PL was extracted from the crushed seeds with bracts using a mixture of chloroform and methanol (2:1, v/v) after the neutral lipids were removed. Using column chromatography on silica gel, PL was separated into GL (eluted with acetone) and PL (eluted with methanol).

Results. The content of phospholipids (PL) was 2,03%, including glycolipids (GL) at 1,54% and free lipids (FL) at 0,49%. The composition of GL included steryl glycosides, esters of steryl glycosides, and mono- and digalactosyl diacylglycerides. The FL consisted of phosphatidylcholines, phosphatidylethanolamines, phosphatidylinositols, and trace amounts of phosphatidic acid. By alkaline hydrolysis of the lipids, fatty acids were extracted, and their composition as methyl esters was determined by gas chromatography on an Agilent 8860 chromatograph (see table).

Table. Composition of fatty acids of polar lipids of the seeds with bracts of *A. filipendulina*, GC, % of acids mass

Acid	GL	PhL	Acid	GL	PhL
10:0, 12:0,14:0,15:0	8,18	4,29	20:1	4,45	3,76
16:0	33,98	33,64	22:0	2,28	1,36
16:1	2.06	0,85	22:1	2,01	2,12
17:0	1,48	1,11	24:0	1,86	0,93
18:0	7,34	5,75	24:1	1,06	0,92
sis-18:1+18:3	12,25	18,57	∑ saturated fatty acid	57,18	48,21
trans -18:1	1,32	1,42	∑ unsaturated fatty acid	42,82	51,79
18:2	19,67	24,15	Total	100	100
20:0	2,06	1,13			

Conclusions. The seeds with bracts of *Achillea filipendulina* contain 1,54% glycolipids and 0,49% phospholipids. 17 fatty acids were found in the lipids, with a predominance of saturated fatty acids in glycolipids (57,18%) and unsaturated acids in phospholipids. In all lipids, a trans isomer of oleic acid ω9-18:1 (1,32 – 1,42%) was detected.

Financing. This work was carried out using budgetary funds of ICPS the Academy of Sciences of the Republic of Uzbekistan. We thank the Academy of Sciences of the Republic of Uzbekistan for supporting this study.

REACTION OF FOLIOSIDINE WITH CHLOROACETYL CHLORIDE

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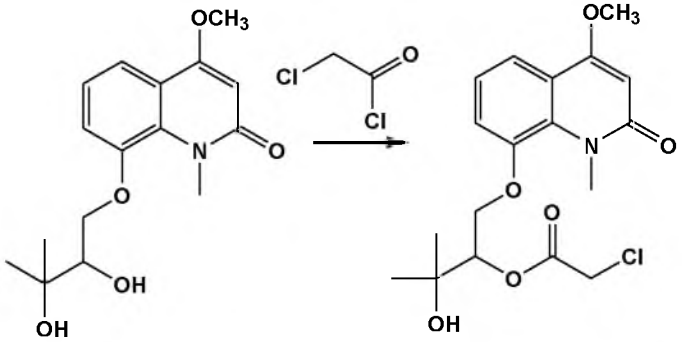
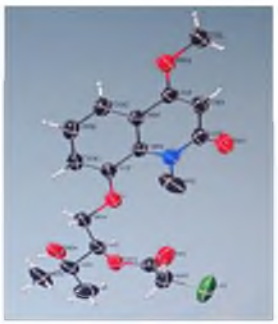
Among the natural compounds of plant origin, alkaloids, including quinoline structures, occupy a special place. The versatility of the use of compounds containing the quinoline core stimulates research aimed at creating new vital substances based on major alkaloids of local raw materials. Therefore, synthesizing and chemically modifying the alkaloid foliosidine contained in the plant Haplophyllum foliosum using modern research methods and creating new biologically active compounds is one of the important tasks of the chemistry of natural compounds.

Of particular interest was the study of the reaction of foliosidine containing the 1,2-diol chain of O-CH(OH)-C(OH)$(CH_3)_2$ at the 8-position, with chloroacetyl chloride 0.09 ml (0.78 mmol) was added to a mixture of 0.3 g (0.97 mmol) of foliosidine (**1**) in 8 ml of benzene and 0.15 ml of triethylaminechloroacetyl chloride and boiled for 4 hours with a chlorocalcium tube. After decanting and distilling benzene, a mixture of two products with Rf 0.63 was obtained (system: chloroform-methanol 8:1). Acetone was added to the reaction products. 0.1 g (yield 33%) of the crystalline product (2,3-hydroxy-1-(4-methoxy-1-methyl-2-oxo-1,2-dihydroxyquinoline-8-yloxy)-3-methylbutane-2-yl-2-chloroacetate) was obtained with a mp 170-172°C. The structure of compound **2** was determined based on ^{1}H and ^{13}C NMR data and confirmed by X-ray structural analysis.



1 **2**



1: 8-(1,2-dihydroxy-2-methylpropoxy)-4-methoxy-1-methylquinolin-2(1H)-one

2: 3-hydroxy-1-((4-methoxy-1-methyl-2-oxo-1,2-dihydroquinolin-8-yl)oxy)-3-methylbutan-2-yl 2-chloroacetate

SYNTHESIS OF NEW 1H-1,2,3-TRIAZOLE DERIVATIVES BASED ON DI(PROP-2-YN-1-YL) ADIPATE

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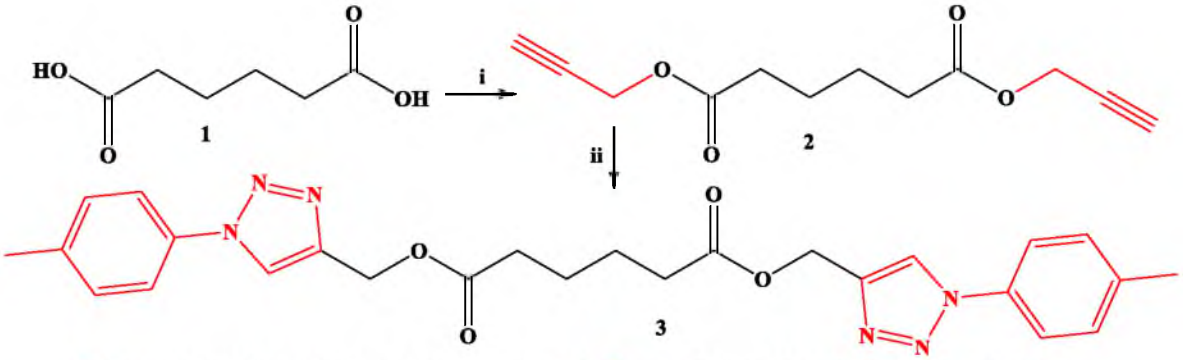
Currently, heterocyclic compounds containing a 1,2,3-triazole ring are among the most extensively studied substances due to their antiviral, anticancer, antifungal, and other pharmacological properties. Their significance extends beyond the scientific community specializing in heterocyclic chemistry to various fields such as medicine [1], agrochemistry[2], and materials science. In particular, triazole derivatives based on carboxylic acids have attracted considerable interest from researchers, as they can serve as syntones for the development of bioactive and functional materials. Despite the substantial body of research dedicated to studying triazole derivatives based on monocarboxylic acids [3], the synthesis of such compounds using dicarboxylic acids remains an area requiring further investigation. In this regard, the present study proposes a method for synthesis of 1H-1,2,3-triazole derivatives based on the dipropargyl ester of adipic acid. The synthesis process consists of two sequential stages, the first of which involves an esterification reaction between adipic acid **(1)** and propargyl alcohol in a 1:2 molar ratio:



i) Propargyl alcohol, *p*-TsOH (cat.), benzene, reflux, 5 h; **ii)** *p*-azidotoluene, Cu_2I_2 (cat.), toluene, reflux, 8 h.

In the second stage of the synthesis, an azide-alkyne cycloaddition reaction occurs, where the synthesized dipropargyl ester of adipic acid **(2)** reacts with *p*-azidotoluene in a 1:2 molar ratio, forming 1H-1,2,3-triazole derivatives of adipic acid **(3)**.

The structure of the synthesized triazoles **(3)** were confirmed by IR, and ^1H, ^{13}C NMR spectra.

Acknowledgments. The authors were awarded a scholarship from the Academy of Sciences of the Republic of Uzbekistan for the project "Creation of scientific foundations for targeted synthesis of new, highly biologically active synthetic and natural compounds for the needs of agriculture and medicine using modern methods of organic synthesis" expresses its gratitude for the financial support provided within the framework of the research program.

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2-PHENYLQUINAZOLIN-4(3H)-ONES THIONATION AND HETEROCYCLIZATION REACTION

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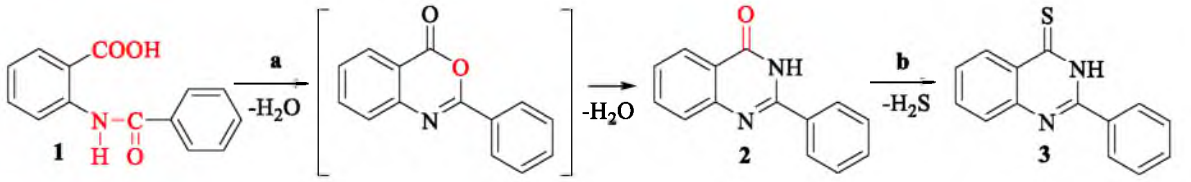
It is known that condensed pyrimidine ring compounds have been introduced into agricultural and medical practice. Compounds based on this class are widely used against viruses, microbes, fungi and cancer [1], as well as stimulants and pesticides for plants [2]. For example, imatinib, erlotinib, and aflatinib, which have been used in recent years to treat tuberculosis and cancer [3].

During the research, 2-benzamidobenzoic acid **(1)** was synthesized. When we heated the synthesized substance in the presence of ammonium chloride at 220-230°C, a mixture of water, hydrochloric acid and the substance was formed. When we neutralized it with NH_4OH, 2-phenylquinazolin-4(3H)-one (**2**) precipitated. The precipitate was filtered and recrystallized in ethyl alcohol. Yield 75.0%. The reactivity of the synthesized substance in the presence of P_2S_5 was studied in various solvents. Among them, in pyridine, 2-phenylquinazoline-4(3H)-thione was formed in a relatively short time and with high yield (93%) (table-1).

Table-1. 2-Phenylquinazoline-4(3H)-thione yields in various solvents

Solvent	Benzene	1,4-dioxane	Methanol	Ethanol	Pyridine
Yield %	27	33	41	45	93
Time	12 h	10 h	10 h	10 h	6 h



a) NH_4Cl. 220-230°C, 4 h. b) P_2S_5, pyridine, 5-6 h.

A convenient and efficient method for the synthesis of 2-phenylquinazolin-4(3H)-one via heterocyclization reaction of 2-benzamidobenzoic acid was developed and thionation reactions were performed with a thiolating agent. The structure of the synthesized substances was determined and proven using physical research methods: IR, and ^1H, ^{13}C YaMR spectra.

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TARGETED SYNTHESIS OF ETHYL 3,5-DIALKYL-4-OXO-3,4-DIHYDROTHIENO[2,3-D]PYRIMIDINE-6-CARBOXYLATES

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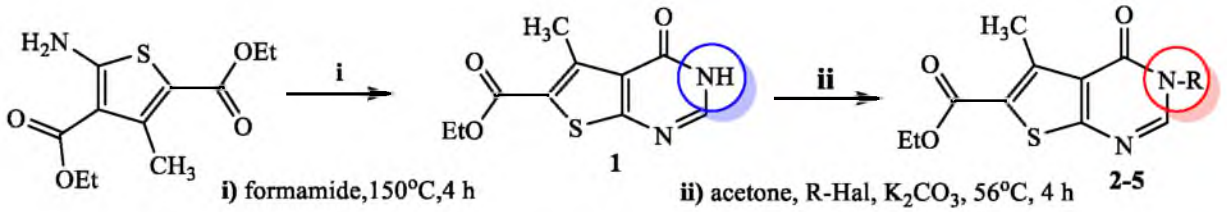
Heterocyclic compounds, distinguished by their cyclic frameworks incorporating carbon and heteroatoms such as oxygen, nitrogen, and sulfur, exhibit enhanced biological activities owing to the introduction of heterocyclic moieties. Thienopyrimidine derivatives hold a unique place between fused pyrimidine compounds. They are important and widely represented in medicinal chemistry as they are structural analogs of purines.

Thienopyrimidine derivatives are important heterocyclic organic compounds, and research on them began many years ago. One of the main reasons for this interest is their significant biological and pharmacological activities [1-3]. Therefore, synthesizing various derivatives of thienopyrimidines, studying their chemical properties, and searching for biologically active compounds among them remain urgent tasks.

The primary objective of this study is carrying out cyclization of diethyl 5-amino-3-methylthiophene-2,4-dicarboxylate with formamide at 150^{0}C for 4 hours. This cyclization gives corresponding ethyl 5-methyl-4-oxo-3,4-dihydrothieno[2,3-d]pyrimidine-6-carboxylate (**1**). The obtained compound **1** reacts with different alkyl halides in acetone in the presence of potassium carbonate:



For this purpose, ethyl 3,5-dialkyl-4-oxo-3,4-dihydrothieno[2,3-d]pyrimidine-6-carboxylates (**2-5**) were synthesized in good yields. The structure of the obtained products (**2-5**) were confirmed using IR and ^{1}H, ^{13}C NMR spectroscopy.

Currently, research is ongoing to develop methods for carrying out nucleophilic substitution reactions of the obtained alkyl derivatives with hydrazine hydrate.

Acknowledgments:The authors were awarded a scholarship from the Academy of Sciences of the Republic of Uzbekistan for the project "Creation of scientific foundations for targeted synthesis of new, highly biologically active synthetic and natural compounds for the needs of agriculture and medicine using modern methods of organic synthesis." expresses its gratitude for the financial support provided within the framework of the research program.

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TARGETED SYNTHESIS OF NOVEL THIENOPYRIMIDINE – TRYPTAMINE HYBRID COMPOUNDS

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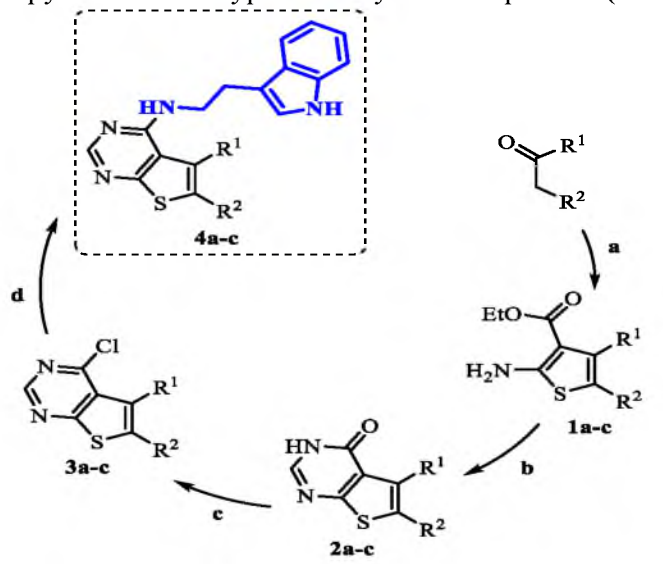
Thienopyrimidines (TPs) are biologically important heterocyclic compounds structurally resemble purines, exerting pharmacological potential in different aspects and attracting attention in medicinal chemistry research since last two decades due to its diverse range of biological activities. Therefore they are known to play a crucial role in various disease conditions. Moreover, TP derivatives have been explored fortheir inhibitory activities towards various protein kinase enzymes. An intensive literature review on TPs and its derivatives revealed that they were found to possesses different biological activities such as antitumor, antimicrobial, anti inflammatory, tyrosine kinase and phosphodiesterases and most of them were patented. Furthermore, TPs are of great importance in medicinal chemistry, as well as pesticides, exhibiting properties such as herbicides and plant growth regulators.

Their susceptibility to nucleophilic substitution reactions suggests that they are one of the most important synthons for modern organic synthesis. Accordingly in view of the biological importance and the past research of the TPs and its derivatives, it is worthwhile to synthesize some novel Thienopyrimidine – Tryptamine hybrid compounds **(4a-e)**:



Reagents and conditions:
(a) ethyl cyanoacetate, S_8, morpholine, absolute ethanol, 40-45°C, 24 h.
(b) formamide, 150°C, 6 h,
(c) $POCl_3$, TEA, reflux, 4 h,
(d) tryptamine, TEA, absolute ethanol, reflux, 6 h.

4a R^1–R^2=$(CH_2)_3$;
4b R^1–R^2=$(CH_2)_4$;
4c R^1–R^2=$(CH_2)_5$;
4d R^1=R^2= CH_3;
4e R^1= CH_3, R^2= CO_2Et;

Particularly, 4-substituted amino TPs was determined excellently, almost equivalent to standards (compared with effective drugs against Alzheimer's disease by Molecular Docking method), where the presence of electron donating substituent on both sides of thienopyrimidine ring enhances the activity and electron withdrawing groups decrease. A systematic approach to the synthesis of targeted compounds was described above. Structure of all synthesized compounds was confirmed by IR, ^1H, ^{13}C NMR spectroscopy and X-Ray diffraction analysis.

Acknowledgments: The authors were awarded a scholarship from the Academy of Sciences of the Republic of Uzbekistan for the project "Creation of scientific foundations for targeted synthesis of new, highly biologically active synthetic and natural compounds for the needs of agriculture and medicine using modern methods of organic synthesis." expresses its gratitude for the financial support provided within the framework of the research program.

SYNTHESIS OF PROPANENITRILE DERIVATIVE IN "GREEN CHEMISTRY" CONDITIONS AND IT'S SOME "GENETIC" MODIFICATIONS

I.E. Yuldashova, M.I. Olimova, R.Ya. Okmanov, B.Zh. Elmuradov

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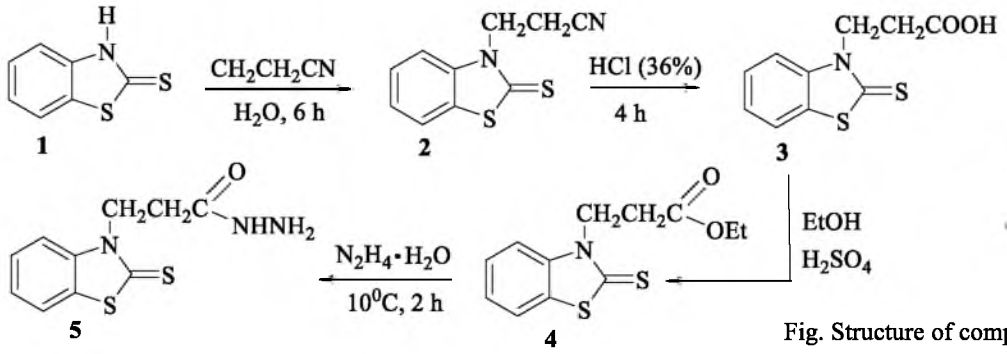
Benzothiazoles are widespread compounds which are distinguished by the presence of various biologically active substances. Benzothiazoles, with their high synthetic potential are still considered as interesting topic among chemists and biologists and are used by scientists as important heterocycles for modern organic synthesis and pharmaceutical chemistry [1].

The reaction of benzo[d]thiazole-2(3H)-thione **(1)** and acrylonitrile was carried out in an aqueous solution without the presence of a catalyst, and 3-(2-thioxobenzo[d]thiazol-3(2H)-yl)propanenitrile **(2)** was synthesized in high (86%) yield. Then it was boiled at 95-100°C in the presence of concentrated hydrochloric acid for 4 hours, and 3-(2-thioxobenzo[d]thiazol-3(2H)-yl)propanoic acid **(3)** (96%) was obtained. The esterification reactions of the acid were carried out in absolute ethanol in the presence of concentrated sulfuric acid (catalyst) for 4 hours and as a result, the corresponding ethyl 3-(2-thioxobenzo[d]thiazol-3(2H)-yl)propanoate (**4**) (81%) was synthesized which in turn was reacted with 85% hydrazine hydrate that resulted in formation of 3-(2-thioxobenzo[d]thiazol-3(2H)-yl)propanehydrazide **(5)** with high yields (92%):



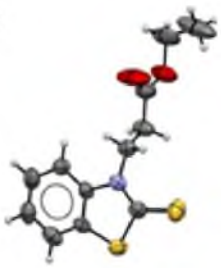


Fig. Structure of compound 4 in the crystal.

The obtained compounds **3-5** are very convenient building-blocks for synthetic organic and bioorganic chemistry. The structure of the synthesized compounds was confirmed by the data of IR-, ^{1}H, ^{13}C NMR spectroscopy and including X-ray analysis.

Acknowledgments: The authors were awarded a scholarship from the Academy of Sciences of the Republic of Uzbekistan for the project "Creation of scientific foundations for targeted synthesis of new, highly biologically active synthetic and natural compounds for the needs of agriculture and medicine using modern methods of organic synthesis." expresses its gratitude for the financial support provided within the framework of the research program.

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TARGETED ACYLATION AND ARYLSULFONYLATION OF BENZO[D]THIAZOLE-2(3H)-THIONE

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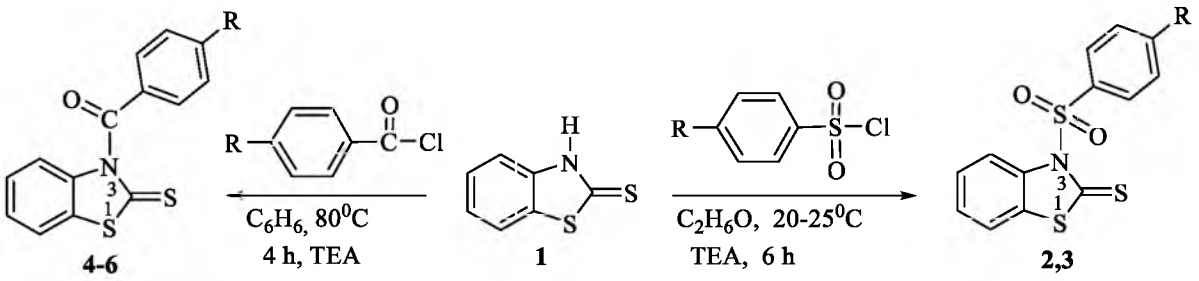
Benzothiazoles with high synthetic potential are still an interesting topic among chemists and biologists. For that reason, benzothiazoles are used by scientists as important heterocycles for modern organic synthesis and pharmaceutical chemistry. In the research studies, drugs with anticancer [1], anti-inflammatory [2], anthelmintic, antioxidant and bactericidal [3] activities have been developed among benzothiazoles.

Continuing our research, we carried out the reactions of benzo[d]thiazole-2(3H)-thione (**1**) with variously substituted aromatic anhydrides and aryl sulfochlorides under simple and convenient conditions, and synthesized sulfonamides (**2,3**) and amides (**4-6**) in good yields. Arylsulfonylation reactions were carried out at room temperature in ethanol solution in the presence of triethylamine for 6 hours. Acylation reactions were found to give good results when carried out in benzene solution in the presence of triethylamine for 4 hours with heating:



It should be noted that in both cases the reactions proceed at the endocyclic nitrogen atom and the corresponding products were synthesized in good and high yields.

The structure of the synthesized compounds was confirmed by the data of IR-, ^{1}H NMR spectroscopy.

Acknowledgments: The authors were awarded a scholarship from the Academy of Sciences of the Republic of Uzbekistan for the project "Creation of scientific foundations for targeted synthesis of new, highly biologically active synthetic and natural compounds for the needs of agriculture and medicine using modern methods of organic synthesis." expresses its gratitude for the financial support provided within the framework of the research program.

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TARGETED REACTIONS OF BENZO((IMIDA)THIA)ZOLIN-2-ONES (THIONES) WITH ARYLSULFOCHLORIDES

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Among all known nitrogen heterocycles, benzimidazole and benzothiazole moieties have been recognized as important and well-known constituents of biologically important molecules in medicinal and pharmaceutical chemistry [1,2].

Due to their wide range of biological activities, these heterocycles are still unavoidable structural motifs in the rational design of novel drugs. Among their versatile pharmacological features, the most important ones are very important biological active substances that can be used in agriculture or medicine [3].

One of the main reasons why benzimidazoline and benzothiazoline are important heterocyclic organic compounds is that they possess important biological and pharmacological activities. This class of compounds includes analgesics, antivirals, fungicides, anticancer agents, bactericides and anthelmintics [4].

Sulfonamides or sulfa drugs are a class of antibiotics that target bacteria causing infections. These classes of drugs are generally broad-spectrum antibiotics that act on a wide range of bacterial types and are therefore employed in treating many kinds of bacterial infections. Continuing our research, when we conducted the reaction of benzimidazolin-2-one (-thione), benzothiazolin-2-one (thione) **(1-4)** with p-methoxybenzenesulfonyl chloride and p-fluorobenzenesulfonyl chloride in acetone (solvent), products **(5-12)** were synthesized in good yields:

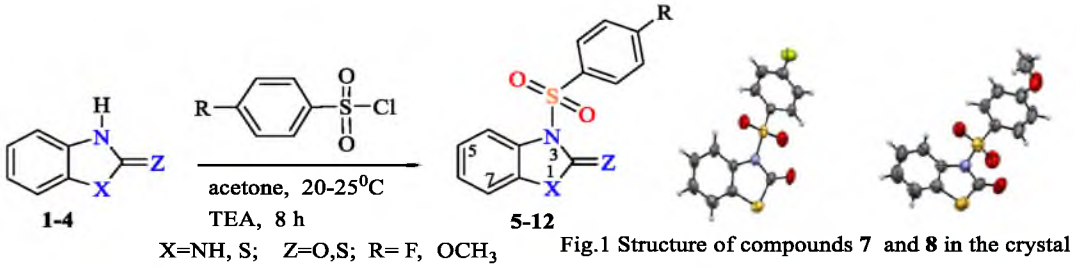

Fig.1 Structure of compounds 7 and 8 in the crystal

Structure of obtained substances was analyzed by modern physical research methods (IR- and ^{1}H, ^{13}C NMR- spectra).

Acknowledgments:The authors were awarded a scholarship from the Academy of Sciences of the Republic of Uzbekistan for the project "Creation of scientific foundations for targeted synthesis of new, highly biologically active synthetic and natural compounds for the needs of agriculture and medicine using modern methods of organic synthesis." expresses its gratitude for the financial support provided within the framework of the research program.

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SELECTIVE REDUCTION OF NITRO DERIVATIVES OF 2-ALKYLBENZIMIDAZOLES

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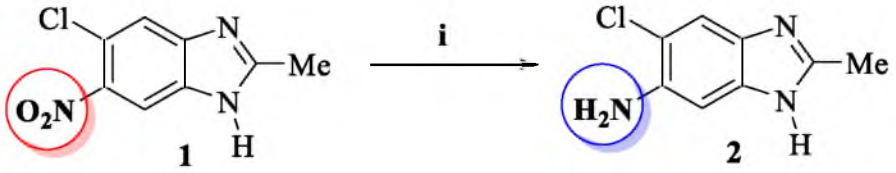
It is well known that from the perspective of organic chemistry, compounds containing amino groups in their molecules are of great importance and continue to attract the attention of synthetic chemists. One of the main reasons for this is the high synthetic potential of such compounds. Specifically, amino groups readily interact with a range of electrophilic reagents to form new, potentially active products. Additionally, these groups possess a high capacity to serve as "bridges" in the synthesis of various hybrid molecules, further highlighting their versatility and importance [1].

Some of the synthesized compounds, such as biologically active preparations like Nocodazole and Maribavir, are primarily used to block cancer cells and prevent metabolic changes in various cells associated with viruses. Additionally, organic compounds containing amino groups exhibit various biological activities. This has led to increasing interest in amino compounds among scientists worldwide. Taking the above into consideration and continuing our previous research, we conducted selective reduction reactions of 2-methyl-6-nitro-5-chlorobenzimidazole (**1**) with tin chloride dihydrate under optimal conditions:



i) $SnCl_2 \cdot 2H_2O$, HCl/EtOH, 20-25 °C, 1 h, 78-80 °C, 4 h

In this case, first, tin chloride dihydrate in a 1:4 molar ratio to the nitro compound is placed in a 100 ml flask and hydrochloric acid is slowly added at room temperature for 20 minutes (the process was carried out in an ice bath). In another flask, ethanol and hydrochloric acid were dissolved and heated with a magnetic stirrer, first at room temperature for 1 hour, then at 78-80°C for 4 hours. The obtained substance was left for overnight and neutralized with NH_4OH. The obtained precipitate was filtered and dried. The resulting crystalline substance was recrystallized in ethanol (yield - 62%). The structure of the isolated amino compound (**2**) was analyzed and fully proven by ^1H and ^{13}C NMR spectroscopy methods.

Acknowledgments: The authors were awarded a scholarship from the Academy of Sciences of the Republic of Uzbekistan for the project "Creation of scientific foundations for targeted synthesis of new, highly biologically active synthetic and natural compounds for the needs of agriculture and medicine using modern methods of organic synthesis." expresses its gratitude for the financial support provided within the framework of the research program.

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SYNTHESIS OF 2,3-DIALKYL-QUINAZOLIN-4(3H)-ONES

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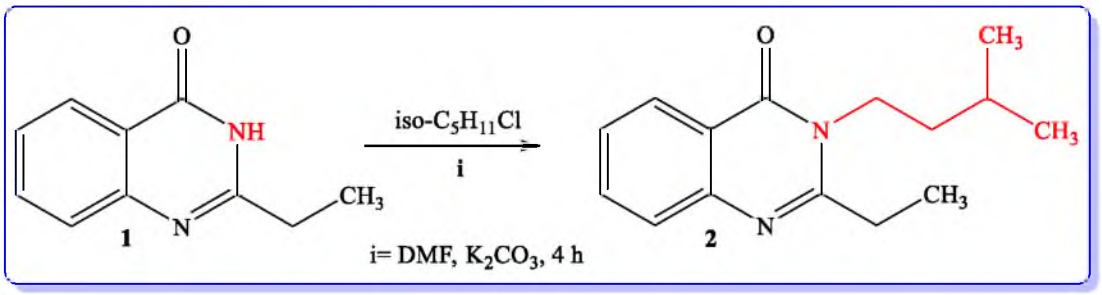
Compounds containing a condensed pyrimidine ring are widely used in agriculture and medicine. They are widely used in the treatment of cardiovascular, diabetes, cancer and viral diseases. In recent years, drugs such as imatinib, erlotinib, and afatinib, created on the basis of benzopyrimidine derivatives, have been used against tuberculosis and cancer.

They are approved by the Food and Drug Administration (FDA) in the United States. Today, the demand for low-toxic drugs containing a new type of pharmacophore group in the molecule is increasing year by year [1,2].

Considering the above points, it is very important to carry out the targeted synthesis of substances containing the potentially biologically active benzopyrimidine ring and their chemical modification, as well as to determine their physico-chemical and biological properties and create new drugs based on this.

During our research, 2-propionamidobenzoic acid was synthesized in the presence of o-aminobenzoic acid and propionic anhydride and heterocyclized in the presence of ammonia at 220-230^{0}C. When 2-ethylbenzopyrimidin-4(H)-one (**1**) was subjected to an alkylation reaction with iso-structural alkyl halides and 2-ethyl-3-isoamylbenzopyrimidin-4(H)-one (**2**) was obtained in a high percentage, yield 84%.



The structure of the synthesized substances was determined and proven using physical research methods: IR, and ^{1}H, ^{13}C NMR spectra.

Acknowledgments:The authors were awarded a scholarship from the Academy of Sciences of the Republic of Uzbekistan for the project "Creation of scientific foundations for targeted synthesis of new, highly biologically active synthetic and natural compounds for the needs of agriculture and medicine using modern methods of organic synthesis." expresses its gratitude for the financial support provided within the framework of the research program.

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CHEMICAL MODIFICATION AND STRUCTURE OF LAPPACONITINE ALKALOID

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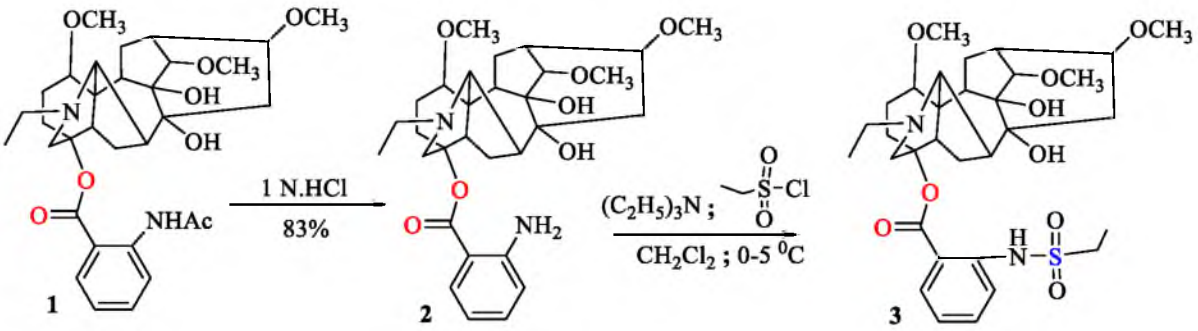
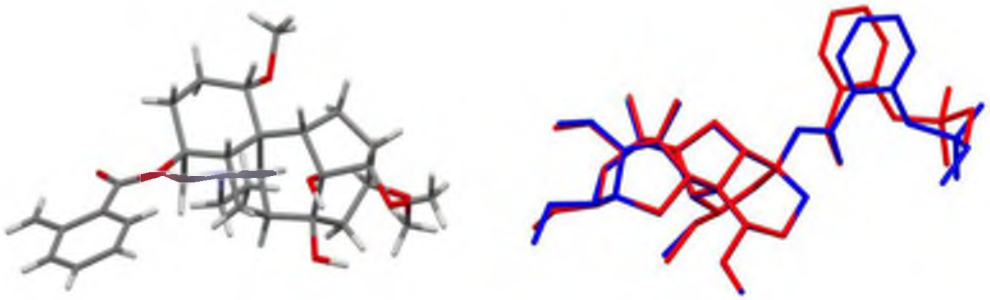
Aconitum and Delphinium plant species have been used for medicinal purposes for centuries. Lappaconitine alkaloid (**1**) has a very wide biological activity, and based on it, the antiarrhythmic drug allapinin has been created. Allapinin is widely used by cardiologists to treat certain types of heart arrhythmias. Lappaconitine alkaloid (**1**) was subjected to acidic hydrolysis, resulting in the formation of N-deacetyllappaconitine (**2**) in 83% yield. An acetylation reaction was carried out using ethanesulfonyl chloride in the presence of this substance:



To obtain compounds **3**, we carried out an acylation reaction of N-deacetyllappaconitine (**2**) with ethanesulfonylchloride in anhydrous methylene chloride at a temperature of 0-5°C. The reaction in 86% yielded 1-ethyl-7a,11a-dihydroxy-6,8,10-trimethoxydodecahydro-2H-3,6a,12-(epiethane[1,1,2]triyl)-7,9-methanonaphtho[2,3-b]azocin-3(4H)-yl-2-(ethylsulfonamido)benzoate (**3**) with a melting point of 190-192°C (in methanol). The structure of the obtained compounds was determined by IR, NMR, ^{1}H and ^{13}C spectroscopy and confirmed by XRD. It was found that compound **3** forms two type polymorphic crystals, in which conformation of alkaloid molecule slightly differs.



2 **3**

ARYLACYLATION OF CYCLOARTANE GLYCOSIDE

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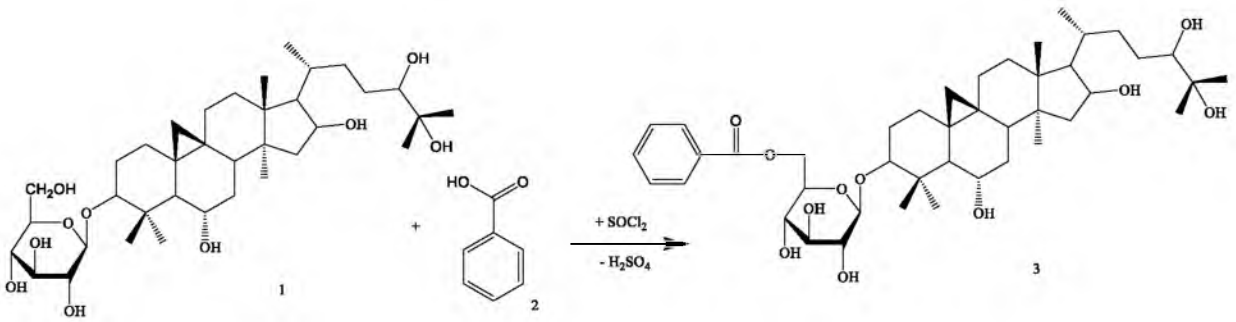
It is known that one of the most promising directions in the development of new pharmaceutical drugs is the structural modification of molecules of known natural compounds. For this purpose, we studied the possibilities of modifying new derivatives of cycloartanes.

A solution containing 0.05 mmol of cyclounifuloside C (**1**) (32 mg) and benzoic acid (**2**) (6 mg) was prepared in 30 ml of pyridine, and 2 ml of thionyl chloride was added. Considering that the boiling point of thionyl chloride is 250 °C, the mixture was stirred on a magnetic stirrer for 10 minutes at 60 °C, in a setup equipped with a reflux condenser. Using a solvent system of chloroform-methanol-water (4:1:0.1), it was determined that, in addition to the starting substance, three additional compounds were formed in the reaction mixture. Water was added to the reaction mixture twice, and methanol was evaporated using a rotary evaporator. The aqueous phase was extracted four times with an equal volume of ethyl acetate. The ethyl acetate was then removed, and the dry reaction mixture was dissolved in benzene to remove excess benzoic acid, resulting in the formation of a white precipitate. The precipitate was filtered, and the obtained mixture of compounds was separated using column chromatography. An individual compound was isolated 16 mg, melting point 141-142 °C by elution with a chloroform-methanol (6:1) solvent system.

The application of this approach in the reaction of cyclounifuloside C (**1**) with benzoic acid (**2**) allows the formation of 6′-benzoyl-3-O-β-D-glucopyranoside cycloasgenin C (**3**) as the reaction product with a yield of 50% (Scheme). The obtained target product (**3**) was named Cycloasin A.

The structure of compound **3** was established based on ^{1}H and ^{13}C NMR spectral data.



Scheme. Acylation of Cyclounifuloside C (1)

Thus, for the first time, the acylation of cyclounifuloside C with benzoic acid in the presence of thionyl chloride has been carried out, and a new one-pot synthesis method for 6′-benzoyl-3-O-β-D-glucopyranoside-24R-cycloartan-3,6,16,24,25-pentaol has been developed.

The work was supported by the Budget Program for Fundamental Scientific Research of the Academy of Sciences of the Republic of Uzbekistan.

APIGENIN GLYCOSIDES IDENTIFIED IN *Stachys hissarica* BY UHPLC-MS

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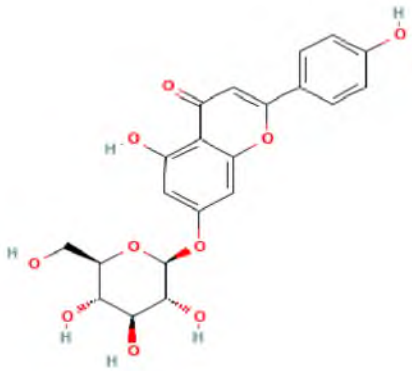
Stachys hissarica Regel (local name is Hisor quddusi) is perennial species and occurs in the regions of Tashkent, Samarkand and Surkhandarya. This plant is an endemic of the Pamir-Alay, grows in mountainous areas, in rocky places. The lipids, fatty acids and carbohydrates were identified in the seeds of *S. hissarica* [1]. Herbal preparations of *Stachys spp*. are widely consumed in Central Asian folk medicine to treat a broad array of disorders and diseases, including stress, skin inflammations, stomach disorders and genital tumors [2].

Accordingly, the aims of this research were the development of analytical methods for metabolic profiling of the *S. hissarica*, and the establishment of their reversed phase ultra-high-performance liquid chromatography mass spectrometry (RP-UHPLC-MS) profiles.

The aerial parts of *S. hissarica* (4 mg) were extracted with 2 mL of LC-grade methanol using an ultrasonic bath for 10 min at room temperature, and then centrifuged at 14000 g for 10 min to remove debris. After centrifugation, the supernatant was transferred to vials (1 mL). This solution (concentration 2 mg/mL) has been used for the UHPLC-MS measurements.

The results of our investigations showed that most of the identified metabolites of the methanol extract of *S. hissarica* were flavonoid glycosides, iridoid glycosides, and phenolic compounds. Initial studies have shown that the plant contains apigenin 7-O-β-D-glycoside (**1**), and apigenin 8-C-glycoside (**2**).



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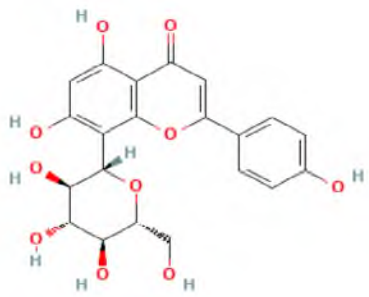

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Several studies have reported various types of flavonoids occurring in *Stachys spp*., including flavones, polymethylated flavones, flavonols, flavanones, and bioflavonoids [3]. Our results confirm and align with these findings. Our next study focuses on evaluating the biological potential of this plant and its metabolites.

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STUDY OF THE COMPOSITION OF THE EXTRACT OF *Perovskia kudryashovii*, A PLANT BELONGING TO THE GENUS *Perovskia* OF THE FAMILY LAMIACEAE

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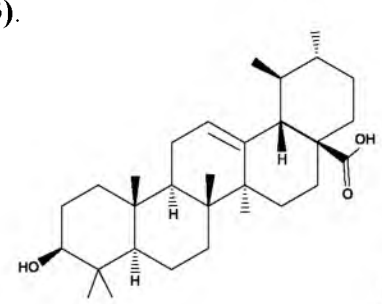
The Lamiaceae (Lamiaceae) family is widely distributed worldwide, comprising more than 236 genera and over 7,000 plant species.

The *Perovskia* genus of the Lamiaceae family is found in Central Asia, the Caucasus, China, and India. Seven species of this genus have been identified, four of which are found in Uzbekistan. *Perovskia* species are medicinal plants that have long been used in folk medicine due to their biologically active compounds.

In Uzbekistan, *Perovskia* species such as *Perovskia scrophulariifolia* are used in folk medicine for skin diseases and intestinal parasites, *Perovskia atriplicifolia* contains steroid glycosides and triterpenoids with anti-inflammatory effects, and *Perovskia abrotanoides* contains diterpenoids with antibacterial properties.

To investigate the triterpene compounds of *Perovskia* plants and their biological activity, we collected 1,5 kg of dried and ground aerial parts of *P. kudryashovii* in the Tashkent region in 2024. An ethanol extraction was carried out, yielding 150 g of alcoholic extract. The extract was then fractionated according to solvent polarity into chloroform (50 g), ethyl acetate (22 g), and n-butanol (14 g) fractions.

Analysis of the chloroform fraction using TLC (Thin Layer Chromatography) and comparison with reference compounds confirmed the presence of ursolic acid **(1)**, oleanolic acid **(2)**, and carnosol **(3)**.



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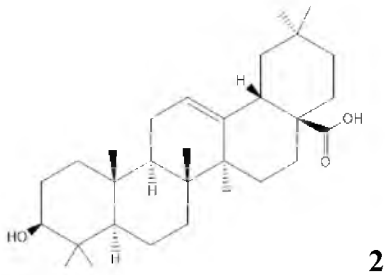

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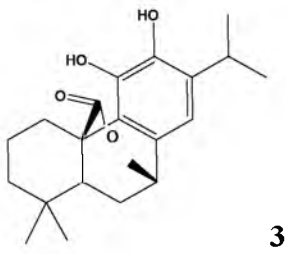

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The ethyl acetate and n-butanol fractions are undergoing further study using column chromatography with silica gel as an adsorbent.

The work was supported by the Budget Program for Fundamental Scientific Research of the Academy of Sciences of the Republic of Uzbekistan.

ISOFLAVONE GLYCOSIDE FROM *Astragalus alopecias*

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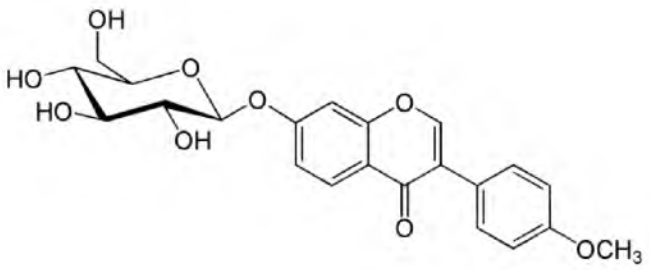
Astragalus (family Leguminosae) is a large genus of plants that is widespread in temperate regions of the world, mainly in Eurasia and North America. In terms of medicinal use and scientific research, special attention is paid to the study of several species of the genus *Astragalus*, which is the largest among flowering plants. *Astragalus* has been used in traditional medicine for centuries to treat various diseases. The fruits of some *Astragalus* species have been used in traditional Central Asian medicine to remove kidney and bladder stones. Phytochemical studies of *Astragalus* species have led to the isolation and identification of triterpenoid saponins, flavonoids, phenylpropanoids, alkaloids, and some other compounds.

Astragalus alopecias Pall., locally known as Tulkikabi astragal, is distributed in Central Asia (Tian-Shan, Pamir-Alay, Kopedtog), Afghanistan, Iran, and Pakistan. It is a perennial plant growing to 40-80 sm tall and flowering from May to June. Based on the results of the literature review and examination, it was found that there is almost no available information about the chemical components of this species. We continued our search for natural compounds in the *Astragalus* genus by studying the aerial parts of *A. alopecias* collected from Boysuntog, Surkhandarya region, Uzbekistan.

Thin-layer chromatography of the methanol extract of *A. alopecias* revealed the presence of several flavonoid and triterpene glycosides in the plant. Treatment of the methanol extract with ethyl acetate yielded the ethyl acetate fraction. This fraction was subjected to several column chromatography to isolate the isoflavonoid glycoside ononine ($C_{22}H_{22}O_9$). The chemical structure of the substance was determined by mass and NMR spectra. This substance was previously isolated from some *Astragalus* species. It was identified from *A. alopecias* for the first time.



Ononin is an isoflavone glycoside, the 7-O-β-D-glucopyranoside of formononetin, or the 4'-O-methyl (4'-methoxy) derivative of daidzein. Ononin exhibits a variety of pharmacological effects, including antiangiogenic, anti-inflammatory, antiproliferative, proapoptotic, and antimetastatic effects. Currently, the isolation of other flavonoids from *A. alopecias* and the study of their biological activities are ongoing.

IN SILICO COMPARATIVE ANALYSIS OF THE B-GALACTOSIDASE GENE MRNA IN *Homo sapiens* AND *Glycine soja*

J. Mengturayev[2], D. Turdaliyev[1,2], R. Sayidova[2], G. Murodullaeva[2], B. Akhrorova[2], F. Kholiyorova[2], M. Ganieva[2], N. Pardaeva[2], J. Abdurakhmanov[1,2], Sh. Hasanov[1], Sh. Azimova[1]

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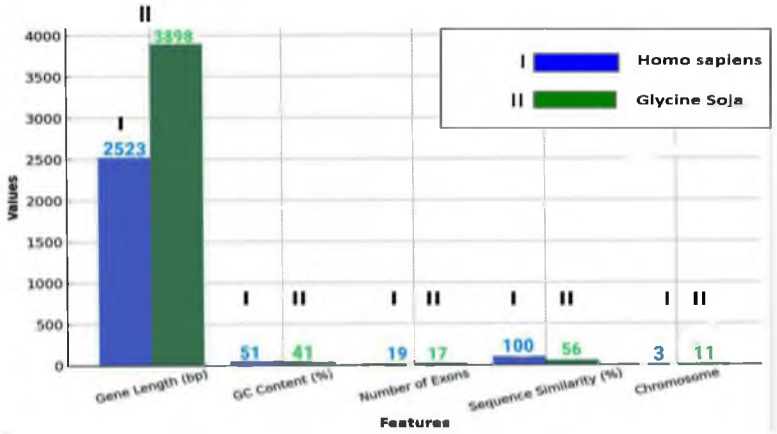
β-Galactosidase (GLB1 in the *Homo sapiens,* LOC114373226 in the *Glycine soja*) is a lysosomal enzyme responsible for breaking down complex carbohydrates. It primarily participates in the hydrolysis of GM1 gangliosides, keratan sulfate, and glycoproteins.

A decrease in β-galactosidase (GLB1) in the human body leads to diseases such as GM1 gangliosidosis and Morquio B syndrome, causing damage to the nervous system and bone tissue. Identifying homologous genes is an important research direction to prevent the deficiency of this enzyme.

In this process, the β-galactosidase gene of the glycine soja was selected as the research object. This gene shares structural and functional similarities with the human GLB1 gene, providing a valuable opportunity for genetic research.

In this study, the mRNA of β-galactosidase genes of *Homo sapiens* and *Glycine soja* were compared using NCBI BLAST and Clustal Omega software.

Table 1. ***In silico*** **comparison of β-galactosidase gene in** ***Homo sapiens*** **and** ***Glycine soja***



According to the research results, the length of the β-galactosidase gene in *Homo sapiens* (2523 bp) is shorter than that in *Glycine soja* (3898 bp). The GC content was 51% in human and 41% in glycine soja. The number of exons differed slightly (19 vs. 17). The most significant difference was a 56% sequence similarity, indicating structural and possibly functional variations in the gene.

The research results indicate that the nucleotide sequences and structure of the β-galactosidase gene in *Homo sapiens* and *Glycine soja* exhibit significant differences.

Financing. This study was carried out using budgetary funds from the ICPS of the Academy of Sciences of the Republic of Uzbekistan.

TOTAL LIPIDS OF SEEDS *Ammodendron conollyi*

S.N. Shomuratova, N.K. Yuldasheva, S.D. Gusakova, S.Z. Nishanbaev

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Ammodendron conollyi Bge. (also known as sand acacia, family Fabaceae) is a halophyte, alkaloid-bearing, and honey-producing plant that grows on saline sandy soils in Central Asia, Iran, and China. In Turkmen folk medicine, the seeds are used to treat kidney diseases. An aqueous infusion of its branches and leaves stimulates the respiratory center and exhibits hypoglycemic properties. The chemical composition of this plant has been poorly studied, with the exception of its alkaloids. The branches, leaves, and seeds contain 0.56–2.80% quinolizidine alkaloids. The roots contain coloring agents, which are used to dye wool and other materials in yellow, brown, and orange shades. The composition of the micro- and macro-elements in the stems of *A. conollyi*, as well as the content of carbohydrates, fats, and proteins in the aerial parts of the plant, is known. However, the lipids of the plant have not been studied in detail.

Determination of the content and composition of lipids in *A. conollyi* seeds collected in the Bukhara region in 2023.

Neutral lipids (NL) were extracted from ground seeds using benzene (boiling point 72-80°C) in a Soxhlet apparatus; polar glyco- (GL) and phospholipids (PL) were extracted from the remaining cake using a chloroform-methanol mixture [1]. The composition of NL, GL, and PL classes was determined by thin-layer chromatography (TLC) on silica gel. The content of lipophilic substances (LS) in NL was determined by alkaline hydrolysis, and the carotenoid content was determined using spectrophotometry (SP). Fatty acids (FA) were isolated from the lipids and analyzed as methyl esters using gas chromatography (GC) on an Agilent 8860 GC chromatograph.

The content of neutral lipids (NL) in the seeds was 15.0% on a dry weight basis, phospholipids (PL) - 1.0%, glyco- lipids (GL) - 0.2%, lipophilic substances (LS) in NL - 14%, carotenoids in NL - 23.35 mg%, and in LS - 501.2 mg%. The components of NL, GL, and PL were determined by thin-layer chromatography (TLC) on "Silufol" plates and silica gel using standard solvent systems, model compounds, and qualitative reactions. In NL, paraffin hydrocarbons, triacylglycerols, carotenoids, complex esters of fatty acids (FA) with phytosterols and triterpenols, free fatty acids (FA), free triterpenols, and phytosterols were detected. The glyco-lipids (GL) composition revealed sterylglycosides, monogalactosyl and digalactosyl diacylglycerides. In the phospholipids (PL), phosphatidylcholine, phosphatidylethanolamines, phosphatidylinositols, as well as traces of alkaloids co-extracted with PL, were found. According to gas chromatography (GC) data, 18-21 fatty acids (FA) were detected in the three lipid groups, with a predominance of unsaturated oleic acid (18:1n9), linoleic acid (18:2n6), and unsaturated palmitic acid (16:0). In all lipids, a minor amount of arachidonic acid (20:4n6) (0.05-0.11%) was identified, which is rarely found in plant lipids.

Financing. This work was carried out using budgetary funds of ICPS from the Academy of Sciences of the Republic of Uzbekistan.

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CHEMICAL COMPONENTS OF *Perovskia angustifolia* ROOTS

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Plants of the genus *Perovskia* kar., (family Lamiaceae) in the Flora of Uzbekistan are represented by 4 species and taxonomically close to each other by *R. angustifolia* and *R. scrophulariIfolia* are relatively often and their phytocenoses occupy large areas. *P. angustifolia* Kudr. - a branching half-brush, which has a fragrant smell that produces in the lower belt of the mountains in the Tashkent, Ferghana, Namangan, Samar-Kand and Surkhandarya regions. In folk medicine, a decoction of leaves is used as an anthelmintic agent, infusion and tincture have an antibacterial and wound healing effect, and the rhythm of heart contractions is increased.

Previously, the component composition of the essential oil of the aboveground part of *R. angustifolia* was studied, flavonoids and phenolcarbon acids were identified from the aboveground part of the plant. We studied the components of the roots of *P. angustifolia,* collected in December 2023 on the territory of the Kamchik Pass of the Namangan region. The crushed air-dry roots extracted at room temperature six times 80%ethanol. From various fractions of the combined extract by the method of column chromatography on silica gel and Sephadex LH-20 were isolated 10 individual compounds.

Based on the study of the data of the UV, ^{1}H and ^{13}C spectra, as well as HSQC and HMBC experiments, the results of X-ray analysis, with subsequent composure with such literary data for these compounds, identified with nor-diterpenoids of cryptotanshinon (**1**), tanshinon II (**2**), przhevalskin Y-1 (**3**), flavonoids by apigenin (**4**), luteolin (5), phenylpropanoids coffee (**6**) and rosemary (**7**) acids, sterins β-sitostosterol (**8**), stigmasterol (**9**), as well as cyclic alcohol D-pinitol (**10**).

The antibacterial and antifungal effects of various samples from the roots *P. angustifolia* were studied by the disk-disjection method in agar. Moreover, the greatest antibacterial effect is observed in chloroform (inhibition zone diameter 22.08 ± 0.12), 80% ethanol (20.04 ± 0.10) extracts of roots and rosemary acid (18.08 ± 0.12) in relation to *Staphylococcus aureus*. All studied samples turned out to be inactive against *Escherichia coli* and *Candida albicans.* The compounds 1-3.8-10 are first selected from *P. angustifolia,* substances 4-7-for the first time from the roots of the studied plant.

THE ANTIOXIDANT ACTIVITY OF A NATURAL STIMULANT IN POTATO CULTIVATION

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As with other technological advancements, the production of high-quality seed potatoes necessitates continuous refinement.

Optimizing the efficiency of biotechnological processes, from *in vitro* cultivation to soil acclimatization, remains a critical area of research. The application of new-generation natural-based preparations in the *in vitro* propagation of potato genotypes enables the development of elite seed material resistant to biotic and abiotic stresses.

It is well known that enzymes play a crucial role in protecting plant cells, particularly against oxidative stress caused by the accumulation of reactive oxygen species (ROS) and other free radicals. Antioxidant enzymes involved in cellular defense mechanisms neutralize harmful substances, thereby protecting cellular structures from damage. These enzymes function in a coordinated manner to prevent ROS and free radical accumulation, maintaining cellular homeostasis and preventing damage.

In this study, microplants of the Evolution potato cultivar, obtained from the unique "Biotechnological Collection of Potatoes" at the Institute of Bioorganic Chemistry named after Academician O.S. Sodykov, Academy of Sciences of the Republic of Uzbekistan, were used. Additionally, the DAG-1 stimulator (a supramolecular complex of glycyrrhizic and salicylic acids) was employed.

During in vitro micropropagation of potato plants, various concentrations of the DAG-1 preparation (10^{-5}, 10^{-6}, 10^{-7}, and 10^{-8} M) were added to the nutrient medium, and the activities of peroxidase (PO) and ascorbate peroxidase (APO) enzymes were analyzed. The highest PO activity was observed at a DAG-1 concentration of 10^{-6} M (35.26 U/mg), while the lowest activity was recorded at 10^{-8} M (30.95 U/mg). Analysis of standard threshold values for each DAG-1 concentration indicated that APO activity was most stable at 10^{-6} M and 10^{-7} M.

The increase in PO activity reduced the demand for APO activity, as PO neutralizes peroxides and maintains cellular balance, whereas APO becomes active under conditions of lower oxidative stress. Together, these two enzymes maintain the redox balance in the cell.

The results demonstrated that PO is primarily activated at higher DAG-1 concentrations, while APO activity is elevated under conditions requiring greater ROS protection.

A higher concentration of DAG-1 may be optimal for protecting cells against oxidative stress, as it enhances the stability of cellular membranes and proteins while minimizing damage.

This study revealed that the application of DAG-1 at concentrations of 10^{-6} M and 10^{-7} M during in vitro micropropagation of the Evolution potato cultivar positively influenced the activity of the plant's antioxidant system. These concentrations effectively maintained stable peroxidase and ascorbate peroxidase activity while reducing ROS accumulation, indicating their efficacy in mitigating oxidative stress.

AMPLIFICATION OF THE DREB2A TRANSCRIPTION FACTOR GENE FROM *Salsola richteri* (MOQ.) KAR. EX LITV

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Salsola richteri is a shrub or a small tree ranging from 1 to 3 meters in height. In its young stage, it is covered with finely tuberculate (or papillose) leaves, which later become leafless. The stem is weakly branched, with smooth gray bark, up to 5 cm thick at the base, and its woody branches soon acquire a milky-white color. This species is promising for phytoremediation practices due to its good growth on sandy soils, high seed productivity, ability to propagate by seeds and cuttings, and tolerance to significant salinity. Its powerful root system makes it effective for sand stabilization. The high protein content and the formation of substantial organic mass with economical water use allow *S. richteri* to be utilized as a valuable forage plant for autumn-winter pastures.

Abiotic stress plays a crucial role in plant growth and development, as plants are exposed to various adverse factors such as drought, low and high temperatures. Under stress conditions, several stress-resistant genes are activated, among which DREB (Dehydration Responsive Element Binding) genes play a particularly important role. These genes encode proteins of the Apetala2 / ethylene (AP2/ERF) family, which bind to the dehydration-responsive element (DRE)/C-repeat in the promoter regions of stress-resistance genes. The DRE cis-element, located near the promoter regions of stress-associated genes, serves as the binding site for DREB transcription factors, which regulate osmotic stress in plants. Drought and high salinity levels induce the expression of the DREB2 gene, which plays a key role in regulating abiotic stress-responsive genes. The expression of OsDREB2A in *Oryza sativa* is enhanced under salt stress and dehydration, but the gene exhibits low sensitivity to low temperatures and abscisic acid (ABA). Similarly, in *Zea mays*, the transcript level of ZmDREB2A increases under high-temperature stress. *Arabidopsis thaliana* demonstrates DREB2A activation primarily in response to drought and salt stress.

The aim of the study is to design a new primer for obtaining the full DREB2A gene sequence from *S. richteri*, a plant from the *Chenopodiaceae* family. As research objects, plant biomaterials of *S. richteri* collected from the Southern Aralkum in 2021 were used. The plant materials were identified by staff of the Institute of Botany, Academy of Sciences of the Republic of Uzbekistan. To amplify the DREB2A gene from plants of the *Chenopodiaceae* family, a search for the nucleotide sequence of the DREB2A gene was conducted in the NCBI database (NCBI - www.ncbi.nlm.nih.gov). Oligonucleotide sequence of primers for amplification of the DREB2A gene of some species of the *Chenopodiaceae* family. Pr_D_F TCGAAGAAAGGDTGTATGAAAGG, Pr_Dr_F1 GGGAWRTTTTAWAWWTTKATTTA, Pr-DOST_R1 AAACCTAYWGAGAATAAGCTT. As a result of the study, a PCR product with an approximate length of 900 and 1200 base pairs was obtained from *S. richteri*.

In this research work using bioinformatics online resources, specific DREB2A primers were designed. The DREB2A gene was successfully amplified from the DNA of *S. richteri* using PCR. It was established that the PCR products obtained from *S. richteri* were suitable for sequencing nucleotide pair sequences. The results of this study provide a foundation for further analytical research aimed at understanding the functionality of the DREB2A gene in *S. richteri*.

ALKYLATION OF MELOXICAM AT THE ENDOCYCLIC *N*-ATOM OF THIAZOLE RING

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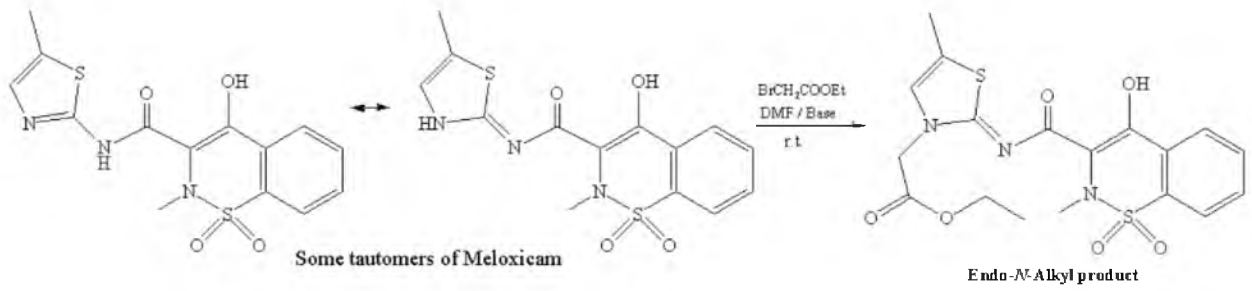
The physicochemical properties of existing and utilized medicinal products, including meloxicam, as well as their metabolites and absorption characteristics, are currently under intensive investigation [1]. Meloxicam, a non-steroidal anti-inflammatory drug (NSAID) with antipyretic and analgesic properties, is also of significant chemical interest due to its molecular structure, which contains multiple reactive centers.

Building on our previous research into the development of new ligands based on established medicinal substances [2], we conducted the alkylation of meloxicam with ethyl monobromoacetate [3]. This reaction occurs at room temperature in *N*,*N*-dimethylformamide (DMF) in the presence of a base. X-ray structural analysis revealed the formation of an *N*-CH_2COOEt alkyl product.

Alkylation occurs at the endocyclic nitrogen atom of the thiazole ring, resulting from a tautomeric transformation, as described below:



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CRYSTALLIC AND MOLECULAR STRUCTURE OF PALLIDOL FROM *Caragana aurantiaca* ROOTS

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Caragana aurantiaca Koehne. is a perennial low shrub of the Fabaceae family, growing on the banks and gravels of mountain rivers and in bushes in the foothills. Three flavonoids were found in the above-ground part of *C. aurantiaca*: rutin, narcissin and quercimeritrin. The chemical composition of the roots of this plant has not been studied.

The purpose of our research is to study the chemical composition of *C. aurantiaca* roots collected at the end of the growing season (November 2023) in the mountainous areas of Suusamyr valley of the Republic of Kyrgyzstan. The crushed air-dried roots of C. aurantiaca were extracted five times at room temperature with methanol.

The ethyl acetate fraction of the methanol extract was separated by column chromatography on silica gel, as well as by rechromatography of the eluates obtained on Sephadex LH-20 to isolate white crystals of composition $C_{28}H_{22}O_6$ with t.p. 199-200°C. Single crystals of the isolated compound were grown from methanol to establish the structure by PCA. The X-ray diffraction experiment was carried out on a transparent single crystal having a needle shape. The unit cell parameters of the crystal were determined and refined on a Bruker D8 VENTURE diffractometer (Germany) using CuK$_\alpha$-radiation. The intensities of independent reflections were measured on the same diffractometer. (Cu-Kα-radiation, ω-scan). Structures were decoded by direct methods within the SHELXS-97 programme suite, and structure refinement calculations were performed using the SHELXL-97 programme [1]. The spatial structure of the molecule was determined by X-ray diffraction analysis (Fig. 1).

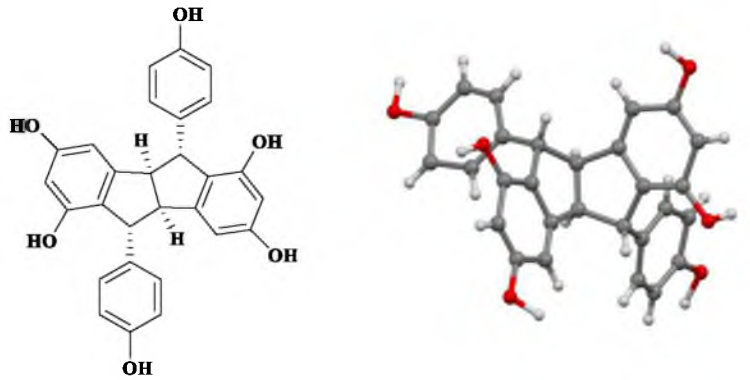

Fig.1. Chemical and spatial structure of the pallidol molecule

Pallidol is a dimer of resveratrol and is a potent and selective quencher of singlet oxygen in aqueous systems. Pallidol also possesses antioxidant and antifungal activities.

Thus, the crystal and molecular structure of pallidol has been established by PCA method for the first time.

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PHYTOCHEMICAL COMPOSITION OF *Oxytropis macrodonta*

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Plants of the genus *Oxytropis* of the Fabaceae family have no practical application in official medicine, but have a wide range of pharmacological activity, as they contain biologically active compounds: phenolic acids, coumarins, flavonoids, alkaloids and others.

The aim of the work is to study the phytochemical composition of the purified butanol fraction of the alcohol extract of the above-ground part of the *Oxytropis macrodonta* Gontsch. The extraction of the dried and crushed plant *O. macrodonta* was carried out with 70% ethyl alcohol at room temperature for five times. Ethanol was poured into a container with crushed plant material, the sum of extractive substances was extracted by distillation of the solvent on a rotary evaporator. Then the concentrated extract was diluted with water and extracted first with chloroform, ethyl acetate, then with n-butanol.

A sample of the butanol fraction of the extract was dried on a rotary evaporator.

Using the recently developed LC-HRMS technique, 13 phytochemical molecules, including 6 flavonoid aglycones, 2 flavonoid glycosides, 4 phenolic acids, one secoiridoid glucoside, were detected and quantified in the investigated butanol extract of *Oxytropis*.

Table. LC-HRMS data of butanol extract *O. macrodonta*

Compounds	Retention time RT, min	Chemical formula	m/z	Content extract, mg/g
Syringic acid	3.13	$C_9H_{10}O_5$	197.0465	65.07
p-Coumaric acid	5.31	$C_9H_8O_3$	163.0409	48.32
Salicylic acid	5.23	$C_7H_6O_3$	137.0251	4.30
Isosacuranetin 7-O rutinoside	5.43	$C_{28}H_{34}O_{14}$	593.1541	0.04
Quercitrin	4.65	$C_{21}H_{20}O_{11}$	447.0955	2.99
Rutin	5.71	$C_{27}H_{30}O_{16}$	609.1691	0,15
Caffeic acid	2.78	$C_9H_8O_4$	179.0359	0.14
Dihydrokaempferol	3.97	$C_{15}H_{12}O_6$	287.0575	0.16
Naringenin	5.45	$C_{15}H_{12}O_5$	271.0625	0.10
Acacetin	5.35	$C_{16}H_{12}O_5$	283.0626	1.54
Oleuropein	5.02	$C_{25}H_{32}O_{13}$	539.1797	0.09
Quercetin	5.41	$C_{15}H_{10}O_7$	301.0369	0.02
Isosakuranetin	4.94	$C_{15}H_{10}O_6$	285.0783	2.63

The main components of the extractive substances are syringic and p-coumaric acids. Syringic acid is a phenolic compound of natural origin, which is used as a therapeutic agent for various diseases. In addition, it exhibits antioxidant, antimicrobial, anti-inflammatory, anti-endotoxic, neuroprotective and hepatoprotective activity, highlighting its multifaceted potential in promoting health and combating various ailments. p-Coumaric acid has various biological properties, namely antioxidant, anti-inflammatory and anti-cancer.

RESEARCH OF LIPIDS FROM *Astragalus pterocephalus* EXTRACTS

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Medicinal plants are the most important source of primary and secondary metabolites, widely used in the pharmaceutical and food industries. Over the centuries, people have learned them and currently widely used for the prevention and treatment of various diseases.

In this regard, the problem of searching for and introducing into practice new medicinal plants as raw materials is relevant for the purpose of producing drugs and dietary supplements for medicine and biopreparations for agriculture.

Astragalus pterocephalus Bunge (Syn: *Tragacantha pterocephala* Bunge) is a perennial branched shrub that grows in the Tashkent, Jizzakh, Samarkand, Kashkadarya, and Surkhandarya regions of Uzbekistan.

In order to identify the source of the biologically active glycoside, cyclosiversioside F, we studied the chemical composition of the plant *A.pterocephalus,* since preparations based on cyclosiversioside F have a pronounced cardioprotective effect, normalizing the impact on impaired metabolic processes in the body and activating the antioxidant system of the heart.

Chemical investigation of the aerial parts of *A. pterocephalus*, Bunge (Leguminosae) growing in different regions of Uzbekistan [1] led to the isolation and identification of a main cycloartane triterpene glycoside cyclosiversioside F (Astragaloside IV).

The qualitative composition of glycosides is preserved in all studied species, and the richest quantitative yield of the main compound - cyclosiversioside F is indicated in a plant growing in the high-mountain zone of the Surkhandarya region.

The plant *A. pterocephalus* has been recommended as a raw material [2] for the production of the medicinal product Cyclosiversioside F.

For further studies, the aerial part of the plant was extracted with ethanol and three fractions were obtained from the ethanol extract. The extract was concentrated to a syrup state, 2 times the volume of water was added and the alcohol was evaporated to the end. The remaining solution was first extracted with chloroform, then with ethyl acetate and butanol. The composition of each extract was analyzed using TLC method and identified by comparison with standard compounds as described in [3].

Glycosides cyclosiversioside F and E were concentrated in the ethyl acetate and more in butanol fractions. The chloroform and ethyl acetate fractions revealed lipid nature compounds and lipophilic substances, such as phytosterols, triterpenols, chlorophyll and carotenoid pigments. Both fractions are enriched in free fatty acids.

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ASTAXANTHIN IN *Artemia* CYSTS: THE ROLE AND APPLICATION OF A NATURAL PIGMENT

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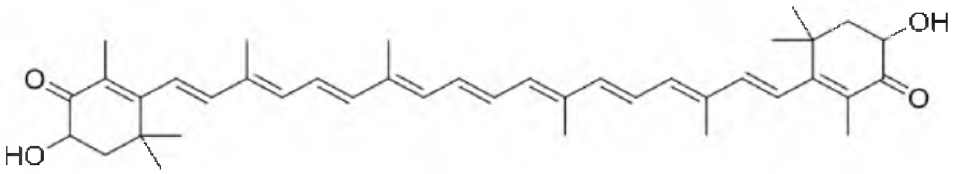
Artemia crustaceans are zooplankton organisms found in seas and saline lakes worldwide, except Antarctica. Belonging to the Artemiidae family, this organism has seven species distributed across the globe. It was first recorded in 982 by a Persian geographer in Lake Urmia. Later, in 1756, the English scientist Schlosser identified both sexes of the species. In 2001, Martin and Davis developed the taxonomic classification of the *Artemia* genus. Currently, the Artemia parthenogenetica species inhabits the Aral Sea. This species was identified in the western basin of the Aral Sea in 1998.

Artemia cysts are highly nutritious eggs of organisms widely used in the fisheries and aquaculture industry. They contain numerous biologically active compounds, including astaxanthin. Astaxanthin is a natural antioxidant belonging to the carotenoid pigment class and plays a crucial role in the pigmentation of Artemia cysts, protection against oxidation, and various biological functions.



Astaxanthin in Artemia cysts has the molecular formula $C_{40}H_{52}O_4$ and features a long polyene chain structure similar to β-carotene. It contains hydroxyl (-OH) and ketone (C=O) groups at both ends, distinguishing it from other carotenoids and allowing it to be partially soluble in water. Astaxanthin possesses key properties such as antioxidant activity, light protection, and nutritional significance for fish and crustaceans..

Artemia cysts are adapted to long-term survival in dry conditions, with astaxanthin playing a crucial role in this process. It prevents oxidative damage, ensuring the prolonged preservation of the eggs and their successful incubation. After Artemia nauplii hatch from the cysts, astaxanthin accumulates in their bodies, giving them a reddish-orange coloration. This serves as an essential nutritional source for fish and crustaceans, helping to maintain their natural pigmentation.

Astaxanthin is widely used not only in Artemia cysts but also in the aquaculture, food, and pharmaceutical industries. Aquaculture industry: used as a natural pigment in feed for salmon, trout, and crustaceans, helping to maintain the reddish color of their flesh. Health benefits: as a powerful antioxidant, astaxanthin enhances immune function, prevents cardiovascular diseases, and improves vision. Cosmetic industry: used to slow down skin aging and protect against UV radiation

Astaxanthin in Artemia cysts serves essential biological and physiological functions as a natural pigment. Due to its antioxidant properties, role in protecting cells from oxidation, and contribution to fish pigmentation, it holds significant importance in the aquaculture, pharmaceutical, and food industries. In the future, astaxanthin, with its unique characteristics, may find even broader applications in various research and practical fields.

IMPROVEMENT OF LECITHIN EXTRACTION TECHNOLOGY FROM UNREFINED COTTONSEED OIL

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Introduction: The aim of this study is to optimize the lecithin extraction process from cottonseed oil using the hydration method.

Relevance: To enhance the quality of lecithin used in various industries, it is essential to develop more cost-effective production methods by optimizing the processes of hydration, purification, and drying.

Materials and Methods: Initial material: Unrefined cottonseed oil. The following methods were used: hydration, sublimation drying, X-ray fluorescence analysis (XRF), infrared spectroscopy (IR spectroscopy), and chromatography techniques.

Results: The optimal ratio of cottonseed oil to water was 4:1, which provided the highest efficiency (90%) during hydration. If this ratio was exceeded or reduced, the efficiency of the process decreased. The effect of hydration temperature showed the following results:Experiment 1: At 50°C, the yield of lecithin was 2%.Experiment 2: At 55°C, the yield of lecithin was 3%.Experiment 3: At 60°C, the yield of lecithin increased to 5%.Experiment 4: At 70°C, the yield of lecithin was 7%.

The obtained lecithin was dried using lyophilization. Lyophilization effectively removed moisture from the phospholipid fraction without thermal decomposition of lecithin molecules, thus preserving its biological activity. Elemental analysis showed that the sample mainly consisted of phosphorus (47.8%) and potassium (40.8%), which together accounted for more than 88% of the mass. Smaller amounts of magnesium (2.68%), calcium (7.41%), and sulfur (1.32%) were also present. Spectral analysis results confirmed the presence of these elements through their characteristic radiation peaks. The IR spectrum confirmed the presence of functional groups typical for phospholipids, such as the phosphate group and choline group. The main peaks and their significance are:

1. 1230–1050 cm^{-1} — indicating the presence of the phosphate group (P=O and P-O-C), which is an essential part of the lecithin molecule.
2. 970–920 cm^{-1} — associated with the vibrations of the $N^+(CH_3)_3$ group, typical for the choline part of lecithin.

It was determined that neutral lipids account for 74.11%, glycolipids for 11.73%, and phospholipids for 14.16% of the total lecithin mass.

Conclusion: The optimization of the hydration of cottonseed oil showed the best result (90%) at an oil-to-water ratio of 4:1. A temperature of 70°C provided the maximum yield of lecithin (7%). Lyophilization helped preserve the biological activity of the product. Elemental analysis confirmed the high content of phosphorus and potassium. IR-spectroscopy and chromatography confirmed the presence of phospholipids.

TECHNOLOGY FOR OBTAINING AN ANTIHYPERTENSIVE AGENT BASED ON MEDICINAL PLANTS

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According to WHO, moreover, 580 million individuals suffering from high blood pressure are unaware of their condition, and 720 million people do not receive treatment [1]. Herbal antihypertensive agents typically exhibit a wide range of effects, including on the digestive and excretory systems. Earlier, we obtained a liquid extract from the fruits of *Berberis vulgaris L.* (common barberry) and the aerial parts of *Leonurus cardiaca L.* (motherwort), which exhibits antihypertensive effects and calms the nervous system. It is known that any medicinal plant must be formulated into a dosage form before being introduced into medical practice. Considering this, we developed a technology for producing a syrup based on medicinal plants and carried out a series of technological operations to achieve this goal. The liquid extraction technology was developed based on experimental data on the yield of extractive substances, literature sources, and pharmaco-technological parameters of the raw materials. Thus, purified water was selected as the extractant, and the raw material particle size was set at 3-5 mm. The calculated amount of common barberry fruits up to 0.5 mm and the above-ground part of motherwort were chopped on a grass cutter to a size of 3-5 mm, loaded in a ratio of 1:2 into a Faithfull - Hot Plate rotary evaporator, filled with the calculated amount of purified water taking into account the absorption coefficient, in a ratio of 1:4. Extraction was carried out at a temperature not exceeding 60°C without forced stirring for 3 hours. The resulting product was settled at a temperature not exceeding 8-10^0 C for 24 hours. The settled extract was separated from the ballast mass and subjected to three-stage filtration (filter pore size: 1.0 μm; 0.5 μm; 0.65/0.45 μm). The purified extract from ballast substances was evaporated under vacuum at a temperature of 50-60°C and a vacuum of 600-650 mm Hg to the required consistency and density of extractive substances. The resulting thick extract was added with pre-calculated granulated sugar and the solution was allowed to boil (skimming off the foam), after which it was evaporated until a syrup with an extractive density of 60.7 g/cm^3 was obtained. 10 parts of 96% alcohol were added to the cooled syrup as a preservative. The settled syrup was separated from the ballast mass, packaged in 50 ml orange glass bottles for pharmaceutical use. To substantiate the choice of extractant and the efficiency of the technological process, the physico-technological parameters of the dried plant material were determined: specific weight of *Leonurus cardiaca* aerial parts: 1000.0 g/cm^3; specific weight of *Berberis vulgaris* fruits: 511.0 g/cm^3; absorption coefficient for purified water: 3.97; particle size: ≤0.5 mm for fruits, 3-5 mm for aerial parts.

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ENHANCEMENT OF SEED GERMINATION IN *Sophora pachycarpa* THROUGH CHEMICAL SCARIFICATION

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Currently, there is high demand for products based on plant materials. *Sophóra pachycárpa*, a member of the Fabaceae family, is of particular interest as a source of medicinal raw materials [1].

S. pachycárpa is a perennial herbaceous plant. The seeds of this plant are characterized by low germination rates, which is attributed to the presence of a dense seed coat that prevents moisture absorption. Scarification is one of the effective methods for enhancing seed germination, as it activates metabolic processes within the seed, improving its water absorption and significantly increasing germination rates.

The objective of this study was to investigate the effect of chemical scarification with varying exposure durations on the germination of *S. pachycárpa* seeds.

In laboratory experiments, *S. pachycárpa* seeds were treated with concentrated sulfuric acid for different exposure times: 10, 15, 20, 25, and 30 minutes. The control seeds were not scarified. The results of our observations indicated that the optimal duration for chemical scarification was 20 minutes, which resulted in a germination rate of 82.5%, whereas the control group showed a germination rate of only 5%. The lowest germination rate (15%) was observed after 30 minutes of treatment.

Thus, the findings of this study emphasize the importance of chemical scarification as an effective method for enhancing seed germination in *S. pachycárpa*. Optimization of this process could improve the success of cultivating this species, which is of significant importance for its use as a source of medicinal raw materials.

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POSSIBILITIES OF OBTAINING ANTI-INFLAMMATORY AND ANTIBACTERIAL MATERIALS BASED ON SOME SYNTHETIC ISOQUINOLINE DERIVATIVES

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Currently widely used implant materials not only have biocompatibility, mechanical strength, and resorbable, but also can be treated with effective antibacterial and anti-inflammatory drugs, which expands their application and increases their competitiveness. It has been found that the inclusion of preparations from natural sources in the composition of artificial bone materials led to the emergence of their anti-inflammatory properties [1]. Among the various synthetic derivatives of isoquinoline alkaloids, some have been found to have anti-inflammatory, antibacterial, antifungal, and antioxidant properties [2].

This work presents studies on the antibacterial and anti-inflammatory properties of some isoquinoline alkaloid derivatives (2-((6,7-dimethoxy-3,4-dihydroisoquinolin-1-yl)alkyl)isoindoline-1,3-dione) synthesized at Samarkand State University, and on the production of artificial bone materials with improved properties based on them. Three derivatives of this substance - alkyl = methyl (1), ethyl (2) and isopentyl (3) derivatives - were synthesized, and their structures were determined using modern methods [3].

The activities of these preparations and products obtained by incorporating them into PLA/HA-based materials were studied against various pathogenic bacteria (Figure 1) and on wound healing (Figure 2).

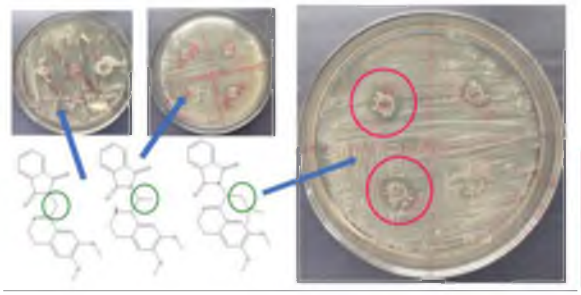

Figure 1. Antibacterial properties of samples

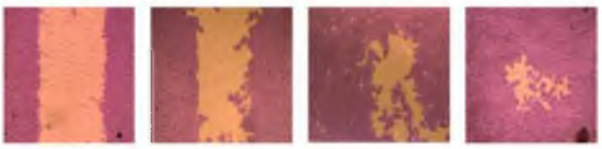

Figure 2. Wound healing properties

As a result of the experiments, the activity of drug (3) against the pathogenic bacterium *Staphylococcus aureus* was determined (Figure 1). It was also found that these preparations and the resorbable biomedical materials obtained with their participation have wound healing properties in 72-hour experiments (Figure 2).

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STUDY OF METABOLITES PROVIDING ANTIFUNGAL PROPERTIES OF *Trichoderma asperellum*

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Strains of fungi belonging to the genus *Trichoderma* are a group of microorganisms capable of stimulating plant growth. Among the metabolites produced by *Trichoderma* spp. The following were identified at the growth and sporulation stages, which are important in antibiosis: harzianic acid, alamethicin, anthraquinones, azaphylones, dauans, harzialactones, bisorbitcillinoids, butenolides, tricholine, glycoprenins, heptellidic acid, gliovirin, trichopyrincin, trichostatins, viridin, peptaibols, etc. [1,2]. In addition, these results of the nematicidal effect of Trichoderma sp. Filtrates from Meloidogyne species, in addition to elucidating one of the mechanisms of action involved in the biocontrol of the pathogen, may support research on the development of bionematicides based on metabolites or bioactive compounds through mass cultivation or chemical synthesis [2,3]. The antimicrobial potential of endophytic Trichoderma asperellum (D7) from Dendrobium orchids was investigated through the characterization and identification of bioactive compounds and 7 fractions were isolated. LC-MS analysis identified antimicrobial compounds from fraction 1 (paeoniflorin, canzonol N, 2-noninoic acid, fenpropidin, (+)-tetrandrin, 12(13)-EpOME-d, rifolenic acid and rifolenic). 3a,12a-dihydroxy-5b-chol-8(14)-en-24-oic acid) and fraction 4 (morpholine, epothilone A, tetroquinone, loperamide, 2,5-dimethoxycinnamic acid, 3,4-dihydroxyphenyl ethanol, atyropheop), T. asperellum 5-hydroxystreptomycin, rifamycin, leukomycin A1, sophoradiol, 5R-hydroxyhexanoic acid, 2-undecanol, 3-methyl-2-quinoxalinone, scandenin and lumichrome) have revealed that the identification of bioactive compounds from T. asperellum (D7) has contributed to the development of natural antimicrobial agents, agrochemicals, fungicides and pesticides [4]. In addition, the bioactive compounds nHexadecanoic acid, Hexadecanoic acid, ethyl ester, 9,12-Octadecanoic acid (Z, Z)-Octadecanoic acid and 1-Octyn-3-ol were identified by GC-MS [5]. The compounds are benzothiazole, cyclohexanol, n-decanal, dimethyl trisulfide, 2-ethyl 1-hexanol, and nonanal. Volatile compounds may play an important role in inhibiting sclerotial activity, limiting ascospore production, and reducing disease severity [6].

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THE EFFECTIVENESS OF INSECTICIDES AGAINST *Helicoverpa armigera*

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Uzbekistan is one of the world's largest cotton producers in the Central Asian region. Cotton farming plays an important role in the country's economy, providing jobs for millions of people and generating significant export revenues. The republic sows 32-33 million hectares of cotton annually.

In 2023, cotton exports from Uzbekistan amounted to $ 1.68 billion. The growth in cotton supplies from Uzbekistan compared to 2022 was 5.05% [1] .

Today, experts recognize that the cotton bollworm (*Helicoverpa armigera* Hb.), which causes severe damage to agricultural crops, is causing great damage to industrial crops, including cotton. *Helicoverpa armigera* is considered a dangerous pest of cotton, and it is known that it destroys 35-50% of the yield [2]. The threshold of economic danger of the pest is determined from the beginning of the boll to the end of fruit formation. In medium-fiber cotton varieties, it is determined when 10–12 H. armigera larvae or 20 eggs appear on 100 plants and 3–5% of bolls are damaged. In fine-fiber cotton varieties, when 5–6 *H. armigera* larvae or 10 eggs and 3–5% of bolls are damaged on 100 plants, it is impossible to maintain productivity without chemical means against it.

Since the resistance of the *H. armigera* pest to chemical preparations is increasing from year to year, the need to create new generation pesticides is increasing.

The purpose of our research is to determine the most optimal chemical means and the effectiveness of highly active substances in the fight against the *H. armigera* larva.

The effectiveness of insecticides with different mechanisms of action was determined in laboratory conditions against the *H. armigera* caterpillar. As a result of the screening, the biological effectiveness compared to the control was 72.0% for the systemic-surface insecticide BI-58 plus (40% dimethoate), 88.5% for systemic (contact-intestinal) insecticideEntospilan (20% acetamiprid), 92.0% for the systemic-internal Decis (10% deltamethrin), 95.0% for the systemic Vayego (20% tetraniliprol), and 90.0% for the 2-benzylthio-5-(4-aminophenyl)-1,3,4-oxadiazole. No insect mortality was observed in the control.

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STUDY OF GALLIC ACID IN *Cistache salsa* PLANTS

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Gallic acid ($C_6H_2(OH)_3COOH$) is a phenolic compound found in many plants, including plants of the genus Cistanche. Cistanche salsa, known for its medicinal properties, is widely used in traditional medicine to improve the immune system and treat kidney and liver diseases. To study the chemical composition of this plant, it is important to determine the concentration of various biologically active components, such as gallic acid, which has pronounced antioxidant, anti-inflammatory and antimicrobial properties.

The genus Cistanche, to which Cistanche salsa belongs, contains a significant amount of such active substances, which makes it an interesting object for phytochemical research. In this regard, one of the important tasks is to accurately determine the concentration of gallic acid in the extracts of this plant. In this context, high-performance liquid chromatography (HPLC) is one of the most effective methods for the quantitative analysis of such biologically active components.

The aim of the study is to determine gallic acid in the extracts of the underground part of Cistanche salsa plants.

Samples of Cistanche salsa were collected in natural conditions, then dried and ground. Various parts of the plant, including the underground part, were used to study the distribution of gallic acid in the plant.

The chromatographic analyses showed that gallic acid has a clearly defined peak manifestation on the chromatographic diagram. The retention time of gallic acid was 4-5 minutes, which allowed its confident identification and differentiation from other compounds in the extracts.

High performance liquid chromatography demonstrated high accuracy and sensitivity in the determination of gallic acid in Cistanche salsa extracts. The method was very effective in separating gallic acid from other phenolic compounds, confirming its applicability for the analysis of complex plant extracts. The results indicate that Cistanche salsa is a valuable source of gallic acid, especially in the roots of the plant, which may be useful for further research and development of pharmaceuticals based on it.

It was found that the amount of gallic acid in the underground part of Cistanche salsa growing in the Republic of Karakalpakstan is 2.12 mg/g.

STUDY OF THE AMINO ACID AND PROTEIN CONTENT OF *Poterium polygamum*

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Poterium polygamous Waldst. et Kit. belongs to the Rosaceae family. It is a perennial herbaceous plant with branched stems that can grow up to 1 meter in height.Its composition includes up to 17% protein, carbohydrates, carotene, and microelements, making it superior to grain and legume crops in terms of nutritional value. The plant is mainly used as fodder for agricultural animals [1,2]. Poterium polygamum is also a honey-bearing plant and improves soil amelioration [3].

There is insufficient data on the plant's chemical composition. However, flavonoids (rutin, quercetin, hyperoside), tannins (gallic acid, epicatechin), hydroxycinnamic acids (chlorogenic acid, caffeic acid, chicoric acid), and coumarins (umbelliferone, dicoumarol) have been identified in the raw material of Poterium polygamum Waldst. et Kit.[4].An HPLC analysis of organic acids revealed 12 organic acids in the aerial parts of the plant for the first time, with 9 of them identified. The main acids were oxalic acid (42.16%) and fumaric acid (15.37%). In the roots, 6 organic acids were found, with 5 identified, the primary ones being ascorbic acid (23.65%) and oxalic acid (23.38%) [5].

Plant samples were collected in April 2024 from the foothills of the Rezaksoy village, Pop district, Namangan region to study the amino acid and protein content of Poterium polygamum. The plant was separated into stem and root parts and dried. The amino acid derivatives accumulated in the plant organs were analyzed using HPLC.

The obtained results indicate that the stems and roots of Poterium polygamum contain 19 types of amino acids, with a total concentration of 10.53 mg/g in the stems and 4.76 mg/g in the roots. Further research showed that the total protein content in the stem was 13.18%, with nitrogen content at 12.11%, whereas the root contained 11.01% protein and 1.76% nitrogen.

Based on the results obtained, Poterium polygamum can be considered a plant with high biological activity and pharmacological properties.

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OPTIMIZATION OF GROWTH CONDITIONS FOR STREPTOMYCES SPECTABILIS STRAIN

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Streptomyces isolates were obtained from various soil samples using standard procedures. The biological properties of the isolated Streptomyces strains were evaluated using the cross-streak method. The most active isolates were selected, purified, and identified through molecular analysis. The selected isolate was identified as Streptomyces spectabilis by molecular genetic analysis and was registered in the National Center for Biotechnology Information (NCBI) international database under the accession number PP 962433.1. To optimize the growth conditions of the Streptomyces spectabilis strain, temperature and pH ranges were initially examined. For this purpose, the strain was grown in a nutrient medium (oat extract 20 g, starch 10 g, $MgCl_2$ 0.05 g, 1 L of distilled water) at pH levels of 4, 5, 6, 7, 8, 9, 10, 11, and 12, and at a temperature range of 28-30°C.
The following results were obtained during the experiment:

- At the end of the incubation period, the pH of the fermentation liquid in each flask was measured using a pH meter. It was observed that the environmental conditions had shifted from alkaline to acidic.
- At pH 4-6 and temperatures of 15-24°C, low biomass accumulation and minimal pigment release into the fermentation liquid were detected.
- At pH 6-8 and temperatures of 15-24°C, moderate biomass accumulation and low pigment release resulted in a light reddish color.
- At pH 9-10 and temperatures of 15-24°C, very low biomass accumulation and low pigment release resulted in a light pink color.
- At pH 11-12 and temperatures of 15-24°C, no biomass formation or pigment release was observed, leading to no change in the color of the medium.

Experimental observations revealed that the most favorable pH range for the Streptomyces spectabilis strain was 6-8, while the optimal temperature was 28-30°C. Under these optimal conditions, ethyl acetate was mixed in a 1:1 ratio with 100 mL of the culture liquid of the strain. After proper mixing, 0.6 mg of dry total extract was obtained using a standard method. These findings indicate that a large amount of dry total extract can be obtained from Streptomyces spectabilis when grown under these conditions. Scientific literature suggests that the optimal pH for maximizing total extract content in Streptomyces spectabilis cultures is close to neutral (6.5-7.5), with an optimal temperature of 28-30°C.

MODIFICATION OF METABOLITES OF THE POISONOUS FUNGUS *Stachybotrys chartarum*

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The use of highly basic systems as solvents in the synthesis process will lead to an increase in the reactivity of nucleophilic reagents and the development of new principles for studying the structure of substances and the creation of synthesis methods based on them.

The structure of the isolated alkaloids and terpenoids was determined and biologically active compounds were obtained by conducting acylation reactions with acetic anhydride based on the alkaloids and terpenoids of the Stachybotrys chartarum fungus. Pyridine and acetic anhydride were used to synthesize these substances. When these substances were dissolved and reacted with alkaloids and terpenoids, the reaction was carried out at different time intervals.

Synthesis of 3-O,24-O-diacetate-13,22-dimethoxystaxybotrine. 9.8 mg of 13,22-dimethoxystaxybotrine was added to 0.5 ml of absolutely dry pyridine and 0.30 ml of acetic anhydride. The reaction mixture was thoroughly mixed and kept in the dark at room temperature for 1 day (24 hours). The solvent of the reaction mixture was evaporated, and the residual product was subjected to column chromatography. The chromatographic column was washed with chloroform:methanol (20:1) eluent to obtain 5.71 mg (yield 52.7%) of 3O, 24-O-diacetate-13,22-dimethoxystaxybotrine. $C_{31}H_{42}NO_8$, Rf=0.33. (YUQX, silufol, 2-system), [α]D24-13.5 ± 2°(c 0.8; $CHCl_3$-MeOH, 1:1) [1].

24-Monoacetate-13,3-dimethoxystaxybotrine. 20 mg of 13,3-dimethoxystaxybotrine was taken, 1 ml of absolutely dry pyridine was added to it, and acetylated with 0.5 ml of acetic anhydride and kept at room temperature for 1 hour. The solvent of the reaction mixture was evaporated, and the residue was subjected to column chromatography. The chromatographic column was washed with the 3rd system eluent to obtain 13.8 mg (yield 62.2%) of 24-monoacetate–13, 3-dimethoxy stachybotrine,

$C_{29}H_{41}NO_6$, Rf = 0.35. (YUQX, silufol, 10-system), [α]D 24-13.8 ± 2°(c 0.8; $CHCl_3$-MeOH, 1:1) [2]

Synthesis of 3-O,13-O,24-O-triacetate-22-dimethylstachybotrine. 8 mg of 22-dimethylstachybotrine was taken, 0.5 ml of absolutely dry pyridine was added to it, and acetylated with 0.25 ml of acetic anhydride and stored at room temperature for 5 days. The solvent of the reaction mixture was evaporated, and the residue was subjected to column chromatography. When the chromatographic column was washed with a 5-system eluent, 5.2 mg (yield 65.2%) of 3, 13, 24-triacetate - 22-dimethylstachybotrine ( ) was obtained. $C_{33}H_{45}NO_8$, Rf=0.38, YUQX, silufol, 10 - system), [α]D24-14.4 ± 2°(c 0.8; $CHCl_3$-MeOH, 1:1) [3].

The structure of the isolated alkaloids and terpenoids and the formation of biologically active compounds with high yields were determined by conducting acylation reactions with acetic anhydride based on alkaloids and terpenoids from the fungus Stachybotrys chartarum.

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LABORATORY EVALUATION OF TOXICITY OF SELECTED INSECTICIDES AGAINST EGG AND LARVAL STAGES OF *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae)

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One of the pressing issues facing the country is the spread of cotton bollworm, a dominant pest affecting cotton and various other crops. The cotton bollworm (*Helicoverpa armigera* Hb.) is a widespread and significant threat, being a polyphagous pest that damages numerous forage and industrial crops, as well as fruit trees. Its most destructive phase occurs during the larval stage, which feeds on buds, flowers, ovaries and bolls of the cotton. *H. armigera* has been found in almost all regions of Uzbekistan. The economic threshold of damage is considered to be established for medium-fiber cotton varieties when there are 10-12 larvae or 20 eggs per 100 plants, or when 3-5% of the cotton bolls are damaged. Among the various strategies for increasing yield and crop quality, effective pest management is critical to minimize losses. It is important to note that chemical methods remain the predominant approach.

The search for new types of insecticides with high activity, low toxicity, preventing the emergence of resistance and low residue content has become an urgent task for scientific researchers.

This study aims to conduct a laboratory evaluation of the toxicity of selected insecticides against the eggs and larvae of *H. armigera* (Hb.) and to assess the biological efficacy of the synthesized compound 2-benzylthio-5-(4-aminophenyl)-1,3,4-oxadiazole, to develop new low-hazard insecticides for the management of the quarantine pest, the cotton bollworm.

The results of the study indicate that 2-benzylthio-5-(4-aminophenyl)-1,3,4-oxadiazole contributed to the mortality of Helicoverpa armigera larvae at developmental stages I–II–III and IV–V, as well as the mortality of pest eggs during 24-, 48-, and 72-hour incubation periods. The highest larval mortality rate was recorded after 24 hours of incubation in the I–II–III instar larvae when treated with the following insecticides: Entospilan (active ingredient: acetamiprid, Ifoda, Uzbekistan) at 20.0% EC – 96.6%; Vaego (active ingredient: tetraniliprole, BASF, Germany) at 200 g/L – 96.5%; Bagira (active ingredient: imidacloprid, Agrochem, Uzbekistan) at 20.0% SC – 93.3%; 2-benzylthio-5-(4-aminophenyl)-1,3,4-oxadiazole – 91.0%; and BI-58 (active ingredient: dimethoate, BASF, Germany) at 400 g/L – 85.5% at a concentration of 0.01%. Larvae at the IV–V instar stages were more resistant to insecticidal treatments compared to larvae at the I–II–III instar stages. The biological efficacy of the insecticides reached up to 99.0% after 72 hours of incubation in IV–V instar larvae.

Furthermore, the insecticides Vaego, BI-58, and the experimental compound 2-benzylthio-5-(4-aminophenyl)-1,3,4-oxadiazole contributed to egg mortality in H. armigera. No larval hatching was observed following egg treatment with these insecticides. Previous studies by Turaeva et al. (2024) have confirmed the high insecticidal activity of 2-benzylthio-5-(4-aminophenyl)-1,3,4-oxadiazole in vitro against H. armigera cells.

Thus, it can be concluded that this compound can be used as an insecticidal agent. The findings indicate that 2-benzylthio-5-(4-aminophenyl)-1,3,4-oxadiazole has the potential to serve as a basis for the development of a novel insecticidal formulation for crop protection in agriculture.

COMPOSITE MATERIALS BASED ON *Nigella sativa*

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The extraction of biologically active compounds from wild and cultivated plants prevalent in the flora of Uzbekistan is an important scientific task. *Nigella sativa* (black seed) are widely known for their therapeutic properties and are actively used in traditional medicine. The aim of the study is to investigate the antioxidant activity of composite extracts from Sample *Nigella sativa* and *Styphnolobium japonica*,1(30:70) , Sample 2(50:50), Sample 3(70:30) as well as their ability to inhibit free radicals and slow down lipid peroxidation in vivo.

The extracts were obtained using aqueous and alcoholic solvents. To assess antioxidant activity, the method of adrenaline auto-oxidation inhibition in vitro was employed, which evaluates the ability of the extract to prevent the formation of reactive oxygen species (ROS).

The results revealed that the aqueous extracts of both mixtures exhibit higher antioxidant activity compared to the alcoholic extracts. The aqueous extracts significantly inhibit free radicals and slow down the processes of lipid peroxidation.

Table 1:Antioxidant Activity of Aqueous Extracts of Samples

Time (minutes)	Sample 1(30:70) (aqueous)	Sample 1(30:70) (alcoholic)	Sample 2(50:50) (aqueous)	Sample 2(50:50) (alcoholic)	Sample 3(70:30) (aqueous)	Sample 3(70:30) (alcoholic)
1 minute	14.81%	2.96%	18.52%	-7.41%	12.59%	-75.56%
3 minutes	12.61%	-8.82%	12.61%	-26.47%	7.14%	-113.87%
5 minutes	10.06%	-16.16%	7.93%	-39.63%	4.88%	-117.99%
10 minutes	5.68%	-25.10%	4.05%	-53.85%	2.23%	-83.40%
Average	10.79%	-11.78%	10.77%	-31.84%	6.71%	-97.70%

The results obtained provide a foundation for further research on composite extracts of *Nigella sativa* and *Sophora japonica*. Additional experiments should be conducted to determine the exact mechanisms of their antioxidant activity, as well as to study their effects on other biologically active systems within the body. One promising direction is the creation of therapeutic agents based on these extracts for the prevention and treatment of diseases related to oxidative stress, such as cardiovascular diseases, cancer, and inflammatory disorders. Moreover, there is potential for the use of these extracts in the cosmetic industry, particularly for developing skincare products with antioxidant and anti-aging properties (Table 1).

The studies have shown that the aqueous extracts of the composite mixture of *Nigella sativa* and *Sophora japonica* possess significant antioxidant activity, confirming their potential as biologically active substances. These extracts could be used in the development of new pharmaceutical drugs with antioxidant and anti-inflammatory properties. Further clinical studies are required to confirm the efficacy and safety of these extracts, ensuring their potential therapeutic value.

STUDY OF CARBOHYDRATES IN THE CONTENT OF MELON PEEL

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The aim of the present research is to isolate water-soluble polysaccharides from the peel of *Melo mill* melon. The *Cucurbitaceae* family includes many species of economically important crop plants, such as watermelon (*Citrullus lanatus* L.), pumpkin (*Cucurbita maxima* L.), cucumber (*Cucumis sativus* L.), and melon (*Cucumis melo* L.). Melon (*Melo mill*) is a widely consumed fruit. While the edible portion is popular, the peel is often discarded as waste. However, melon peel contains valuable bioactive compounds, including carbohydrates, which can be utilized in various industries.

Melon peels collected in August 2024 in the territory of the Republic of Karakalpakstan (Xojeli district) were used to isolate polysaccharides. The peel was pre-cleaned and air-dried. The primary objective of this study is to investigate the types and quantities of carbohydrates present in melon peel and evaluate their potential for industrial and nutritional use.

Fresh melon peels were collected, cleaned, and air-dried. Carbohydrate content was determined using the phenol-sulfuric acid method to measure total sugars, while, gas chromatography (GC) was used to identify specific sugar types. The amount of total carbon was determined using the phenol-sulfur method. Polysaccharides were isolated using the classical method and the total yield was 11-14%.

The GC analysis revealed that melon peel contains a significant amount of carbohydrates, including arabinose, xylose, glucose, galactose (2,0:1,0:1,5:2.0). Total carbohydrate content was approximately 22-65% by dry weight.

Melon peel is a promising source of carbohydrates with potential applications in the food, pharmaceutical industries. The results obtained make it possible to demonstrate their potential in the creation of new biologically active additives on their basis, and the data obtained will be used in the future for standardization and their implementation in production. They are of great importance for the development of the economy of the Republic of Karakalpakstan.

STUDY OF FLAVONOIDS IN THE CONTENT OF MELON PEEL

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Flavonoids are a diverse group of polyphenolic compounds known for their antioxidant, anti-inflammatory, and antimicrobial properties. This study focuses on the identification and quantification of flavonoids present in melon (Cucumis melo) peel, an underutilized by-product of melon consumption. The research aims to evaluate the potential of melon peel as a natural source of bioactive compounds that could be used in food, pharmaceutical, and cosmetic industries. In this study, melon peels collected in August 2024 in the territory of the Republic of Karakalpakstan (Xojeli district) and subjected to extraction using appropriate solvents to isolate flavonoids. The extracted compounds were analyzed using spectrophotometric methods and high-performance liquid chromatography (HPLC) for precise identification and quantification. The results indicate that melon peel contains significant amounts of flavonoids, including dihydroquercetin, luteoline, rutin, and cynaroside (trace amounts), which contribute to its antioxidant activity.

Quantitative analysis revealed the presence of various flavonoids in melon peel. The identified compounds and their concentrations were as follows: dihydroquercetin (0.022 mg/g), luteoline (0.025 mg/g), rutin (0.16 mg/g), and synaroside (trace amounts). These findings highlight the diverse flavonoid profile of melon peel and its potential as a rich source of bioactive compounds.

Therefore, the melon extracts could be used in the production of functional waters, greatly demanded by markets and consumers all over the world, or in food and cosmetic products. Indeed, it has been observed that these by-products act against the oxidation process, thus suggesting their possible future uses as natural colorants and antioxidants in yogurt, biscuits, cupcakes, jellies, sweets and bread, and in anti-wrinkle creams, soaps and bathroom foams, as reported in the literature.

The findings suggest that melon peel, often discarded as waste, holds promise as a valuable source of natural antioxidants. Utilizing this by-product can reduce agricultural waste while providing eco-friendly and cost-effective raw materials for developing functional foods and pharmaceutical products. This study emphasizes the importance of exploring agricultural by-products to discover new sources of bioactive compounds and promote sustainable practices in food processing industries.

ANTIBACTERIAL ACTIVITY SCREENING OF *Streptomyces* ISOLATES (GROUPS III-IV) AGAINST PATHOGENIC STRAINS

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Soil samples (40°26'25"N 70°53'30"E) were collected under field conditions using sterile polyethylene bags. To isolate *Streptomyces* strains, the soil samples were dried at 60°C.

Subsequently, 50 mL of a 0.9% NaCl solution was added sterile 100 mL Erlenmeyer flasks containing the soil samples. The flasks were incubated in an orbital shaker at 28°C for 30 minutes. A 5 ml aliquot of the suspension was then transferred to the first of six test tubes, each containing 5 ml of 0.9% NaCl solution, followed by vortexing. A 1 ml sample was taken from the first tube and transferred to the second tube, which was then vortexed. This serial dilution process continued up to the sixth tube. Next, 100 µL from the 4th, 5th, and 6th test tubes was spread onto pre-prepared solid nutrient agar plates. The Petri dishes were incubated at 28°C for seven days. *Streptomyces* colonies were isolated between the 5th and 7th days of incubation. The antimicrobial activity of the *Streptomyces* isolates was tested against pathogenic bacterial strains (S. aureus MRSA 12023, E. coli ATCC 12012, P. aeruginosa NCTC 13045, S. enteritidis NCTC 11042) using the double-layer agar method. A 100 µL aliquot of each test strain, previously cultured in Nutrient Broth for 24 hours, was mixed with semi-solid agar and poured onto Petri dishes containing the *Streptomyces* isolates. The plates were then incubated at 37°C for 24 hours. All *Streptomyces* isolates exhibited antibacterial activity against the tested pathogenic strains (Figure 1).

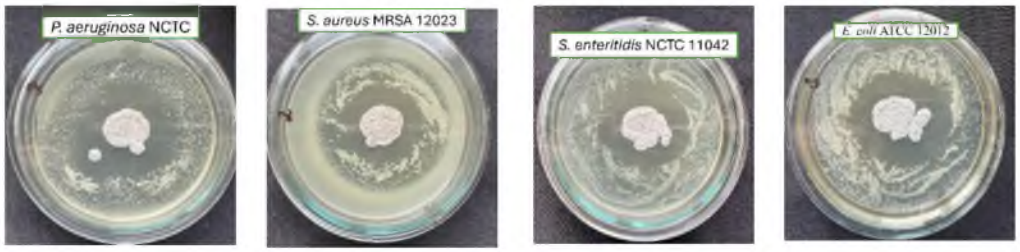

Figure 1. Antimicrobial activity of a pure *Streptomyces* isolate against microorganisms using the double-layer agar method

The obtained results suggest that the selected *Streptomyces* isolate possesses the ability to synthesize antibiotic compounds.

THE MOLECULAR COMPOSITION OF *Thymus vulgaris* L. CULTIVATED BY HYDROPONIC METHOD

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Thymus vulgaris L. is notable for its high levels of bioactive compounds and pronounced aromatic properties. The most important compounds synthesized by this plant are carvacrol and thymol. Apart this, *T. vulgaris* contains rosmarinic acid and its derivatives, with rosmarinic acid being reported as the main component along with luteolin, apigenin, caffeic acid and their derivatives, and eriodictyol.

The objective of the present study was to investigate the molecular composition of an aqueous-alcoholic extract of *Thymus vulgaris* L. obtained by ultrasound-assisted extraction (UAE). The *T. vulgaris* L. cultivar Zmejka (seeds supplied by the agrofirm "SeDeK" and AgroSydsTrade Ltd.) was cultivated under white light (light flux 8000 lm, colour temperature 4000 K, PPFD 165 μmol/s/m^2) on a horizontal hydroponic system employing a periodic flooding mechanism (Ebb & Flow). Mineral wool was used as a substrate (Speland, Ryazan, Russia).

The variable parameters for UAE using an ultrasonic bath (Nordberg NU-20, China) were defined as follows: particle size (0.2-2.0 mm), temperature (20-70 °C), extraction time (2-20 min) and plant material : extractant ratio (1:30-1:100). The total polyphenol content in aqueous extracts was determined spectrophotometrically at 765 nm (Shimadzu UV 1900i, Japan) and expressed in gallic acid equivalents (GAE). The individual flavonoid content was determined by high-performance liquid chromatography with diode-matrix detection (HPLC-DMD) (Agilent 1260 Infinity LC, USA) in gradient mode (phase A: acetonitrile; phase B: 0.04 M KH_2PO_4 + H_3PO_4 (pH 2.8); flow rate 1.0 cm^3/min).

The maximum total yield of polyphenols (71.4 ± 2.8 mg GAE/g dw) was obtained through the UAE under the following conditions: the plant material was ground to a particle size ranging from 0.2 to 0.5 mm; the ratio of plant material to extractant was 1:100; the extract was heated to 70 °C; and the extraction time was 15 minutes. The following substances (μg/cm^3) were detected in the extract obtained using optimal extraction parameters: rutin (0.51), quercetin (>0.1), dihydroquercetin (0.25), naringenin (1.89), resveratrol (0.21), hesperidin (>0.05), naringin (>0.05), baicalin (>0.1).

The optimisation of extraction conditions of biologically active substances (BAS) from *Thymus vulgaris* L. through the use of UAE has resulted in an increased yield of phenolic compounds. The findings substantiate the efficacy of hydroponic cultivation as a method for BAS accumulation and underscore the potential applications of thyme extracts in the pharmaceutical and food industries.

The study received financial support from the Ministry of Science and Higher Education of the Russian Federation (Programme of the West Siberian Interregional Scientific and Educational Centre, agreement № 4-CS dated 08.11.2023) and the Government of Khanty-Mansiysk Autonomous Okrug - Yugra (grant № 2023-227-28).

FLAVONOID COMPOSITION OF WILD PEAR *Pyrus pyraster* NATIVE TO THE REPUBLIC OF UZBEKISTAN

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The thesis presents literature data on the chemical composition and biological activity of the generative organs of the *Pyrus pyraster* plant, a representative of the *Rosaceae* family. In addition, information is provided on the preliminary studies conducted to determine the flavonoids in the fruits of the *P. pyraster* plant, which grows in the mountainous regions of our republic and to obtain extracts in the form of a sum in various solvents.

The work carried out qualitative and quantitative analysis of flavonoids, quantitative determination of proanthocyanidins in flowers of naturally growing *Pyrus* communis and in flowers of cultivated varieties. Flavonoid compounds were investigated by chromatographic methods. Flavonoid samples were found in all the plant materials studied. The content of flavonoids was determined by the Christ-Muller and HPLC methods after acid hydrolysis. Quantitative determination of proanthocyanidins was carried out by the spectrophotometric method [1].

Fourteen compounds were isolated from 60% ethanol extracts of unripe pear fruits (*Pyrus pyrifolia* Nakai) using an Amberlite XAD-2 HPLC column with directional analysis of DPPH radical neutralization. Based on MS and NMR analysis, the isolated compounds were identified as methyl ester of 5-O-trans-caffeoylquinic acid (**1**), malaxic acid (**2**), methyl ester of 5-O-trans-p-coumaroylquinic acid (**3**), methyl ester of 5-O-cis-p-coumaroylquinic acid (**4**), 5-O-trans-p-coumaroylquinic acid (**5**), trans-coumaric acid (**6**), methyl-cis-p-coumarate (**7**), methyl-trans-p-coumarate (**8**), 3,5-O-dicofeoylquinic acid (**9**), (-)-epicatechin (**10**), (S)-(+)-2-cis-abscisic acid (**11**), isoramnetin 3-O-β-D-galactopyranoside (**12**), isoramnetin-3-O-β-D-glucopyranoside (**13**) and isoramnetin 3-O-α-L-ramnopyranosyl (1→6)-O-β-D-glucopyranoside (**14**). Eight compounds (**3-5**, **7**, **8**, **11**, **12** and **14**) were first isolated from a pear [2].

To study the content of the flavanoid composition of wild pear fruits – *Pyrus pyraster*, dried fruits were extracted with 70% ethanol twice, at 70-75°C for 3 hours, with intensive stirring in the ratio solvent: plant (90:10) The extracts were filtered out and a 100 ml aliquot was diluted with 9.9 ml of an acetonitrile solvent system: buffer (acetate) 70:30 (1 mg/ml). Centrifuged and filtered through a membrane filter. The Agilent Technologies 1260 chromatographic system was used, the mobile phase was acetonitrile buffer solution (30:70) (isocratic mode). pH=2.92, injection volume – 5 µl at a mobile phase velocity of 0.75 ml/min. The speaker is Eclipse XDB – C18. 5.0 microns, 4.6x250mm. The detector is a diode-matrix detector, and was detected at wavelengths of 254 nm, 320 nm, and 381 nm. As a result, it was found that the fruits contain flavanoids such as gallic acid, rutin, hyperazide and isoquercetin.

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PROTEOLYTIC ACTIVITY OF THE ENZYME COMPLEX FROM *Bacillus sp*

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Worldwide, considerable attention is given to the development of competitive technologies aimed at improving the quality of food products and ensuring the production of high-quality, export-oriented goods. In this context, scientific research focused on the application of enzymes for targeted modification of food quality indicators is of particular relevance [1]. Such studies seek to enhance the quality, flavor, aroma profile, and technological characteristics of food products through enzymatic catalysis, as well as to improve production technologies by determining the functional significance of enzymes and their role in directed modification of product parameters [2].

The objective of this study was to investigate the physicochemical properties of protease derived from *Bacillus sp*., using azo-casein as the substrate.

To determine the pH optimum of the investigated protease, a 2% solution of azo-casein in phosphate buffer was used, with pH values ranging from 5.0 to 8.5. Enzyme quantification was determined by Lowry method [3]. The temperature optimum was assessed at pH 7.0 by measuring enzyme activity at temperatures ranging from 20°C to 70°C.

It was found that, within the enzyme concentration range of 0 to 10 mg/mL, the initial rate of azo-casein hydrolysis ($V_0 = f([E])$) displayed a parabolic dependence. This behavior is likely due to enzyme aggregation. The progress of substrate hydrolysis was monitored via the breakdown of azo-casein in the reaction mixture. Experimental data showed that the optimal hydrolysis time was 40 minutes. The enzyme exhibited maximal activity at pH 7.0 and remained stable for 30 minutes, after which it lost 18.5% of its activity within 60 minutes.

Thus, the physicochemical and kinetic parameters of the hydrolytic function of the neutral protease were identified: the optimal pH was 7.0, and the temperature optimum was 50°C. It was also established that enzymatic hydrolysis of the substrate depends on several factors, including enzyme concentration, substrate concentration, and the duration of enzyme-substrate incubation.

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SCREENING OF LACTIC ACID BACTERIA FOR THE PREPARATION OF STARTER CULTURES FORTHE SOFT CHEESE PRODUCTION AIMS

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Starter cultures play a central role in forming the flavor and texture characteristics of cheese, as well as ensuring its safety. The development of new starter culture preparation technologies allows for the creation of cultures with specific properties, contributing to the improvement of the final product's quality and safety. Cheese, as a traditionally high-value product, is particularly attractive for health-conscious consumers when combined with beneficial probiotics. The starter culture is a crucial component of cheesemaking, and its quality directly influences the flavour, texture, and nutritional characteristics of the final product. The objective of this study was to screen and select lactic acid bacteria to produce soft cheese.

The research objects were strains of *Lactobacillus plantarum* (B-1, B-2, B-3, B-8, CH-1, CH-2, Mal, Ferrum 5-8), obtained from the collection of the Center for Advanced Technologies (Tashkent, Uzbekistan). For lactobacilli cultivation, cow's milk was used after autoclaving (1 atm., 10 min). Fermented samples were obtained by inoculating sterile skimmed cow's milk with 0.02% of each *Lactobacillus plantarum* strain, followed by incubation for 48 hours at (37 ± 1)°C. Upon completion of fermentation, the concentration of lactobacilli in each sample averaged (8.8 ± 0.1) lg CFU/mL. After fermentation, an organoleptic evaluation of the samples was conducted with the participation of eight experts familiar with the product. Samples were assessed for consistency, aroma, taste, bitterness, colour, and overall acceptability.

The screening results for lactobacilli based on sensory indicators showed that cheeses prepared using selected strains of *Lactobacillus plantarum* (B-1, CH-1, CH-2) had a very fresh taste with a hint of coconut. Based on these selected strains, a starter culture for soft cheese production was developed. The conditions for obtaining a dry starter culture were optimized, including bacterial cultivation, stabilizers, drying, etc.

The data obtained in this study can be used to develop starter cultures for soft cheese production and to expand the range of soft cheeses in cheesemaking.

MALT EXTRACT WITH A SOFTENED BITTERNESS IN THE TASTE

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The brewing industry faces relevant scientific and technical challenges, the resolution of which can improve the quality characteristics of the product and expand the range of beer varieties. Existing methods for the production of dark beer, which include the use of unmalted materials and two-step mashing processes, are known [1-2]. However, such methods often result in beers with an unbalanced flavor profile—lacking fullness of taste and exhibiting excessive bitterness.

The objective of this study was to develop a brewing wort and, subsequently, a dark beer characterized by high drinkability, full-bodied flavor, low bitterness, and a creamy-coffee aftertaste.

In this work, the wort formulation included 15% unmalted adjuncts—namely oats, barley, and wheat—and 75% malted materials—specifically, light and dark (chocolate) barley malts. The mashing process was carried out using a single-decoction method. The mash was heated to 56°C and held for 60 minutes, then raised to 62°C and maintained for 45 minutes. Subsequently, the temperature was increased to 70°C and held for 45 minutes, and finally raised to 75°C for 15 minutes. Fermentation was carried out using a *Saccharomyces cerevisiae* yeast strain tolerant to melanoidins.

The use of unmalted oats, barley, and wheat in a ratio of 2:2:1 imparted the beer with high drinkability, a soft and full-bodied taste, creamy notes, and coffee-like undertones. The use of oats alone as the only unmalted material yielded a very soft flavor but lacked fullness. Conversely, omitting unmalted grain adjuncts resulted in increased bitterness; the wort exhibited low fermentability, and the final alcohol content dropped to 4.3% v/v. An increased proportion of dark malt, using a light-to-dark malt ratio of 0.35:0.50, produced beer with a highly intense color, excessive bitterness, a strong dark malt flavor and aroma, and a reduced alcohol content of 4.0% v/v.

Thus, by preparing a mash with 75% malted light and dark (chocolate) barley malts and 15% unmalted adjuncts (oats, barley, and wheat in a 2:2:1 ratio), and fermenting the wort with a *Saccharomyces cerevisiae* strain, it is possible to obtain a dark beer variety with high drinkability, a soft and full-bodied flavor, and a distinctive creamy-coffee aftertaste.

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ANTIMICROBIAL ACTIVITY OF THE TOTAL FLAVONOIDS OF *Hypericum perforatum*

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The high level of ultraviolet radiation in Uzbekistan enables plants to accumulate a high content of flavonoids, determining their significant potential for the pharmaceutical industry. Therefore, in terms of raw material sources for the development of herbal medicines, medicinal plants grown in countries with dry and hot climates are the most preferable [1].

The aim of this study was to investigate the antimicrobial activity of Hypericum perforatum collected in the Ugam-Chatkal State Biosphere Reserve, Uzbekistan.

To extract flavonoids from the plant, a 0.1 g portion of dry plant material was ground with the addition of 10 ml of 70% ethanol in a porcelain mortar. Extraction was carried out for 1 hour. The ethanol extract was then quantitatively transferred to a centrifuge tube and centrifuged at 5000 rpm for 10 minutes. The total flavonoid content was determined using the Folin-Ciocalteu method in the modification of Singleton and Rossi, which is based on the reaction of phenols with the Folin-Ciocalteu reagent [2].

Antimicrobial activity was determined using the agar well diffusion method [3]. During the experiment, the method was slightly modified. The tested gram-positive bacteria included Staphylococcus aureus 91 and Bacillus subtilis 5, while the gram-negative bacteria included Pseudomonas aeruginosa 225 and Escherichia coli 221. All bacterial suspensions were prepared at a concentration of 1.5×10^8 CFU/ml according to the McFarland standard.

Ethanolic fractions of *Hypericum perforatum* exhibited antimicrobial activity against *Bacillus subtilis* (14 mm) and Candida albicans (18 mm).

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THE EFFECTIVENESS OF THE USE OF GROWTH REGULATORS AT DIFFERENT SOWING DATES OF *Astragalus babatagi*

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Substantial evidence indicates that plant growth regulators enhance seed germination, accelerate plant growth, and stimulate processes that eventually result in increased agricultural productivity. The focus of this study is to examine the influence of plant growth regulator efficacy on the yield of raw biomass from *Astragalus babatagi*. The experiment was conducted in the Kuyichirchik district of the Tashkent region under controlled conditions. It was designed with three sowing dates and four repetitions.

The results revealed significant differences between sowing dates and experimental treatments. The first sowing date demonstrated the highest yield of the aerial part of *A. babatagi* biomass compared to the second and later sowing dates. Plant growth regulators contributed to an additional increase in the yield of raw biomass.

Figure 1: Plants in the flowering phase

Concerning all indicators, including growth, development, and biomass yield, the experimental treatments showed superiority over the control group, especially on the first sowing date, which led to high results. For instance, the yield of raw biomass from the aerial part of *A. babatagi* was 66.8 c/ha for the "scarification" treatment, 75.3 c/ha for the "scarification + Uchkun" treatment, 79.1 c/ha for the "scarification + Floraksan" treatment, and 78.6 c/ha for the "scarification + potassium humate Souffleur" treatment. The control group exhibited the lowest productivity, with an average yield of 0.22 c/ha for the first sowing date and 0.21 c/ha for the second sowing date.

APPLICATION OF PLANT EXTRACT OF *Mentha asiatica* BORISS. TO ENHANCE SEED GERMINATION

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The flora of the Republic of Uzbekistan is characterized by a wide variety of medicinal plants. Representatives of the genus *Mentha L.* are of great interest among them. The *Lamiaceae* family, which contains biologically active compounds such as monoterpenoids, phenolic and polyphenolic compounds. One of the species of this family is *Mentha asiatica* Boriss, which has long been used in folk medicine as an antispasmodic, carminative, anti-inflammatory agent, and is a part of many culinary dishes and cosmetics. Asian mint - *Mentha asiatica* Boriss. the plant was described for the first time in 1954 by A. Borisova as *Mentha asiatica* species. Its homeland is Central Asia (Kazakhstan, Kyrgyzstan, Turkmenistan, Tajikistan and Uzbekistan), Western Asia (Afghanistan, Iran and Iraq) and China (South Central China, Tibet and Xinjiang). Almost all types of mint are used as medicinal, essential oil and aromatic plants. In folk medicine and scientific medicine, they are used to treat gastrointestinal diseases and spasms, to improve the functioning of respiratory organs, to treat itching and pain, and to improve the taste of medicinal preparations. The species, native to Central Asia, has attracted considerable attention due to its diverse phytochemical profile and antimicrobial potential. A review of the literature shows that the chemical composition of Asian Mint and its biological activity have not been sufficiently studied. Therefore, research on the comprehensive study and implementation of this plant species in the biological practice of Uzbekistan is relevant.

Based on the above, it was of interest to study the chemical composition of individual fractions and their biological activity. The aim of the work was to study the effect of pre-sowing treatment of soybean seeds with alcohol extract of *Mentha asiatica* Boriss plant. for their germination in the laboratory.

The laboratory experiment was carried out four times. The following concentrations were tested: 0.01, 0.001, 0.0001 and 0.00001%. In the control version, the seeds were soaked in water. Processing of soybean seeds with 0.001% extracts of plant *Mentha asiatica* Boriss it stimulated germination and germination process. The absolute values of germination energy at the studied concentration of substances exceeded the values of the control variant by 25.4%, and germination - by 29.2%.

Studies show that *Mentha asiatica* Boriss plant extract. It can positively affect various aspects of plant growth and development, including the stimulation of germination.

Based on this, we can consider the possibility of using the *Mentha asiatica* plant as a valuable raw material for the production of drugs for agriculture.

The work was carried out within the framework of budgetary funding from the Academy of Sciences of the Republic of Uzbekistan.

DEVELOPMENT OF AN EFFECTIVE METHOD FOR STERILIZING *Dracocephalum moldavica* SEEDS TO ENHANCE THEIR GERMINATION RATE

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It is well known that the successful implementation of biotechnological research involving various plant species requires the development of optimal seed sterilization methods. This stage of research presents a complex challenge, necessitating a careful selection of the appropriate method and treatment parameters. Different plant species exhibit significant variations in their sensitivity to sterilizing agents. Insufficient sterilization results in contamination of cultures and the loss of valuable material, whereas excessive treatment may cause embryo damage and reduce seed germination. Therefore, the development of efficient and optimized seed sterilization methods remains a pressing issue.

The production of sterile seedlings begins with the seed sterilization process, which aims to eliminate surface microflora—comprising bacteria and fungi—without compromising the seed's viability. The effectiveness of this stage directly influences the success of subsequent procedures and the reliability of the obtained results.

The plant *Dracocephalum moldavica* L. is a valuable medicinal and essential oil-bearing species known for its antioxidant, anti-inflammatory, and antimicrobial properties. This species is widely distributed across Central Asia, Russia, Mongolia, and China. *In vitro* studies of *D. moldavica* are of great significance for the conservation and examination of this species. Microclonal propagation methods enable the production of genetically uniform planting material in large quantities, which is essential for preserving rare and endangered species as well as for the commercial cultivation of medicinal plants. *In vitro* research is also utilized to study the biochemical and physiological processes of *D. moldavica*, such as the synthesis and accumulation of valuable secondary metabolites.

The aim of this study was to optimize seed treatment methods for *D. moldavica* to enhance their germination rate.

The seeds were immersed in a solution of diacid for 10 and 20 minutes, after which they were thoroughly rinsed multiple times with sterile distilled water to remove any remaining sterilizing agent. The washed seeds were then dried on sterile filter paper and sown onto an agar-based nutrient medium. Additionally, some seeds were soaked under sterile conditions for 18 hours in a Murashige and Skoog mineral salt solution supplemented with the growth regulator Floraxan at a concentration of 0.00001%, after which they were sown onto the medium.

It was found that pre-soaking *D. moldavica* seeds in a mineral salt solution with the addition of the growth regulator Floraxan after diacid sterilization significantly increased their germination rate. The best results were obtained with a 10-minute diacid treatment, which achieved a germination rate of 32%. In contrast, a 20-minute diacid treatment resulted in a germination rate of 26%, indicating the negative effects of prolonged exposure to the sterilizing agent.

Thus, for the successful production of sterile *D. moldavica* seedlings, it is recommended to combine a 10-minute diacid sterilization with pre-soaking the seeds in a mineral salt solution containing Floraxan.

The work was carried out within the framework of budgetary funding from the Academy of Sciences of the Republic of Uzbekistan.

POTENTIAL APPLICATIONS OF POLYPRENOLS FROM THE WILD PLANT *Vitis vinifera* L. TO IMPROVE SOYBEAN SEED GERMINATION

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In Uzbekistan, amidst climatic changes and the imperative for efficient land management to enhance crop yields, the implementation of innovations in plant cultivation holds particular significance. Soybean (Glycine max (L.) Merr.) constitutes a valuable agricultural crop with significant potential for supplying the population with plant-based protein and oil, as well as for enhancing soil fertility due to its nitrogen-fixing capabilities. However, successful soybean cultivation under Uzbekistans conditions is frequently challenged by various abiotic and biotic stressors, including drought, soil salinity, high temperatures, and infestation by diseases and pests, which can substantially diminish its productivity.

In this context, a promising approach to enhancing the resilience and yield of soybeans involves the application of biologically active substances (BAS) for pre-sowing seed treatment.

Currently, plant cultivation practices widely utilize growth regulators derived from lipid extracts or the total lipophilic compounds isolated from higher plants. Information exists regarding the use of PP (Polyprenols) in agriculture.

Lipid extracts contain a variety of biologically active substances, such as phytohormones (e.g., auxins, gibberellins, cytokinins), fatty acids, sterols, and other lipophilic components, which can exert a stimulatory effect on the growth and productivity of agricultural crops.

Information exists regarding the use of polyprenols in agriculture. Polyprenols are long-chain isoprenoid alcohols found in significant quantities in coniferous plants, particularly in their needles. They play a crucial role in plant metabolism, participating in glycoprotein synthesis, enzyme activity regulation, and protection against stress factors. Research indicates that polyprenols can positively influence various aspects of plant growth and development, including the stimulation of germination.

The objective of this study was to investigate the effect of pre-sowing treatment of soybean seeds with polyprenols from the wild plant *Vitis vinifera L.* on their germination rate.

The laboratory experiment was conducted with four replications. The following concentrations were tested: 0.01%, 0.001%, 0.0001%, and 0.00001%. In the control group, seeds were soaked in water. Treatment of soybean seeds with biologically active substances from *V. vinifera* stimulated germination energy and the overall germination process. The absolute values for germination energy under the tested substance concentrations exceeded the control values by 27.1%, while the overall germination percentage surpassed the control by 33.3%.

The work was funded under the fundamental project IL-7923051851.

SYNTHESIS AND STRUCTURE OF 2,5-DIMERCAPTO-1,3,4-THIADIAZOLE DERIVATIVES

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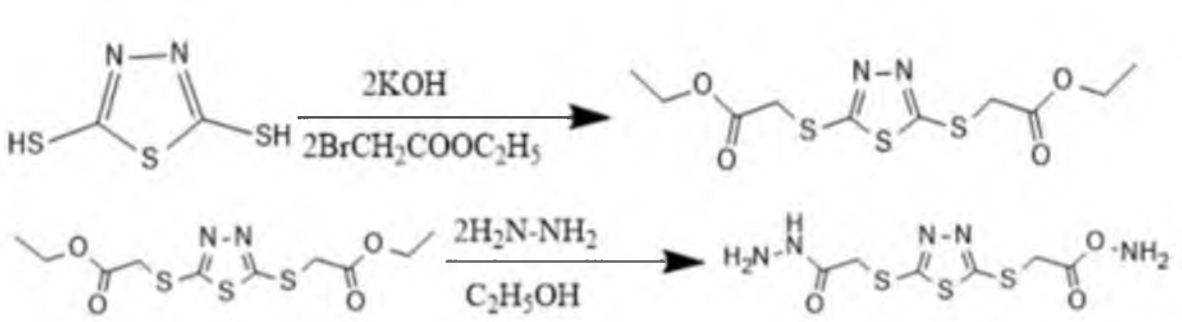
It is known that derivatives of 1,3,4-thiadiazole have a wide range of biological activity. They have antibacterial, antifungal, anti-inflammatory, antitubercular, anticancer, antiviral, anticonvulsant, analgesic and other types of activity.

Diethyl 2,2'-((1,3,4-thiadiazol-2,5-diyl)-bis-(sulfandiyl)acetate (I) and 2,2'-((1,3,4-thia-diazol-2,5-diyl)-bis-(sulfandiyl)di(acetohydrazide) (II) were synthesized to determine the anti-inflammatory, hepatoprotective, antidiabetic and growth-stimulating activities:



For the synthesis of diethyl 2,2'-((1,3,4-thiadiazol-2,5-diyl)-bis-(sulfandiyl) acetate, 2,5-dimercapto-1,3,4-thiadiazole was dissolved in absolute ethanol and potassium hydroxide was added. With vigorous stirring, ethyl bromoacetate was added to the reaction flask. After stirring for 4-5 hours (t=77-79 °C), the reaction mixture was poured with ice water at room temperature, filtered, washed with water and recrystallized from absolute ethanol.

Slow addition of 80% hydrazinacetate to a solution of 2,2'-((1,3,4-thiadiazol-2,5diyl)-bis (sulfandiyl)-acetate in absolute ethanol and heating the mixture for 5 hours at the boiling point of the solvent. The precipitate was filtered off, washed with water and recrystallized from absolute ethanol.

The IR spectrum (I) shows characteristic peaks at 3289 cm^{-1} and 3100 cm^{-1} corresponding to the N-H stretching vibration, confirming the presence of a hydrazide group. The intense peak at 1690 cm^{-1} indicates a carbonyl (C=O) stretching vibration, while the peak at 1045 cm^{-1} indicates the presence of a C-O-C bond.

In the IR spectrum (II), a characteristic peak of valence vibrations of N-H bonds in amide groups is observed at 3289.74 cm^{-1}. The valence vibrations of C-H bonds in methyl groups are observed at 2956.43 cm^{-1}. The valence vibrations of C=N bonds in heterocycle and/or amide groups are observed at 1630.22 cm^{-1}. The valence vibrations of the C=O carbonyl group in amide groups are observed at 1690.13 cm^{-1}.

REACTIONS OF 5-ARYL-2-AMINO-1,3,4-THIADIAZOLES WITH ARYLISO(THIO)CYANATES

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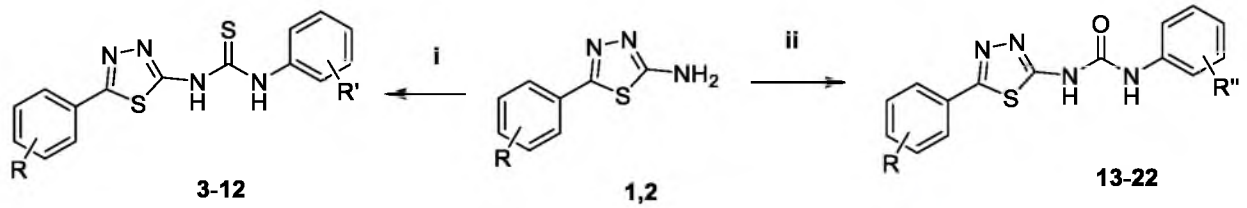
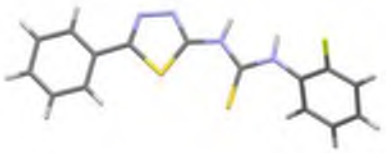
It is well known that heterocyclic compounds containing urea and thiourea fragments exhibit biological activity, and a significant amount of literature data is available regarding their pharmacological properties [1, 2]. However, information on derivatives of 5-substituted-1,3,4-thiadiazol-2-amines containing such groups is quite scarce. Based on this, we have synthesized derivatives of 5-aryl-2-amino-1,3,4-thiadiazoles **1,2** (aryl=phenyl, 2,4-dichlorophenyl) incorporating urea and thiourea fragments. For this purpose, reactions of thiadiazoles with **1,2**-aryliso(thio)cyanates were carried out in various solvents (ethanol, DMF, dioxane) at room temperature and at the boiling points of the solvents in the presence of KOH, TEA, and K_2CO_3. The highest yields of the target products (75-87%) were obtained in dimethylformamide (KOH, 20-25°C, 5 hours):



i = R′-C_6H_5-NCS, DMFA, KOH, 20-25 °C
ii =R″-C_6H_5 -NCO, DMFA, KOH, 20-25 °C
R = H, R'=2-F(**3**), 2-Br(**4**), 4-Cl(**5**), 4-Br(**6**), 4-F(**7**);
R = 2,4-Cl_2, R'=2-F(**8**), 2-Br(**9**), 4-Cl(**10**), 4-Br(**11**), 4-F(**12**)
R = H, R"=2-CH_3(**13**), 2-F(**14**), 3-Cl(**15**), 4-CH_3(**16**), 4-F(**17**);
R = 2,4-Cl_2, R"=2-CH_3(**18**), 2-F(**19**), 3-Cl(**20**), 4-CH_3(**21**), 4-F(**22**).



1-(2-fluorophenyl)-3-(5-phenyl-1,3,4-thiadiazol-2-yl)thiourea **3** crystal structure

The structures of the synthesized **1-(R-phenyl)-3-(5-aryl-1,3,4-thiadiazol-2-yl)thioureas (3-12)** and **1-(R-phenyl)-3-(5-aryl-1,3,4-thiadiazol-2-yl)ureas (13-22)** were confirmed by IR, ^1H and ^{13}C NMR spectroscopy, as well as X-ray diffraction (XRD). Currently, the biological activity of these compounds (pesticidal, antimicrobial, etc.) is being investigated through laboratory tests.

This research was funded by the state budget.

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STEP-BY-STEP CONTROL OF THE PRODUCTION OF NATURAL SWEETENER SUBSTANCES SWEETLIFE-I AND SWEETLIFE-II FROM THE AERIAL PARTS OF *Stevia rebaudiana* BERTONI

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In recent times, due to the consumption of high-calorie foods and beverages containing large amounts of sugar, various diseases such as obesity, diabetes, metabolic syndrome, and decreased physical activity have become widespread among both children and adults worldwide. Currently, scientific research is actively being conducted to develop and implement natural sweeteners with extremely low calorie content derived from plant raw materials as substitutes for synthetic sweeteners, which have numerous adverse effects on the human body.

One such plant-based raw material is *Stevia rebaudiana Bertoni*, which contains natural diterpene glycosides and serves as a sugar substitute with a sweetness level 200–400 times higher than that of sugar. This plant is widely cultivated in tropical regions and has been domesticated in many countries. As a result of our recent technological research, *Stevia rebaudiana Bertoni* has been cultivated in various regions of our country, and plantations have been established for its large-scale production. Based on the diterpene glycosides extracted from its aerial parts, we have developed a technology for producing the natural sweetener substances Sweetlife-I and Sweetlife-II as sugar substitutes.

Our research focuses on the step-by-step control of the production process for the natural sweeteners Sweetlife-I and Sweetlife-II. Through our studies, we analyzed the material losses and expenditures at each technological stage. For quantitative analysis of the processes, we primarily used high-performance liquid chromatography (HPLC) and spectrophotometric methods. The results of these analyses are presented in the following table.

Step by step control of technological processes (main yields and losses)

Objects being studied	Amount of diterpene glycosides, %	
	Relative to the mass of the raw material	Yield efficiency relative to the amount in the raw material
Plant raw materials	18	100
Aqueous-alcoholic extract	17,1	95
Plant waste (meal)	0,9	5
Watery residue	17,1	95
Chloroform extract	0,54	3
Butanol extract	16,56	92
Activated carbon waste	0,36	2
A collection of diterpene glycosides	16,2	90
Sweetlife I (stevioside)	6,12	34
Sweetlife II (sum of glycosides)	9,72	54
Unaccounted for losses	0,36	2

As seen in the table, the loss of the main compound relative to its content in the plant raw material during the production process was found to be 12.0%. The yield of the main compounds—Sweetlife-I (34%) and Sweetlife-II (54%)—was determined to be 88%. Based on these results, technological guidelines were developed for the production of these substances: **TI-03535440-041:2021** for Sweetlife-I and **TI-03535440-042:2022** for Sweetlife-II.

SYNTHESIS OF AZOMETHINES IN THE BENZIMIDAZOLE SERIES

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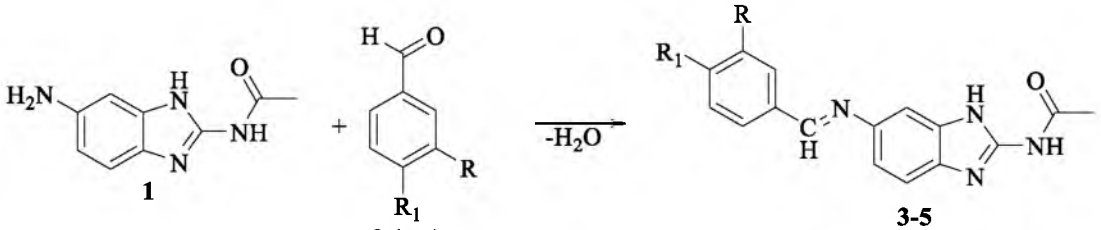
Schiff bases (imines or azomethines) are formed as a result of the interaction between aldehydes or ketones and compounds containing an amino group. Their general formula is represented as Ar-CH=N–R, where R can be an aryl, alkyl, cycloalkyl, or heterocyclic group. Schiff bases were first discovered by the German chemist Hugo Schiff in 1864.

The azomethine or imine group in these compounds plays a crucial role in exhibiting biological activity. Schiff bases and their metal complexes have demonstrated antibacterial, antitubercular, anticancer, antiviral, anti-inflammatory, and antitoxic (antipoisoning) activities, as well as potential effectiveness against diseases such as diabetes [1,2].

The condensation reaction of N-(6-amino-1H-benzo[d]imidazol-2-yl)acetamide (**1**) with 4-nitro-, 4-dimethylamino-, and 3,4-dimethoxybenzaldehydes (**2**) was carried out under heating in ethanol as a solvent. The reaction mixture was left at room temperature for 24 hours, resulting in the precipitation of Schiff bases (**3-5**). The obtained products were filtered, dried, and purified using the recrystallization method.



2a: R_1 NO_2, R=H;
2b: R_1= $N(CH_3)_2$, R=H;
2c: R_1=R=OCH_3

The reaction was monitored using thin-layer chromatography (TLC).

Financing. This work was carried out using budgetary funds of ICPS from the Academy of Sciences of the Republic of Uzbekistan.

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EFFECT OF DAG-1 PREPARATION ON FLAVONOID CONTENT IN COTTON VARIETIES UNDER HEAT STRESS

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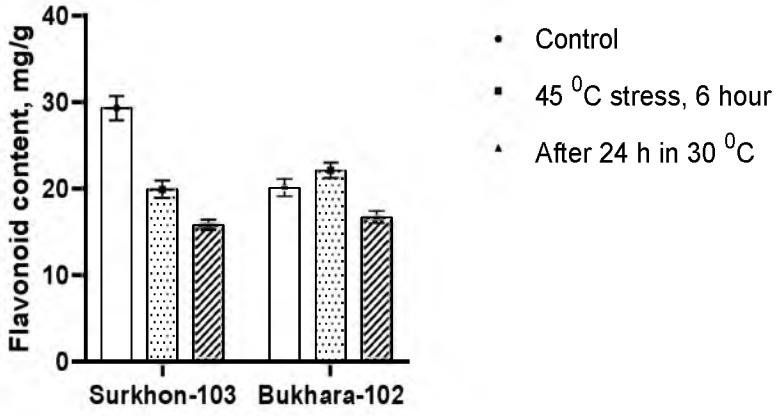
Flavonoids play a crucial role in neutralizing intracellular free radicals and enhancing antioxidant defense. The DAG-1 preparation is recognized as a promising agent for modulating the antioxidant system in plant physiology.

The main aims of our study were to investigate the effect of the DAG-1 preparation on flavonoid content in cotton varieties under hyperthermia conditions.

The object of study were cotton seeds of the Surkhan-103 and Bukhara-102 varieties. The seeds were treated with a DAG-1 solution (10^{-7} M) for 8 hours and cultivated for 7 days under dark conditions at 30°C. To induce hyperthermia stress, the samples were then exposed to a temperature of 45°C for 6 hours, followed by a 24-hour recovery period at an optimal temperature of 30°C. Flavonoid concentration was determined using the Zhishen method (1999).



Under control conditions, the measured flavonoid content was 29.3 ± 1.25 mg/g in Surkhan-103 and 20.1 ± 0.73 mg/g in Bukhara-102. During the hyperthermia stress period, flavonoid concentration increased to 19.9 ± 0.41 mg/g and 22.1 ± 0.18 mg/g in Surkhan-103 and Bukhara-102, respectively. However, during the recovery phase, these values further decreased to 15.8 ± 0.32 mg/g and 16.7 ± 0.35 mg/g, respectively.

Our results indicate that changes in flavonoid concentration during stress conditions were influenced by the effect of the DAG-1 preparation on phenolic compound biosynthesis. The supramolecular complex of glycyrrhetinic acid, present in the preparation, exhibits a synergistic interaction with regulatory elements of flavonoid biosynthesis, thereby enhancing the intracellular defense mechanisms of plants.

STUDY OF CYTOTOXICITY OF EXTRACTS OBTAINED FROM LICHENES *X. sanspersa, X. elegans* AND *L. argopholis*

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It is important to study the biological activity of lichen-based extracts or substances isolated from them. Their antiviral, antimicrobial, immunomodulatory, antioxidant, anticancer, photoprotective, and many other properties have been studied. [1,2]. They have also been used to treat various diseases such as ulcers, hemorrhoids, dysentery, and cancer, and have been found to be effective. Lichens are also used as food supplements or as easily accessible sources of natural medicines that can be used in the pharmaceutical industry after safety assessment [3]. Based on this, it has become interesting to study the cytotoxicity of extracts obtained from lichens *X. canspersa, X. elegans* and *L. argopholis*.

The experiments were performed on cervical epithelial carcinoma (HeLa), breast adenocarcinoma (HBL-100), laryngeal adenocarcinoma (Hep-2), and T-lymphoblastic leukemia (CCRF-CEM) cancer cell lines using the MTT assay [3]. The cytotoxicity of the compounds was compared with that of cisplatin ("Cisplatin-Naprod", India). The test was performed three times, and the data were analyzed and statistically processed using Origin 8.6.

According to the results, extracts of lichens *X. canspersa*, *X. elegans* and *L. argopholis* at a concentration of 100 μg/ml showed noticeable cytotoxicity to T-lymphoblastic leukemia cells (49-50.1% cell growth inhibition). Suppression of laryngeal adenocarcinoma cell growth in the same range (43-50%) was caused by *X. canspersa* and *L. argopholis*. The breast adenocarcinoma line was insensitive to all the studied samples, and in relation to HeLa cells, cytotoxicity was recorded only in *X. canspersa* – 45.7% cell death.

In conclusion, extracts obtained from the lichens *X. canspersa*, *X. elegans*, and *L. argopholis* did not exhibit moderate cytotoxicity against cancer cell lines.

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ANTIRADICAL ACTIVITY OF POLYPHENOLIC COMPOUNDS YAN-1 AND YAN-2, DIAZOIMINO DERIVATIVES OF GOSSYPOL

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Numerous studies have shown that compounds with antioxidant activity have the ability to reduce the formation of free radicals in mitochondria and neutralize them. Among these compounds, polyphenols have been studied to have strong antioxidant and antiradical properties. Despite a sufficient number of experimental studies on many polyphenols to absorb free radicals, the antiradical activity of gossypol derivatives diazoiminopolyphenol YaN-1 and YaN-2 has not yet been determined. Considering the above, in this experiment, the antiradical activity of diazoimino derivatives of gossypol polyphenols YaN-1 and YaN-2 was studied.

Materials and methods. The antiradical activity of the samples was determined by a standard method based on the kinetics of measuring the optical density of an alcohol solution of 1,1-diphenyl-2-picrylhydrazyl (DPPH). Based on this, in this experiment the antiradical activity of the two presented samples in relation to the stable free radical DPPH was studied.

Results. The antiradical properties of the polyphenols YaN-1 and YaN-2, diazoimino derivatives of gossypol, were investigated by recording changes in the optical density of the free radical DPPH. The antiradical activity of the polyphenols was studied depending on concentration. Initially, in the concentration-dependent analysis of polyphenol YaN-1, it was found that upon the addition of this polyphenolic compound to an ethanol solution of DPPH at concentrations of 5, 10, 15, 20, and 25 μM, radical inhibition by DPPH was observed at 11,9%, 20,1%, 25,5%, 31,7% and 39,5%, respectively. Subsequently, in the study of the concentration-dependent effect of polyphenol YaN-2, it was determined that the addition of this polyphenolic compound to an ethanol solution of DPPH at concentrations of 5, 10, 15, 20, and 25 μM resulted in radical inhibition by 6,3%, 15,9%, 28,4%, 41,9% and 52,5%, respectively. Thus, the investigated polyphenol YaN-2, a diazoimino derivative of gossypol, exhibited more active antiradical properties than polyphenol YaN-1.

AMINO ACID AND MINERAL COMPOSITION OF *Iris pseudacorus* SEEDS

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Iris pseudacorus L., belonging to the genus *Iris* L. of the Iridaceae family, is one of the most widespread species, introduced in many countries, including Uzbekistan. The phytochemical composition of the aerial and root parts of *Iris pseudacorus* L. has been relatively well studied, whereas the phytochemical composition of the plant's seeds remains largely unexplored [1].

The aim of the research is to investigate the amino acid and elemental composition of *Iris pseudacorus* seeds cultivated under introduction conditions at the Tashkent Botanical Garden named after academician F.N. Rusanov.

The amino acid composition of *Iris pseudacorus* L. seeds was analyzed using high-performance liquid chromatography (HPLC) on an Agilent Technologies 1200 chromatograph. According to the results, the total amino acid content was found to be 2.024 mg/g. The seeds were shown to contain 20 amino acids, 8 of which are essential, accounting for 51.79% of the total amino acids. The predominant amino acids were tryptophan (20.52%), arginine (15.43%), leucine (13.45%), isoleucine (10.34%), and alanine (8.7%). The amino acids were ranked in decreasing order of content as follows: Trp >Arg > Leu > Ile > Ala > Pro > Gln > His > Cys > Tyr > Val > Ser > Asp > Glu > Phe > Asn > Met > Gly > Thr > Lys.

The mineral and elemental composition of the plant seeds was determined using inductively coupled plasma mass spectrometry (ICP-MS) on an AT 7500 instrument, utilizing a spectral analysis method. According to the results, the seeds contained a total of 22 micro- and macroelements, including the following macroelements: potassium, phosphorus, calcium, magnesium, sulfur, and aluminum. Among the essential microelements, iron, zinc, copper, manganese, nickel, and titanium were identified. Conditional essential microelements included silicon, molybdenum, and vanadium. Potentially toxic microelements found were strontium, rubidium, zinc, and chlorine, while toxic elements such as arsenic, thallium, and lead were detected in trace amounts. The presence of vital elements, particularly iron (2.480 mg/kg), zinc (0.044 mg/kg), potassium (14.300 mg/kg), magnesium (2.790 mg/kg), and calcium (3.230 mg/kg), indicates the biological significance of this plant.

The obtained data suggest that *Iris pseudacorus* L. seeds can be considered a promising source of mineral elements and amino acids with a wide range of pharmacological activity. Based on these findings, new biologically active supplements could be developed in the future.

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STUDY OF THE CYTOTOXIC PROPERTIES OF MODIFIED NUCLEOSIDES ON VERO B CELL LINE

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One of the most actual tasks is the search for new antiviral agents due to the widespread occurrence of viral infections and the growing resistance of pathogens to existing drugs. Currently, modified nucleosides are a promising class of substances on the basis of which highly effective antiviral (Sofosbuvir, Tenofovir, etc.) and antitumor (Fludarabine, Cladribine, etc.) drugs have been created. When developing new drugs, the candidate molecule, along with the antiviral effect, should have low-toxic to normal (healthy) cells. Therefore, studying the cytotoxic properties of selected compounds that exhibit high activity is a relevant task.

We investigated the cytotoxic properties of some modified 1,2,4-triazole-based nucleosides [1] on the normal *Vero B* cell line (African green monkey kidney epithelial cells) by using the MTT method [2]. For this purpose, the substances were dissolved in 25% ethanol and introduced into the cells at concentrations from 3000 μM to 500 μM. The well-known antiviral drug Ribavirin (Sigma-Aldrich) was used as a comparison drug. Cell viability was determined by the ratio of living cells exposed to the test substance to the number of living cells in the control. Testing was performed in triplicate, the data were analyzed and statistically processed using Origin 8.6.

During the studies it was established that the investigated substances do not have a cytotoxic effect on *Vero B* cells ($CC_{50} \geq 2000$ μM), which indicates their low toxicity and can be recommended for further investigations as antiviral compounds.

Funding. The study was carried out within the framework of the F-FA-2021-360 project, Agency for Innovative Development of the Republic of Uzbekistan.

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POLYSACCHARIDES OF THE ABOVEGROUND AND UNDERGROUND PARTS OF *Cistanhe salsa* AND *C. mongolica*

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Cistanhe salsa and *C. mongolica* are perennial parasitic, more or less hairy plants from the Orobanchaceae family, 10-40 cm high. The stem is unbranched, thick, yellowish, 5-20 mm thick in the middle part, significantly thickened towards the base, covered with oblong-lanceolate, alternate scales of the same color. Plants of the genus *Cistanche* grow on calcareous, clayey, chalky soils, solonetz, steppes and semi-deserts of North Africa, the Pyrenees, Transcaucasia, Asia, including China, mongolia, Japan, South Korea, Central Asia (Kazakhstan, Uzbekistan). In the Lower Volga region of Russia, you can find the saline cistanche. Cistanche salsa contains carbohydrates and related compounds, organic acids (succinic acid), iridoids (cystin, cis-gachlorin), sterols (β-sitosterol, β-D-glucoside of β-sitosterol), phenols and their derivatives (cystanoside, A, B, C, D, E, F, G, H, J, acteoside, echinacoside, osmanthuside B, salidroside, dicaffeoylacteoside), lignans (liriodendrin, syringin), flavonoids (0.55%).

The aim of our study is to study the polysaccharides of two *Cistanche*species: *Cistanhe Salsa* and *C. mongolica.*

Polysaccharides of the aboveground and underground parts of *Cistanhe Salsa* and *C. mongolica* plants were isolated using a known technique. To remove low-molecular sugars, raw material was extracted with 85% alcohol. Then, water-soluble polysaccharides were isolated with water at room temperature of 20-22 °C, the yield and monosaccharide composition of polysaccharides are in Table 1.

Table 1. Qualitative and quantitative composition of polysaccharides of *Cistanhe salsa* and *Cistanhe mongolica*

PS	Output, %	Quantitative monosaccharide composition, %						UAc
		Gal	Glc	Man	Xyl	Ara	Rha	
Aerial part of *Cistanhe salsa*								
PS 1	1,5	6,1	12,8	2,5	45,2	22,1	11,2	+
Cistanhe salsa roots								
PS 1'	0,7	15,1	9,6	9,5	25,6	26,4	13,6	-
Aerial part of *Cistanhemongolica*								
PS 2	-	6,3	14,0	-	55,0	12,2	12,5	+
Roots of *Cistanhe mongolica*								
PS 2'	-	-	15,8	11,6	32,0	14,0	26,4	-

Thus, alcohol-soluble sugars and water-soluble polysaccharides were isolated from the above-ground and underground parts of the plants *Cistanhe salsa* and *C. mongolica*. The yield and quantitative monosaccharide composition of the isolated polysaccharides were determined.

DEVELOPMENT OF ANALYTICAL METHODS FOR THE DETERMINATION OF SODIUM HYALURONATE IN DRUGS

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The purpose of the study: to develop and validate a spectrophotometric (UV) method for the quantitative determination of sodium hyaluronate in drugs and medical products containing sodium hyaluronate.

Materials and methods. The main task was to develop the simplest, most convenient, rapid, reliable, general, and inexpensive methods of analysis. Their properties were studied based on the hypothesis that sodium hyaluronate forms a colored compound with carbazole in the presence of borate buffer in an acidic environment. The work used class A measuring instruments, CAI-234 CONTECH (India) analytical balances, "UV-1800" UV-spectrophotometer (Shimadzu Corporation, Japan): (wavelength range from 190 to 1100 nm, relative error less than 0.1%).

Linearity of the method: at least 80-120% of the analyte in the test solution is determined in at least 5 diluted solutions of the test solution.

To determine compatibility, at least 6 prepared samples were tested at 100% concentration of the active substance in the test solution.

Results: Preparation of sodium hyaluronate standard sample solution. 50.0 mg of sodium hyaluronate is placed in a 50 ml volumetric flask and dissolved in 30 ml of water, then diluted to the mark. 1.0 ml of the solution is placed in a 20 ml volumetric flask and made up to the mark with water.

Preparation of test solution: 5.0 ml (2.0 mg/ml) of the drug is placed in a 100 ml volumetric flask and make up to the mark with water. 1.0 ml of the prepared solution is taken and 5.0 ml of sodium tetraborate-sulfate acid solution is added. Then 0.2 ml of carbazole solution is added to each solution and boiled in a water bath for 10 minutes and cooled to room temperature in cold water. The optical density of the standard and test solutions relative to the placebo solution is measured at a wavelength of 520 ± 2 nm in cuvettes with a layer thickness of 1 cm.

A result of 1.9878 mg/ml (P=95%, u=±0.09 mg/ml) (2 mg/ml drug) was obtained by spectrophotometric method.

High performance liquid chromatography (HPLC) method:

Chromatographic conditions – column Shim-pack VP-ODS 250×4.6 mm particle size 5 μm or equivalent.

The detector is spectrophotometric - 205 nm.

The speed of the mobile phase is 1.0 ml/min

Thermostat temperature - 25℃ .

The mobile phase is 0.05 M potassium dihydrogen phosphate (with 10% KOH adjusted to pH=7.0) and acetonitrile 80:20.

In this way, 0.4 mg/ml standard and sample solutions are prepared and 10 μl are sent to HPLC.

A result of 1.9941 mg/ml (P=95%, u=±0.05 mg/ml) (2 mg/ml drug) was obtained by high-performance liquid chromatography method .

Conclusion: The study of the validation parameters and statistical data of the spectrophotometric method proposed by us showed a low relative error, reliability of the method, and competitiveness with other detection methods. Based on the results obtained, it can be assumed that the method can be used to assess the quality of drugs containing sodium hyaluronate.

INVESTIGATION OF THE TOXICITY OF LIPOSOMES FROM EGG YOLK AND SOY LECITHINS

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Recent advancements in liposome production technologies enable the development of systems capable of targeted delivery of active substances to specific organs or tissues. Liposomes are microscopic vesicles composed of phospholipid bilayers, widely applied in various fields of science and medicine [1]. Due to their ability to encapsulate both hydrophobic and hydrophilic molecules, liposomes serve as effective carriers for drugs and vaccines, protecting them from degradation.

In this study, we performed the first comparative analysis of the cytotoxicity of liposomes obtained from soy and egg lecithin. Vero B kidney cells were chosen as the object of the study, since it is the nephrons that filter the blood, removing from it (and consequently from the body) metabolic products, toxins, and many medications. For that, lecithins were dissolved in chloroform, methanol in a 2:1 ratio, followed by solvent removal using a rotary evaporator. The resulting thin phospholipid film was rehydrated with a 0.9% NaCl solution. To evaluate cytotoxicity, Vero B cells (epithelial kidney cells of the African green monkey) were exposed to varying liposome concentrations (0,69 μM, 1,39 μM, 2,78 μM, 3,48 μM, 4,17 μM, 5,56 μM, 6,95 μM, 13,9 μM). Experimental data indicate that soy-derived liposomes completely inhibited cell growth at a concentration of 4,17 μM, whereas liposomes from egg lecithin exhibited 100% cytotoxicity at 3,48 μM. This suggests that soy-based liposomes are more toxic than egg lecithin-based liposomes.

Thus, we have established for the first time that liposomes obtained from egg lecithin exhibit lower cytotoxicity compared to liposomes from soybean lecithin. Therefore, liposomes based on egg lecithin may be more suitable for further biomedical applications and research.

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SPATIAL STRUCTURE OF NEW IGALAN DERIVATIVES

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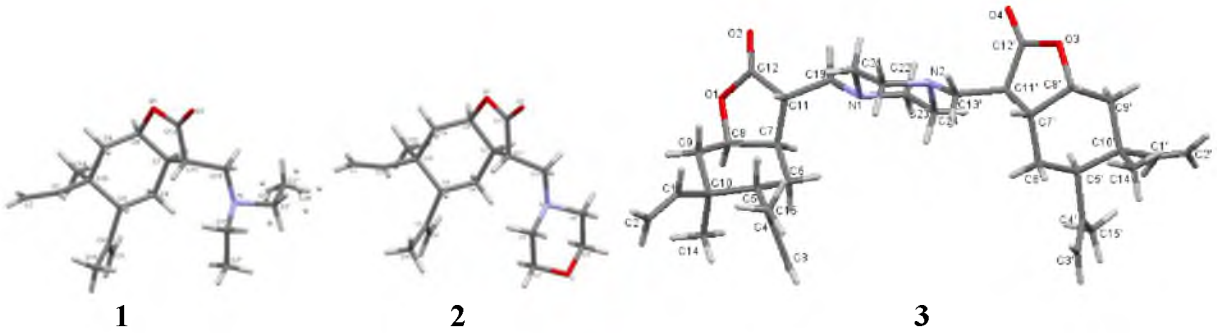
As a result of X-ray structural analysis, the spatial structures of new igalan derivatives containing diethylamine (**1**), morpholine (**2**), and piperazine (**3**) fragments were studied. The structure of the obtained derivatives shows that the *cis*-junction of the lactone ring with the six-membered cycle sterically favors the addition on the C11=C13 double bond in the α-direction, i.e., the formation of α-oriented C13-dehydro derivatives. At the same time, the cis-junction of the cycles and the orientation of the substituents in the derivatives remain the same as in the structure of the original igalan.

The spatial structure of the bicyclic system in all derivatives is practically identical: the lactone cycles adopt a 7α-envelope conformation, and the six-membered rings assume a chair conformation (Fig. 1).



1 **2** **3**

Fig. 1. Igalan derivatives with diethylamine (**1**), morpholine (**2**) and piperazine (**3**)

In the structure of the igalan derivative with diethylamine (**1**), the carbon atoms of one ethyl group are disordered, with atoms C1'-C2' occupying two approximately equivalent positions: C1', C2' and C1'A, C2'A.

In the molecule of derivative **2**, the morpholine heterocycle with a nitrogen atom is attached to the C13 atom of igalan also in the α-direction, and the heterocycle adopts an ideal chair conformation.

Derivative **3** forms as a dimer, which is generated by the attachment of the initial igalan lactone to the two nitrogen atoms of piperazine. The piperazine cycle adopts a chair conformation. The molecule of the piperazine derivative exhibits conformational flexibility due to the rotational mobility in the six-membered heterocycle, which may also influence its pharmacological properties.

Thus, X-ray structural analysis made it possible to determine the structural features of new igalan derivatives and to identify the effect of various substituents on the spatial structure of the molecules. The obtained data may be useful for further study of their properties and the development of promising biologically active compounds.

REACTION OF THE ALKALOID LYCORINE WITH ACETYL CHLORIDE

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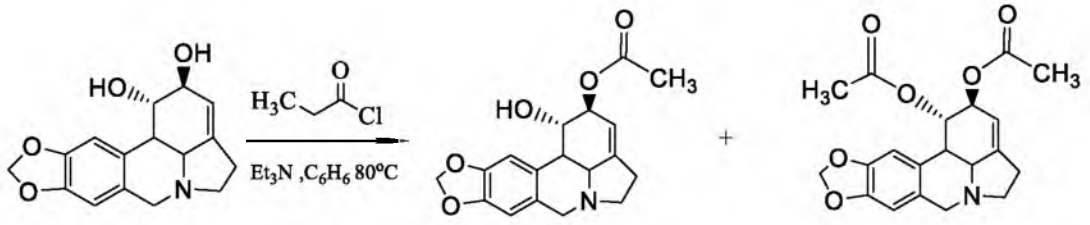
Lycorine is an alkaloid belonging to the Amaryllidaceae family and possesses significant biological and pharmacological activity, including antibacterial, antiviral, and anti-inflammatory effects. It has demonstrated positive effects against lymphoma, carcinoma, melanoma, leukemia, A549 lung cancer, OE21 esophageal cancer, and several other cancer cell lines. Considering the high bioactivity of lycorine, the synthesis of its derivatives with various structural features is of great interest.

In this study, a reaction between lycorine and acetyl chloride was carried out. Initially, 0.2 g (0.6 mmol) of lycorine, 0.082 g (1 mmol) of CH_3COCl, catalytic amount of Et_3N, and benzene as a solvent were used. The reaction was conducted at 80°C for 8 hours. The resulting reaction products were separated by column chromatography ($CHCl_3$:CH_3OH 100:0→100:1). The isolated compounds were analyzed via mass spectrometry and identified as (1S,2S)-1-hydroxy-2,3a1,4,5,7,12b-hexahydro-1H-[1,3]dioxolo[4,5-j]pyrrolo[3,2,1-de]phenanthridin-2-yl acetate and (1S,2S)-2,3a1,4,5,7,12b-hexahydro-1H-[1,3]dioxolo[4,5-j]pyrrolo[3,2,1-de]phenanthridine-1,2-diyl diacetate based on their molecular masses.

When the biological activity of these products was studied using the PASS online predictor program, it showed that the mono-substituted derivative of lycorine exhibited a high activity against lung cancer (0.749) **2**, and the di-substituted derivative showed high activity against lung cancer (0.752) and the parasite *Trypanosoma*, which causes infectious diseases (0.895) **3**.



1 **2 (45%)** **3 (40%)**

REACTION OF 2-(6,7-DIMETHOXY-1,2,3,4-TETRAHYDROISOQUINOLIN-1-YL)-PHENOL WITH BROMINE

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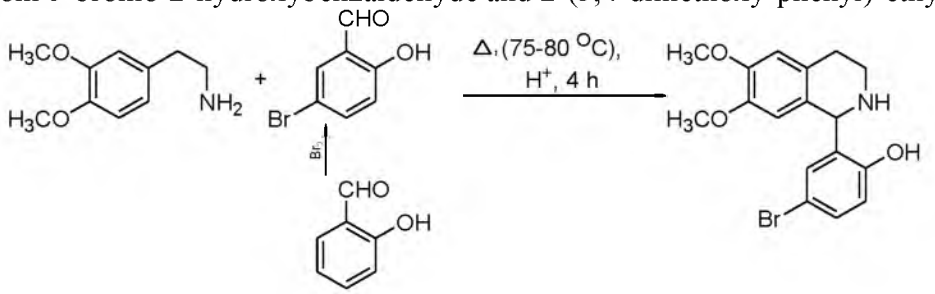
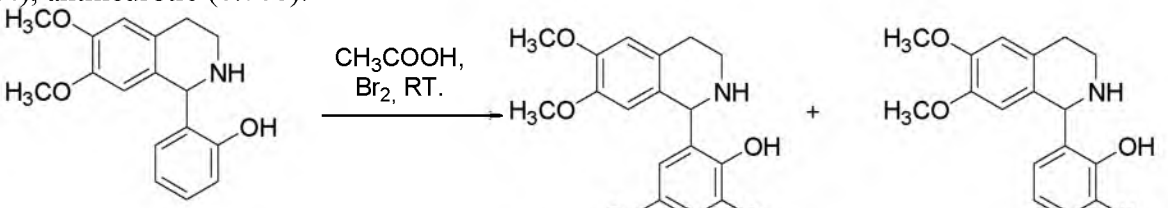
The compound 5-bromo-2-(6,7-dimethoxy-1,2,3,4-tetrahydroisoquinolin-1-yl)-phenol was synthesized from 5-bromo-2-hydroxybenzaldehyde and 2-(3,4-dimethoxy-phenyl)-ethylamine.



This study was interested in obtaining a C-3-protected brominated derivative of tetrahydroisoquinoline. For this, 0.1 g (0.35 mmol) of 2-(6,7-dimethoxy-1,2,3,4-tetrahydroisoquinolin-1-yl)-phenol was dissolved in CH_3COOH and added dropwise solution 0.056 g (0.35 mmol) of Br_2 in 3 ml of CH_3COOH. The reaction was stirred 3 hours at RT. The Se precipitate was removed. $NaHCO_3$ was added and the pH was adjusted to 8, the solution was extracted with $CHCl_3$ and concentrated under reduced pressure. When the products formed as a result of the reaction were examined by HPLC, it was determined that there were two different products: 3,5-dibromo-6-(6,7-dimethoxy-1,2,3,4-tetrahydroisoquinolin-1-yl)-phenol **(2)** and 3-bromo-6-(6,7-dimethoxy-1,2,3,4-tetrahydroisoquinolin-1-yl)-phenol **(3)**. When the products were studied for their activity in the PASS online predictor programm, they were expressed as follows. **2:** nicotinic alpha4beta4 receptor agonist (0.804), aspulvinone dimethylallyltransferase inhibitor (0.816), HMGCS2 expression enhancer (0.687); **3:** 5-hydroxytryptamine release stimulant (0.819), nicotinic alpha4beta4 receptor agonist (0.810), aspulvinone dimethylallyltransferase inhibitor (0.824), antineurotic (0.706).



1 **2** 70 % **3** 20 %

ALKALOIDS OF PLANTS OF THE GENUS *Heliotropium*, GROWING IN THE FERGANA VALLEY OF UZBEKISTAN

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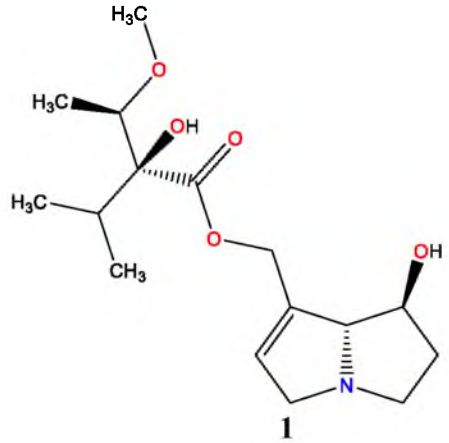
Heliotropium is a genus of plants of the Boraginaceae family (borage), containing pyrrolizidine alkaloids, which has more than 325 species in the world, distributed in tropical and subtropical regions of the globe. In Uzbekistan plants of the genus *Heliotropium* L. are widespread. The aim of this study is to study the alkaloids in the organs of *H. lasiocarpum* Ledeb. and *H. dasycarpum* Ledeb. plants growing in the Fergana Valley of Uzbekistan. The plants for the study were collected in the Namangan region (Mingbulok area) in July 2024 during the end of flowering. The sum of alkaloids (SA) from the organs (aerial part, roots, leaves, stems) of 2 plant species was obtained by extraction with methanol in an ultrasonic bath and processing by a standard method. The results are presented in Table 1.

Table 1. **Quantitative content of alkaloids in plant organs *H. lasiocarpum* and *H. dasycarpum* (% of raw material weight)**

№	Plant	Aerial part	Roots	Stems
1	*H. lasiocarpum*	0,29	1,21	0,27
2	*H. dasycarpum*	0,21	0,22	0,17

From the results presented in Table 1 it follows that the content of alkaloids in the organs of *H. lasiocarpum* is higher, than in those of *H. dasycarpum*. Extraction of the sum of alkaloids from 1.4 kg of the aerial part of *H. lasiocarpum* yielded 4.06 g of SA, from which crystals with a m.p of 125-126 °C, R_f 0.48 (system: n-butanol-acetic acid-water, 10:0.5:10; developer iodine vapor) were isolated by treatment with acetone, which turned out to be identical to the alkaloid Heliotrine (1). The alkaloid Europine (2) [(7S,8 R)-7-hydroxy-5,6,7,8-tetrahydro-3H-pyrrolizin-1-yl]methyl(2R)-2,3-dihydroxy-2-[(1S)-1-methoxyethyl]-3-methyl-butanoate was found in the mother liquors. An alkaline solution containing alkaloids, but not further extracted with chloroform, was treated with n-butanol and an additional sum of alkaloids in the amount of 2.0 g was obtained, from which an amorphous alkaloid, Heliotrine N-oxide, was isolated.



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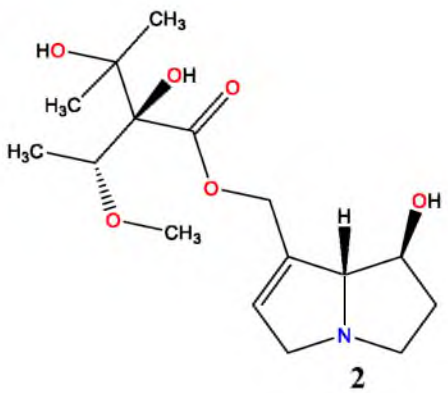

2

SECONDARY METABOLITES OF *Cousinia microcarpa*

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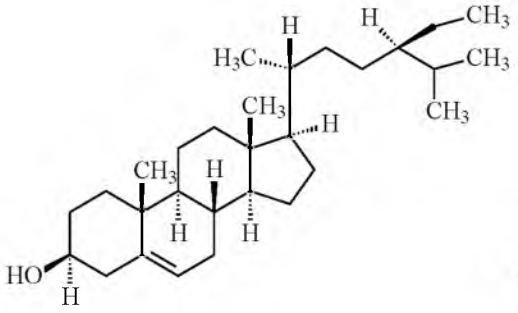
The genus Cousinia, one of the largest representatives of the Asteraceae family, includes approximately 650–700 described species and is distributed across Central and Western Asia.

In Uzbekistan, 137 species of this genus have been identified. Scientific research has shown that Cousinia species contain various natural compounds, including flavonoids and phenolic compounds. The plant species Cousinia *microcarpa* is widely distributed in the mountainous and foothill regions of our country.The C. microcarpa plant was extracted using methanol and then fractionated with different solvents: chloroform, ethyl acetate, and n-butanol. The obtained extracts were analyzed using Thin Layer Chromatography (TLC). The results revealed the presence of steroids, triterpenes, flavonoids, and glycoside compounds.When compared with reference standards, the extract was found to contain the following natural substances:
Stigmasterol (**1**), β-Sitosterol (**2**), Lupeol (**3**), and quercetin 3,4'-dimethyl 7-O-α-L-rhamnopyranosyl (1→6)-O-β-D-glucopyranoside (**4**).



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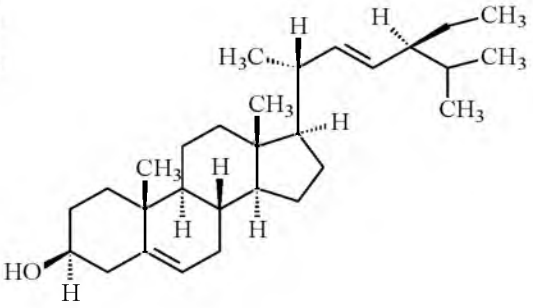

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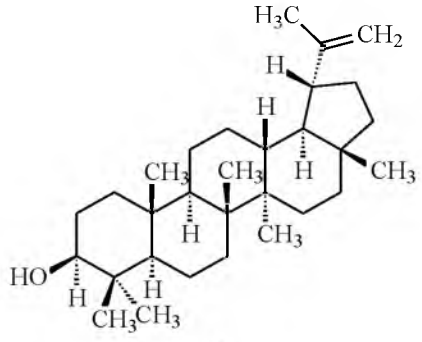

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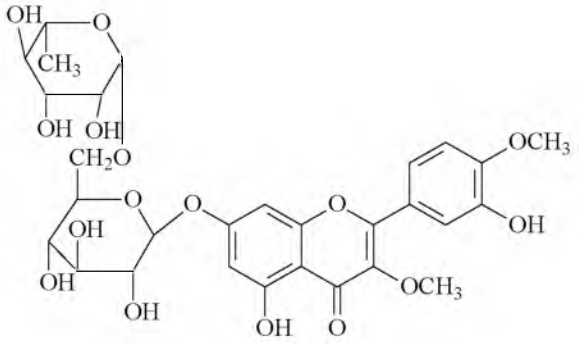

4

Further research is ongoing based on these compounds

The work was supported by the Budget Program for Fundamental Scientific Research of the Academy of Sciences of the Republic of Uzbekistan.

THE EFFECTS OF TRIBURENAL ON THE EXPERIMENTAL ACUTE RENAL FAILURE IN RATS

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The effects of Triburenal, based on biologically active substances from *Tribulus terrestris* meal, on the excretory function of the kidneys in rats with experimental acute renal failure (ARF) were studied. The experiments were carried out on 40 white rats (190-210 g). To simulate ARF, rats were kept without food for 24 hours, after which a 50% aqueous solution of glycerol was injected intramuscular at a dose of 10 ml/kg of animal body weight. The third and fourth groups of animals were orally administered Triburenal and Lespefril at doses of 100 mg/kg and 2 ml/kg, respectively, one hour before the administration of glycerol and throughout the experiment. Daily diuresis, glomerular filtration rate (GFR), and water reabsorption in the renal tubules were determined, and relative diuresis was calculated based on these indicators. Total protein, creatinine and urea were determined in urine and blood serum samples.

In the daily diuresis study, in the polyuric stage of ARF on the 3rd day after administration of glycerol, an increase in this indicator was found to be 2.8 times higher than in intact animals. After administration of the studied drug Triburenal and the reference drug Lespefril to rats with acute renal failure, daily diuresis decreased by 16.0 and 14.6%, respectively, compared with animals in the control group. When animals were injected with a 50% aqueous solution of glycerol, a decrease in GFR of 2.0 times was observed. This indicates a deep degree of damage to the glomerular apparatus. Triburenal and Lespefril had a moderate positive effect on this indicator, with an increase in GFR of 12.5 and 11.2%, respectively.

Water consumption in animals with experimental ARF was significantly higher (by 97.4%) than in intact animals and amounted to 15.4 ml/100 g per day. When Triburenal and Lespefril were administered, this indicator decreased by 21.4 and 20.8%, respectively. We also calculated the rate of water reobsorption in the renal tubules. Triburenal and Lespefril have a positive effect on this important indicator of the renal tubular apparatus. Relative diuresis in animals with ARF increased 1.4 times compared with intact ones. Under the influence of Triburenal and Lespefril, a decrease in diuresis was observed. After ARF in animals, the concentration of creatinine in the blood increased and a decrease in urinary creatinine excretion was observed. Triburenal and Lespefril decrease the blood creatinine by 36.7 and 31.3% and an increase in urine by 48.4 and 38.7%, respectively, compared with control animals. Also, in animals with ARF increased daily protein excretion in the urine by 1.6 times in compare to the control. Triburenal and Lespefril had a positive effect on this indicator with tendency to decrease the elevated protein content in urine, noted after the development of renal failure.

Thus, the obtained results indicate that Triburenal has a pronounced hypoazothemic activity, reduces polyuria, and has a beneficial effect on the functional state of the kidneys and protein metabolism in the early stages of acute renal failure of toxic etiology.

DEVELOPMENT OF A MODEL OF EXPERIMENTAL ENDOMETRIOSIS IN RATS

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Relevance. Endometriosis is one of the most common diseases of the female reproductive system, leading to infertility in up to 40% of women. Endometriosis is an inflammatory disease characterized by the presence of endometrial-like tissue outside the endometrium and myometrium.

In this regard, the creation of adequate animal models of this disease for testing medicines is an urgent task.

The purpose of the work was to evaluate the formation of endometrioid heterotopias and inflammatory markers during surgically induced intraperitoneal modeling of endometriosis in rats.

Material and research methods. The study was carried out on mature female rats weighing 200-220 g. Experimental modeling of endometriosis was carried out according to the modified method of M.W. Vernon and E.A. Wilson. For surgical modeling of endometriosis, females with a regular 4 - 5 day estrous cycle were selected. The estrous cycle was monitored daily for 2 weeks. Surgery was performed at the estrus stage, standardizing the conditions for transplantation of uterine fragments at the same stage of the estrous cycle. 4 weeks after surgery, a repeat laparotomy was performed to assess viability and determine the size of the implants in 3 planes. An autopsy was performed and a visual macroscopic assessment of the implants was performed. The excised material was fixed in 10% buffered formalin. A morphological study of all samples was carried out for the presence of endometrioid tissue in the implants. In the blood serum of the animals under study, anti-inflammatory markers were determined - interleukin-6 and C-reactive protein on an enzyme immunoassay device "Accuris", USA, using CYPRESS reagent kits, Belgium.

Results. It was found that in the implants of 30% of experimental rats there were hemosiderophages and small hemorrhages, lymphatic leukocytes, in 45% of animals hypervascularization of endometrioid heterotopias was revealed and glandular, prismatic and cylindrical cells among the tissues, glandular structures with a tubular structure resembling endometrial glands, were also found. Exudative infiltration and plasmacytic infiltration were determined in 25% of animals. A significant increase in interleukin-6 and C-reactive protein (by 128-80.0%), which are specific markers of inflammation in the body, was also detected.

Thus, we have obtained an experimental model of uterine endometriosis in rats, which is confirmed by histological and biochemical studies.

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