

Academy of Sciences of the Republic of Uzbekistan



*S.Yu. Yunusov Institute of the Chemistry of
Plant Substances AS RUz*

INTERNATIONAL SCIENTIFIC AND TECHNICAL CONFERENCE

*Actual Problems of the
Chemistry of Natural Compounds*

ABSTRACTS

September 19–20, 2024
Tashkent

CONFERENCE TOPICS

1. Chemistry, biology, pharmacology, and technology of natural compounds and their derivatives.
2. Successes and problems of creation of new drugs.

ORGANIZING COMMITTEE

Chairman: Acad. Sagdullaev Sh. Sh.

Members

Acad. Aisa H.A. (China)	Prof. Gusakova S.D. (Uzbekistan)
Acad. Adekenov S.M. (Kazakhstan)	Prof. Ihsan Calish (Turkiye)
Acad. Aripov T.F. (Uzbekistan)	Prof. Jenis J. (Kazakhstan)
Acad. Bachurin S.O. (Russia)	Prof. Karl W.K. Tsim (Hong Kong)
Acad. Ibragimov B.T. (Uzbekistan)	Prof. Nenaydenko V.O. (Russia)
Acad. Kuchin A.V. (Russia)	Prof. Normakhamatov N.S. (Uzbekistan)
Acad. Sabirov R.Z. (Uzbekistan)	Prof. Sadikov O.Z. (Uzbekistan)
Acad. Salikhov Sh.I. (Uzbekistan)	Prof. Sasmakov S.A. (Uzbekistan)
Acad. Turaev A.S. (Uzbekistan)	Prof. Salakhutdinov N.F. p(Russia)
Acad. Yunusov M.S. (Russia)	Prof. Shen J. Sh. (China)
Prof. Abdullaev N. D. (Uzbekistan)	Prof. Syrov V.N. (Uzbekistan)
Prof. Aripova S.F. (Uzbekistan)	Prof. Trifonov A.A. (Russia)
Prof. Azimova Sh.S. (Uzbekistan)	Prof. Vorotyntsev I.V. (Russia)
Prof. Baser K.H. (Turkey)	Prof. Ye Yang (China)
Prof. Batirov E.Kh. (Uzbekistan)	Dr. Nishanbaev S.Z. (Uzbekistan)
Prof. Elmuradov B.J. (Uzbekistan)	Dr. Tursunkhodjaeva F.M. (Uzbekistan)
Prof. Fedorov A.Yu. (Russia)	

Executive Committee

Eshboev F.B.	Khodiraliyeva F.
Abdurakhmanov J.M.	Mukhammathanova R.F.
Vinogradova V.I.	Mamatkhanova M.A.
Bobakulov Kh.M.	Okhundedaev B.S.
Kalbaeva G.K.	Okmanov R.Y.
Kodirova D.R.	Sanoev A.I.
Tadjikulov A.M	Usmanov D.A.
Adizov Sh.M.	Yusupova U.Y.
Abbasova G.A.	

Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances,
77, Mirzo-Ulugbek Str., Tashkent, 100170, Uzbekistan

PLENARY PRESENTATION

SYNTHESIS, IDENTIFICATION AND *IN SILICO* STUDY OF TRINITRO DERIVATIVE FROM TROPIC ACID

Eldar Abdulla Garaev, Konul Fada Huseynguliyeva, Shafa Baxish Alieva

Azerbaijan Medical University, Department of Pharmaceutical Toxicology and Chemistry, Baku eldargar@mail.ru (+99450-210-24-41), k-f-h-82@mail.ru, alievaashafa@gmail.com

When creating a new medicinal substance, computer programs are widely used in order to minimize the additional toxic effect on the living organism, but to maximize the biological activity of the substance. For this purpose, it is proposed to synthesize a substance with higher biological activity by introducing certain chemical changes in the chemical structure of plant substances. For this purpose, it was synthesized by us a semi-synthetic derivative - a trinitro derivative of tropic acid of the natural alkaloid atropine, obtained from plant raw materials, and investigated the biological activity and toxicity of the obtained tropane derivative *in silico* using various computer programs. During the experiments, we focused on strengthening the therapeutic benefits and minimizing the side effects of various tropane derivatives by investigating their pharmacokinetic effects. As mentioned, atropine is used in various medical practices. Therefore, our goal was to identify semi-synthetic derivatives with pharmacokinetic profiles compared to the native compound. To achieve the goal, we isolated atropine alkaloid from the plant *Datura stramonium* L. using a general alkaloid extraction method. When the isolated individual atropine alkaloid was heated with nitric acid, it decomposed to form tropic acid and tropine alcohol. The aromatic ring of the resulting tropic acid reacted with nitric acid to form trinitro tropic acid. To identify trinitro tropic acid, color reactions and thin-layer chromatography (TLC) methods were used. Color reaction: when trinitrotropic acid is treated with a 10% alcohol solution of KOH and acetone, a violet-coloured quinoid derivative is obtained. TLC analysis: the obtained substances were identified by the TLC method in a chloroform: methanol: ammonia (9 : 1 : 0.1) medium. Alkaloids were detected by Dragendorff's reagent. An orange spot with $R_f = 0.74$ was obtained on the chromatographic plate (Alugram SILG/UV254; Macherey-Nagel Silica gel 60). Additionally, the presence of substances was investigated under UV rays. As a result of the research, atropine alkaloid was individually isolated from the *Datura stramonium* L. plant, and trinitro derivative of tropic acid was synthesized. The trinitro derivative of tropic acid was studied *in silico* using the PASS online software program, and its biological activity and toxicity were predicted. It has been determined that the trinitro derivative exhibits higher fibrinolytic (71%), antihypoxic (64%), and antitoxic (56%) effects compared to atropine. The use of this trinitro derivative in medical practice will show more effective results.

THE CHEMISTRY OF KRATOM (*MITRAGYNA SPECIOSA* KORTH.) LEAVES: DISPELLING MYTHS ON THIS MALAYSIAN INDIGENOUS MEDICINAL PLANT

Thiruventhan Karunakaran

Centre for Drug Research, Universiti Sains Malaysia, 11800 USM, Penang, Malaysia

Mitragyna speciosa, often known as kratom, ketum, and biak-biak, is a Southeast Asian tree that is indigenous to Malaysia. The leaves have long been used by locals to alleviate pain and opium withdrawal symptoms. Kratom leaves are also utilized in traditional medicinal practices to treat a number of ailments for centuries. The kratom leaf contains more than 50 alkaloids. Kratom leaf has two prominent psychoactive substances known as mitragynine (MG), which constitutes up to two-thirds of the alkaloid content (66%), and 7-hydroxymitragynine (7-OHMG), an oxidative derivative of mitragynine that comprises up for 0.02%-2% of the total alkaloid content in the dried leaves. The legal status of kratom and its active compounds, MG and 7-OHMG, differs widely throughout the world. In Malaysia, MG and 7-OHMG are regulated under the Poisons Act of 1952, and they have been categorized as psychoactive drugs in the First and Third Schedules since 2003. Apart from the traditional applications and pharmacological properties of kratom, toxicity concerns, especially in cases of misuse or inappropriate consumption, have drawn attention to the plant. There have been several hypotheses regarding the presence of some alkaloids in botanical product of the plant that might exert toxic effect, such as 7-OHMG, an oxidative derivative of MG.

This presentation will describe the phytochemistry of kratom especially on the chemistry of alkaloids and phenolics that correlates to its ethnomedicinal and pharmacological attributes. The potential toxicity that might cause by some of the alkaloids that related to the kratom toxicity due to post-harvest effect will also be discussed. To date, majority of research has focused on kratom leaf extracts and its two primary compounds, mitragynine (MG) and 7-hydroxymitragynine (7-OHMG). Understanding the chemical profile of this medicinally beneficial plant will be useful to dispel the myths about its toxic effects, as claimed by previous preclinical and clinical research.

RESEARCHES ON THE ACTIVITIES AND PREPARATION OF SULFORAPHANE FROM BROCCOLI

Xili Liang¹, Yao Zhang¹, Sabir Z. Nishanbaev², Yuanfeng Wu^{1*}

¹*School of Biological and Chemical Engineering, Zhejiang University of Science and Technology, Hangzhou, Zhejiang 310023, China, e-mail: wuyuanfeng@zju.edu.cn*

²*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, Tashkent, Mirzo Ulugbek st, 77, e-mail: sabir78@rambler.ru*

The isothiocyanate sulforaphane (SF) is produced via hydrolysis of its alkyl GLS precursor glucoraphanin (GRP), which is abundant in Brassica vegetables including broccoli, cabbage, broccolini, kale, Brussels sprouts, etc. SF is a very potent inducer of phase II enzymes like NAD(P)H: quinone oxidoreductase 1 (NQO1) and glutathione-S-transferase, which can prevent inflammation and oxidative stress. SF also have many beneficial properties, including anti- cancer, anti-microbial, mitigate colitis, metabolic disorder regulatory, neuroprotective, and renoprotective effects. These findings indicate that dietary SF is a promising drug against various disorders, and underscore the potential clinical applications of food-derived substances. Both SF and plant myrosinase are thermal-labile, and the epithiospecifier protein (ESP) directs the hydrolysis of GRP toward formation of sulforaphane nitrile instead of SF. Therefore, we discuss strategies that could be employed to improve the stability of SF, include HP- β - cyclodextrin inclusion complex, SF- α -cyclodextrininclusion complex, microcapsules using maltodextrin as wall material, and prolamin-based composite nanoparticles with NaCas/PGA. A polyethylene glycolointment base and/or an organic oleaginous base can also increase the stability of SF. Ingestion of broccoli releases SF via hydrolysis of GRP by plant myrosinase and/or intestinal microbiota. Since myrosinase are thermal-labile, the production of SF can be increased by adding exogenous myrosinase from other plants, such as mustard, horseradish, radish, moringa, to GRP or cooked broccoli. GRP can also be metabolized by bacteria or microbiota. We have selected some lactic acid bacteria that can metabolize GRP into SF or erucin, and potential genes and pathways in GRP hydrolysis were identified. We also find that continuously feeding mice with raw broccoli (which have GRP) increased the myrosinase-like activities of the gut microbiota, and improved the NQO1 activity of the colon mucosa.

BIOLOGICAL EFFECTS OF SOME 1-ALKYL AND 1-ARIL TETRAHYDROISOQUINOLINES AND MECHANISMS OF THEIR ACTION

Sh.S. Azimova, E.O. Terenteva, U.B. Khamidova, M.R. Umarova, E.G. Yusupova, V.I. Vinogradova, Sh.N. Jurakulov, A.Sh. Saidov

Acad. S. Yu. Yunusov Institute of the Chemistry of Plant Substances, M. Ulugbek Str. 77, 100170, Tashkent, Uzbekistan; e-mail: genlab_icps@yahoo.com

The cytotoxicity of some tetrahydroisoquinoline derivatives (THIQs) was studied against 4 cancer cell lines, 3 primary cultures of healthy cells *in vitro* and components of whole blood of 125 patients with various types of leukemia. The structural-functional relationship of the compounds was determined. Based on the results of the studies, three samples (F-9, F-14, 14:0) were selected that exhibited high cytotoxicity to cancer cells with IC_{50} values of 2-8.5 μ M and weakly toxic to healthy cells (selectivity index $SI \geq 5$). It was found that the presence of 2 methoxyl substituents in ring A, the presence of a benzene ring with methylenedioxy groups and halogens (Br, Cl) in position C-1 (F-9, F-14) or a methylene chain in $(-CH_2-)_{13}$ at the N atom of ring B of THIQ 14:0 are responsible for cytotoxicity. It was established that the most sensitive type of leukemia to the action of THIQ 14:0 was acute lymphocytic leukemia, for F-9, F-14 – chronic myeloid leukemia.

The effects of THIQs F-14, F-9, 14:0 on the expression of the Bcl-2, Bax, casp.3, and casp.7 genes in HeLa and HEP-2 cancer cells were studied. It was found that F-14 triggers cell death by reducing the activity of the Bcl-2 gene and activating the Bax gene, just like the comparison drug cisplatin. The effect of THIQ F-9 on these genes was weak. It is possible that the main target for the manifestation of cytotoxicity of this substance is a gene other than those studied by us. THIQ 14:0 increased the expression of caspases 3 and 7 and had virtually no effect on the activity of Bcl-2 and Bax genes. It is likely that the activity of genes other than the products of the Bcl-2 and Bax genes is responsible for the activation of effector caspases responsible for cell death.

The effect of cytotoxic-active THIQs on increasing primary and secondary lipid peroxidation products in cancer and healthy cells was studied. It was found that the cytotoxicity of 14:0 is accompanied by oxidative stress only in cancer cells, which most likely explains their lower toxicity on healthy cells compared to the effect on cancer cells. Cytotoxicity of samples F-14 and F-9 was not accompanied by oxidative stress.

Acute and chronic toxicity of THIQ 14:0 *in vivo* was studied. It was found, LD_{50} was 12.0 ± 2.5 mg/kg. A 14-day administration of the experimental substance to laboratory mice, even at a concentration equal to half the LD_{50} dose, resulted in non-critical changes in hematological blood indices and morphological changes revealed after the administration were reversible. Thus, THIQs 14:0, F-9, F-14 are promising compounds that can be proposed for further *in vivo* studies.

ANION AND CATION CHANNELS AS PHARMACOLOGICAL TARGETS

Ravshan Z. Sabirov

*Institute of Biophysics and Biochemistry, National University of Uzbekistan, Tashkent
100174, Uzbekistan*

Ion channels play critical roles in a number of physiologically and pathophysiologically important cellular functions, such as excitability of neurons, skeletal, cardiac and smooth muscle cells, secretion, volume regulation, cell proliferation, apoptotic and necrotic cell death. Sodium, potassium and calcium are major cations of extracellular and intracellular fluids, and their concentration gradients across the cellular membrane and voltage- and time-dependent changes in membrane permeability determine the neuronal and muscle excitability as well as contractile and motility properties of cell and tissues. Fast responses of the excitable cells to the stimuli are mediated by Na^+ - K^+ - and Ca^{2+} -selective ion channels. Therefore, these proteins serve as promising targets for developing specific, efficient and low-toxic pharmaceuticals. As an example, the anti-arrhythmic drugs are known to affect ion channels involved in shaping the cardiac action potentials as well as GPCRs, such as adrenoreceptors.

Although anion-selective channels can be constitutively active (e.g. ClC-1 in skeletal muscles to determine the resting membrane potential), most of them are silent in resting state and become active upon stimulation. Thus, the CFTR is activated in response to the adenylyl cyclase stimulation in fluid-secreting epithelia, such as lung, sweat and intestine. CaCC is a Ca^{2+} -activated chloride channel which opens whenever intracellular Ca^{2+} rises, for instance in salivary gland or in pancreas.

Osmotic disbalance often occurs during normal life (e.g. in lung epithelium during intensive breezing, in the epithelium of the gastro-intestinal tract upon drinking, in kidney epithelium upon salt stress, etc.) and in pathological conditions, such as ischemia/reperfusion in heart and brain, trauma and stroke. Cellular swelling induces Ca^{2+} influx via TRPM-type calcium-permeable channels that in turn activates the K^+ -channels and the volume-activated anion channels (VAACs) to mediate the KCl , osmolytes and water efflux in the process of the regulatory volume decrease (RVD). At normal metabolic state with high intracellular ATP, the major anionic pathway is the volume-sensitive outwardly rectifying (VSOR) Cl -channel of intermediate conductance ($\sim 30\text{-}70$ pS) (Okada et al. *Pharmacol. Rev.* 2019). Meanwhile, when ATP is depleted (e.g. under ischemia/hypoxia), cellular swelling results in activation of the Maxi- Cl channel with a large conductance of $\sim 300\text{-}400$ pS (Sabirov et al. *Life (Basel)*. 2021, 11: 509). The human VSOR Cl -channel was shown to be a hexameric complex of the leucine-rich repeat containing family 8 (LRRC8) protein A as an obligatory component and paralogs C, D and E as a second necessary component. We have demonstrated that the mouse counterpart is also composed of the same orthologs (Okada et al. *Channels* 2017; 11(2): 109-120). The Maxi- Cl channel was shown to be a complex of the SLCO2A1 protein (Sabirov et al. *EMBO J.* 2017, 36: 3309-3324) and two auxiliary regulatory components: annexin 2A (ANXA2) and S100A10 (also known as p11) (Islam et al. *Cell Physiol. Biochem.* 2020, 54: 538-555).

Recent advance in establishing the molecular nature and 3D-structures of cation- and anion-selective channels and clarifying their role in physiology and pathophysiology opens the doors for developing new effective pharmaceuticals targeting ion channels.

THERAPEUTIC INDEX IMPROVEMENT OF DOXORUBICIN-POLYGALACTURONANS CONJUGATE

Tagayalieva N.A., Turaev A.S.

Institute of Bioorganic chemistry named after O.Sodikov, AS RUz

Doxorubicin (DOX) with topoisomerase II inhibiting activity is widely used as the prime drug of choice for acute leukemia, breast cancer, pediatric solid tumors, non-Hodgkin lymphomas, Hodgkin's disease, and soft tissue sarcomas. However, its applicability in treating solid tumors is limited, due to drawbacks such as insolubility, fast clearance, lack of tumor cell targeting capacity and dose-related organ damage. A variety of drug delivery systems such as polymeric micelles, liposomes, inorganic nanoparticles, and polymer-drug conjugates, was investigated, to improve DOX aqueous solubility and bioavailability, which ultimately extend its circulation time in the bloodstream and increase its passive target function to tumor tissue.

In the results of research in this direction in the Institute of Bioorganic Chemistry a conjugated drug PG-DOX, based on doxorubicin (DOX) and polysaccharide – polygalacturonans, was developed.

This report is devoted to a comprehensive study of PG-DOX conjugate, its structure, the therapeutic efficacy in comparison with its toxic effect on organs and systems of laboratory animals.

The focus of this work will be on a comparative assessment of free and conjugated forms of DOX, upon the next indications:

- Acute toxicity with LD50 definition;
- Cumulative properties;
- Genotoxicity in in vitro and in vivo conditions;
- Myelotoxicity;
- Immunotoxicity;
- Cardiotoxicity;
- Hepatotoxicity;
- Nephrotoxicity and other.

In the final part of the report, based on the analysis of the results of this study, the proposed mechanism of action of the PG-DOX conjugate will be presented.

EFFECTIVENESS OF TRADITIONAL AND MODERN METHODS FOR EXTRACTING ACTIVE COMPOUNDS FROM MEDICINAL PLANTS

Sh.Sh. Sagduullaev, A.I. Sanoev

*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances Tashkent, M.
Ulughbek St., 77 Phone.: (998-90) 979-03-86 e-mail: sanoev.a85@mail.ru*

Extraction methods can be divided into traditional and modern categories. Traditional methods include pressing (both hot and cold), steam extraction, and solvent extraction. Modern techniques involve supercritical fluid extraction (using liquefied gases), ultrasonic extraction, and other advanced technologies.

Extraction methods can be broadly classified into static and dynamic types. Static methods involve periodically soaking the plant material with the extractant and allowing it to infuse for a set duration. Dynamic methods involve the continuous replacement of either the extractant, or both the extractant and the plant material. Commonly used static methods include maceration and remaceration, which are employed for preparing extracts and tinctures. Remaceration methods are more frequently used in producing thick and dry extracts.

Currently, maceration does not fully meet the requirements for intensified production and is used only in specific cases. Its advantages include simplicity and accessibility of equipment, but it also has drawbacks such as incomplete extraction of active substances, lengthy processing time, high content of ballast substances (e.g., polysaccharides, pectins, mucilages, proteins), and labor intensity (e.g., double pressing, washing of the marc).

Recently, there has been increasing interest in high-energy extraction methods, such as microwave and ultrasonic extraction, for isolating natural bioactive compounds from plant materials. Among various physical methods for intensifying extraction, ultrasound is particularly prominent. In ultrasonic extraction, the main mechanisms within the "solid-liquid" system include surface structure disruption, diffusion, capillary acoustic effects, acoustic microvortices, membrane permeation, and localized thermal effects. Ultrasonic cavitation can reduce extraction time by 8–9 times and lower the processing temperature to 35–40°C.

The use of liquefied gases for processing medicinal and essential oil plant materials to extract components in their native (unaltered) form represents a highly efficient technological process. It reduces labor costs, improves product quality, and promotes comprehensive utilization of raw materials and resources. Active substance recovery through liquefied gas extraction can reach 88–98%, generally exceeding the yields from other methods such as maceration, percolation, and steam distillation.

Extracts obtained with liquefied gases may lack certain extractive substances and components responsible for specific taste, organoleptic, and pharmacological properties that differentiate one preparation from another. For example, after extraction with carbon dioxide, almost all water-soluble substances remain in the marc. Many extracts obtained via liquefied gases exhibit detrimental effects on microorganisms. The identified antibacterial properties of extracts obtained through supercritical CO₂ extraction open new possibilities for their use as natural preservatives, especially for liquid medicinal forms intended for long-term storage.

A key aspect of the extraction process is optimizing its conditions. It is crucial to determine the optimal temperature, pressure, and contact time to achieve the maximum yield of target substances with minimal resource expenditure. Optimizing process conditions and choosing the right solvent are essential for achieving maximum extraction efficiency.

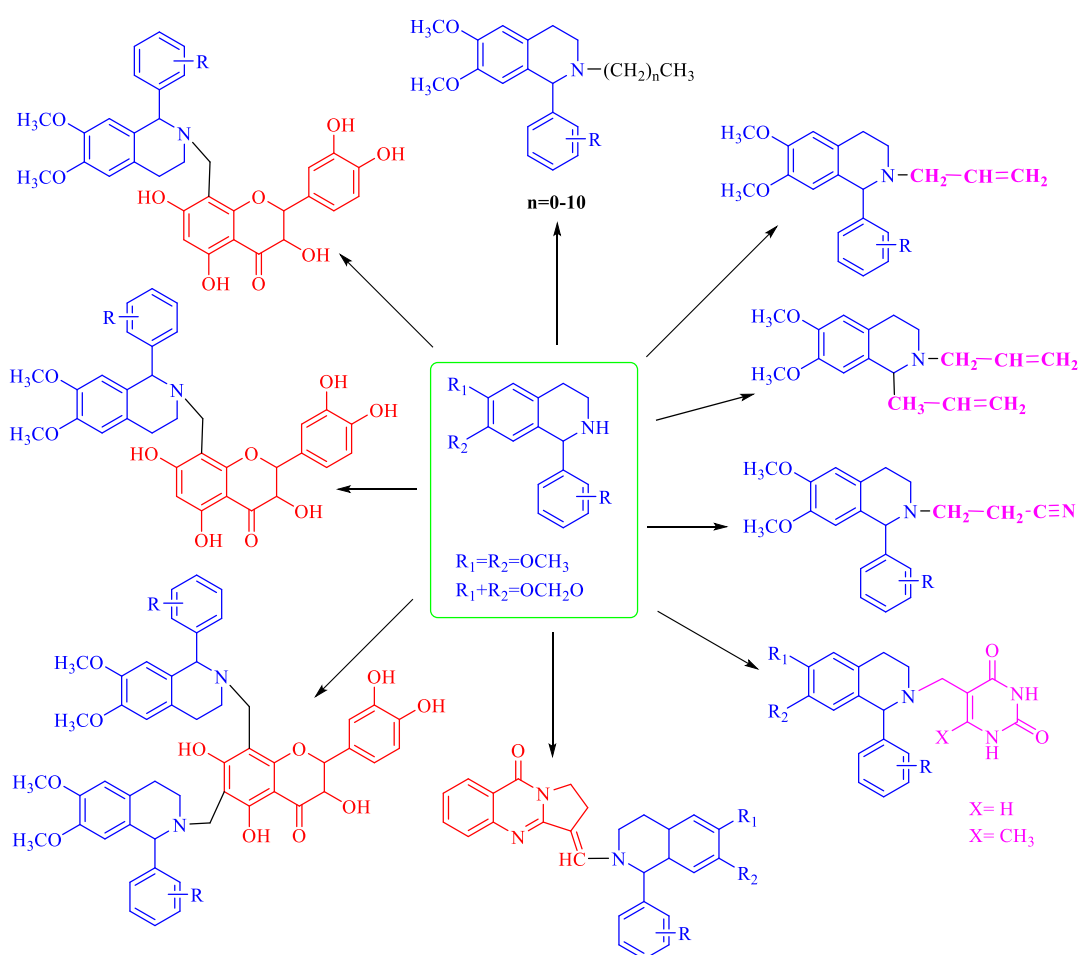
ARYLTETRAHYDROISOQUINOLINE ALKALOIDS AND THEIR BIOLOGICAL ACTIVITY

Sh. N. Zhurakulov^{1,2}, V.I. Vinogradova¹

¹ Institute of the Chemistry of Plant Substances named after S. Yu. Yunusov, Academy of Sciences of Uzbekistan, st. Mirzo Ulugbek, 77, 100170 Tashkent, Uzbekistan, e-mail: j.sherzod.78@mail.ru

² National University of Uzbekistan named after Mirzo Ulugbek, Universitetskaya st., 4, 100174 Tashkent, Uzbekistan

Among the nitrogenous heterocycles, isoquinoline compounds are the most important and biologically interesting. Of particular interest among isoquinolines is a small group of 1-aryltetrahydroisoquinolines that exhibit sedative-anxiolytic, neuroleptic, cardioprotective, antiarrhythmic, anti-inflammatory, etc. effects. Cytotoxic activity of 1-aryltetrahydroisoquinoline derivatives against laryngeal cancer and cervical carcinoma was also revealed. The groups responsible for the manifestation of the biological properties of synthesized substances according to the scheme are determined:



COLLECTION AND CHARACTERIZATION OF METABOLITES OF MUSHROOMS FROM AZAD JAMMU AND KASHMIR, PAKISTAN

Mehmoona Sharif, Shayan Naeem, Umme Habiba Saeeda,
Afshan Altaf, Usama Imtiaz and Samiullah Khan

*Department of Microbiology, Faculty of Biological Sciences, Quaid-i-Azam University,
Islamabad-45320, Pakistan, E-mail: samikhan@qau.edu.pk*

Mushrooms are recognized as prolific sources of unique bioactive compounds that often-exhibiting potent pharmacological properties. The distinctive ecology and seasonal variations in Pakistan have fostered diverse fungal species, which require further exploration of novel therapeutic compounds. This study involved the systematic collection and biochemical analysis of 50 mushroom specimens from diverse ecological zones in Azad Jammu and Kashmir, Pakistan. Twenty-two samples were selected for preliminary screening through a series of *in vitro* bioassays, which demonstrated significant bioactive potential. The ethyl acetate extract of *Auricularia auricula judae* and the ethanol extract of *Lactarius subatlanticus* exhibited the highest antibacterial the highest antibacterial activity against the MDR bacterial strains. The acetonitrile extract of *Lactarius subatlanticus* displayed the strongest antifungal activity against *A. flavus*, *A. niger*, and *C. albicans*. Furthermore, most extracts demonstrated potent free radical scavenging activity, and pronounced cytotoxicity in brine shrimp lethality assays, with a mortality rate of 100%. The bioactive fractions of five mushrooms samples underwent further chromatographic purification, and chemical characterization and two of them yielded putative novel secondary metabolites, reported for the first time in mushrooms. LCMS analysis revealed the existence of polysaccharides, triterpenoids, and alkaloids, which are responsible for the biological potential of mushrooms. These findings contribute to the identification of novel bioactive metabolites with potential pharmacological and biotechnological applications.

METABOLOMIC DETERMINATION OF SPECIALIZED METABOLITES USING LIQUID CHROMATOGRAPHY – TANDEM MASS SPECTROMETRY IN *Silene* SPECIES

Nilufar Z. Mamadalieva

Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Mirzo Ulugbek str. 77, Tashkent 100170, Uzbekistan, E-mail: nmamadalieva@yahoo.com

Silene L. is a large genus of plants from the Caryophyllaceae family with more than 700 species of annual, biennial, and perennial plants. Young shoots and the leaves of some *Silene* species are used as medicine and food in European countries. Biological activities, such as tonic, immunomodulator, actoprotector, adaptogen, antioxidant, and enzyme inhibitory, for the extracts and components isolated from the *Silene* species have been reported. Ecdysteroids, triterpene glycosides, lipids, neutral substances, carbohydrates, and microelements are regarded as a common phytochemical feature of *Silene* species. Nevertheless, no data are present on the whole metabolite composition in the aerial parts of *S. viridiflora* and *S. kuschakewiczii*. Therefore, it was relevant to conduct a phytochemical analysis of these species in order to understand the chemistry for the potential health benefits of these plants.

The ultra-high performance liquid chromatography electrospray ionization-tandem mass spectrometry (UHPLC-ESI-MS) was applied to investigate the metabolites composition of the methanolic extract obtained from the aerial parts of *S. viridiflora* and *S. kuschakewiczii*. The antioxidant, cytotoxic, and enzyme-inhibitory activities of the samples were evaluated *in vitro*. The methanol extract and a variety of metabolites identified in *Silene* species were screened for their cytotoxic and Wnt pathway-inhibiting activities against triple-negative breast cancer (TNBC) – the deadliest form of cancer in women, identifying 2-deoxy-20-hydroxyecdysone with submicromolar IC₅₀ against a panel of TNBC cell lines. In addition, *in silico* docking was conducted to provide additional insights into the molecular interactions of the enzymes and some major compounds identified in the extract.

Acknowledgments

This work was supported by the Ministry of Higher Education, Science and Innovation, Swiss National Research Foundation and Alexander von Humboldt Foundation.

ORAL PRESENTATIONS

THE CHEMICAL CONSTITUENTS AND BIOLOGICAL ACTIVITIES OF *Lepidium sativum* SEEDS

Yergazy Shybyray^{1,2}, Ulpan Amzeyeva^{1,2}, Aliya Nurlybekova²,
Haji Akber Aisa^{3,4}, Jun Li³, Janar Jenis¹

¹The Research Center for Medicinal Plants, Al-Farabi Kazakh National University, al-Farabi Ave. 71, Almaty 050040, Kazakhstan; janarjenis@kaznu.kz

²Research Institute for Natural Products & Technology, Almaty 050046, Kazakhstan;

³State Key Laboratory Basis of Xinjiang Indigenous Medicinal Plants Resource Utilization and Key Laboratory of Plants Resources and Chemistry of Arid Zone, Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, South Beijing Road 40-1, Urumqi 830011, Xinjiang, PR China, E-mail: haji@ms.xjb.ac.cn (Haji Akber Aisa);

⁴University of Chinese Academy of Sciences, Beijing 100039, PR China

Lepidium sativum Linn. is a member of the *Lepidium* genus (Brassicaceae family). It is also known as “Garden cress”, which has been widely cultivated all over the world. It can be eaten as a vegetable, and its leaves, roots and seeds have high nutritional and medicinal values [1]. Eaten plants and the seed oils are used in treating dysentery, diarrhea and migraine [2]. It is also reported to be useful in the treatment of diabetes, hypertension, cough and bleeding piles [3]. *L. sativum* contains various minerals, amino acids, fatty acids, terpenes, alkaloids, flavonoids, phenolic acid, sterols, proteins and main source of glucosinolates [4]. In our research group, four undescribed and four known compounds were isolated from *L. sativum* seeds using a variety of chromatographic techniques for example Sephadex LH-20, Flash chromatography, and semi-preparative HPLC. All the compounds were identified by a combination of spectroscopic methods including mass and NMR. The spectroscopic data of all the compounds were in good agreement with the literature data. One of the isolated compounds is **1** which can be characterized as yellow powder, ESI-MS m/z : 431.1025 $[M - H]^-$, $C_{18}H_{24}O_{10}S$ (Fig 1) and was identified as a Raphanuside C [5].

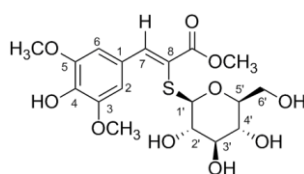


Fig 1. The structure of compound **1**

Acknowledgment: This work was financially supported by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (AP19177815).

References:

1. M. Sakran, Y. Selim and N. Zidan, *Molecules* 2014, 19, 15440-15451; doi: 10.3390/molecules191015440.
2. Q.L Fan, Y.D. Zhu, W.H. Huang, Y. Qi and B.L. Guo, *Molecules* 2014, 19, 11341-11349.
3. R.G Mali, Sh.G Mahajan and A.A Mehta, *Oriental Pharmacy and Experimental Medicine* 2007 7(4), 331-335.
4. V.D. Prajapati, P.M. Maheriya, G.K. Jani, P.D. Patil, B.N. Patel, *International Journal of Biological Macromolecules* 65 (2014) 72-80.
5. Wei-sheng Feng, Chun-Ge Li, Xiao-Ke Zheng, Ling-Ling Li, Wen-Jing Chen, Yan-Li Zhang, Yan-Gang Cao, Jian-Hong Gong and Hai-Xue Kuang, *Natural Product Research*, 2016, 30 (15): 1675-1681.

STUDY ON THE DITERPENOID ALKALOIDS FROM *Aconitum barbatum* var *puberulum* and *Aconitum sinomontanum*

Wenjuan Xue^a, Bo Zhao^a, Nurfida Ablajan^a, Jiangyu Zhao^a,

Sh. Sh. Sagdullaev^b, H. A. Aisa^a

^aState Key Laboratory Basis of Xinjiang Indigenous Medicinal Plants Resource Utilization, Chinese Academy of Sciences, 40-1 South Beijing Road, Urumqi 830011, Xinjiang, P. R. China.

^bS.Yu.Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Tashkent, Uzbekistan

Diterpenoid alkaloids cover over a thousand natural products with diverse skeletons mainly distributed in *Delphinium* and *Aconitum* of Ranunculaceae family. Many species of the genus *Aconitum* have been used as traditional folk medicine for the treatment of many kinds of diseases, such as traumatic injury, rheumatism, enteritis, asthma, ringworm, scabies and other skin diseases, as well as stomach ache, migraine, tooth ache, neuralgia, and other kinds of pain. Four diterpenoid alkaloids have been used in clinical. In order to have a greater chance of obtaining novel active lead compounds, we have found that the diterpenoid alkaloids from the characteristic *Aconitum* plants in Central Asia have the characteristics of diverse skeleton types, high novelty and great potential for medicine, which have a great value for in-depth research and development. On the basis of the existing research, *Aconitum barbatum* var *puberulum* and *Aconitum sinomontanum* grown in Central Asia were chosen as the research objects. The isolation, purification, structure identification and bioactivity screening of diterpenoid alkaloids were carried out. 84 compounds, including 62 diterpenoid alkaloids were isolated from these two plants. Of which 15 of them were new compounds, one of them was a new sub-skeleton diterpenoid alkaloid. At the same time, the inhibitory effects on hERG of isolates were tested. Compound **AS-4** showed moderate inhibitory activity.

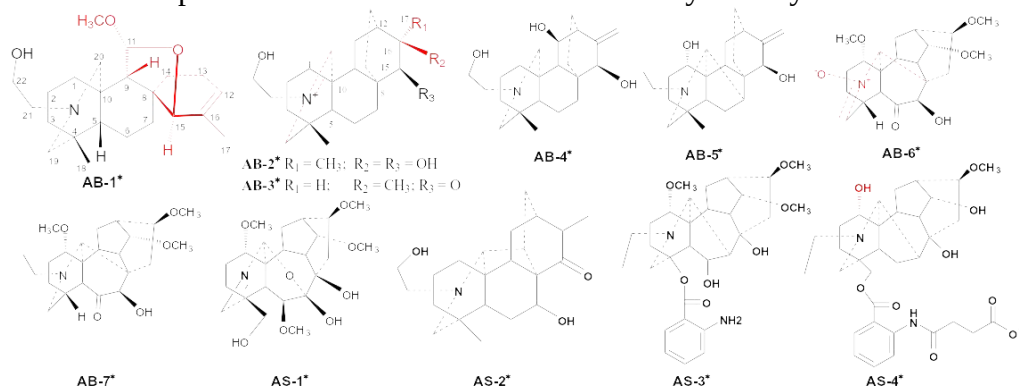


Fig. 1 Structures of part new diterpenoid alkaloids

ACKNOWLEDGEMENTS

This research was financially supported by the Youth fund of Natural Science Foundation of Xinjiang Uygur Autonomous Region, Grant No. 2021D01B104; the Young Talent Support Project of "Tianshan Elite" Youth Outstanding Talent Program of Xinjiang Uygur Autonomous Region Science and Technology Association, Grant No. 2023TSYCQNTJ0042; and the Central Asian Drug Discovery & Development Center of Chines Academy of Sciences.

STUDY ON THE CHEMICAL CONSTITUENTS OF *Piper longum* L.

Guanghui Gou^{a, b}, Wenli Bao^a, Jun Li^a, Bo Zhao^{a, b}, Sh. Sh. Sagdullaev^b, H. A. Aisa^{a*}

^aState Key Laboratory Basis of Xinjiang Indigenous Medicinal Plants Resource Utilization, Chinese Academy of Sciences, 40-1 South Beijing Road, Urumqi 830011, Xinjiang, P. R. China.

^bS.Yu.Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Tashkent, Uzbekistan

Piper longum L., a perennial liana belonging to the *Piper* genus of Pieraceae family, is commonly known as long pepper. Its fruits are harvested when they turn from green to black, and are used as a traditional Chinese medicine as well as a well-known flavoring. Thus, studies on the chemical constituents of this plant is of great importance.

This work focused on the the isolation, purification, and identification of chemical constituents of *P. longum*. As a consequence, four compounds were isolated from the ethyl acetate extract of *P. longum* by column chromatography with silica gel, ODS gel and Sephadex LH-20 together with semi-preparative HPLC. They were identified as methylpiperate (**1**), dehydropipernonaline (**2**), piperine (**3**), and pipernonaline (**4**) on the basis of HR-ESI-MS, IR and 1D-NMR and 2D-NMR experiments. Their chemical structures were shown in Figure 1. This study can provide a critical scientific foundation and theoretical support for the discovery and development of novel drug molecules.

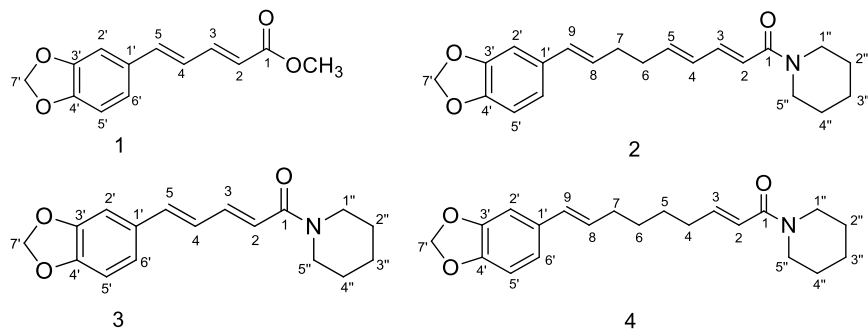


Figure1. Chemical Structures of Compounds **1–4**

Acknowledgements

This work was financially supported by the National Key R&D Program of China (No. 2020YFE0205600); the Tianshan Talent Training Program (2023TSYCJU0008); the Tian-Shan Talent Program (2022TSYCLJ0064) and the Central Asian Drug Discovery & Development Center of Chinese Academy of Sciences.

References

1. Agrawal, A. K., V. K. Joshi and R. K. Goel, *Indian J Exp Biol.* 38,994 (2000).
2. Atal, C. K., R. K. Dubey and J. Singh, *J Pharmacol Exp Ther.* 232,1258 (1985).
3. Atal, C. K., U. Zutshi and P. G. Rao, *J Ethnopharmacol.* 44, 1229 (1981).
4. Dawid, C., M. Bader and T. Hofmann, *J Agric Food Chem.* 60, 2884 (2012).

PREPARATION OF LIPOSOMES FROM SOYBEAN PHOSPHOLIPIDS

Ashirov O.N^{1,2}, Yarilkaganova A.M¹, Sadullayev T.X¹, Piyakina G.A¹, Azimova Sh.S¹.

1. *S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Mirzo Ulugbek Str. 77, 100170, Tashkent, Uzbekistan*

2. *Faculty of Biology, National University of Uzbekistan, Tashkent, 100174, Uzbekistan.*
oyashirov1991@gmail.com

Liposomes, spherical vesicles composed of phospholipid bilayers, have garnered significant attention in the field of drug delivery due to their unique properties, such as the ability to encapsulate a wide range of therapeutic agents, both hydrophilic and hydrophobic, and their potential to improve the pharmacokinetics and pharmacodynamics of the loaded drugs (Luiz et al., 2023). Soybean phospholipids are a widely used source of phospholipids for the preparation of liposomes (Harthi et al., 2019).

For the preparation of liposomes was used the thin-film hydration technique, in which soybean phospholipids were isolated in a mixture of methanol and chloroform at a ratio of 2:1, which was then evaporated to form a thin lipid film. Subsequently, PBS (pH 7.4) was added into flask containing the thin lipid film, leading to the creation of liposomes. The freeze and thawing method was utilized to prepare the liposomes, with the process being repeated 10 times. The size of the liposomes was measured using the Dynamic Light Scattering (DLS) method (Anton Paar Litesizer DLS 500).

The outcomes demonstrated that the liposomes exhibited a size of roughly 200 nm following the freeze and thawing process.

References

1. Luiz, H., Pinho, J O., & Gaspar, M M. (2023, February 2). Advancing Medicine with Lipid-Based Nanosystems—The Successful Case of Liposomes. Multidisciplinary
2. Harthi, S A., Alavi, S E., Radwan, M A., Khatib, M M E., & Alsarra, I A. (2019, July 2). Nasal delivery of donepezil HCl-loaded hydrogels for the treatment of Alzheimer's disease. Nature Portfolio, 9 (1).

FERLAPIOSIDE, NEW IRIDOID GLYCOSIDE FROM *Ferula lapidosa*

K. A. Eshbakova¹, Kh. I. Khasanova², Xin-Xin Li^{3,4}, A.U. Babekov⁵, Ying-Jun Zhang^{3,4}

¹ Institute of the Chemistry of Plant Substances named after Acad. S.Yu. Yunusov Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, 77 M. Ulugbek Str., fax (99871) 120 64 75, e-mail: e_komila@yahoo.com;

² Tashkent institute of irrigation and agricultural mechanization engineers, National research university, Tashkent 100000, Uzbekistan

³ State Key Laboratory of Phytochemistry and Plant Resources in West China, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650201, PR China.

E-mail: zhangyj@mail.kib.ac.cn

⁴ University of Chinese Academy of Sciences, Beijing 100049, PR China

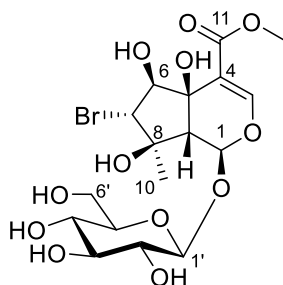
⁵ Osh State Pedagogical University. A.Zh.Myrsabekov, 723500, Osh st. Isanov 73., Kyrgyzstan. e-mail: eababekov2511@mail.ru

Ferula lapidosa Korovin is a perennial herb belonging to the genus *Ferula* in the Apiaceae family. From which, were reported, mainly sesquiterpenes and their esters.

Our further phytochemical study on the roots of *F. lapidosa* One of which is a new brominated iridoid glycoside, named ferlapioside.

The ethanolic extraction and n-butanol fraction from the roots of *F. lapidosa* were subjected separately to repeated silica gel and RP-18 column chromatography (CC), followed with semi-preparative HPLC, resulted in the isolation of new compound. Their structures were elucidated by extensive spectroscopic analyses, e.g. 1D and 2D-NMR, HR-ESI-MS, IR, UV, CD techniques, as well as comparison with literature values.

Ferlapioside (**1**) was isolated as a white amorphous powder with $[\alpha]_D^{22} -180.8$ (c = 0.1, MeOH). The negative ESI-MS exhibited a characteristic peak ratio pattern at m/z 545 $[M+COOH]^-$ and m/z 547 (isotope peak) (approx. 1:1), indicating the existence of a bromine atom in the structure. Further HR-ESI-MS data (m/z 499.0455 $[M-H]^-$, calcd for $C_{17}H_{25}BrO_{12}$, 499.0457) indicated its molecular formula to be $C_{17}H_{25}BrO_{12}$.



References

1. Babekov A.U, Khasanova Kh.I, Eshbakova K.A, Turgunov K.K, Tashkhodzhaev B. (2024). CHEMICAL CONSTITUENTS OF *Ferula lapidosa*, *Chem Nat Compd.* 60(1): 177-178.
2. Khasanova Kh.I, Babekov A.U, Eshbakova K.A (2023). Benzodioxols from *Ferula lapidosa*. *J.Res.Pharm.* 27: 85.

MICROBIAL DEGRADATION OF THE PESTICIDE CHLORPYRIFOS

D.I. Kosimov, L.I. Zaynitdinova, R.B. Ergashev, A.M. Mavjudova

*Institute of Microbiology of the Academy of Sciences of the Republic of Uzbekistan,
Tashkent, Uzbekistan. E-mail: diyor-qosimov91@mail.ru*

Microbial degradation studies of chlorpyrifos were conducted in sterile soils using bacteria isolated from the soil. Initially, in laboratory conditions, the soil was dried and all unnecessary parts (stones, plant debris) were removed. Then it was sterilized in an autoclave at 121°C for 45 minutes. After preparing acetone-based solutions of chlorpyrifos, they were added to a small part of the soil (approximately 20% of the total soil mass), after thoroughly mixing the soil with the solution, mixed with the remaining amount of soil. Then the biomass culture formed within 48 hours was added. Inoculation of the strain into the soil was carried out at three optical densities (OD = 0.03; OD = 0.2; OD = 0.32). The experiments lasted 30 days. For the reproduction and development of microorganisms, it is necessary to maintain humidity. Since when humidity decreases, the growth and reproduction of microorganisms slows down, which negatively affects the process of biodegradation. To maintain humidity (about 70%), the test soil samples were irrigated with sterile water every 3 days. Soil samples for chromatographic analysis were taken at intervals of 5 days. The results of GC-MS analyze show the presence of chlorpyrifos with a peak appearing in soil samples at a retention time of 10.410 min. Over time, this peak decreases gradually. Initially, the rate of decomposition was somewhat slower, then with an increase in microbial biomass in the soil environment, starting from 10–15 days, the degradation of the pesticide accelerated. On day 15 of the study, a new peak appeared at a retention time of 9.648 min, corresponding to TCP. The metabolite obtained as a result of the decomposition of chlorpyrifos is a representative of organochlorine pollutants; its half-life in the natural environment ranges from 65 to 360 days. Because TCP has three chloride atoms in its molecular structure, it is highly toxic and resistant to microbial degradation. Because of these characteristics, TCP is classified as a persistent pollutant by the U.S. Environmental Protection Agency. The formation and accumulation of TCP in soil may limit the proliferation of microorganisms and also inhibit the degradation of chlorpyrifos. GC-MS results showed that TCP residues were undetectable at the end of our studies and had degraded to an unknown polar metabolite. Inoculation of the culture into the soil at different optical densities showed the effectiveness of using the PDB-3 strain in the process of degradation of chlorpyrifos. For example, the percentage of pesticide decomposition was 88.7% when bacteria were introduced at OD = 0.03. Further results are as follows: 88.4; 80.8 and 54.4% (initial 75; 100 and 125 mg/kg). The introduction of the strain at OD=0.2 showed 91.6; 91.3; 84.8 and 72% respectively. An increase in OP to 0.32 had a positive effect on the decomposition process and was 97.4; 94.8; 92.5 and 83.6% respectively. The maximum degradation of chlorpyrifos was observed when the PDB - 3 strain was introduced at OP = 0.32, which showed the possibility of further use of this strain in the process of bioremediation of soils contaminated with the pesticide chlorpyrifos. And also, the decomposition of the total mass of the pesticide decreases with a decrease in the optical density of the strain.

FLAVONOIDS FROM *Oxytropis macrodonta* PLANT

U.M.Omanova¹, M.A. Agzamova¹, Y.J. Ishimov²

- 1) Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances,
2) Acad. O.S. Sadykov Institute of Bioorganic Chemistry Academy of Sciences
of the Republic of Uzbekistan e-mail: agzamova_manzura@mail.ru

Plants of the genus *Oxytropis* (Fabaceae) have no practical use in official medicine, but have a wide range of pharmacological activities. From the literature we know about flavonoids from *O. falcata*, which have shown analgesic, anti-inflammatory, antibacterial, hemostatic and antitumor effects. Coumarins have been isolated from *O. oxyphylla*. And alkaloids have been isolated from *O. trichophysa* at the Institute of Chemistry of Plant Substances.

There are 65 species of the genus *Oxytropis* growing in Uzbekistan, the chemical composition of which has been little studied to date. Distribution area of *Oxytropis macrodonta* Gontsch: Tashkent, Syrdarya and Fergana regions.

The purpose of the work is to study the flavonoid composition of the butanol extract of aerial part of *O. macrodonta* plant.

The raw material was collected in May 2022 in the Tashkent Oblast near the village of Sidzhak. Air-dried and ground plant material *O. macrodonta* were extracted exhaustively with EtOH (70%) at room temperature. The solvent was evaporated. The condensed extract was diluted with water and extracted first with chloroform then with n-butanol.

Separation was carried out on an Agilent 51200 chromatograph and an autosampler with a diode array detector (DAD) at 254 nm, 276 nm. with reverse-phase column Exlipse XDB C 18, 5 mkm, 4.6 x 250 mm. Eluent - phosphate buffer: acetonitrile 0-5 min 95:5, 6-12 min 70:30, 12-13 min 50:50, 13-15 min 95:5. Injected sample volume -10mkm.

Table. Physical and chemical constants and HPLC data for flavonoids

Name	Mol. formula	Retention time T (min)	%
Rutin	C ₂₇ H ₃₀ O ₁₆	8.577	3.32
Rosavin	C ₂₀ H ₂₈ O ₁₀	8.836	0.81
Quercetin	C ₁₅ H ₁₀ O ₇	11.763	2.75
Dihydroquercetin	C ₁₅ H ₁₂ O ₇	9.073	1.66

Table 1 shows the retention time of the identified compounds and a percentage of the yield of an individual flavonoids: rutin, quercetin, dihydroquercetin and rosavin. The phenylpropanoid rosavin and quercetin were observed in the butanol extract, respectively, with yields of 0.41% and 1.62%. Retention time, T(min) – 8.972 and 11.386.

Thus, flavonoids were identified on the basis of HPLC with analogous for the first time from this plant.

THE HYPOLYPIDEMIC EFFECT OF THE FLAVONOIDS SUM FROM *Crocus sativus*

Narbutaeva D.A., Djuraeva D.I., Maxmudova Sh.R.

*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of
Sciences Republic of Uzbekistan, 100170, Tashkent, M. Ulugbek st., 77, e-mail:
narbutaeva83@list.ru, tel. (97)7292383*

It is known that metabolic disorders, in particular lipid metabolism disorders, are a leading factor in the development of atherosclerosis and, accordingly, a risk factor for cardiovascular diseases and the development of ischemic stroke. Currently, despite the constantly growing range of synthetic drugs, the development and introduction into medical practice of drugs of natural origin, as less toxic and not causing complications, remains urgent. Continuing the search in this direction, our attention was drawn to the amounts of flavonoids isolated from the petals of *Crocus sativus*.

The study was carried out on male rats weighing 180-200 g. Experimental hyperlipidemia (HL) was induced by sequential administration of 50% ethanol for three days at doses of 2, 4 and 6 g/kg. The sum flavonoids isolated from the petals of *Crocus sativus* was administered at a dose of 100 mg/kg orally. The reference drug Atoris was administered at a dose of 20 mg/kg. The lipid spectrum of blood serum (total cholesterol - TC, triglycerides - TG, high-density lipoproteins - HDL, low-density lipoproteins - LDL and very low-density lipoproteins - VLDL) was studied using reagents produced by Cypress Diagnostics (Belgium). Biochemical studies were performed on a semi-automatic biochemical analyzer CYANSmart (Cypress Diagnostics, Belgium).

It was established that the administration of the study drugs to animals with ethanol hyperlipidemia contributed to the normalization of lipid metabolism disturbed by ethanol. Thus, treatment of animals with experimental hyperlipidemia with the studied preparations of the sum of flavonoids isolated from the petals of *Crocus sativus* and Atoris led to a decrease in serum cholesterol levels by 41.4 - 33.3% ($p < 0.05$), triglycerides by 38.9 - 36.7% ($p < 0.002$). At the same time, HDL level increased by 19.0 - 17.5%, LDL content decreased by 21.0 - 22.5% ($p < 0.05$) compared to the value in control animals.

The data obtained significantly complement the known spectrum of biological action of the flavonoids sum isolated from the petals of *Crocus sativus*. In previous experiments it displayed pronounced antioxidant and anti-inflammatory activities, which can be of significant practical importance in the development of a new drug.

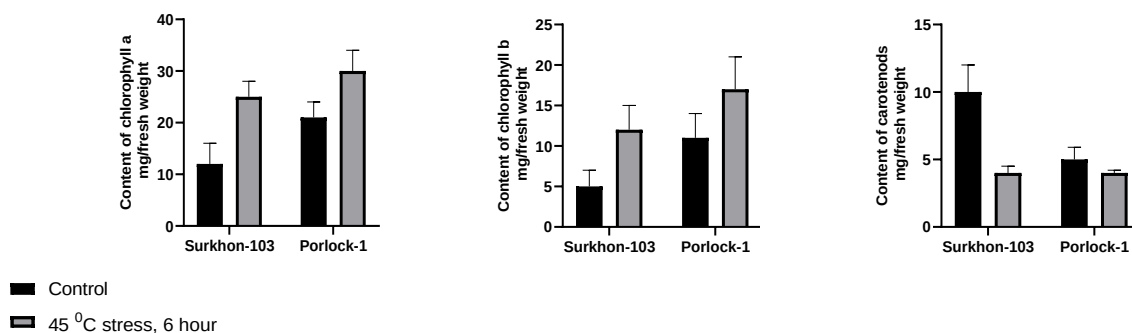
EFFECT OF HEAT STRESS ON CONCENTRATIONS OF CHLOROPHYLLS IN COTTON VARIETIES

K.M.Kuldoshova, S.B.Navruzov, A.M.Anorova, A.A.Akhunov

A. Sadykov Institute of Bioorganic Chemistry, Uzbekistan Academy of Sciences

zarabarlos90@bk.ru +99890 956 58 25

Photosynthesis is a well-studied process in which plants convert light energy into chemical energy and transform carbon dioxide to produce organic molecules to be subsequently used for plant growth and development. Photosynthesis is strongly influenced by drought, cold, salt, heat, oxidative stress, heavy metal toxicity, and other stressors. Stress conditions destroy the chloroplast ultrastructure and lead to a decrease in chlorophyll, which results in lower photosynthetic activity. Concentrations of chlorophyll a, chlorophyll b, and total chlorophyll content were found to reduce under the influence of several stresses.



We studied Porlok-1 cotton cultivar generated by means of the gene knockout method provided by the Center for Genomics and Bioinformatics, Uzbekistan Academy of Sciences, and Surkhan-103, a cotton variety of *Gossypium barbadense* family, generated by the method of classical selection provided by the Research Institute of Breeding, Seed Growing and Agrotechnology for Cotton Growing. Concentrations of chlorophyll a and b, as well as those of carotenoids were determined according to Arnon's method.

It was found that the highest concentrations of chlorophyll a and chlorophyll b were synthesized in Porlok-1 cotton cultivar. The chlorophyll concentrations were found increased significantly in both cultivars under heat stress effect. The highest concentrations of carotenoid were synthesized in Surkhan-103 variety to be found significantly decreased under heat stress effect. In our preliminary studies, the effect of hyperthermia on activity of the antioxidant system in cotton leaves was studied.

According to findings of the study, the integrity of the plastids was preserved due to the effective activity of the antioxidant systems neutralizing free radical in cotton leaves, and as a result, high temperature did not affect concentrations of chlorophyll a and chlorophyll b.

SECONDARY METABOLITES OF SAPONARIA OFFICINALIS AND THEIR BIOLOGICAL ACTIVITY

L.N. Ashurova¹, A.R. Khurramov¹, Kh.M. Bobakulov¹, D. Kh. Akramov²,
N.Sh. Ramazonov¹

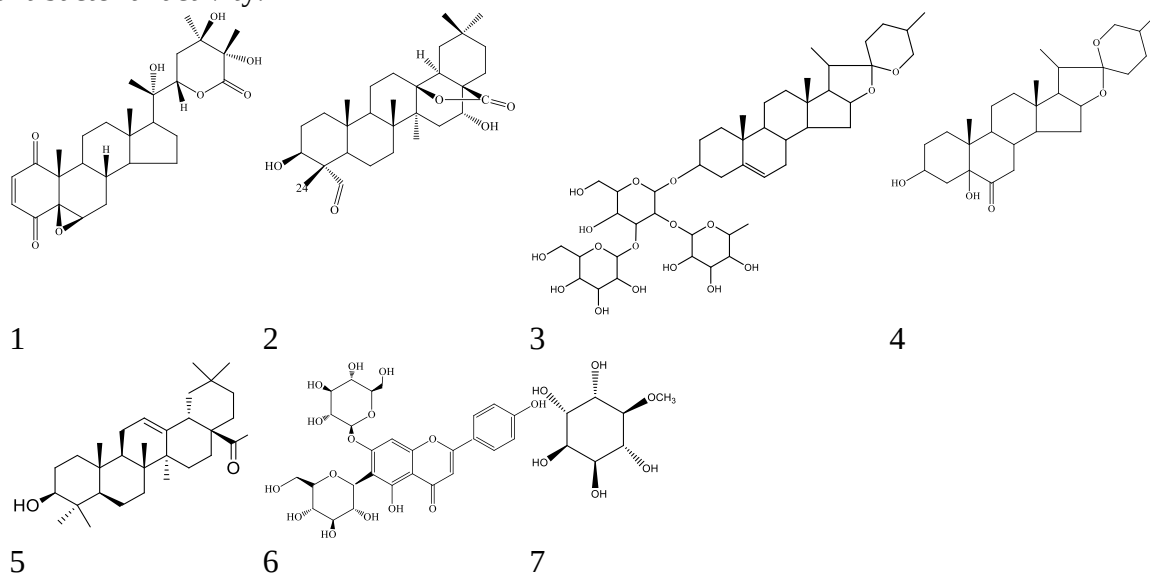
1. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, 77, M.
Ulugbek, str., 100170, Tashkent, Uzbekistan, e-mail: ashurova_lola85@mail.ru

2. Institute of Biochemistry, Samarkand State University, Uzbekistan, 140104,
Samarkand, blvd. Universitetskiy, 15.

Saponaria officinalis, also known as soapwort or fuller's herb, is a well-known perennial plant in the family Caryophyllaceae [1]. It grows naturally from Europe to Central Asia in various habitats, usually along roadsides, in hedges, and close to water. *S. officinalis* is characterized by its high content of saponins [2]. In traditional phytomedicine, extracts of *S. officinalis* are still used to treat bronchitis, skin ailments, and rheumatic disorders [3].

Two new triterpene saponins, 5 β ,6 β -epoxy-20 α ,24 β ,25 α -trihydroxy-1,3-dioxowitha-2-enolide (1) and sapolid (2), as well as five known compounds, gracillin (3), 5 α -hydroxylaxogenin (4), hederagenin (5), saponarin (6), and pinitol (7), have been isolated from the aerial parts of plants. Furthermore, the biological activity of isolated compounds as well as extracts, fractions and essential oils has been studied.

The chemical structure of isolated compounds 1–7 was confirmed by 1D (¹H, ¹³C) and 2D (HSQC, HMBC, COSY, and NOESY) NMR spectroscopy data. Extracts and fractions containing isolated compounds showed high anti-ulcer, cytotoxic, and antibacterial activity.



The chemical structures of secondary metabolites of *Saponaria officinalis*.

QUANTITATIVE DETERMINATION OF POLYSACCHARIDES FROM THE AERIAL PARTS OF *Capparis spinosa*

G.E. Saidova, R.A. Botirov, A.I. Sanoev, A.Z. Sadikov, Sh.Sh. Sagdullaev

*Institute of Plant Chemistry named after academician S.Y.Yunusov, Academy of
Sciences of the Republic of Uzbekistan, Tashkent,, e-mail: botiroovr@mail.ru*

One of the significant challenges facing healthcare systems worldwide is the development of drugs that stimulate the human immune system to protect public health and enhance resistance to various environmental stresses. The *Capparis spinosa*, used as a food additive in several countries, possesses properties that enhance human immunity, improve metabolism, and positively impact overall health. In our country, developing technology for producing dry extracts from the aerial parts of this plant is crucial and timely. Studying the factors influencing the extraction process is essential for developing technology to extract biologically active substances from plant materials. Therefore, our objective is to develop a method for extracting polysaccharide aggregates from the aerial parts of *Capparis spinosa*. To achieve this, we first need to determine the total amount of water-soluble polysaccharides in the plant materials. We utilized the method described in the XIth State Pharmacopoeia to quantify the polysaccharides.

The polysaccharide content in the plant material (X) was calculated using the formula:

$$X = \frac{(m_2 - m_1) \cdot 500 \cdot 100 \cdot 100}{m \cdot 25 \cdot (100 - W)}$$

where m₁ is the mass of the filter in grams,

m₂ - total mass of the filter with sediment in grams,

m - mass of raw materials in grams,

W - is the percentage weight loss of raw materials during drying.

The total amount of water-soluble polysaccharides in the samples ranged from 6.0% to 6.5%, depending on the growing season and location of the *Capparis spinosa* plant. Currently, research is focused on optimizing various stages of the extraction process, including raw material extraction, extract concentration, polysaccharide sedimentation, and the production of highly pure polysaccharides. Sufficient quantities of the extract have been produced and provided to pharmacologists for comprehensive studies on the non-toxicity and biological activity of the substance. Concurrently, efforts are underway to develop methods for the qualitative and quantitative determination of biologically active polysaccharides in raw materials and to establish phased control measures for polysaccharide production.

POSTER PRESENTATIONS

CHEMICAL COMPONENTS OF *Tribulus terrestris* MEAL

D. R. Siddikov, A. R. Khurramov, A. A. Ganiev, T. A. Khadzhibaev,
Kh. M. Bobakulov, R.M. Khalilov

S. Yu. Yunusov Institute of the Chemistry of Plant Substances Academy of Sciences
of the Republic of Uzbekistan, Mirzo Ulugbek str. 77, Tashkent 100170,
Uzbekistan, e-mail: khayrulla@rambler.ru

The genus *Tribulus*, belonging to the *Zygophyllaceae* family, has about 20 species worldwide. *Tribulus terrestris* L. is an annual plant that grows in the Mediterranean region but is now widespread in warm regions around the world. In the CIS countries, the plant has a wide range, including Moldova, the Caucasus, southeastern Ukraine and Central Asia.

T. terrestris is used in folk medicine as a tonic, aphrodisiac, palliative, astringent, stomachic, antihypertensive, diuretic, lithotriptic and urinary tract disinfectant. Various parts of the plant contain many chemical components of medical importance, such as flavonoids, flavonol glycosides, steroidal saponins, alkaloids and tannins. It has diuretic, aphrodisiac, antiurolytic, immunomodulatory, antidiabetic, absorption enhancing, hypolipidemic, cardiogenic, central nervous system, hepatoprotective, anti-inflammatory, analgesic, antispasmodic, anticancer, antibacterial, anthelmintic, larvicidal and anticary effects.

At the Institute of the Chemistry of Plant Substances, a hypoazotemic agent was created based on the flavonoids of the *T. terrestris* plant. When processing the plant, meal remains as waste. In order to find biologically active compounds, we studied the chemical composition of the plant meal.

The air-dried ground meal was extracted with 40% ethanol, evaporated in a vacuum and treated five times (1.5 L each) with *n*-butanol. The evaporated butanol extract was chromatographed on a Sephadex LH-20 column. As a result, six compounds were isolated: tribestin (diosgenin 3-O- α -L-rhamnopyranosyl (1 $\rightarrow$ 2)- β -D-glucopyranoside) (**1**), rutin (**2**), caffeoyl tyramine (N-*trans*-caffeoyl tyramine) (**3**), 6''-O-*p*-coumaroyl trifolin (**4**), quercetin (**5**) and tiliroside (**6**) (Fig. 1).

The chemical structure of the isolated compounds **1–6** was established by studying their ^1H and ^{13}C NMR spectral data, as well as 2D experiments, followed by comparison with those of the literature data for these compounds.

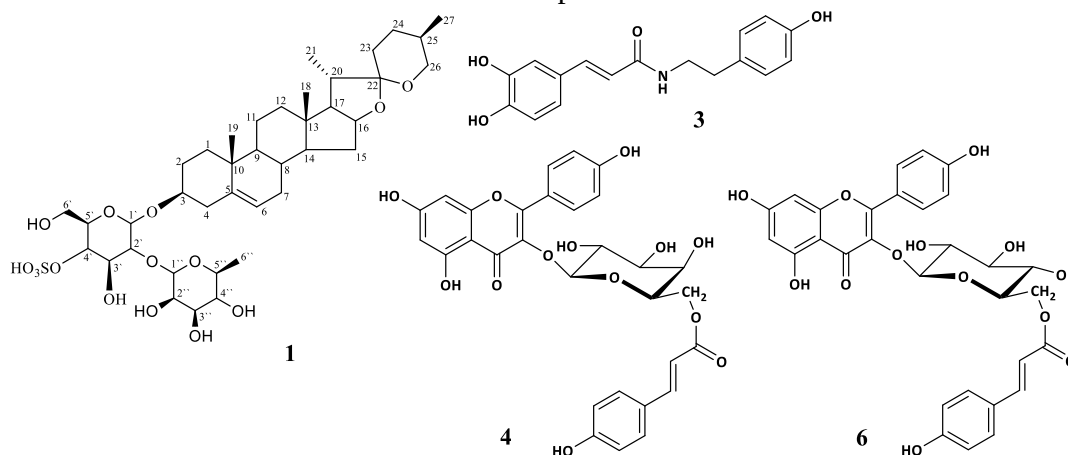


Fig. 1. Chemical structures of isolated compounds **1**, **3**, **4** and **6**.
The work was supported by application grant PZ-2020102917.

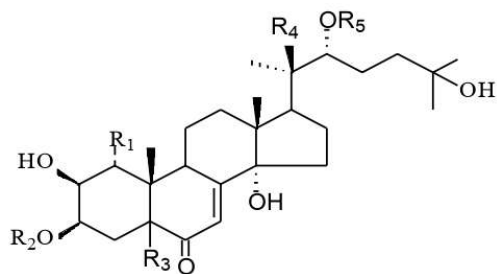
PHYTOECDYSTEROIDS OF THE PLANT OF *Stachys byzantina*

N.Sh. Ramazonov, U.Yu. Yusupova, D.A. Usmanov

Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, 77, M. Ulugbek, str., 100170, Tashkent, Uzbekistan, E-mail: ramazonovn@list.ru

Phytoecdysteroids were isolated from the plant *Stachys byzantina*: ecdysterone, polypodine B, 2-deoxy-20-hydroxyecdysone, integristerone A, 2-deoxyecdysone. As a result of the search for ecdysteroid-containing plants among representatives of the domestic flora, it was possible to show that some species of the genus *Stachys* are quite promising in this regard. Thus, a frequently occurring species in Central Asia, in particular in the Tashkent and Fergana regions, is *Stachys byzantina* (family Lamiaceae).

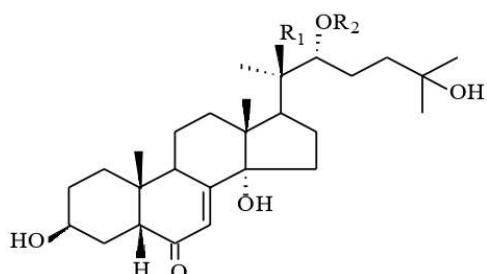
This report provides data on the presence, composition and quantity of phytoecdysteroids in *Stachys byzantine* [1,2].



1. R₁ = R₂ = R₃ = R₅ = H; R₄ = OH

2. R₁ = R₂ = R₅ = H; R₃ = R₄ = OH;

4. R₂ = R₃ = R₅ = H; R₁ = R₄ = OH;



3. R₁ = OH; R₂ = H

5. R₁ = R₂ = H

A preliminary study of the *Stachys byzantina* plant allowed us to isolate and identify its main ecdysteroids: 20-hydroxyecdysone (1) (0.33% of the dry weight of the plant), polypodin B (2) (0.22%), 2-deoxy-20-hydroxyecdysone (3) (0.2%), integristerone A (4) (0.2%) and 2-deoxyecdysone (5) (0.01%) [3]. The isolated individual ecdysteroids were identified based on the results of IR, PMR and mass spectroscopy, as well as comparison with reference samples.

The work was carried out with financial support from the Budgetary Program for Basic Scientific Research of the Academy of Sciences of the Republic of Uzbekistan.

References

1. Yusupova U.Yu., Ramazonov N.Sh., Syrov V.N., Sagdullaev Sh.Sh. Phytoecdysteroids: Properties, Biological Activity and Applications // Monograph. Springer Nature. Singapore Pte Ltd., 2022. 209 p.
2. Ramazonov N.Sh. Phytoecdysteroids of genus *Silene*, *Rhapontcium* and *Ajuga*: Avtoref. Tashkent. 2007. 49 p. (in Russian)
3. Ramazonov N.Sh., Bobaev I.D., Faskhuddinov M.S., Djiembraev B.J. Chem. J. Kazakhstan. Almata. 2007. № 2. P. 158-163.

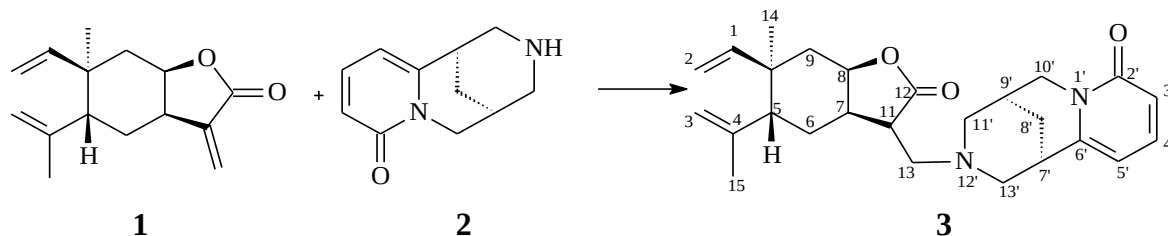
AMINATION OF LACTONE IGALAN WITH ALKALOID CYTISINE

D.E. Dusmatova, R.F. Mukhamatkhanova, Kh. M. Bobakulov, I.D. Sham'yanov,
V. I. Vinogradova, N.D. Abdullaev

*S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, Tashkent, M.
Ulugbek st., 77, fax (99871) 1206475, e-mail: doctor.dusmatova@mail.ru*

The biologically active sesquiterpene lactone igalan (**1**) has in its structure an activated double bond in the γ -lactone ring, which easily reacts with nucleophilic agents, in particular amines.

Used in medical practice as a respiratory analeptic, as well as for the treatment of nicotine addiction, the quinolizidine alkaloid cytisine (**2**) contains a nucleophilic nitrogen atom. In this regard, the reaction of addition of a cytisine molecule at the secondary amino group to the double bond of the γ -lactone ring of igalan was carried out. The reaction was carried out in methanol with a fivefold molar excess of cytisine relative to the amount of igalan. Product yield 60%. The reaction was carried out as according to the scheme:



The structure of the resulting derivative was confirmed by ^1H and ^{13}C NMR spectral analysis methods.

The resulting derivative 3 was tested for biological activity using the PASS program. According to the analysis, the amino derivative of igalan with cytisine can be an antagonist of nicotinic receptors $\alpha\beta 2$ (Pa, 0.719), analeptic (0.664), including respiratory (0.573), antitumor agent (0.671), including against pancreatic cancer (0.529), β -glucuronidase inhibitor (0.629), gluconate-2-dehydrogenase (0.646), phosphatase (0.597), neurotransmitter uptake (0.501), anti-inflammatory (0.547), antimetastatic (0.507), anti-eczematic (0.530) agents, CYP2H substrate (0.510).

The resulting derivative 3 is of interest in terms of studying its biological activity.

COMPONENTS OF HEXANE EXTRACT OF *Chrysanthemum koreanum* LEAVES CULTIVATED IN UZBEKISTAN

D.Sh. Tojiboeva, Kh.M. Bobakulov, R.F. Mukhamatkhanova, S.A. Sasmakov,
I.D. Sham'yanov, Sh. S. Azimova, N.D. Abdullaev

*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, Tashkent,
M. Ulugbek st., 77, fax (99871) 1206475, e-mail: dtojiboeva58@gmail.com*

The genus *Chrysanthemum* L. belongs to flowering plants of the Asteraceae family, contains about 40 species and is distributed in subtropical and temperate latitudes of Europe and Asia. Plants of the chrysanthemum genus are perennial herbs or subshrubs, used as ornamental plants, having many varietal species, which increase every year. In addition, *Chrysanthemum* flowers have long been used in traditional Chinese medicine to treat headaches, inflammation, hypertension and fever, and have insecticidal activity. Volatile compounds from the leaves of cultivated in Uzbekistan *Ch. koreanum* plants were studied using GC-MS. Hexane extracts of the Korean chrysanthemum varieties "Evelyn Bush pink", "Evelyn Bush yellow", "Coral Cavalier" were taken as objects of study.

As a result of the analysis, it was found that hexane extracts of *Ch. koreanum* are rich in phytol (14.20, 10.54, 14.19%, respectively), linoleic acid (5.08, 7.83, 8.75%), linolenic acid (2.62, 8.88, 8.96%), nonacosane (6.36, 6.66, 7.03%), neophytadiene (2.73, 2.99, 1.81%), palmitic acid (0.68, 3.39, 1.16%). Some hydrocarbons were found in the «Evelyn Bush pink» and «Coral Cavalier» varieties, such as docosane (1.12, 1.21%, respectively), tricosane (2.82, 2.83%), tetracosane (2.70, 2.89%), pentacosane (3.03, 3.39%), hexacosane (2.34, 2.42%), heptacosane (2.72, 2.96%), octacosane (2.14, 2.15%), triacontane (1.27, 1.46%). Oleic acid was found in hexane extracts of leaves of the «Evelyn Bush pink» and «Evelyn Bush yellow» varieties (0.99 and 2.12%, respectively). In addition, tetradecanal (0.28%), heneicosane (0.32%), linolenic acid methyl ester (0.99%), and dotriacontane (1.44%) were found in the hexane extract of leaves of the «Coral Cavalier» variety.

It should be noted that one of the main components of hexane extracts of Korean chrysanthemum varieties «Evelyn Bush pink», «Evelyn Bush yellow», «Coral Cavalier» with RI 4268 was not identified (19.20, 28.15 and 12.54%, respectively). Therefore, to identify this compound, it is necessary to further conduct additional research to isolate this component using column chromatography.

These samples were tested for antimicrobial activity. Hexane extract of «Coral Cavalier» leaves showed weak activity against *Pseudomonas aeruginosa* (7.04 mm), noticeable activity against *Staphylococcus aureus* (12.04 mm) and pronounced activity against *Bacillus subtilis* (16.04 mm).

COMPONENTS OF ESSENTIAL OILS OF FLOWERS AND LEAVES *Handelia trichophylla*

D.Sh. Tojiboeva, Kh.M. Bobakulov, R.F. Mukhamatkhanova,
I.D. Sham'yanov, N.D. Abdullaev

*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, Tashkent,
M. Ulugbek st., 77, fax (99871) 1206475, e-mail: dtojiboeva58@gmail.com*

The components of the essential oils of *Handelia trichophylla* flowers and leaves have not been studied previously. For research, the plant was collected in the Jizzakh region in the vicinity of the village of Bobur (05/16/2024) during the flowering period. Essential oils of flowers and leaves were obtained by hydrodistillation and analyzed by GC-MS.

In the essential oil of the leaves, 44 compounds were identified, which were mainly represented by monoterpenoids and sesquiterpenoids. The major components of the essential oil of *Handelia trichophylla* leaves are the following compounds: 1,8-cineole (12.63%), γ -terpinene (11.90%), endo-borneol (10.13%), α -terpineol (8.81%), *cis*-ocimene (5.97 %), (+)-epi-bicyclosesquifellandrene (2.30%), aromadendrene (2.12%), cadina-1,4-diene (2.10%), *cis*-tricyclo[7.5.0.0(2.8)]tetradeca-7,9-diene (1.52%), 6-methylene-spiro[4.5]decane (1.30%), (Z)-3-hexen-1-ol (1.14%).

64 compounds have been identified in the essential oil of flowers. The major components of the essential oil of *Handelia trichophylla* flowers are: γ -terpinene (17.16%), endo-borneol (14.79%), 1,8-cineole (4.05%), (+)-epi-bicyclosesquifellandrene (3.91%), α -pinene (3.65%), α -terpineol (3.20%), aromadendrene (2.53%), *cis*-ocimene (2.01%), cadina-1,4-diene (1.91%), [4aS,8aS]-1,2,3,4,4a,5,8,8a-octahydro-1,1,4a,6-tetramethyl-5-methylenenaphthalene (1.76%), 1-methyl-2-(1-methylethyl)benzene (1.70%), *cis*-tricyclo[7.5.0.0(2.8)]tetradeca-7,9-diene (1.16%), torreol (1.15%).

It should be noted that the essential oil of the leaves is rich in 1,8-cineole, γ -terpineol, endo-borneol and α -terpineol, while the essential oil of the flowers is rich in γ -terpinene and endo-borneol, and the content of 1,8-cineole, α -terpineol is significantly lower compared to the content in the essential oil of the leaves. It should also be noted that the amount of sesquiterpenoids in the essential oil of flowers is higher than in the essential oil of leaves. Thus, it has been shown that essential oils of flowers and leaves of *Handelia trichophylla* produce biologically active mono- and sesquiterpenoids.

ANTIMICROBIAL ACTIVITIES OF THE EXTRACTS OF PLANTS SPECIES BELONGING TO *Lamiaceae* FAMILY

Z. Kabirova¹, A. Abdurashidov², K. Mardieva², N. Sattarova², F. Eshboev², E. Yusupova², Sh. Azimova¹

1. Faculty of Biology, National University of Uzbekistan, 100174, Tashkent, Uzbekistan;

2. S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of Uzbekistan, Mirzo Ulugbek Str. 77, Tashkent 100170, Uzbekistan;

3. School of Chemical Engineering, New Uzbekistan University, Movarounnahr Street 1, Mirzo Ulugbek District, Tashkent 100000, Uzbekistan;

*Correspondence: farkhod.eshboev@gmail.com

Antibiotic resistance is an important issue due to the frequent use of antibiotics for the treatment of common bacterial infections. According to the World Health Organization, antimicrobial resistance has emerged as one of the most serious public health concerns of the 21st century. Medicinal plants are one of the major sources of antimicrobial compounds. The *Lamiaceae* family is one of the largest and most diverse plant families, comprising over 7,000 species distributed across the globe. This study focuses on the antimicrobial activities of ethanolic plant extracts derived from species of *Lamiaceae* family which have historically been used in traditional medicine for treating infectious diseases.

In this study, five plant materials were selected and extracted with ethanol. The antimicrobial activities of the extracts were evaluated by the disk-diffusion method against five species of microorganisms: Gram-positive bacteria *Bacillus subtilis* (RKMUZ - 5) and *Staphylococcus aureus* (ATCC 25923); Gram-negative bacteria *Escherichia coli* (RKMUZ - 221) and *Pseudomonas aeruginosa* (ATCC 27879); and the fungus *Candida albicans* (RKMUZ - 247).

According to the obtained results, extracts of *Thymus vulgaris* showed the highest antimicrobial activities among the tested samples (10 mm - 17 mm). The extract of *Origanum sp.* also showed good antimicrobial activities against the tested microorganisms (Table 1).

Table 1. Diameter of inhibition zones of studied extracts

Plant extracts	Inhibition zone diameter, mm				
	<i>B. subtilis</i>	<i>S. aureus</i>	<i>E. coli</i>	<i>P. aeruginosa</i>	<i>C. albicans</i>
<i>Melissa officinalis</i>	N/A	N/A	N/A	N/A	N/A
<i>Thymus vulgaris</i>	6	9	8	7	N/A
<i>Lavandula officinalis</i>	14	15	N/A	13	N/A
<i>Origanum sp.</i>	N/A	N/A	N/A	N/A	N/A
<i>Salvia officinalis</i>	6	10	N/A	9	7
Ampicillin (10 µg/disc)	26	22	N/T	N/T	N/T
Gentamicin (10 µg/disc)	N/T	N/T	18	20	N/T
Fluconazole (25 µg/disc)	N/T	N/T	N/T	N/T	30

N/A – activity not detected.

N/T – not tested.

DETERMINATION OF THE FLAVONOID CONTENT IN TWO TYPES PLANTS OF THE GENUS *Heliotropium* OF THE FLORA OF UZBEKISTAN

S.S. Omonova¹, O.D. Matchanov², R.S. Esanov², S.F. Aripova³

¹Kokand Pedagogik Institute, Kokand, Fergana region, Turon st., 77.

² Institute of the Bioorganik Chemistry, Tashkent, M. Ulugbek str., 83

³Institute of the Chemistry of Natural Compounds, Tashkent, M. Ulugbek str., 77, e-mail: salima_aripova@mail.ru

Plants of the genus *Heliotropium* – *H. lasiocarpum* Ledeb and *H. dasycarpum* Ledeb of the Boraginaceae family are widely distributed in Uzbekistan. Plants contain significant amounts of toxic alkaloids that are toxic to the liver.

We have studied the content of flavonoids in two organ samples (leaves, flowers) of these plants (the results are shown in the table).

Table. The content of flavonoids in organ plants *Heliotropium lasiocarpum* and *H. dasycarpum*

Name of the sample	Quantitative content mg/100 g							
	Apigenin	Gipolactin	Rutin	Gipolactin 7-O-β-D-Glcp	Kaempferol	Gallic acid	Giperosid	Quercetin
<i>H. lasiocarpum</i> (leaves)	40.74	28.25	25.12	-	-	5.21	142.98	-
<i>H. lasiocarpum</i> (flowers)	94.49	41.25	88.75	-	-	29.12	162.35	-
<i>H. dasycarpum</i> (leaves)	58.21	88.97	108.23	-	-	24.20	54.26	-
<i>H. dasycarpum</i> (flowers)	105.63	83.23	119.33	-	-	36.32	55.32	-

Materials and methods of research. Extraction is carried out on 70% ethanol in two multiples at 70-75 °C for 3 hours with intensive stirring and in solvent: plant ratios of 90:20. The solutions are filtered out and combined. Take a 1ml aliquot and dilute 9ml with an acetonitrile solvent system: buffer (acetate) 70:30. Centrifuged and filtered through a membrane filter. The analysis was performed using HPLC using the isocratic elution mode and a diode-matrix 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.

Chromatography conditions: Chromatograph - Agilent Technologies 1260 Mobile phase– acetonitrile buffer solution (30:70) (isocratic mode) pH=2.92 15-20 min. The injection volume is 5 µl. the velocity of the mobile phase is 0.75 ml/min. the column is Eclipse XDB – C18. 5.0 microns, 4.6x250mm. The detector is a diode-matrix detector, wavelength 254, 320, 381nm.

VOLATILE COMPONENTS OF THE ROOT OF *Perovskia scrophulariifolia*

S.I. Atqiyayeva, Kh.M. Bobakulov, E.Kh. Botirov, B.S. Okhundedaev, S.A. Sasmakov

*S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences
Republic of Uzbekistan, 100170, Tashkent, M. Ulugbek st.,77 e-mail:asi@gmail.com*

The genus *Perovskia* L. (family *Lamiaceae*) consists of nine species of subshrubs, most of which grow wild in the mountainous regions of Southwest and Central Asia [1]. A decoction of the above-ground part of *Perovskia scrophulariifolia* is used in folk medicine in Uzbekistan to treat scabies, sunburn, skin diseases, and to remove intestinal parasites from the body [1,2].

The component composition of the essential oil of the above-ground part of this plant was previously studied [2], and diterpenoids and flavonoids were isolated from the above-ground part [3-5]. The components of the roots of *P. scrophulariifolia* have not been studied.

We present the results of a chromatograph mass-spectrometry study of the components of the essential oil obtained by hydrodistillation and hexane extract of the roots of *P. scrophulariifolia*, collected in the Samarkand region. The qualitative and quantitative composition of the hexane extract and essential oil was determined on an Agilent 5975C Inert MSD/7890A GC chromatograph mass spectrometer.

In the composition of the essential oil of the roots, 67 compounds were identified by GC-MS, of which the major components are alloaromadendrene (16.1%), isocaryophyllene (10.1%), valerenal (7.0%), 9,10-dehydro-isolongifolene (5.6%), α -guaiene (5.0%), aristola-1,9-diene (4.6%) and trans- β -caryophyllene (4.1%). In the hexane extract, 25 compounds were identified, of which the major components were the diterpenoid trans-ferruginol (15.9%), cembrene (7.9%), alloaromadendrene (2.1%) and dehydroabietan (1.7%).

From the gasoline fraction of the methanol extract of the roots, needle-shaped crystals of red color of the composition $C_{19}H_{20}O_3$ with a mp of 190-191°C, λ_{max} (MeOH): 263, 270, 293, 356, 449 nm were obtained by chromatography on a column with silica gel. The isolated compound was identified with cryptotanshinone by studying the spectral.

The results of in vitro screening showed that the hexane extract of *P. scrophulariifolia* roots exhibits significant antibacterial activity against the gram-positive strain of bacteria *Bacillus subtilis* (14.04 $\pm$ 0.10) and *Staphylococcus aureus* (14.04 $\pm$ 0.10), as well as the gram-negative strain of *Pseudomonas aeruginosa* (15.04 $\pm$ 0.10).

The work was carried out within the framework of basic fundamental scientific research of the Academy of Sciences of the Republic of Uzbekistan.

References

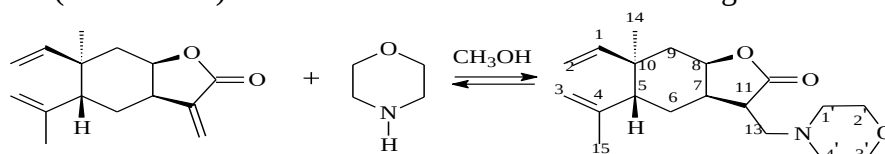
1. Mohammadhossein M., Venditti A., Akbarzadeh A. *Toxin Reviews*, **40** (4), 484 (2021).
2. Takeda Y., Hayashi T., Masuda T., Honda G., Takaishi Y., Ito M., Otsuka H., Matsunami K., Khodzhimatov O.K., Ashurmetov O.A. *Journal of Natural Medicines*, 61, 84 (2007).
3. Nuriddinov Kh.R., Khodzimatov K.Kh., Aripov Kh.N., Ozek T., Demirchakmak B., Basher K.H.C. *Chem Nat Compd.*, 33, 299 (1997).
4. Tanaka N., Niwa K., Kajihara S., Tsuji D., Itoh K., Mamadalieva N.Z., Kashiwada Y. *Organic Letters*, 22, 7667 (2020).
5. Tanaka N., Takahashi S., Kajihara S., Tsuji D., Itoh K., Mamadalieva N.Z., Kashiwada Y. *Fitoterapia*, 149, 104826 (2021).

MODIFICATION OF SESQUITERPENE LACTONE IGALAN

D.E. Dusmatova¹, R.F. Mukhamatkhanova¹, A.M. Nagmatullaev²,
I.D. Sham'yanov¹, N.D. Abdullaev¹, A.D. Kurbanova²

- 1) Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, M. Ulugbek st., 77, Tashkent, fax (99871) 1206475, e-mail: doctor.dusmatova@mail.ru
- 2) Chirchiq State Pedagogical University, Amir Temur st., 104, Chirchiq

The sesquiterpene lactone igalan produced by the plant *Inula grandis* exhibits cytotoxic and anthelmintic activity. An analysis of the structures of pharmaceutical drugs showed that the molecule of the widely used antibiotic linezolid, used to treat severe infectious diseases, as well as the oncology drug gefitinib, includes a morpholine fragment. In this regard, the amination reaction of igalan with morpholine was carried out. Due to the presence of an oxygen atom in the structure, which draws electron density from the nitrogen atom, morpholine has less nucleophilic and less basic properties. Therefore, when carrying out the amination reaction, the amount of morpholine in a molar ratio to the amount of igalan was taken to be 1:3. The reaction was carried out in methanol. Product yield 92%. The resulting derivative is colorless needle-shaped crystals (from hexane). The reaction was conducted as according to the scheme:



Morpholine derivative of igalan. ¹H NMR (600 MHz, CDCl₃, δ, ppm, J/Hz, 0-HMDS): 5.76 (1H, dd, J = 10.8, 17.5, H-1), 4.965 (1H, dd, J = 10.8, 0.9, H-2E), 4.92 (1H, dd, J = 18.4, 0.8, H-3Z), 4.896 (1H, sextet, J = 1.5, 3.1, H-3E), 4.665 (2H, m, H-2Z, H-8), 3.65 (4H, m, H-1', 4'), 2.81 (1H, ddd, J = 2.1, 3.8, 13.1, H-13a), 2.63 (1H, ddt, J = 3.3, 6.7, 13.0, H-13b), 2.72 (2H, dd, J = 2.3, 5.9, H-6b), 2.46 (4H, m, H-2', 3'), 2.05 (2H, m, H-6a, H-9a), 1.96 (1H, dd, J = 10.7, 12.8, H-9b), 1.92 (1H, dd, J = 6.2, 13.4, H-5), 1.71 (3H, dd, J = 0.8, 1.5, H-15), 11.41 (1H, dd, J = 2.1, 11.2, H-11), 1.05 (3H, s, H-14). ¹³C NMR (150 MHz, CDCl₃, δ, ppm): 178.1 (C-12), 147.6 (C-1), 111.9 (C-2), 113.3 (C-3), 145.8 (C-4), 75.8 (C-8), 67.0 (C-1', 4'), 57.9 (C-2', 3'), 54.3 (C-13), 46.9 (C-5), 41.6 (C-7), 39.99 (C-11), 39.4 (C-9), 38.7 (C-10), 26.9 (C-6), 24.9 (C-15), 16.7 (C-14).

According to the above, the resulting compound is of interest in terms of studying its biological action, since it contains a new pharmacophore group, which can lead to both an enhancement of known properties, as well as the emergence of new types of activity.

STUDY OF *Perovskia angustifolia* ROOT COMPONENTS

M.U. Zhuraev, Kh.M. Bobakulov, O.K. Askarova, D.B. Turdaliev, S.A. Sasmakov,
E.Kh. Botirov, Sh.S. Azimova

S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences
Republic of Uzbekistan, 100170, Tashkent, M. Ulugbek st., 77 e-mail: botirov-
nepi@mail.ru

Plants of the genus *Perovskia* are dyeing and essential oil plants, and an extract from the leaves of *P. angustifolia* is used for stomach disorders, skin diseases and as a diuretic anthelmintic [1]. Previously, we from the aerial part of *P. angustifolia* Kudr. caffeic and rosmarinic acids, flavonoids cirsimaritin, hesperidin and neoponcirin, apigenin, luteolin, diosmetin, taxifolin and hesperitin were isolated [2,3]. There is no information in the literature on the chemical composition of *P. angustifolia* roots. We used GC-MS to study the component composition of the essential oil obtained by hydrodistillation and hexane extract of *P. angustifolia* roots collected in the Namangan region. The composition of the essential oil is dominated by sesquiterpenes (35.3%) and oxidized sesquiterpenes (24.6%). The major components of the essential oil are aromadendren (19.0%), iceol (6.4%), spatulenol (5.4%), (E)- β -farnesene (5.2%), tau-cadinol (5.1%). The dominant components of the hexane extract were oxidized diterpenes (24.8%), sesquiterpenes (12.6%) and compounds of other classes (31.0%), the major components were ferruginol (18.4%), di(ethylhexyl) phthalate (12.0%), aromadendren (8.9%) and salvicanol (6.0%). An interesting fact is the discovery of diterpenoids and nor-diterpenoids of the abietane series - dehydroabietane, ferruginol, salvicanol and deoxynimbiol in the hexane extract.

From an 80% ethanol extract of the roots, the nor-diterpenoid cryptotanshinone, caffeic and rosmarinic acids were isolated and identified.

The antibacterial and antifungal effects of various samples from the roots of *P. angustifolia* were studied by the agar disk diffusion method. The following strains of microorganisms were used as test cultures: gram-positive bacteria - *Bacillus subtilis* (RKMUz - 5), *Staphylococcus aureus* (ATCC 25923); gram-negative bacteria - *Pseudomonas aeruginosa* (ATCC 27879), *Escherichia coli* (RKMUz - 221) and the fungal strain *Candida albicans* (RKMUz - 247). Impregnated discs with ampicillin/sulbactam, gentamicin and fluconazole (Himedia) were used as positive controls, and extraction solvents were used as negative controls.

The results of in vitro tests showed that *B. subtilis*, *S. aureus*, and *P. aeruginosa* are sensitive to the action of all studied samples to varying degrees of severity. At the same time, the greatest antibacterial effect is observed in chloroform, 80% ethanol extract of roots and rosmarinic acid with inhibition zone diameters of 22.08 ± 0.12 , 20.04 ± 0.1018 and 08 ± 0.12 mm, respectively, against the gram-positive bacterium *S. aureus*.

The work was carried out within the framework of basic fundamental scientific research of the Academy of Sciences of the Republic of Uzbekistan.

References

1. M. Mohammadhosseini, A. Venditti, A. Akbarzadeh. *Toxin Reviews*, **40** (4), 484 (2021).
2. O. K. Askarova, A. A. Ganiev, Kh. M. Bobakulov, D. R. Siddikov, E. Kh. Botirov, N. D. Abdullaev. *Chem. Nat. Compd.*, **59**, 170 (2023).
3. O. K. Askarova, A. A. Ganiev, Kh. M. Bobakulov, D. R. Siddikov, E. Kh. Botirov, 4. O. Abdulalimov, K. K. Turgunov, B. Tashkhodzhaev. *Chem. Nat. Compd.*, **59**, 941 (2023).

VOLATILE COMPONENTS OF *Perovskia botschantzevii* ROOTS

S.Kh. Mullabaeva, Kh.M. Bobakulov, E.Kh. Botirov, D.R. Siddikov

*S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences
Republic of Uzbekistan, 100170, Tashkent, M. Ulugbek st., 77 e-mail:
mullabayevasevara65@gmail.com*

The genus *Perovskia* Kar. belongs to the *Lamiaceae* family, most of which grow wild in the mountainous regions of Southwest and Central Asia [1,2]. This genus includes 9 species, 4 of which grow in Uzbekistan [2]. Representatives of the genus *Perovskia* are dyeing, honey-bearing and essential oil shrubs with phytoncidal properties. They are practically not affected by pests and diseases, since the essential oils secreted by the plant have insecticidal and repellent properties [1]. The component composition of the essential oil of the above-ground part of this species was studied earlier [1]. We studied the component composition of the essential oil of the roots of *Perovskia botschantzevii*. The isolation of essential oil from crushed roots (200 g) was carried out by hydrodistillation at atmospheric pressure for 3 hours. The obtained distillate was extracted with dichloromethane, the essential oil extract was dried over anhydrous sodium sulfate.

The analysis of the essential oil components was carried out on an Agilent 7890A GC gas chromatograph with an Agilent 5975C inert MSD quadrupole mass spectrometer as a detector. The separation of the mixture components was carried out on an HP-5MS quartz capillary column (30 m × 250 μm × 0.25 μm) in the following temperature range: 50 °C (2 min) - 10 °C / min up to 200 °C (6 min) - 15 °C / min up to 290 °C (15 min). The volume of the introduced sample was 1 μl (hexane, benzene), the flow rate of the mobile phase was 1.3 ml / min. The components were identified based on comparison of mass spectral characteristics with data from electronic libraries (Wiley Registry of Mass Spectral Data-9th Ed., NIST Mass Spectral Library, 2011).

The main components of the essential oil are β-caryophyllene (38.4%), β-farnesene (17.9%), γ-curcumene (4.0%), α-curcumene (3.9%), aromadendrene (3.3%), α-zingiberene (3.1%), α-caryophyllene (2.8%), isoborneol (2.6%) and cis-calamene (1.9%).

The antibacterial and antifungal effects of various samples from the roots of *P. botschantzevii* were studied by the agar disk diffusion method. The results of in vitro tests showed that *Bacillus subtilis*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* are sensitive to the action of all studied samples to varying degrees of severity. At the same time, the greatest antibacterial effect is observed in hexane extract of roots with inhibition zone diameters of 12.04±0.10 and 15.04±0.10, respectively, against the bacterium *S. aureus* and *P. aeruginosa*.

The work was carried out within the framework of basic fundamental scientific research of the Academy of Sciences of the Republic of Uzbekistan.

References

1. M. Mohammadhosseini, A. Venditti, A. Akbarzadeh. *Toxin Reviews*, 40 (4), 484 (2021).
2. O.A. Turdiboev, A. A. Shormanova, M. B. Sheludyakova, F. Akbarov, B.T. Drew, F. Celep, *Phytotaxa*, 543 (1), 1 (2022).
3. O.K. Askarova, Kh.M., Bobakulov, E.Kh. Botirov, M. U. Zhuraev, A. M. Yarylkaganova, S. A. Sasmakov, Sh. S. Azimova. *Chem Nat Compd.*, 60, 174 (2024).

COMPONENTS OF FLOWERS *Achillea filipendulina*

B.S. Okhundedaev^{1,2}, Kh.M. Bobakulov¹, R.F. Mukhamatkhanova¹,
B.N. Babaev², I.D. Sham'yanov¹, E.Kh. Botirov¹, N.D. Abdullaev¹

- 1) Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, Tashkent, M. Ulugbek st., 77, fax (99871) 1206475, e-mail.: boxundedayev@mail.ru
- 2) National University of Uzbekistan by Mirzo Ulugbek, University st., 4

Achillea filipendulina Lam. - a perennial plant up to 120 cm high, has a very wide distribution area.

Chemically, the chemical composition of the essential oil of the Azerbaijani (Caucasus) and Kazakhstani (Tien Shan) populations of *A. filipendulina* has been studied. Two flavonoids and a number of carotenoids were isolated from the aerial part of the European population (Balkan Mountains), as well as coumarins from the roots of the Tien Shan population.

Secondary metabolites of the aerial part of the *A. filipendulina* population growing in Uzbekistan have not been previously studied. In this regard, this message presents the results of phytochemical studies of flower baskets of *A. filipendulina*, collected in the first ten days of June 2022 on the Ugam ridge in the vicinity of the village of Sidzhak, Tashkent region.

The resulting chloroform fraction of the alcoholic extract was separated on a chromatographic silica gel column, and when eluting with extraction petrol and its mixture with ethyl acetate in a gradient of increasing polarity, the sesquiterpene lactones anhydroausticin (**1**), austicin (**2**) and the flavonol centaureidin (**3**) were isolated.

By chromatography of the ethyl acetate fraction eluting with chloroform and its mixture with methanol in a gradient of increasing polarity, the following flavonoids were isolated: quercetin (**4**), jaceoside (**5**), 6-methoxytricin-7-*O*- β -*D*-glucopyranoside (**6**), cynaroside (**7**) and isorhamnetin-7-*O*- β -*D*-glucopyranoside (**8**).

Identification of isolated secondary metabolites was carried out by studying their spectral data (¹H and ¹³C NMR, as well as HSQC, HMBC) followed by comparison with those of the literature data for these compounds.

The isolated components except **3** have isolated for the first time from *A. filipendulina*. This work was carried out with the support of the Budget Program for Fundamental Research of Academy of Science of Republic of Uzbekistan.

AMINOMETHYLATION OF CENTAUREIDINE

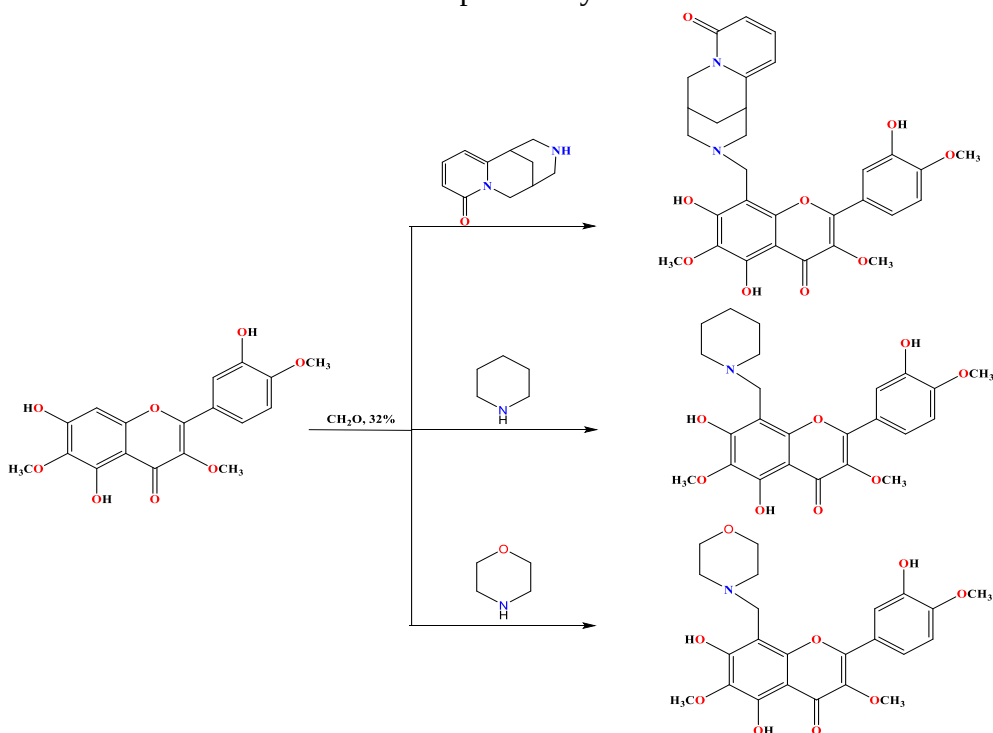
B.S. Okhundedaev^{1,2}, Kh.M. Bobakulov¹, A.T. Sarabekov²,
I.D. Sham'yanov¹, B.N. Babaev², S.A. Maulyanov², E.Kh. Botirov¹

- 1) Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, Tashkent,
M. Ulugbek st., 77, fax (99871) 1206475, e-mail:: boxundedayev@mail.ru
2) National University of Uzbekistan by Mirzo Ulugbek, University st., 4

Chemical transformation of natural flavonoids expands their spectrum of pharmacological action and is currently a promising area for the creation of new drugs for medicine, veterinary science and agriculture.

Based on this, monosubstituted conjugates of centaureidine isolated from *Achillea filipendulina* growing in Uzbekistan with cytosine, piperidine and morpholine were obtained by the Mannich reaction. The reaction was carried out in isopropyl alcohol at room temperature using the flavonoid-secondary amine-formalin ratio of 1:1:1. The aminomethylation reaction took place at the 8-position of centaureidine. The structures of the obtained derivatives were established on the basis of ¹H and ¹³C NMR spectroscopy and their two-dimensional experiments.

The obtained monosubstituted aminomethyl derivatives of centaureidine are new flavonoid alkaloids which have not been previously described in the literature.



This work was carried out with the support of the Budget Program for Fundamental Research of Academy of Science of Republic of Uzbekistan.

METABOLITES OF *Artemisia juncea* AERIAL PART

B.S. Okhunderaev^{1,2}, Kh.M. Bobakulov¹, R.F. Mukhamatkhanova¹,
S.A. Maulyanov², I.D. Sham'yanov¹, N.D. Abdullaev¹

- 1) Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, Tashkent, M. Ulugbek st., 77, fax (99871) 1206475, e-mail.: boxunderaev@mail.ru
- 2) National University of Uzbekistan by Mirzo Ulugbek, University st., 4

The population of *Artemisia juncea* Kar et Kir, growing in Uzbekistan, produces biologically active guaianolides and flavonoids.

This report presents the results of phytochemical studies of intermediate eluates obtained by separating the chloroform, ethyl acetate and *n*-butanol fractions of the alcoholic extract of the aerial part of *Artemisia juncea*.

The combined eluates (2.3 g) of the chloroform fraction obtained after the isolation of guaianolides were rechromatographed on a Sephadex LH-20 column and, when eluting with methanol, the sesquiterpene acid parishin B (**1**, 38 mg) and the flavones cirsilineol (**2**, 260 mg) and 6-methoxytricin were isolated (**3**, 150 mg).

By rechromatography of intermediate eluates (6 g) of the ethyl acetate fraction on a column with Sephadex LH-20 and elution with methanol have been isolated the flavones diosmetin (**4**, 55 mg), luteolin (**5**, 550 mg) and diosmetin-7-*O*- β -*D*-glucopyranoside (**6**, 90 mg).

From the *n*-butanol fraction, rechromatography of mother solutions (1.5 g) of the cyclic polyol *D*-pinitol on a silica gel column, eluting with an ethyl acetate-methanol system in a ratio of 4:1, isolated the glycosylated flavone isoschaftoside (**7**, 330 mg).

Identification of isolated secondary metabolites was carried out by studying their spectral data (¹H and ¹³C NMR, as well as HSQC, HMBC) followed by comparison with those of the literature data for these compounds.

Compounds **1–7** have first isolated from *Artemisia juncea*.

This work was carried out with the support of the Budget Program for Fundamental Research of Academy of Science of Republic of Uzbekistan.

VOLATILE COMPOUNDS OF *Crataegus songarica*

D.R. Siddikov¹, Kh.M. Bobakulov¹, M.S. Zokirova²,
B.S. Okhundedaev^{1,3}, E.Kh. Botirov¹

¹*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences Republic of Uzbekistan, 100170, Tashkent, M. Ulugbek st., 77*

²*Tashkent Institute of Chemical Technology, Tashkent, A. Navoi st., 32*

³*National University of Uzbekistan by Mirzo Ulugbek, University st., 4*

Interest in essential oils as therapeutic agents is based on their biological activity. Volatile components of plants are successfully used in the treatment of respiratory diseases and have a pronounced antispasmodic and sedative effect. In this regard, studying the component composition of essential oils of plant raw materials and creating preparations based on them for medical practice are an urgent task for our country.

Previously, we studied pectins from *C. songarica* fruits [1]. This report presents the results of chromatography-mass spectral analysis of the component composition of essential oil obtained by hydrodistillation from the peel of the fruit of *Crataegus songarica* K. Koch. (*Rosaceae* family).

Essential oil from crushed air-dried raw materials was obtained by hydrodistillation for 3 hours using a glass flask and a Clevenger nozzle. The resulting essential oil was a pale yellow mobile liquid with a specific odor. The product was stored in a refrigerator at -4 °C until analysis.

The analysis of essential oil components was carried out on an Agilent 7890A GC gas chromatograph with an Agilent 5975C inert MSD quadrupole mass spectrometer as a detector. The separation of the mixture components was carried out on a quartz capillary column HP-5MS (30m250m0.25m) in the temperature regime: 50°C (2 min) - 10C/min up to 200°C (6 min) - 15C/min up to 290°C (15 min). The volume of the introduced sample is 1 l (hexane, benzene), the flow rate of the mobile phase is 1.3 ml/min. The components were identified based on a comparison of the characteristics of the mass spectra with data from electronic libraries (Wiley Registry of Mass Spectral Data-9th Ed., NIST Mass Spectral Library, 2011).

The main components of the essential oil of the fruit peel of *C. songarica* were 3,3-diethyldiaziridine (6.93%), heptan-3-ol (5.49%), heptan-1-ol (5.25%), pseudocumene (4.27%), palmitic acid (4.11 %), 1-ethyl-2-methylbenzene (3.94%), methyl palmitate (2.60%), heptan-2-ol (2.10%), heptanoic acid methyl ester (1.38%) and (+)-thujopsene (1.14%) .

This work was supported by application grant IL-59734673.

References

1. Zokirova M.S., Malikova M.Kh., Botirov E.Kh. *Khimiya Rastitel'nogo Syr'ya*, 2024, № 2, pp. 118–125. (in Russ.).

PHENOLIC COMPOUNDS *Crataegus songarica*

D.R. Siddikov¹, Kh.M. Bobakulov¹, M.S. Zokirova², E.Kh. Botirov¹

¹ Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences Republic of Uzbekistan, 100170, Tashkent, M. Ulugbek st., 77

²Tashkent Institute of Chemical Technology, Tashkent, A. Navoi st., 32

Crataegus is a genus of deciduous, rarely semi-evergreen tall shrubs or small trees belonging to the *Rosaceae* family, represented by more than 300 species, 10 of which grow in the mountainous and foothill regions of Uzbekistan. *Crataegus songarica* K. Koch is a shrub or small tree. In nature, the range of this species covers Central Asia, the western regions of China, Iran, Pakistan and Afghanistan. *C. songarica* grows in the middle mountain zone, among bushes, in river valleys and on the slopes of gorges.

Previously, we studied pectins from *C. songarica* fruits [1]. In this message we present the results of phytochemical studies of the peel of *C. songarica* fruits, collected in August 2022 on the Chatkal ridge of the Tashkent region.

To isolate metabolites, air-dried peels (6 kg) were extracted with methanol seven times at a raw material-extractant ratio of 1:6. The combined extracts were evaporated to dryness and the residue was mixed with KSK brand silica gel in a 1:1 weight ratio. The resulting amount was fractionated on a column by sequential elution with extraction gasoline, chloroform, ethyl acetate and n-butanol. As a result, 36.2 g of gasoline, 9.2 g of chloroform, 33.5 g of ethyl acetate and 98.7 g of n-butanol fractions were obtained.

The resulting chloroform fraction was separated on a chromatographic column with silica gel, and upon elution with extraction gasoline and its gradient mixture with ethyl acetate, protocatechuic acid (**1**) and (+)-catechol (**2**) were isolated.

By chromatography of the ethyl acetate fraction on a silica gel column in a chloroform-methanol gradient system, the flavonoids quercetin (**3**), isoquercitrin (**4**) and hyperin (**5**) were isolated.

Identification of isolated phenolic compounds was carried out by studying their spectral data (¹H and ¹³C NMR, as well as HSQC, HMBC) followed by comparison with literature data for the above compounds.

Compounds **1-5** were first isolated from the peel of *C. songarica* fruits of the flora of Uzbekistan.

This work was supported by application grant IL-59734673.

References

1. Zokirova M.S., Malikova M.Kh., Botirov E.Kh. *Khimiya Rastitel'nogo Syr'ya*, 2024, № 2, pp. 118–125. (in Russ.).

INTERNAL CONTROL SYSTEMS FOR PCR DIAGNOSTICS

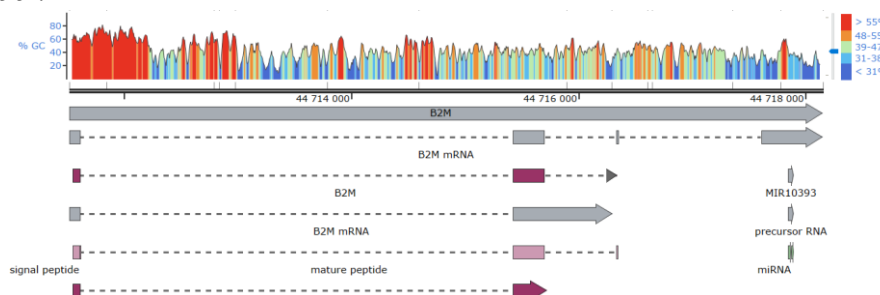
O. Alimuhammedova*, J. Abdurakhmanov, S. Ikramov, A. Baymirzayev, Kh. Nasriddinov, D. Mansurov, Sh. Azimova

S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Mirzo Ulugbek Str. 77, 100170, Tashkent, Uzbekistan

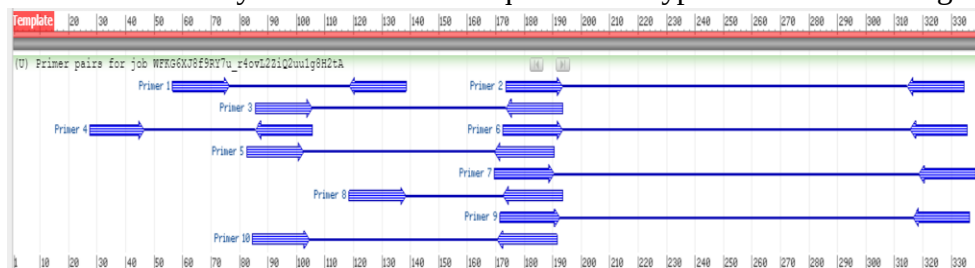
*Correspondence: orzu_gul.ali@mail.ru

Polymerase Chain Reaction (PCR) diagnostics have transformed molecular biology by enabling rapid and sensitive detection of nucleic acids. Internal controls in PCR diagnostics confirm nucleic acid quality and quantity, identify potential inhibitors, and provide a baseline for accurate quantification. Beta-2-Microglobulin ($\beta 2M$), a component of major histocompatibility complex (MHC) class I molecules, can be a candidate for internal control sample because of its consistent expression across various tissues and stable presence under different conditions. Its gene, located on chromosome 15, ensuring reliable detection in diverse sample types, including blood and tissue biopsies. In PCR assays, $\beta 2M$ is co-amplified with the target gene using specific primers, serving as a positive control to confirm the PCR reaction's success and sample purity. This is critical in clinical diagnostics, where precise detection of pathogens, viruses such as HBV, HCV and HIV, genetic mutations, or biomarkers is essential.

To address this, a comparative *in silico* analysis (Pic. 1) of $\beta 2M$ subtypes was conducted using NCBI data and software tools such as UGENE, BioEdit, SnapGene, and OligoAnalyzer. Ten pairs of oligonucleotides were designed using Primer3Plus (Pic. 2), targeting conserved regions with melting points of 60°C and G/C compositions of 45-60%. These oligonucleotides, 20-25 nucleotides in length, are the subject of a patent and confidential.



Picture 1. *In silico* analysis of nucleotide sequences subtypes of Beta-2-Microglobulin.



Picture 2. Designing oligonucleotides for Beta-2-Microglobulin as a PCR internal control.

STUDY OF CYTOTOXIC ACTIVITY OF COMPOUNDS BASED ON BICYCLIC QUINAZOLINE SULPHONYLUREAS

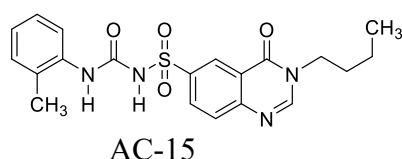
N.A. Tosheva, M.R. Umarova, U.B. Khamidova, G.A. Pyakina, S.M. Allabergenova, U.M. Yakubov, Sh. S. Azimova

Acad. S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, nika1705@bk.ru

One of the most important problem of the medicine is the investigation of effective cytotoxic compounds that can be used as drugs. In this study the cytotoxic activity of bicyclic quinazolinsulfonylureas has been studied (Fig. 1, Fig. 2, Fig. 3). The samples were tested for cytotoxicity *in vitro* on cells - epithelial cervical carcinoma HeLa and laryngeal adenocarcinoma Hep-2 (ATCC:CCL-23) using the MTT method [1]. The cisplatin (Cisplatin-Naprod, India) was used as a standard drug. The experiments were carried out in triplicate, then the obtained data were analyzed and statistically processed using Origin 8.6.

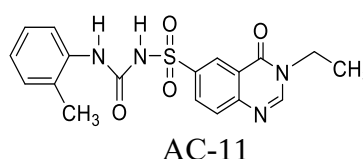
The compounds AC-15 (Fig. 1) (35.4 ± 0.1) and AC-11 (Fig. 2) (27.2 ± 0.5) showed the strong cytotoxic activity on the HeLa cervical carcinoma cell line. Compound AC-17 (Fig. 3) demonstrated weak cytotoxicity (25.3 ± 0.4) on the Hep-2 laryngeal adenocarcinoma cell line.

Figure 1



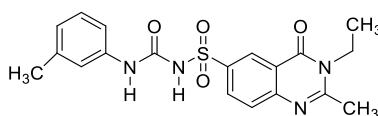
AC-15

Figure 2



AC-11

Figure 3



AC-17

In conclusion, compound AC15 showed higher cytotoxic activity because of of the large number of methyl groups on the aliphatic radical than compounds AC-11 and AC-17.

References:

Niks M., Otto M. Towards an optimized MTT assay// Journal of Immunological Methods, 1990, 130, p.149-151.

NEW ANTI-HSV NUCLEOSIDE ANALOGUES OF 1,2,4-TRIAZOLE-3-THIONE

Sobirdjan A. Sasmakov^{1*}, Jaloliddin M. Abdurakhmanov¹, Abdukhakim A. Ziyaev¹, Nigora A. Tosheva¹, Ilya V. Fateev², Irina D. Konstantinova², Shakhnoz S. Azimova¹, Anatoly I. Miroshnikov²

¹*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Mirzo Ulugbek Str. 77, 100170 Tashkent, Uzbekistan; sasmakov@web.de*

²*Shemyakin and Ovchinnikov Institute of Bioorganic Chemistry, Russian Academy of Sciences, Miklukho-Maklaya St. 16/10, 117997 Moscow, Russia*

1,2,4-Triazole derivatives have a wide range of biological activity. The most well-known drug that contains 1,2,4-triazole as part of its structure is nucleoside analogue ribavirin, an antiviral drug. The aim of this study was to biocatalytic synthesize ribosides and deoxyribosides of 1,2,4-triazole-3-thione derivatives and test their antiviral activity against herpes simplex viruses (HSV).

Three compounds from a series of mono- and disubstituted 1,2,4-triazole-3-thione derivatives were found to be substrates for *E. coli* purine nucleoside phosphorylase and using an enzymatic transglycosylation reaction a new 1,2,4-triazole-3-thione nucleosides with bulky substituents at positions 3 and 5 of the heterocyclic base were synthesized. The yields of disubstituted 1,2,4-triazol-3-thiones were low due to the effect of bulky substituents at the C3 and C5 positions on the selectivity of enzymatic glycosylation over one particular nitrogen atom in the triazole ring.

The antiviral activity of triazole derivatives and their nucleosides against the HSV type 1 of two strains has been studied. The results of cytotoxic and antiviral studies on acyclovir-sensitive wild-type strain HSV-1/L2(TK+) and acyclovir-resistant strain (HSV-1/L2/RACV) in *Vero E6* cell culture showed that the incorporation of a thiobutyl substituent into the C5 position of 3-phenyl-1,2,4-triazole results in a significant increase in the cytotoxicity of the base and antiviral activity. The highest antiviral activity was observed in 3-phenacylthio-1-(β -D-ribofuranosyl)-1,2,4-triazole and 5-butylthio-1-(2-deoxy- β -D-ribofuranosyl)-3-phenyl-1,2,4-triazole nucleosides with their selectivity index significantly higher than that of ribavirin. It was also found that with increasing lipophilicity of nucleosides, the activity and toxicity of tested compounds increase.

PURIFICATION OF RECOMBINANT ESCHERICHIA COLI URIDINE PHOSPHORYLASE BY ION EXCHANGE MEDIA

Jaloliddin Abdurakhmanov*, Dilmurodjon Turdaliyev, Sh. Khasanov, Galina Piyakina, Sobirdjan Sasmakov, Shakhnoz Azimova

S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Mirzo Ulugbek Str. 77, 100170, Tashkent, Uzbekistan

* Correspondence: jaloliddin0919@mail.ru; Tel.: +998 97157 9944;

Ion exchange chromatography (IEX) is used for purifying biomolecules based on their net surface charge differences. DEAE Sepharose Fast Flow is a popular IEX medium, featuring 90 μm agarose particles, and provides high chemical and physical stability, suitable for pharmaceutical production with flow rates up to 300 cm/h.

Bacterial glycosyltransferases, like *Escherichia coli* uridine phosphorylase (*EcUP*, EC 2.4.2.3), are crucial for synthesizing nucleoside analogues by attaching pentofuranose groups to nucleobases. It can also facilitate the synthesis of nucleosides from uracil or 5-fluoro-uracil (5-FU) and ribose-1-phosphate (Rib-1-P). Today, UP is being investigated as a potential treatment for cancer, viral infections, and bacterial infections.

The yeast *Pichia pastoris* is an effective expression system for large-scale recombinant protein production, often yielding higher protein levels compared to other systems, making it ideal for industrial applications.

This study aims to optimize chromatography conditions for isolating recombinant *Escherichia coli* uridine phosphorylase (*EcUP*, E.C. 2.4.2.3; UP; ~ 29 kDa) expressed in *Pichia pastoris*. The initial washing with 50 mM Tris-HCl at pH 8.5 (Buffer I) did not detect the enzyme in the eluate. The analysis of enzymatic activity was carried out according to the method described in [1]. Successful isolation was achieved using Buffer II (50 mM Tris-HCl, 400-450 mM NaCl, pH 8.5). Optimal conditions included a binding capacity of 38 mg/ml, flow rate of 160-250 cm/h, pH 8-8.5, and maximum pressure of 0.32 MPa.

The DEAE Sepharose FF sorbent step resulted in a $71\% \pm 3\%$ recovery rate of the recombinant enzyme, with a 25% loss, as measured by a Spectrophotometric enzyme activity assay.

References

1. D. Ubiali, S. Rocchietti, F. Scaramozzino, M. Terreni, A.M. Albertini, R. Fernández Lafuente, J.M. Guisàn, M. Pregnolato, Adv. Synth. Catal. 346 (2004) 1361–1366.

ALKALOIDS OF PLANTS OF THE GENUS *Convolvulus* GROWING IN UZBEKISTAN

D.B. Kadirova, S.F. Aripova

*Institute of Plant Chemistry of the Academy of Sciences of Uzbekistan, Tashkent, 77
Mirzo Ulugbek str., e-mail: salima_aripova@mail.ru*

We have studied the content of alkaloids in insufficiently studied plant species of the genus *Convolvulus*: *C. krauseanus*, *C. lineatus*, *C. fruticosus*, *C. arvensis*, *C. korolkovii*, growing in Uzbekistan. Alkaloids were isolated from plants by extraction with 85% ethanol. *Convolvulus lineatus* is a perennial herbaceous plant. We have studied the alkaloids of this plant, collected from 3 growing sites in the Ferghana region. From the obtained amounts of bases, the alkaloid kuskiggrin was isolated in the form of hydrochloride (m.p. 226-228°C), the alkaloid tropine was also found in the sum of alkaloids to TLC. The sum of alkaloids in the amount of 0.047% was obtained from *C. fruticosus*, from which the alkaloid kuskiggrin was isolated. Table. Alkaloids of plants of the genus *Convolvulus* of the flora of Uzbekistan

№	The type and organ of plant	Place of growth	Vegetation phase	The sum of alkaloids, %	Isolated alkaloids
1	<i>C. lineatus</i> , aerial part	Fergana region: Yerdon, Nanai, Yertosh	Rapid growth	0.054 0.04 0.05	Kuskiggrin Tropine
2	<i>C. fruticosus</i> , aerial part	Bukhara region	Blossom	0.047	-/-
3	<i>C. korolkovii</i> , aerial part	Bukhara region Jingeldi	Blossom	0.07	-/-
4	<i>C. arvensis</i> , aerial part	Tashkent region, Kizilchasoy	Rapid growth	0.05	Kuskiggrin
5	<i>C. krauseanus</i> aerial part	Ferghana region Boysun, Surkhandarya	-/- -/-	0.43 0.60	Convolvin, convolamin convolicin, phyllalbin convolidin convolin

The alkaloid tropine was found in the mixture of alkaloids according to TLC. *Convolvulus arvensis* is a herbaceous plant, choleric, cleansing agent. The aerial part contains 0.06% of the total alkaloids, in which, according to TLC data, the alkaloid cuskgygrin was found. The *C. korolkovii* contains 0.07% of the total alkaloids, in which, according to TLC data, the alkaloid kuskiggrin was found. Thus, the presence of these alkaloids in this plant species has been determined for the first time.

STEROLS FROM *Centaurea belangeriana*

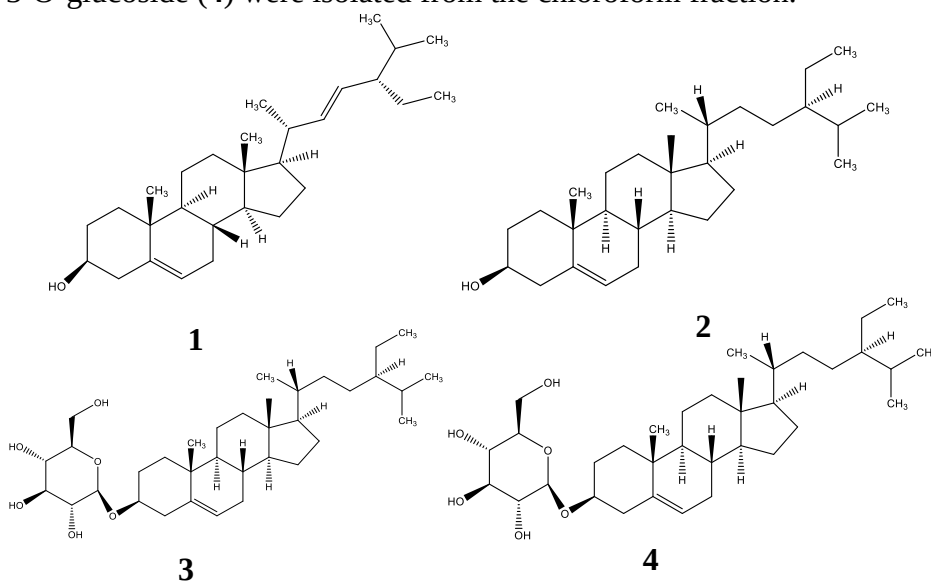
B.J. Komilov, Sh.Sh.Ergashev, K.A. Eshbakova

Institute of Chemistry of Plant Substances. acad. S.Yu. Yunusov Academy of Sciences of the Republic of Uzbekistan, 700170, Tashkent, M. Ulugbek Ave. 77, fax (99871) 120 64 75, e-mail: e_komila@yahoo.com

Centaurea belangeriana plants were collected on the mountain and foothill slopes of the Yakkabog district of the Kashkadarya region, and this species was named by O. Turgunov, a researcher at the Institute of Botany of the Academy of Sciences of Uzbekistan, by comparing the collected plants with the herbariums of the institute.

Crushed and air-dry raw material (20 kg) was extracted exhaustively with 70% alcohol at room temperature. The combined extracts were distilled in vacuo, the thickened residue was diluted with water (1:1) and shaken successively with extraction gasoline, chloroform, ethyl acetate, and n-butanol.

The ethyl acetate extract was chromatographed on a silica gel column in a chloroform-methanol (25:1-6:1) gradient system. As a result of chromatographic separation, eight compounds β -sitosterol (**1**), β -stigmasterol (**2**), stigmasterol-3-O-glucoside (**3**), β -sitosterol-3-O-glucoside (**4**) were isolated from the chloroform fraction.



Compounds 1-4 from *Centaurea belangeriana* isolated for the first time.

Many researchers have shown that β -sitosterol has a high antioxidant activity, activates apoptosis in leukemic cancer cell lines, and inhibits the expression of the Trx/TrxR1 protein.

FLAVONOIDS OF *Centaurea ugamica*

B.J. Komilov¹, Z.Yu. Atajanova², K.A. Eshbakova¹

1.S.Yu. Yunusov Institute of the Chemistry of Plant Substances Academy of sciences of the Republic of Uzbekistan st. Mirzo-Ulugbek, 77, 100170 Tashkent e-mail:

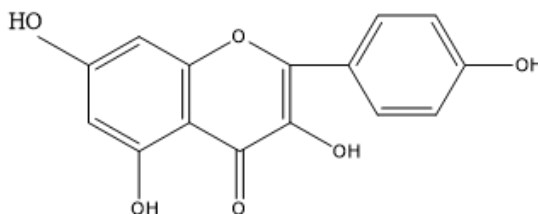
e_komila@yahoo.com

2.Urganch Branch of Tashkent Medical Academy

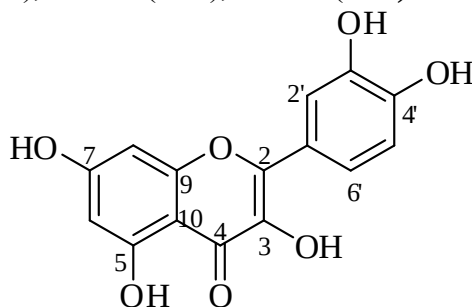
The chemical components of flavonoids of the aerial parts of *Centaurea ugamica* (*Asteraceae* family) growing in Uzbekistan were studied by column chromatographic methods, and the following compounds (kaempferol, quercetin) were isolated [1].

The isolated compounds were determined using ¹H and ¹³C NMR spectra, their structure was compared with the samples by physicochemical and spectral parameters (UV, IR and PMR).

Kaempferol (**1**), C₁₅H₁₀O₆, yellow crystals, mp 276–277°C (EtOAc). ¹H, NMR-spectra (600 MHz, DMSO, δ, ppm, J/Hz): 6.20 (1H, d, J = 2.0, H-6), 6.46 (1H, d, J = 2.0, H-8), 6.98 (2H, d, J = 8.5, H-3',5'), 8.10 (2H, d, J = 8.5, H-2',6'), 9.40 (1H, s, 4'-OH), 10.9 (1H, s, 3-OH).



Quercetin (**2**), C₁₅H₁₀O₇, mp 305–307 °C (EtOAc). ¹H NMR (600 MHz, DMSO δ, ppm, J/Hz): 7.71 (1H, d, J=1.8, H-2'), 7.53 (1H, dd, J = 1.8; 9.0, H-6'), 6.89 (1H, J = 9.0, H-5'), 6.40 (1H, d, J=2.4, H-8), 6.18 (1H, d, J=2.4, H-6), 12.48 (1H, 5-OH). ¹³C NMR (150 MHz, DMSO δ, ppm): 160.02(C-2), 135.68 (C-3), 176.79 (C-4), 160.68 (C-5), 98.13 (C-6), 163.85 (C-7), 93.30 (C-8), 156.10 (C-9), 102.96 (C-10), 121.90 (C-1'), 115.55 (C-2'), 145.02 (C-3'), 146.76 (C-4'), 115.02 (C-5'), 119.92 (C-6').



Kaempferol and quercetin were first isolated from *Centaurea ugamica*.

COUMARINS FROM *Ferula tadshikorum*

K.S. Juraev, B.J. Komilov, K.A. Eshbakova

Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances Academy of sciences
of the Republic of Uzbekistan st. Mirzo-Ulugbek, 77, 100170 Tashkent e-mail:
e_komila@yahoo.com

We investigated the chemical components of *F. tadshikorum* Resin (100 g) collected in the Bobotog mountains of Surkhandarya region. The air-dried resin was crushed and washed with extraction gasoline to remove ballast substances, then dissolved in alcohol. The alcohol solution of the resin was concentrated and chromatographed on a silica gel column, eluting with a solvent mixture of extraction gasoline: ethyl acetate (9:1→1:1). At the same time, 4 substances related to coumarins were isolated. The isolated compounds were identified using ^1H and ^{13}C NMR spectra, as well as comparison with authentic samples.

8-Methoxycoumarine ^1H NMR spectra (400 MHz, CDCl_3 , δ , ppm J/Hz): 6.27 (1H, d, J = 9.5, H-3), 7.08 (1H, d, J = 9.0, H-5), 7.11 (1H, d, J = 9.0, H-7), 7.18 (1H, t, H-6), 3.97 (3H, s, OCH_3). ^{13}C NMR (400 MHz, CDCl_3 , δ , ppm.): 163.21 (C-2), 114.17 (C-3), 144.56 (C-4), 110.21 (C-5), 111.75 (C-6), 109.71 (C-7), 151.02 (C-8), 151.22 (C-9), 114.12 (C-10) 57.78 (OCH_3).

8-Hydroxycoumarin ^1H NMR (400 MHz, CDCl_3 , δ , ppm. J/Hz): 6.47 (1H, d, J = 10, H-3), 6.80 (1H, d, J = 9.0, H-5), 7.02 (1H, d, J = 9.0, H-7), 7.18 (1H, t, H-6), 10.37 (1H, br.s. 8-OH). ^{13}C NMR (400 MHz, CDCl_3 , δ , ppm.): 162.21 (C-2), 114.10 (C-3), 144.16 (C-4), 110.22 (C-5), 111.07 (C-6), 109.81 (C-7), 161.02 (C-8), 151.53 (C-9), 114.30 (C-10).

Umbelliferone ^1H NMR (400 MHz, CDCl_3 , δ , ppm. J/Mz): 6.28 (1H, d, J = 9.5, H-3), 7.01 (1H, s, H-8), 7.11 (1H, d, J = 9.0, H-5), 7.17 (1H, d, J = 9.0, H-3), 7.73 (1H, d, J = 9.5, H-4). NMR ^{13}C NMR (400 MHz, CDCl_3 , δ , ppm.): 162.50 (C-2), 113.30 (C-3), 144.56 (C-4), 110.32 (C-5), 147.43 (C-6), 150.79 (C-7), 104.58 (C-8), 151.73 (C-9), 114.60 (C-10), 56.76 (OCH_3).

Scopoletin ^1H NMR (400 MHz, CDCl_3 , δ , ppm. J/Mz): 6.25 (1H, d, J = 9.5, H-3), 7.05 (1H, s, H-8), 7.11 (1H, s, H-5), 7.73 (1H, d, J = 9.5, H-4), 3.75 (3H, s, OCH_3). ^{13}C NMR (400 MHz, CDCl_3 , δ , ppm.): 162.50 (C-2), 113.30 (C-3), 144.56 (C-4), 110.32 (C-5), 147.43 (C-6), 150.79 (C-7), 104.58 (C-8), 151.73 (C-9), 114.60 (C-10), 56.76 (OCH_3).

The above coumarins from *F. tadshikorum* were isolated for the first time.

FATTY ACID ISOMERS AND ESSENTIAL OILS OF *Ferula* SPECIES GROWING IN UZBEKISTAN

D. T. Asilbekova¹, Kh. M. Bobakulov¹, G. Ozek², T. Ozek², A. M. Nigmatullaev¹

¹Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances, AS RUz,
100170, Tashkent, Uzbekistan, e-mail: dasil@rambler.ru

²Anadolu University, Faculty of Pharmacy, Department of Pharmacognosy, 26470,
Eskisehir, Turkiye

About 40 *Ferula* species (Apiaceae family) naturally grow in Uzbekistan. The aim of this research is to compare the fatty acids (FAs) and essential oils (EOs) of four *Ferula* species - *F. kuhistanica* Eug. Kor., *F. penninervis* Regel & Schmalh., *Ferula prangifolia* Korovin, and *F. tenuisecta* Korovin ex Pavlov belonging to the flora of Uzbekistan. Previous studies on lipids from representatives of the genus *Ferula* have shown that they consist of extraordinary FAs in leaves and fruit lipids and the EOs are rich monoterpenes or sesquiterpenes [1, 2].

GC-MS analysis of FA methyl esters and EO carried out on an Agilent 5975 GC-MSD gas chromatography mass-spectrometry (Agilent, USA; SEM Ltd., Istanbul, Turkiye) equipped with a polar HP-INNOWax FSC column (60 m × 0.25 mm × 0.25 μm). An Agilent 6890N GC chromatograph (SEM Ltd.) was used for GC-FID analysis. In parallel, EOs were analyzed on an Agilent 7890A GC/5975C Inert MSD instrument (Agilent Technologies, USA) over an HP-5MS column (30.0 m × 250.0 μm × 0.25 μm [1, 2].

The table data shows that in the FAs from fruit lipids of all four *Ferula* species, the main ones are the sum of (Z)-octadeca-6-enoic (18:1ω12) and (Z)-octadeca-9-enoic (18:1ω9) acids. The lipids from the leaves of *F. kuhistanica*, *F. tenuisecta* and *F. prangifolia* consisted of (Z,Z,Z)-hexadeca-7,10,13-trienoic acid (16:3ω3), which is a homologue of (Z,Z,Z)-octadeca-9,12,15-trienoic acid. Thus, *F. tenuisecta* and *F. kuhistanica* are rich in α-pinene and belong to the 16:3 plant group that preserved a discrete biosynthetic pathway to prokaryotic galactolipids during evolution.

Table. The main components of FAs and EOs of four *Ferula* species

Species	Organ	FAs	Eos
<i>F. tenuisecta</i> (16:3 plant)	Leaves	13.1% 16:3ω3	69.3% α-pinene
	Fruits	41.1% sum of 18:1ω9 and 18:1ω12	50.8% α-pinene
<i>F. kuhistanica</i> (16:3 plant) [1]	Leaves	9.4% 16:3ω3	72.9% α-pinene
<i>F. penninervis</i>	Fruits	53.6% sum of 18:1ω12 and 18:1ω12	26.2% β-pinene, 19.4% myrcene
<i>F. prangifolia</i> (18:3 plant) [2]	Leaves	0.4% 16:3ω3	18.3% spathulenol
	Fruit	39.3% sum of 18:1ω9 and 18:1ω12	20.8% α-cadinol, 13.1% δ-cadinene

References

1. D. T. Asilbekova, G. Ozek, T. Ozek, Kh. M. Bobakulov, K. H. C. Baser, Sh. Sh. Sagdullaev, *Chem. Nat. Compd.*, **55**, 993 (2019).
2. T. Asilbekova, G. Ozek, T. Ozek, Kh. M. Bobakulov, A. M. Nigmatullaev, Sh. Sh. Sagdullaev, *Chem. Nat. Compd.*, **58**, 217 (2022).

TRITERPENE GLYCOSIDE FROM THE *Astragalus atrovinosus*

F.A. Kengesbaeva, A.R. Khurramov, T.N. Kaypnazarov, Kh.M. Bobakulov, N.Sh. Ramazonov

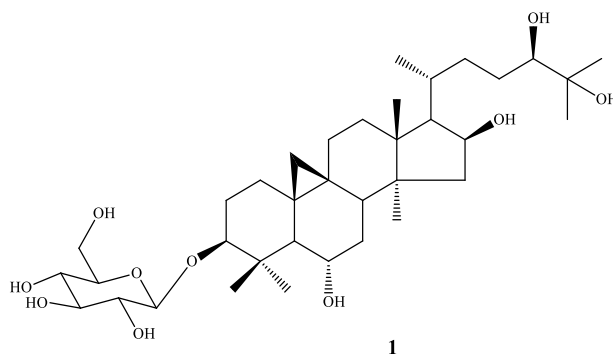
Acad.S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, 77, M. Ulugbek, str., 100170, Tashkent, Uzbekistan, E-mail: kturdibay1@mail.ru

As a promising source of biologically active compounds, representatives of the plant genus *Astragalus* belonging to the family of beans (family *Fabaceae*) are the topical objects of the study. *Astragalus* is the world's largest genus of perennial flowering plants, with about 2,500 species.

The object of the study was the aerial part of the plant of the species *Astragalus atrovinosus* Popov ex Baranov (Wine-red Astragalus), growing in the Bostanlyk district of the Tashkent region and collected in May 2023.

Ground air-dried aerial parts (2 kg) of *A. atrovinosus* were exhaustively extracted with methanol (5 x 10 L). The methanol extract was concentrated under reduced pressure to the consistency of syrup, and then a double volume of distilled water was added to the resulting mass. Residual amounts of methanol were evaporated and the resulting aqueous solution was first washed with chloroform and then with *n*-butanol. After evaporation of *n*-butanol, an amorphous mass (62 g) was obtained.

Then the amorphous mass was separated by column chromatography on silica gel. Column chromatography was carried out gradiently with an eluent solvent system of chloroform–methanol with a sequential change in the ratio of components - 9: 1 and 4: 1. Alexandroside I, previously described in the literature, was isolated using the column chromatography method.



Thus, based on the study of NMR spectra (^1H , ^{13}C , HSQC, HMBC, COSY), the chemical structure of the triterpene glycoside was established as 3-O- β -D-glucopyranoside-24S-cycloart-3 β ,6 α ,16 β ,24,25-pentaol.

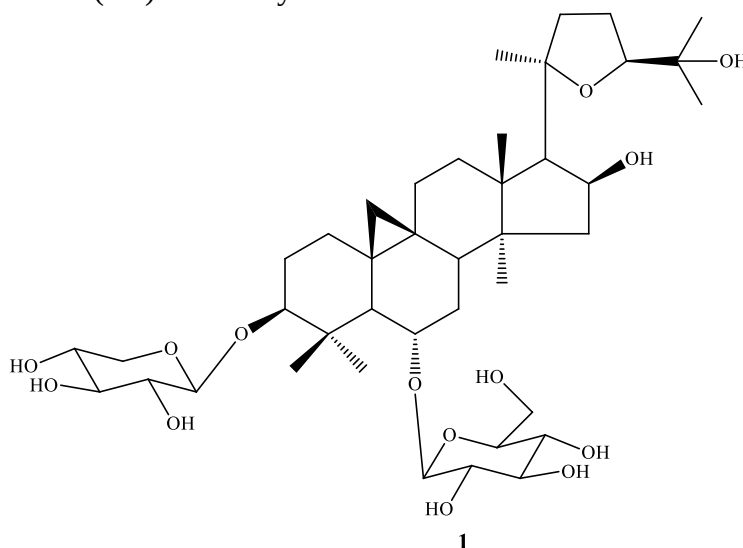
The work was carried out with financial support from the Budgetary Program for Basic Scientific Research of the Academy of Sciences of the Republic of Uzbekistan.

TRITERPENE GLYCOSIDE OF *Astragalus macronyx*

T.N. Kaypnazarov, A.R. Khurramov, F.A. Kengesbaeva, Kh.M. Bobakulov, N.Sh. Ramazonov

Acad.S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, 77, M. Ulugbek, str., 100170, Tashkent, Uzbekistan, E-mail: kturdibay1@mail.ru

In continuation of our research on cycloartane triterpenoids from plants of the genus *Astragalus*, we studied the plant *Astragalus macronyx* (Fabaceae). Ground air-dried aerial parts (1 kg) of *Astragalus macronyx*, collected in June 2023 in the Bostanlyk district of Tashkent region, were exhaustively extracted with methanol (5 x 5 L). The combined methanol extracts were concentrated to a syrupy mass. The condensed extract was diluted with twice the volume of water and extracted first with chloroform and then with n-butyl alcohol. The butanol extract was evaporated to dryness and obtained 48 g of the total extractive substances. The resulting amount was chromatographed on a silica gel column, eluting the column first with a chloroform-methanol (9:1) solvent system and then with a chloroform-methanol (6:1) solvent system.



By eluting the column with a chloroform-methanol system (6:1) was isolated cyclosiversioside F (**1**) (22 mg, 0.0022% yield, on air-dried raw material), which was identified based on the 1D (^1H , ^{13}C) and 2D spectra (HSQC, HMBC, COSY) NMR, as well as direct comparison with the true sample.

The work was carried out with financial support from the Budgetary Program for Basic Scientific Research of the Academy of Sciences of the Republic of Uzbekistan.

MEANS FOR PROTECTING WINTER WHEAT FROM *Schizaphis graminum* RONDANI

S.M. Turaeva, P.A. Nurmakhmadova, E.O. Rakhmatov, F. Zulpanov, N.O.

Panaeva, B.U. Ergashov

Acad. S.Y. Yunusov Institute of the Chemistry of Plant Substances Academy of Sciences of the Republic of Uzbekistan saidaicps@gmail.com

The global pest known as the greenbug, *Schizaphis graminum* Rondani, attacks all cereal crops. Aphids can directly cause yield losses (35–40%) by sucking sap from plants, or they can indirectly cause yield losses (20–80%) by spreading fungi and viruses.

Today, increasing the resistance of grain crops to aphids is one of the primary tasks of both science and practice. The most popular strategy for stopping the spread of pests that affect grain crops is chemical control. Despite the many negative consequences of their use notably on cereals, which have been established recently, chemical plant protection solutions will continue to be important in the future as a means of guaranteeing the preservation of yields with an increase in the threshold number of pests. In this regard, the task of further improving chemical control measures and searching for effective substances and developing rules for their use remain relevant.

The aim of our work was efficiencies of Nitrozol (a.s. 6-nitroquinoxolin-4-one) and ZF-1 (a.s. 3-ethylquinoxaline-4-one) against *S. graminum* in field. Nitrozol and ZF-1, which have insecticidal activity have been synthesized at the Institute of Chemistry of Plant Substances of the AS RUz. The insecticide Nurell-D 55% EC (AgroSciences, USA) was used as a standard at a consumption rate of 0.2 l/ha.

Our research trial was comprised of two experiments. In the first experiment, the effect of the suspension Nitrozol on the population of wheat aphids on variety of wheat Alexseich was studied. In addition, the synthesized compound based on quinoxolin-4-one and its derivatives exhibit effective insecticidal properties against pests of grain product [4]. In the second experiment, the effectiveness of ZF-1 was studied, in the third experiment, Nurell-D (a.s. 500 g of chlorpyrifos and 50 g of cypermethrin) against *S. graminum* during 2024 winter wheat. As a result of the field experiment, it turned out that the effectiveness of Nitrozol at a consumption rate of 0.2 kg/ha on the 7th day of crop treatment was 71.8%. On the 7th day, the biological effectiveness of ZF-1 at a consumption rate of 0.3 kg/ha against pests reached 75.2%, which was practically at the level of the Nurell-D insecticide, 0.2 kg/ha (76.6%).

The results of the study confirm the hypothesis that the synthesized quinoxaline 4-one derivatives can help reduce the population number of sucking pests of winter wheat.

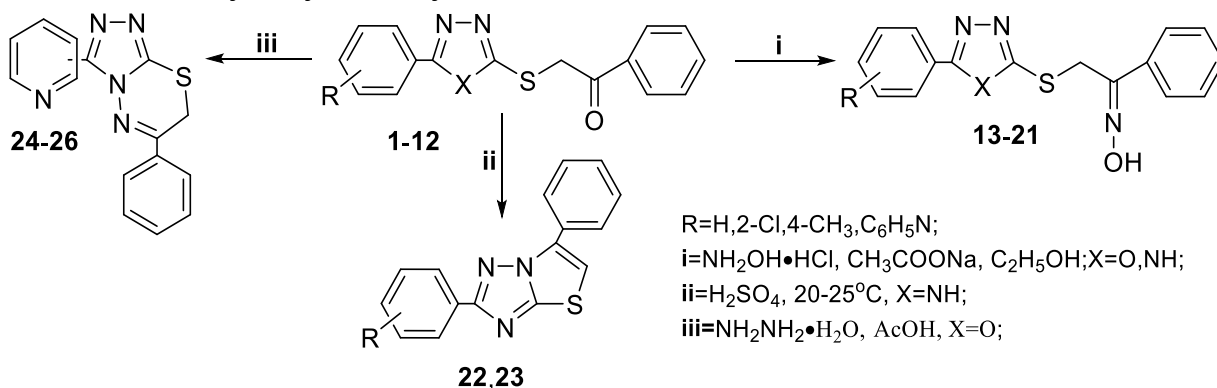
MODIFICATIONS OF 2-PHENACYLTHIO-5-ARYL-1,3,4-OXADIAZOLES AND 3-PHENACYLTHIO-5-(4H)-ARYL-1,2,4-TRIAZOLES

A.A. Ziyaev, I.F. Tozhiev, T.T. Toshmurodov

Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, e-mail: aziyaev05@rambler.ru

Among the numerous five-membered heterocycles, 1,3,4-oxadiazole-2-thiones and 1,2,4-triazole-3-thiones are of great interest to researchers, since their derivatives have a wide spectrum of biological activities [1].

In order to obtain new heterocyclic systems (compounds) with potential biological activity, we carried out heterocyclization reactions of 2-phenacylthio-5-aryl-1,3,4-oxadiazoles **1-9** and 3-phenacylthio-5-aryl-(4H)-1,2,4-triazoles **10-12**, as well as their interaction with hydroxylamine hydrochloride:



The resulting oxime derivatives are 1-aryl-2-((5-phenyl-4H-1,2,4-triazol-3-yl)thio)ethan-1-one oximes and 1-aryl-2-((5-phenyl-1,3,4-oxadiazol-3-yl)thio)ethan-1-one oximes **13-21**, bicyclic compounds - 2-aryl-6-phenyl-1,3-thiazolo[3,2-b][1,2,4]triazoles **22,23** and 3-(2,3,4-pyridyl)-6-phenyl-7H-[1,2,4]triazolo[3,4-b][1,3,4]thiadiazines **24-26** have good yields (78-92%) and are white crystalline substances, soluble in organic solvents. The structure of the synthesized compounds was confirmed by spectral (IR, ^1H and ^{13}C NMR) data. The presence of an oxime group in compounds **13-21**, a methine group in the molecules of compounds **22, 23** as well as a methylene group in compounds **24-26** make it possible to carry out further modifications of these compounds and study the biological activity of the newly obtained substances.

The work was carried out with financial support from the Budgetary Program for Basic Scientific Research of the Academy of Sciences of the Republic of Uzbekistan

Literature.

1. Tawfik S.S., Liu M., and Farahat A.A. (2020) Antiviral activity of thiadiazoles, oxadiazoles, triazoles and thiazoles. *Arkivoc*, part i, 180-218.

EFFECT OF NITRATING COMPOUNDS ON THE QUINOLINE ALKALOID ACETYLHAPLOPHYLIDINE

A.U. Ubaydullaev¹, Sh.N. Zhurakulov^{1,2}, V.I. Vinogradova¹, K.K. Turgunov^{1,3}
A.U. Aminboev⁴

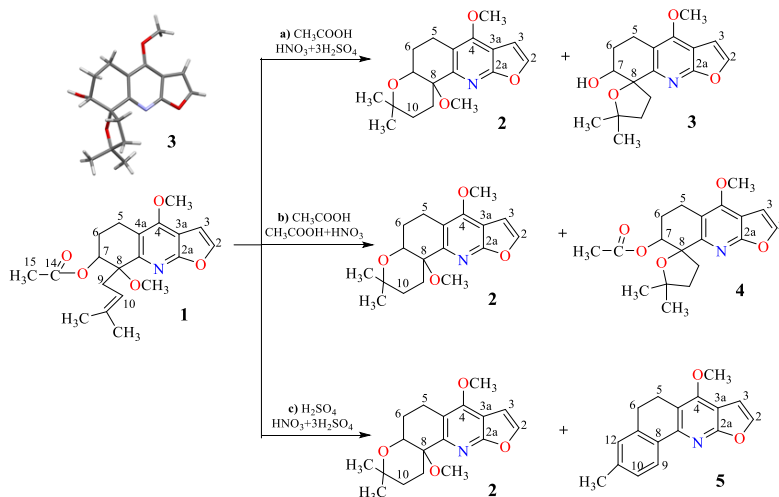
¹*Institute of the Chemistry of Plant Substances named after academic S.Yu.Yunusov*

²*National University of Uzbekistan named after Mirzo Ulugbek*

³*Turin polytechnic University in Tashkent, Tashkent 100095 Uzbekistan.*

⁴*Student of Urgench State University Tashkent, ubaydullayev-aziz@mail.ru*

Furo[2,3-b] quinoline derivatives, widely distributed in plants of the *Rutaceae* family, exhibit antimicrobial and cytotoxic activities. It is known from the literature that acetylhaplophyllidine alkaloid, which is a representative of this class, has the properties of improving the central nervous system and dilating blood vessels. Taking into account these activities of acetylhaplophyllidine, the effect of nitrating compounds under different conditions was studied. **Method(a):** Acetylhaplophyllidine alkaloid was dissolved in concentrated acetic acid and nitrating mixture ($\text{HNO}_3 + 3\text{H}_2\text{SO}_4$) was added while stirring. The reaction was carried out at 65°C for 4 hours. As a result of the reaction, a mixture of substances **2** and **3** was formed. **Method(b):** Substance **1** was dissolved in concentrated acetic acid and, while stirring, a nitrating mixture ($\text{HNO}_3 + \text{CH}_3\text{COOH}$) was added in a (1:1) ratio. The reaction was carried out at $65\text{--}70^\circ\text{C}$ for 5 hours. As a result of the reaction, a mixture of substances **2** and **4** was formed. **Method(c):** Concentrated H_2SO_4 was used as solvent. Nitrating mixture ($\text{HNO}_3 + 3\text{H}_2\text{SO}_4$) was added to the resulting solution in parts. The reaction was carried out at 65°C for 5 hours. As a result of the reaction, a mixture of substances **2** and **5** was formed. The progress of the reaction was monitored using the TLC method. The structure of the product was fully proven by ^1H and ^{13}C NMR spectroscopic and X-ray structural analysis methods.



REACTION OF THE QUINOLINE ALKALOID HAPLOPHYLIDINE WITH HYDROCHLORIDE OF MONOCHLOROACETIC ACID UNDER DIFFERENT CONDITIONS

A.U. Ubaydullaev¹, Sh.N. Zhurakulov^{1,2}, V.I. Vinogradova¹, K.K. Turgunov^{1,3}, A.U. Aminboev⁴

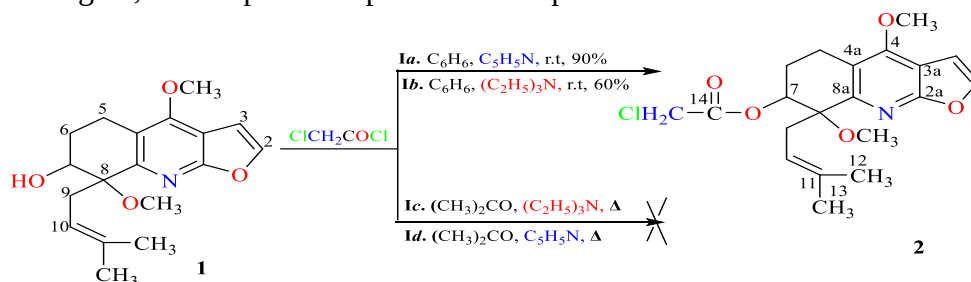
¹*Institute of the Chemistry of Plant Substances named after academic S.Yu.Yunusov*

²*National University of Uzbekistan named after Mirzo Ulugbek*

³*Turin polytechnic University in Tashkent, Tashkent 100095 Uzbekistan.*

⁴*Student of Urgench State University, Tashkent, ubaydullayev-aziz@mail.ru*

Quinoline alkaloids, belonging to the class of alkaloids, are of particular importance for their anti-tuberculosis, anti-malarial, anti-inflammatory, antibacterial and anti-cancer activities. Mefloquine (4-methanolquinoline derivative) and chloroquine (4-aminoquinoline derivative) have been used as antimalarial agents. Such a diverse activity of quinoline alkaloids led to a deeper study of quinoline alkaloids, to change them by introducing active functional groups. Taking this into account, the effect of solvents and catalysts in the acylation reactions of haplophylidine, belonging to the class of quinoline alkaloids, with monochloroacetic anhydride under different conditions was studied. **Method Ia:** 0.1 g (0.315 mmol) of haplophylidine was dissolved in 3 ml of benzene. Then 0.036 g (0.315 mmol), 0.025 ml of monochloroacetic acid chloride and 0.025 g (0.0315 mmol), 0.025 ml of pyridine (1:1:1) were added as a catalyst while stirring with a magnetic stirrer. The reaction was carried out with stirring at room temperature for 3 h and 90% yield of compound (4,8-dimethoxy-8-(3-methylbut-2-en-1-yl)-5,6,7,8-tetrahydrofuro[2, 3-β]quinolin-7-yl 2-chloroacetate) (**2**) was obtained. **Method Ib:** 0.1 g (0.315 mmol) of haplophylidine was dissolved in 3 ml of benzene and triethylamine, monochloroacetic anhydride was added in a (1:1:1) ratio. The reaction was carried out at room temperature for 5 h and product **2** was obtained in 60% yield. **In method Ic,** unlike the above methods, 0.1 g (0.315 mmol) of haplophylidine was dissolved in 3 ml of acetone and triethylamine was added in a (1:1) ratio. Then, while stirring, 0.036 g (0.315 mmol), 0.025 ml of monochloroacetic acid chloride was added. After adding monochloroacetic anhydride to the mixture, a partial precipitate formed. This method did not react at room temperature. Then the reaction was carried out at a temperature of 56°C for 6 hours, but no change was observed in the initial substances, that is, the reaction did not take place. **Method Id:** unlike **method Ic** above, pyridine was used as a catalyst, but no product was formed in this method either. The structure of the isolated substance was proved using IR, NMR spectroscopic and mass spectrometric methods.



ABOUT THE PHARMACOLOGICAL PROPERTIES OF VERALOSININE

Yu.R. Mirzaev

Institute of Chemistry of Plant Substances An. RUz, rahmanykh@rambler.ru

Veralosinine (V) is a steroidal alkaloid of the verazine series, isolated from the Veratrum plant. According to [1, 2], (V) previously had antitumor, antibacterial, fungicidal, emetic, antioedemic, antifungal and cardiotoxic properties. Pharmacological studies (V) in ICPS revealed activation of motor activity (MA), verticalization behavior, and attacks of tremor. In moderate doses, the tremor is more prolonged; in toxic doses, muscle weakness, continuous convulsions and death. LD₅₀ in mice with intravenous administration was 27 ± 6 , subcutaneous - 39 ± 11 and orally 77 ± 18 mg/kg. In acute experiments on anesthetized cats, there was no effect on blood pressure (BP) at a dose of 1 mg/kg. At a dose of 3 mg/kg, it reduced the frequency and increased the amplitude of heart contractions lasting 10-30 minutes. At a dose of 5 mg/kg with slow administration (5-10 minutes), blood pressure decreased to 20 mm hg. lasting 20-30 minutes while increasing the amplitude of contractions. With rapid administration, a sharp decrease in blood pressure, a decrease in heart rate, a decrease and deepening of breathing were observed, the duration of hypotension was 15-30 minutes. At a concentration of 10^{-6} on the isolated frog sartorius muscle, an increase in contraction force of up to 2 times was noted. (V) at concentrations of 10^{-6} - 10^{-5} g/ml increased the threshold for assimilation of the maximum imposed frequency of electrical stimuli in the isolated left atrium of a guinea pig: at a concentration of 10^{-6} g/ml from 480 ± 10 to 516 ± 10 imp/min (+7%), $3 \cdot 10^{-6}$ /ml from 480 ± 10 to 540 ± 11 (+10%), 10^{-5} g/ml from 480 ± 10 to 552 imp/min (+15%). Thus, (V) exhibited elements of a psycho-stimulating, cardiotoxic effect, and also increased the ability to assimilate the maximum frequency of assimilation of electrical stimuli to 15%, i.e. increased myocardial excitability, which is of interest in sick sinus syndrome.

REFERENCES

1. Суладзе Т.Ш., Вачнадзе В.Ю. //Исследование надземной части Veratrum/ Lobelianum, произрастающей в Грузии. //Химия природ. соедин., 2001, №4, с. 335–336.
2. Ivanova A/ Alkaloids derived from genus Veratrum and Peganum of Mongolian origin as multidrug resistance inhibitors of cancer cells// Serly J, Christov V.///Fitoterapia.-2011. V. 82 (4).-P. 570-575

HPLC ANALYSIS OF FLAVONOIDS IN WILD AND CULTIVATED SPECIES OF *Astragalus babatagi*

R.P. Zakirova^{1*}, E.R. Kurbanova¹, M.A. Agzamova¹, A.A. Janibekov², A.D. Matchanov³

¹ Acad. S. Y. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, e-mail: ranozakirova@mail.ru

² Alfraganus university

³ Acad. A.S. Sadykov Institute of Bioorganic Chemistry, Academy of Sciences of the Republic of Uzbekistan, Tashkent

Each year, the demand for plant-based medicinal products increases. Preserving biodiversity reserves has become a critical issue. One way to create a sustainable raw material base for the pharmaceutical industry is through the cultivation of medicinal plants.

Astragalus babatagi M. Pop, from the genus *Astragalus*, is an endemic species of the Fabaceae family. The objective of this study is to comparatively analyze the flavonoid composition of two samples of *A. babatagi* plants collected from their natural habitat (Surkhandarya region) and cultivated under the conditions of the Tashkent region. Quantitative differences in the phenolic metabolites of the studied samples were identified. The major components in both samples were apigenin, quercetin, and rutin. A significant difference was noted in the content of gallic acid between the wild and cultivated species.

Extraction was carried out twice using 70% ethanol at 70-75°C for 3 hours with intensive stirring and an overall solvent-to-plant ratio of 99:1. The extracts were filtered, and the solutions were combined. A 1 ml aliquot was taken and diluted with 9 ml of a solvent system consisting of acetonitrile and buffer (acetate) in a 70:30 ratio (1 mg/ml). The solution was centrifuged and filtered through a membrane filter.

The HPLC analysis was performed using an Agilent Technologies 1260 system. The mobile phase was acetonitrile-buffer solution (30:70) in isocratic mode. The pH was set to 2.92 for 20 minutes. The injection volume was 5 µl, and the mobile phase flow rate was 0.75 ml/min. The column used was an Eclipse XDB-C18, 5.0 µm, 4.6x250 mm. Detection was carried out using a diode-array detector (DAD) at wavelengths of 254 nm, 320 nm, and 381 nm. The analysis was conducted using isocratic elution and a diode-array detector. The mobile phase consisted of acetonitrile and buffer solution, and the studies were performed in the spectral range from 200 to 400 nm.

As a result of the study of extracts from the aerial parts of wild and cultivated *A. babatagi* using HPLC, it was established that in addition to the previously identified rutin and quercetin, luteolin, apigenin, norwogonin-7-O-β-D-Glcp, hypolaetin and its 7-O-D-Glcp, and gallic acid were identified for the first time in this species.

SYNTHESIS AND BUTYLATION OF BENZOPYRIMIDINE-4-THIONE

F.A. Zulpanov¹, S.S. Egamberdiyev², A.O. Nasrullayev², D.M. Ruziboev¹,
B.Zh. Elmuradov¹

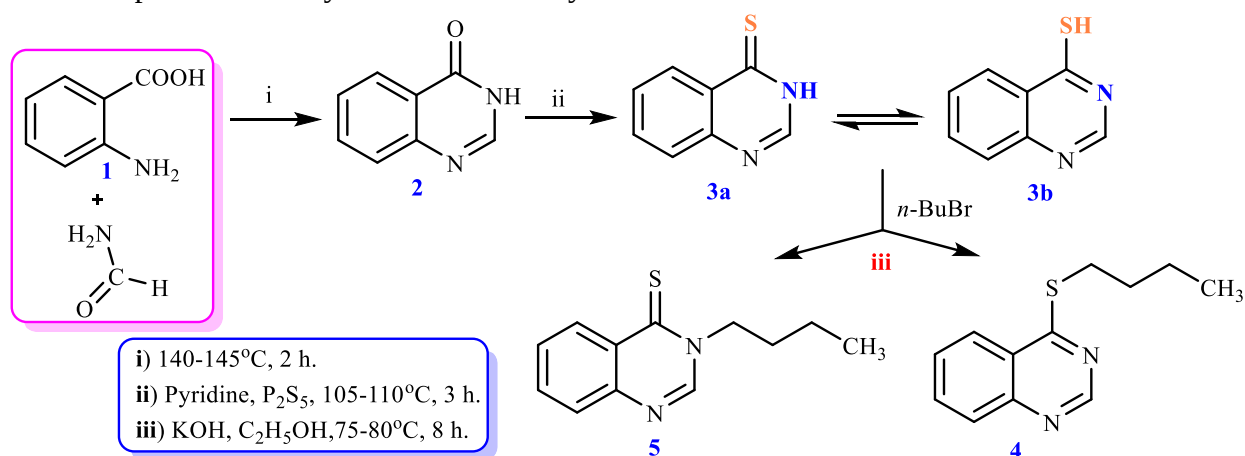
¹S. Yunusov Institute of Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Mirzo-Ulugbek Str., 77, 100170, Tashkent, Uzbekistan.

E-mail: zulpanovf@gmail.com

²Sharof Rashidov Samarkand State University, e-mail: nasrullayev1@gmail.com

Many substances with a condensed pyrimidine ring are widely used as inhibitors of harmful substances involved in a large number of biochemical processes. Benzopyrimidin-4-one compounds with an amide bond have a high activity to bind to the active center and stop their activity due to their specific physicochemical molecular parameters. Currently, the widely used inhibitors have been described as substances with a successful effect against glaucoma, epilepsy, duodenal ulcer, mountain sickness and nervous diseases [1].

In the course of research, an efficient and convenient synthesis method of benzopyrimidin-4-one (**2**) is cyclization of o-aminobenzoic acid (**1**) and formamide (yield 98%). Benzopyrimidine-4-one (**2**) was thionated by P₂S₅, purified from excess starting materials in ethanol, benzopyrimidine-4-thione (**3a**) and benzopyrimidine-4-thiol (**3b**) tautomeric products was synthesized in 96% yield:



The resulting compound **3a** and **3b** were reacted with butyl bromide and *S*-butyl: 4-(butylthio)quinazoline (**4**) and *N*-butyl: 3-butylquinazoline-4(3H)-thione (**5**) were synthesized, which separated by column chromatography.

The obtained substances were recrystallized in ethanol. The structure of the synthesized substances confirmed by physical research methods as IR-, ¹H and ¹³C NMR spectroscopy.

Reference

1. Cohen M.H., Johnson J.R., Chen Y.F., Sridhara R., Pazdur R. (2005) FDA drug approval summary: erlotinib (Tarceva) tablets. *Oncologist*; 10:461–466 p

CARBOHYDRATES OF THE AERIAL PARTS OF PLANTS

Capparis spinosa

A.A.Siddikova, F.A. Kodiraliyeva, R.A. Botirov, N.B. Bekmurzayeva, A.A.Azamatov,
A.Z.Sadikov, Sh.Sh.Sagdullaev

*Institute of Plant Chemistry named after academician S.Yu. Yunusov, Academy of
Sciences of the Republic of Uzbekistan, Tashkent, e-mail: fatimahon.82@ mail.ru,
(99)971-09-84*

Previously, the buds and fruits of *Capparis spinosa* plants were studied. As a result of the study, the presence of alcohol-soluble sugars, water-soluble polysaccharides, pectin substances and hemicelluloses was established.

The toxicity level of the sum of water-soluble polysaccharides obtained from the buds and immature fruits of the *Capparis spinosa* plant and its properties such as the effect on the central nervous system, anti-inflammatory, antihypoxic, antioxidant, analgesic, serum glucose and cholesterol levels were studied and positive results were obtained in experiments by scientists from the Department of Pharmacology and Toxicology.

We have studied carbohydrates of the above-ground parts of this plant for the first time. As a result of the study, it was established that alcohol-soluble sugars obtained by extraction of the above-ground part of the *Capparis spinosa* plant are represented by hexose - glucose, ketosugars fructose and sucrose. The yield of water-soluble polysaccharides was 6.5%. The isolated polysaccharides are amorphous beige powders, well soluble in water, giving color with iodine solution, which indicates the presence of starch-type glucan in the studied raw material.

Galactose and arabinose were identified in the monosaccharide composition of water-soluble polysaccharides. The yield of pectin substances was 3.1%. Pectin substances are amorphous white powder, well soluble in water. A solution of pectin substances with iodine gives a barely noticeable blue coloration that quickly disappears. It has been shown that the monosaccharide composition of pectin substances is represented by galacturonic acid, galactose, arabinose and, in small quantities, xylose. The yield of hemicellulose from the aboveground part of the plant was 4.5%. Hemicelluloses isolated from this plant are an amorphous powder of light brown color, insoluble in water, but soluble in dilute alkalis.

As a result of chromatographic analysis, the presence of glucuronic acid, galactose, arabinose, xylose, and smaller amounts of glucose was established in the composition of hemicelluloses. Pectin substances and hemicellulose are also characterized by the presence of arabinose and xylose. This is typical for hemicellulose, the basis of which is xylans.

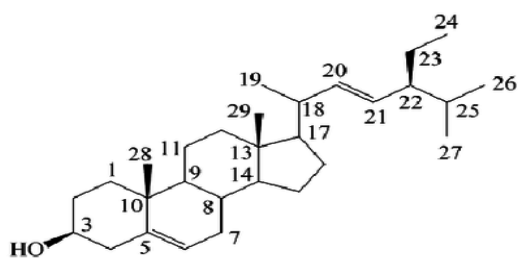
STEROLS OF *Cousinia maracandica*

A.F. Hamidov, A.R. Khurramov, N.Sh. Ramazonov

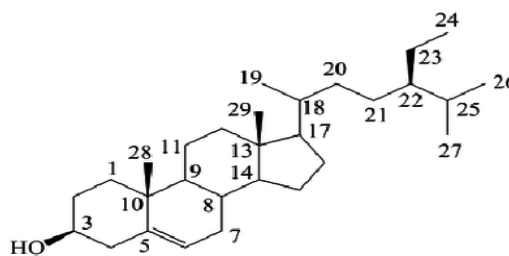
Institute of the Chemistry of Plant Substances, Academy of Sciences of Uzbekistan, 77, Mirzo Ulugbek str., 100170, Tashkent, Uzbekistan. E-mail: abdullokhon@mail.ru

Cousinia (Asteraceae family) includes about 700 species worldwide. They are mainly distributed in Central, South, and Western Asia. 137 species are found in the flora of Uzbekistan. The plant species *Cousiniamaracandica* is endemic to the flora of Uzbekistan. Few studies have been conducted on the chemical composition and biological activity of this plant. Therefore, studying the chemical composition, structures, and their dependence on the biological activity of this plant is one of the most difficult issues.

1 kg of dried aerial part of *C. maracandica* was crushed into 1-2 cm size, extracted in methanol (96%), and 142 g (14.2%) of dark mass was obtained. This thick mass was separated into fractions with chloroform (45 g) and ethyl acetate (64 g). As a result of the separation of the substances in the chloroform fraction by column chromatography with silica gel (solvent system benzine-ethylacetate, 15:1), two phytosterols were isolated.



Stigmasterol (1)



β-Sitosterol (2)

Their structure was determined by NMR spectroscopy, including 1D and 2D spectra, and it was revealed that they are stigmasterol (1) and β-sitosterol (2). These substances were isolated from *C. maracandica* for the first time.

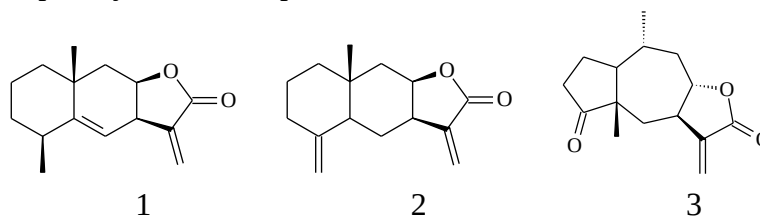
The work was carried out with financial support from the Budgetary Program for Basic Scientific Research of the Academy of Sciences of the Republic of Uzbekistan.

CHEMOTYPIC DIFFERENCE OF SESQUITERPENOIDS OF THE AERIAL PART OF *Inula helenium* FLORA OF UZBEKISTAN

D.E. Dusmatova, R.F. Mukhamatkhanova, Kh. M. Bobakulov,
I.D. Sham'yanov, N.D. Abdullaev

*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz,
Tashkent, M. Ulugbek st., 77, fax (99871) 1206475, e-mail: doctor.dusmatova@mail.ru*

Inula helenium L. has a very wide distribution area. It was previously established that the aboveground part of the West Siberian population of elecampane produces alantolactone (1) and isoalantolactone (2). However, it is known that the qualitative and quantitative composition of the produced metabolites depends on the place of growth, which is due to different environmental conditions. Due to the fact that the population of *I. helenium* growing in Uzbekistan has not been studied, this report presents the results of a study of the aerial part of *I. helenium* collected during the flowering period on the Chatkal ridge of the Tashkent region. From the chloroform fraction of the ethanol extract of the aerial part of this plant using the CC method on silica gel, along with eudesmanolides 1 and 2, linear-type pseudoguaianolide (3) was first isolated from *I. helenium* in the form of colorless needle-shaped crystals with m.p. 144-145°C.



^1H NMR (600 MHz, CDCl_3 , δ , ppm, J/Hz): 1.03 (3H, s, H-15), 1.09 (3H, d, $J = 6.1$, H-14), 1.42 (1H, dd, $J = 11.7$, H-9a), 1.52 (1H, dd, $J = 11.8, 14.8$, H-9b), 1.57-1.67 (2H, m, H-6a, H-10), 1.88-1.98 (2H, m, H-2a, H-6b), 2.10 (1H, m, H-1), 2.17 (1H, ddd, $J = 9.2, 10.7$, H-2b), 2.44 (1H, m, H-3a), 2.50 (1H, m, H-3b), 2.81 (1H, sextet, $J = 2.7, 5.9$, H-7), 4.28 (1H, dddd, $J = 3.0, 9.4, 2.8, 11.8$, H-8), 5.51 (1H, d, $J = 3.19$, H-13a), 6.18 (1H, d, $J = 3.52$, H-13b). ^{13}C NMR (75 MHz, CDCl_3 , δ , ppm, J/Hz): 20.1 (C-15), 22.2 (C-14), 24.3 (C-9), 29.7 (C-10), 34.6 (C-6), 35.3 (C-2), 44.2 (C-3), 44.9 (C-1), 48.8 (C-5), 50.1 (C-7), 80.9 (C-8), 120.2 (C-13), 140.4 (C-11), 169.99 (C-12), 222.8 (C-4).

According to a comparative analysis of spectral characteristics with literature data, lactone 3 was identified as a graveolide. It is possible that the population growing in Uzbekistan is a new chemotype of *I. helenium*.

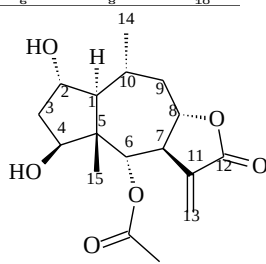
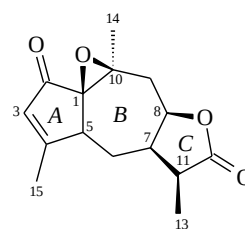
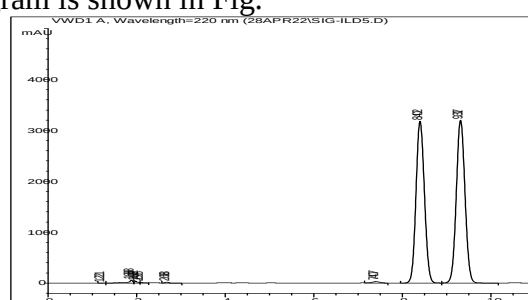
SESQUITERPENE LACTONES OF FLOWERS *Inula britannica* OF FLORA OF UZBEKISTAN

D.E. Dusmatova¹, R.F. Mukhamatkhanova¹, V.V. Uzbekov², Kh. M. Bobakulov¹,
I.D. Sham'yanov¹, N.D. Abdullaev¹

1) Akad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz,
Tashkent, M. Ulugbek st., 77, fax (99871) 1206475, e-mail: doctor.dusmatova@mail.ru

2) Akad. A.S. Sadykov Institute of the Bioorganic chemistry AS RUz, Tashkent, M.
Ulugbek st., 83

Column chromatography of the chloroform fraction of the ethanol extract of *Inula britannica* flowers collected on the Chatkal ridge yielded eluates containing a complex mixture of secondary metabolites. In this regard, work was carried out to separate the components of these eluates using HPLC. The analysis was performed on an Agilent 1100 chromatograph (Agilent Technologies Inc., USA) equipped with a G1311A 4-gradient pump, a G1322A 1260 series degasser, a gradient mixer, a G1314A variable wavelength detector (VWD) and a Rheodyne 7725i manual loop injector (Rheodyne, USA). Column Supelco Ascentis C18 4.6 x 250 mm in isocratic mode. At the first stage of the analysis, the optimal mobile phase was found - 30% acetonitrile-water. The resulting chromatogram is shown in Fig.



1

2

According to the HPLC chromatogram, there are two main components. The HPLC method was used to separate these components. One of the components, according to spectral characteristics (¹H NMR, ¹³C NMR), is identified as inulonolide (1). The second one corresponds to the structure of 6α-acetoxy-2α,4β-dihydroxy-1,7α,8,10β(H),15β(CH₃)-pseudoguai-11(13)-ene-8,12-olide (2 - flexuosin A).

The sesquiterpene lactones inulonolide and flexuosin A were isolated for the first time from plants of the genus *Inula* L.

AMINO ACID COMPOSITION OF BEAN PROTEIN *Psoralea drupacea*

Sh. Kh. Rakhimova, L.G. Mezhlumyan, R.F. Mukhamatkhanova, I.D. Sham'yanov

*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, Tashkent,
M. Ulugbekst., 77, fax (99871) 1206475, e-mail: doctor.dusmatova@mail.ru*

Determination of the protein content in *Psoralea drupacea* beans was carried out after preliminary mineralization of the sample with sulfuric acid, followed by determination of protein nitrogen using the photolorimetric method with Nessler's reagent at a wavelength of 400 nm. The analysis showed that the protein content in the meal is 24.7%. The amino acid composition was determined by synthesizing FTC (phenylthiocarbamyl) derivatives of free amino acids according to the method of Steven A. and Cohen Daviel. Identification of FTC amino acids was carried out on an Agilent Technologies 1200 chromatograph on a 75x4.6 mm Discovery HS C18 column. Solution A: 0.14M CH₃COONa + 0.05% TEA pH 6.4, B:CH₃CN. Flow rate 1.2 ml/min, absorption 269 nm. Gradient % V/min: 1-6%/0-2.5 min; 6-30%/2.51-40 min; 30-60%/40.1-45 min; 60-60%/45.1-50 min; 60-60%/50.1-55 min. The results of amino acid analysis are presented in Table 1.

Table 1

Amino acid composition of proteins from *Psoralea drupacea* beans

Name of amino acids	Concentration mg/g	%
Aspartic Acid + Asparagine	73,36156	7,3
Glutamic Acid + Glutamine	112,8783	11,3
Serine	53,43249	5,3
Glycine	30,47994	3,0
Cysteine	98,73536	9,9
Threonine*	27,65442	2,8
Arginine*	3,962981	0,4
Alanine	27,67177	2,8
Proline	52,52805	5,2
Tyrosine	32,02775	3,2
Valine*	46,25592	4,6
Methionine*	5,645915	0,6
Histidine*	40,44079	4,0
Isoleucine*	31,11943	3,1
Leucine*	73,22520	7,3
Phenylalanine*	24,88731	2,5
Lysine* HCl	23,66447	2,4

Note: * - essential amino acids

As a result of the studies, a high protein content in beans was revealed - 24.7% with the presence of a set of amino acids, including essential amino acids.

FATTY ACID COMPOSITION OF *Psoralea drupacea* BEAN OIL OF UZBEKISTAN FLORA

N.K. Yuldasheva, S.Z. Nishanbaev, R.F. Mukhamatkhanova, I.D. Sham'yanov

*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUZ,
Tashkent, M. Ulugbek st., 77, fax (99871) 1206475, e-mail: doctor.dusmatova@mail.ru*

The resulting oil is an oily liquid of brown color with a slightly reddish tint with a specific taste and pleasant odor. Below, in Tables 1 and 2, the characteristics of the resulting oil from *Psoralea drupacea* beans are given.

Table 1. Characteristics of *Psoralea drupacea* fruit oil

Index	Content
Oil yield, %	16.4
Acid number of lipids, mg KOH/g	1.76
Refractive index at 20°C	1.5285
Iodine number, g J/100 g	93.78
Unsaponifiables, %	3.12
Carotenoids, in lipids, mg%	208.27
Carotenoids, in unsaponifiables, mg%	284.11

Table 2. Fatty acid composition of *Psoralea drupacea* fruit oil, % by weight

Fatty acid	Content	Fatty acid	Content
Caproic acid, 6:0	0.16	Linoleic acid, 18:2n6	31.70
Caprylic acid, 8:0	0.14	Linolenic acid, 18:3n3	9.17
Capric acid, 10:0	0.79	Arachidic acid, 20:0	0.45
Lauric acid, 12:0	0.05	Eicosenoic acid, 20:1n9	0.23
Myristic acid, 14:0	0.13	Eicosatrienoic acid, 20:3n3	0.44
Pentadecanoic acid, 15:0	Сл.	Behenic acid, 22:0	0.20
Palmitic acid, 16:0	10.91	Lignoceric acid, 24:0	0.24
Palmitoleic acid, 16:1	0.13	∑ saturated fatty acids	16.75
Stearic acid, 18:0	3.68	∑ unsaturated fatty acids	83.25
cis-Oleic acid, 18:1n9	40.31	∑ monounsaturated fatty acids	41.31
trans-Oleic acid, 18:1n9	1.27	∑ polyunsaturated fatty acids	41.94

Table data 2 show that the fatty acids of *Psoralea drupacea* bean oil consist of 18 components. The content of essential biologically active fatty acids is: linoleic acid (omega 6-18:2n6) – 31.70%, linolenic acid 18:3n3 – 9.17%, eicosatrienoic acid 20:3n3 – 0.44%. Studies have shown that *Psoralea drupacea* beans are a good source of biologically active essential fatty acids.

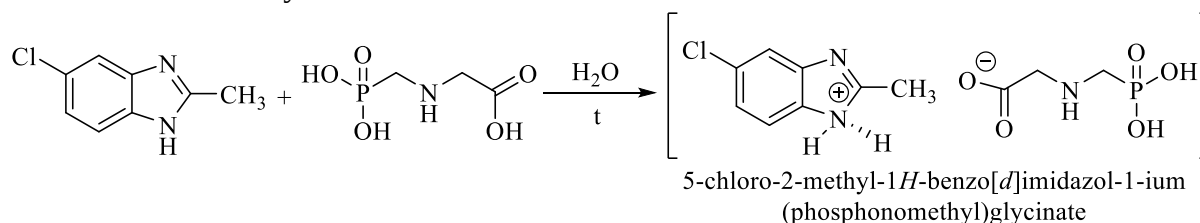
OBTAINING A HIGHLY EFFECTIVE HERBICIDE

Rakhmatov E.O., Saidov S.S., Juraev B.B., Abdurazakov A.Sh., Elmuradov B.J.

S. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, Mirzo-Ulugbek str., 77

Since the biological activity of nitrogen-containing heterocyclic compounds has a wide range of effects, they are almost the first among other organic compounds in terms of production volume due to the wide range of applications [1]. Scientists from different countries have identified a wide range of biologically active substances based on benzimidazole derivatives, which are widely used in medicine, animal husbandry and plant protection [2]. Among them, 2-methyl-5-chloro benzimidazole was used as a herbicide at the rate of 7-8 kg/ha. But today, due to the high rate of consumption, the preparations used as herbicides cannot compete with other types of herbicides in the market economy and are environmentally harmful.

In this work, 2-methyl-5-chlorobenzimidazole was chosen as the object of research and its reaction with N-(phosphonomethyl)-glycinic acid, which is currently used as a herbicide in agricultural fields at doses of 3-4 kg/ha, was carried out in order to increase its herbicide efficiency:



It is known from the literature that the initial substances as a base are almost insoluble in water, and from the interaction of these substances, an easily soluble salt in water, 5-chloro-2-methyl-1H-benzo[d]imidazol-1-yl-(phosphonomethyl)glycinate was obtained. The results of the biological test showed that 5-chloro-2-methyl-1H-benzo[d]imidazol-1-ium-(phosphonomethyl)glycinate compared to the starting substances (2-methyl-5-chloro benzimidazole and N-(phosphonomethyl)-glycinic acid) it was found that it exhibits high herbicidal activity against monocotyledonous and dicotyledonous weeds even when the norm is low.

References

1. Abdurazakov A.Sh, Saidov S.S, Okmanov R.Ya., Kubaev Sh.Kh., Elmuradov B.J. *Egypt. Jour. Chem.* 2021, 5(64), 2247 – 2252.
2. Rakhmatov E.O., Yuldoshev Sh.U., Abdurazakov A.Sh. *Universum: chemistry and biology*, 2023, 1(103), P. 40-44.

PHYSICO-CHEMICAL ANALYSIS OF 5-CHLORO-2-METHYL-1H-BENZO[d]IMIDAZOLE-1-IUM (PHOSPHONOMETHYL) GLYCINATE

Abdurazakov A.Sh., Rakhmatov E.O., Juraev B.B., Saidov S.S.

S. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, Mirzo-Ulugbek str., 77
e-mail: elyor-raxmatov@mail.ru

The solubility of 5-chloro-2-methyl-1H-benzo[d]imidazol-1-yl (phosphonomethyl)-glycinate (**3**) in water at room temperature was found to increase by 274 and 52 times, respectively, compared to the solubility of individual components **1** and **2** (Table 1).

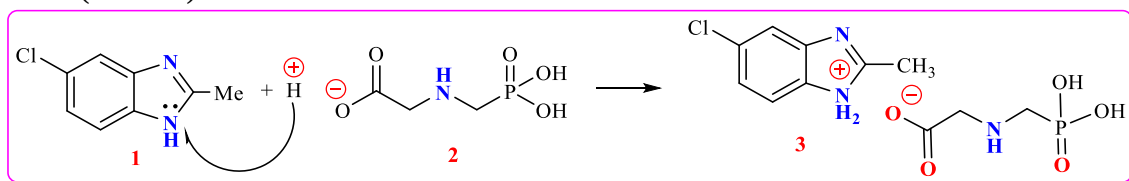
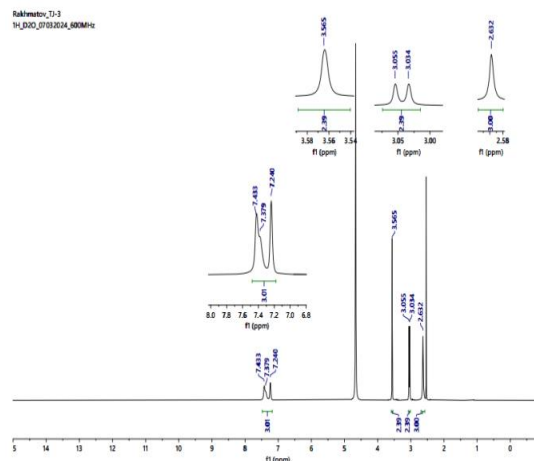


Table 1

№	Compound	Amount of water (mL), 25°C	Amount of dissolved substance in water, g
1	2-Methyl-5-chlorobenzimidazole (1)	100	0.23
2	N-(Phosphonomethyl)glycine (2)	100	1.2
3	5-Chloro-2-methyl-1H-benzo[d]imidazol-1-yl (phosphonomethyl)-glycinate (3)	100	63

^1H NMR-spectrum (600 MHz) analysis of the quaternary salt (**3**), formed as a result of the reaction was performed. In the ^1H NMR spectrum of the resulting quaternary salt (**3**), aliphatic protons belonging to the benzimidazole ring in the strong field as the main chemical shifts (CS) at 2.63 ppm (CH_3) in singlet form, aliphatic protons belonging to **2** at 3.04 ppm (CH_2) and 3.56 ppm (CH_2) in the form of a doublet and a singlet, respectively, the aromatic



protons of the benzimidazole ring (4,6,7-H (ArH)) appear in the weak region appears as a multiplet at 7.24-7.43 ppm.

It should be noted that the ^1H NMR spectrum was obtained in water, which confirms that indeed a quaternary salt is formed between **1** and **2**. This facilitates the use of the drug.

DETERMINATION OF THE AMOUNT OF FLAVONOIDS QUERCETIN-3-O-SOPHOROSIDE AND KAEMPFEROL-3-O- SOPHOROSIDE IN THE DRY EXTRACT OF WRINKLED ROSE PETALS BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY

Alimujiang.Abulizi^{1*}, R.M. Xalilov¹, Bo Zhao², Sh.Sh. Sagdullaev¹

¹ Acad. S. Yu. Yunusov Institute of Chemistry of Plant Substances, AS of UzR, Mirzo
Ulugbek St., 77, Tashkent Sh., 100125 (Uzbekistan)

² State Key Laboratory Basis of Xinjiang Indigenous Medicinal Plants Resource
Utilization, Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of
Sciences, Urumqi 830011, China; *E-mail: atux@ms.xjb.ac.cn

Wrinkled Rose - *Rosa rugosa* Thunb. (Rosaceae family) flavonoids in the extract obtained using 70% ethyl alcohol were cleaned in XAD-16N brand adsorption resin, and then the quercetin-3-O-sophoroside and kaempferol-3-O-sophoroside flavonoids in the dried extract were quantitatively determined. The possibilities of performing the analysis by high-performance liquid chromatography (HPLC) method were studied. The tests were performed on a high-pressure pump chromatograph with a variable wavelength UF detector and a Shim-pack GIST C18 (4.6 × 250 mm, 5 micron) column chromatograph (Shimadzu). During chromatography, the sample was injected at room temperature with a column temperature of 30 °C and an injection volume of 5 ml. UF detection was performed at a wavelength of 360 nm. The ratio of solvents shown in the table was used as the mobile phase.

Table. Proportions of mobile phase solvents over time

t/min	A% (0.2% aqueous solution of formic acid)	C%(atsetonitril)
0	8	1
38	8	1
40	8	1
50	8	1
55	5	9

Preparation of solutions of quercetin-3-O-sophoroside and kaempferol-3-O-sophoroside standard samples was carried out as follows: 150 mg of quercetin-3-O-sophoroside and kaempferol-3-O-sophoroside standard samples were dissolved in methanol in a 50 ml flask. Then the solution was brought to the mark of the required volume.

The obtained results showed that quercetin-3-O-sophoroside has a standard linear relationship between 0.02 mg/ml ~ 0.2 mg/ml injection volume: ($y=5765435.8X+5998.2$), $r = 0.9991$; kaempferol-3-O-sophoroside has the following standard linear relationship in the injection volume range from 0.025 mg/ml to 0.25 mg/ml: ($y=5269733.2X+5887.8$), $r=0.9995$.

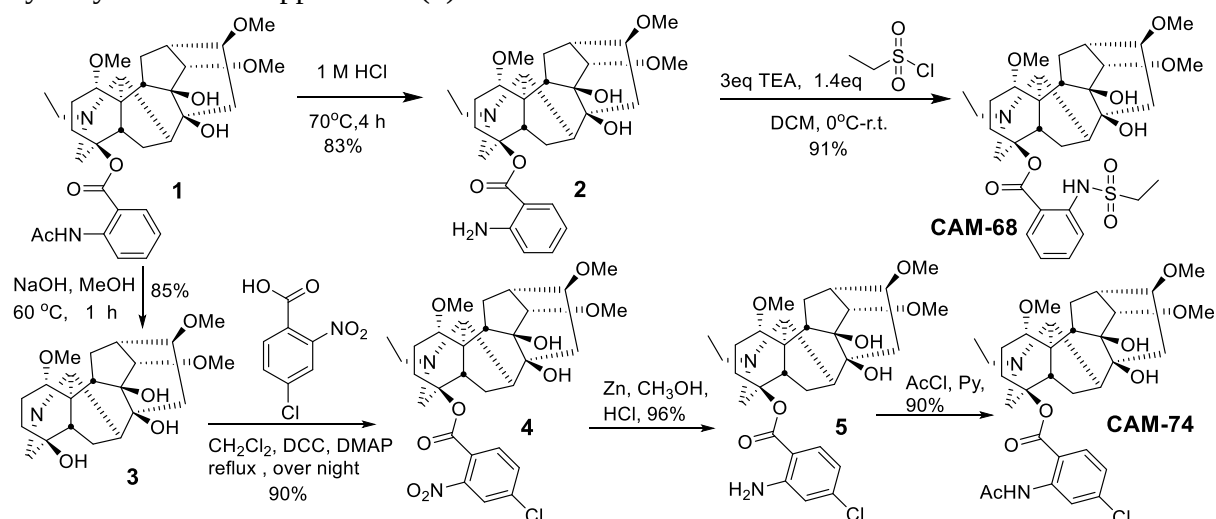
CHEMICAL MODIFICATION OF LAPPACONITINE ALKALOID

E.A. Baynazarov¹, Sh.Sh. Sagdullaev¹, Sh.N. Zhurakulov^{1,2}, S.A. Safarova¹

¹*S.Yunusov Institute of the Chemistry of Plant Substances.*

²*Mirzo Ulugbek National University of Uzbekistan. Email: ebaynazarov46@gmail.com*

Nowadays, the search for antiarrhythmic drugs in a series of diterpene alkaloids (DA) and their derivatives, differing in the nature and location of functional groups in the lycotectonin, heterothysine and perhydrophenanthrene skeletons is relevant. Industrial technology and all regulatory and technical documentation are being developed for these compounds to obtain permission for extensive clinical trials. It is known that acid hydrolysis of lappaconitine (1) leads to N-deacetylappaconitine (2), and alkaline hydrolysis leads to lappaconine (3).



To obtain substances CAM-68 we acylated N-deacetylappaconitine (2) with ethanesulfonyl chloride at a temperature of 0-5 °C in anhydrous methylene chloride.

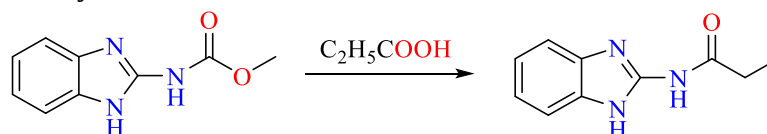
To obtain substances CAM-74 we alkaline hydrolysis of lappaconitine (1) obtained lappaconine (3), which was carried out by esterification of lappaconine (3) with 4-chloro-2-nitrobenzoic acid and the reduction of the nitro group of compound (4) by the amine group (5) and subsequent acylation formed the product CAM-74.

SYNTHESIS AND OPTIMAL TECHNOLOGY FOR THE PRODUCTION OF BIOLOGICALLY ACTIVE AMIDES IN THE SERIES OF BENZIMIDAZOLES

Kubayev Sh.Kh, Saidov S. S, Abdurazakov A.Sh, Karimov R.K, Elmuradov B.Zh.

*Acad. S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, Mirzo-Ulugbek str., 77
e-mail: kubayevshoxrux1992@mail.ru*

It is known that the synthesis of heterocyclic compounds is of great importance in the field of organic chemistry, including benzimidazole derivatives, which are widely used in medicine and animal husbandry against parasitic diseases. Below, the reaction of benzimidazole derivative - 2-methoxycarbonylamino benzimidazole with propionic acid, and the method of obtaining acetamizole substance was applied [1]. The reaction was carried out at 135-145°C for 14 hours and N-(1H-benzimidazol-2-yl)-propionamide was synthesized in 78.5% yield:



One-factor experiments were conducted to determine the optimal conditions for obtaining N-(1H-benzimidazol-2-yl)-propionamide, and based on the obtained results, the influence of a number of factors on the reaction process was studied. Based on the selected factors, a mathematical model was created, and the main variability levels and intervals for them were presented in the table.

Factor levels and range of variation

Level limits of influencing factors	Affecting factors			Yield, %
	X ₁ °C	X ₂ Time	X ₃ mol ratios	
The top step	145	16	1/8	81.4
The middle step	140	14	1/7	78.5
The bottom step	135	12	1/6	58.7
Difference of limits	5	2	1	-

X₁ – temperature, °C; X₂ – duration of reaction, time; X₃ – substance ratios (mol:mol).

The results of calculation of the constructed mathematical model show that temperature is the main factor influencing the process of formation of N-(1H-benzimidazol-2-yl)-propionamide.

Reference

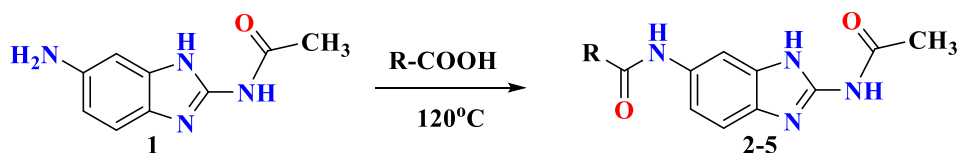
Abdurazakov A.Sh., Saidov S.S., Okmanov R.Ya., Kubaev Sh.Kh., Elmuradov B.Zh. *Egyptian Journal of Chemistry*, 2021. Vol. 64, No. 5. P. 2247 - 2252.

SYNTHESIS OF BIOLOGICALLY ACTIVE DIAMIDES OF BENZIMIDAZOLE SERIES

Kubayev Sh.Kh, Saidov S.S, Kurbonova E.R,
Nurmakhmadova P.A, Abdurazakov A.Sh.

*Acad. S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, Mirzo-Ulugbek str., 77
e-mail: kubayevshoxrux1992@mail.ru*

World scientists have identified a wide range of biologically active substances based on benzimidazole derivatives, which are widely used in medicine, animal husbandry and plant protection. Due to the fact that the biological activity of nitrogen-containing heterocyclic compounds has a wide range of effects, they are almost the first among other organic compounds in terms of production volume due to the wide range of applications. Below thermal acylation reactions of N-(5-amino-1H-benzimidazol-2-yl)-acetamide, which is product of reduction of N-(5-nitro-1H-benzimidazol-2-yl)-acetamide, with carboxylic acids were carried out:



R= CH₃ 64.3% (2), CH₂CH₃ 83.2% (3), CH₂CH₂CH₃ 86.7% (4), CH₂CH(CH₃)₂ 89.8% (5)

The structure of the synthesized compound was confirmed by IR, ¹H NMR spectra. In addition, the inhibitory and growth-promoting activities of the synthesized substances were studied in the "Biology of Medicinal and Technical Plants" laboratory of the Institute of Chemistry of Plant Substances. The substances were tested in the concentrations of 0.1%, 0.01%, 0.001% on the seeds of the "Grom" variety of wheat and the seeds of the "Orzu" variety of cucumber.

As a result of the experiments, it was observed that the substance inhibits the growth of the root and stem parts of plants at a concentration of 0.1%. When the concentration was reduced to 0.01%, the inhibition of the root part of wheat was 84.7%, the stem part was 94.7%, and in cucumber seeds, these indicators were 48% and 86.6%. It can be concluded that diamide (compound 5) has the highest (100%) effect according to its inhibitory properties.

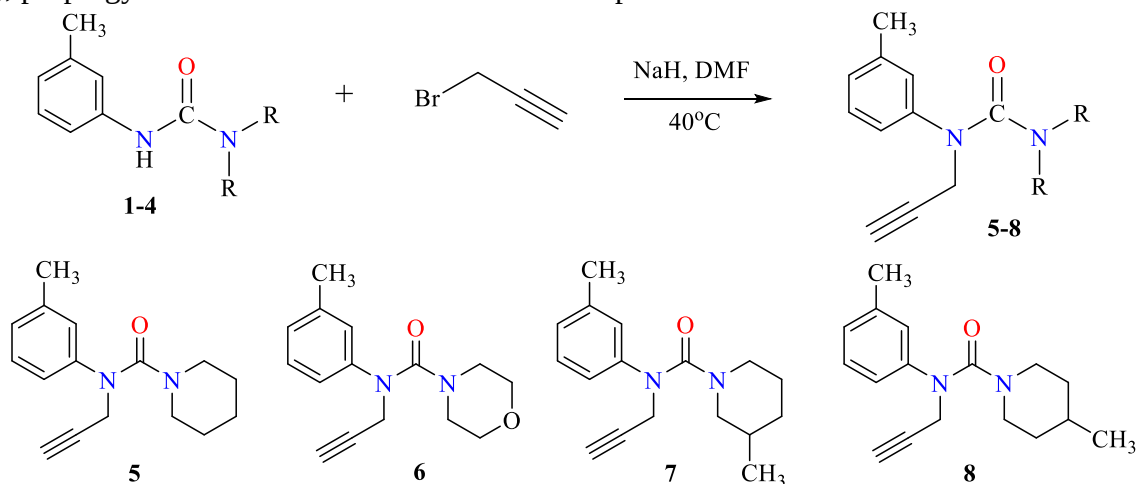
SYNTHESIS OF N-PROPARGYL DERIVATIVES OF 1,3-UNSYMMETRICAL UREAS

G. N. Kudratov, I. S. Ortikov, B. Zh. Elmuradov

*Acad.S. Yunusov Institute of the Chemistry of Plant Substances AS RUz,
100170, Uzbekistan, Tashkent, Mirzo-Ulugbek str., 77.*

Currently, the increasing resistance to drugs of various diseases requires the creation and development of new biologically active substances. It is known from the literature that substituted ureas are important raw materials for the synthesis of heterocyclic compounds. In addition, there are many medicinal compounds among urea derivatives. Derivatives of substituted urea are used to treat high blood pressure, complications of diabetes, rheumatoid arthritis, and kidney disease [1]. Therefore, the synthesis of urea derivatives and the development of convenient methods of their chemical modification are important issues.

For propargylation of 1,3-unsymmetrical ureas the mixture of N-(*m*-tolyl)piperidine-1-carboxamide (1), N-(*m*-tolyl)morpholine-4-carboxamide (2), 3-methyl-N-(*m*-tolyl)piperidine-1-carboxamide (3) and 4-methyl-N-(*m*-tolyl)piperidine-1-carboxamide (4), propargyl bromide in a DMFA solution in the presence of NaH are mixed at 40°C:



Reaction products (5-8) were isolated by extraction method and obtained in high yields (5-78%, 6-74%, 7-83%, 8-78%). The structure of substances was proved by IR, ¹H, ¹³C NMR spectra. Currently, biological activities are being studied.

We thank for financial support of the Ministry of Higher Education, Science and Innovations of Uzbekistan (Grant № F-FA-2021-408).

Reference

1. Sushma P.Y., Pooventhiran T., Adamilli V., Dharmarpu V., Katta E., Ahmad I., Renjith T. *Biointerface Research in Applied Chemistry*, 2022, Vol. 12, Issue 3, pp. 3996 – 4017.

COMPONENTS OF STAMENS AND PETALS OF *Crocus sativus* INTRODUCED IN THE JIZZAKH REGION OF UZBEKISTAN

Sh.R. Makhmudova¹, Kh.M. Bobakulov¹, B.S. Okhundedaev¹, S.Z. Nishanbaev¹,
Yuanfeng Wu²

¹Acad. S.Yu.Yunusov Institute of the Chemistry of Plant Substances AS RUz, Tashkent, Mirzo Ulugbekst, 77, e-mail: sabir78@rambler.ru

²School of Biological and Chemical Engineering, Zhejiang University of Science and Technology, Hangzhou, Zhejiang, China, e-mail: wuyuanfeng@zju.edu.cn

Among the crocus species, the *Crocus sativus* L. (sown saffron) is considered the most valuable due to the unique coloring of its flowers, aroma, color and taste of the dry stigmas of the flowers, used as a valuable spice. The stigmas are also used as a food coloring and in medicine. In folk medicine, saffron is recommended as a sedative, soporific, mild antidepressant and mental enhancer, as well as for the prevention and treatment of a number of other diseases.

The *Crocus sativus* flower consists of purple tepals (petals), yellow stamens and three redstigmas. Each fresh flower weighs about 300–500 mg, and the fresh stigmas weigh about 25–47 mg, so it takes about 200,000 flowers to produce 1 kg of the spice. Saffron spice production results in numerous by-products, as only 15 g of the spice can be obtained from 1 kg of flowers, indicating that more than 90% of the saffron flower material is eventually discarded as biowaste.

The aim of this work is a phytochemical study of the volatile components of the flower stamens and petals of *Crocus sativus* introduced in the Jizzakh region. Volatile components of the stamens and petals of *Crocus sativus* (essential oil (EO) components) were obtained by hydrodistillation from air-dried raw materials for 3 hours using a glass flask and Clevenger nozzle.

The obtained EO were analyzed on an Agilent 5975C inert MSD/7890 AGC chromatograph mass spectrometer. The mixture components were separated on an Agilent HP-INNO Wax quartz capillary column (30 m × 250 µm × 0.25 µm). The components were identified based on a comparison of the mass spectral characteristics with the data of the W9N11.L electronic library and a comparison of the retention indices (*RI*) of the compounds, determined by the ratio of the retention times of a mixture of n-alkanes (C₉–C₃₂).

The analysis showed that the main components of the EO of the petals are the following compounds: furfural (8.9%), safranal (4.6%), 2(5H)-furanone (35.2%), phenylethyl alcohol (1.7%), palmitic acid (13.0%).

As a result of the analysis of the composition of the stamen essential oil, it was established that the dominant components are: benzaldehyde (2.7%), 2-phenylacetaldehyde (2.1%), saffronal (1.9%), 2(5H)-furanone (6.3%), phenylethyl alcohol (30.7%), palmitic acid (5.8%).

The chemical composition of the volatile components of the flower stamens and petals of *Crocus sativus* does not differ sharply; they are practically identical in composition, but differ in content.

This work was carried out with financial support from the budget of the Academy of Sciences of the Republic of Uzbekistan.

ON THE PHARMACOLOGICAL ACTIVITY OF DITERPENOID ALKALOIDS N-DEACETYLRANACONITINE, SEPTEFINE AND N-ACETYLSEPACONITINE

F.M.Tursunkhodzhaeva, A.A.Azamatov, A.Z.Sadikov, Sh.Sh.Sagdullaev

Institute of Chemistry of Plant Substances named after academician S.Yu.Yunusov the Academy of Sciences of the Republic of Uzbekistan email: azizbek.azamatov@bk.ru

Pharmacological activity of diterpenoid alkaloids N-deacetylranaconitine, septefine and N-acetylsepaconitine has been investigated. The local anesthetic effect of the substances was studied using the Rainier method on the cornea of rabbits.

Calcium chloride arrhythmia was induced in white nonlinear rats weighing 180-250 g by intravenous (into the jugular vein) rapid (1 sec) administration of 100 mg/kg calcium chloride (0.1 ml of 10% solution per 0.1 kg of animal body weight). The antiarrhythmic activity of the presented samples was assessed on the model of aconitine arrhythmia in male rats weighing 170-280 g. Only animals having signs of persistent heart rhythm disturbance under the influence of aconitine were selected for each group. The criterion for the sample's effectiveness was the weakening of arrhythmia phenomena with subsequent gradual restoration of the ECG rhythm.

The study of analgesic and anti-inflammatory activity was carried out in the hot plate and acetic writhing tests. Spasmolytic activity was evaluated *in vitro* using Magnus method on the rabbit's small intestine.

In *in vitro* experiments, N-deacetylranaconitine (*Aconitum septentrionale*) in concentrations of 5×10^{-6} - 10^{-4} g/ml reduces the tone, decreases the amplitude of contractions of the rabbit's small intestine and prevents by 10-95% spasm caused by barium chloride (EC_{50} - 2×10^{-5} g/ml). The alkaloid has a pronounced local anesthetic effect, the effective concentration for terminal anesthesia of the rabbit's cornea is 0.25%, exceeding lidocaine. The alkaloid has an analgesic effect when administered subcutaneously to mice. The ED_{50} of analgesic effect is 8.6 mg/kg.

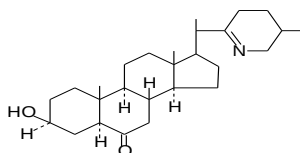
Septefine (*Aconitum septentrionale*) introduced into the rabbit eye in 0.1%, 0.25% and 0.5% solutions after 10.8 and 6 minutes, respectively, led to the corneal anesthesia lasting more than 2 hours. In activity and duration of terminal anesthesia, septefine surpasses cocaine, but the rate of anesthesia was less. In activity and duration of local anesthetic action, septefine surpasses novocaine and lidocaine. In intraperitoneal administration to mice at a dose of 2-5 mg/kg, septefine increases the pain threshold to thermal irritation (hot plate test) by 1.5-2 times. At a concentration of 10^{-5} - 5×10^{-5} g/ml it reduces tone, decreases the amplitude of a rabbit small intestine contraction, suppresses by 30-60% the spasm caused by barium chloride and aconitine.

N-acetylsepaconitine (*Aconitum leucostomum*) has a pronounced local anesthetic and analgesic effect. In introduction of 0.1-0.2 ml of 0.25, 0.5, 1% solutions of N-acetylsepaconitine into the rabbit's eye, corneal anesthesia lasts more than 2 hours. The alkaloid is not inferior to cocaine in local anesthetic activity and surpasses it in the duration of terminal anesthesia. In local anesthetic activity with infiltration and trunk anesthesia methods, the drug surpasses novocaine and lidocaine. In experiments on mice, intraperitoneal administration of the alkaloid at doses of 3-5 mg/kg leads to a 1.5-2-fold increase in the threshold of thermal pain stimulation (hot plate test).

ABOUT M-CHOLIN-BLOCKING ACTIVITY OF PETILINE

Yu.R. MIRZAEV

Institute of Chemistry of Plant Substances of the Academy of Sciences of the Republic of Uzbekistan, rahmanysh@rambler.ru



Petiline alkaloid isolated from the *Retilium Raddeanae* plant by R. Shakirov [1]. Brutto formula is C₂₇H₄₃N₀₂. The chemical name is 22,26-imino, 3-hydroxycholestanone. Molecular mass 413.

Pharmacological studies of petiline (P) have shown that at a dose of 5.0 mg/kg i.v. it causes activation of motor activity (LA) and reflex excitability. The LD₅₀ values in white mice were i.v.-49(41÷59). with s.c. administrations - 98 (81÷118), and orally - 178 (147÷213) mg/kg. In anesthetized cats in doses of 0.1-1.0 mg/kg (P) began to increase blood pressure levels and increased heart contractions without affecting the frequency and amplitude of breathing. The comparative M-anticholinergic activity (P) and atropine was studied graphically (according to Schild), the activity of the latter was assessed as the reference (100%). In experiments on the heart (M2-) and salivary gland (M3-), carbacholine was administered at a maximum tolerated dose of 0.02 mg/kg i.v., and on the isolated intestine (M4-) (A. Roffel 1989), carbacholine was administered at a concentration of 10⁻⁷ g/ml, giving maximum spasm. The ED₅₀ of atropine antagonism to carbacholine bradycardia was 0.012 mg/kg i.v.; and in experiments with-(P) 0.036 mg/kg, i.e. 33% of the activity of atropine; ED₅₀ in isolated intestine was 10⁻⁹ g/ml or 3% of the activity of atropine. Antagonism (P) to the salivatory effect of carbacholin in anesthetized rats was manifested at a dose exceeding 5.0 mg/kg i.v. (0.1% of the activity of atropine). The ratio of M-anticholinergic action on the heart (M2-), on the isolated intestine (M4-) and on the salivary gland (M3-) was approximately the ratio of numbers 300:30:1. (Y.R. Mirzaev et al., 1998; 2004). [2], [3].

REFERENCES.

1. Р.Шакиров и др/Особенности мускаринолит. активности типичного стероидного алкалоида петилина//Программа и тезисы Респ.науч.конферен.-Ташкент, 3-4 ноября 1998.
2. Ю.Р.Мирзаев/Растения сем. Liliaceae-источник БАС//Развитие ботанической науки в Центр. Азии и ее интеграции производство. Матер международной конф. (16-17 сент) г. Ташкент, 2004-с. 415-417

REACTIONS OF THE DITERPENE ALKALOID N-DEACETYLLAPPACONITINE WITH ISOCYANATES

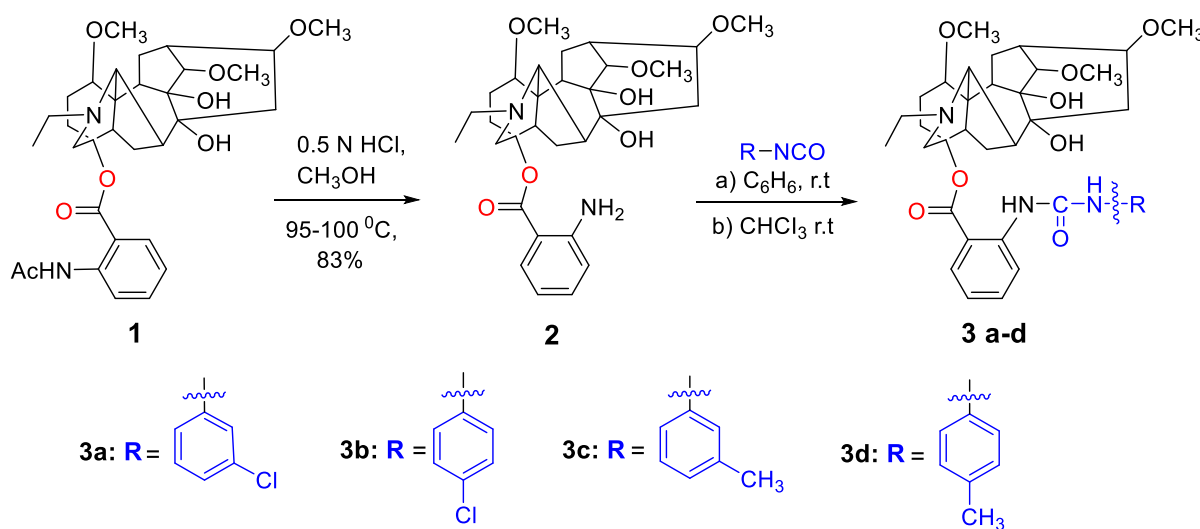
S.A. Safarova¹, Sh.N. Zhurakulov^{1,2}, V. I. Vinogradova¹, E.A. Baynazarov¹

¹*S.Yunusov Institute of the Chemistry of Plant Substances.*

²*Mirzo Ulugbek National University of Uzbekistan.*

email:safarovasadoqatabdualilqizi@gmail.com

Diterpene alkaloids were isolated from plant species belonging to *Aconitum* and *Delphinium* families belonging to the *Ranunculaceae* family. It has been described that diterpene alkaloids exhibit antiarrhythmic, neurotoxic, analgesic, local anesthetic, antitumor, antimicrobial, antiviral, insecticidal and other activities, and are related to the chemical structure and functional groups of substances. Taking into account the biologically active properties of representatives of this class, modification reactions were carried out on the basis of lappaconitine alkaloid, which is a diterpene alkaloid. Initially, lappaconitine alkaloid was hydrolyzed under acidic conditions to obtain N-deacetylappaconitine. N-deacetylappaconitine was reacted with 3-chloro-, 4-chlorophenylisocyanate, meta-, para-tolyl isocyanates in chloroform or benzene solvents, and carbamoyl products of lappaconitine alkaloid were obtained with 65-88% yields.



The structure of the resulting substance was confirmed using IR, ¹H and ¹³C NMR spectroscopic analysis methods.

NEW FLAVONOID GLYCOSIDE FROM *Oxytropis rosea*

Sh. A. Sulaymonov¹, B. J. Komilov², K. A. Eshbakova², and Sh. V. Abdullayev¹

1) 1Namangan State University, Bobur Shoh str. 161, Namangan, 160107, Uzbekistan;

2) S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, 77 Mirzo Ulugbek St., Tashkent, 100170, Uzbekistan

Corresponding author's e-mail: sherali.87.s@mail.ru

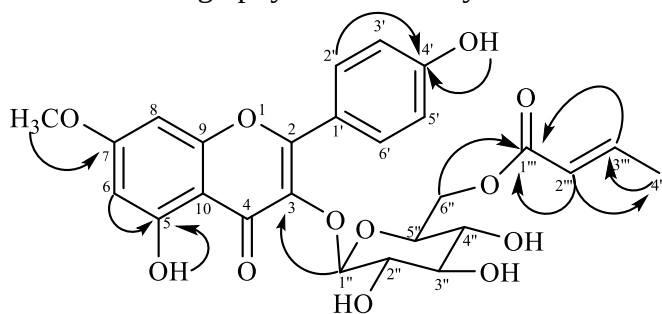
Continuing the study of the chemical components of the aerial part of *Oxytropis rosea* [1], we isolated a new flavonoid glycoside (1- figure), which we named roseanoside. The structure of rosanoside was established based on the analysis of data from the ¹H and ¹³C NMR spectra, DEPT, HSQC and HMBC experiments.

The dried aerial parts of the plants (2.3 kg) were exhaustively extracted with ethanol at room temperature (five times). The amount of extractives obtained was successively filtered and then extracted with hexane, chloroform, ethyl acetate and butanol. After evaporation of the extractant, the weight of the total extractive substances was 235.6 g, of which chloroform extract was 28.6 g, ethyl acetate extract was 23.15 g, butanol extract was 58.85 g.

The ethyl acetate extract was separated by column chromatography on silica gel, eluting sequentially with chloroform and chloroform-methanol solvent systems (20:1-4:1). As a result, a fraction containing compound 1 was obtained.

The resulting fraction was divided into Sephadex LH-20 in a chloroform-methanol 1:1 system (3.0 g), and roseanoside was isolated from 20 to 35 elevates.

Roseanoside (1) is a pale-yellow powder with melting point. 225-227°C. The substance was isolated in an amount of 1.0 g (yield 0.043% of the weight of the air-dried raw material) by column chromatography in a solvent system: chloroform-methanol 1:1.



1. Figure

Thus, the isolated new compound, roseanoside from *Oxytropis rosea*, has the structure rhamnocitrin-3-O-(6'' - crotonyl- β -glucopyranoside).

REFERENCES

1. Sh. A. Sulaymonov, B. J. Komilov, K. A. Eshbakova, G. O. Mamajanov, and Sh. V. Abdullayev, *Chem. Nat. Compd.* **59**, 937 (2023)

TERPENOIDS OF THE VIRGINAL PERIOD OF GROWTH OF *Artemisia annua* OF FLORA OF UZBEKISTAN

I.D. Sham'yanov, Kh.M. Bobakulov, B.S. Okhundedaev,
R.F. Mukhamatkhanova, N.D. Abdullaev

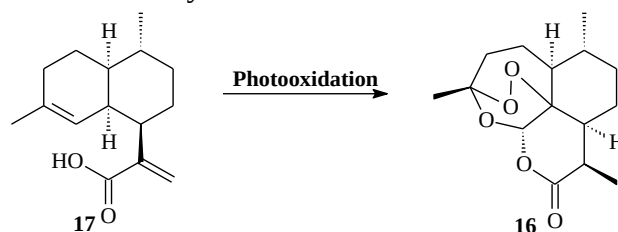
Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz,
Tashkent, M. Ulugbek st., 77, fax (99871) 1206475

This report presents the results of a study of the composition of terpenoids in leaves of *Artemisia annua* L., collected at the end of the immature stage of the virginal period of plant development. The terpenoid composition of the purified sum of leaf extractives was analyzed by gas chromatography-mass spectrometry on an Agilent 5975C inert MSD/7890A GC-MS instrument (Agilent Technologies, USA). The percentage composition of identified compounds was calculated from peak areas without using correction factors.

As a result of the analysis, the following monoterpenoids were identified in the extractive amount: 1,8-cineole (**1**, 1.99%), *m*-cymene (**2**, 0.14%), γ -terpinene (**3**, 0.25%), α -campholenal (**4**, 0.20 %), camphor (**5**, 5.37%), pinocarvone (**6**, 1.09%), 5-isosylvesterpine (**7**, 0.18%), mentha-1,4,8-triene (**8**, 0.22%); sesquiterpenoids: *trans*- β -caryophyllene (**9**, 1.64%), (-)- β -selinene (**10**, 0.25%), (-)-germacrene D (**11**, 0.79%), α -selinene (**12**, 6.17%), (-)-alloaromadendrene (**13**, 0.70%), 4(15),7(11)-oppositadien-12-al (**14**, 0.24%), β -himachalene (**15**, 0.70%), artemisinin (**16**, 0.99 %), artemisinic acid (**17**, 32.32%), β -elemene (**18**, 3.13%), vellerdiol (**19**, 2.66%), arteannuin B (**20**, 9.31%).

The dominant components of this period of plant development are the sesquiterpenoids artemisinic acid (32.32%) and arteannuin B (9.31%).

Artemisinic acid (**17**) is a precursor to artemisinin (**16**), as it has been established that photo-oxidation of **17** leads to the synthesis of **16**.



A comparative analysis of the results obtained with the literature showed that terpenoids **2-4**, **7**, **8**, **12**, **14**, **15**, **19** were identified for the first time in *Artemisia annua*. This confirms that the qualitative composition of terpenoids depends on the growing season of the plant.

PHENOLIC COMPOUNDS OF *Cistanche salsa* ROOTS

D. R. Siddikov, A. A. Ganiev, A. B. Bazarbaeva, Kh. M. Bobakulov,
G.B. Satimov, E.Kh. Botirov

*Acad. S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of
Sciences of the Republic of Uzbekistan, 77 Mirzo Ulugbek St., 100170, Tashkent*

Cistanche salsa (C.A. Mey) Beck. is a perennial herbaceous plant of the *Orobanchaceae* family that parasitizes the roots of perennial plants from the genera *Anabasis*, *Calligonum*, *Haloxylon*, and *Salsola*. Plants of the genus *Cistanche* do not produce chlorophyll, nutrients and water are taken from the roots of the host plant. It is found mainly on sandy-clayey and clayey-saline soils and salt marshes in the desert zone. In Uzbekistan, it is found in Bukhara, Navoi, Khorezm regions and Karakalpakstan.

In Central Asia, a decoction of *Cistanche salsa* is used for syphilis; water extracts exhibit bactericidal activity. In traditional Chinese medicine, *cistanche* is used for disorders in the male and female genital areas, diseases of the urinary system and kidneys, nephrogenic hypertension, circulatory disorders, erectile dysfunction, and infertility. *Cistanche* preparations improve cognitive functions and have a general tonic effect [1,2].

C. salsa contains carbohydrates and related compounds, organic acids, phenylethanoid glycosides, terpenoids, alkaloids, iridoids, sterols and their glucoside, lignans, phenolic compounds, flavonoids, tocopherols, minerals and other compounds [1-4].

In order to search for new sources of biologically active substances, we studied the components of the underground part of *C. salsa* collected in the Urgench district of the Khorezm region in April 2022. Air-dried plant material was extracted five times at room temperature with ethanol. By separating the ethyl acetate fraction of the alcohol extract using column chromatography on silica gel, as well as rechromatography of the resulting eluates on Sephadex LH-20, 7 individual phenolic compounds were isolated. Identification of the isolated substances was carried out by studying their spectral data (IR, ^1H and ^{13}C NMR, as well as HSQC, HMBC) followed by comparison with those of the literature data for these compounds, as well as direct comparison with authentic samples. The resulting compounds were identified with *n*-hydroxybenzoic, protocatechuic, vanillic, *p*-coumaric, caffeic acids, protocatechuic acid, and coumarin esculentin.

Caffeic acid exhibits immunomodulatory and anti-inflammatory activity and is used to prevent inflammation, cancer, neurodegenerative diseases and diabetes.

Esculetin has antioxidant, antitumor, anti-inflammatory, antibacterial, antidiabetic, and immunomodulatory properties.

Compounds 1-7 from *C. salsa* were isolated for the first time.

REFERENCES

1. R. Shi, Ch. Zhang, X. Gong, M. Yang, M. Ji, L. Jiang, M. Leonti, R. Yao, M. Li. *Journal of Ethnopharmacology*, **263**, 113154 (2020).
2. C. Gu, X. Yang, L. Huang, *Front. Pharmacol.*, **7**, 289 (2016).
3. E. B. Kartbaeva, G. R. Donald, Z. B. Sakipova, L. N. Ibragimova, E. N. Bekbolatova, I. I. Ternynko, P. D. Fernandes, F. Boylan. *Revista Brasileira de Farmacognosia*, **27**, 587 (2017).
4. Y. Jiang, P-F. Tu, *Journal of Chromatography A*, **1216**(11), 1970 (2009)

BIOLOGICAL ACTIVITY POLYSACCHARIDES FROM *Capparis spinosa*

R.A. Botirov, G.E. Saidova, A.Z. Sadikov, Sh.S. Sagdullaev

Institute of Plant Chemistry named after academician S.Yu. Yunusov, Academy of Sciences of the Republic of Uzbekistan, Tashkent,, e-mail: botiroovr@mail.ru

In our institute, scientific research is conducted to study the chemical composition of the peeling plant, common in our country, the release of biologically active substances and the study of its biological activity.

As a result of the study of the chemical composition of the extracts of the roots, tips and fruits of the claw plant, it was established that the raw material studied contains a large amount of different substances - polysaccharides, proteins, flavonoids, lipids, organic substances, acids, macro- and trace elements. As a result of research, it was found that the surface of the plant is rich in polysaccharides. As a result of preliminary pharmacotoxicological studies, it was found that the water-soluble part of these polysaccharides has such biological activity as central nervous, anti-inflammatory, antihypoxic, antioxidant, pain reliever, lowering the amount of glucose and cholesterol in the blood serum.

In order to create the technology of obtaining water-soluble polysaccharides of high purity from plant raw materials, the raw material extraction process (plant grinding degree, extractor type, hydromodule, extracting temperature, extraction duration, kinetics of extraction) has been carefully studied. As a result of experiments to extract high-purity water-soluble polysaccharides from plant raw materials, all chemicals soluble in ethyl alcohol are separated from the raw material in water (75-95%) and then extracted from it in water. The extraction method has been developed.

Currently, research is ongoing to develop optimal conditions for processes such as raw material extraction, extract concentration, polysaccharide sedimentation and the production of a highly pure polycarbonate. Sufficient quantities have been produced and delivered to pharmacologists for an in-depth study of the non-toxicity and biological activity of the substance. At the same time, research is continuing on the creation of methods of qualitative and quantitative determination of biologically active polysaccharides in raw materials and substances, development of phased control of the process of production of polysaccharides.

FLAVONOIDS FROM *Artemisia persica*

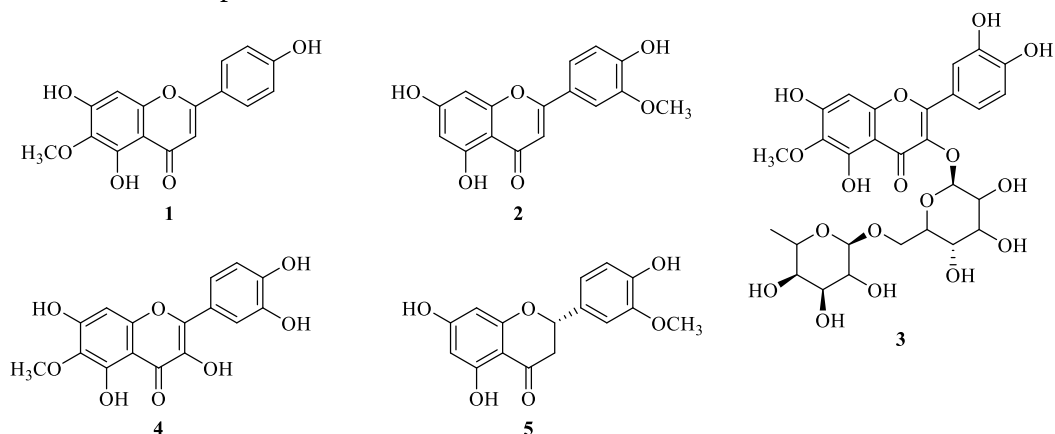
J. F. Umaraliev^{1,2}, A.A. Ganiev³, A. Turak¹, N.B. Begmatov³, Zao Bo¹, Kh.M. Bobakulov³, N.D. Abdullaev³, Zhao Jiangyu^{1,2*}

1) State Key Laboratory Basis of Xinjiang Indigenous Medicinal Plants Resource Utilization and the Key Laboratory of Plant Resources and Chemistry of Arid Zone, Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Urumqi, 830011, China

2) University of Chinese Academy of Sciences, Beijing 100049, China

3) S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, 77, M. Ulugbek, str., 100170, Tashkent, Uzbekistan, e-mail: khayrulla@rambler.ru

The genus *Artemisia* L, commonly known as wormwood, comprises about 500 species, mainly found in temperate zones across Europe, Asia, and North America. The *Artemisia* species are rich in phenolics and flavonoids, which have shown various biological activities, including anticancer, antioxidant, anti-inflammatory, and antiviral properties. From the chloroform fraction of the aerial parts of *Artemisia persica* collected in Pop district of Namangan region of the Republic of Uzbekistan, five flavonoids were isolated using traditional separation methods such as column chromatography, gel chromatography, and reversed-phase chromatography, along with modern techniques including flash chromatography, preparative, and analytical high-performance liquid chromatography. Structural elucidation was performed using 1D and 2D NMR spectroscopy, supplemented by comparison with spectral data from the literature. The identified flavonoids include hispidulin (**1**), chrysoeriol (**2**), patuletin-3-O-rutinoside (**3**), patuletin (**4**), and homoeriodictyol (**5**). All the above-mentioned compounds were obtained from this species for the first time.



PHENOLIC COMPOUNDS FROM *Artemisia persica*

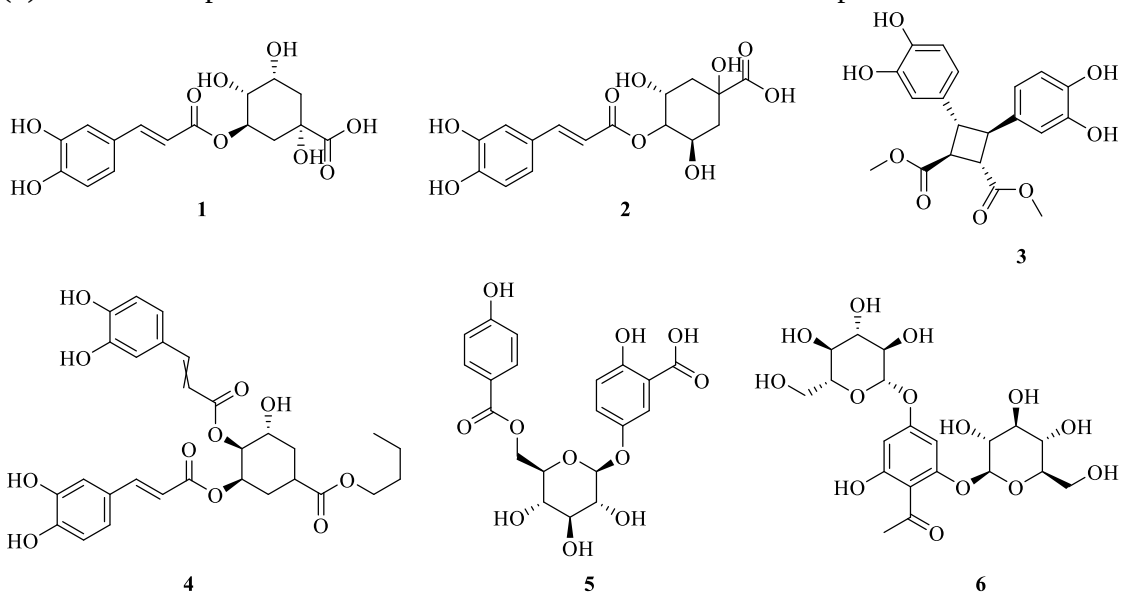
J. F. Umaraliev^{1,2}, A.A. Ganiev³, A. Turak¹, N.B. Begmatov³, Zao Bo¹, Kh.M. Bobakulov³,
N.D. Abdullaev³, Zhao Jiangyu^{1,2*}

1) State Key Laboratory Basis of Xinjiang Indigenous Medicinal Plants Resource Utilization and the Key Laboratory of Plant Resources and Chemistry of Arid Zone, Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Urumqi 830011, China

2) University of Chinese Academy of Sciences, Beijing 100049, China

3) S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUZ, 77, M. Ulugbek, str., 100170, Tashkent, Uzbekistan

The genus *Artemisia L.* is well-known for its wide array of biological activities, such as antimalarial, anticancer, antioxidant, anti-inflammatory, and antiviral effects. *Artemisia* species contain high amounts of phenolic compounds, and the majority of them identified in the genus belong to the phenolic acid group. A study investigating the chemical composition of the areal parts of *Artemisia persica* Boiss resulted in the isolation and identification of six phenolic compounds and their glycosides from the butanol fraction. The plant material was collected from the Namangan region of Uzbekistan and processed using various chromatographic techniques, including column chromatography with silica gel, Sephadex LH-20 gel chromatography, and high-performance liquid chromatography (HPLC). Identification of isolated compounds was performed by studying their spectral data from 1D and 2D NMR spectroscopy, followed by comparison with literature data. They identified as chlorogenic acid (**1**), cryptochlorogenic acid (**2**), dimethyl 3,3',4,4'-tetrahydroxy- δ -truxinate (**3**), 4,5-di-O-caffeoyl quinic acid butyl ester (**4**), 2,4,6-trihydroxy-acetophenone-2,4-di-O- β -D-glucopyranoside (**5**), and parmentins B (**6**). All the compounds were isolated for the first time from this species.



GLUCOGALACTAN FROM THE LEAVES OF *Ficus carica* L.

M.A. Kuronbayeva¹ K.S. Zhaunbayeva¹, R.K. Rakhmanberdieva¹, M.R. Mirzayeva²

1) *Yunusov Institute of Plant Chemistry of the Academy of Sciences of the Republic of Uzbekistan, 77 M. Ulugbek str., Tashkent, 100170, e-mail: kzhauynbaeva@inbox.ru*

2) *Osh State University, Department of Chemistry and Chemical Technology*

From the leaves of *Ficus carica* L. glucogalactan with a molecular weight of 36 kDa and a glucose, galactose ratio of 1.3:2.0 was isolated. The structure of glucogalactan was studied by chromic oxidation, methylation, and using ¹H and ¹³C NMR spectroscopy. In the IR spectrum of glucogalactan GG-Fc, characteristic absorption bands were present in the region at 3259, 2300, 1567, 1410, 1195, 1086, 1045, 880, 599 cm⁻¹. The presence of an absorption band at 880 cm⁻¹ indicates a β-glycoside bond between monosaccharide residues. To confirm this assumption, we used a method based on the oxidation of a fully acetylated polysaccharide with chromium anhydride in glacial acetic acid [1]. Analysis of the reaction products showed that all sugar residues were oxidized (the absence of monosaccharides in the hydrolysate), which indicates the presence of a β-glycoside bond between monosaccharides.

To establish the types of glycosidic bond between monosaccharide residues, GG-Fc methylation was performed according to the method [2] and as a result, the following sugars were found by GC/MS: 2,3,4,6-tetra-OMe-Galp, 2,4,6-tri-OMe-Galp, 2,6-di-OMe-Galp, 2,3,4,6-tetra-OMe-Glcp, 2,6-di-OMe-Glcp, 2,3,4-tri-OMe-Glcp.

The presence of 2,4,6-tri-OMe-Galp as the main product indicates that the main polymer chain in the GG-Fc macromolecule consists of β-1,3 bound galactopyranose residues. The identification of 2,6-di-OMe-Glcp and 2,6-di-OMe-Galp makes it possible to assume that galactose and glucose residues have 1→3, and the identification of 2,3,4-tri-OMe-Glcp gives 1→6 glycoside bonds in the main chain of the polymer, and the side branches are replaced only by glucose residues in position C-4.

Thus, it was found that the main chain of the macromolecule consists of β-1,3 and β-1,6 bound galacto- and glucopyranose residues, in which the lateral branches are represented only by glucose residues at the C-4 position.

By studying the biological activity of the water-soluble polysaccharide *F. carica* on the formalin arthritis model, it was shown that WSPS exhibits a pronounced anti-inflammatory effect at a dose of 150 mg/kg (58%), inferior to the effect of ketoprofen at a dose of 5 mg/kg (70%) and superior to diclofenac at the same dose (50%) [3].

Literature

1. J. Hoffman, B. Lindberg, S. Svensson, *Acta Chem. Scand.*, 26, 661 (1972).
2. I. Ciucanu, F. Kerek, *Carbohydr. Res.*, 131, 209 (1984).
3. M.A. Kuronbayeva, K.S. Zhaunbayeva, A.A. Azamatov, F.M. Tursunkhodzhaeva *Polysaccharides of Ficus carica*, Actual problems of the chemistry of natural compounds, Abstracts March 15-16, Tashkent 2023, p.169.

INTERACTION OF O-PHENYLENEDIAMINE WITH ALDEHYDES

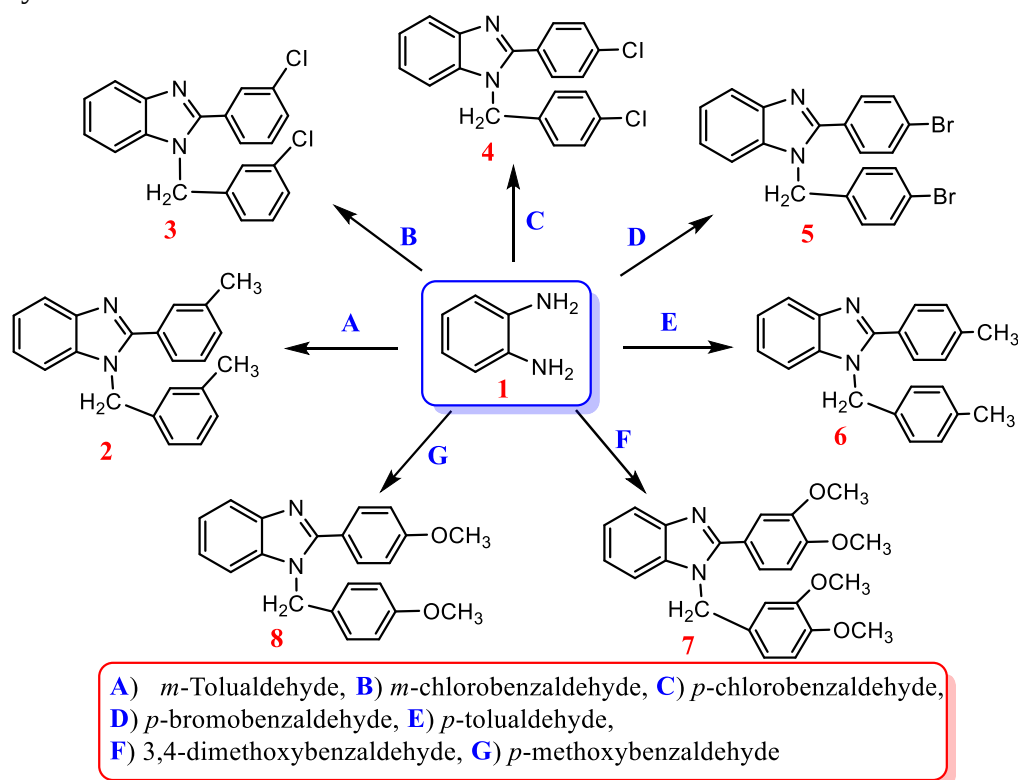
¹M.I.Olimova,²F.O. Pulatova,¹B.Zh. Elmuradov

¹*S. Yunusov Institute of the Chemistry of Plant Substances,
Academy of Sciences of the Republic of Uzbekistan, Tashkent, Mirzo-Ulugbek, 77*

²*Tashkent Pharmaceutical Institute. E-mail: manzura_o@mail.ru*

Benzimidazoles and their derivatives have been identified as potential anti-inflammatory, anti-cancer, herbicide, anthelmintic, anti-malarial, anti-viral and anti-microbial drugs [1].

When o-phenylenediamine interacts with various aldehydes, instead of 2-substituted benzimidazoles 2,3-(disubstituted)-benzimidazoles are formed. The reaction was carried out under different conditions in the presence of different solvents. As a result, when reaction mixture of reagents in a ratio of 1: aldehyde – 1:2 in alcohol is heated at 78°C for 8 hours corresponding 2,3-(disubstituted)-benzimidazoles (**2-8**) can be synthesized in good yields:



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

Reference

Rathod C.P., Rajurkar R.M., Thonte S.S. Benzimidazole synthesis and biological evaluation: A Review // Indo American Journal of Pharm Research. 2013. Vol.3. №2. P.2323-2329.

PROTEINS AND AMINO ACID COMPOSITION OF *XYLOSALSOLA RICHTERI* (Moq.) AKHANI & ROALSON

M.A.Karlybaeva², Sh.Kh. Rakhimova¹, L.G. Mezhlumyan¹, M.T. Baltabaev²

1) Institute of the Chemistry of Plant Substances named acad. S.Yu. Yunusov of the Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, st. Mirzo Ulugbek, 77, e-mail: shahnoza2380@mail.ru

2) Nukus State Pedagogical Institute named after Ajiniyaz, Uzbekistan, Republic of Karakalpakstan, 230100, Nukus, st. Pirjana Seytova, e-mail: karlibaevamiyassar@gmail.com

Xylosalsola richteri is a rich source of various phytochemical classes of compounds such as alkaloids, cardenolides, triterpenoids, coumarins, flavonoids, isoflavonoids and phenolic acids. *Xylosalsola richteri* is a raw material for the production of alkaloids such as salsolidine and salsolin [1]. Preparations from this plant have hypotensive, sedative, vasodilator and antispasmodic properties. The purpose of the study is to quantify the total protein and amino acid composition of annual branches and leaves of *Xylosalsola richteri* plants, depending on the growing location, collected during the same period of vegetation development. The quantitative content of total protein in *Xylosalsola richteri* was determined by the colorimetric method using Nessler's reagent on a V-5000 Metach spectrophotometer [2]. It was found that the protein content in plants growing in Northwestern Kyzylkum is 12.46%, and in the conditions of the southern Aral Sea region it is 9.22%. To identify the functional groups of the proteins under study, IR spectral analysis was performed. IR spectral analysis of the proteins is practically the same, which shows the identity of the plants.

In order to determine the quality of isolated proteins from *Xylosalsola richteri* plants of Northwestern Kyzylkum and the Southern Aral Sea region, their amino acid composition was analyzed. Identification of FTC amino acids was carried out on an Agilent Technologies 1200 chromatograph [3].

It should be noted that the content of essential amino acids for proteins from plants of Northwestern Kyzylkum was 148.27 mg/g, and for proteins from plants of the Southern Aral Sea region - 169.05 mg/g.

Analysis of the mineral composition of the ash samples showed the presence of 16 elements, the predominant ones being magnesium, sodium, calcium, silicon, and potassium. There are no heavy metals (As, Bi, Pb) in two research objects.

The acute toxicity of the studied substances turned out to be above 5000 mg/kg, which allows them to be classified as practically non-toxic substances [4].

Literature:

1. И.Э.Акопов. Важнейшие отечественные лекарственные растения и их применение.-Ташкент: Медицина, 1990.- 446с.
2. А.И.Ермаков, В.В.Арасимович, в кн.: Методы биохимического исследования растений М. 1982, 430
3. S. A. Cohen, D. J. Strydom, Anal. Biochem., 174, 1 (1988)
4. А.Н. Миронов, Руководство по проведению доклинических исследований лекарственных средств. М: Гриф и К. Часть I, С. 939 (2012)

SYNTHESIS OF NOVEL 1,4-ISOMERIC 1,2,3-TRIAZOLES

I.S. Ortikov¹, Sh.R. Khojimatova², B.Zh. Elmuradov¹

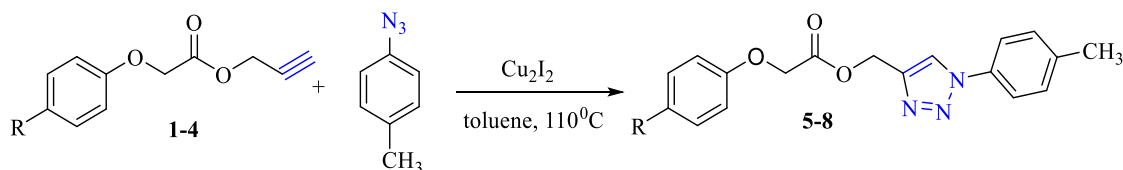
¹*Acad. S.Y.Yunusov Institute of the Chemistry of Plant Substances AS RUz,
100170, Uzbekistan, Tashkent, Mirzo-Ulugbek str., 77.*

²*Andijan Institute of Machine-Building, Andijan, 170119, Uzbekistan*

Five-membered heterocyclic compounds containing three nitrogen atoms have always attracted scientists due to their high biological and pharmacological activity. Especially 1,2,3-triazole derivatives are distinguished by their low toxicity and compatibility of the synthesis method with the principles of green chemistry [1].

1,2,3-Triazole derivatives have been found to have anti-inflammatory, anti-tuberculosis, anti-tumor, anti-viral, anti-bacterial, anti-fungal, analgesic and many other activities [2-3].

We also aimed to synthesize new derivatives of 1,2,3-triazoles based on azide-alkyne cycloaddition. First, propargyl chloroacetate ester and substituted phenoxyacetic acid propargyl esters were synthesized. It is known that 1,2,3-triazoles are formed from mutual ringing of azide and alkynes. This reaction proceeds in the mechanism of Huisgen's 1-3-bipolar cycloaddition reaction. In particular, when the reaction occurs catalytically between alkyl or aryl azides and terminal alkynes, only 1,4-isomers of 1,2,3-triazoles are formed. In this way, propargyl esters (**1-4**) were reacted with *p*-methylphenylazide:



The reaction was carried out in toluene (110°C) for 6 hours in the presence of a copper (I) iodide catalyst in a 1:1 ratio of reagents and 1,4-isomers of 1,2,3-triazole derivatives (**5-8**) were obtained in high yields and their structure was confirmed by IR, ¹H NMR spectra.

We thank for financial support of the Ministry of Higher Education, Science and Innovations of Uzbekistan (Grant № F-FA-2021-408)

References

1. Divya D., Virender S., Ravi Sh. Bioorg Chem. 2017. V.71. P.30–54.
2. Bozorov K., Zhaoa J., Haji A. A. Bioorg. Med. Chem. 2019. V.27. P.3511– 3531.
3. Ayati A., Emami S., Foroumadi A. Eur. J. Med. Chem. 2016. V.109. P.380–392

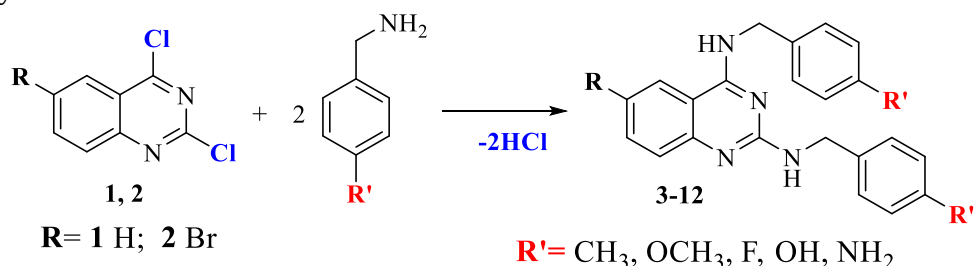
SYNTHESIS OF "AMINO-BRIDGED" BENZYL-QUINAZOLINE CONJUGATES IN THE PRESENCE OF 6H(BROMO)-2,4-DICHLOROQUINAZOLINE AND BENZYLAMINES

R.Z. Khudoykulova, I. S. Ortikov, B. Zh. Elmuradov

*Acad.S. Yunusov Institute of the Chemistry of Plant Substances AS RUz,
100170, Uzbekistan, Tashkent, Mirzo-Ulugbek str., 77.*

It is known from the literature that among the synthetic heterocyclic compounds containing the pharmacophore - quinazoline fragment, there are many medicinal preparations. The emergence of drug resistance of various diseases requires the creation of new antibacterial agents [1]. Therefore, methods of synthesis of quinazolines and quinazolinones and their biological activities are still being studied. Therefore, one of the important issues is the development of easy and convenient methods for the synthesis of biologically active 2,4-disubstituted quinazoline derivatives with different functional groups.

We performed nucleophilic substitution reactions of 6H(bromo)-2,4-dichloroquinazolines. In this case, substances **1,2** were reacted with benzylamines in a benzene solution in a ratio of 1:2, and quinazoline derivatives (**3-12**) were synthesized in good yields:



Reactions were carried out with 4-methyl, 4-methoxy, 4-fluoro, 4-hydroxy and 4-aminobenzylamines of substances **1** and **2** in benzene for 6 hours at 80-82°C in an oil bath. As a result, in good yields (**3**-71%, **4**-80%, **5**-74%, **6**-77%, **7**-67%, **8**-72%, **9**-70%, **10**-76%, **11**-72%, **12**-78%) new products were formed. It was observed that chlorine atoms in the 2nd and 4th positions of 2,4-dichloroquinazolines easily enter the nucleophilic substitution reactions. The structure of the substances was proved by IR, ¹H NMR spectra and X-ray structural analysis.

We thank for financial support of the Ministry of Higher Education, Science and Innovations of Uzbekistan (Grant № F-FA-2021-408).

Reference

1. Sugden R, Kelly R, Davies S. Combating antimicrobial resistance globally. *Nature Microbiology*. 2016, **1**, P.16187-16187

ANTHELMINTIC ACTIVITY OF 2-PROPIDAMIZOLE

Kubayev Sh.Kh, Saidov S.S, Abdurazakov A.Sh, Oripov A.O, Elmuradov B.Zh.

Acad. S. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, Mirzo-Ulugbek str., 77
e-mail: kubayevshoxrux1992@mail.ru

N-(1H-Benzimidazol-2-yl)-propionamide was synthesized with high efficiency in large laboratory facilities, and studies of its anthelmintic activity were conducted at the Veterinary Scientific Research Institute of Uzbekistan. N-(1H-Benzimidazol-2-yl)-propionamide was tested in sheep infected with nematodiosis by giving 100 mg/kg to 2 sheep and 200 mg/kg to 8 sheep.

5 Days after administration of N-(1H-benzimidazol-2-yl)-propionamide substance, during caprological examinations, 1 of 2 sheep given 100 mg/kg, 8 sheep given 200 mg/kg, it was noted that all of them were free from nematodiosis. The results are presented in the table 1.

Table 1

Number of sheep affected by extension	Dose of N-(1H-benzimidazol-2-yl)-propionamide, mg/kg	Before the experiment		5 days after administration of N-(1H-benzimidazol-2-yl)-propionamide	
		nematodiosis		nematodiosis	
		the sheep	percent	the sheep	percent
2	100	2	100.0	1	50.0
8	200	8	100.0	8	-

So, this drug has 50% anti-nematode effectiveness at 100 mg/kg and 100% antihelminthic effectiveness at 200 mg/kg. From the above experiments, it was found that the N-(1H-benzimidazol-2-yl)-propionamide substance is toxic to sheep in combination with its high anthelmintic effect at 200 mg/kg against fascilliosis, nematodiosis, and marshallagiosis, which are the main helminthiasis of sheep and no toxic effect was noted.

Thus, when the N-(1H-benzimidazol-2-yl)-propionamide substance is used, no pathological changes occur in the body of sheep, therefore, the 2-propionyl-aminobenzimidazole substance can be considered to belong to the class of non-toxic compounds.

SELECTIVE REDUCTION OF NITRO-BENZIMIDAZOLES

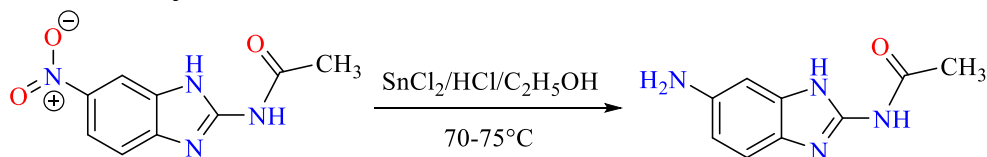
Kubayev Sh.Kh, Saidov S.S, Abdurazakov A.Sh, Elmuradov B.Zh.

*Acad. S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, Mirzo-Ulugbek str., 77
e-mail: kubayevshoxrux1992@mail.ru*

Benzimidazole derivatives are heterocyclic compounds with theoretically plural reactivity. The presence of an imidazole ring condensed with a benzene ring in the benzimidazoles allows various nucleophilic and electrophilic substitution and coupling reactions [1]. Benzimidazole derivatives are important heterocyclic compounds in obtaining new biologically active compounds. In addition, benzimidazole derivatives are widely used in medicine and agriculture.

Therefore, the synthesis of N-(6-amino-1H-benzimidazol-2-yl)-acetamide was carried out and some modifications were made to the existing methods for carrying out the reaction.

First, N-(6-nitro-1H-benzimidazol-2-yl)-acetamide and tin II chloride dihydrate in a ratio of 1:6 were kept in absolute alcohol at 70-75°C for 2 hours (under nitrogen gas). It was then neutralized with 10% sodium hydroxide and the suspension was filtered, the filtrate was extracted with ethyl acetate and the solvent was removed. The precipitate was recrystallized from ethyl alcohol and N-(6-amino-1H-benzimidazol-2-yl)-acetamide was obtained in 84.3% yield:



The structure of the synthesized amino compound was fully confirmed by IR, ¹H and ¹³C NMR spectra.

It should be noted that the obtained compound is a synthon with a high synthetic potential, and it can show plural reactivity. As a result, the molecule can undergo various electrophilic and nucleophilic substitution reactions.

Reference

1. Kubayev Sh.Kh., Saidov S.S., Muminova T.M., Abdurazakov A.Sh., Bobakulov Kh.M. Synthesis and spectroscopic analysis of some derivatives of 2-aminobenzimidazole. *News of NUUZ*, 2022, 3/2/1, pp.360-363.

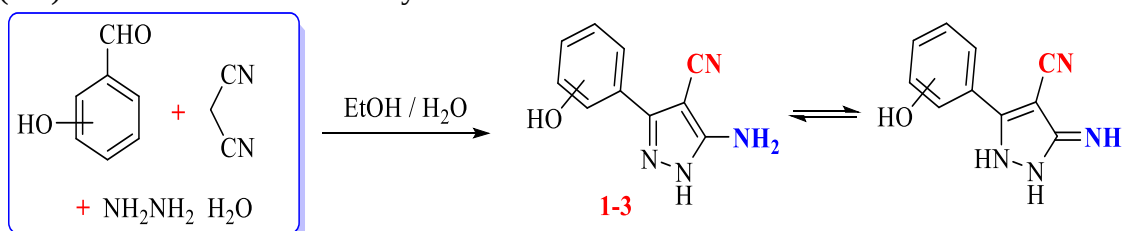
SYNTHESIS OF 5-AMINO-3-ARYL-4-CARBONITRILPYRAZOLE DERIVATIVES

N. B. Akhmedova, I. S. Ortikov, B. Zh. Elmuradov

*Acad. S.Y. Yunusov Institute of the Chemistry of Plant Substances AS RUz,
100170, Uzbekistan, Tashkent, Mirzo-Ulugbek str., 77.*

Pyrazole derivatives are widely studied heterocyclic organic compounds, and research with them began many years ago. The main reason for this is explained by the fact that they have important biological and pharmacological activities [1]. Analgesics for pharmaceuticals, active substances against viruses, fungi, cancer, bacteria and helminths, various herbicides and fungicides for agriculture are common among compounds of this class [2]. We can also include 5-aminopyrazole-4-carbonitrile derivatives among such active compounds of pyrazole. Many of their derivatives are potentially biologically active substances and show high activity against inflammation and diabetes [3].

We are also conducting research on the synthesis of pyrazole-containing compounds, the main goal of which is to search for an effective synthesis method of 3-aryl-5-aminopyrazole-3-carboxamides and to carry out various chemical modifications based on pyrazole derivatives with active pharmacophore groups, and search for biological active compounds among the new products obtained. In this research work, we obtained products with substituted oxy-benzaldehydes, malononitrile and hydrazine derivatives (hydrazine hydrate and phenylhydrazine). First, the corresponding oxybenzaldehyde and malononitrile were mixed in equal amounts (1:1), and when imine was formed as an intermediate product (color change was evident), hydrazine hydrate was added in abundance and stirring was continued. The reaction product was washed with water, recrystallized from ethanol, and 5-amino-3-(hydroxyphenyl)-1H-pyrazole-4-carbonitriles (**1-3**) were obtained in 70-93% yields:



It is noteworthy that these reactions were carried out in accordance with the principles of green chemistry, that is, at room temperature, without a catalyst, with high efficiency and without exhaust gases to the environment.

We thank for financial support of the Ministry of Higher Education, Science and Innovations of Uzbekistan (Grant № F-FA-2021-408).

References

1. Bye J. W., and Falconer R. *J. Phys Chem Chem Phys*, 2015, 17 (21) 14130– 14137.
2. Siddiqui S.M., Salahuddin, A., Azam, A. *Med. Chem. Research*, 2013, 22(2), 775-781.
3. Balbi A., Anzaldi M., MacCi C., Aiello C., Mazzei M., Gangemi R., and Viale M. *Eur. J. Med Chem*, 2011, 46 (11) 5293–5309.

ABOUT HYPOTENSIVE ACTION OF APOGALANTAMINE MONOMETHYL ETHER

Yu.R. Mirzaev

Institute of Chemistry and Plant Substances of the Academy of Sciences of the Republic
of Uzbekistan, rahmanysh@rambler.ru +998 90 9286307

The monomethyl ester of apogalantamine Apochlorin (A), isolated from *Ungernia Victoris* (Amarillidaceae fam.). H. Aliev drowsiness take place in white mice at a dose of 25 mg/kg s.c, at a dose of 100 mg/kg muscle relaxation and decreased motor activity (MA) during 3.5 hours. At 300 mg/kg—call respiratory arrest and death. LD 50-255 mg/kg. In acute experiments at narcotized dogs and cats (A) at the dose 0,005-0,01 mg/kg take place hypotension effect down 5-10 mm. hg art. during 40 minutes; at doses 0.1-0.5 mg/kg take place hypotension to 25-60 mm. hg art 2.5-4.5 hours. From 2 mg/kg to 9 hours. From 4-7 mg/kg, respiratory activation, convulsions for 5-10 minutes and prolonged hypotension were noted. Doses of 1-3 mg/kg did not have H-, M-, or histamine-blocking effects on the heart. (A) in doses of 0.5-1 mg/kg reduced the tone of the third nictitating membrane by 20-60% for several hours; the pressor effect of adrenaline 0,005-0,01 mg/kg decreased by 40-60%, and the contraction of the third nictitating membrane on intravenous administration of adrenaline was completely deleted within 2.5-4 hours. At a dose of 1-2 mg/kg it reduces by 40-90 mm hg. art recovery up to 12 hours or more. However, when assessing activity (A) on isolated rabbit spleen, the EC₅₀ was 5.2*10⁻⁵ g/ml. When determining the ED₃₀ hypotensive effect, (A) At a dose of 20 mkg/kg, blood pressure decreased by 10%; from 50 mkg/kg -22%; from 500 mkg/kg-42%., and ED₃₀ (A) was 0.14 mg/kg orally. The pharmacological range of the hypotensive effect (A) according to the author [1] was 1,821 mkg/kg orally. LD₅₀ in mice 255 mg/kg divided by ED₃₀ 0.14 = 1,821. The pharmacological wide index (A) seems to be an implausibly large latitude. The pronounced discrepancy between these two indicators is noteworthy. 0.14 mg/kg and 5.2 g/ml on isolated spleen i.e. adrenoletic effect according to these tests is illogical. From the data presented, it can be assumed that the mechanism of hypotension is associated with activation of α_2 stimulation or the participation of a substance that inhibits the renin-angiotensin system, which plays a decisive role in the regulation of blood pressure.

LOCAL ANESTHETIC EFFECT OF THE 1-(2-HYDROXYPHENYL)-6,7-DIMETHOXY-1,2,3,4-TETRAHYDROISOQUINOLINE HYDROCHLORIDE

A.A. Azamatov., Sh.N. Zhurakulov., F.M. Tursunkhodzhaeva

*S. Yunusov Institute of the Chemistry of Plant Substances AS RUz,
100170, Uzbekistan, Tashkent, Mirzo-Ulugbek str., 77. email: azizbek.azamatov@bk.ru*

One of the most commonly used drugs in surgical practice is local anesthetics. It is important to expand the range of new types of painkillers that are more effective than those currently known. In this article, the local anesthetic effect of the substance 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride was studied, and the experimental results obtained were reported.

To conduct the study, the local anesthetic activity of the newly selected substance 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride was assessed. The study involved groups of 15 intact male rabbits weighing 2.5-3.5 kg, belonging to the Chinchilla genus. The rabbits were divided into an intact animal group, a control group treated with lidocaine, and 3 rabbits for each of the substances under study. Experiments were conducted to observe the effect of the substance on terminal anesthesia of the cornea using the Rainier method, with lidocaine (in 1.0%, 0.5%, and 0.25% solutions) serving as a comparative drug. The solutions of the substance under study (0.25%, 0.5%, and 1.0%) were instilled twice, for 1 minute each time, into the conjunctival sac of the rabbits' eyes in a volume of 0.2 ml (4 drops). The substance's effectiveness was evaluated by detecting the corneal reflex after instillation. The results obtained at the end of the experiments were processed using statistical analysis with an accuracy indicator of $R \leq 0.05$. The method proposed by Strelkova was employed for scheduling. The results showed that the local anesthetic activity of the 0.25%, 0.5%, and 1.0% solutions of the studied compound was compared with the anesthetic effect of lidocaine solutions (1.0%, 0.5%, 0.25%) and lasted 16.2 ± 3.9 , 15.6 ± 1.4 , and 14.0 ± 0.5 minutes, respectively. When applied, the 1.0% solution of the studied compound demonstrated a local analgesic property 2.7 times higher than the 1.0% solution of lidocaine and 3.1 times higher than the 0.25% solution of lidocaine.

1-(2-hydroxyphenyl)-6,7-dimeth-tetrahydroisoxinoline hydrochloride-1,2,3,4-dimeth and lidocaine's effect on the terminal anesthetic of the rabbit's royal veil (Rainier method)

№	Substance	Dose, %	Anesthesia effect. continue., min.
1	Control lidocaine	0.25	14.0 ± 0.5
		0.5	15.6 ± 1.4
		1.0	16.2 ± 3.9
2	1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoxinoline hydrochloride	0.25	15.0 ± 2.1
		0.5	20.0 ± 1.9
		1.0	$44.0 \pm 1.5^*$

Note: * - relative to control group animals ($p < 0.05$).

In conclusion, according to the results of the experiments carried out, the new substance 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoxinoline hydrochloride, which is being studied, has shown significant local anesthetic activity, which will lead to a deeper study of the biological activity of this substance in the future.

STUDY OF THE EFFECT OF 1-(2-HYDROXYPHENYL)-6,7-DIMETHOXY-1,2,3,4-TETRAHYDROISOQUINOLINE HYDROCHLORIDE ON THE THERMAL IRRITABILITY OF THE SKIN

A.A. Azamatov., Sh.N. Zhurakulov., F.M. Tursunkhodjayeva

*S. Yunusov Institute of the Chemistry of Plant Substances AS RUz,
100170, Uzbekistan, Tashkent, Mirzo-Ulugbek str., 77. email: azizbek.azamatov@bk.ru*

Currently, one of the urgent challenges in modern medicine and experimental pharmacology is the search for and development of new, effective, and safe painkillers. The limited variety of analgesic drugs in medical practice, along with their low therapeutic efficacy, necessitates deeper scientific investigation into creating new pain-relieving medications. This study focuses on evaluating the analgesic activity of 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride, a derivative of isoquinoline alkaloids.

The study involved white, male, weightless mice, each weighing between 18-20 grams, which were quarantined for 10 days under standard vivarium conditions, with a 12-hour light cycle and an ambient temperature of $25 \pm 2^\circ\text{C}$. The mice were fed according to standard experimental animal feed norms, with unlimited access to water. In compliance with the "International Convention for the Protection of Vertebrates Used for Experimental and Scientific Purposes" (Strasbourg, 1986), the mice were divided into groups of six for each administered dose.

To assess the analgesic activity of the substance under study, 2.0 ml of physiological saline was administered orally to the intact group of laboratory animals, while the control group received ketoprofen (Vertex, Russia) in doses of 1.0, 5.0, and 10.0 mg/kg. The experimental group was given 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride at doses of 0.1, 0.5, 1.0, 5.0, and 10.0 mg/kg. After 60 minutes, the "Hot Plate" test was conducted at 57°C , and acetic acid (2.5% - 250.0 mg/kg) was injected into the abdomen to induce "Acetic Writhing." Additionally, acetylcholine (3.2 mg/kg) was administered intraperitoneally to study the effects on "Acetylcholine Writhing."

The results of the pharmacological studies showed that in the 57°C "Hot Plate" test, ketoprofen at doses of 1.0, 5.0, and 10.0 mg/kg produced analgesic effects in 58.8%, 94.4%, and 106.2% of the experimental animals, respectively. In contrast, 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride at doses of 0.1, 0.5, 1.0, 5.0, and 10.0 mg/kg produced effects in 131.7%, 115.8%, 95.4%, 75.5%, and 70.8% of the animals, respectively. In the "Acetic Writhing" and "Acetylcholine Writhing" tests, ketoprofen at the same doses produced effects in 68.2%, 71.5%, 61.7%, and 51.6%, 57.3%, 48.4%, respectively. The experimental substance at doses of 0.1, 0.5, 1.0, 5.0, and 10.0 mg/kg produced effects in 22.4%, 31.9%, 33.7%, 36.5%, and 35.0%, and 39.5%, 50.0%, 65.3%, 58.0%, and 52.4%, respectively, indicating an analgesic property.

Screening studies have shown that the analgesic effect of ketoprofen, used as a control drug, is generally higher than that of 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride. However, the new substance under investigation exhibited an analgesic effect that was 50% higher in some tests compared to the control drug, suggesting the potential for further study of its mechanisms of action.

INTERACTION OF THE 1-(2-HYDROXYPHENYL)-6,7-DIMETHOXY-1,2,3,4-TETRAHYDROISOQUINOLINE HYDROCHLORIDE WITH SUBSTANCES THAT STIMULATE THE CENTRAL NERVOUS SYSTEM

A.A. Azamatov., Sh.N. Zhurakulov., F.M. Tursunkhodzhaeva

*S. Yunusov Institute of the Chemistry of Plant Substances AS RUz,
100170, Uzbekistan, Tashkent, Mirzo-Ulugbek str., 77. email: azizbek.azamatov@bk.ru*

Seizures are a neurological disorder characterized by convulsions. Despite advancements in modern pharmacology, the presence of several undesirable side effects in currently used antiepileptic drugs necessitates the development of a new generation of anticonvulsants. In seizure models involving the new substance 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride (induced by nicotine, arecoline, carosol, strychnine, bicuculline, picrotoxin, isoniazid, and thiosemicarbazide), an anticonvulsant effect was observed.

For the experiments, non-breeding white male mice weighing 18-20 g were used. Each dose administered included 6 units: an intact group (receiving physiological saline), a control group (receiving carbamazepine at 5.0-10.0 mg/kg), a second control group (receiving convulex at 75.0-100.0 mg/kg), and an experimental group that received 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride in doses of 0.1, 0.5, 1.0, 5.0, 10.0, and 25.0 mg/kg, administered orally via an atraumatic probe. After 60 minutes, all the test convulsants (nicotine, arecoline, carosol, strychnine, bicuculline, picrotoxin, isoniazid, and thiosemicarbazide), which cause tremors and seizures, were administered subcutaneously to the abdominal cavity. The onset time and duration of tremors and seizures, along with animal survival and mortality, were recorded. Statistical analysis of the data was carried out using IBM® SPSS® Statistics v27.0.1.0 software.

The pharmacological analysis of the experiments showed that the mechanism of action of 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride is related to its effect on GABAergic, glutamatergic, glycinergic, and catecholaminergic systems. The substance demonstrated anticonvulsant activity across experimental models with various pathophysiological mechanisms.

From this, it can be inferred that the pharmacological effects of 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride are comparable to those of carbamazepine and convulex. In all epileptic models tested, the substance exhibited a moderate anticonvulsant effect.

ANTI-HYPOXIA ACTIVITY OF THE NEW 1-(2-HYDROXYPHENYL)-6,7-DIMETHOXY-1,2,3,4-TETRAHYDROISOQUINOLINE HYDROCHLORIDE

A.A. Azamatov, Sh.N. Zhurakulov, F.M. Tursunkhodzhaeva

*S. Yunusov Institute of the Chemistry of Plant Substances AS RUz,
100170, Uzbekistan, Tashkent, Mirzo-Ulugbek str., 77. email: azizbek.azamatov@bk.ru*

Hypoxia, a state of oxygen deficiency in the body, leads to cell death and contributes to various pathological processes. Additionally, hypoxia induces free radical oxidation, which further exacerbates its harmful effects. One of the primary goals of medical and experimental clinical pharmacology today is to discover new chemical compounds that can prevent acute hypoxia and ultimately preserve human life, thereby increasing life expectancy.

To address these challenges, the new compound 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride has shown potential anti-hypoxia properties. Experiments were conducted on hypoxia models using 54 non-breeding white male mice, each weighing between 18.0 and 22.0 grams, which were kept under standard vivarium conditions. The laboratory animals were divided into groups of six mice per dose. The choice of dosage and route of administration was guided by the "Guide to the Experimental (Pre-Clinical) Study of New Pharmacological Compounds."

The intact group received 0.2 ml of physiological saline, while the control group was administered the comparative drug "Mildronate Neo" at doses of 1.0, 5.0, and 10.0 mg/kg. The experimental group received 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride at doses of 0.1, 0.5, 1.0, 5.0, and 10.0 mg/kg, administered orally via an atraumatic probe. After 60 minutes, the experiments were conducted using the "Normobaric Hypoxia," "Cytotoxic Hypoxia," and "Chemical Hypoxia" models.

In the "Normobaric Hypoxia" model, the mice were placed in 250 ml glass containers with hermetic lids, and the anti-hypoxia effect was studied by comparing the duration of their survival. The control group treated with "Mildronate Neo" at doses of 1.0, 5.0, and 10.0 mg/kg showed extended survival times of 28.5%, 34.5%, and 30.4% compared to the intact group. The experimental group treated with 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride at doses of 0.1, 0.5, 1.0, 5.0, and 10.0 mg/kg demonstrated extended survival rates of 19.8%, 21.2%, 24.8%, 25.3%, and 23.9%, respectively, compared to the intact group.

In the "Cytotoxic Hypoxia" and "Chemical Hypoxia" models, the control group treated with "Mildronate Neo" extended survival times by 27.7%, 38.1%, 31.2%, and 32.2%, 43.4%, 37.5%, respectively, compared to the intact group. The experimental group treated with the new substance at the same doses showed extended survival times of 36.4%, 43.3%, 45.6%, 39.8%, and 30.6%, and 19.7%, 21.0%, 24.3%, 23.0%, and 22.4%, respectively, compared to the control group.

Based on the results of these experiments, it is evident that the new substance under investigation demonstrated anti-hypoxia effects in all hypoxia models, although it did not surpass "Mildronate Neo" in efficacy. These findings suggest that further in-depth studies on the biological activity of this compound are warranted.

ANTIOXIDANT ACTIVITY OF 1-(2-HYDROXYPHENYL)-6,7-DIMETHOXY-1,2,3,4-TETRAHYDROISOQUINOLINE HYDROCHLORIDE

A. A. Azamatov, D. A. Narbutayeva, U. K. Aytmuratova,
A. M. Karakulova, Sh.N. Zhurakulov

*S. Yunusov Institute of the Chemistry of Plant Substances AS RUz,
100170, Uzbekistan, Tashkent, Mirzo-Ulugbek str., 77. email: azizbek.azamatov@bk.ru*

The disruption of the body's antioxidant defense system leads to the accumulation of reactive oxygen species, both radical and non-radical, which imposes a significant burden on the body. This accumulation contributes to the development of numerous diseases, including Alzheimer's disease, Parkinson's disease, diabetic neuropathy, and various cardiovascular and viral diseases. The use of antioxidant strategies in the treatment of these conditions holds great potential. To obtain more comprehensive and objective information about the antioxidant properties of synthesized compounds, it is essential to apply integrated approaches that consider various reaction mechanisms.

The primary goal of this experiment is to study the antioxidant activity of the newly synthesized compound 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride (**1**). The level of malondialdehyde (MDA) in vivo was determined through a color reaction with thiobarbituric acid in the compound 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride, which was selected for this study. The state of the antioxidant system was assessed by measuring the activity of superoxide dismutase (SOD) and catalase (CT). Superoxide dismutase activity was determined using the Dubinina method, while catalase activity was measured according to the Korolyuk method. Statistical analysis of the data was performed using IBM® SPSS® Statistics v27.0.1.0 software. The results obtained from our experiments provided the following insights:

The effect of the newly synthesized substance on certain indicators of the content of malondialdehyde and the activity of the antioxidant system in the blood serum under conditions of pulmonary edema ($M \pm m$, $n=6$)

Experimental conditions	Dose mg / kg	MDA, nmol/ml	effect, %	Catalase, mkat / l	effect, %	SOD, ShB/ml	effect, %
Intact Group	Sal. sol. 0.2ml	5.38±0,21	-	45.7±2.20	-	5.24±0.30	-
Control group (pulmonary edema)	Sal. sol. 0.2ml	8.56±0,40	59.0	32.3±1.24	29.3	3.65±0.21	30.3
Control Mildronate	10.0	3.96±0,14 [*]	53.7	4.65±0.16	27.4	46.2±1.34 ^{**}	43.0
Compound 1	10.0	6.33±0,26	26.1	4.42±0.08	21.1	39.8±1.77	23.2

Note. * - With respect to intact animals, ** - with respect to control animals ($p < 0.05$)

From the results of the experiments carried out, we can see that the indicators of the animals of the experimental group, to which the substance 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride was sent, did not show antioxidant activity with a significant difference from the indicators of the animals of the control group.

ACUTE TOXICITY OF THE COLLECTION OF BIOLOGICALLY ACTIVE POLYSACCHARIDES FROM THE ROOT OF *Capparis spinosa*

N.B. Bekmurzayeva, A.A. Azamatov, R.A. Botirov

S. Yunusov Institute of the Chemistry of Plant Substances AS RUz, 100170, Uzbekistan, Tashkent, Mirzo-Ulugbek str., 77. email: nurjamal.bekmurzayeva@mail.ru

The study of the acute toxicity of extracts and individual substances isolated from medicinal plants is a crucial step in the development of new and effective drugs. This article describes the acute toxicity of a biologically active polysaccharide complex isolated from the root portion of the *Capparis spinosa* plant, as determined in experimental animals.

The acute toxicity study of the polysaccharide complex isolated from the aerial parts of the *Capparis spinosa* was conducted in non-breeding white male mice with a body weight of 18-22 g. The animals selected for the experiment were divided into groups, each consisting of 6 mice. The nature of the resorptive effects of the polysaccharide complex isolated from the aerial parts of the *Capparis spinosa*, along with the acute toxicity indicators, was assessed according to the guidelines outlined in the "Guide to the Experimental (Pre-clinical) Study of New Pharmacological Substances."

After administering a 5.0-10.0% solution of the test substance to the stomach using an atraumatic metal tube, the condition of the experimental animals was monitored for 14 days. Statistical analysis of the median lethal dose (LD₅₀) was performed using the IBM® SPSS® Statistics v27.0.1.0 software. The results of the experiment are presented in Table 1.

Table 1. Acute toxicity of polysaccharide assemblage isolated from the root of the plant *Capparis spinosa*

№	Substance name	Dose mg/kg	Animal death / survival	LD ₅₀
1	The assemblage of water-soluble polysaccharides isolated from the root of the <i>Capparis spinosa</i>	1000.0 5000.0 8000.0 8300.0 8500.0 8750.0 8900.0 9000.0 9100.0	0/6 0/6 0/6 1/5 2/4 3/3 4/2 5/1 6/0	8582.8 (8150.0+8916.7)
2	LD ₅₀ *	8582.8 (8150.0+8916.7)		
3	LD ₁₀₀ **	10232.8 (9502.9+15442.2)		

Note: * - LD₅₀; ** - LD₁₀₀

The average lethal dose (LD₅₀) of the polysaccharide aggregate isolated from the root of the *Capparis spinosa* is 85-82.8 mg/kg, with a confidence interval of 81-50.0 to 89-16.7 mg/kg. According to GOST 12.1.007-76, this places the substance in the category of low-toxic substances (Class IV). Additionally, based on the Stefanov classification, it is categorized as a substance with low practical toxicity (Class V). The classification of the polysaccharide aggregate isolated from the root of *Capparis spinosa* as a substance with low acute toxicity provides a foundation for further in-depth pharmacological research into its biological activity.

ACUTE TOXICITY OF POLYSACCHARIDE ASSEMBLAGE FROM THE ABOVEGROUND PART OF *Capparis spinosa*

N.B. Bekmurzayeva, A.A. Azamatov, R.A. Botirov

*S. Yunusov Institute of the Chemistry of Plant Substances AS RUz, 100170, Uzbekistan,
Tashkent, Mirzo-Ulugbek str., 77. email: nurjamal.bekmurzayeva@mail.ru*

In contemporary medical and pharmaceutical practice, drugs derived from extracts and individual substances obtained from medicinal plants are widely utilized by local populations for the prevention and treatment of various diseases. This widespread use is attributed to the low side effects of plant-based drugs and their convenient methods of administration. In light of these factors, the acute toxicity of the polysaccharide complex isolated from the aboveground parts of the *Capparis spinosa* was investigated.

To study the acute toxicity of the polysaccharide complex, white mice with a body weight of 18-22 g were quarantined for 10 days under standard vivarium conditions. The animals selected for the experiment were divided into groups, with each group consisting of 6 mice. The resorptive effects of the polysaccharide complex and the assessment of acute toxicity indicators were conducted following the guidelines outlined in the "Guide to the Experimental (Pre-clinical) Study of New Pharmacological Substances."

After administering a 5.0-10.0% solution of the test substance to the stomach using an atraumatic metal tube, the condition of the experimental animals was monitored for 14 days. Statistical analysis of the median lethal dose (LD₅₀) was performed using the IBM® SPSS® Statistics v27.0.1.0 software. The results of the experiment are presented in Table 1.

Table 1. Study of acute toxicity of water-soluble polysaccharide assemblage isolated from the ground surface of *Capparis spinosa*

№	Substance name	Dose mg/kg	Animal death / survival	LD ₅₀
1	The assemblage of water-soluble polysaccharides isolated from the ground surface of the <i>Capparis spinosa</i>	1000.0	0/6	4201.2 (3972.9±4422.0)
		3500.0	0/6	
		3800.0	1/5	
		4000.0	2/4	
		4200.0	3/3	
		4500.0	4/2	
		4700.0	5/1	
		4800.0	6/0	
2	LD ₅₀ *	4201.2 (3972.9±4422.0)		
3	LD ₁₀₀ **	5300.9 (4865.2±6812.6)		

Note: * - LD₅₀; ** - LD₁₀₀

The accumulation of water-soluble polysaccharides isolated from the aerial parts of the *Capparis spinosa* was found to exhibit acute toxicity when administered orally to mice using an atraumatic metal tube. According to GOST 12.1.007-76, the substance falls into the category of moderately hazardous substances (Class III). Additionally, based on the classification by A.V. Stefanov, it is categorized as a low-toxicity substance (Class IV). These findings suggest that further pharmacological studies of this substance across a broad range of applications are warranted.

LIPIDS OF *Atriplex tatarica* LEAVES

Ibotov Sh.Kh., Yuldasheva N.K., Gusakova S.D.

*S.Yu. Yunusov Institute of the Chemistry of Plant Substances of AS of RUz
Tashkent, Republic of Uzbekistan e-mail: s.gusakova2004@mail.ru*

Atriplex tatarica L. (Tatarian orach, family Amaranthaceae) is a widespread annual herbaceous, weed, medicinal and food plant. It grows on slightly saline soils of North Africa, Central Asia, and Europe. It is found everywhere in Uzbekistan. In folk medicine, decoctions of *A. tatarica* leaves are used for jaundice and as a diuretic. It has been proven that *A. tatarica* improves digestion, maintains kidney health, and strengthens the cardiovascular system. Leaves, stems, and flowers are used for medicinal purposes. The lipids of the leaves have not been studied.

We investigated the lipids of air-dried leaves of *A. tatarica* collected in the Jizzakh region of Uzbekistan. Total lipids (TL) were extracted from powdered leaves using a mixture of chloroform and methanol (2:1, v/v), the yield was 2.47% by dry weight. TL had a dark green color and contained 1136 mg% of chlorophyll pigments according to SF. Then the TL were chromatographed on silica gel, eluting neutral lipids (NL) with chloroform, glycolipids (GL) with acetone, and phospholipids (PhL) with methanol. Their yields were 0.46; 1.42; 0.44%, respectively. The content of carotenoids in NL, according to SF, was 400 mg%. The components of NL, GL and PhL were determined by TLC on silufol plates and silica gel using generally accepted solvent systems, model compounds and qualitative reactions. In NL were found paraffin hydrocarbons, esters of phytosterols and triterpenols, traces of squalene and triacylglycerides, free fatty acids (FFA), triterpenols and phytosterols (main), pigments of the chlorophyll group ("a" and "b") and carotenoids. GL consist of steryl glycosides, monogalactosyl- and digalactosyldiacylglycerides were found; in PhL - phosphatidylcholines, phosphatidylethanolamines, phosphatidylinositols and phosphatidic acids.

According to GC, the fatty acids of the NL contained 17 FAs, the sum of acids 18:2n6, 18:1n9 and 18:3n3 is 51.73%. Of the saturated FAs, 16:0 is dominant (21.11%). The minor component of the FA is the trans-isomer 18:1n9 (1.04%).

Thus, the lipid composition of air-dried leaves of *Atriplex tatarica* and the fatty acid composition of their neutral lipids were established for the first time.

POLAR LIPIDS OF *Ammodendron conollyi* SEEDS

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

*S.Yu. Yunusov Institute of the Chemistry of Plant Substances of AS of RUz Tashkent,
Republic of Uzbekistan e-mail: saltanatnormatovna@gmail.com*

Ammodendron conollyi Bge. (sand acacia, family Fabaceae) is a halophytic plant growing on sandy soils of Central Asian countries, Iran, and China. In folk medicine, *A. conollyi* is used for cardiopulmonary insufficiency, kidney diseases, and its analeptic and hypoglycemic properties have been described.

We have previously reported on neutral lipids of *A. conollyi* seeds. In this report, we present data on polar lipids (PL) of the seeds. PL was extracted from finely grounded seeds after removing NL, with a mixture of chloroform and methanol (2:1 v/v) [1] the yield was 1.15% by dry weight of seed. Using the method gel chromatography on silica, PL was divided into GL (eluted with acetone, yield 0.15%) and PhL (eluted with methanol, yield 1.0%). Mono- and digalactosylglycerides, steryl glycosides and their esters with fatty acids (FA) were detected in the GL composition using TLC on silica gel. PhL contained phosphatidylcholines, phosphatidylethanolamines, phosphatidylinositols and traces of quinolizidine alkaloids, co-extracted with PL. Alkaline hydrolysis of GL and PhL resulted isolation of FA, then FA subjected to methylation to obtain methyl esters of them. They were determined by GC. The obtained results are presented in the table.

Table. Fatty acids composition of polar lipids of *A. conollyi* seeds,
GC, % by the mass of acids

Fatty acid	GL	PhL	Fatty acid	GL	PhL
12:0, 14:0, 15:0	2.0	0.9	20:1n9	1,01	0,55
16:0	20,83	17,17	22:0, 24:0, 26:0	0.52	0,39
16:1	0,21	0,32	20:4n6	0,08	0,11
17:0, 20:0	3.2	0.61	22:1n9	0,11	0,14
18:0	12,23	6,83	22:6 n3	0,07	-
<i>cis</i> -18:1n9	29,66	30,20	24:1	0,04	0,07
<i>trans</i> -18:1	1,70	2,44	26:1	0,31	-
18:2n6	26,53	39,02	$\sum$ saturated fatty acids	38,78	25,90
18:3n3	1,50	1,25	$\sum$ unsaturated fatty acids	61,22	74,10

Thus, in the seeds of *Ammodendron conollyi*, phospholipids were predominate in PL, the main saturated acid in the PL is 16:0, the unsaturated acid is 18:2n6 and minor amounts of arachidonic acid 20:4n6 are present in PhL.

1. M. Kates. Technique of Lipidology, Mir, Moscow, 1975, p. 311.

LIPIDS OF *Senna angustifolia* SEEDS

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

S.Yu. Yunusov Institute of the Chemistry of Plant Substances of AS of RUz Tashkent,
Republic of Uzbekistan e-mail: saltanatnormatovna@gmail.com

Senna angustifolia (syn. *Cassia angustifolia* Vahl, senna or narrow-leaved cassia, family Fabaceae) is a valuable medicinal plant growing in the desert regions of Sudan, Saudi Arabia and Somalia. It is cultivated in Russia, Azerbaijan, and the Surkhandarya region of Uzbekistan. The Senna leaves are one of the ancient medicinal products used in folk medicine as a laxative. The medicinal effect of the plant is due to the presence of anthraquinones.

For the first time we investigated the lipids of *S. angustifolia* seeds cultivated in Uzbekistan. The moisture content of the seeds is 7.4%. Neutral lipids (NL) with burgundy-colored anthraquinones were first isolated from powdered seeds by extraction with gasoline (b.p. 75-80°C) in Soxhlet (yield 4.93%). Then residual material was subjected to extraction with a mixture of chloroform and methanol (2:1) several times, after which 1.37% polar lipids with anthraquinones were extracted, obtained PL separated by silica gel chromatography into glycolipids with anthraquinones (0.21%) and phospholipids with anthraquinones (1.16%). In the NL were detected triacylglycerides (Rf 0.60 main spot), hydrocarbons (Rf 0.98), carotenoids (Rf 0.97 yellow spot), esters of phytosterols and triterpenols (Rf 0.89), free fatty acids (Rf 0.40), anthraquinones (Rf 0.37 burgundy spot), free triterpenols (Rf 0.32) and phytosterols (Rf 0.18). Fatty acids were isolated from the NL, methylated with diazomethane and analyzed by GC on an Agilent 8860GC chromatograph (Table).

TABLE. Composition of fatty acids of neutral lipids of *Senna angustifolia* seeds, GC, % of acids mass

Fatty acid	%	Fatty acid	%
12:0, 14:0, 15:0	0,31	18:2n6	54,37
16:0	15,26	18:3n3	5,61
16:1	0,41	20:0, 22:0, 24:0	1,69
17:0	0,10	20:1n9	0,40
18:0	2,27	22:1n9	Следы.
18:1n9	17,67	$\sum_{\text{saturated fatty acids}}$	19,63
<i>trans</i> - 18:1	1,91	$\sum_{\text{unsaturated fatty acids}}$	80,37

Thus, *Senna angustifolia* seeds contain 7.14% total lipids, anthraquinones are present in all lipid groups, dominant fatty acids in NL were 18:2n6, 18:1n9 and 16:0.

POLAR LIPIDS OF THE AERIAL PARTS OF *Datisca cannabina*

¹Ibragimova D.Sh., ¹Yuldasheva N.K., ¹Nishanbaev S.Z.,
²Keneshov B.M., ¹Gusakova S.D.

1. Institute of Chemistry of Plant Substances named after. acad. S.Yu. Yunusov Academy of Sciences of the Republic of Uzbekistan ,100170, Tashkent, Republic of Uzbekistan
2. Osh State University, Osh, Republic of Kyrgyzstan

Datisca cannabina L. (hemp datisca, family Datisceae) is a perennial plant 2-3 m high with large, long-petiolate leaves. The species is widespread in the Caucasus, Central Asia, Pamir-Alai, Tien Shan along the banks of rivers and irrigation ditches. The dominant substances in the above-ground part of the plant are flavonoids, triterpenoids, steroids, and tannins. The leaves and flowering stems have a diuretic, antipyretic, and laxative effect. In folk medicine, the plant is used to treat fevers, gastric, and scrofulous diseases.

The aim of the work was to study the polar lipids of the aboveground part of *D. cannabina* collected in the Tashkent region in June 2023. The finely grounded and air-dried raw material was defatted, polar lipids (PL, 1.29%) were extracted using a mixture of chloroform and methanol (2:1v/v), after which they were separated by the method chromatography on silica gel into glycolipids (GL, 0.92%) and phospholipids (PhL, 0.37%). Fatty acids (FA) of GL and PhL were analyzed by GC on an Agilent GG 8860 chromatograph (Table).

TABLE. Composition of fatty acids of polar lipids of *Datisca cannabina*, GC, % by weight

Fatty acid	GL	PhL	Fatty acid	GL	PhL
12:0, 14:0, 15:0	5.38	2.25	18:3n3	6,89	9,12
16:0	49,93	59,37	20:0, 22:0, 24:0,	4.09	1.75
16:1	0,97	0,17	20:1n9	-	1,97
17:0	1,28	0,90	22:1n9	2,20	0,90
18:0	13,50	8,77	24:1	-	0,51
18:1n9	10,02	6,33	∑saturated fatty acids	74,18	73,04
18:1 tr.	1,72	0,94	∑unsaturated fatty acids	25,82	26,96
18:2n6	4,02	7,02			

Thus, for the first time, data were obtained on the group and fatty acid composition of polar lipids of the aboveground part of the *D.cannabina* plant growing in Uzbekistan.

LIPIDS OF *Climacoptera aralensis* SEEDS AND THEIR STRESS-PROTECTIVE ACTIVITY

S. D. Gusakova^{1*}, R.P. Zakirova¹, M.T. Paulanova², N.K. Yuldasheva¹

¹S. Y. Yunusov Institute of the Chemistry of Plant Substances, AS RUz, Tashkent,
e-mail: s.gusakova2004@mail.ru

² Mirzo Ulugbek National University of Uzbekistan, Tashkent

Climacoptera aralensis (Iljin) Botsch (family Amaranthaceae) is an annual endemic plant growing on saline soils of Central Asia. There is no information on the lipids of *C. aralensis* in the literature. The aim of this work was to study the lipids of *C. aralensis* seeds and their stress-protective activity under salinity conditions.

Study of Lipids: Mature seeds of the plant were collected from the dried bottom of the Aral Sea (Uzbekistan) on soil with increased chloride-sulfate salinity. It was determined by known methods that the seeds contain 5.8% moisture, 23.1% total lipids (TL), including 21.06% neutral lipids (NL), 2.04% polar lipids (PL), which included 0.78% glycolipids (GL) and 1.26% phospholipids (PL). NL contained triacylglycerides, hydrocarbons, esters of aliphatic and cyclic alcohols, and their free forms; GL consisted of steryl glycosides (mainly), their esters, cerebrosides, di- and monogalactosyldiacylglycerols. PL included phosphatidylcholines (mainly), phosphatidylethanolamines, phosphatidylinositols, and phosphatidic acid. The fatty acid (FA) composition of lipids was determined by gas chromatography (GC) using an Agilent 6890 N. NL contained 14 FAs, GL contained 13, and PL contained 16 FAs. The main acids in all lipid groups were 16:0, the sum of 18:1n9, 18:3n3, and 18:2n6. Gamma-linolenic acid 18:3n6 was found as a minor FA.

Study of Stress-Protective Activity: Wheat and cucumber seeds were soaked in 0.001% and 0.0001% concentrations of TL solution for 18 hours, then placed in Petri dishes with 3 ml of 1% NaCl. The control group consisted of seeds soaked in water. The activity of the substances was evaluated by the linear growth of seedlings. In wheat, the maximum effect was shown by TL at a 0.001% concentration, with root length exceeding the control by 32.6% and stems by 11.5%. In cucumber culture, the high growth-stimulating activity was shown by TL solution at a 0.0001% concentration, with root length exceeding the control by 18.5% and stems by 30.3%.

Thus, the lipids of *Climacoptera aralensis* seeds were studied for the first time, and their potential for use as a plant stress-protective agent against salinity stress was demonstrated.

A NEW FUROCOUMARIN FROM *Ferula lehmannii*

Q. S. Jurayev, K. A. Eshbakova

Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances AS RUz, 100170, Tashkent, 77 M. Ulugbek Str., fax (99871) 120 64 75, e-mail: e_komila@yahoo.com;

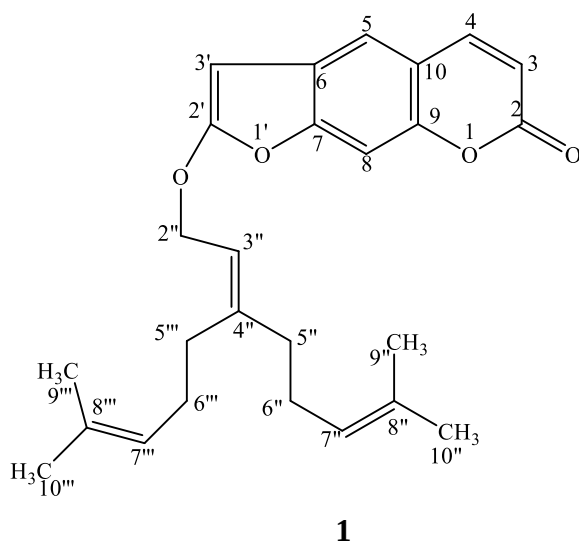
Ferula lehmannii Boiss. is a perennial herbaceous plant that is distributed in Central Asia, grows in sandy-clayey arid lands, and is an agent for treating stomach ulcers in traditional medicine. Extracts exhibit potential antiulcer activity.

Previously, the isoimperatorin, imperatorin, pranchimgin, xanthotoxin and xanthotoxol were isolated from roots of *F. lehmannii*.

Continuing studies of the chemical components of the aerial parts of *Ferula lehmannii* have isolated a new furocoumarin derivative, named is Lehmanien (**1**).

Lehmanien is a white powder and has the composition $C_{26}H_{30}O_4$, mp.83-84.

The chemical structures of the Lehmanien was established using ^1H and ^{13}C NMR spectra and 2D experiments HSQC, COSY, HMBC.



PREPARATION OF DRY EXTRACT OF THE AERIAL PART OF *Pulicaria gnaphalodes* AND ITS ANTIOXIDANT ACTIVITY

O.U.Rajabova^{1,2}, K.A.Eshbakova^{1,2}

¹*Institute of the Chemistry of Plant Substances named after Acad. S.Yu. Yunusov Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, 77 M. Ulugbek Str., fax (99871) 120 64 75, e-mail: e_komila@yahoo.com;*

²*Kimyo International University in Tashkent. 100121, Tashkent, Sh.Rustaveli 156, e-mail:rajabovaoydinoy8@gmail.com*

In continuation of the study of the chemical components of the aerial part of *Pulicaria gnaphalodes*, a dry extract was obtained. 5 kg of the dried and crushed upper part of the *Pulicaria gnaphalodes* L. plant, collected in the village of Khanbandi, Farish district, Jizzakh region, was taken. It was placed in a percolator, filled with 25 liters of 70% ethyl alcohol at room temperature in a ratio of 1:5 to the raw material and left for 24 hours. The resulting extract was separated and another 25 liters of 70% ethyl alcohol was added to the raw material. This process was repeated 5 times in total. The resulting extract was evaporated on a rotary evaporator to a remaining volume of 1.2 L. The condensed extract was diluted with water 1:1. The separator was removed from oils and other additional non-polar substances by sequential extraction of aqueous-alcoholic extract from a volume of 0.5 l with extraction gasoline 6 times in a funnel. The purified extract was extracted 6 times with 0.5 L of chloroform, 10 times with 0.5 L of ethyl acetate and 10 times with 0.5 L of n-butanol in a separating funnel and divided into fractions as indicated above). From here the amount of ethyl acetate was taken and the solvents were evaporated to dryness on a rotary evaporator. The resulting amount was dissolved in 100 ml of alcohol, 100 ml of boiling water was added little by little and left for 24 hours. In this way, chlorophyll and ballast substances were deposited. The remaining extract was again evaporated on a rotary evaporator and dried in a ventilated Binder oven at 50°C. As a result, 75.0 g of dry extract was obtained. The obtaining dry extract studied antioxidant activity.

The resulting dry extract has high antioxidant activity.

Antioxidant activity of dry extract of *Pulicaria gnaphalodes*.

Sample	IC ₅₀ (μg/ml)
Dry extract	5.87±0.31
VitC	5.34±0.42(μg/ml) 30.32±2.38 (μM)

OBTAINING CARBOHYDRATEALDIMINES BASED ON PECTINS

Adizov Sh.M., Azizov D.Z., Malikova M.Kh., Rakhmanberdyeva R.K.

Acad. S.Yu. Yunusov Institute of Chemistry of Plant Substances of the Academy of Sciences of the Republic of Uzbekistan. M. Ulugbek str. 77, 100170 Tashkent.

E-mail: adizovsh@gmail.com

Polysaccharides are a group of polymers that can be used as carriers of various medicinal substances. Pectin substances are characterized by a large number of hydroxyl and carboxyl groups, but it should be noted that hydroxyl groups exhibit low reactivity. The most active groups are aldehydes, so there is a need to oxidize pectin substances with sodium periodate or iodic acid. Apple pectin used as the starting compounds.

Partial acid hydrolysis of pectin (1N H₂SO₄, 100 °C, 4 hours) yielded a polysaccharide with a yield of 65%, consisting only of D-galacturonic acid residues, i.e. galacturonan.

Next, pectin and galacturonan were oxidized with a 0.4 N H₂IO₄ solution for 24 hours, and the corresponding polyaldehydes were isolated with yields of 80 and 92.5%, respectively, and an aldehyde group content of 5.8% and 15.22%. The IR spectra of polyaldehydes contain characteristic absorption bands: 1678 and 1618 (pectin polyaldehyde), 1675 and 1610 cm⁻¹ (galacturonan polyaldehyde), which indicates the presence of aldehydes.

Modification of natural polyaldehydes with substances containing an amino group is of interest from the point of view of obtaining compounds with new biological properties. We have synthesized pectin aldimin, a derivative based on pyrazoline and tryptophan. The reaction is based on the nucleophilic attack of the aldehyde groups of polyaldehydes, which leads to the formation of carbohydrate aldimines.

The IR spectra of the compounds contain characteristic absorption bands (cm⁻¹): a broad intense band 3384-3409 (-OH), 1668-1677 (C=N), 1602-1632, (C=O), 1555 (C=C) and 1282-1332 (N-C) groups.

The absence of an absorption band at 1608 cm⁻¹ in the IR spectra, caused by the stretching vibrations of the -CHO group, indicates the formation of carbohydrate aldimines. In addition, absorption bands appear in the region of 1668-1677 cm⁻¹, which corresponds to the stretching vibrations of the C=N groups.

Thus, the IR spectral data confirm the formation of carbohydrate aldimines.

This work was carried out with the support of the budget program of fundamental scientific research of the Academy of Sciences of the Republic of Uzbekistan.

FLAVONOIDS OF THE AERIAL PART OF *Inula salicina*

N.M. Yuldasheva¹, B.J. Komilov¹, K.S. Juraev¹, Kh.I. Khasanova¹, Ha Wei²,
K.A. Eshbakova¹, K.K. Turgunov¹

1) Institute of Chemistry of Plant Substances named after. acad. S.Yu. Yunusova
Academy of Sciences of the Republic of Uzbekistan, 700170, Tashkent, M. Ulugbek Ave.
77, fax (99871) 120 64 75, e-mail: e_komila@yahoo.com

2) Lanzhou Institute of Chemical Physics, CAS, Lanzhou 730000, China, e-mail:
hawei2012@licp.cas.cn

Inula salicina L. is a perennial plant belonging to the *Asteraceae* family.

According to the results of the study of spectral data and direct comparison with real samples, the isolated compounds were identified with certain flavonoids: jaceosidin (5,7,4'-trihydroxy-6, 3'-dimethoxyflavone) (1), chrysin (5, 7-dihydroxyflavone), apigenin (5,7,4'-trihydroxyflavone), chrysoeriol (4',5,7-trihydroxy-3'-methoxyflavone), chrysoeriol-7-O- β -D-glucoside and rutin. X-ray diffraction (XRD) analysis of jaceosidin was performed for the first time.

Jaceosidine 5,7,4'-trihydroxy-6,3'-dimethoxyflavone (1), C₁₇H₁₄O₇, m.p. 235-236 °C. NMR spectra (600 MHz, DMSO-d₆+CCl₄, δ , ppm, J/Hz):

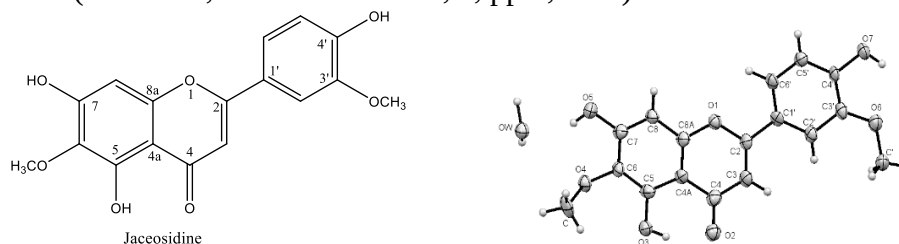


Fig.1. Structure of compound 1 in the crystal

The parameters of intramolecular and intermolecular H-bonds involving a water molecule are shown in Table 1.

Table.1. Hydrogen bonds in crystal 1(d: distance, D: donor, A: acceptor)

D-H ... A	<i>d</i> (D...A), Å	<i>d</i> (H...A), Å	$\angle$ (DHA), grad	Symmetry
O3-H...O2	2.558	1.89	143	<i>x,y,z</i>
O7-H...O6	2.651	2.20	116	<i>x,y,z</i>
O5-H...Ow	2.731	1.97	152	<i>x,y,z</i>
Ow-H1...O4	2.839	2.00	173	<i>x,y,1+z</i>
Ow-H2...O5	2.862	1.80	160	<i>x,y,1+z</i>

Substances 1,2,4-6 were isolated for the first time from the aerial part of *Inula salicina*.

ISOLATION OF THE ALKALOID SONGORINE FROM TECHNICAL WASTE OF THE PLANT *Aconitum soongoricum*

U.Kh. Kurbanov

*S.Yu. Yunusov Institute of Chemistry of Plant Substances AS RUz, 77, Mirzo Ulugbek
Str, 100170, Tashkent, e-mail: utkir.88.88@inbox.ru*

In pharmacological studies the genus *Aconitum L.* is known to have a wide range of biological activities such as antioxidant, antifungal, anti-inflammatory, antiproliferative, antidiarrheal, antimicrobial and enzyme inhibitory activities [1].

According to the literature about the isolation of the alkaloids aconine, senbusin A, chasmanin, 14-benzoyl-8-O-methyлаconine, neojiangyaconitine, senbusin C, neoline which belong to the aconitine type of C₁₉-norditerpene alkaloids, related to the napelline type isolated C₂₀-diterpene alkaloids songorine, 15-acetylsongorine, songoramine, 15-acetylsongoramine, norsongorine, 12-epinepeline, aconicarmichinium A and B, 12-epidehydronapelline, 16,17-dihydro-12,16-epoxynapellin from the plant *Aconitum soongoricum* [2,3].

In ICPS the alkaloid aconitine is isolated from the plant component *A. soongoricum*. A mixture of other alkaloids is disposed of as technical waste. We have developed a method for extracting the alkaloid songorine from these wastes. In this case, we divided 0.5 liters of technical waste into 8 fractions according to their acid-base nature. From the chloroform fraction obtained at pH=8-9, alkaloids were precipitated in the form of a salt and 64.58 g of hydrochloride sediment was separated. The hydrochloride was converted to a base, recrystallized from methanol and 27.84 g of the alkaloid zongorin was isolated.

Spots of the alkaloids norzongorine, zongoramine and aconitine were determined in the part of the spent liquor in comparison with standard substances in the TLC and TLC-Mass sectors.

References

1. Y.Y. Zhu, G. Yu, Y.Y. Wang, J.H. Xu, F.Zh. Xu, H. Fu, Y.H. Zhao, J. Wu, *Chem.Nat.Comp.*, Vol. 55(1), p. 189-193 (2019)
2. W. Kamil, B. Zhao, Kh. M. Bobakulov, H. A. Aisa, *Chem.Nat.Comp.*, Vol. 53(2), p.403-405 (2017)
3. Sh.S. Azimova, M.S.Yunusov, *Natural Compounds*, Springer Science, Business New York, p. 155-250 (2013)

PHARMACOLOGICAL PROPERTIES OF *Melilotus officinalis* COMPONENTS

Narbutaeva D.A.¹, Karakulova A.M.¹, Usmanova N.K.², Tursunkhodzhaeva F.M.¹

¹S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences
Republic of Uzbekistan, 100170, Tashkent, M. Ulugbek st., 77, e-mail:
narbutaeva83@list.ru, tel. (97)7292383

²Namangan State University, Uychinskaya st., 316, Namangan, 160100 (Uzbekistan), e-mail: nargiza_unq@mail.ru

The herb *Melilotus officinalis* (L.) Pall is used in scientific medicine as an anticonvulsant, for angina pectoris, coronary thrombosis and rheumatism. Coumarin, pinitol, sterols, flavonoids and other biologically active compounds were isolated from the aerial part of *Melilotus officinalis*. We have studied the antioxidant properties of pinitol, coumarin and 70% alcoholic extract of sweet clover in order to assess the prospects for its use in gerontology.

The antioxidant properties of the compounds were assessed in *in vitro* experiments on the accumulation of malondialdehyde (MDA) under conditions of iron-induced ascorbate-dependent lipid peroxidation (LPO), which was induced by 10 μ M FeSO₄ in the presence of 200 μ M ascorbate in a medium containing 145 mM KCl, 25 mM Tris HCl, pH 7.4. The MDA content was determined by a color reaction with thiobarbituric acid. All studied samples were pre-dissolved in ethyl alcohol (70%) and studied at a dose of 1*10⁻⁵ mg/ml. An oil solution of vitamin E (10%) at a concentration of 1*10⁻⁵ mg/ml was used as a comparison drug. Statistical processing was performed using Student's t-test in the Statistica version 6 program. Statsoft, Inc. (2001).

The data obtained showed that the addition of the studied drugs to the incubation medium at a concentration of 10⁻⁵ g/ml contributed to a more pronounced inhibition of liver lipid peroxidation processes in *in vitro* experiments. At the same time, a more pronounced decrease in the formation of MDA was observed - in the 70% extract by 70.2% (p<0.05) and comparison drug vitamin E decreased by 78.0% (p<0.001). Pinitol and coumarin showed the least inhibitory effect (33.6 - 55.0%).

Research results have shown that a 70% alcohol extract of the aerial part of *Melilotus officinalis* has a significantly pronounced antioxidant effect, inferior to vitamin E by 8%. Based on these data, it can be assumed that the studied extract can be used as a promising remedy for complex treatment in gerontology.

INDICATORS OF LIPID METABOLISM IN EXPERIMENTAL HYPERLIPIDEMIA IN RABBITS CAUSED BY ADMINISTRATION OF FAT PARENTERAL EMULSION “SEPID”

Narbutaeva D.A.¹, Davronova Kh.A.¹, Tursunkhodzhaeva F.M.¹, Khudaynazarov S.K.²

¹*S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences
Republic of Uzbekistan, 100170, Tashkent, M. Ulugbek st., 77, e-mail:
narbutaeva83@list.ru, tel. (97)7292383*

²*Republican Center for Pathological Anatomy, the Ministry of Health of the Republic of
Uzbekistan*

To search and select candidate substances for the treatment of atherosclerosis, adequate models of the atherosclerotic process in animals are required. The article (1) shows that the lipid load caused experimentally by the parenteral administration of lipid emulsions leads to the development of atherogenic dyslipidemia. The goal of our work was to determine whether fat emulsions can be used to formation of plaques in the vessels of experimental animals.

The experiment was carried out on 20 chinchilla rabbits of both sexes weighing 2.5-3.0 kg. Hyperlipidemia was modeled by intravenous administration of 10% fat emulsion for parenteral nutrition “Sepid” produced by Sichuan Kelun Pharmaceutical Co., Ltd. (China) daily 0.5 ml/kg for 120 days. The lipid spectrum of blood serum was studied using reagents produced by Cypress Diagnostics (Belgium) on a semi-automatic biochemical analyzer CYANSmart (Cypress Diagnostics, Belgium).

The experiments showed that administration of 10% fat emulsion once a day for 120 days, increases very significantly the level of cholesterol in the blood serum of experimental animals by 89,4%, but the content of triglycerides increases - by 39,2% ($p < 0.001$) compared to those of intact animals. The content of LDL and VLDL in the blood of experimental animals increased at the 4th week of the study, respectively, by 30,2% ($p < 0.05$) and 34,1% ($p < 0.05$) compared to the initial level. The HDL content decreased by 21,5% ($p < 0.001$). However, subsequent autopsy and histological examination of the rabbits' arteries showed that the vessels did not contain plaques or signs of inflammation. Obviously, the sizes of the “Sepid” fat emulsion particles do not allow them to penetrate the walls of blood vessels. Thus, we have concluded that this model is unsuitable for modelling the formation of atherosclerotic plaques in experimental animals.

E.V. Nemytysheva, N.E. Scheglova, M.N. Kalinkin. Studying the theory of patoautokinesis on laboratory animals at experimental hyperlipidemia. Medical Bulletin of Bashkortostan. Volume 9, No. 5, 2014, p.146-149.

CHEMICAL COMPONENTS OF *Ferula* SPECIES GROWING IN THE FLORA OF UZBEKISTAN AND KIRGIZISTON, THEIR CITOTOCSIC, ANTIBACTERIAL, ANTIOXIDANT, INHIBITOR ACTIVITY

K. A. Eshbakova¹, Kh. I. Khasanova², Xin-Xin Li³ Q. S. Jurayev¹, N.M. Yuldasheva¹, B.J.Komilov¹, Junli Yang⁴, A. U. Babekov⁵, Ying-Jun Zhang³

¹*Institute of the Chemistry of Plant Substances named after Acad. S.Yu. Yunusov Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, 77 M. Ulugbek Str., fax (99871) 120 64 75, e-mail: e_komila@yahoo.com;*

²*Tashkent institute of irrigation and agricultural mechanization engineers, National research university, Tashkent 100000, Uzbekistan*

³*State Key Laboratory of Phytochemistry and Plant Resources in West China, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650201, PR China. E-mail: zhangyj@mail.kib.ac.cn*

⁴*Lanzhou Institute of Chemical Physics, CAS, Lanzhou 730000, China, e-mail: yangjl@licp.cas.cn*

⁵*Osh State Pedagogical University. A.Zh.Myrsabekov, 723500, Osh st. Isanov 73,, Kyrgyzstan.e-mail: eababekov2511@mail.ru*

We studied the following species of *Ferula*: *F. tadshikorum*, *F. lapidosa*, *F. ovine*, *F. samarkandica*, *F. kuhistanica*, *F. ferganses*, *F. foetida*, *F. lemanin* and others. New and known compounds have been isolated from these plants: sesquiterpenes, coumarins, alkaloids, furocoumarins, sesquiterpene esters, lactones, alcohols, coumarins and their glucosides, iridoid glucosides.

The chemical structures of the isolated compounds were established using ¹H and ¹³C NMR spectra and 2D experiments DEPT, HSQC, COSY, HMBC, X-ray crystal structure analyses (XSAs).

The cytotoxic, antibacterial, antioxidant, and inhibitory activities of the isolated compounds were studied. Many new and known compounds isolated from *Ferula* species have shown high biological activity.

STUDIES ON THE CHEMICAL CONSTITUENTS OF *Ferula lapidosa*

K.A. Eshbakova¹, Kh.I. Khasanova², Xin-Xin Li^{3,4}, A.U. Babekov⁵, Ying-Jun Zhang^{3,4},
N.M. Yuldasheva¹

¹ Institute of the Chemistry of Plant Substances named after Acad. S.Yu. Yunusov
Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, 77 M. Ulugbek
Str., fax (99871) 120 64 75, e-mail: e_komila@yahoo.com;

² Tashkent institute of irrigation and agricultural mechanization engineers, National
research university, Tashkent 100000, Uzbekistan

³ State Key Laboratory of Phytochemistry and Plant Resources in West China, Kunming
Institute of Botany, Chinese Academy of Sciences, Kunming 650201, PR China.
E-mail: zhangyj@mail.kib.ac.cn

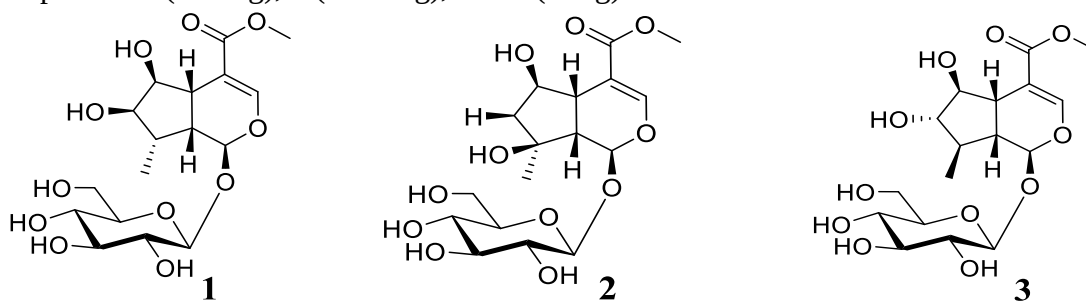
⁴ University of Chinese Academy of Sciences, Beijing 100049, PR China

⁵ Osh State Pedagogical University. A.Zh. Myrsabekov, 723500, Osh st. Isanov 73.,
Kyrgyzstan. e-mail: eababekov2511@mail.ru

The genus *Ferula* (Apiaceae) involves more than 200 species distributed worldwide, are primarily located in Central Asia, the Middle East, Siberia, and South Asia. As perennial herbs, *Ferula* plants can be divided into two categories: stinky and fragrant ones according to whether the plants have smell like onion and garlic.

Three compounds (1-3) were determined based on the analysis of their NMR spectroscopic data, along with a comparison with literature data, as four iridoid glycosides, 5-deoxypulchelloside (1), shanzhiside methyl ester (2), and 6 β -hydroxy-7-epi-loganin (3) respectively. All the known compounds were isolated from *F. lapidosa* for the first time.

The n-butanol fraction (9.0 g) was subjected to silica gel (200-300 mesh) column chromatography (CC), eluting with CH₂Cl₂-MeOH (100:1-0:1, v/v) to give 10 fractions (B1~B10). The fraction B7 (179 mg) was separated by semi-preparative HPLC [with 10% aqueous acetonitrile (ACN) as mobile phase, at a flow rate 3.0 mL/min] to afford compounds 1 (2.0 mg), 2 (51.4 mg), and 3 (8 mg).



COMPARATIVE EVALUATION OF THE EFFECTIVENESS OF THE ANTI-INFLAMMATORY EFFECT OF THE SUM OF VITASTEROIDS FROM PLANTS *Datura stramonium* AND DICLOFENAC SODIUM

Negmatova M.U., Egamova F.R., Syrov V.N., Yusupova S.M., Makhmudova M.M.,
Abdurakhmanov B.A.

*Institute of Plant Chemistry of the Academy of Sciences of Uzbekistan, Tashkent,
Uzbekistan,*e-mail: ferustamovna_14@mail.ru*

Most diseases that occur in the body are accompanied by inflammation, since the inflammatory process is an involuntary reaction of the body to various endogenous and exogenous influences. With a high level of inflammation, the function of most organs and tissues is disrupted and their insufficiency occurs (burn disease, peritonitis, rheumatism, etc.). Currently, drugs belonging to the group of steroid and nonsteroidal drugs with anti-inflammatory effects are used worldwide. These drugs are not active enough and have a number of side effects. In such cases, the best solution is the widespread use in medicine of biologically active substances with anti-inflammatory properties obtained from plants.

In this regard, the staff of the Institute of Plant Chemistry of the Academy of Sciences of the Republic of Uzbekistan studied the anti-inflammatory activity of the sum of vitasteroids isolated from the plant *Datura stramonium* (daturalactone, vitastramanolide, etc.). The anti-inflammatory activity of the sum of vitasteroids in the experiment was evaluated on a model of acute inflammation caused by the introduction of 0.2 ml of 1% formalin solution under plantar aponeurosis of the hindlegs of rats. The studied and reference drug diclofenac sodium was administered orally at a dose of 10 mg / kg, 2 hours before and 30 minutes after inoculation of the inflammatory agent. The results of the study showed that the amount of vitasteroids weakens the development of formalin edema. 3 hours after the administration of formalin, the anti-inflammatory effect of the studied drug and diclofenac sodium in relation to the control was 54.2 and 24.1%, respectively. Thus, the data obtained showed that the studied sum of vitasteroids has an anti-inflammatory effect (antiexudative effect). In specially designed experiments, it was found that it is also more active than the reference drug diclofenac sodium in its antiproliferative effect and can be used to develop anti-inflammatory drugs in medical practice.

COMPONENT COMPOSITION OF ESSENTIAL OIL OF *Salvia sarawschanica* AERIAL PART

M.U. Zhuraev, Kh.M. Bobakulov, S.A. Sasmakov, E.Kh. Botirov

*S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences
Republic of Uzbekistan, 100170, Tashkent, M. Ulugbek st., 77 e-mail: botirov-nepi@mail.ru*

Sage (*Salvia*) is one of the largest genera of the family *Lamiaceae* and is represented by more than 1000 species, widely distributed in various regions of the world, including Southeast Asia [1,2]. There are 25 species of plants of this genus growing on the territory of Uzbekistan [2]. Many types of sage are known for their brightly colored flowers and some of them are used to create herbal medicines, as well as in folk and traditional medicine in various countries [3,4].

Salvia sarawschanica Regel et Schmalh - grows in dry riverbeds, rocks, rocky, gravelly and fine-earth slopes of the lower and middle zones of the Pamir and Pamir-Alai mountains in Central Asia and Kazakhstan. Medicinal and essential oil, decorative honey plant. The infusion is used in folk medicine in Tajikistan for heart diseases; the extract has antiprotozoal and fungistatic properties. In the aerial part of the plant, flavonoids, tannins, saponins, alkaloids, coumarins, and quinones were found.

In order to search for biologically active compounds, we studied the composition of the essential oil of the aerial part of *S. sarawschanica*, collected during the flowering period (July, 2023) in the Navoi region. Isolation of essential oil from crushed air-dried aerial parts was carried out by hydrodistillation at atmospheric pressure for 2.5 hours. The qualitative and quantitative composition of the essential oil was determined on an Agilent 5975C Inert MSD/7890A GC chromatography-mass spectrometer. Using the GC-MS method, 25 compounds were identified in the essential oil from the air-dried plant, which accounted for 91.5% of the total amount of essential oil.

The dominant components of the hexane extract were oxidized monoterpenes (40.8%) and monoterpenes (31.1%). The content of sesquiterpenes in the essential oil is only 9.7%. The major components of the essential oil were 1,8-cineole, camphene, limonene, camphor, and aromadendren, the content of which was 34.0, 18.8, 8.2, 6.8 and 5.2%, respectively.

The results of *in vitro* screening for antibacterial and antifungal activity showed that the essential oil of *S. sarawschanica* exhibits a noticeable antibacterial effect against the Gram-positive strain of bacteria *B. subtilis* (10.04 ± 0.10 mm).

The work was carried out within the framework of basic fundamental scientific research of the Academy of Sciences of the Republic of Uzbekistan.

References

1. Drew B. T., González-Gallegos J. G., Xiang C. L., Kriebel R., Drummond C. P., Walker J. B., Sytsma K. J. *Salvia* united: The greatest good for the greatest number. *Taxon*, V. 66 (1), 133 (2017).
2. Turdiboev O.A., Shormanova A.A., Sheludyakova M.B., Akbarov F., Drew B.T., Celep F. Synopsis of the Central Asian *Salvia* species with identification key. *Phytotaxa*, V. 543 (1), 1 (2022).
3. Yi-Bing Wu, Zhi-Yu Ni, Qing-Wen Shi, Mei Dong, Hiromasa Kiyota, Yu-Cheng Gu, Bin Cong. Constituents from *Salvia* Species and Their Biological Activities. *Chem Rev.*, V.112 (11), 5967 (2012).
4. Llurba-Montesino N., Schmidt Th. J. *Salvia* Species as Sources of Natural Products with Antiprotozoal Activity. *Int. J. Mol. Sci.*, V. 19 (1), 264 (2018).

STUDY OF THE TOXICITY AND SEDATIVE EFFECT OF A DRY EXTRACT ISOLATED FROM *Melissa officinalis*

Egamova F.R., Yusupova S.M., Abdurakhmanov B.A.,
Sotimov G.B., Mamatkhanova M.A.

*Institute of the Chemistry of Plant Substances Academy of Sciences of Uzbekistan,
Tashkent, Uzbekistan, *e-mail: ferustamovna_14@mail.ru*

Melissa officinalis is a perennial herbaceous plant from the family of *Lamiaceae*. Her homeland is on the shores of the Mediterranean Sea, somewhere between Portugal and Syria. From there, it gradually spread throughout Southern and Central Europe, southern Russia and the Caucasus. Melissa belongs to essential oil crops. The essential oil content in it reaches 0.3%, and in some cases reaches 0.8%. Substances such as neral and geranal are responsible for the incredible aroma of the herb, they are part of the oil. In addition, the fragrant plant contains sterols and saponins, flavonoids, phenylpropanoids and monoterpenes, tannins, coumarins, phenolic acids and ursolic acid. In modern medicine, the infusion of melissa herb is recommended to be used as an auxiliary sedative and antidepressant in the complex treatment of diseases of the nervous and cardiovascular system; as an antimicrobial and anti-inflammatory agent for the treatment of colds. The infusion is prescribed as an independent remedy for insomnia.

The purpose of this study is to study the toxicity and sedative effect of a dry extract from *Melissa officinalis*. The acute toxicity of a dry extract from *Melissa officinalis* was studied, according to the requirements for a preclinical study of the general toxic effect of new pharmacological substances, on mice weighing 18-20 g of both sexes. The drug was administered orally in doses of 200, 500, 1000, 2000, 3000 and 5000 mg/ kg. The observation was conducted for the first 24 hours, and then for the next 14 days. After administration of the dry extract to animals orally at doses of 200, 500, 1000 and 2000 mg/kg, there were no visible changes in their behavior. An increase in the dose to 3000 and 5000 mg/kg caused depression of the general condition in animals, lasting 3-4 hours. No animal deaths were reported in these groups. Therefore, it can be classified as a low-toxic substance.

In the next series of experiments, studies were conducted to study the effect of the extract on the motor activity of mice. The studied extract was administered orally daily for seven days at doses of 10, 25 and 50 mg/kg. The studied extract at a dose of 25 mg/kg had the most pronounced sedative effect on motor activity, while doses of 10 and 50 mg/kg had an unstable effect.

Thus, it follows from the data obtained that the dry extract isolated from *Melissa officinalis* is non-toxic and has a sedative effect.

ECO-PHYTOCENOTIC DESCRIPTION TSENOPOPOULOS OF *Ajuga turkestanica* (REGEL) BRIQ

¹A.E.Egamberdiev, ¹A.M.Nigmatullaev, ²I.O'.Muqimov

¹S.Yu. Yunusov Institute of the chemistry of plant substances, 100170, Tashkent, Mirzo Ulugbek street, 77. akmal-egamberdiyev-76@mail.ru

²Sh.Rashidov Samarkand State University, universtitet alley 15 houses, associate professor of the Department of Botany. ilhommumov65@gmail.com

Studied in various ecological phytocenotic conditions of Mount Boysun *A. turkestanica* the tsenopopulasias belonging to belong to the montane hypsophytes or variegated low montane vegetation type (Oregogypsophyta).

A.turkestanica (Regel) Briq. - of the mint family (Lamiaceae Martinov.) is a representative, endemic plant. During our field research, *A. turkestanica* 3 tsenotic populations of the endemic species in various ecological-phytocenotic conditions have been identified. *A. turkestanica* Boysun is endemic to the mountain (the population localitet administratively corresponds to the western area of Boysun district, Surkhandarya region. Boysun belongs to the areal type.

1. Darband tsenopopulation was recorded as part of the *Artemisia tenuisecta* – *Poa bulbosa* - *Ajuga turkestanica* community in the ola gendered, gypsum Hills (N38.206850°E66.959355°, h=1200 m) near Qapchigay, upper Darband, around the village of Darband. The total coverage of the area with plants reaches 32-35%, with a.the share of *turkestanica* is formed around 10-12%. *Artemisia tenuisecta*, *Artemisia oliveriana*, *Ajuga turkestanica* are found as dominants of the plant community, and *Carex pachystylis*, *Eremurus luteus*, *Poa bulbosa* have been recorded as subdominants. An analysis of our geobotanical records from different seasons of the year has shown that this plant community contains a total of 58 species (5 species of shrubs, 3 species of hemispheres, 11 perennials, 2 biennial, 19 annual, including 18 species of ephemers).

2. *A. turkestanica* tsenopopulation involving was recorded near the village of Yalpizbuloq (N38.255618°E66.922934°, h=1274 m). The tsenotic population was isolated as part of the *Salvia buharica* - *Artemisia tenuisecta* - *Ajuga turkestanica* community with shirach participation and spread on plastered fertile soils. The overall coverage of the region with vegetation was higher compared to Darband tsenopopulation at 38-42%. The plant community in question is dominated by *Eremurus olgae*, *Salvia buharica*, *Ajuga turkestanica*. The next dominant species was *Zygophyllum atriplicoides*, *Pholmus*. Assector species include *Carex pachystylis*, *Poa bulbosa*, *Alhagi pseudalhagi*, *Ziziphora tenuior*, *Onosma liwanowii* and others.

3. The tsenopopulation of the To`da was assigned to Boysun District 9 km west, in areas (N38.289-165°E66.987-108°, h=1288 m) as part of the All-Grass – ayuga community. Tsenopopulation is distributed on both sides of the palate, *A.turkestanica* is relatively sparse on the western slopes of the soy, mostly common on the eastern slope. It should be noted that *A. turkestanica* this population of was first identified in our studies. Until recently, we had data on 2 local populations of the species. We have recorded To`da tsenopulation as the main tsenopulation of the species with the highest number of individs (468). According to our geobotanical records, the overall coverage rate of the community with plants was 45%. In This, *A. turkestanica* the share of was 18-22%. *Prunus spinosissima*, *Tulipa korolkowii*, *Bromus tectorum*, *Ziziphora tenuior*, *Eremurus olgae*, *Atraphaxis spinosa* and more than 87 other plant species form this community in the ecotope.

TRENDS IN THE TRANSFORMATION OF *Ajuga turkestanica* TSENOPOPULATIONS UNDER DIFFERENT ECO- PHYTOCENOTIC CONDITIONS

¹A.E.Egamberdiev, ¹A.M.Nigmatullaev, ²I.O'.Muqimov

¹S.Yu. Yunusov Institute of the chemistry of plant substances, 100170, Tashkent, Mirzo
Ulugbek street, 77. akmal-egamberdiyev-76@mail.ru

²Sh.Rashidov Samarkand State University, universitet alley 15 houses, associate
professor of the Department of Botany. ilhommumov65@gmail.com

In geobotanical studies conducted in the 1970 s of the XX century, the species composition of plant communities in which species studied from our side were involved was compared with the current state. In the 1970 s, variegated soils were developed by *A. turkestanica* references are made to the 13 plant communities in which participated. The first team was he. It was recorded by Allanazarova (1972) as a marmaracal-mattiolasor Association, part of the mixed-mattiolali (Mixtomatthioleta) formation, in the olagendered hills of the Darband and Sayrob line highway. Due to the increase in the number of inhabitants and the expansion of the land of lalmi, today the composition of the community has completely changed. In the course of our field studies in 2020-2024, not only *A. turkestanica* not a single assumption with the participation of, which perhaps *mattiola* was dominant, was also recorded.

A. turkestanica considered a locus-classicus for, gravel near Darband from a mixed amorphous and crystalline gypsum Hill was discovered in 1972 by A. Butkov and he. Allanazarova isolated the astragalli-levkoyli-cleomazor Association, part of the *Cleome* (*Cleomideta*) formation (a preserved in the TASH herbarium). all herbarium specimens collected in different years on *turkestanica* were collected from this particular locality). With a total coverage rate of 32-35%, the composition is *A.turkestanica* in a team of 38 species participant, *Cleome quinquenervia* and *Scutellaria colpodea* are listed as the main dominants. This assumption has recorded 86 plant species in its composition, and *A. turkestanica* estimated the area of the scattered area to be about 260 hectares. What structural and structural changes have taken place in this community, in which almost 90 species of plants were recorded in the seventies of the last century, for half a century, and we compared the data we collected in 2020-2024 with the sources of literature.

According to the analysis, a positive trend was observed in some species, for example, the number of *Artemisia oliveriana* individuals increased sharply, an abundance of Wormwood was observed in all our transects.

According to Ibragimov, this species belongs to the southwestern isor areal type, the presence of which confirms that those regions have a sharply continental climate [3; 40-b.]. In subsequent years, the intensive introduction of xerophilous species into the community and an increase in the ecological density of existing ones are explained by aridisation processes. The research area is strongly influenced by the Turkmen steppe in the West and the steppe plains in the Surkhan-Sherabad Valley in the Southeast.

Compared to the seventies of the last century, it can be observed that a large part of the total biomass in the plant community studied today is made up of annuals, and this contribution is further increased at the expense of anthropogenic species. In the studied phytocenosis dynamics, it is an alarming case that mesophilic species are disappearing and instead xerophilic species share is increasing.

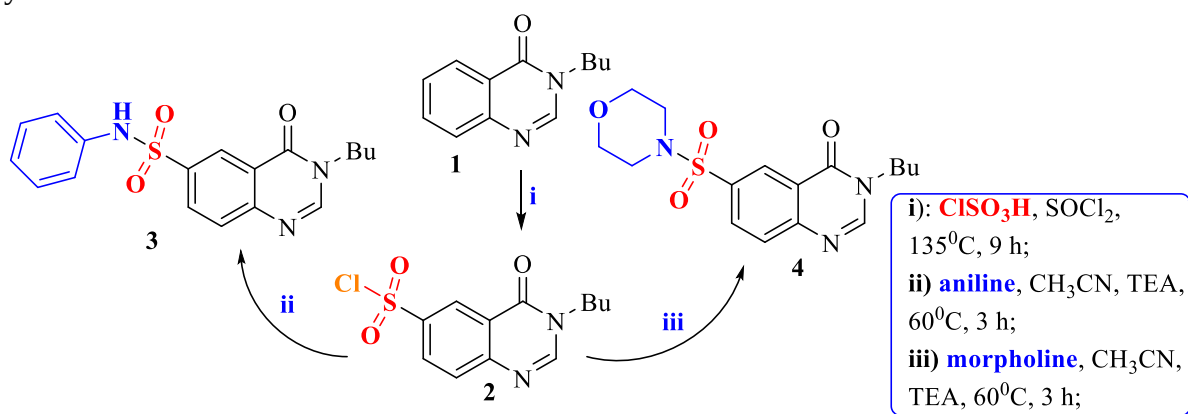
NOVEL SULFONAMIDES IN THE SERIES OF BICYCLIC QUINAZOLINES

S.M. Allaberganova, U.M. Yakubov, B.Zh. Elmuradov

*S. Yunusov Institute of the Chemistry of Plant Substances,
Academy of Sciences of the Republic of Uzbekistan, Tashkent, Uzbekistan.
e-mail: sevara_alla@mail.ru*

Currently, research in the field of synthesis of new compounds with the sulfonamide group has received a “second wind”, which is due to the increase in the synthetic capabilities of organic chemistry and the study of their medical and biological properties with a wide spectrum of action. New reagents and reactions make it possible to significantly increase the structural bank of compounds with a sulfonamide fragment in combination with other pharmacophoric groups. The result of these synthetic capabilities is the expansion of the spectrum of biological activity - along with antibacterial activity, many of them reveal physiologically important actions. Scientists at the Institute of Chemistry of Plant substances have developed improved optimal methods for the synthesis of sulfonamides. They were able to synthesize many sulfonamide derivatives, including bi- and tricyclic quinazolines, benzimidazoles, benzoxazoles and benzothiazoles.

Continuing our research, we synthesized sulfonamides (**3**, **4**). 3-Butylquinazolin-4-one (**1**) was chosen as the object. At the first stage of this experiment, the synthesis of 3-butyl-4-oxo-3,4-dihydroquinazoline-6-sulfochloride (**2**) was carried out, and at the next stage, the resulting sulfochloride reacts with morpholine and aniline in acetonitrile at 60°C for 3 h. As a result, 3-butyl-4-oxo-N-phenyl-3,4-dihydroquinazoline-6-sulfonamide (**3**) and 3-butyl-6-(morpholinosulfonyl)quinazolin-4(3H)-one (**4**) were synthesized in good yields:



The resulting substances were recrystallized from isopropyl alcohol, the yield was 85-87%. The structure of the synthesized substances was confirmed by physical research methods (IR, ^1H and ^{13}C NMR spectroscopy).

RAW MATERIAL RESERVES OF YARROW INFLORESCENCES (*Achillea filipendulina* LAM.) IN THE TASHKENT REGION

A.M. Nigmatullaev¹, D.K. Pulatova², F.F. Urmanova²

1) S. Y. Yunusov Institute of the Chemistry of Plant Substances AS RUz

2) Tashkent Pharmaceutical Institute, Tashkent, e-mail: dildora.pulatova.74@bk.ru

Due to its diverse geographical and climatic conditions, Uzbekistan is a rich region of medicinal plants, among which there are quite a few species that are of interest to scientific medicine. These include *Achillea filipendulina* (*Achillea filipendulina* Lam.), one of the most common species *Achillea* of the *Achillea* L. genera. the Asteraceae. Our research has allowed us to recommend its inflorescences as an effective diuretic, hemostatic and anti-ulcer agent. In order to introduce *achillea filipendulina* medical practice, it was necessary to have data on its resource potential on the territory of our country. According to the literature data and the floristic catalog of the Central Herbarium of Uzbekistan, yarrow is found in the Fergana Valley, the valleys of the Zarafshan and Chirchik rivers, in the vicinity of Tashkent, Tien - Shan, Pamir-Alai (ridges of the Central Herbarium of Uzbekistan). Yarrow meadowsweet inhabits territories with different types of vegetation and different ecological conditions. Not only is it abundant, but it also plays an important role in plant landscapes. This report is dedicated to determining the raw material reserves *Achillea filipendulina* in the Tashkent region of Uzbekistan. Resource studies were carried out in 2023-2024 in places of mass growth of plants in the Tashkent region by the method of laying accounting platforms. The results are presented in table.

Area of yarrow thickets and raw *achillea filipendulina* material reserves in Tashkent region

Key area	Koordinates	Area of the massif, ha	Productivity, t / ha	Total reserve, t/ha	Operational reserve, t /
Area with Koksaroy (118 km)	41°17'21"N 70°37'17"E	3.5	0.72	6.0	4.0
133 km from Tashkent	41°47' 11 N 70°51' 33 E	2.0	0.24	0.55	0.2.2
148 km from Tashkent	41°27'21"N 70°49'53"E	30.0	0.25	7.5	4.5
150 km from Tashkent (dachi)	41°6'53" N 70°29'43 "E	40.0	0.38	15.2	9.1
Chatkal	41°6'50"N 70°39'49 E"	3.0	0.36	1.1	0.6 .
Gazalkent	41°30'12"N 69°41'17"E	4.0	0.35	1.4	0.8
Trans. Charvak	41°23'33"N 69°21'13 "E	8.0	0.15	1.2	0.7
Okr. Burchmulli	41°20'19"N 70°40'27" E	2.5	0.13	0.2	0.1
Okr. Bogustan	41°30'12"N 70°41'11"E	5.0	0.24	1.2	0.7
Total :		98.0		34.3	20.7

From the data obtained, it follows that the total raw material reserve of yarrow of sweet-leaved tomatoes in the Tashkent region is 34.3 t / ha, and the operational reserve is 20.7 t / ha in dry form.

TYPE SELECTION AND INFLUENCING PARAMETERS OF DRYING THE LEAVES OF *Rosa rugosa* DURING THE PROCUREMENT OF RAW MATERIALS

Alimujiang Abulizi^{1*}, R.M. Khalilov¹, Zhao Jiangyu², Sh.Sh. Sagdullaev¹

¹S.Yu. Yunusov, Institute of the chemistry of plant substances of the Academy of Sciences Republic of Uzbekistan. 100170 Tashkent, Mirzo Ulugbek str. 77. E-mail: munir_05@mail.ru

² State Key Laboratory Basis of Xinjiang Indigenous Medicinal Plants Resource Utilization, Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Urumqi 830011, China

We carried out research on the selection of optimal drying conditions for leaves of *Rosa rugosa* Thunb. (family Rosaceae) for harvesting raw materials without loss of the active substance.

By 2.0 kg of freshly prepared samples of plant materials were dried at the following conditions, determining the moisture contents in the interval of every 0.5 hours:

- in a drying cabinet without vacuum, at a temperature of 50 ± 5 °C;
- in a drying cabinet at a vacuum of 0.6-0.8 kg/cm² and a temperature of 50 ± 5 °C;
- in a drying infrared radiation dryer "IKS-2M" (Russia) at a temperature of 50 ± 5 °C,
- with forced air ventilation at a temperature of 50 ± 5 °C.

It has been established that drying with infrared radiation and drying with forced ventilation is superior in terms of time consumption to other considered methods. Drying in a non-vacuum dryer and infrared radiation dryer results in a reduction in the flavonoids quercetin-3-O-sophorose and kaempferol-3-O-sophoroside content of the dried leaves of *Rosa rugosa*.

Taking into account the data about changes in the content of flavonoids and waste of time on the process, it was found that drying leaves of *Rosa rugosa* at a temperature not exceeding 50°C is optimal with forced air ventilation.

Based on the results obtained, the following optimal drying conditions for leaves of *Rosa rugosa* established with forced ventilation:

- thickness of the layer of plant materials on the baking sheet of the dryer - 20 mm;
- speed of supplied air – 8 m/s;
- process temperature – no more than 50 °C;
- duration of the process - at least 6 hours.

The developed drying method is included in the Instructions for the collection and drying of leaves of *Rosa rugosa*.

SELECTION OF ADSORPTION RESIN TYPE AND ELUENT FOR PURIFICATION OF QUERCETIN-3-O-SOPHOROSIDE AND KAEMPFEROL-3-O-SOPHOROSIDE FLAVONOIDS FROM WRINKLED ROSE (*Rosa rugosa* THUNB.) LEAVES

¹ Acad. S. Yu. Yunusov Institute of Chemistry of Plant Substances, AS of UzR, Mirzo Ulugbek St., 77, Tashkent Sh., 100125 (Uzbekistan)

² State Key Laboratory Basis of Xinjiang Indigenous Medicinal Plants Resource Utilization, Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Urumqi 830011, China; *E-mail: atux@ms.xjb.ac.cn

o
f The results are presented in Tables 1 and 2.

Table 1. Verification test

	Quercetin-3-O-sophoroside			Kaempferol-3-O-soforozid		
	1	2	3	1	2	3
30%	1491287	1326098	646889	1576496	1344322	643313
50%	422373	326831	314866	426556	329595	322997
70%	6683	5244	4041	7106	5860	6080
95%	-	-	-	-	-	-

Table 2. Extract yield of each part

	30%	50%	70%	95%
M1 (g)	94.7735	86.6851	96.4121	94.4954
M2 (g)	95.0056	86.7121	96.4067	94.4996
Extract (g)	0.2321	0.027	0.0054	0.0042
Yield (%)	9.67	1.13	0.16	0.18

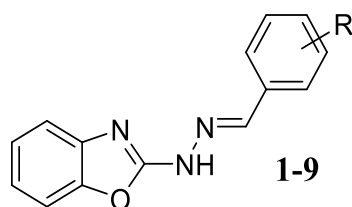
As can be seen from the results presented in Jalval, when eluting with 70% and 95% ethyl alcohol, quercetin-3-O-sophoroside and kaempferol-3-O-sophoroside flavonoids are significantly reduced in the eluent composition. Therefore, 50% ethyl alcohol was chosen as an eluent.

CYTOTOXICITY OF NEW 2-HYDRAZONES BASED ON HYDRAZINYLBENZOXAZOLE *IN VITRO*

M.R. Umarova, U. B. Khamidova, E.O. Terenteva, N.A. Tasheva, E.G. Yusupova,
Z.Zh. Pulatova, I.S. Ortikov, B.Zh. Elmuradov, Sh. S. Azimova

*S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences
of the Republic of Uzbekistan, Mirzo Ulugbek Str. 77, 100170, Tashkent, Uzbekistan. e-
mail: mukaddas4933@icloud.com*

The cytotoxicity of new nine derivatives of 2-hydrazones obtained from the reaction of 2-hydrazinylbenzoxazole with carbonyl compounds was determined against 2 cancer cell lines HEP-2 (laryngeal adenocarcinoma) and HeLa (cervical epithelial carcinoma) by MTT in vitro [1]. The substances' cytotoxicity was compared with cisplatin ("Cisplatin-Kemoplat", India).



R= **1**) 3,4 di -OCH₃, **2**) 4-OCH₃, **3**) 3-CH₂OH, 4-OCH₃, **4**) 2-OH, 5-OCH₃,
5) 2-OH, 3-OCH₃, **6**) 4-OH, **7**) 3-OH, **8**) 2-OH, **9**) 2-OH, 5-Br

Among the nine new derivatives, sample 5 showed slight cytotoxicity against HEP-2 and HeLa cells with IC₅₀ values of 100 and 88.9 μM, and sample 9, with IC₅₀ = 94.6 and 66.9 μM, respectively. The remaining derivatives of 2-hydrazones did not exhibit any cytotoxicity under the same conditions — IC₅₀ values exceeded 100 μM. The study of the structural-functional relationship of the obtained compounds showed that the manifestation of cytotoxicity requires the simultaneous presence of a hydroxyl substituent and a Br atom or a methoxy group in the benzene ring of 2-hydrazone.

References:

1. Niks M., Otto M. Towards an optimized MTT assay// Journal of Immunological Methods, 1990, 130, p.149-151.

DETERMINATION OF THE CONTENT OF CAROTENOIDS IN THE ROOT PART OF *Curcuma longa* L CULTIVATED IN THE REPUBLIC OF UZBEKISTAN

M.R. Tursunova

Tashkent Scientific Research Institute of Vaccines and Serums, Uzbekistan,
100084, Tashkent, Yunusabad district, e-mail: malikaphd@mail.ru

In medical practice, *Curcuma longa* L. uses parts of the plant containing biologically active substances that have a positive effect on the human body. The roots, rhizomes and leaves are mainly used as a medicine. One of the main active ingredients of turmeric is curcumin and carotenoids, which give the plant its characteristic yellow color and have many beneficial properties. Carotenoids are powerful antioxidants that play an important role in maintaining skin, hair and the immune system. Determination of the amount of carotenoids in the root part of *Curcuma longa* L. determines the effectiveness of its medicinal properties and quality standards in raw materials. The content and composition of curcuminoids in turmeric rhizomes often varies depending on varieties, location, sources and growing conditions. However, studies on the chemical composition of turmeric of local varieties *Curcuma longa* grown in the territory of the Republic of Uzbekistan have not been carried out. Therefore, the purpose of this study was a comparative analysis of carotenoid content. *Curcuma longa* grown in Tashkent and Surkhandarya regions. Our study included the determination of carotenoids in the root part of *Curcuma longa* L harvested in 2021 using standard methods [1]. Before extraction, dried rhizomes of local turmeric varieties were first crushed and sieved with a pore size of 1 mm. To determine the amount of carotenoids, the resulting extractant was measured on a spectrophotometer at 450 nm. It has been established that the amount of carotenoids in the root part of *curcuma longa* varies depending on soil and climatic conditions and methods of processing during cultivation. At the same time, the average concentration of carotenoids ranged from 3.98% (Tashkent region) to 6.50% (Surkhandarya region) of the dry mass of plant raw materials. Which indicates an increase in the amount of biological active substances, in particular carotenoids, increases in the transition to more tropical climatic conditions. It has been established that the content of biological active substances, in particular carotenoids, is about 4.0-7.0%, which makes it possible to recommend it as a raw material for the manufacture of various valuable medicines.

Literature:

1. Farkhutdinova R.G., Kudashkina N.V., In the book. : Fundamentals of phytochemical analysis, UFA 2016, pp. 56-57

IMMUNOMODULATORY EFFECTS OF COLCHIPRIT-NEO

Enikeeva Z.M., Urazov N.E., Ibragimov Sh.N., Agzamova N.A.

The republican specialized scientifically-practical medical centre of Oncology and Radiology of MH RUz, Republic Uzbekistan, Tashkent - 700174, Street Faroby 383

Most anticancer drugs used to treat cancer patients have a noticeable immunosuppressive effect, therefore, the characteristics of each new anticancer drug necessarily include the study of its effect on the immunological reactions of the body.

Also, for colchicine derivatives, information was obtained that after the therapy, some - K-48, with intraperitoneal and oral, and K-42 after oral administration, had the ability to stimulate immunity [Enikeeva, 2005].

The aim of this work was to study the immunological effect of the new compound by determining the number of antibody-forming cells (AOC) in the spleen using the method of local hemolysis of erythrocytes according to Erne and Nordin [1963] in mice with a transfected tumor strain of Sarcoma 180.

The AOC formation index, chosen by us as a criterion for assessing the immunological effect of the test compounds, reflects the state of the immunocompetent system, and its decrease indicates the development of immunosuppression. Ram erythrocytes are a thyme-dependent antigen, AOC to which are formed only after the interaction of progenitor cells with T-lymphocytes. After 8-fold intraperitoneal administration of drugs and colchamine as a control in therapeutic doses, on the 15th day after tumor transplantation, the animals were immunized with washed ram red blood cells. AOC quantification was performed on day 4 after immunization.

The results showed that colchipritis has a different effect on the number of AOCs in the spleen: the drug administered intraperitoneally at a dose of 4 mg/kg significantly, almost halved, reduces the number of AOCs (8,300 -K-20; 14.000 control) compared to the control group with simultaneous spleen weight suppression. In contrast, K-20 administered orally at a dose of 100 mg/kg increased the amount of AOC in tumor carriers (17,000 AOC per spleen). At the same time, the weight of the spleen increases significantly compared to other substances considered

Thus, the fact of the stimulating effect of colchiprit-neo on the immune status of tumor-carrying animals with its 8-fold use at a therapeutic dose, along with high antitumor activity, was obtained.

EFFECT OF GLYCYRRHIZIC ACID COMPLEX WITH 6-BENZYLAMINOPURINE ON SHOOT DEVELOPMENT AND MICROTUBER FORMATION IN *IN VITRO* POTATO REPRODUCTION

Saydullaeva Kh.T., Sobirova M.Sh., Gafurov M.B., Kholmuratov E.G.,
Nasirova G.B., Yuldashev Kh. A.

Academy of Science Republic of Uzbekistan named after O.S. Sadykov Institute of Bioorganic Chemistry, Mirzo Ulugbek St, 83. khulkarsxt@gmail.com

The developed standard plant regeneration system can serve as a convenient test system for determining the biological activity of new substances. In this regard, the biological activity of the XT-4 complex (glycyrrhizin acid (GA) with 6-benzylaminopurine (6-BAP) was studied during the cultivation of nodal explants of potato plants *in vitro*. The potato varieties Red Skarlet and Pikasso were used in the work. To determine the biological activity, the effect of various concentrations of the complex was studied: 10^{-5} , 10^{-6} , 10^{-7} , 10^{-8} M on such parameters as shoot height and number of nodes, root length, and the number of formed microtubers. The experiments showed that the effect of the complex on the growth and development of shoots is clearly dependent on the concentration. Thus, the highest concentration of 10^{-5} M in both varieties had an inhibitory effect on shoot development. As the concentration decreased, the activity of the complex increased. If the concentration of 10^{-5} M slowed down the growth rate of the shoot almost 5 times in comparison with the control, while the formation of roots was completely absent, then at a concentration of 10^{-8} M, on the contrary, it intensified the growth of the shoot almost 1.5 times, and also increased the number of roots formed and their length by 20-25% in comparison with the control [1].

When studying the effect of the complex on the tuberization process, it was determined that the highest activity was also possessed by a concentration of 10^{-8} M. If in the control, the formation of microtubers in relation to explants was observed in the ratio of 13/20 (microtuber/explant), then under the influence of the minimum concentration of the complex, this ratio changed to 16/20. At the same time, the sizes of the formed microtubers increased significantly 0.5 - 0.6 cm in the control and 0.8 - 1.0 cm in the experiment.

REFERENCES

1. Saydullaeva Kh. T., Gafurov M. B., Yuldashev Kh. A. et al, Concentration dependence of the influence of glycyrrhizin acid complex with 6-benzylaminopurine on the growth of shoots during micropropagation potato plant *in vitro*. Материалы международной научной конференции актуальные проблемы развития биоорганической химии. 13 – 14 ноября 2023 г. Ташкент. С.372-373.

QUANTITATIVE DETERMINATION OF VITAMINS FROM THE PLANT *Fritillaria severzovii* BY HPLC

¹N.T.Khuzhaeva, ¹V.U.Khuzhaev, ²B.Y.Abduganiev

¹ Kokand State Pedagogical Institute, 150700, Uzbekistn, Kokand, Turon street, house 23, E-mail: xujayev_030@mail.ru,

² Customs Institute of the State Customs Committee 100071, Uzbekistan, Tashkent, Kazirabad street, 118.

There are 8 species of the genus *Fritillaria* in the flora of Uzbekistan. The object of the study of this report is the species *Fritillaria (Korolkowia) sewerzowii*, the chemical composition of which has been little studied. This report briefly presents the results of the quantitative determination of some water-soluble vitamins: vitamins of group B - B1, B2, B6, B9, B12, as well as vitamins PP and C from various organs of the plant *Fritillaria sewerzowii*.

Water-soluble vitamins were analyzed using HPLC with gradient elution mode and diode array detector (DAD). Acetonitrile and buffer solution were used as mobile phase. Spectral data were analyzed in the spectral range from 200 to 400 nm.

Chromatography conditions: Mobile phase (gradient mode) – acetonitrile – buffer solution pH=2.92 (4%: 96%) 0-6 min., (10%: 90%) 6-9 min., (20%: 80%) 9-15., (4%: 96%) 15-20 min; Injection volume – 10 µl; Mobile phase flow rate – 0.75 ml/min. Column – Eclipse XDB – C18. 5.0 µm, 4.6x250 mm; Detector – diode array detector, wavelengths 272, 292, 254, 297, 360 nm.

The results of the analyses are presented in the table:

№	Plant organs	Quantitative content, mg/100 g						
		B1	B6	B9	PP	C	B2	B12
1	Roots	3,751	-	-	-	-	11,176	-
2	Stems	-	-	-	-	-	86,764	-
3	Leaves	13,878	-	-	-	-	19,558	-
4	Flowers	1,951	-	-	18,965	-	42,562	-

As can be seen from the table, the roots, leaves and flowers contain vitamin B1, the highest amount of which is found in the leaves. Vitamin PP is found only in the flowers of the plant. Vitamin B2 was found in all the organs studied, the predominant amount of which is observed in the stems and flowers. Vitamins B6, B9, B12 and ascorbic acid were not found. Research on the chemical composition of the *Fritillaria sewerzowii* plant is ongoing.

FLAVONOIDS FROM *Astragalus bakaliensis*

¹*Artikbaeva B.R.*, ¹*Naubeev T.Kh.*, ²*Pirniyazov A.J.*, ³*Ramazonov N.Sh.*

¹*Karakalpak State University named after Berdakh, Nukus, e-mail: timan05@mail.ru,
tel: (93) 485 83 77*

²*Institute of Bioorganic Chemistry named after A.S. Sadikov AS RUz, Tashkent*

³*Institute of Plant Substances named after S.Yu. Yunusov AS RUz, Tashkent*

Plants *Astragalus bakaliensis* Bunge (Leguminosae), growing on the territory of the Republic of Karakalpakstan, is one of the objects of our research.

In continuation of the study of isoprenoids in plants of the genus *Astragalus*, we studied the plant *Astragalus bakaliensis* Bunge (Leguminosae). Comparative studies of the aerial parts of *Astragalus bakaliensis* using thin layer chromatography (TLC) showed compounds of a phenolic nature.

Ground air-dried roots (1.5 kg) of *Astragalus bakaliensis* were exhaustively extracted with ethanol (5 x 8 l). The combined ethanol extracts were concentrated to a syrupy mass.

When studying the ethanol fraction by HPLC-MC, flavonoids were detected in the mass range 150-1250 Da on an Agilent 1260 Infinity II instrument equipped with a Waters qDAAcquity mass detector under ESI+ conditions (Table 1).

Table 1.

No	Compound name and chemical formula	Average Rt (min)	Exact mass (<i>m/z</i>)
1	Luteolin, C ₁₅ H ₁₀ O ₅	3.971	286.05
2	Acacetin diacetate, C ₂₀ H ₁₆ O ₇	28.527	368.09
3	Hispidulin acetate, C ₂₂ H ₁₈ O ₉	23.419	426.10
4	Genistein 8-C-glucoside, C ₂₁ H ₂₀ O ₁₀	8.213	432.11
5	Osajin, C ₂₅ H ₂₄ O ₅	8.23	404.16
6	Astragalin, C ₂₁ H ₂₀ O ₁₁	5.734	448.10
7	Scoparin, C ₂₂ H ₂₂ O ₁₁	8.064	462.12
8	Apigenin, C ₂₅ H ₂₆ O ₁₃	2.074	534.14
9	Tiliroside, C ₃₀ H ₂₆ O ₁₃	7.348	594.14

Separation conditions: Solvents Water (A): Acetonitrile (B). HPLC column: Poroshell 120 EC18, 4 µl, 4.5x150 mm.

Mass terms: Scan 50-1250 Da, Cone Voltage 15V, Capillar Voltage for Positive 0.8 kV, ESI+. Database: PubChem and NIST 2017.

CHEMICAL COMPOSITION OF THE ESSENTIAL OIL OF THE ABOVE-GROUND PARTS OF *Haplophyllum acutifolium*

G.M. Ikromova¹, O.K. Askarova², E.Kh. Botirov³

¹Namangan State University, Namangan, Uychinskaya st., 316, Namangan, 160119, Uzbekistan

²Namangan Institute of Engineering and Technology, 160115, Namangan, Uzbekistan
e-mail: oydinasqarova90@gmail.com

³ S.Yu.Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan

Plants of the genus *Haplophyllum* A. Juss (family *Rutaceae*) are represented worldwide by about 70 species, which are distributed from the Mediterranean to western Siberia. 23 species of *Haplophyllum* grow in the countries of Central Asia, including 16 in Uzbekistan [1,2]. *Haplophyllum acutifolium* (DC.) G. Don fil. grows in Samarkand, Kashkadarya and Surkhandarya regions. A decoction of the plant in folk medicine is used for toothache, stomach diseases, flatulence, and externally for scabies, ethanol extract has cytotoxic activity [2]. Alkaloids, lignans, sterols, terpenoids, and carboxylic acids were isolated from the aerial part of *H. acutifolium* [2].

The aerial part of *H. acutifolium* used in this work was collected during the flowering period in the Bostandyk district of the Tashkent region.

Isolation of essential oil from crushed air-dried aerial parts of *H. acutifolium* was carried out by hydrodistillation at atmospheric pressure. The qualitative and quantitative composition of the essential oil was determined on an Agilent 5975C inert MSD/7890A GC chromatography-mass spectrometer. In the composition of the essential oil from the aerial part, 74 components were identified by GC-MS, which is 94.5% of the oil mass. It was found that its composition is dominated by sesquiterpene hydrocarbons (51.2%) and oxidized sesquiterpenes (19.0%), while the content of monoterpenes and oxidized monoterpenes is only 6.4 and 7.6%, respectively.

The main components of the essential oil are α -elemol (12.6%), germacrene B (12.5%), β -caryophyllene (8.4%), 3-methyl-2-butenal (4.9%), germacrene D (4.5%), δ -cadinene (3.1%), δ -selinene (3.0%), spatulenol (2.4%), 8-isopropyl-5-methyl-2-methylene-1,2,3,4,4a,5,6,7-octahydronaphthalene (2.4 %), β -eudesmol (1.7%), (E)-2-Hexenal (1.5%), limonene (1.5%), α -eudesmol (1.5%), citronellol (1.4%), β -phenchol (1.4%) .

The composition of the essential oil of *H. acutifolium* growing in Uzbekistan differs from the composition of the essential oil of the plant growing in Iran, which is probably due to soil and climatic conditions [3].

References

1. Salvo G., Manafzadeh S., Ghahremaninejad F., Tojibaev K., Zeltner L., Conti E. Phylogeny, morphology, and biogeography of *Haplophyllum* (*Rutaceae*), a species-rich genus of the Irano-Turanian floristic region. *Taxon*. 2011. Vol. 60. Pp. 513–527.
2. Mohammadhosseini M., Venditti A., Frezza C., Serafini M., Bianco A., Mahdavi B. The Genus *Haplophyllum* Juss.: Phytochemistry and Bioactivities – A Review. *Molecules*. 2021. Vol. 26. Pp. 4664–4679.
3. Asili J., Fard M.R., Ahi A., Emami S.A. Chemical composition of the essential oil from aerial parts of *Haplophyllum acutifolium* (DC.) G. Don from Iran. *J. Essent. Oil-Bear. Pl.* 2011. Vol. 14. Pp. 201–207.

APPLICATION OF THE PM6 SEMI-EMPIRICAL METHOD TO MODEL THE DIMER FORM OF GLYCYRRHIZIC ACID

R.S. Esanov, A.G. Yeshimbetov, A.D. Matchanov

O.S. Sadykov Institute of Bioorganic Chemistry Academy of Science Republic of
Uzbekistan Mirzo Ulugbek St, 83100125, Tashkent, Uzbekistan
esanovrahmat2836@gmail.com

In the literature, supramolecular complexes of glycyrrhizic acid (GA) and its monoammonium salt (MASGA) with a number of biologically active compounds (antimicrobial drugs, anti-inflammatory agents, antioxidants) were obtained, their solubility in water was improved, and as a result, their bioactivity increased [1].

Japanese scientists M. Kondo and others showed that the aglycon group and the glucuronic acid carboxyl groups located at the end of the carbohydrate part can form a ring shape due to the intramolecular interaction of the aglycon group and the carboxyl groups using the ^{13}C -NMR method [2]. However, a group of Uzbek scientists (M.G. Levkovich, N.D. Abdullayev, D.N. Dalimov) based on theoretical calculations found that the formation of this ring is much greater than the energy of the non-ring-forming state of GA, and the size of the gap in the ring (3.8–4.0 Å) was found to be insufficient for the entrance of the guest molecule [3]. It was also shown that the orientation of carbonyl and hydroxyl groups of acid residues is spatially unfavorable for forming two hydrogen bonds at the same time.

Based on the above considerations, this article aims to analyze dimer states of GA based on semi-empirical calculations. The obtained results were that a total of four dimer forms were formed in the form of "head - tail" (2) and "head - head" and "tail - tail" (2), and their spatial structures and formation heats were analyzed. In this case, the result of theoretical calculations was found to be energetically favorable for dimers I-IV in the values of ΔH_f and $\Delta\Delta H_f$ calculated by the PM6 method, compared to the rest of dimer form IV. The obtained results can be used to obtain new GA complexes and to model the complexes in computer programs.

References

1. Арыстанова Т.А., Джиембаев Б.Ж., и др. Матер. Междунар. науч.-практ. конф. «Фармация Казахстана: интеграция науки, образования и производства». – Шымкент (Казахстан). – 2009. – Т. 1. – С.83-86.
2. Kondo M., Minamino H., Okuyama G., Honda K., Nagasawa H., Otani Y. J.Soc.Cosmet.Chem. - 1986. - V.37. - P.177-189.
3. M.G.Levkovich, N.D.Abdullaev, D.N.Dalimov., International Workshop on Biotechnology Commercialization and Security. 2003, Tashkent, p.91.

THE EFFECT OF SOME GOSSIPOL DERIVATIVES WITH MASGA COMPLEXES ON BLOOD SERUM BIOCHEMICAL INDICATORS

N.Kh.Yakubova, L.U.Makhmudov, K.Zh.Rezhhevov, N.A.Tagayalieva, M.B.Gafurov

A. S. Sadykov Institute of Bioorganic Chemistry, Academy of Sciences of the Republic of Uzbekistan, 83 Mirzo Ulugbek St., 100125, Tashkent, (nozi_1705@mail.ru)

In the model of acute toxic hepatitis caused by paracetamol, the effect of complexes of some diazoimino derivatives of gossypol with MASGA on the biochemical parameters of rat blood serum was studied, and prospective agents of substances with activity were selected and their effectiveness compared with comparative substances was comprehensively evaluated.

It is known that in this model, paracetamol, which has hepatotoxic properties, damages liver function more deeply. The researches were carried out on white rats of two different sexes weighing 180-200 g. During the experiment, the drugs were administered orally in specified doses with a special probe, and on days 7 and 14, the amount of glucose, total protein, alanine and aspartate aminotransferase (ALT, AsT) in blood serum was determined using test kits manufactured by Cupress Diagnostica biochemical tests (Belgium).

At the end of the experiment, the animals were anesthetized with chloroform, decapitated, and studied to determine the differential, efficiency and mechanism of action of the pathological changes.

Conclusion: We present the following conclusions to summarize the results obtained from the studies conducted on the selection of promising agents of substances with activity in the model of acute toxic hepatitis induced by the influence of paracetamol in rats and comprehensive evaluation of their effectiveness: XAN-2 (4:1) 75mg/kg, XAN-2 (6:1) 75 mg/kg, YAN-1 (4:1) 75 mg/kg, YAN-1 (6:1) 75 mg/kg when the amount of glucose, total protein, alanine and aspartate aminotransferase (ALT, AsT) in the blood serum of the substances was analyzed in comparison with phosphogliv (55 mg/kg) and Ragosin (100 mg/kg), which are used in medical practice as comparative drugs, their biochemical parameters were significantly lower than those of healthy animals. 2 (6:1) complex (75 mg/kg) had little difference. XAN-2 (4:1) 75mg/kg also showed activity, but statistically XAN-2 (6:1) 75mg/kg was found to be more effective.

SYNTHESIS OF ACETYLENE ALCOHOL USING $\text{ZnBr}_2/\text{i-Pr}_2\text{NEt}/\text{TGF}$ COMPLEX CATALYTIC SYSTEM

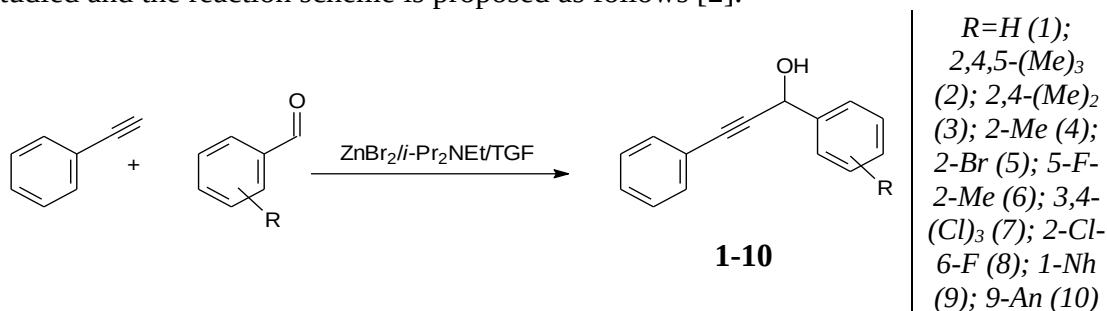
¹S.S.Abdurakhmanova, ²O.E.Ziyadullayev, ³K.M.Saliyeva

¹National University of Uzbekistan, Tashkent. saidaoilgaz@mail.ru

² Academy of the Ministry of Emergency Situations of the Republic of Uzbekistan, Uzbekistan, Tashkent

The sp hybridized carbon atoms in acetylene hydrocarbons are closer to each other than the sp^2 carbon atoms in alkenes, and their electronegativity is high. This leads to a strong polarization of the triple bond and an increase in the mobility of hydrogen atoms in the molecule, which creates the basis for the combination of nucleophilic reagents. Compounds obtained on the basis of nucleophilic coupling reactions of acetylene hydrocarbons are used in the field of organic chemistry to obtain special materials for construction materials, pharmaceutical preparations, and biologically active substances [1,2].

In this work, alkynylation reactions of some aromatic aldehydes to terminal acetylene containing an aromatic ring in its molecule were carried out using the $\text{ZnBr}_2/\text{i-Pr}_2\text{NEt}/\text{TGF}$ catalytic system, and respectively, acetylene alcohols - 1,3-diphenylpropyn-2-ol-1 (1), 1-(2,4,5-trimethylphenyl)-3-phenylpropyn-2-ol-1 (2), 1-(2,4-dimethylphenyl)-3-phenylpropyn-2-ol-1 (3), 3-phenyl-1-o-tolylpropyn-2-ol-1 (4), 1-(2-bromophenyl)-3-phenylpropyn-2-ol-1 (5), 1-(5-fluoro-2-methylphenyl)-3-phenylpropyn-2-ol-1 (6), 1-(3,4-dichlorophenyl)-3-phenylpropyn-2-ol-1 (7), 1-(2-chloro-6-fluorophenyl)-3-phenylpropyn-2-ol-1 (8), 1-(naphthalinyl-1)-3-phenylpropyn-2-ol-1 (9), 1-(anracenyl-9)-3-phenylpropyn-2-ol-1 (10) process has been studied and the reaction scheme is proposed as follows [2].



In order to ensure the productivity of the synthesized acetylene alcohols, the factors affecting the process - the duration of the reaction, temperature, the mole ratio of the catalyst and the starting materials, and the nature of the solvent - were systematically analyzed. Purity, structure and composition of the obtained acetylene alcohol were studied by modern physico-chemical analysis methods and 70-90% product yield was achieved.

Foydalanilgan adabiyotlar

1. Q. Wang, Sh.Y. Chen, X.Q. Yu, L. Pu. // Tetrahedron. – 2007. – Volume 63. – P.4422-4428.
2. S.S. Abdurakhmanova, O.E. Ziyadullaev, G.Q. Otamukhamedova, A.B. Parmanov // Журнал химии Узбекистана. – Ташкент, 2021, №3. – С. 53-64.

SYNTHESIS AND SPECTRAL ANALYSIS OF BIS (N-SALICYLIDENE-4,4' - DIPHENYLAMINE)

Ganiev B. Sh., Kholikova G. K., Mardonov U. M.

Bukhara State University, Bukhara, Republic of Uzbekistan

e-mail: b.sh.ganiyev@buxdu.uz

Schiff-based ligands are excellent chelating ligands and are used because of the simplicity of synthesis and high yield in a single-step reaction using inexpensive commercial reagents, which allows us to systematically investigate the effects of ligand base modifications by which we try to control the exact topography or microarchitecture of matrices. The bis-bidentate ligand – H₂L synthesized by us is apparently capable of performing restrictive torsion with respect to the central C-C bond between two aromatic rings, which makes it possible to create metallic triangular complexes.

The H₂L ligand was synthesized according to the literature methods [1]. Benzidine (0.55 g, 3.0 mmol) and salicylic aldehyde (0.73 g, 6.0 mmol) were mixed with methanol (30 ml) and refluxed for 1 hour in a refrigerator. Then the solution was evaporated to 5 ml, and the yellow product (1.1 g, 2.7 mmol, yield 90%) was filtered and dried under vacuum. Anal. Calculated for C₂₆H₂₀N₂O₂: C - 79.57; H - 5.14; N - 7.14. Found: C - 79.82; H - 4.88; N - 7.34.

The ¹H and ¹³C NMR spectra were recorded on a JNM-ECZ600R spectrometer (JEOL, Japan) at an operating frequency of 600 MHz for ¹H in CD₃OD solutions. TMS (0 ppm) was used as the internal standard in the ¹H NMR spectra. In the ¹³C NMR spectra, the chemical shift of the solvent (CD₃OD, 49.00 ppm relative to TMS) was used as the internal standard. ¹H NMR (600 MHz, CD₃OD): δ 11.04 (bs, 2H, OH), 8.00 (d, 2H, imine), 7.60 (m, 4H), 7.28 (m, 8H), 7.07 (d, 2H), 7.02 (t, 2H).

IR spectra were recorded on the Bruker Invenio S-2021 Fourier spectrometer) in the range 4000-400 cm⁻¹. IR: 3448.5 w, 3051.5 w, 1619.9 vs, 1600.2 m, 1572.7 s, 1498.9 m, 1487.2 s, 1455.9 m, 1411.1 m, 1365.3 m, 1283.4 s, 1190.4 s, 1176.6 m, 1150.7 m, 910.9 m, 847.5 m, 826.8 s, 749.3 s, 527.7 m.

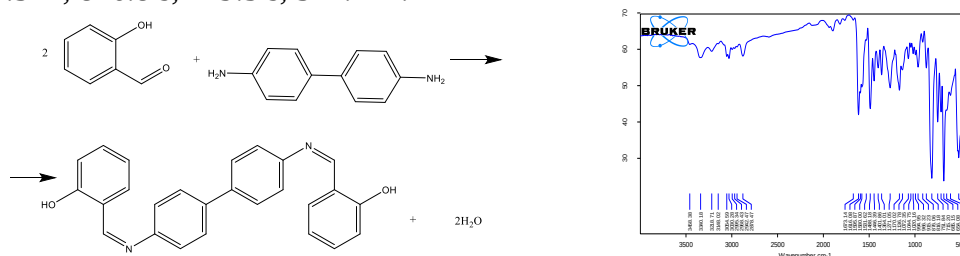


Рис.1. Схема синтеза и ИК спектр бис(Н-салицилиден-4,4'-дифениламин)

The bis-bidentate ligand, H₂L, which we have synthesized, has a strong coordinating ability. Because of this property, we are currently working on synthesizing complexes with transition metal ions, such as Cu²⁺, VO²⁺, Mn²⁺, Co²⁺ and others. The next stage of our research will involve the synthesis and investigation of the structure and properties of these complex compounds.

1. Boulechfar C. et al. Schiff bases and their metal Complexes: A review on the history, synthesis, and applications //Inorganic Chemistry Communications. – 2023. – T. 150. – C. 110451.

ANTI-INFLAMMATORY EFFECT OF *Gnaphalium uliginosum* L. exTRACT

Zaripova M.R., Makhmudov L.U., Gayibov U.G., Gayibova S.N., Aripov T.F.

Institute of Bioorganic Chemistry of the Academy of Sciences of Uzbekistan

Email: mexrangiz1004@gmail.com (97)3060024

The genus *Gnaphalium*, a herb distributed worldwide, comprises approximately 200 species of the Compositae (Asteraceae) family that belongs to the tribe Gnaphalieae. The extracts of species, as well as compounds isolated from them, have been demonstrated to possess multiple pharmacological activities such as antioxidant, antitussive and expectorant, cytotoxic, anti-inflammatory, antidiabetic and antihypouricemic properties. One of the species, *G. uliginosum* L., is highly distributed in traditional medicine while its therapeutic activities are very poor studied. Thus the aim of this work was to study the anti-inflammatory effect of the *G. uliginosum* L. plant extract.

For the initial screening of anti-inflammatory activity, a classic carrageenan-induced edema in rat paws was used. The experiments were carried out on 24 rats of both sexes weighing 180 ± 20 g. Paw volumes were measured (intact) and then inflammation was caused by subplantar injection of 0.1 ml of 1% carrageenan solution (control). *G. uliginosum* L. extract was diluted in distilled water and administered orally at a dose of 50, 100 and 200 mg/kg one hour prior to the administration of carrageenan. The inflammation response was measured 1, 2, 3, 4, 5 and 24 hours after the induction of inflammation and was expressed as a percentage relative to the intact. The activity of the extract was determined by its ability to reduce the development of edema compared to the control that was taken as 100%.

The peak of inflammation response was fixed at 3 hours. In the control group of rats, the maximum paw edema volume was observed after 3 hours, paw volume increased up to $53 \pm 3.8\%$ in comparison to intact, and even after 24 hours it remained significantly increased $26 \pm 2.2\%$. *G. uliginosium* L. extract significantly prevented edema up to $30 \pm 2.5\%$ at a dose of 50 mg/kg, $27 \pm 2.0\%$ (100 mg/kg) $18 \pm 1.8\%$ (200 mg/kg). The results of the study suggest that *Gnaphalium uliginosium* might possess anti-inflammatory activity. Further experiments are needed to elucidate the mechanisms of action.

SYNTHESIS OF SURFACE-ACTIVE SUBSTANCE FOR EMULSION SOLUTIONS AND CREAMS

A.A. Kadirov¹, V.G.Kalyadin¹, N.A. Kadirov², M.A.Eshmuxamedov²

¹National university of Uzbekistan,

²Tashkent state technical university abdusamig@rambler.ru

The problems of effective synthesis and technology of surface active substances (SAS) of local and secondary raw materials is an important problem. We have elaborated designed technology of the obtain SAS on base local secondary material of chemical and fatty-oil plant republic Uzbekistan, which can be used in oil and gas industry (the emulsions, stabilizing and lubricating creams, foamy solutions). Oil fatty plants of the republic Uzbekistan have produced of distillations the fatty acids cotton soapstock's as wastes. Results of researches of composition wastes have shown that they consisted from 76 - 80% carbon fatty acids, which used for obtained SAS. On collected by us experimental to installation on designed optimum obtain of new surface-active substance in the manner of pastes and in the manner of granules. Elaborated technology of the obtaine and using SAS is based on using local inorganic raw material-wastes of tertiary processing of aluminum slags. Proposed synthesis has provided obtaine anion's SAS (the name NA-1) on base of the local secondary product – gossypol resin after the process distilled fatty acids of cotton oil soapstock. Methods of investigation founded on consequent undertaking well-known colloidal-chemical characteristics (surface-activity, adsorption, viscosity, concentration micelle formation) have been used.. Composition of distilled fatty acids from local raw materials for obtains of SAS has been investigated.

SAS was obtained in laboratory conditions, correlations main source components, and best conditions of the syntheses (temperature, pressure, time of reaction, concentration) were selected. Optimum conditions of the syntheses: ratio of main components, time of reaction, temperature and concentration have been determined. The comparison of new SAS with other known, was carried out. The main colloidal-chemical characteristic of synthesized SAS: surface activity, adsorption, viscosity, concentration of micelle formation have been determined. The certain class of SAS was determined. Technology of obtain of anion surface-active substances from local organic raw material was elaborated, which by qualitative factor is a substitute of the import Russian SAS. Patent on inventor of technology of obtain the SAS- NA-1 was receive. The important stage of innovation is elaboration of technical documentation (the technological regulation and standard specifications) experimental-industrial technological installation was montaged and experienced- industrial party SAS- NA-1 was produced.

ALKYNYLATION REACTION OF KETONES WITH ACETYLENE IN THE 3,3'-Ph₂BINOL-2Li/Ti(OⁱPr)₄/Et₂Zn CATALYTIC SYSTEM

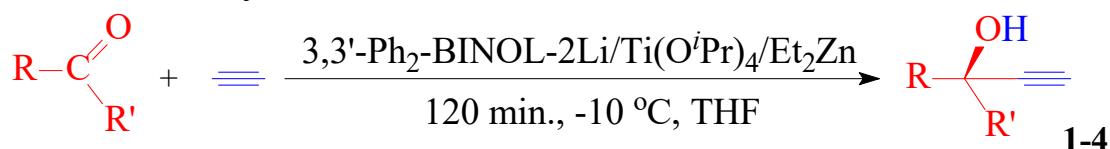
O.E. Ziyadullaev^{1,2}, G.K.Otamukhamedova¹, F.Kh. Buriev¹

¹Chirchiq State Pedagogical University

² Ministry of Higher and Secondary Special Education of the Republic of Uzbekistan,
E-mail: guzal020003@yandex.ru

Today, world scientists are conducting a number of strategic studies aimed at paying special attention to green chemistry, energy-saving, cost-effective and waste-free technologies for the synthesis of new organic substances [1-5].

In this work, the synthesis of acetylene alcohols, which can be used in various fields as ion exchangers, inhibitors, demulsifiers, biocides, solvents and pharmacological drugs, was carried out using the 3,3'-Ph₂BINOL-2Li/Ti(OⁱPr)₄/Et₂Zn catalytic system. The synthesis of acetylene alcohols was studied based on the reaction of nucleophilic addition of ketones containing alkyl, aryl, cyclic and heterocyclic radicals with an acetylene molecule in a tetrahydrofuran solution.



RR' = cHx (1); R = Me, R' = Et (2); R = Me, R' = Ph (3), R = Me, R' = Tp (4).

The influence of the spatial structure, optical activity and the nature of substituents of selected ketone molecules on the yield of acetylene alcohols was studied. The influence of temperature, reaction duration, nature and amount of starting materials, solvent and catalyst on the course of chemical processes and product yields is analyzed. According to the results obtained, at a temperature of -10 °C, the reaction duration is 120 minutes, while when the starting substances were chosen in a 1.5:1 ratio, acetylene alcohols were synthesized with the highest yield.

Synthesized terminal acetylene alcohols are proposed as inhibitors of the complex separation of sulfur compounds in natural gas, as ion exchangers against components (salt layer) formed in metal structures of industrial enterprises.

Reference

- [1] Yuan H. Zhjou Q., Wang J. // *Organic Chemistry Frontiers*. 2023. V. 28. P. 2081-2094.
- [2] Abonia R. Insuasty D., Laali K. // *Molecules*. 2023. V. 28. Iss. 8. P. 3379.
- [3] Voronin V.V., Ledovskaya M.S., Bogachenkov A.S. // *Molecules*. 2018. V. 23. P. 2442.
- [4] Otamukhamedova G.Q., Ziyadullaev O.E., Ikramov A. // *International Journal of Advanced Science and Technology*. 2020. V. 29. №12s. pp. 2503-2511.
- [5] Bauer T. // *Coordination Chemistry Reviews*. 2015. V. 299. pp. 83-150.

SESQUITERPENE LACTONES FROM *Ferula lapidosa*

Kh.I. Khasanova¹, Xin-Xin Li³, A.U. Babekov⁴, K.A. Eshbakova², Ying-Jun Zhang³,
N.M. Ashirmatova⁵

¹Tashkent institute of irrigation and agricultural mechanization engineers, National research university, Tashkent 100000, Uzbekistan

²Institute of the Chemistry of Plant Substances named after Acad. S.Yu. Yunusov Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, 77 M. Ulugbek Str., fax (99871) 120 64 75, e-mail: e_komila@yahoo.com;

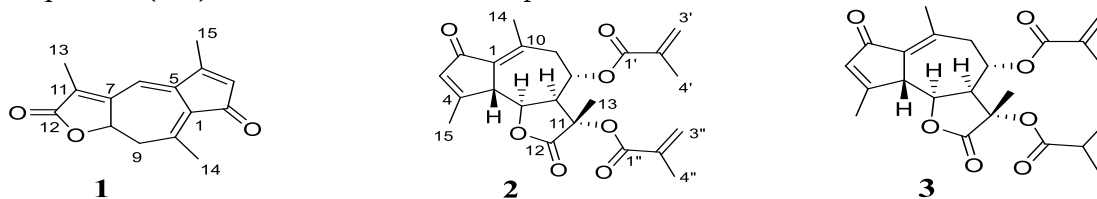
³State Key Laboratory of Phytochemistry and Plant Resources in West China, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650201, PR China. E-mail: zhangyj@mail.kib.ac.cn

⁴Osh State Pedagogical University. A.Zh. Myrsabekov, 723500, Osh st. Isanov 73,, Kyrgyzstan. e-mail: eababekov2511@mail.ru

⁵Branch of the National Research Nuclear University "MEPhI" Khurason street, 100214 Tashkent. e-mail: nargisa__@mail.ru

The roots of *F. lapidosa* (1.0 kg) were collected from the Sussamir Valley of Kyrgyzstan in mid-June 2022. Our further phytochemical study on the roots of *F. lapidosa* led to the isolation of three sesquiterpene lactones. Known compounds (1-3) were determined based on the analysis of their NMR spectroscopic data, along with a comparison with literature data three sesquiterpene esters, taraxacin (1), olgoferin (2) and oferin (3) respectively.

The 95% ethanol fraction (60 g) was subjected to silica gel (200–300 mesh) CC, eluting with petroleum ether-EtOAc (50:1-0:1, v/v) to give 10 fractions (E1~E10). The methanol soluble fraction (30 mg) from fraction E7 (200 mg) was applied to semi-preparative HPLC (with 40%-90% aqueous ACN as mobile phase, at a flow rate 3.0 mL/min), yielding compounds **1** (6.0 mg), **1** (4.0 mg), and **3** (4.0 mg). All the known compounds (**1-3**) were isolated from *F. lapidosa* for the first time.



References

1. Babekov A.U, Khasanova Kh.I, Eshbakova K.A, Turgunov K.K, Tashkhodzhaev B. (2024). CHEMICAL CONSTITUENTS OF *Ferula lapidosa*, *Chem Nat Compd.* 60(1): 177-178.
2. Khasanova Kh.I, Babekov A.U, Eshbakova K.A (2023). Benzodioxols from *Ferula lapidosa*. *J.Res.Pharm.* 27: 85.

IRIDOID GLYCOSIDES FROM *Ferula lapidosa*

Kh.I. Khasanova¹, Xin-Xin Li³, A.U. Babekov⁴, K.A. Eshbakova², Ying-Jun Zhang³,
N.M. Ashirmatova⁵

¹Tashkent institute of irrigation and agricultural mechanization engineers, National research university, Tashkent 100000, Uzbekistan

²Institute of the Chemistry of Plant Substances named after Acad. S.Yu. Yunusov Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, 77 M. Ulugbek Str., fax (99871) 120 64 75, e-mail: e_komila@yahoo.com;

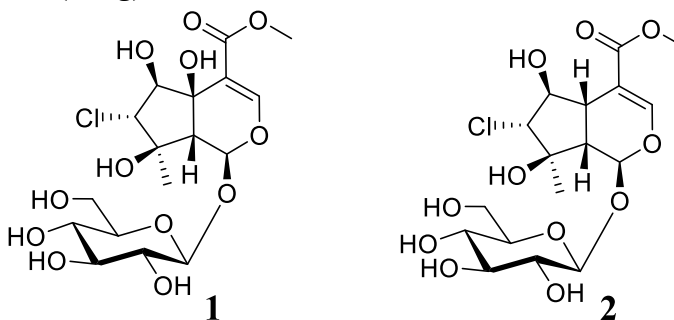
³State Key Laboratory of Phytochemistry and Plant Resources in West China, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650201, PR China. E-mail: zhangyj@mail.kib.ac.cn

⁴Osh State Pedagogical University. A.Zh. Myrsabekov, 723500, Osh st. Isanov 73,, Kyrgyzstan. e-mail: eababekov2511@mail.ru

⁵Branch of the National Research Nuclear University "MEPhI" Khurason street, 100214 Tashkent. e-mail: nargisa@mail.ru

As a continuation of our work on the bioactive constituents two known iridoid glycosides compounds were isolated from the root of *F. lapidosa*. Based on their spectroscopic data (1D and 2D-NMR, HR-ESI-MS, IR, UV, CD), and by comparison with those reported in the literature, the structures of the isolated compounds were elucidated as phloyoside and chlorotuberoside. After phytochemical study of the roots of *F. lapidosa*, resulting in the isolation and structure determination of two iridoid glycosides with rich structure types, where the C-7 position was replaced by chlorine atoms (1, 2). These known compounds were isolated from *F. lapidosa* for the first time.

The sub-fraction B6-7 (22.5 mg) was applied to semi-preparative HPLC (with 10% aqueous ACN as mobile phase, at a flow rate 3.0 mL/min) to obtain compound **1** (4.5 mg). Further CC of fraction B5 (218 mg) on RP-18 gel (MeOH-H₂O, 1:10-1:0, v/v) led to the isolation of compound **2** (7 mg).



References

1. Babekov A.U, Khasanova Kh.I, Eshbakova K.A, Turgunov K.K, Tashkhodzhaev B. (2024). CHEMICAL CONSTITUENTS OF *Ferula lapidosa*, *Chem Nat Compd.* 60(1): 177-178.
2. Khasanova Kh.I, Babekov A.U, Eshbakova K.A (2023). Benzodioxols from *Ferula lapidosa*. *J.Res.Pharm.* 27: 85

CHANGES IN THE AMOUNT OF PHOTOSYNTHETIC PIGMENTS IN COTTON UNDER HYPERTHERMIA CONDITIONS

S.B. Navruzov., K.M. Kuldoshova, A.M. Anarova, A.A. Akhunov

Institute of Bioorganic Chemistry, Uzbekistan Academy of Sciences

Email: sanjarbeknavruzov@gmail.com Phone: +998 93 668 88 44

It is well-known that cotton is highly sensitive to high temperatures during its growing season. High temperatures negatively affect cellular homeostasis and metabolism, leading to changes in the rate of photosynthesis and slowing down physiological and biochemical processes.

The aim of this study is to investigate the changes in the photosynthesis process in different cotton varieties under heat stress.

Experimental seeds germinated at 30°C for 7 days under the influence of light spectra in an artificial climate chamber. The samples were then divided into two groups: control samples remained in the 30°C climate chamber, while experimental samples were grown at 45°C for 6 hours. To determine the recovery processes in the studied cotton varieties, the samples were grown under normal conditions (30°C) for 24 hours after the cessation of heat stress. The content of chlorophyll a and b and the amount of carotenoids were determined using Arnon's method.

According to the obtained results, after 6 hours of heat stress at 45°C, the amount of chlorophyll a increased by 106.78%, 31%, and 46.3% in the Surkhan-103, Bukhara-102, and Porlok-1 cotton varieties, respectively, compared to the control samples. In the Porlok-4, Ravnaq-1, and Ravnaq-2 varieties, the amount of chlorophyll a remained at the control level (an average decrease of 10%). After 24 hours of growth under normal conditions post-stress, the amount of chlorophyll a increased in almost all samples.

During our research, we also studied the effect of high temperatures on the amount of chlorophyll b. Hyperthermia conditions did not significantly affect the amount of chlorophyll b in the studied cotton varieties. The amount of chlorophyll b increased in the Surkhan-103, Bukhara-102, Porlok-1, and Ravnaq-2 varieties after 6 hours of 45°C stress but decreased in the Porlok-4 and Ravnaq-1 varieties. In samples grown for 24 hours at 30°C post-stress, the amount of chlorophyll b recovered, with the exception of the Bukhara-102 and Ravnaq-1 varieties where the amount decreased.

It can be concluded that 6 hours of 45°C stress did not significantly affect the amount of chlorophyll a and b in the studied varieties under hyperthermia conditions. However, the amount of carotenoids, an important component of the photosynthesis process, sharply decreased under high-temperature stress.

THE ROLE OF BIOSTIMULANTS IN PLANT ADAPTATION TO STRESS

Babaeva D.T., Shomakhamadov Sh.Sh., Kuldoshova K.M., Navruzov S.B.,
Khashimova N.R., Akhunov A.A.

*Institute of Bioorganic Chemistry named after academician A.S. Sadykov, Academy of
Sciences of Uzbekistan, 83 Mirzo Ulugbek street, 100125, Tashkent, Uzbekistan.*

Correspondence: dildora.babaeva.11@mail.ru

As one of the important components of plant cell wall, lignin is of great significance to plant growth and environmental adaptability. An increase in the concentration of lignin occurs in plant tissues under the influence of abiotic and biotic stresses. Lignin is one of the most important secondary metabolites which is produced by the phenylalanine, tyrosine metabolic pathway in plant cells. Many studies have shown that lignin biosynthesis is enhanced under high salt stress [1].

Quantitative analysis of free amino acids in 7-day sprouts under salinity conditions (100 mM) under the influence of DAG-1 (10^{-7}) preparation and DAG-1+P-4 (P-4 - fungicide) composition during the assessment of salinity tolerance of cotton variety "C-4727" by high-performance liquid chromatography (HPLC) determined using the method. According to the results of the analysis, 20 different free amino acids were found in sprouts.

Under salinity conditions, the amount of free amino acid tyrosine under the influence of the drug DAG-1 is almost the same as the control (100 mM NaCl), and under the influence of the DAG-1+P-4 composition, it increased compared to 100 mM NaCl medium. It was found that the amount of free amino acid phenylalanine decreased under the influence of the drug DAG-1 compared to 100 mM NaCl medium, and it increased dramatically under the influence of the DAG-1+P-4 composition. Changes in the amount of phenylalanine and tyrosine free amino acids in plants as a result of salinity conditions may be related to the activation or inhibition of their protein synthesis, as well as changes in metabolic processes involved in their transport.

These researches showed the biological and biochemical compatibility of the combined use of both drugs for the treatment of cotton seed under salinity conditions. The composition has reduced the potential damage of frictional stress.

References:

Agarwal P.K., Shukla P.S., Gupta K., Jha B. Bioengineering for salinity tolerance in plants: State of the art. *Mol. Biotechnol.* 2012; 54:102–123. doi: 10.1007/s12033-012-9538-3.

EFFECT OF NPK ON TOTAL POLYPHENOLIC CONTENT AND ANTIRADICAL ACTIVITY OF MEDICINAL PLANT EXTRACTS

Abduazimova D.Sh.*, Gayibova S.N., Abdullayeva M.O., Gayibov U.G., Aripov T.F.

Republic of Uzbekistan, Tashkent 100125, st. Mirzo Ulugbek 83, Institute of Bioorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan,

**E-mail: abduazimovadildora12@gmail.com*

Mineral nutrition is crucial for sustainable agriculture and global human health. Particularly noteworthy are herbal plants as their mineral nutrient status has significant impact on health repercussions on humans. Therefore, optimization of the phytochemical composition of medicinal plants using environmentally friendly agricultural methods is given priority. The present work is devoted to study the effect of mineral nutrition on *Leonurus turkestanicus* V. KRECZ. ET KUPR.

Leonurus turkestanicus seeds were used as planting material in this study. The plant was grown in the experimental area of the Botanic Garden (Tashkent, Uzbekistan) under standard conditions typical of the local environment. 70gr/m² (7 kg/ha) of plant seeds were sown in early spring (25/03/23) on an area of 15 m² in 5 different options. Experiments were conducted in 5 different groups depending on NPK ratios: group №1 - control, cultivation without adding fertilizers; Group № 2 - NPK, ratio 32:10:12; Group № 3 - NPK, ratio 10:38:10; Group № 4 - NPK, 10:10:38 ratio, Group № 5 - treatment with NPK depending on the vegetative period. The dose of each nutrient was determined as follows: NPK 32:10:12 = 1.5gr/m², NPK 10:38:10 = 1.5gr/m² and NPK 10:10:38 = 1.5gr/m². Fertilizers were dissolved in water and fed through the drip irrigation system. Fertilization is applied twice: on the 15th and 45th days after planting.

Aerial part of *Leonurus turkestanicus* was extracted in 40% ethanol by soxhlet method and analyzed for total polyphenolic content using the Folin-Ciocalteu method, and total flavonoid content using the AlCl₃-colorimetric method.

The greatest increase in polyphenols was in Group № 3 and was 14.2±0.6 mg (mg gal.ac. eqv/g DW); the greatest increase in flavonoids was 5.36±0.5mg (0.5 mg quercetin eqv /g DW) and was also observed for Group № 3. The highest DPPH radical scavenging activity was also observed in the Group № 3 (147.33 TE/g dry weight). Correspondingly, the same NPK treatment produced the highest antioxidant activity of 76.48±9.5 µg (mg asc.ac. eqv/g DW) (Group № 3) based on ferric reducing antioxidant power assay method. Correlation analysis showed a positive-strong relationship between polyphenols and antioxidant capacity in the ethanolic extract of *Leonurus turkestanicus*.

ANTIFUNGAL ACTIVITY OF SOIL BACTERIA

U.A. Iskandarova¹, D.I. Kosimov², L.I. Zaynitdinova²

1) National University of Uzbekistan named after M. Ulugbek

2) Institute of Microbiology of the Academy of Sciences of the Republic of Uzbekistan,
Tashkent, Uzbekistan. E-mail: diyor-qosimov91@mail.ru

As our planet's population increases, so do their needs for agricultural products. Increased cultivation of agricultural crops can cause the growth of various (insects, bacteria, fungal and other) diseases among them. If such problems are not prevented, the disease will spread throughout the plant and, as a result, the yield will decrease. This study examined the antifungal activity of a number of bacteria isolated from soil (*Lysinibacillus sphaericus*, *Ochrobactrum intermedium*, *Stenophomonas pictorum*, *Bacillus pumilus*, *Bacillus zhangzhouensis*) against phytopathogenic fungi (*F. oxysporum*, *F. solani* and *Alternaria sp.*).

Many strains of the *F. oxysporum* complex are soil pathogens of plants, especially in agricultural settings. *F. solani* causes great damage to the root system of the plant and causes it to rot. It also penetrates and damages plant cell walls, thereby causing soft rot of plant tissue. *F. solani* can also cause corn and root rot and sudden death in soybeans. This fungus causes wilting and large necrotic spots on the roots of peas, beans, potatoes and many cucurbits. *Alternaria* species are also known as major plant pathogens.

Initially, bacterial strains were inoculated on liquid media and grown in a thermostat at 30°C for 24 hours. After this, the indicated fungal strains were sown in Chapek medium. Experiments to determine the antifungal activity of bacterial cultures were carried out using the Well method. The experiments were carried out over 5 days. The results showed that *Bacillus zhangzhouensis* showed high antifungal activity against all fungal strains. *Ochrobactrum intermedium* also showed high antifungal activity against *Fusarium oxysporum* and *Fusarium solani*. In table Figure 1 shows the antifungal activity of the isolated bacterial strains against phytopathogenic fungi.

Table 1. Antifungal activity of bacteria, inhibition zones (mm)

Bacterial strains	Phytopathogenic fungi		
	<i>Fusarium oxysporum</i>	<i>Fusarium solani</i>	<i>Alternaria sp.</i>
<i>Bacillus pumilus</i>	15	17	-
<i>Ochrobactrum intermedium</i>	29	27	15
<i>Stenophomonas pictorum</i>	-	-	13
<i>Bacillus zhangzhouensis</i>	25	28	31
<i>Lysinibacillus sphaericus</i>	17	19	-

DETERMINATION OF Se(IV) IN PLANT AND VITAMIN PRODUCTS BY THE VOLTAMMETRIC METHOD USING BISMUTH-MODIFIED SCREEN PRINTED ELECTRODES

S.D. Aronbayev, D.T. Isakova, D.M. Aronbayev

*Institute of Biochemistry of Samarkand State University named after Sh.Rashidov,
e-mail: diron51@mail.ru , tel. +998902243129*

Selenium is a powerful antioxidant and plays an important role in homeostasis [1]. Its natural content in nature varies significantly – from extremely high to very low. All this dictates the need to develop a simple methodology for its determination in appropriate samples, including plant products. These, by right, should include methods of voltammetry [2].

The aim of the study is to develop a voltammetric method for determining Se(IV) in samples of plant products using screen printed electrodes modified with bismuth film.

It has been experimentally established that a peak of Se(IV) oxidation is observed in all the obtained voltammograms in the region of +0.8 V in the concentration range of 0-1000 µg/l Se(IV) against a background of 0.1 M HClO₄. The developed technique was applied in determining the selenium content in some objects of plant origin and vitamin complexes.

Table 1. Results of the determination of selenium in plant products and vitamin supplements by the voltammetric method

Sample (content of Se. mcg/100 g)	Found Se, mcg/100 g	Sr, %
Vegetable products		
Green walnut peel	1405,5±0,4	7,10
porcini mushrooms Champignons	131,6±0,3	5,10
Coconut chips	14,5±0,3	5,70
Tanacétum vulgäre (flowers)	7,3±0,2	2,70
Valeriana (rhizomes)	2,73±0,01	1,57
Vitamin products		
VITRUM multivitamins (20 mcg/pellet	18,2±0,2	2,85
Selenium (Yeast Free), 200 mcg/pellet	196,8±2,46	1,25
Complivit-selenium 70 mcg/capsule	66,4±1,18	1,80
Selenium-active, 50 mcg/pellet	49,5±3,8	7,6

References

1. Vikhreva V.A., Blinokhvatov A.A., Kleimenova T.V. Selenium in plant life. - Penza: Publishing House of the National Academy of Sciences, 2012. - 225 p.
2. Isakova D., Aronbaev S., Aronbaev D. Analytical review of voltammetric methods for the determination of selenium // Slovak international scientific journal. – 2023. – No 70. – P.3-12

PROPERTIES OF ANION EXCHANGE MATERIALS BASED ON POLYVINYL CHLORIDE

Babojonova G.K.

*Pharmacy and Chemistry Department, Alfraganus University, e-mail:
muhammadali20201009@gmail.com*

Due to their high operational properties, ion-exchange materials are widely used in almost all fields of science and industrial practice. With their help, one of the most urgent social and environmental problems is being solved: environmental protection. In particular, it has a high sorption property against various metals, is chemically stable, is stable to temperature changes, and is cheap, combined with the property of being reused many times, it is technological, ecological and economic in the process of sorption of metal ions. must meet the requirements. The method of separation of existing ions in water with the presence of ionites meets exactly such requirements [1,2]. Therefore, synthesis of new ionites with high sorption properties is of great practical importance.

In our research work, we have mainly produced a polymer material with a porous structure as a result of extracting the plasticizer from the plasticizer polyvinyl chloride, usually in this case a macroporous structure is formed, that is, materials with a macroporous structure polymer materials with mesoporous and microporous structures were obtained as a result of modification with modifiers having [3].

From the obtained results, the Ssol specific surface area of PPE-2 and PPE-3 anionites modified by PVC with urea and thiourea increased by almost 10 and 7 times, respectively, compared to the original polyvinyl chloride. we can see that it is caused by the increased level of opacity. Thus, by modifying polyvinyl chloride, anion exchange materials with a high degree of porosity and, accordingly, a high specific surface area for exposure were synthesized.

REFERENCES

- [1]. A.M.K. Choi, J. Alam, American Journal of Respiratory Cell and Molecular Biology 15(1996)
- [2]. M. Suwalsky, R. Castro, F. Villena, C.P. Sotomayor, Cr(III) exerts stronger structural effects than Cr(VI) on the human erythrocyte membrane and molecular models .Journal of Inorganic Biochemistry 102 (2008) 842.
- [3]. Arezoo Azimi, Ahmad Azari, Mashallah Reza kazemi, Meisam Ansarpour. Removal of Heavy Metals from Industrial Wastewaters:A Review February 2017 ChemBioEng Reviews 4(1):37-59

PREPARATION OF BIOLOGICALLY ACTIVE SALTS OF OLEANOLIC ACID WITH HETEROCYCLIC AMINO COMPOUNDS

Sh.M. Boboyorova, M.B. Gafurov, Kh.A. Yuldashev, R.S. Esanov

*O.S. Sadykov Institute of Bioorganic Chemistry Academy of Science Republic of
Uzbekistan Mirzo Ulugbek St, 83. 100125, Tashkent, e-mail: boboyorovash@gmail.com*

The presence of biologically active compounds in plants has attracted the attention of researchers for several years. Among them, oleanolic acid (OA) is a natural active compound isolated from plants, found in stems, leaves, bark and fruits of medicinal plants. This acid belongs to the class of pentacyclic triterpenoids, it is found to be present in large quantities in olive and white birch plants, and it often serves as a barrier against various diseases and water loss in plants. In addition, information about the antioxidant, anti-tumor, anti-inflammatory, anti-diabetic, anti-microbial effects of oleanolic acid on various diseases in the human body is covered in scientific sources. Some other compounds synthesized based on oleanolic acid include oleanolic acid vinyl boronates, esters, oximes, and oxadiazole derivatives of oleanolic acid. Oleanolic acid has been used as a hepatoprotection in China for over 20 years due to its hepatoprotective effects [1].

In-depth study of the biological activity of oleanolic acid and its other derivatives allows the creation of less toxic, highly effective drugs in medicine.

Other representatives of compounds with high biological activity are 1,3,4-thiadiazoles belonging to the class of heterocyclic compounds, these compounds are mainly used for various cancers (breast adenocarcinoma, liver, lung, prostate, thyroid gland, cervix, human melanoma cancer) shows activity against.

Taking into account the above characteristics, in order to further increase the biological activity of oleanolic acid, various heterocyclic amino compounds (2-amino-1,3,4-thiadiazole, 2-amino-5-methyl-1,3,4-thiadiazole, 2-amino-5-ethyl-1,3,4-thiadiazole, 2-amino-5-propyl-1,3,4-thiadiazole, 2-amino-5-isobutyl-1,3,4-thiadiazole) salts were obtained. The physico-chemical parameters of the obtained compounds, including the liquefaction temperature, were determined and the structure was analyzed using physico-chemical research methods (IR-, UV-spectroscopy).

REFERENCES

1. Vyas N., Argal A. Isolation and characterization of oleanolic acid from roots of *Lantana camara* //Asian J Pharm Clin Res. – 2014. Vol. 7. – №. Suppl 2. – P. 189-191

DPPH RADICAL SCAVENGING ACTIVITY OF *Gnaphalium uliginosum* ETHANOLIC CRUDE EXTRACT

A.A. Bokova, T.F.Aripov

Institute of Bioorganic Chemistry, Academy of Sciences of Uzbekistan, Tashkent, Uzbekistan, E-mail: bokovaa16@gmail.com (+998935159370)

To obtain an extract of *Gnaphalium uliginosum*, determine its inhibitory activity at various concentrations, and evaluate its antioxidant properties through DPPH radical scavenging activity analysis, in order to assess its potential as a natural antioxidant.

The medicinal plant *Gnaphalium uliginosum* (manufacturer: LLC "Herbs of Mountain Crimea") was used. The dried herb was ground and extracted with 40% ethanol in a 1:10 ratio for 24 hours. The prepared mixture was filtered and then evaporated using a rotary evaporator. For the experiment, the obtained extract was diluted in distilled water to a concentration of 1 mg/ml. The volumes used were 10, 20, 30, 40, and 50 μ l. Antioxidant activity (AOA) was evaluated using the DPPH method

The *Gnaphalium uliginosum* extract demonstrated significant antioxidant activity, as confirmed by the study results. The inhibitory activity of the extract was observed at various volumes during the experiment. The addition of 10 μ l of extract resulted in a 28.84% inhibition of free radicals, which increased with volume. At 20 μ l, activity increased to 36.35%, then 30 μ l showed 35.94%, 40 μ l – 46.74%, and 50 μ l exhibited an inhibitory activity of 61.30%. These data indicate a dose-dependent effect of the antioxidant activity of the extract, where an increase in volume correlates with an increase in inhibitory activity. The *Gnaphalium uliginosum* extract demonstrated an $IC_{50} = 0.0242$ mg/ml, Pearson's $r = 0.9446$ indicating a very strong positive linear correlation between the studied variables. This means that as one variable increases, the other variable also increases almost proportionally.

The results indicate that *Gnaphalium uliginosum* extract exhibits strong antioxidant activity in a dose-dependent manner, with maximum free radical inhibition observed at 50 μ L.

EFFECT OF EXTRACTS FROM *Leonurus turkestanicus*, *Crataegus turkestanica*, *Gnaphalium uliginosum*, AND THEIR PHYTOCOMPLEX ON LIPID PEROXIDATION IN VITRO

Bokova A. A, Aripov T.F

Institute of Bioorganic Chemistry, Academy of Sciences of Uzbekistan, Tashkent, Uzbekistan, E-mail: bokovaa16@gmail.com (+ 998935159370)

To evaluate the antioxidant activity of extracts from *Leonurus turkestanicus*, *Crataegus turkestanica*, *Gnaphalium uliginosum*, and their phytocomplex on LPO processes in vitro, using malondialdehyde (MDA) as a marker of oxidative stress.

Extracts of *Leonurus turkestanicus*, *Crataegus turkestanica*, *Gnaphalium uliginosum* (1 mg/ml) and their phytocomplex (in a 1:1:1 ratio) were dissolved in distilled water (1 mg/ml). LPO was determined according to (H. Ohkawa et al.) using rat liver homogenate (tissue mass: solution volume ratio 1:9) with the thiobarbituric acid reaction.

The study of antioxidant activity of the extracts and their phytocomplex showed that all extracts at volumes of 25, 50, 100, and 200 μl (1 mg/ml) effectively reduce MDA concentration, indicating their ability to decrease LPO. The results are as follows: *Leonurus turkestanicus*: 369.7 ± 0.7 nmol/ μl , 342.3 ± 1.6 nmol/ μl , 316.4 ± 3.9 nmol/ μl , 295.3 ± 1.8 nmol/ μl .- *Gnaphalium uliginosum*: 366.6 ± 3.9 nmol/ μl , 335.8 ± 2.1 nmol/ μl , 301.7 ± 7.2 nmol/ μl , 286.6 ± 3.9 nmol/ μl .- *Crataegus turkestanica*: 377.9 ± 3.6 nmol/ μl , 370 ± 1.8 nmol/ μl , 367.1 ± 2.1 nmol/ μl , 342.5 ± 5.0 nmol/ μl . Phytocomplex: 357.4 ± 2.9 nmol/ μl , 320.5 ± 1.4 nmol/ μl , 276.9 ± 4.3 nmol/ μl , 165.3 ± 3.2 nmol/ μl . These findings indicate that the extracts and phytocomplex significantly reduce MDA levels in rat liver homogenate, demonstrating a high antioxidant potential of these substances. The phytocomplex shows a particularly pronounced effect, with the greatest reduction in MDA levels across all concentrations.

He results indicate that the extracts of medicinal plants exhibit antioxidant activity; however, the phytocomplex demonstrates significantly higher antioxidant activity by effectively reducing MDA levels in rat liver homogenate across all tested concentrations. This suggests its ability to mitigate lipid peroxidation and highlights the potential of the phytocomplex as a powerful natural antioxidant.

COMPARATIVE STUDY OF THE EFFECTS OF MASGA, AS WELL AS THE COMPOSITION OF MASGA WITH CYSTEINE, METHIONINE, AND TRYPTOPHAN ON THE FUNCTIONAL STATE OF MITOCHONDRIA IN PARACETAMOL-INDUCED LIVER INJURY

Davron Tukhtaev, Sherali Kuziyev, Gulbakhor Umarova, Guzal Mukhammadzhanova,
Suraya Dalimova, Sobir Khamraev

National university of Uzbekistan after named Mirzo Ulugbek

Paracetamol is one of the most common hepatotoxic drugs with dose-dependent hepatotoxicity. This hepatotoxin severely impairs the liver's detoxification function with prooxidant properties. Various forms of liver damage caused by paracetamol are known, among which mitochondrial cytopathy holds a special place. Mitochondrial cytopathy occurs as a result of direct or indirect inhibition of respiratory chain enzymes by paracetamol. The lack of aerobic oxidation in the absence of free fatty acid metabolism leads to the accumulation of lactate and free radicals. The activation of lipid peroxidation, which arises due to the suppression of beta-oxidation of fatty acids in the mitochondria under the toxic influence of paracetamol, disrupts the electron transport processes in the respiratory chain.

The aim of this study is to investigate the effects of a supramolecular complex consisting of monoammonium salt of glycyrrhizic acid (MASGA) and the flavonoid quercetin, as well as a composition of MASGA: cysteine: methionine: tryptophan, on the functional state and activity of mitochondrial respiratory chain enzymes in the liver of rats with paracetamol poisoning.

The study was conducted on white non-breed rats of both sexes weighing 140-200 g. Liver damage was induced by administering paracetamol orally at a dose of 500 mg/kg for 2 days. Hepa-NOVO was used as a comparative drug. The tested compounds and the comparative drug were administered for 7 days following the induction of paracetamol-induced hepatitis.

It was found that in the mitochondria of rats with toxic hepatitis induced by paracetamol administration, there was a significant reduction in mitochondrial respiration and oxidative phosphorylation processes. A sharp decrease of more than 2 times in the activity of respiratory chain enzymes localized in the inner mitochondrial membranes—succinate dehydrogenase and cytochrome c oxidase—was also observed, indicating severe damage to the intracellular membrane systems of these organelles. In previous studies, we established that the supramolecular complex of MASGA: quercetin and the composition of MASGA: cysteine: methionine: tryptophan exhibit antioxidant activity, as well as the ability to significantly increase the levels of reduced glutathione in the liver, thereby enhancing organ protection against oxidative stress and maintaining normal detoxification function of the liver. When examining the effects of the studied compounds on the mitochondria of rats poisoned with paracetamol, incomplete restoration of mitochondrial respiration and oxidative phosphorylation processes was observed. It was shown that administration of both the supramolecular complex MASGA: quercetin and the composition MASGA: cysteine: methionine: tryptophan increased the activity of succinate dehydrogenase and cytochrome c oxidase, but did not reach the levels seen in intact animals. The supramolecular complex exhibited a more pronounced positive effect on the studied parameters compared to the composition. Thus, the supramolecular complex MASGA: quercetin is capable of restoring not only the functional state of mitochondria but also the activity of respiratory chain enzymes.

DISRUPTIONS IN PLASMA HEMOSTASIS INDICATORS AND CYTOKINE LEVELS IN EXPERIMENTAL ADRENALINE-INDUCED MYOCARDITIS AND METHODS FOR THEIR CORRECTION

Nigora Khadamova, Sherali Kuzyev, Natalya Vypova, Gulbakhor Umarova, Guzal Mukhammadzhanova, Suraya Dalimova

National university of Uzbekistan after named Mirzo Ulugbek

Myocarditis is an inflammation of the heart muscle. The disease is usually caused by a viral infection, but it can also result from alcohol abuse, certain autoimmune disorders, and the use of certain medications. Currently, the prevalence of myocarditis accounts for up to 28% of all non-coronary heart lesions and 5 to 15% of all cardiovascular diseases. In recent years, there has been an increase in the incidence of myocarditis. This increase is partly due to the implementation of new diagnostic methods in clinical practice. On the other hand, the rise in myocarditis cases is also associated with the recent coronavirus pandemic and the effects of the SARS-CoV-2 virus. Myocarditis leads to the development of heart failure, thrombus formation, and arrhythmias, which are the leading causes of fatal outcomes. Myocarditis is more commonly seen in young people (the average age of patients is 30-40 years), although the disease can occur at any age.

Earlier, we demonstrated that the drug GLAS, developed based on acetylsalicylic acid (ASA) and monoammonium salt of glycyrrhizic acid (MASGA), exhibits significant antiplatelet activity. The aim of this study is to investigate the effects of GLAS and comparison drugs—Cardiomagnyl and MASGA—on certain plasma hemostasis indicators, the levels of aminotransferases ALT and AST, and pro-inflammatory cytokines: TNF-alpha and interleukin-6 in the blood plasma of rats with experimental adrenaline-induced myocarditis.

As a result of the conducted research, it was established that in the plasma of experimental animals, the administration of adrenaline leads to a 41% reduction in prothrombin time (PT), a 35% reduction in activated partial thromboplastin time (APTT), a 51% increase in plasma fibrinogen levels, and a 45% increase in the hypercoagulation index, indicating a significant increase in blood coagulation. A significant increase in the levels of marker enzymes—ALT and AST, as well as C-reactive protein—by 43% was also noted. In the context of adrenaline-induced myocarditis, the levels of pro-inflammatory cytokines, TNF-alpha, and interleukin-6 in blood plasma, also increase by 5 and 1.5 times, respectively, compared to the levels in intact rats. The administration of GLAS and comparison drugs—Cardiomagnyl and MASGA—daily for 3 days to these animals led to partial normalization of the studied parameters, although complete recovery was not observed. Among the studied drugs, GLAS exhibited the most pronounced stabilizing effect.

OPTIMIZATION OF DNA EXTRACTION FROM *Rheum* L. SPECIES

Mahmudova M.U., Nikitina E.V.

Institute of Botany, Academy of Sciences of the Republic of Uzbekistan
mmahmudova078@gmail.com

Identifying species according to their morphological characters, which was main criteria for species discrimination for many years, cannot now provide us with a good result. Thus, using genetic data is one of the best approaches in order to distinguish species. And the first step for this is DNA extraction using the appropriate technique. It is necessary to choose the right DNA extraction protocol to get pure and high yielded DNA. We used modified CTAB method to isolate the DNA of *Rheum* species which are rich in polysaccharides and secondary metabolites because of their medicinal properties.

Rheum genus (commonly known as rhubarb) consists of about 60 herbaceous perennial plants belonging to the family Polygonaceae. In Uzbekistan 8 species of *Rheum* (*R.cordatum*, *R.tataricum*, *R.maximowiczii*, *R.wittrockii*, *R.darvasicum*, *R.fedtschenkoi*, *R.macrocarpum* and *R.turkestanicum*) are distributed and some of them have been traditionally used in local medicine. We used herbarium samples of plants collected from Bobotog, Surkhandarya region. DNA extraction process using modified CTAB (2%) method using chloroform-isoamylalcohol (24:1) was done.

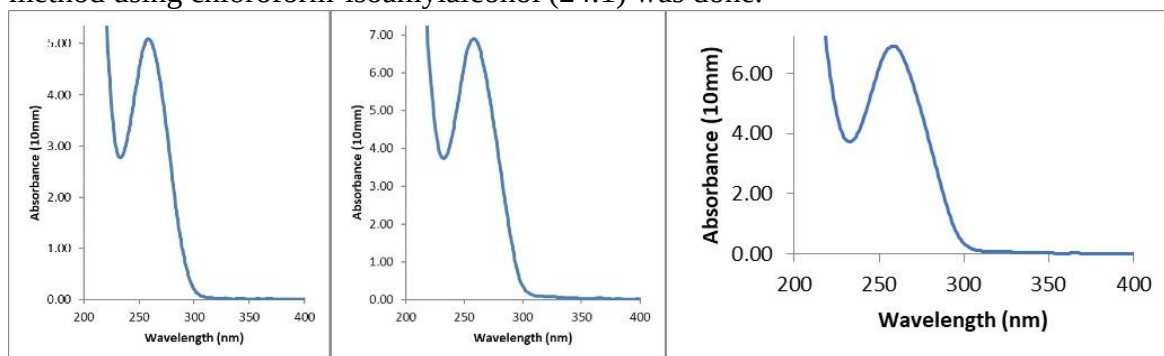


Figure. The quantity and quality of extracted DNA measured by NanoDrop. (Average DNA concentration~320 ng/mkl (252,75; 340.25; 369,15) A260/A280- 2.098; A260/A230- 1.815).

The DNA is stored at -20°C for further genetic analyses.

In conclusion, we recommend to use this modified CTAB method of DNA extraction to get good quality and high yielded DNA from *Rheum* species in Uzbekistan.

TRITERPENOIDS OF THE ENDOPHYTIC BACTERIA *Bacillus zhangzhouensis*

F.A. Melikuziyev*, Z.O. Toshmatov, I.S. Aytenov, M.Z. Isokulov, T.A. Bozorov

*Institute of Genetics and Plants of Experimental Biology RUz AS, Tashkent region,
Kibray district, 266 Yukori-yuz street, 111208, Tel: (71) 264 22 23; Fax: (71) 264 23
90; E-mail: fmelikuziev23@gmail.com*

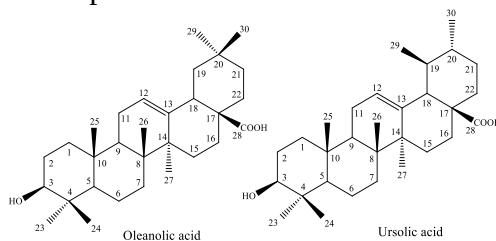
Among natural compounds, terpenoids constitute the largest and most diverse class with more than 50,000 structural units [1]. It is well known that hemi-, mono-, sesquiterpenoids of variable lower molecular weight help plants to survive in ecological niches, while higher molecular terpenes, di-, tri-, tetra-, polyterpenoids perform localized biological functions in plants. [2].

The occurrence of triterpenoids in bacteria, especially non-photosynthetic bacteria, is of interest from both evolutionary and functional perspectives. This interest has led to the discovery and identification of several rare triterpenoids in bacteria over the past decade, one of the most convincing arguments for the possible origin of sterols in these prokaryotes.

In continuation of our previous research, it was reported that endophytic bacteria *B. zhangzhouensis* was isolated from the root of *Zygophyllum oxianum* plant and its chemical composition is being studied.

As a result of the research, crude methanolic extract from bacterial strain was fractionated by performing column and gel chromatographies. Each was subjected to thin layer chromatography and the process was monitored. As a result, 2 pure pentacyclic terpenoids were isolated. Literature data and NMR spectral data were compared. It turned out that these substances are oleanolic and ursolic acids [3-4].

These compounds isolated from various medicinal plants have shown many biological activities. These substances isolated from the endophytic bacteria *B. zhangzhouensis* have shown similar activities with reported studies.



References:

1. P. Liao, A. Hemmerlin, T.J. Bach, M.L. Chye, The potential of the mevalonate pathway for enhanced isoprenoid production, *Biotechnol. Adv.* 34 (2016) 697–713.
2. S. Ghosh, Biosynthesis of structurally diverse triterpenes in plants: the role of oxidosqualene cyclases, *Proc. Indian Natl. Sci. Acad.* 82 (2016) 1189–1210.
3. Seebacher W., Simic N., Weis R., Saf R., Kunert O. Complete assignments of ^1H and ^{13}C NMR resonances of oleanolic acid, 18 α -oleanolic acid, ursolic acid and their 11-oxo derivatives, *Magn. Reson. Chem.*, (2003) 41, 636–638.
4. Xia Y, Xiu-zhen L, Chen X (2010) Chemical constituents from *Viola yedoensis*. *Chemistry of Natural Compounds*, Vol. 46, 809-810.

SECONDARY METABOLITES OF THE ENDOPHYTIC BACTERIA *Bacillus zhangzhouensis*

F.A. Melikuziyev*, Z.O. Toshmatov, I.S. Aytenov, M.Z. Isokulov, T.A. Bozorov

Institute of Genetics and Plants of Experimental Biology RUz AS, Tashkent region, Kibray district, 266 Yukori-yuz street, 111208, Tel: (71) 264 22 23; Fax: (71) 264 23 90; E-mail: fmelikuziev23@gmail.com

Microbes associated with plants are the main source of secondary metabolites with unique chemical structures and various pharmacological properties [1]. In recent decades, many natural compounds have been isolated from multiple endophytic bacteria and fungi with promising and diverse biological activities [2].

A total of 2 endophytic bacteria *B. zhangzhouensis* was isolated. The bacterial strain was identified by comparison with similar isolates from the NCBI GenBank using BLASTN algorithm. The isolated bacterium was found to be 99.93% similar to *Bacillus zhangzhouensis*. The methanolic extract of this bacterium showed antifungal activity against microbes, so we aimed to study the composition of secondary metabolites of this strain.

Bacterial strains were cultivated in a liquid nutrient rich broth medium for 3 days using an incubation shaker. Cell-free supernatants were separated by centrifugation and dehydrated. The dry supernatant was extracted in methanol. In the extraction process, an average of 150-200 mg of total methanolic extract was obtained from one liter of culture.

2 pure substances were isolated by column chromatography and gel chromatography. It was analyzed as a result of physico-chemical research (NMR and PMR). They were found to be uracil tautomers and cyclo-(pro-ser) known in the literature [3-4].

These compounds were isolated for the first time in the bacterial strain *Bacillus zhangzhouensis*.

References:

1. Qu, H.-R., Yang, W.-W., Zhang, X.-Q., Lu, Z.-H., Deng, Z.-S., Guo, Z.-Y., Cao, F., Zou, K., and Proksch, P. (2020). Antibacterial bisabolane sesquiterpenoids and isocoumarin derivatives from the endophytic fungus *Phomopsis prunorum*. *Phytochemistry Letters* 37, 1-4.
2. Asaf, S.; Khan, M.A.; Khan, A.L.; Waqas, M.; Shahzad, R.; Kim, A.-Y.; Kang, S.-M.; Lee, I.-J. Bacterial endophytes from arid land plants regulate endogenous hormone content and promote growth in crop plants: An example of *Sphingomonas* sp. and *Serratia marcescens*. *J. Plant. Interact.* 2017, 12, 31–38.
3. S.K. Amini, H. Shaghaghi, A.D. Bain, A. Chabok, M. Tafazzoli Magnetic resonance tensors in Uracil: Calculation of ^{13}C , ^{15}N , ^{17}O NMR chemical shifts, ^{17}O and ^{14}N electric field gradients and measurement of ^{13}C and ^{15}N chemical shifts *Solid State Nuclear Magnetic Resonance* 37 (2010) 13–20 DOI: 10.1016/j.ssnmr.2009.12.001
R. Huang, T. Yan, Y. Peng, X. Zhou, X. Yang, and Y. Liu (2014).
4. DIKETOPIPERAZINES FROM THE MARINE SPONGE *Axinella* sp. *Chemistry of Natural Compounds*, Vol. 50,191-193.

PLANT BIOSTIMULANT FOR PRE-SOWING TREATMENT OF RICE SEEDS

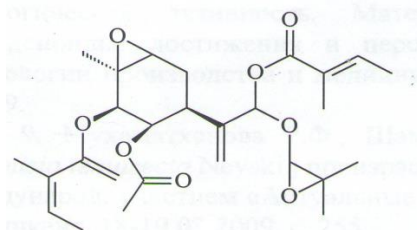
Z.Sh.Mukhidova¹, S.Kh.Zakirov^{1,2}

1. Astrakhan State Technical University branch in Tashkent region¹, E-mail: muxidova.zulfiya@mail.ru +998946015999

2. Tashkent State Agrarian University², E-mail: 1950-zakirov@mail.ru. +998946180524

Plant biostimulants are derivatives of various natural substances that activate natural biological processes in plants, which helps crops cope with stress and achieve their maximum genetic potential in terms of yield and quality.

As a result of the conducted phytochemical studies of terpenoids of the roots of *Ligularia thomsonii* belonging to the Asteraceae family, the monoterpeneoid liganolide was isolated by extraction with petroleum ether (1). The biological activity of the environmentally friendly monoterpeneoid liganolide on seed germination and rice yield was studied in laboratory and field conditions.



1

As a result of the conducted studies, the growth-regulating property of “Liganolide” was established, which effectively increases rice yield with a single pre-sowing seed treatment. For field tests, a sample of the terpenoid was dissolved in a small amount of alcohol and diluted with water to a volume of 1:10,000. The yield was determined by dry weight and the results were compared with the control.

During field tests it was established that the actual yield was 68.9-70.1 centners, which is 12.9-14.1 centners per hectare higher than the control. From the results of the tests it follows that the proposed product “Liganolide” has high growth-regulating activity at low concentrations, which leads to an increase in rice yield, and, thus, this product can find application in farms specialized in rice cultivation.

USE OF THE ELECTROLYSIS METHOD IN THE SYNTHESIS OF ORGANIC SUBSTANCES

Muminov B.S., Karimov M.U., Djalilov A.T.

Tashkent Scientific Research Institute of Chemical Technology

e-mail: baxriddin-muminov@mail.ru tel: +99897 641 17 70

Today, the production of organic substances and the study of their structure and properties have developed significantly. The fact that organic products are used in many fields and have a different structure distinguishes them from other industrial products [1].

In the organic synthesis industry, while obtaining products considered important in various sectors of the national economy, it also produces semi-products for other industries on a large scale [2]. Development of this industry is necessary to establish and improve human interaction with nature, to preserve the earth's biosphere.

In the synthesis of organic substances, different methods are used depending on the structure, properties, and reaction conditions of the raw materials. We considered the use of electrolysis in the production of some organic substances. We used the electrolysis method in the synthesis of amines belonging to the type of nitrogenous organic compounds.

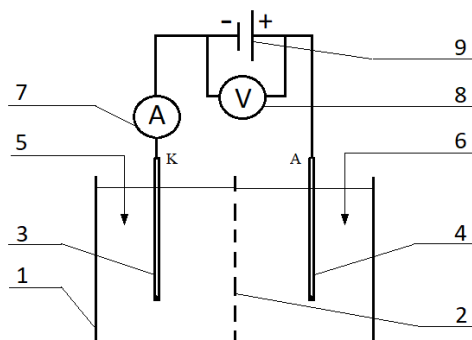


Figure 1. Schematic structure of the device:

1-electrolyzer; 2-cation exchange membrane; 3- cathode; 4- anode;
5- cathode chamber; 6-anode chamber; 7-ammeter; 8-voltmeter; 9- power source.

Depending on the nature of the material, we used graphite, lead, and nickel electrodes. To increase the reaction yield, we separated the electrodes with MK-40, NafionN117 and CMI-7000S cation exchange membranes. One of the advantages of the electrolysis method is that it does not require high pressure or high temperature.

Literature:

1. Maksumova O.S., Turobjonov S.M. Technology of organic synthesis products. Science and technology. Tashkent 2010. 3-4p.
2. Muminov B.S., Karimov M.U., Djalilov A.T. Use of electrolysis in the synthesis of ethylenediamine. Universal Scientific Research (JSR) journal. ISSN (E): 2181-4570.T: 6.4 /09/23/2023. 317-323p

INFLUENCE OF EXOGENOUS CYTOKININS ON THE LEVEL OF VIRAL INFECTIONS DURING INTRODUCING POTATOES IN CULTURE *IN VITRO*

M.Sh. Sobirova, G.B. Nasirova

*A.S. Sadykov Institute of Bioorganic Chemistry of the Uzbek Academy of Sciences,
100143, Uzbekistan, Tashkent, St. M. Ulugbek - 83. e-mail: biorast50@mail.ru*

Damage to potato crops caused by viral infections ranges from 30 to 80% of losses caused by all diseases. This depends on the concentration of viruses, their aggressiveness and the resistance of the plant. The tuber, as a vegetative organ through which potatoes reproduce, has tendency to accumulate viruses. Therefore, repeated reproduction over 5–7 years lead the tuber accumulates such a quantity of viruses that it makes the potato unsuitable for further reproduction. This feature of potatoes determines the necessity of constantly obtain virus-free starting material for introduction into production.

In this regard, the effect of cytokinins with various structures on the content of viruses when potatoes were introduced into *in vitro* culture was studied.

N6-benzylaminopurine (BAP), N6-isopentylaminopurine (2-ipa), N6-furfurylaminopurine (kinetin) were used as exogenous cytokinins at concentrations of $1 \times 10^{-4} \text{M}$, $1 \times 10^{-6} \text{M}$, $1 \times 10^{-8} \text{M}$. Etiolated seedlings of tubers, obtained from field, were introduced into *in vitro* culture. Quantitative determination of six main potato viruses - PVY, PVS, PVX, PVA, PVM, PLRV in plant tissues was carried out on the basis of an enzyme immunoassay using a SUNRISE Absorbance plate reader (Tecan Group Ltd., Switzerland).

As a result, it was shown that exogenous cytokinins reduce the level of viral infections in potato plants introduced into *in vitro* culture. Based on a comparative analysis of potato plants cultivated in the presence of various structures cytokinins, it was determined that the activity of cytokinins in terms of influencing the level of viral infections in cultivated plants depends on the structure of cytokinin and its concentration. It has been established that kinetin has the greatest virus - reducing activity among the studied cytokinins. It has been determined that the presence of kinetin in the cultivation medium at a concentration of $1 \times 10^{-6} \text{M}$, even in the case of a very high virus - contaminated starting material, already at the third passage makes it possible to completely eliminate the plant material from viral infections. A similar concentration of 2-ipa also makes it possible to reduce the level of viral infections, but over a much longer period, the use of BAA even in the lowest concentration leads to inhibition of the growth of the emerging shoot.

THE SIGNIFICANCE OF GLYCOALKALOID PROFILE AS SELECTION MARKERS OF POTATO GENOTYPES

G.B. Nasirova., M.Sh. Sobirova., G.T. Mavlonov

*A.S. Sadykov Institute of Bioorganic Chemistry of the Uzbek Academy of Sciences,
100143, Uzbekistan, Tashkent, St. M. Ulugbek - 83. e-mail: biorast50@mail.ru*

Synthesis and accumulation of the glycosylated alkaloids (GA) of the steroid basis solanidin is characteristic property of a potatoes metabolic profile. The physiological value of GA consists in protection against pests and microbial pathogens. The purpose of this work was comparison of a GA profile of microtubers, the received in vitro and corresponding tubers of three genotypes of potatoes - a grade of Sarnav, Psk and the S-73 line that are grown up in field conditions. All genotypes differed according to the morphological-physiological characteristics.

The microtubers received in vitro and tubers received in field conditions processed spraying by solution of low-molecular chitosan ($M = 100 \pm 20$ kda), as a biostimulation factor. In addition, tubers subjected to a light stress within 3 days when lighting (5000 ± 500 lx; with day/night of 8/16 h) as analog of ecological stress factor. GA determined by LC-MS using Agilent 1260 Infinity chromatograph combined with triple quadrupole MS detector Agilent 6400. Chromatographic separation developed using 10×0.2 cm, $1.8 \mu\text{m}$ C₁₈ column and mobile phase: "A"- 0.1% formic acid, "B" - acetonitrile. Pump program was: linear gradient of B from 10% to 80 % for 13 min; flow rate was 0.2 ml/min, chromatography profile was controlled by registration of total ion current (TIC) in positive mode (+ESI). Amount of GA was calculated on base of single ion monitoring (SIM) profile, derived from TIC chromatogram (α -solanine SIM profile extracted at 868 m/z and α -chaconine profile - at 852 m/z). GA quantitatively determined from integrated SIM chromatogram of extracts at specific m/z relating to α -chaconine standard (Sigma, USA).

Results of the GA quantitative analysis, showed variability of content of alkaloids and a ratio of α -solanine / α -chaconine. The total GA contents in the potato tubers that are grown up in field conditions were 3.5-4.0 times higher, than in the corresponding microtubers of tissue culture. In potatoes microtubers, as well as in field tubers, the contents of the GA after 3 days of lighting or after processing by chitosan raised. On a scale of principal component analysis (PCA) coordinates the GA levels allocates in three different groups associated with induced methods.

Our study has shown that glycoalkaloids metabolome profiling using tissue culture is convenient model for assessment of potato genotypes, which intended for alien cultivars introducing and breeding projects. Data visualization by means of bioinformatics tools is reasonable as an efficient approach.

OPTIMIZATION OF IRON (II) SULFATE DOSAGE FOR WASTEWATER TREATMENT OF HYDROMETALLURGICAL PLANTS: MECHANISMS OF ACTION AND PRACTICAL APPLICATION

Norbek Allayorov

*Navoi State University of Mining and Technologies, asadjon_2515@mail.ru,
+998942542540*

Wastewater treatment from hydrometallurgical plants plays an important role in industrial ecology. These waters contain various heavy metals and other pollutants that need to be removed before they are released into the environment. One method of purification involves the use of iron sulfate, which effectively removes harmful components.

Iron(II) sulfate has been widely used for the coagulation and removal of pollutants such as heavy metals, phosphates, and organic substances from wastewater. Hydrometallurgical plant wastewater often contains metals like copper, zinc, nickel, and cadmium that require effective treatment before being released into the environment.

To achieve optimal results in wastewater treatment, it is important to determine the correct dosage of iron sulfate. This will depend on factors such as the concentration of pollutants in the wastewater and the desired level of treatment. By adjusting the dosage, operators can ensure that all harmful substances are effectively removed from the water. The dosage of iron sulfate used in wastewater treatment depends on several factors, including the concentration of pollutants and other parameters in the wastewater. Typical dosages range from 50 to 300 milligrams per liter (mg/l), but the specific dosage will depend on the specific conditions of the wastewater and the desired treatment goals. Factors that influence the dosage include:

1. Type and concentration of pollutants: The higher the concentration of heavy metals in the wastewater, the more iron sulfate will be required to remove them.
2. Wastewater pH: The optimal pH range for iron sulfate precipitation is between 4 and 6, as this is the range where most metals precipitate out of solution. However, it's important to maintain an appropriate acidity level to ensure effective treatment.
3. Water temperature: Increased temperature can speed up precipitation reactions, but it may also require more iron sulfate to be added.

Iron sulfate in wastewater treatment involves the formation of insoluble metal hydroxide compounds that precipitate out of the water, removing heavy metals and other contaminants. Iron (II) sulfate reacts with hydroxide ions to form iron hydroxide ($\text{Fe}(\text{OH})_2$), which is an effective coagulant. This hydroxide then precipitates with pollutants, removing them from wastewater. During this process, various metal complexes can form, increasing the efficiency of the purification process.

In practice, iron sulfate dosage can be determined experimentally based on laboratory tests using specific wastewater samples. For instance, if there are high concentrations of copper in the wastewater, it may be necessary to increase the dose in order to meet the standard limits for metal content in the purified water.

The use of iron (II) sulfate is a highly effective method of wastewater treatment in hydrometallurgical plants. However, the optimal dosage of this substance depends on various factors and requires a customized approach for each individual case. By conducting experiments and monitoring the cleaning process, it is possible to adjust the dosage in order to achieve optimal results.

LEVERAGING SOMATIC EMBRYOGENESIS TO DEVELOP BIOTECHNOLOGICAL PLANTS AS A SOURCE FOR PHARMACY

Rakhmanov B.K., Imamkhodjayeva A.S., Ubaydullayeva X.A., Usmonov D.E.,
Shermatov Sh.E., Buriev Z.T., Abdurakhmonov I.Y.

Center of Genomics and Bioinformatics, AS RUz

Email: bakhtiyor.rakhmanov@gmail.com, Mobile: +998883337907

Artemisinin is a vital terpene used in medicine, primarily known for its effectiveness in treating malaria. Beyond its antimalarial properties, artemisinin is also being researched for its potential therapeutic applications in treating cancer and other widespread and aggressive diseases. Therefore, different heterologous sources are used to produce the artemisinin compound via chemical synthesis and bio-engineering techniques. These methods involve transferring artemisinin biosynthesis genes into various host organisms to enhance production. Advances in genetic engineering have enabled the development of transgenic microorganisms and plants capable of efficiently producing artemisinin, offering a sustainable alternative to traditional extraction methods. This biotechnological approach not only reduces costs but also mitigates the environmental impact associated with large-scale cultivation of *Artemisia annua*. The development of biotechnological plant lines through somatic embryogenesis is a promising approach for enhancing artemisinin production in transformant plants. This study aimed to obtain and characterize transgenic plant lines harboring artemisinin biosynthesis genes (ADS, IPPI1, CYP71AV1, HDR1, DBR2, and ALDH1). The process began with the genetic transformation of explants using key artemisinin production genes. Following transformation, callusogenesis was induced, leading to the formation of somatic embryos. These embryos were then regenerated into whole plants through a carefully controlled aseptic in vitro environment. The regenerated plants were further analyzed to confirm the expression of the introduced genes. This work demonstrates the potential of somatic embryogenesis combined with genetic transformation for producing stable, biotechnological plant lines with heterologous artemisinin production, paving the way for improved biotechnological applications in plant-based pharmaceutical production.

ETHYNATION OF SOME HETERATOMIC ALDEHYDES USING THE CATALYTIC SYSTEM $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}/\text{Et}_3\text{N}/\text{Et}_2\text{O}$

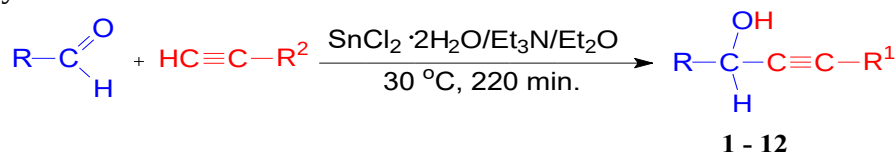
¹M. K. Saliyeva, ^{1,2}O.E. Ziyadullayev, ¹O. Boytemirov, ¹L.K.Ablakulov

¹Chirchik State Pedagogical University, Uzbekistan, Chirchik

²Academy of the Ministry of Emergency Situations of the Republic of Uzbekistan, Uzbekistan, Tashkent, muyassar.saliyeva@mail.ru, Tel +998935933309

Acetylene alcohols and their compounds are widely used as compounds with biological activity and are gaining high positions in chemistry in obtaining new substances in organic synthesis, with widespread use in agrochemistry, pharmacimy. [1-2]. New types of catalytic systems are being developed for high-efficiency synthesis of acetylenic alcohols with several active centers in their molecule. [3].

Below, for the first time, acetylene alcohols were synthesized using the reaction of ethynylation of some heteroatomic aldehydes with alkynes in the $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}/\text{Et}_3\text{N}/\text{Et}_2\text{O}$ catalytic system. A series of reaction factors were analyzed for the production of synthesized acetylene alcohols, and their biological properties were studied, and their physical and chemical properties were analyzed using IR, - NMR ¹H and ¹³C-spectroscopy methods.



Here:

R = thiophenyl-	R ¹ = -H
R = furanyl-	R ¹ = -(CH ₂) ₃ -CH ₃
R = piridiny-3-	R ¹ = -(CH ₂) ₅ -CH ₃
	R ¹ = -phenyl

In this research work, as a result of SnCl_2 activation of aldehydes and breaking of the C=O p bond between alkynes and Lewis acid and aldehydes, acetylenic alcohols are highly 1- 1-(thiophen-2-yl)prop-2-yn-1-ol, 68%, 2 - 1-(furan-2-yl)prop-2-yn-1-ol, 88%, 3- 1-(pyridin-3-yl)prop-2-yn-1-ol, 78%, 4- 1-(thiophen-2-yl)hept- 2-in-1-ol, 54%, 5- 1-(furan-2-yl)hept-2-yn-1-ol, 82%, 6- 1-(pyridin-3-yl)hept-2-yn-1-ol, 66%, 7 - 1-(thiophen-2-yl)non-2-yn-1, 42%, 8- 1-(furanyl-2)non-2-yn -1-ol, 78%, 9- 1-(pyridin-3-yl)non- 2-yn-1-ol, 52%, 10- 1-(thiophen-2-yl)-3-phenylprop-2-yn-1-ol, 60%, 11- 1-(furan-2-yl)-3-phenylprop-2-yn- 1-ol, 84%, 12- 1-(pyridin-3-yl)-3-phenylprop-2-yn-1-ol, 68% yield was synthesized.

List of used literature

1. Trofimov B.A., Gusarova N.K. // Russian Chemical Reviews, 2007. №76(6) pp. 507-527.
2. Е. Г. Гиладжов //Вестник АГТУ, 2007 №6(41) pp 54.
3. Trotush I.T., Zimmermann T., Schuth F. // Chemical Industry Revisited, 2014. №3, pp. 1761-1782.

POLYSACCHARIDES OF OBI-NAVAT PEEL AND THEIR PREBIOTIC ACTIVITY

Siddikova Sevinch¹, Elova Nilufar², Eshbekov Azamat¹, Mauliyonov Salikhdjan¹

1) National University of Uzbekistan, Faculty of Chemistry, Tashkent

2) Institute of Microbiology of the Academy of Sciences of the Republic of Uzbekistan, Tashkent, e-mail: sevinch.siddikova@inbox.ru 998909085152

Melons are widely grown and consumed worldwide and are native to Asia Minor and Central Asia. According to statistics for the period from 2008 to 2016, Asia was the largest producer, accounting for about 74% of world production (31,166,896 tons), followed by America (11.9%) and Europe (7.2%). Ultra-early, mid-season and late 160 cultivated varieties of melon are grown in Uzbekistan. To isolate the carbohydrate complex, we used the barks of *Cucumis melo* collected during the ripening period: *Torpedo* in September and *Obi-navvat* in October 2023 in the territory of the Republic of Uzbekistan (Syrdarya region). We sequentially isolated various polysaccharides from the melon rinds: alcohol-soluble sugars (ASS), water-soluble polysaccharides (WSPS), pectin substances (PS), hemicelluloses (HMC). Water-soluble polysaccharides (WSPS) were isolated in two ways: by extracting raw materials with cold water (WSPS-c) at room temperature and with hot water at a temperature of 80-90 °C (WSPS-h). Pectin substances (PS) were isolated with a mixture of 0.5% solutions of oxalic acid and ammonium oxalate, hemicelluloses (HMC) - with a 5% solution of KOH.

Prebiotic activity of polysaccharides. The local strain of lactobacilli *Pediococcus acidilactici* was used to study the prebiotic activity. The bifidogenic activity of water-soluble polysaccharides and pectin substances of the peel of *Cucumis Melo* (*Obi-navvat*) was studied in vitro experiments. The production strain of *Pediococcus acidilactici* was used as a prebiotic. The bifidogenic activity of polysaccharides was investigated by assessing their effect on the dynamics of growth and reproduction of bifidobacteria during cultivation in MRS medium (Hi-Media, India) in vitro. The substances showed an effect stimulating the growth of bifidobacteria compared to the control. It should be noted that of the above polysaccharides, WSPS-c and PS contributed to a significant growth of bifidobacteria. After 48 hours of cultivation on a medium enriched with PS, the content of bifidobacteria in a volume of 2% was 5×10^{10} and 3×10^8 CFU/g, respectively, which is higher than in the control group.

CREATE A SEMI-SOLID PHARMACEUTICAL FORMULATION OF HEMOSTATIC AGENTS

F.A. Sobirova^{1,2}, A. D. Matchanov²

1. *Alfraganus University - Senior Lecturer, Department of Pharmacy and Chemistry*

2. *Institute of Bioorganic Chemistry Named After Academician O.S. Sodikov of the Academy of Sciences of Uzbekistan, Tashkent, Uzbekistan 700143*

Gel and liniment forms of drugs are increasingly being used in medical practice (in surgery, phthisiology, allergology, therapy, etc.). Currently, various gels with hemostatic properties are being produced: Katergel (Austria), Instillagel (Germany), Surzhigel (England), Retragel, Endozhigel (Russia), anti-burn gel (Medgroup LLC), Algigel (Dneprofarm OJSC), Visostat - hemostatic gel (CJSC Meridian). Hemostatic gels and liniment are widely in demand in many surgical operations. Especially during tonsillectomy, burns, gynecological operations compared with other dosage forms. [1].

To study the hemostatic effect of the drug, 6 gel samples were prepared with a complex of monoammonium salt of glycyrrhizic acid with lagochilin with different concentrations. As can be seen from the data given in table 1, the most effective were gel samples containing 0.5 and 1.0% of the substance. Under the influence of these samples, the time of parenchymal. bleeding was reduced by 2.6-2.7 times, and the amount of blood loss decreased by 7-9 times. a sample containing 0.5% Gillagin. Table 2 presents the research data on the hemostatic effect of the study drug and comparison drugs on the model of parenchymal bleeding in intact rats. A hemostatic drug was compared with commonly used local hemostatic agents: hemostatic gauze (Russia), hemostatic sponge (Russia), and TakhoKomb (Austria). Hemostatic gauze reduced bleeding time - from 360 ± 30 to 194 ± 18 sec (by 46%), hemostatic sponge in 140 ± 10 sec (by 61%) and TachoComb - in 225 ± 11 sec (by 37%).

Thus, from the above data, we can conclude that the studied drug has a pronounced hemostatic effect. It reduces by 45-70% the time of parenchymal bleeding of rabbits with increased bleeding and 2-3 times the amount of blood loss in the liver, kidneys and spleen. And also, in terms of the effectiveness of the hemostatic effect, the drug surpasses foreign analogues, such as Hemostatic Gauze (Russia), Hemostatic Sponge (Russia) and TakhoKombom (Austria) by 1,5-2,0 times.

1. *Preclinical study of the harmlessness of drugs. Preclinical study of antianemic drugs, anticoagulants and fibrinolytics, State Pharmacological Center / ed. A.V. Stefanova, Kiev, 2002; 310-326.*

PHYTOCHEMICAL ANALYSIS AND ANTIRADICAL ACTIVITY OF MEDICINAL PLANT EXTRACTS

*Abdullaeva M.O., Gayibova S.N., Abduazimova D.Sh., Abdullayev I.Z.,
T.F.Aripov

*Institute of Bioorganic Chemistry Academy of Sciences of Uzbekistan**
e-mail: abdullayevamuyassar211@gmail.com, tel.: (+998990470022)

The aim of this work was to determine the content of total flavonoids, saponins, tannins and terpenoids, and radical scavenging activity of medicinal plant extracts. Crude ethanol extracts of *Ajuga turkestanica* L. (AT) aerial part, *Rhodiola heterodonta* L. (RH) roots, and *Inula helenium* L. (IH) aerial parts were generously provided by BIOTON Ltd (Tashkent, Uzbekistan).

Our preliminary phytochemical analysis of crude ethanol extracts of AT, RH and LT revealed the presence of biologically active compounds such as flavonoids, saponins, tannins and terpenoids. No traces of proteins, alkaloids or cardiac glycosides were detected. Table 1 below lists the results of phytochemical screening from medicinal plant extracts. Taxiles show that flavonoids have high antioxidant properties and high levels of them have come out compared to other components .

Table 1. Phytochemical screening of AT, RH, IH extracts.

	AT	RH	IH
Total flavonoids content (mg/eq rutin 100 mg/DW)	0.02±0.00	192±9.4	153,1±4,2
Total saponins content (µg/eq glycyrrhizic acid 100 mg/DW)	3.028±0.02	0.441±0.022	1,213±0,01
Total tannins content (µg/eq epigallocatechin 100 mg/DW)	0.03±0.000	0.308±0.0154	0.02±0.000
Total terpenoids content (µg/eq ecdysterone 100 mg/DW)	0.82±0.00	111±6.55	-

Radical scavenging activity was observed by DPPH protocols. Table 2 summarizes the in vitro antioxidant capacity of AT, RH, IH expressed as IC₅₀ mg/ml (table 2).

Table 2. In vitro DPPH radical scavenging activity (n=10, mean ± SEM p<0.001).

DPPH, IC ₅₀ (mg/mL)		
<i>Ajuga turkestanica</i> L.(AT)	<i>Rhodiola heterodonta</i> L.(RH)	<i>Inula helenium</i> L.(IH)
4.87±0.0300	0,01±0.00	3,094±0.94

The analyzes presented in Table 2 above showed that the medicinal plant extract of *rodioda* manifested the highest antiradical activity. The abundance of flavonoids in its composition also indicates that *rodioda* has a high and effective antioxidant activity compared to other medicinal plants.

DYNAMICS OF ACCUMULATION OF POLYPHENOLS OF THE *Pinus sylvestris* PLANT

K.V. Raimova, R.R. Makhmudov, R.N. Rakhimov, N.G. Abdullajanova, Yu.I.
Oshchepkova

*Academy of Sciences of the Republic of Uzbekistan, Institute of Bioorganic Chemistry
named after A.S. Sadykov, 83 Mirzo Ulugbek str., Tashkent, 100125 (Republic of
Uzbekistan), e-mail: k.raimova_81@mail.ru*

In recent years, due to an unusually wide range of biological activity, much attention has been paid to biologically active natural compounds, among which a special place is occupied by phenolic substances of coniferous trees. We have established the dynamics of accumulation of the sum of plant polyphenols in *Pinus Sylvestris* in the period from May to November. The place of collection and sampling is Tashkent region, Republic of Uzbekistan. The conditions for isolating polyphenolic compounds from the cones of the plant *Pinus Sylvestris* under various conditions have been selected. The raw materials were dried to a constant weight in a drying cabinet and crushed to a size of no more than 2–4 mm. The dried raw materials were extracted in 70% acetone (v/v 1: 10). The extraction was carried out in a water bath equipped with a reflux condenser for 2 hours at a temperature of 40–45 °C. The dynamics of accumulation of the sum of polyphenols in plant raw materials was studied during the year (from January to December). Quantitative determination was carried out by the gravimetric method. Individual phenolic compounds were identified by the method of high-performance liquid chromatography – mass spectrometry (HPLC-MS/MS) using standard samples of phenolic compounds.

The content of polyphenols varies throughout the year: the maximum occurs in the spring (8%), the level decreases by 2-3% in summer, reaches 3-5% by autumn, and is the lowest in winter (2%). Several phenolic compounds were identified in the extracts obtained: salicylic and ferulic, gallic acids, isorhapontigenin, catechin, catechol, dihydroquercetin, quercetin, rutin, dihydrokaempferol, kaempferol, dihydromyricetin, luteolin, apigenin, chrysin, pinocembrin.

Thus, a qualitative and quantitative analysis of the polyphenolic substances of *Pinus Sylvestris* cones was carried out. It was found that tannins of condensable nature predominate in the raw material. The highest content of the sum of polyphenolic substances in the cones is noted in the spring months. In spring cones, mainly monomers catechins and gallic acid accumulate, and in autumn cones, proanthocyanidin and flavonoid glycosides were found. Based on the data obtained, it can be concluded that *Pinus Sylvestris* cones can be used as promising sources of polyphenols.

GAS CHROMATOGRAPHY-MASS SPECTROMETRY ANALYSIS OF HEXANE FRACTION FROM AERIAL PARTS OF *Limonium otolepis*

Urmonov D.G., Ibragimov A.A.

Department of Chemistry, Fergana State University, dadahonu252@gmail.com

Limonium tolepis, also known as saltmarsh sea lavender, is a perennial plant belonging to the genus *Limonium* Mill. It typically grows to a height of 40-80 cm. In our country, it grows as a weed in saline soils, usually in river valleys. In this study, the aerial parts of the plant were examined by transferring non-polar compounds into hexane. The sample was analyzed using a Chromatec Crystal GC/MS equipped with a CR-5MS 30m*0.25mm*0.25µm capillary column. Hydrogen was used as the carrier gas.

Figure: Chromatogram of Hexane Fraction

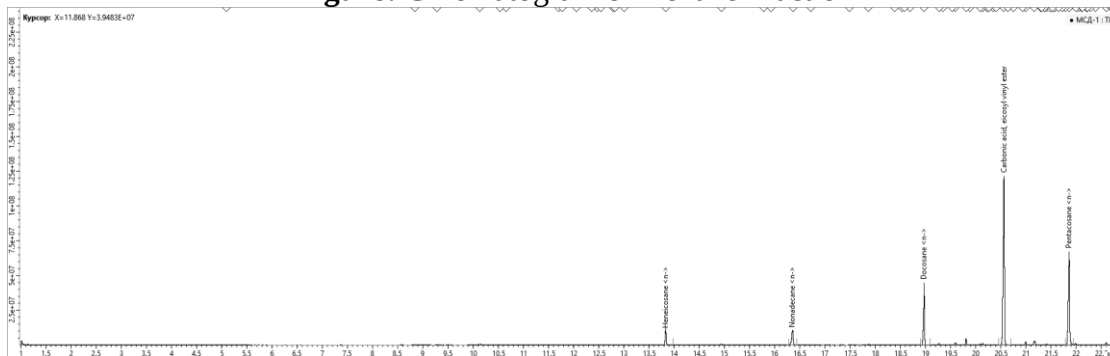


Table: Major Identified Components

№	RT, min	% of peaks	Molecular formula	Identified name
1	13.836	3.456198842	C ₂₁ H ₄₄	n-Heneicosane
2	16.359	4.940600436	C ₁₉ H ₄₀	n-Nonadecane
3	18.979	12.34021421	C ₂₂ H ₄₆	n-Docosane
4	20.566	43.92483129	C ₂₃ H ₄₄ O ₃	Carbonic acid, eicosyl vinyl ester
5	21.863	25.15096319	C ₂₅ H ₅₂	n-Pentacosane

A total of 74 compounds were identified by comparing with the NIST mass spectral database. Among them, 5 compounds were found to constitute 89.81% of the total identified compounds.

STUDY OF ANTI-RADICAL ACTIVITY OF MEDICINAL PLANTS IN SOUTH FERGANA

P. K. Turdalieva

Fergana State University, Fergana, Uzbekistan, E-mail : parizod70@mail.ru

In this work, the antiradicality of extracts of medicinal plants from Southern Fergana was studied in order to create a biologically active food supplement used in the treatment and prevention of cancer.

Antiradical activity (ARA) of ethanolic extracts of 3 types of medicinal plants was determined by spectrophotometric method in relation to the stable free radical DPPH (2,2-diphenyl-1-picrylhydrazyl).

The level of inhibition of free radicals by DPPH is presented in the table.

Table. Antiradical activity of medicinal plants relative to the stable free radical DPPH.

Plant extracts (alcohol infusion)	inhibition, % (at 10 min.)					
	50 μ l	100 μ l	200 μ l	300 μ l	400 μ l	500 μ l
<i>Tribulus terrestris L.</i>	8.9 $\pm$ 1.2	12.2 $\pm$ 2.1	18.1 $\pm$ 2.4	26.5 $\pm$ 1.8	31.5 $\pm$ 2.3	32.2 $\pm$ 2.1
<i>Melissa officinalis L.</i>	-	-	-	-	-	-
<i>Taraxacum officinale Wigg.s.L.</i>	-	-	-	-	-	-

As a result of this study, an alcoholic extract (30% ethyl alcohol) of the *Tribulus terrestris* plant showed (ARA) relative to the free radical DPPH (2,2-diphenyl-1-picrylhydrazyl) (Table), extracts of lemon balm and dandelion officinalis do not have antiradical activity. Also, the table shows that the extract *Tribulus terrestris L.* has high antiradical activity, and accordingly actively counteracts cancer cells. Therefore *Tribulus terrestris L.* as a natural antioxidant, it is promising to use in the treatment and prevention of cancer.

X-RAY ANALYSIS AND MOLECULAR DOCKING OF THE ETHYL 2-(4-(DIMETHYLAMINO)BENZOYL)-3-HYDROXY-5-METHYLPYRAZOLIDINE-3-CARBOXYLATE

Furkat N. Khayrullayev¹, Bako B. Umarov¹, Murod A. Tursunov¹, Jamshid M. Ashurov², Ne'mat G. Sevinchov¹, Maftuna J. Ruzieva¹, Dilobar N. Sevinchova³, Bakhtiyor Sh. Ganiev¹

¹Bukhara State University 200117, Uzbekistan, Bukhara, M. Ikbol 11.

²Institute of Bioorganic Chemistry, Uzbekistan Academy of Sciences, 100125, M. Ulugbek Str., 83

³Bukhara State Medical Institute named after Abu Ali ibn Sina, 200118, Gijduvan str., 23, Bukhara, Uzbekistan.e-mail: b.ganiyev1990@gmail.com

The interest in the fine structure of acylhydrazones is primarily due to the fact that they are capable of being in various tautomeric forms. Depending on the structural features of the dicarbonyl component in the series of acylhydrazones of 1,3-diketones, a triple ring chain equilibrium can be expected between linear (hydrazone, enhydrazine) and cyclic 5-hydroxy-2-hydroxypyrazoline tautomeric forms. It should be noted at once that paired prototropic equilibrium was observed for acylhydrazones of both 1,3-ketoesters and 1,3-ketoaldehyde derivatives. We have studied the structure of condensation products of 2,4-dioxopentanoic acid (I) ethyl ether with hydrazides of para-substituted aromatic acids. We report herein the synthesis, crystal structure, DFT calculation and Molecular docking analysis for a new ethyl ester of 2,4-dioxopentanoic acid derivative, 4-dimethylaminobenzoylhydrazone ethyl ester of 2,4-dioxopentanoic acid (H₂L).

The molecular structure of the title compound is illustrated in Fig. 1. Five membered heterocyclic pyrazoline rings, consisting of atoms C(1)C(2)C(3)N(2)N(1) flat. The maximum deviation of atoms from the plane of heterocycles is 0.0036–0.0067 Å (H₂L), respectively, and for phenyl rings these deviations are 0.0067 Å. The phenyl ring of the benzoylhydrazone residue in the molecule (H₂L) is rotated relative to the pyrazoline ring in space by 45.66°. The angle between the ester group of the β-diketone part of the molecule and the hydroxypyrazoline ring is 136.42° and they lie outside the same plane, although the ester group itself is sufficiently coplanar, as indicated by the value of the dihedral angle O(1)C(4)O(2)C(5) - 4.38°. An analysis of the bond lengths of the molecule shows that this molecule has double bonds N(2)=C(3) 1.27 Å, O(1)=C(4) 1.20 Å and O(4)=C(8) 1.23 Å. The slight difference between the double bonds O(1)=C(4) and O(4)=C(8) is explained, as was determined above, by the inclusion of the oxygen atom O(4) in the p-π-conjugation by the free pair of the p-electron with the π-orbital of the aromatic nucleus.

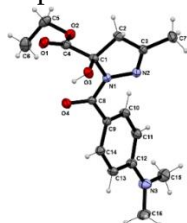


Fig. 1. Crystal structure of the H₂L

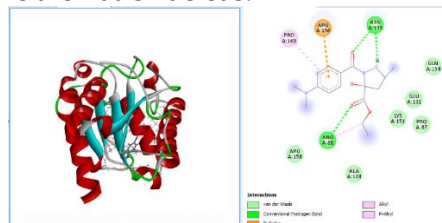


Fig. 2. Molecular docking results of the H₂L

In the case of the molecular docking analysis of H₂L -3QPC, the position with the highest binding affinity, determined by various interactions at the binding site, has a binding energy of -6.97462 kcal/mol.

DEVELOPMENT OF A KINETIC MODEL OF THE PROCESS OF EXTRACTION OF BIOLOGICALLY ACTIVE SUBSTANCES FROM POMEGRANATE PEEL

Ziyaeva S.F., Vasina S.M., Tagirova M.A.

Samarkand State University named after Sh. Rashidov

Pomegranate is widely used in the food industry, and the peel of this fruit, containing valuable substances of polyphenolic compounds (PPC) and pectic polysaccharides (PP), is thrown away as waste. The purpose of this study was to study the influence of temperature (110-130° C), time (5-39 min) and solid-liquid ratio (10-30) on the yield of PPC and pectin extracted from pomegranate peels, and to optimize extraction conditions.

To optimize the process parameters for the flash extraction of polysaccharides and PPC, experimental designs were developed using the Box-Behnken response surface (BBRS) calculation methodology, and the obtained results were analyzed and optimized using the response surface method with a confidence level of 95% using software Origin trial Pro 7 Trial. To vary the process conditions, factors such as temperature, liquid-solid (L:S) ratio and hydrolysis time were selected, and the response surface function of the Box-Behnken design was used to optimize operating parameters and optimize the yield of pectin and phenolic compounds

Flash extraction (hydrothermal treatment of plant materials with a short hydrolysis time) crushed Pomegranate peeling was carried out in a laboratory autoclave reactor. The parameters studied were temperature (110-130°C), liquid-solid (L:S) ratio (10-25) and extraction time (8-30 min).

A mathematical model for process optimization is presented in the form of 3D graphs of the dependence of the EV yield on the extraction time and the ratio of the solid and liquid phases in accordance with the BBRS model. It was found that when optimizing extraction parameters for the studied KGC variety, at a constant temperature of 120°C, the yield increased significantly until the L:T ratio and extraction time reached 18:1 and 25 minutes, respectively. The EV yield also increases slowly with increasing extraction time up to 30 min and then decreases slowly after this point. The analysis results show that when the L:S ratio and extraction time were at 1:15, the recovery of products obviously increased with the addition of extraction time from 15 to 25 min. Ideally, the extraction yield increases with time, and maximum extraction is achieved when the equilibrium of the L:S phases is reached, beyond which it remains constant. Increasing the L:S ratio is not beneficial in production, since it requires additional costs to evaporate the extract before isolating PP and PPC.

Therefore, this argument suggests that hydrothermal treatment should be carried out for a maximum of 25 min. At the same time, the qualities of PP and PPC can be preserved.

ALKALOIDS FROM *Annona senegalensis*

Rixsivoy Ziyayev¹; Sory Fofana², Kuchkar Giyasov¹

1) Toshkent State Agrarian University, Department of Biochemistry and Physiology

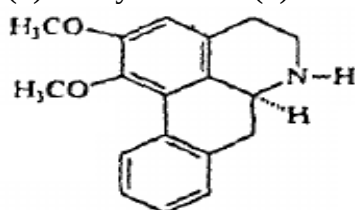
E-mail : ziyayev 05@mail ru, tel. +998 935791947.

¹²) University of Kindia, Republic of Guinea, E-mail: Rectorat@univ-Kindia

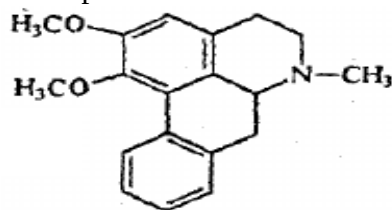
Annona senegalensis Pers is a 4-7 meter tall medicinal fruit tree of the Annonaceae family in the Republic of Guinea and has been used in folk medicine to treat various ailments including colds, coughs, dysentery and skin diseases [1].

Continuing the investigation of the alkaloids of plants of the *Annona* genus, the alkaloids of the plant *Annona senegalensis* Pers, collected from the vicinity of the Kindia region of the Republic of Guinea, were studied for the first time. We obtained 0.095% (relative to the dry plant mass) total alkaloids from the leaves of this plant as a result of the usual chloroform extraction.

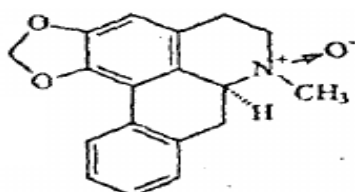
Separation of this mixture of alkaloids into phenolic and non-phenolic parts, multiple chromatography on a silica gel column, and recrystallization in appropriate solvents resulted in the isolation of a total of 9 alkaloids, 5 of which were previously isolated from *Annona muricata* [2,3]. 4 additional alkaloids: nornutsiferin (6), nutsiferin (7), N-oxide remerine (8) and lysicamine (9) were isolated from this plant for the first time.



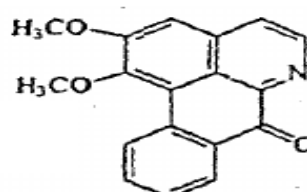
6. Nornutsiferine



7. Nutsiferine



8. N-oxide remerine



9. Lysicamine

REFERENCIS

[1]. Pousset J. L.// Plantes medicinales d'Afrique. Comment les reconnaitre et les utiliser. Ed. Secum-edisud., Paris, 2004., P.325.

[2]. Ziyayev R., Sory Fofana, Diallo Salifou Kaby., Aripova S. F. Alkaloids tetrahydroisoquinolineiques des feuilles d'*Annona muricata* (Annonaceae) //Bulletin du Centre de Recherche Scientifique de Rogbane. 2013.-№ 23.-P.37 – 40.

[3]. Sory Fofana, Keita A., Зияев Р., Арипова С.Ф.Алкалоиды листьев *Annona muricata* L // Химия природ. седин.-2012.-№ 4.-С.637

CHEMICAL CONSTITUENTS AND BIOLOGICAL ACTIVITY OF *Yucca gloriosa* L.

E. Kemertelidze¹, M. Benidze¹, A. Skhirtladze², V. Nebieridze¹

¹TSMU Iovel Kutateladze Institute of Pharmacochimistry, Tbilisi, Georgia

²I. Javakhishvili Tbilisi State University, Tbilisi, Georgia

The steroidal sapogenin tigogenin – (25R)- 5 α -spirostan- 3 β -ol obtained from the leaves of *Yucca gloriosa* L. (fam. Agavaceae) introduced on an industrial scale in Georgia, is recognized as an economical raw material for the synthesis of 5 α -steroidal hormonal preparations. Plantations of *Yucca gloriosa* were cultivated in eastern Georgia on an area of 150 ha to ensure a supply of tigogenin from plant raw material.

The leaves of the lower tier of *Yucca gloriosa* dry at 3-4 years of age. Our observations showed that leaves drying on the living plants contain only spirostanol glycosides. In all probability, the furostanols are converted to the corresponding spiro- forms during drying and they consist tetra-, penta- and hexaosides of tigogenin. Antifungal activity of the total and individual glycosides was studied in vitro tests against human pathogenic, yeast, dermatophyte and filamentous fungi. High activity was shown by individual yuccaloesides B and C in the concentration range of 0,39 -6,25 μ g/ml, for dermatophyte fungi – in the range of 0,78 – 12,5 μ g/ml and were similar to those of reference agents – amphotericin B and ketoconazole.

Polyphenolic compounds of stilbene nature with a rare spiro- structure are obtained from the roots and bark of stem and rhizomes . They have been shown to have antioxidant, specific antiproliferative and pro- apoptotic effects on MCF-7, HepG2 and U937 cancer cells.

From the flowers of *Yucca gloriosa* there were isolated 8 individual substances. Their chemical structures were established by physical - chemical data and modern spectral methods of analysis such as one- and two-dimensional NMR (¹H, ¹³C, HSQC, HMBC, COSY) and mass – spectrometry (ESI-MS). Spectral data of 1-7 substances were indicative to sesquiterpene glycosides of nerolidol type and 8 – triterpene glycoside derivative of soyasapogenol B with the structures:

(1E,3S,5R,6E,9E)-5-O- β -D-Glcp(1 $\rightarrow$ 6)-O- β -D-Glcp-3,5,11-trihydroxy-3,7,11-trimethyldodeca-1,6,9-trien; (1E,3S,5R,6E,9E)-5-O- β -D-Glcp(1 $\rightarrow$ 6)-O- β -D-Glcp-3,5,11,12-tetrahydroxy-3,7,11-trimethyldodeca-1,6,9-trien; (1E,3S,5R,6E,10E)-(12-O- β -D-Glcp)-5-O- β -D-Glcp(1 $\rightarrow$ 6)-O- β -D-Glcp-3,5,12-trihydroxy-3,7,11-trimethyldodeca-1,6,10-trien; (1E,3S,5R,6E,10E)-5-O- β -D-Glcp-3,5,12,13-tetrahydroxy-3,7-dimethyldodeca – 1,6,10-trien; (1E,3S,5R,6E,10E)-5-O- β -D-Glcp-3,5,12-trihydroxy-3,7,13-trimethyldodeca-1,6,10- trien; (1E,3S,5R,6E,10E)-5-O- β -D-Glcp-3,5-dihydroxy-3,7,12,13-tetramethyldodeca-1,6,10-trien; (1E,3S,5R,6E,10E)-5-O- β -D-Glcp-3,5-dihydroxy-12-carbonyl-3,7,13-trimethyldodeca-1,6,10-trien;

Soyasapogenol B – 3-O - α -L-Rhap-(1 $\rightarrow$ 2)-O- α -L-Arabp.

Sesquiterpene and triterpene glycosides is new class for the genus of *Yucca*.

In this way, our studies have determined that *Yucca gloriosa* L. cultivated in Georgia in an industrial scale is rich with substances of different chemical classes, they exhibit various biological activities, which gives a great opportunity to use them in practice

PHENOL PROFILING OF *Sophora japonica* L. FLOWERS EXTRACTS

S.A. Fatykhava, V.I. Dolgopalets, P.S. Shabunya

Institute of Bioorganic Chemistry, National Academy of Sciences of Belarus, Minsk, Belarus, e-mail: iboh_lfhi@rambler.ru; +375(17)399-96-80

In the market for healthy food products, *Sophora japonica* L. flowers play a significant role as a source of bioactive components with antioxidant, antidiabetic and antihypertensive properties [1]. Commercially available *S. japonica* L. flowers may vary in the composition of active phenolic compounds. The proposed HPLC-DAD-MS method can be used to assess authenticity and quality of *Sophora japonica* L. raw material.

1 gram of dried flowers and buds of *S. japonica* from different manufacturers (S1, S2, S3) that are commercially available were extracted with 30 mL of 70% (v/v) ethanol in ultrasonic bath for 30 min. The mixture was then centrifuged at 10 000 g/min for 20 minutes. The supernatants were filtered through a membrane filter. HPLC-MS analysis was performed using Agilent 6410 QQQ HPLC-DAD-MS with an ESI source using Eclipse XDB C18 column, (50x4,6 mm, ID;1,8 μ m). The mobile phase consisted of 0,2% (v/v) formic acid in water and acetonitrile. Elution procedure was from 2% to 90% acetonitrile for 20 minutes. The flow rate was 0.5 mL/min. The chromatogram from the DAD detector ($\lambda = 270$ nm) was used for the search and quantitative analysis. A full scan mode was adjusted in the mass range of 80–1500 m/z. The compounds were tentatively identified using MS data (in the negative and positive ionization mode) in comparison to previously known compounds from the genus *Sophora* and using standards (rutin, quercetin, kaempferol, isorhamnetin and ferulic acid).

The extracts contained 15 main phenolic compounds: glycosides of quercetin, kaempferol, isorhamnetin and genistein, as well as free aglycones (kaempferol, quercetin, isorhamnetin) and derivatives of phenolic acids and putrescine. Five glycosides of quercetin were found with various combinations of sugars in the carbohydrate part. Derivatives of putrescine with coumaric and ferulic acids, as well as their combination, were also noted. Rutin was the main content among glycosides, and quercetin among aglycones, in all extracts. The S1 extract contained the highest amount of rutin. The S2 extract had the highest content of putrescine derivatives. The S3 extract contained only 14 phenolic compounds with their lower concentration compared to other extracts.

Reference

1. Na Guo et al. *Sophora japonica* L. bioactives: chemistry, sources and processing techniques // Food Frontiers. – 2024. – V. 5. – P. 1166-1187.

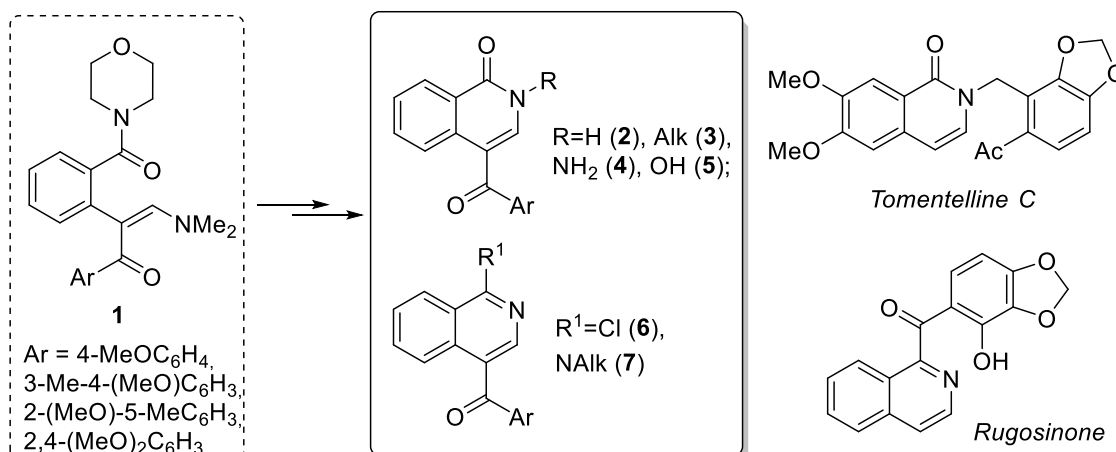
This work was supported by the Belarusian republican foundation for fundamental research (X23Y3B-083)

A NEW SYNTHETIC APPROACH TO ISOQUINOLIN(ON)ES THROUGH 2'-CARBOXAMIDODEOXYBENZOINS ENAMINOKETONE HETEROCYCLIZATIONS

K.V. Kukushkina, V.S. Moskvina, V.P. Khilya

Taras Shevchenko National University of Kyiv, 64/13 Volodymyrska st., Kyiv, 01033, Ukraine

Isoquinoline alkaloids, a significant class of nitrogen-based heterocyclic compounds, are abundant in the plant kingdom and exhibit wide structural diversity and biological activity. Known for their pharmacological effects, these compounds have garnered significant interest from researchers since the early 19th century. For instance, Tomentelline C, first isolated from *C. tomentella*, exhibits hepatoprotective activities, while Rugosinone from *Thalictrum cirrhosum* shows immunosuppressive properties. The traditional and clinical uses of these alkaloids are likely related to their diverse biological activities [1]. Consequently, the synthesis of structurally diverse isoquinoline(on)es continues to be an active area of research.



In this study, an efficient method for synthesizing isoquinolin-1(2H)-ones and isoquinolines from enaminone **1** was developed. The heterocyclization of compound **1** with nitrogen-containing nucleophiles, such as ammonia, hydrazine, hydroxylamine, alkylamines, and amino acid esters, yielded structurally diverse isoquinolin-1(2H)-ones **2-5**. The synthetic potential of the obtained derivatives was further explored, leading to the synthesis of chloroisoquinolines **6** and *N*-alkylaminoisoquinolines **7**. This method provides a valuable route for the introduction of functional groups relevant to both organic and medicinal chemistry, significantly enhancing the versatility and applicability of the structurally diverse isoquinolin-1(2H)-ones and isoquinolines synthesized in this study for drug discovery and chemical research.

1. Shang, X., Yang, C., Morris-Natschke, S. L., Li, J., Yin, X., Liu, Y., Lee, K. Med. Res. Rev. 2020;1–78

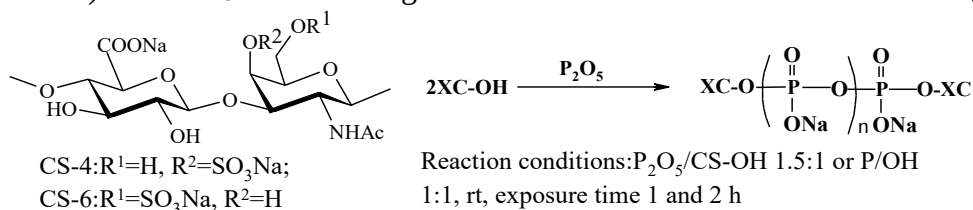
SOLID-PHASE PHOSPHORYLATION OF CHONDROITIN SULFATES WITH PHOSPHORUS (V) OXIDE

Kozyrev S.V., Rakhimova L.Yu., Khaybrakhmanova E.A., Ponedel'kina I.Yu.

Institute of Petrochemistry and Catalysis, Ufa Federal Research Centre of the Russian Academy of Sciences, 141, Prospekt Oktyabrya, Ufa 450075, Russia

Previously, phosphorylated derivatives of such polysaccharides (PS-P) as water-soluble starch, carboxymethylcellulose, apple pectin, alginic acid, chitosan and arabinogalactan were obtained by solid-phase reaction with P_2O_5 [1]. A feature of the phosphorylation processes was the formation of various types of phosphate fragments in the structure of PS-P: mono-, and di- and polyphosphates (polyP).

In this work, phosphorylation of chondroitin-4,6-sulfates (from cartilage tissue, CS-4/CS-6 ~ 2:3) with P_2O_5 without using a solvent was carried out for the first time (Scheme).



SCHEME. Phosphorylation of CS with P_2O_5 .

The phosphorylation products of CS (CS-P) contained, depending on the reaction time, 5.1-6.5 (1 h) and 4.3-4.4% wt. P (2 h) in the form of mono-, di- and polyP. The polyP proportion found from ^{31}P NMR spectra was the largest and amounted to 3.5-4.4 and 3.0% wt. P. Inorganic polyP are known to participate in the processes of bone mineralization as a source of phosphate, act as a storage and generator of metabolic energy in the extracellular matrix, and have an antiviral (SARS-CoV-2) effect [2, 3]. Hybrid macromolecules, consisting of CS chains and polyP sequences, are interesting for using in medicine as materials with reparative-regenerative and antiviral properties.

References.

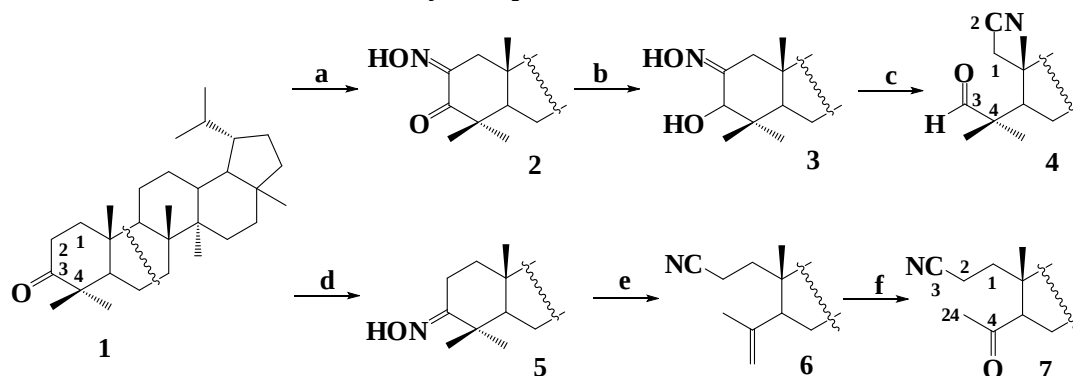
1. Ponedel'kina I.Yu., Khaybrakhmanova E.A., Kozyrev S.V., Tyumkina T.V. Solid-Phase Phosphorylation of polysaccharides by phosphorus pentoxide. *Chemistry of Natural Compounds*, 2023, V. 59, P. 625-628.
2. Müller, W.E.G., Schröder, H.C., & Wang, X., Inorganic polyphosphates as storage for and generator of metabolic energy in the extracellular matrix. *Chemical Reviews*, 2019, V. 119(24), P. 12337-12374.
3. Müller, W.E.G., Wang, X., Neufurth, M., & Schröder, H.C., Polyphosphate in antiviral protection: a polyanionic inorganic polymer in the fight against coronavirus SARS-CoV-2 infection. *Progress in molecular and subcellular biology*, 2022, V.61, P.145-189

BECKMAN FRAGMENTATION OF THE A-RING OF DIHYDROLUPEOL OXYMES

G.F. Krainova, V.V. Grishko

Institute of Technical Chemistry, Ural Branch of the Russian Academy of Sciences,
Russian Federation, 614013 Perm, Academician Korolev St., 3
E-mail: Gulja.perm@mail.ru

A-secolupane **4** (C2) and **7** (C3) nitriles with an aldehyde group or a fragment of methyl ketone in the A ring with a cleaved C2–C3 or C3–C4 bond were synthesized from the C3 oxidized derivative of dihydrolupeol **1**.



a: $t\text{-C}_4\text{H}_{11}\text{OK}$, $i\text{-C}_5\text{H}_{11}\text{NO}_2$, $t\text{-C}_4\text{H}_9\text{OH}$; b: NaBH_4 , MeOH ; c: SOCl_2 , CH_2Cl_2 ;
d: $\text{NH}_2\text{OH} \times \text{HCl}$, $\text{AcONa} \times 3\text{H}_2\text{O}$, $\text{C}_2\text{H}_5\text{OH}$; e: TsCl , Pyridine ; f: O_3 , CH_2Cl_2

According to the Scheme, the corresponding C2 and C3 oximes **2** and **5** were obtained from dihydrolupenone **1**. By reducing compound **2** to α -hydroxyoxime **3** and subsequent Beckman fragmentation of the C2–C3 bond, the corresponding 2,3-seco-aldehydonitrile **4** was obtained [1]. By Beckman fragmentation of the C3–C4 bond of the ring A of oxime **5**, alkennitrile **6** was synthesized, by ozonation of which the corresponding 3,4-secolupane methyl ketone **7** was obtained [2]. Compounds **4** and **7** can be considered as a promising synthetic platform for the development of new biologically active substances.

This research was financially supported by the State Contractual Order Nr. 124021400012-1.

REFERENCES

1. G.F. Krainova, O.N. Gagarikh, V.V. Grishko, *Chem. Nat. Compd.*, 58, 693 (2022).
I.A. Tolmacheva, Y.A. Beloglazova, M.A. Nazarov, O.N. Gagarikh, V.V. Grishko, *Int. J. Mol. Sci.*, 24, 9863 (2023).

SYNTHESIS, IDENTIFICATION AND *IN SILICO* STUDY OF TRINITRO DERIVATIVE FROM TROPIC ACID FROM THE ATROPIN ALKALOID

Eldar Abdulla Garaev, Konul Fada Huseynguliyeva, Shafa Baxish Alieva

Azerbaijan Medical University, Department of Pharmaceutical Toxicology and Chemistry, Baku eldargar@mail.ru (+99450-210-24-41), k-f-h-82@mail.ru, alievaashafa@gmail.com

When creating a new medicinal substance, computer programs are widely used in order to minimize the additional toxic effect on the living organism, but to maximize the biological activity of the substance. For this purpose, it is proposed to synthesize a substance with higher biological activity by introducing certain chemical changes in the chemical structure of plant substances.

For this purpose, it was synthesized by us a semi-synthetic derivative - a trinitro derivative of tropic acid of the natural alkaloid atropine, obtained from plant raw materials, and investigated the biological activity and toxicity of the obtained tropane derivative *in silico* using various computer programs. During the experiments, we focused on strengthening the therapeutic benefits and minimizing the side effects of various tropane derivatives by investigating their pharmacokinetic effects. As mentioned, atropine is used in various medical practices. Therefore, our goal was to identify semi-synthetic derivatives with pharmacokinetic profiles compared to the native compound. To achieve the goal, we isolated atropine alkaloid from the plant *Datura stramonium* L. using a general alkaloid extraction method. When the isolated individual atropine alkaloid was heated with nitric acid, it decomposed to form tropic acid and tropine alcohol. The aromatic ring of the resulting tropic acid reacted with nitric acid to form trinitro tropic acid. To identify trinitro tropic acid, color reactions and thin-layer chromatography (TLC) methods were used. Color reaction: when trinitrotropic acid is treated with a 10% alcohol solution of KOH and acetone, a violet-coloured quinoid derivative is obtained. TLC analysis: the obtained substances were identified by the TLC method in a chloroform: methanol: ammonia (9 : 1 : 0.1) medium. Alkaloids were detected by Dragendorff's reagent. An orange spot with $R_f = 0.74$ was obtained on the chromatographic plate (Alugram SİL G/UV254; Macherey-Nagel Silica gel 60). Additionally, the presence of substances was investigated under UV rays. As a result of the research, atropine alkaloid was individually isolated from the *Datura stramonium* L. plant, and trinitro derivative of tropic acid was synthesized. The trinitro derivative of tropic acid was studied *in silico* using the PASS online software program, and its biological activity and toxicity were predicted. It has been determined that the trinitro derivative exhibits higher fibrinolytic (71%), antihypoxic (64%), and antitoxic (56%) effects compared to atropine. The use of this trinitro derivative in medical practice will show more effective results.

SYNTHESIS AND CYTOTOXICITY OF ENAMINONES' DERIVATIVES

A.A. Khudoyberdiyeva¹, E.O. Terenteva³, U.B. Khamidova³, M.R. Umarova³, Sh.S. Azimova³, Z.E. Urunbaeva^{1,2}, A.Sh. Saidov¹, V.I. Vinogradova³

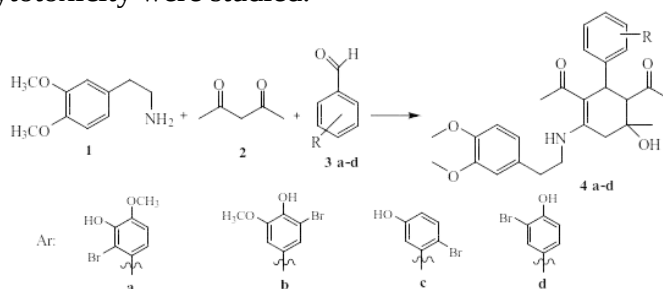
¹ Samarkand State University named Sh. Rashidov, Samarkand, Uzbekistan

² Samarkand State Medical University, Samarkand, Uzbekistan

³ S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Tashkent, Uzbekistan

Enaminones are highly active polyfunctional compounds containing several electrophilic and nucleophilic centres. Currently, enaminones represent a promising platform for the preparation of new substances, as their synthesis is characterised by simplicity, high yields, availability of starting reagents and a wide range of products formed.

In this work, the synthesis of enaminone derivatives under mild conditions in the presence of acetylacetone, homoveratrilamine and a series of aromatic aldehydes was carried out. 5-N-((3,4-dimethoxyphenylethyl)amino)-2,4-diacetyl-1-methyl-bromophenyl-cyclohexen-4-ol-1 enaminones were obtained in high yields. Their structural analyses and cytotoxicity were studied.



The cytotoxic effects of the compounds were studied against 4 cancer cell lines at 100 μ M.

Compounds
Cells

Inhibition of cell growth, %

	Gross formula	CCRF-CEM	HeLa	HBL-100	HEp-2
4a	C ₂₈ H ₃₄ BrNO ₇	0.0 $\pm$ 0.0	10.6 $\pm$ 0.8	8.5 $\pm$ 0.9	19.6 $\pm$ 1.3
4b	C ₂₈ H ₃₄ BrNO ₇	0.0 $\pm$ 0.0	25.7 $\pm$ 0.0	8.6 $\pm$ 0.7	25.7 $\pm$ 1.5
4c	C ₂₇ H ₃₂ BrNO ₆	0.0 $\pm$ 0.0	8.0 $\pm$ 0.0	26.7 $\pm$ 0.6	8.0 $\pm$ 0.8
4d	C ₂₇ H ₃₂ BrNO ₆	0.0 $\pm$ 0.0	93.8 $\pm$ 2.3	13.5 $\pm$ 0.4	66.5 $\pm$ 1.8
	Cisplatin	51.6 $\pm$ 1.9	92.4 $\pm$ 2.7	100.0 $\pm$ 0.0	45.7 $\pm$ 2.1

It was found that only derivative 4d showed high cytotoxicity to cervical epithelial carcinoma HeLa (93.8%) and laryngeal adenocarcinoma HEp-2 (66.5%) cells, which corresponded to or exceeded the values of the reference drug under similar conditions. It is interesting to note that this compound was absolutely inactive against CCRF-CEM and HBL-100 cell lines.

BIOLOGICALLY ACTIVE SUBSTANCES FROM *Artemisia albida*

Ayaulym Minkayeva¹, Akmeiir Murai², Uljan Jenis¹, Yasmina Ulfanova², Janar Jenis^{1*}

¹The Research Center for Medicinal Plants, Al-Farabi Kazakh National University, al-Farabi Ave. 71, Almaty 050040, Kazakhstan; janarjenis@kaznu.kz

²Research Institute for Natural Products & Technology, Almaty 050046, Kazakhstan;

The endemic species of *Artemisia* L. genus is the most widespread as well as the rich source of constituents with pharmaceutical activity which is a base of novel prospective natural drugs. The *Artemisia albida* L. (*A. albida*) is the specimen mostly distributed in Central Asia countries, especially the southern east of Kazakhstan, which was discovered insufficiently [1].

According to our research progress, *A. albida*'s DCM fraction was identified as the most promising part consisting active complexes with valuable pharmaceutical properties. Using a range of chromatographic and physio-chemical methods such as column chromatography (CC), TLC, preparative HPLC as well as ¹H and ¹³C NMR, 3 new compounds, along with 10 known compounds were isolated from the DCM part of *A. albida* collected from the Almaty region Kazakhstan. One of the isolated compounds is **1** which can be characterized as yellowish oil (Fig. 1). Compound **1** had a molecular formula C₂₂H₂₆O₆ on the basis of LC-MS results at *m/z* 385 [M-H]⁻ and was identified as a neolignan derivative [2].

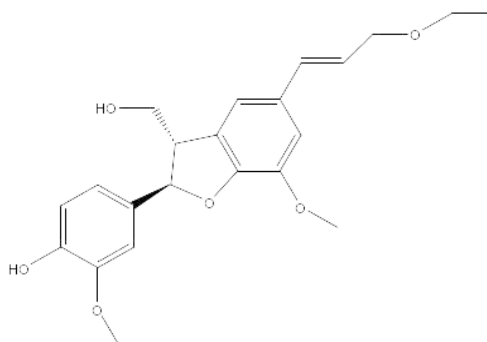


Fig 1. The structure of compound **1**

References:

1. Nurlybekova, A., Kudaibergen, A., Kazymbetova, A., Amangeldi, M., Baiseitova, A., Ospanov, M., ... & Jenis, J. (2022). Traditional use, phytochemical profiles and pharmacological properties of *Artemisia* genus from Central Asia. *Molecules*, 27(16), 5128.
2. Qiao, L. R., Yang, L., Zou, J. H., Li, L., Sun, H., Si, Y. K., ... & Dai, J. (2012). Neolignans and sesquiterpenes from cell cultures of *Stellera chamaejasme*. *Planta medica*, 78(07), 711-719.

Acknowledgment: This work was supported by The Ministry of Science and Higher Education of the Republic of Kazakhstan (grant number AP19676281).

CHEMICAL COMPOSITION AND ANTIMICROBIAL ACTIVITY OF THE ESSENTIAL OIL FROM *Lavandula angustifolia* MILL. CULTIVATED IN THE COLLECTION OF THE MBG IN THE ALMATY CITY

Zh.Zh. Karzhaubekova*¹, L.M. Grudzinskaya¹, R.B. Arysbaeva¹, A. Aliakhim²

¹*Institute of Botany and Phytointroduction WFC MENR RK Almaty, Kazakhstan*

²*Al-Farabi Kazakh National University, Almaty, e-mail: zhanna1322@mail.ru*

The introduction and cultivation of *Lavandula angustifolia* Mill. belong to *Lamiaceae* Lindl. family in the foothill zone of the Zailiyskiy Alatau (MBG, Almaty) have been extensively documented since the late 1950s by seeds from Europe and Russia botanical gardens. In the medicinal plant experimental plot in the MBG preserves generative specimens of the species sown in 1965, 1980, 1990, 2014 and 2021. In Almaty region, lavender not only thrives but also completes all stages of seasonal development and consistently produces viable seeds. This species remains stable in cultivation, regularly blooming and yielding viable seeds.

METHODS: We extracted the essential oil from the upper twigs of *L.angustifolia* by water distillation from fresh raw material (IBPh). The GC-MS laboratory at Mugla University analysed the chemical composition of the isolated essential oil. We tested the antimicrobial activity of lavender narrow-leaved essential oil against gram-positive bacteria *Staphylococcus aureus* subsp. *aureus* ATCC® 6538P™; gram-negative bacteria: *Escherichia coli* ATCC® 8739™; *Pseudomonas aeruginosa* ATCC 9027; fungi: *Candida albicans* ATCC® 10231™.

The results of the accumulation essential oils in the aboveground part of *Lavandula angustifolia* leaf has been monitored annually since 1997. The oil is a light yellow liquid, with quantitative contents varying from 1.56 – 4.3% w/w. Fifty-three compounds were identified by GC. The most prevalent were bi- and monocyclic terpenes (fenchol and phenylacetate 31.6 and 19.4%), followed by borneol and terpene-4-ol (4.8%), caryophyllene oxide (4.1%), santalene (2.4%), lavandulol (1.9%), and geraniolacetate (1.4%). The isolated essential oil effectively inhibits the growth of the following bacteria and fungi: *Staphylococcus aureus* and *Escherichia coli* in dilution 1:8, *Pseudomonas aeruginosa* in dilution 1:2, and *Candida albicans* in dilution 1:2.

BACILLUS-DERIVED CYCLE LIPOPEPTIDES MODULATE MICROBIOME STRUCTURE AND ENZYMATIC ACTIVITY OF SOIL AND INCREASE PRODUCTIVITY OF *Solanum tuberosum*

Alexey S. Vasilchenko^{1*}, Diana S. Dilbaryan¹, Darya V. Poshvina¹, Olga V. Domanskaya¹, Alexander V. Iashnikov¹, Anastasia V. Teslya^{1,2}

¹Laboratory of Antimicrobial Resistance, Institute of Environmental and Agricultural Biology (X-BIO), Tyumen State University, Tyumen

²Laboratory of Biochemistry and Ecology of Microorganisms, All-Russian Institute of Plant Protection, 196608 Pushkin, Russia

Cyclic lipopeptides (CLPs) are secondary metabolites produced by *Bacillus* bacteria and are well-known. Recent research on the role of these lipopeptides in soil microbial ecology has suggested that their significance extends beyond simply suppressing phytopathogens. In our work, we have studied CLPs (bacillomycins and fengicides) as potential modulators of the microbiome structure and its functional properties in agroecosystems. These changes in the microbiome can lead to improvements in soil health and, consequently, plant productivity.

The metabolic activity of the soil microbial community was found to be stimulated by the application of CLPs (chemicals) to soil. In the experimental condition, microbial enzymes involved in the cycling of carbon, nitrogen, and phosphorus were activated. Three enzymes were involved in carbon cycling, two enzymes in nitrogen cycling, and one enzyme in phosphorus cycling. Exposure to CLPs did not alter the alpha diversity of the bacteria but increased the alpha diversity of the fungi. DNA metabarcoding showed that the action of CLPs altered the relative abundance of approximately 20% of the bacterial and fungal ASVs that comprised the dominants. The effect was the same for both bacteria and fungi: the relative abundance of most of these ASVs increased. Finally, we tested the preparation based on CLPs on potato tubers and found that it improved the physiological and biochemical parameters of plants. Therefore, the use of purified *Bacillus*-derived CLPs allows for a better understanding of the biological effects of soil bacilli on the soil microbiome.

In addition, CLPs have been found to be non-toxic and beneficial to soil microbiota. This may lead to the development of biological preparations that could improve crop productivity.

Funding. This work was supported by the Ministry of Science and Higher Education of the Russian Federation for financial support (FEWZ-2024-0005). This work was supported by the Russian Science Foundation (Grant No. 19-76-30005) in the section 3.6. (“Biological effects of treating potatoes(*Solanum tuberosum*) with CLPs”).

QUANTITATIVE DETERMINATION OF FLAVONOIDS FROM THE AERIAL PARTS OF *Linaria vulgaris* MILL.

D.K. Nurkadirov, Kh.I. Itzhanova

NJSC “Karaganda Medical University”, Karaganda, Kazakhstan

Linaria vulgaris Mill. (*Scrophulariaceae* family) is a perennial herbaceous plant, widespread in the territory of Central Kazakhstan. The aerial part of *Linaria vulgaris* Mill. is used in folk medicine as an anti-inflammatory, diuretic, antimicrobial, antihemorrhoidal agent.

The herb of *Linaria vulgaris* Mill. contains tannins, alkaloids, flavonoid glycosides, organic acids, vitamin C and minerals.

Flavonoids are valuable groups of biologically active substances, as they have various types of pharmacological activity (antioxidant, capillary-strengthening, etc.), affect peripheral circulation, help normalize the lipid composition of the blood, increase the absorption of vitamin C in the small intestine [1].

The aim of the work is to study the quantitative composition of flavonoids using spectrophotometry.

Quantitative determination of flavonoids in the alcoholic extract of *Linaria vulgaris* Mill. was carried out by spectrophotometric method at a wavelength of 430 nm.

The result of the quantitative content of flavonoids in terms of quercetin is given in table 1.

Table 1 – Quantitative content of flavonoids in terms on quercetin

Sample	Total flavonoids in terms of quercetin, in %
Aerial part of <i>Linaria vulgaris</i> Mill.	0,0525

As a result of the research carried out it was established that the aerial part of *Linaria vulgaris* Mill. contains up to 0.0525% of flavonoids in terms of quercetin. The obtained results will be used to develop quality control methods for the analyzed raw materials.

References

1. Flavonoids: biochemistry, biophysics, medicine // edited by Yu.S. Tarakhovsky. - Pushchino: Synchronbook, 2013. – 310 p

ESSENTIAL OIL CONSTITUENTS OF *Ferula persica* FRUITS

E.H. Kerimli^{1,2}, E.A. Garayev¹

¹*Azerbaijan Medical University, Baku, Azerbaijan*

²*Institute of Botany, Ministry of Science and Education of the Republic of Azerbaijan*

The genus *Ferula* belongs to the celery family, unites 130 species distributed in Central Asia, Siberia, China (Xinjiang), Afghanistan, Iran and North Africa, 10 species in the Caucasus and 8 species in Azerbaijan.

From the roots of *F. persica* species, essential oils, sesquiterpene coumarins, lactones, terpenoid sesquiterpene esters, steroid compounds, etc. received. Stereological and molecular studies on the effects of *F. persica* extract on wound healing in rats. The morphological and anatomical characteristics of the roots of *F. persica* roots were studied.

The chemical composition of the essential oil was studied by chromato-mass spectrometry on a gas chromatograph Agilent Technologies 7890B Network GC System, 5977A inert Mass Selective Detector with a mass spectrometer. Qualitative analysis was based on comparison of retention times, indices, and mass spectra with corresponding data from the literature and NIST/FFSNC mass spectrum computer libraries.

Vegetable raw materials. The raw material of *F. persica* was harvested during the fruiting period on July 20, 2021 in the Republic of Azerbaijan (Jangi village, Gobustan district; 40°30'03.04" C 49°15'33.11" B 356 m a.s.l.).

Obtaining the sum of biologically active substances: 100 gr of finely ground air-dried fruits of the part were extracted three times with acetone for three days. The extract is filtered, acetone is expelled. The obtained dark light-brown resin was 6.5 g and yield was 6.5%.

Extractive substances with an amount of 6.5 g was dissolved in 50 ml of chloroform and chromatographed on a column of Al₂O₃ neutral II degree of activity (h=80, d=2.5 cm) was eluted with petroleum ether solvent: A yellowish resin is obtained from fractions 5-11. That resin is subjected to repeated column chromatography. Eluted with petroleum ether solvent. From the 40-55th fraction, a liquid fatty mass is obtained.

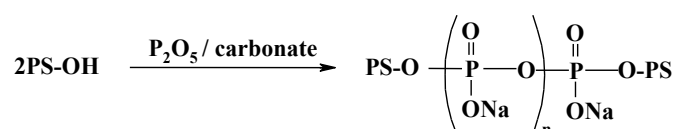
Were identified 16 components from the gas-chromatographic mass spectroscopic analysis of that oil. The components that make up the main advantage are the following. α -pinene 25.41%, limonene 17.00%, terpinen-4-ol 14.07%, sabinene 8.49%, p-cymene 6.42%, (E)-thujone 6.12%, g-terpinene 3.42%, 3-carene 5.60%, (E)-b-terpenyl acetate 2.69%.

PHOSPHORYLATION OF POLYSACCHARIDES BY PHOSPHOROUS PENTOXIDE IN THE PRESENCE OF Na/K CARBONATES

Rakhimova L.Yu., Kozyrev S.V., Khaybrakhmanova E.A., Ponedel'kina I.Yu.

Institute of Petrochemistry and Catalysis, Ufa Federal Research Centre of the Russian Academy of Sciences, 141, Prospekt Oktyabrya, Ufa 450075, Russia

Previously, for a number of polysaccharides (PS) (water-soluble starch St, carboxymethyl cellulose CMC, alginic acid AA, etc.), phosphorylated derivatives (PS-P) containing from 0.25 (for AA) to 14.2 wt. % P (for CMC) were obtained by solid-phase reaction with P_2O_5 without using any additives [1]. In this work, phosphorylation of St, CMC, AA, dextran (DE), chitosan (Ch), and guar was carried out in the presence of K_2CO_3 and $Na_2CO_3 \times 10H_2O$ (Scheme, Table).



SCHEME. Phosphorylation of PS under the action of P_2O_5 /carbonate (K, Na).

TABLE. Content of P in PS-P, obtained in the presence of K_2CO_3 and $Na_2CO_3 \times 10H_2O$.

№	PS-P	Content of P* (% wt.) at a ratio of PS/P(in P_2O_5)/K(in K_2CO_3)= 1:1:0.5	Content of P* (% wt.) at a ratio of PS/P(in P_2O_5)/Na (in $Na_2CO_3 \times 10H_2O$)=1:1:0.5
1	ST-P	5.2	17.0
2	CMC-P	16.6	15.9
3	AA-P	5.2	12.0
4	DE-P	1.7	9.2
5	Ch-P	13.8	14.1
6	Guar-P	2.4	6.7

*The total P content in PS-P samples was determined using X-ray fluorescence analysis.

The advantage of carbonates for obtaining PS-P was an increase in the efficiency of phosphorylation (compare with [1]) and a decrease in the destructive effect of acidic P_2O_5 media on PS macromolecules. When using $Na_2CO_3 \times 10H_2O$, ST-P, AA-P, DE-P and Guar-P with a higher P content, than in the potash presence, were obtained. This indicated the influence of crystallization water on the phosphorylation process. CMC and Ch showed high reactivity regardless of the carbonate nature (Table, 2 and 5). The PS-P contained all types of mono- and disubstituted phosphate subunits: mono-, di- and polyphosphates (Scheme).

References.

Ponedel'kina I.Yu., Khaybrakhmanova E.A., Kozyrev S.V., Tyumkina T.V. Solid-Phase Phosphorylation of polysaccharides by phosphorus pentoxide. Chemistry of Natural Compounds, 2023, V. 59, P. 625-628.

PLANT METABOLITES AS PROMISING CARRIERS OF DELIVERING ANTHELMINTIC SUBSTANCES

S.S. Khalikov

A. N. Nesmeyanov Institute of Organoelement Compounds of Russian Academy of Sciences (28, Vavilova st., Bldg. 1, Moscow, 119334, Russia)

Glycyrrhizic acid (GA) is the main (up to 24%) active component of the licorice root *Glycyrrhiza glabra* L., growing in Uzbekistan and Russia, as well as *Glycyrrhiza uralensis* Fish (Russia) [1]. Licorice processing products have been actively used in traditional Chinese, Japanese and Uzbek medicine since ancient times. However, only in the XXI century was a new property of GA discovered to enhance the activity of other drugs and play the role of drug delivery carriers [2].

Our studies on the use of GA and its derivatives (disodium salt of GA, licorice extract) to improve the physicochemical properties of a number of anthelmintic substances (fenbendazole, praziquantel, ivermectin, etc.) have found that their solubility and bioavailability increases significantly, anthelmintic properties increase with a decrease in the consumption rate of substances [3-6]. Such properties are explained, on the one hand, by the amphiphilic nature of GA, which is capable of forming self-associates in aqueous and non-aqueous media, as well as water-soluble complexes with the substances of the studied anthelmintics. On the other hand, the ability of GA to be included in the lipid bilayer and increase the fluidity and permeability of membranes. This ability of GA and its aggregates to change the properties of cell membranes is of great importance from both fundamental and practical points of view [2].

References

1. Tolstikov G.A., Baltina L.A., Shultz E.E., Pokrovsky A.G. *Glycyrrhizic acid*. Bioorg Chem. 1997, 23(9):691-709.
2. Selyutina O.Yu., Polyakov N.E. *Glycyrrhizic acid as a multifunctional drug carrier – from physicochemical properties to biomedical applications: a modern insight on the ancient drug*. Int J Pharm. 2019, 559:271-279.
3. Varlamova A.I., Movsesyan S.O., Arkhipov I.A., Khalikov S.S., Arisov M.V., Kochetkov P.P., Abramov A.E., Ilyin M.M., Lokshin B.V. *Biological activity and pharmacokinetic behavior of fenbendazole integrated into a supramolecular delivery system with licorice extract and sodium dioctyl sulfosuccinate*. Biol Bull. 2020, 47 (6): 549-558.
4. Arkhipov I., Khalikov S., Dushkin A., Sadov K., Meteleva E., Arisov M., Varlamova A. *Anthelmintic Efficacy of Supramolecular Complex of Praziquantel Obtained by Mechanochemical Technology*. Iran J Parasitol. 2020, 15 (3): 364-373.
5. Khalikov S.S. *Mechanochemical technology for regulation of the solubility of anthelmintic drugs by using Polymers*. INEOS OPEN. 2021, 4 (2): 53-60.
6. Marchenko V.A., Vasilenko Yu.A., Biryukov I.V., Khalikov M.S., Khalikov S.S., Sazmand A. *Efficacy of suspension preparations based on niclosamide and ivermectin in parasitoses of sheep*. J Adv Vet Anim Res. (in press).

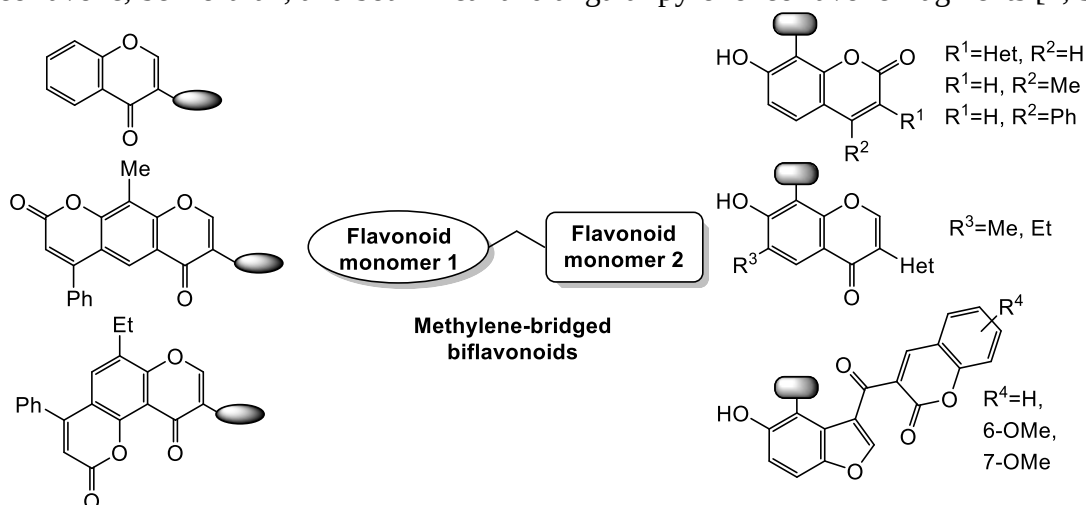
SYNTHESIS OF METHYLENE-BRIDGED BIFLAVONOIDS

Ye.V. Antsybora, N.V. Gorbulyenko, E.K. Hlibov,
V.S. Moskvina, T.V. Shokol, V.P. Khilya

*Taras Shevchenko National University of Kyiv, 64/13 Volodymyrska st., Kyiv, 01033,
Ukraine*

Methylene-bridged biflavonoids, a subclass of biflavonoids comprising two identical or non-identical flavonoid fragments linked symmetrically or asymmetrically via an alkyl- or alkoxy-based linker of varying lengths, are significant plant metabolites. They exhibit diverse biological activities, including anti-inflammatory, antitumor, antiviral, antimicrobial, anticoagulant, and antiprotozoal properties, with relatively low toxicity. A promising synthetic approach for methylene-bridged biflavonoids with non-identical fragments involves an oxa-Diels–Alder reaction between 3-(*N,N*-dimethylamino)-1-(2-hydroxyphenyl)prop-2-en-1-ones and *ortho*-quinone methides, generated from aryl/hetaryl-substituted *ortho*-(*N,N*-dimethylaminomethyl)phenols [1].

This method was successfully applied using structurally diverse enaminketones as precursors for flavonoid monomer 1 and Mannich bases of 7-hydroxyneoflavones, 7-hydroxy-3-hetarylcoumarins, 7-hydroxy-3-hetarylchromones, and modified 5-hydroxybenzofurans (flavonoid monomer 2). This approach enabled the creation of a diverse library of methylene-bridged biflavonoids featuring chromone, coumarin, neoflavone, benzofuran, and both linear and angular pyrononeoflavone fragments [2, 3].



Additionally, the recyclization of the obtained derivatives was explored using 1,2-*N,N*-, 1,2-*N,O*-, and 1,3-*N,N*-binucleophiles. The outcomes of these recyclization reactions provide further insights into the synthetic significance, versatility, and potential applications of methylene-bridged biflavonoids in medicinal chemistry.

References

- [1] G.P. Mrug, N.V. Myshko, S.P. Bondarenko, V.M. Sviripa, M.S. Frasinuk, *J. Org. Chem.*, **2019**, *84*, 7138-7147.
- [2] E.K. Glibov, N.V. Gorbulyenko, V.S. Moskvina, A. V. Suprun, O. V. Shablykina, T. V. Shokol, V. P. Khilya *Chem. Nat. Compd.* **2022**, *51*, 617–622.
- [3] E.K. Hlibov, N.V. Gorbulyenko, V.S. Moskvina, O.V. Shablykina, T.V. Shokol, A.V. Kozytskyi, V.P. Khilya *Chem. Nat. Compd.* **2024**, *60*, 223-228.

CONCEPT AND SOME ASPECTS OF MEDICAL CHEMISTRY

^{1,2} Kh.I.Hasanov, ¹A.N.Azizova, ²N.M.Quliyeva, ¹Sh.H.Gasimov, ¹M.Y.Yusifova,
¹R.I.İsmailova

1. Azerbaijan Medical University, SIC.

*2. Western Caspian University 12 , H.Aliyev ave., AZ 1029, Baku, Azerbaijan,
e.mail:x.qasanov58@gmail.com; tel. +994703653734*

A deep understanding of the reasons for the specificity and selectivity of processes in nature and the associated biological activity of compounds is the largest problem of modern science, to the solution of which research in the field of medicinal chemistry can make a significant contribution.

Medicinal chemistry can be defined as a composite field, the main interrelated scientific components of which are: organic, inorganic synthesis, pharmacology and human biochemistry. Sections of bioinorganic chemistry, biocoordination chemistry, physical chemistry, analytical chemistry, quantum chemistry, molecular biology, presentation of supramolecular chemistry, etc. can be used as second-order components.

The modern protocol of the “medicinal chemistry” direction is considered, which includes: selection of the starting target synthetic platform, selection of appropriate pharmacophore functions, analysis of possible synthetic solutions, identification of probable biomedical objects, postulation of the mechanism of pharmacophore-target interaction, determination of structure-activity relationships (QSAR). In favorable cases, by developing a quantitative QSAR model, it is possible to sharply limit the range of synthesized compounds in the search for drugs.

In connection with the above, the most promising (key) synthetic approaches are considered, a classification of pharmacophores is proposed, possible mechanisms of their interaction with molecular fragments of cellular structures. This last point is directly related to the experimental determination of the structure of molecular fragments of cells - very important and the most problematic in decisions. The role of natural compounds as starting substances and the medicinal classification of constituents are especially highlighted. The subject of medicinal chemistry is the search and structural design of PAS, identifying the relationship between chemical structure and physiological activity and solving the inverse “structure-property” problem, namely the design of the necessary structures with a given property

STUDY OF THE SOLUBILITY OF DIHYDROQUERCETIN IN WATER IN THE PRESENCE OF FULVIC ACIDS

A.S. Bagaev^{1,*}, S.V. Nekhoroshev²

¹ *Yugra State University, Khanty-Mansiysk*

² *Khanty-Mansiysk State Medical Academy *bagantti@gmail.com, +79526903122*

Dihydroquercetin (trivial name – taxifolin) is a representative of a family of natural compounds called flavonoids. There are two main directions for the use and study of flavonoid compounds and, in particular, dihydroquercetin – as biologically active additives and as food additives. The antioxidant and antiradical properties of taxifolin have been proven by a number of studies and are already being actively implemented in the food industry. Dihydroquercetin stands out from other polyphenols due to its minimal toxicity, high pharmacological activity and the prospect of use in clinical practice for a number of diseases.

The problem with using taxifolin is its low solubility in water, which reduces its bioavailability and requires the use of high concentrations. Current research has not presented a technology to significantly increase the solubility of this compound in water. The study uses fulvic acids, which have good solubility in water and a similar polyphenolic structure. It is assumed that dihydroquercetin interacts with fulvic acids to form co-crystals with increased solubility in water. During the work, the optimal temperature and pH parameters were selected, which influenced solubility.

The concentration of dihydroquercetin in water in the presence of fulvic acids was studied using a spectrophotometric method and high-performance liquid chromatography.

As a result, the solubility of dihydroquercetin in water in the presence of fulvic acids was studied. The obtained values were compared with the ultimate solubility of taxifolin in water under the same conditions. As a result, there was a significant increase in the concentration of dihydroquercetin in the form of co-crystals compared with an individual compound.

Thus, further study of the solubility of dihydroquercetin in water in the presence of fulvic acids will allow us to develop a technique for increasing solubility and expand the possibilities of its use in the pharmacological and food industries

A SERIES OF NOVEL SUBSTITUTED EPOXYBENZO[7,8]OXOCYNO[4,3-*b*]PYRIDINE DERIVATIVES: SYNTHESIS AND *IN SILICO* STUDY OF ANTIVIRAL ACTIVITY

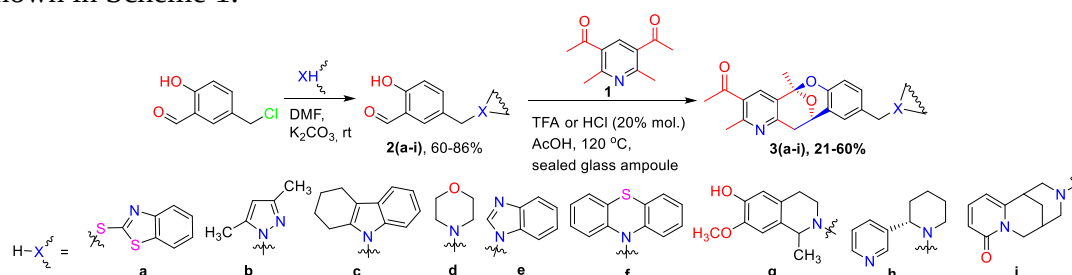
A.L. Stalinskaya¹, I.A. Pustolaikina², R.A. Muzaparov², A.F. Kurmanova²,
A.S. Rakhimzhanova², S.Sh. Normatov³, I.V. Kulakov¹

¹ University of Tyumen, Tyumen, Russia;

² Karaganda Buketov University, Karaganda, Kazakhstan;

³ Infochemistry Scientific Center, ITMO University, Saint Petersburg, Russia

We have previously shown that the reaction of pyridine **1** with salicylaldehyde derivatives leads to the formation of 5H-5,11-epoxybenzo[7,8]oxocino[4,3-*b*]pyridines – new synthetic pyridine analogs of natural integrastatins A and B, which are inhibitors of HIV-1 integrase [1]. This work presents the synthesis and *in silico* study of the antiviral activity of oxocinopyridine derivatives modified with pharmacophore groups, including alkaloids (cytisine, anabasine, salsoline). The synthesis of the target compounds **3a-i** is shown in Scheme 1.



Scheme 1. Synthesis of epoxybenzo[7,8]oxocino[4,3-*b*]pyridines **3a-i**

Next, target compounds **3a-i** were tested for potential biological activity using PASS online platform, and all of them were predicted to have antiviral activity with $P_{\alpha} \sim 0.42-0.52$. According to the 2024 report of the World Health Organization, such viral diseases as HIV-1, Coronavirus and Rhinovirus are among the most common, so target compounds **3a-i** were examined for the imbibition potential to the corresponding proteins HIV-1 (PDB ID: **3V81**), SARS-CoV2 (PDB ID: **7AAP**) and (PDB ID: **4PDW**) using the molecular docking approach. As a result compound **3i** have shown the highest binding affinity with all three proteins. Molecular dynamics simulations over 50 ns demonstrated high stability of the **3i** – HIV-1 complex, while **3i**-SARS-CoV2 complex was quite stable, and **3i**- Rhinovirus complex exhibited unstable binding.

Thus, a series of novel S-methylthio- and N-methylamine substituted epoxybenzo[7,8]oxocyno[4,3-*b*]pyridine derivatives **3a-i** were synthesized. Their antiviral activity was predicted using *in silico* approach and compound **3i** was selected as the top one, as it demonstrated excellent binding affinity to the HIV-1 protein and high stability of the resulting complex. Compound **3i** can be recommended for further *in vivo* and *in vitro* study as a potential therapeutic agent for HIV-1 viral disease.

This study was funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. AP23488790).

Reference

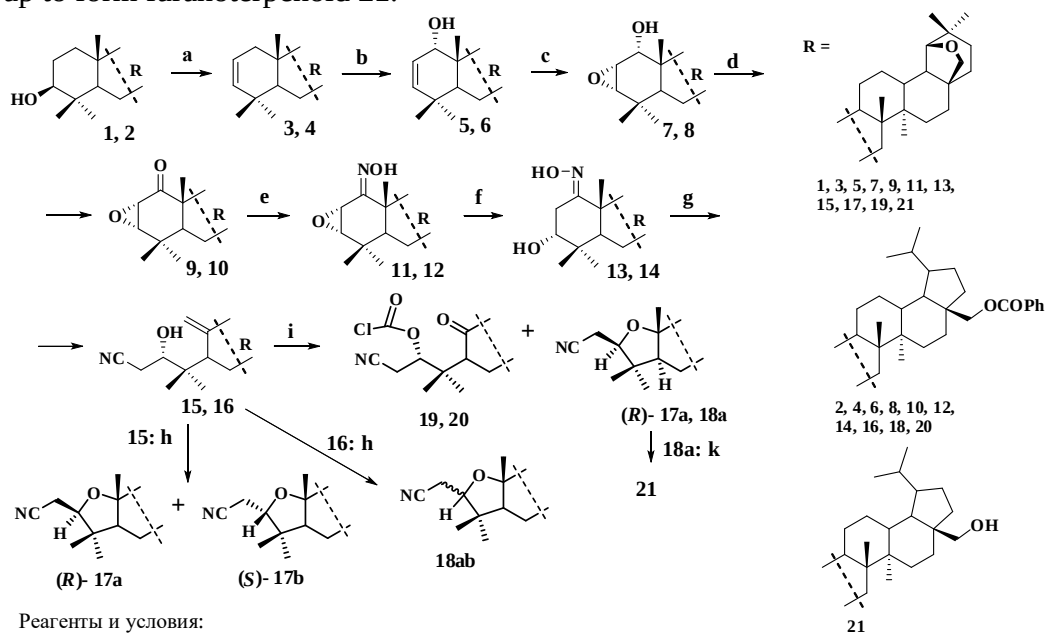
1. Kulakov, I.V., Stalinskaya, A.L., Chikunov, S.Y., Gatilov, Y.V. (2021) *New J. Chem.*, 2021, 45, 3559

SYNTHESIS OF FURANOTRITERPENOIDS FROM 1,10-SECO-TRITERPENOIDS

I.A. Tolmacheva, M.A. Nazarov, V.V. Grishko

Perm Federal Scientific Centre, Institute of Technical Chemistry UB RAS, Academician Korolev St. 3, 614013 Perm, Russia

The wide range of biological activity of natural furanoterpenoids determines the relevance of developing methods for constructing new furanoterpenoids, including those based on available pentacyclic triterpenoids. Skeletal modifications of triterpenoids, including the formation of a heterocyclic ring involving triterpene backbone atoms, are highly effective methods for the synthesis of new biologically active triterpene derivatives. Based on allobetulone **1** and 28-benzoyl derivative of dihydrobetulin **2**, according to a previously developed scheme [1], 1,10-seco-triterpene derivatives **15** and **16** were obtained. When refluxing compound **15** in formic acid, isomeric oleanane furanoterpenoids **17a** and **17b** were formed, the diastereomeric mixture of which was separated by column chromatography. Under these conditions, compound **16** gave an inseparable isomer mixture of furanoterpenoids **18a,b** in the ratio 7:3. Ozonolytic oxidation of compounds **15**, **16** proceeded with the formation of diastereomeric 3(*R*)-furanoterpenoid **17a** or **18a** mixed with chloroformate product **19** or **20**. Subsequent boiling of compound **18a** with 5% KOH in ethanol initiated hydrolysis of the 28-benzoyl group to form furanoterpenoid **21**.



Реагенты и условия:

(a) POCl₃, C₅H₅N, reflux; (b) SeO₂, 1,4-dioxane, reflux; (c) *m*-ClC₆H₄CO₂H, CHCl₃, 5°C; (d) CrO₃, (CH₃)₂CO, H₂SO₄, rt; (e) NH₂OH·HCl, C₅H₅N, reflux; (f) NaBH₄, C₂H₅OH, THF, reflux; (g) TsCl, C₅H₅N, reflux; (h) HCOOH, reflux; (i) O₃, CH₂Cl₂, -50°C; (l) KOH, EtOH, reflux

This research was financially supported by the State Contractual Order Nr. 124021400012-1.

[1] Tolmacheva I.A., Nazarov A.V., Dmitriev M.V., Boreko E.I., Grishko V.V.. Synthesis of 1,10-seco-triterpenoids by the Beckmann fragmentation from allobetulin // Tetrahedron. – 2017. – Vol. 73. – P. 6448-6455

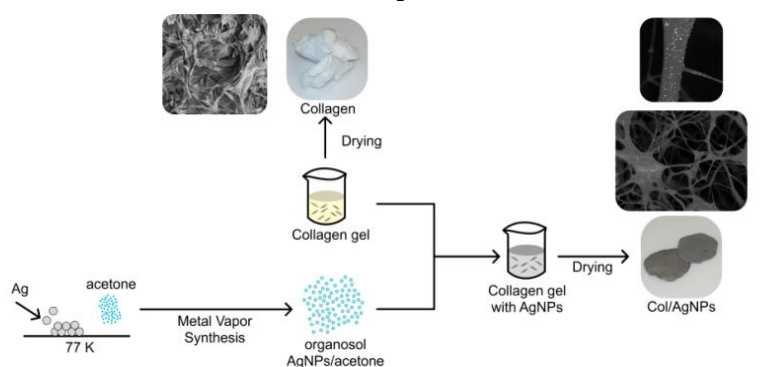
CREATION OF NEW COMPOSITE MATERIALS FOR REGENERATIVE MEDICINE BASED ON COLLAGEN AND SILVER NANOPARTICLES.

Anastasia Nikitichna Tretyakova¹, Natalya Evgenevna Tseomashko², Alexander Yurievich Vasil'kov¹

¹ A.N. Nesmeyanov Institute of Organoelement Compounds, Russian Academy of Sciences, 28/1 Vavilova St., 119334, Moscow, Russia;

² Republican Specialized Scientific and Practical Medical Center for Mental Health, Orom str., 1, Salar village, Qibray district, 102147, Tashkent region, Uzbekistan
e-mail: anastasia.n.tretyakova@gmail.com

The synthesis of compounds of organic and inorganic nature is the most actively studied area for the creation of biomimic materials for replacement therapy and regenerative medicine. Collagen is most suitable for these purposes. In this work, collagen-based film composite incorporated with silver nanoparticles were prepared. Metal vapor synthesis (MVS) method was used for nanoparticles formation. Figure shows the synthesis scheme of the obtained nanocomposite.



Collagen was obtained by enzymatic acid extraction from the tendons of the tails of cows.

The structure, phase composition, surface and morphology analysis of the prepared composite materials in films was performed with spectroscopic and microscopic methods. PXRD analysis revealed the presence of metallic phase proving that nanoparticles were successfully incorporated into the biopolymer matrix. The particles size in the composite materials was estimated using the peaks broadening of the XRPD patterns by the Scherrer formula and amounted to 23 nm. The examination of film morphology by means of SEM showed that film is formed a network of interpenetrating pores and modifying collagen matrix by silver nanoparticles synthesized by the MVS method does not change the collagen microstructure. Structure and possible stabilization mechanisms of metal nanoparticles in polymer matrix were studied with XPS analyses of samples. XPS results showed that the composite contained Ag⁰ states. Collagen-based nanocomposite with Ag nanoparticles exhibited antimicrobial activity against *Bacillus subtilis*, *Escherichia coli* bacteria and *Aspergillus niger* fungi.

Funding: This research was funded by the Russian Science Foundation, grant number 24-23-00220.

PENICILLIC ACID AS A POTENTIAL INHIBITOR OF FtsZ PROTEIN OF *Staphylococcus aureus*

F. Eshboev^{1,2}, A. Tajimuradov², O. Atabaev², Sh. Samandarov², Sh. Azimova¹

1. S.Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of Uzbekistan, Mirzo Ulugbek Str. 77, Tashkent 100170, Uzbekistan;
2. School of Chemical Engineering, New Uzbekistan University, Movarounnahr Street 1, Mirzo Ulugbek District, Tashkent 100000, Uzbekistan;

The rise of multidrug-resistant strains of *Staphylococcus aureus*, including methicillin-resistant *Staphylococcus aureus*(MRSA), underscores the urgent need for novel antibacterial agents. One promising strategy involves targeting the filamentous temperature-sensitive protein Z (FtsZ), a key player in the formation of the Z-ring required for cytokinesis in bacteria. Inhibiting FtsZ can disrupt bacterial cell division, leading to cell death. The strong antibacterial activity of penicillic acid isolated from *Hyssopus officinalis* was confirmed in our previous study using the disk-diffusion method. However, the mechanism of action of penicillic acid has not yet been confirmed. Therefore, this study aims to explore the potential of penicillic acid as an inhibitor of the FtsZ protein in *S. aureus* through molecular docking simulations.

Docking experiments were performed with help of AutoDock Vina. The crystal structure of FtsZ from *S. aureus* was obtained from Protein Data Bank with PDB Code 3VOB. Penicillic acid molecule was downloaded from PubChem. Results of docking were analysed and figure was prepared in UCSF Chimera. Docking analyses were performed separately for each chain of the FtsZ protein. The results indicated that the B chain exhibited the most favorable binding energy, with a value of -5.949 kcal/mol (Table 1), suggesting a stronger interaction compared to the other chains.

Table 1. Docking results of penicillic acid with FtsZ.

Model	Calculated affinity (kcal/mol)
1	-5.949
2	-5.709
3	-5.532
4	-5.316
5	-5.284

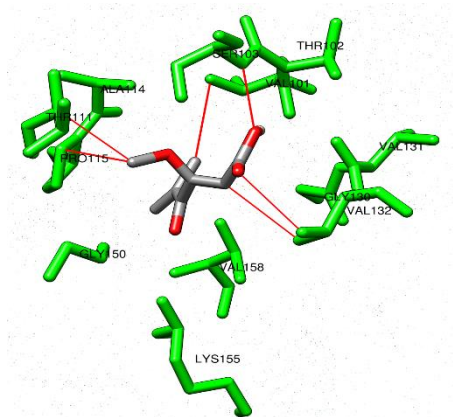


Figure 1. *In silico* docking simulation of penicillic acid to FtsZ of *S.*

aureus.

Results indicated that penicillic acid interacts with B chain of FtsZ. These findings suggest that penicillic acid could serve as a lead compound for the development of novel antibacterial agents targeting FtsZ in *S. aureus*, providing a new avenue for combating resistant bacterial infections. Further *in vitro* and *in vivo* studies are required to validate these computational predictions and assess the therapeutic potential of penicillic acid.

PHARMACOLOGICAL PROPERTIES OF QUINOLINE ALKALOIDS OF THE GENUS *HAPLOPHYLLUM*, GROWING IN THE SURKHAN-DARYA REGION, AND THE PROSPECTS OF THEIR APPLICATION IN MEDICINE

Kh.A. Rasulova¹, Kh.A. Rasulova²

¹*Institute of Plant Chemistry named after academician S. Yu. Yunusov of the Academy of Sciences of the Republic of Uzbekistan, 100170, Tashkent, M. Ulugbek str., 77, fax (99871) 120 64 75, e-mail: khalida.rasulova@gmail.com*

²*Termez branch of the Tashkent Medical Academy, Surkhandarya region, 132000, Termez, Islam Karimov str., 64, e-mail: khurshidakhon@gmail.com*

Alkaloid-bearing plants have been used in medicine since ancient times. In the 19th century, when the first alkaloids were obtained in pure form, they immediately found their application in clinical practice as a drug, and many of them are still used in medicine. Comprehensive studies of Central Asian species of the *Rutaceae* family (Rutae) have shown that the genus *Haplophyllum* A. Juss (whole-leaf), in terms of the number of isolated quinoline alkaloids and their structural diversity among the studied genera, is unique. In addition, plants of this genus have long been known for their medicinal properties. Tinctures of a number of plants are widely used in folk medicine as an analgesic for toothache, chest and stomach diseases, externally for skin diseases, as a sedative for increased nervous excitability and nervous palpitations.

We have studied the genus *Haplophyllum* from different places of growth (R. Uzbekistan, Kazakhstan, and Tajikistan) and, if possible, depending on the vegetation period and plant organ. A comparative study of the data on the alkaloid composition of the plant showed that the richest in both the content and composition of alkaloids are objects from Uzbekistan, in particular plants from Babatag (Surkhandarya). Five species of plants of the *Rutaceae* family were studied: *Haplophyllum acutifolium*, *Haplophyllum perforatum*, *Haplophyllum ramossimum*, *Haplophyllum griffithianum*, *Haplophyllum pedicellatum*. Using various methods for separating natural substances, 50 bases and 7 compounds were isolated, including 15 alkaloids identified with known ones. The structure of 26 new alkaloids was established. A rich source of the practically valuable preparation skimmianine, which has pronounced sedative, antidepressant, antistrychnine, tranquilizing and estrogenic effects with low toxicity, has been found. Laboratory regulations have been developed for obtaining the preparations “Skimmianine” and “Haplopolifin” from the above-ground part of *Haplophyllum perforatum*. For the first time among quinoline alkaloids, substances with antihypoxic, estrogenic, antitumor, antibacterial, sedative, neuroleptic, antidepressant and psychostimulating activity have been identified.

Thus, the isolation and unification of alkaloids of the genus *Haplophyllum* are of extreme importance for practical medicine. Medicines containing these alkaloids actually occupy one of the most significant places in the control system of physiological processes occurring in the body of a healthy and sick people, and play the leading role in the treatment of many diseases, which causes great interest among researchers.

ON THE PRODUCTION OF METABOLITES AND DERIVATIVES OF THE LAPPACONITINE ALKALOID WITH PRONOUNCED ANTIARRHYTHMIC PROPERTIES

D.M.Saijdjanova, D.K.Mutalova, A.I. Sanoev, Sh.N.Zhurakulov, A.Z.Sadikov,
Sh.Sh. Sagdullaev

*S.Yu. Yunusov Institute of the Chemistry of Plant Substances Tashkent, M. Ulughbek St.,
77 Phone.: (998-93) 367-54-00 e-mail: sanoev.a85@mail.ru*

Based on alkaloids extracted from the widely distributed plant *Aconitum septentrionale*, new antiarrhythmic drugs such as Allapinin, Aclezin, and Aksaritmin have been developed and introduced into medical practice. These drugs consist of mixtures of alkaloids found in *Aconitum septentrionale* with a high degree of purity. The Allapinin drug is composed of alkaloids including lappaconitine, leukonine, acetylseppaconitine, N-desacetylappaconitine, and ranonitine, extracted from *Aconitum septentrionale*. The Aclezin drug is a mixture of alkaloids from the above-ground parts of northern *Aconitum septentrionale*, while the Aksaritmin drug is composed of alkaloids extracted from the roots and rhizomes of *Aconitum septentrionale*.

During the production of the Allapin substance from plant raw material, it was found that the residue formed after recrystallization of technical Allapin using a methanol solvent contains N-desacetylappaconitine hydrobromide as the main metabolite. Scientific research has led to the development of a technology for isolating N-desacetylappaconitine hydrobromide from this residue and the creation of a new drug with more pronounced antiarrhythmic properties compared to Allapin, Aclezin, and Aksaritmin. This new drug is currently undergoing clinical trials in the clinics of our republic.

Currently, scientific research is underway to develop technologies for producing promising drugs that rapidly eliminate arrhythmia attacks, based on the metabolites and derivatives of the lappaconitine alkaloid. The primary raw material is the metabolite N-desacetylappaconitine, which is obtained through the hydrolysis of the lappaconitine alkaloid. Hydrolysis conditions in acidic and alkaline environments at various temperatures have been studied. As a result, conditions have been developed for obtaining N-desacetylappaconitine metabolite with high efficiency. Ongoing scientific research continues to analyze the quality and quantity of samples obtained by hydrolysis of the lappaconitine alkaloid, as well as their pharmacotoxicological properties.

SELECTION OF OPTIMAL CONDITIONS FOR CULTIVATION OF *TRICHOPLUSIA NI* INSECT CELLS

Kopaysinova I., Gaynazarova S.A., Khasanov Sh.Sh., Abdurakhmanov J.M., Ashirov O.N., Azimova Sh.S.

*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances,
M.Ulugbek Str. 77, 100170, Tashkent, Uzbekistan; e-mail: genlab_icps@yahoo.com*

Currently, many researchers base their scientific investigations on baculovirus-insect cell systems, highlighting the numerous advantages of these insect cells. The cabbage looper (*Trichoplusia ni*), belonging to the Noctuidae family, damages cabbage, broccoli, and other vegetables. It is named after its primary host plant, cabbage [1].

Presently, High Five™ (*Trichoplusia ni*) insect cells are widely used in baculovirus expression systems to obtain recombinant proteins. These cells are highly sensitive to baculoviruses, providing extensive opportunities for baculovirus expression vector systems (BEVS). Additionally, the growing world population has increased the demand for agricultural products, necessitating proper cultivation and protection of crops from various pests. Insect cells are now being used to study the insecticidal activity of various synthetic and biologically active substances in vitro, enabling the discovery of new-generation insecticides quickly and easily [2-3].

Given these factors, maintaining insect cells and continuously cultivating them under optimal conditions is crucial for ongoing research. High Five™ cells are usually cultured in serum-free media or media containing up to 5% serum. In our research, we cultured High Five™ (Cat. no. B85502 Thermo Fisher Scientific) cells in Grace's (Gibco™) medium containing 5% fetal bovine serum (Gibco™ Fetal Bovine Serum) and in serum-free Express Five™ SFM (Thermo Fisher Scientific) medium at +26°C for 7 days [4-5].

Our experiments showed that Express Five™ SFM serum-free medium at +26°C for 4-5 days provided the most optimal conditions for High Five™ insect cell lines, saving on the relatively expensive FBS reagent. As a result of this study, we identified optimal laboratory conditions for cultivating High Five™ insect cell lines. These conditions open up wide opportunities for studying the insecticidal activity of natural and synthetic substances and for conducting other biotechnological research on these cells.

References

- 1) Chow, Jennifer K.; Akhtar, Yasmin; Isman, Murray B. (2005-09-01). "The effects of larval experience with a complex plant latex on subsequent feeding and oviposition by the cabbage looper moth: *Trichoplusia ni* (Lepidoptera: Noctuidae)". *Chemoecology*. 15 (3): 129–133. Bibcode:2005Checo..15..129C. doi:10.1007/s00049-005-0304-x. S2CID 21637615.
- 2) Ahmad M., Saeed F., Noor Jahan M. Evaluation of Insecticidal and Anti-oxidant activity of Selected Medicinal Plants // *Journal of Pharmacognosy and Phytochemistry*. 2013, 2 (3): 153-158.
- 3) Singh T., Kumar V.R., Bhavani N.L., Pravallika D., Roja K. and Pravallika V. In vitro insecticidal activity of *Solanum melongena* // *European journal of pharmaceutical and medical research*. 2016, 3(5): 420-422.
- 4). Grace's insect cell culture medium, supplemented instructions for use. Doc ID: 179405 Rev. No.: 2. ©2016 Expression Systems LLC.
- 5). Dwight E. Lynn. Methods for Maintaining Insect Cell Cultures *J Insect Sci*. 2002; 2: 9 doi: 10.1093/jis/2.1.9

INVESTIGATION OF OPTIMAL CONDITIONS FOR LONG-TERM STORAGE OF *HELICOPEVRA ZEA* INSECT CELL LINES

Khasanov Sh.Sh., Gaynazarova S.A., Navrozov G.R.,
Eshboev F.B., Sasmakov S.A., Azimova Sh.S.

Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances, M. Ulugbek Str. 77,
100170, Tashkent, Uzbekistan; e-mail: genlab_icps@yahoo.com

Helicoverpa zea, commonly known as the corn earworm, is a species (formerly in the genus *Heliothis*) in the family Noctuidae [1]. The larva of the moth *Helicoverpa zea* is a major agricultural pest. Since it is polyphagous (feeds on many different plants) during the larval stage, the species has been given many different common names, including the cotton bollworm and the tomato fruitworm. It also consumes a wide variety of other crops [2].

Insect cell lines, such as those derived from *Helicoverpa zea*, are invaluable tools in biotechnology, particularly for the production of recombinant proteins and the study of insect physiology and biochemistry [3]. However, the long-term storage of these cell lines poses significant challenges, necessitating the identification of optimal conditions that preserve their viability, genetic stability, and functional integrity over extended periods. By evaluating various cryopreservation techniques, storage temperatures, and cryoprotective agents, this study seeks to provide a comprehensive understanding of the factors that influence the survival and quality of stored insect cells. This thesis aims to investigate and establish the most effective methods for the long-term storage of *Helicoverpa zea* insect cell lines.

Our experiment used the method of freezing cells at a low temperature with liquid nitrogen (-196°C) [4]. To freeze the cells, we used a mixture of DMSO (dimethyl sulfoxide) and glycerol, along with two different buffers containing trypsin. The obtained results showed that during the freezing and thawing of *Helicoverpa zea* cells, the cells extracted using a mixture of DMSO and glycerol recovered 86-88% of their original state after 4-6 months of long-term storage. In contrast, when using the mixture with trypsin, this indicator was 72%.

In conclusion, optimal conditions for the long-term storage of *Helicoverpa zea* cells in laboratory conditions were selected. It was observed that cell freezing using a DMSO and glycerol buffer preserved cell viability up to 86-88%

References

1. Lambert B, Buysse L, Decock C, Jansens S, Piens C, Saey B, et al. (January 1996). "A *Bacillus thuringiensis* insecticidal crystal protein with a high activity against members of the family Noctuidae". *Applied and Environmental Microbiology*. 62 (1): 80–6. Bibcode:1996ApEnM..62...80L. doi:10.1128/AEM.62.1.80-86.1996. PMC 167775. PMID 8572715.
2. Light DM, Flath RA, Buttery RG, Zalom FG, Rice RE, Dickens JC, Jang EB (September 1993). "Host-plant green-leaf volatiles synergize the synthetic sex pheromones of the corn earworm and codling moth (Lepidoptera)". *Chemoecology*. 4 (3–4): 145–52. doi:10.1007/BF01256549. S2CID 21610251
3. Ikonomou L, Schneider YJ, Agathos SN. Insect cell culture for industrial production of recombinant proteins // *Appl Microbiol Biotechnol*. 2003, 62: 1-20. <http://www.ncbi.nlm.nih.gov/pubmed/12733003>
4. O'Reilly, D. R., Miller, L. K., and Luckow, V. A. (1992) *Baculovirus Expression Vectors: A Laboratory Manual*, W. H. Freeman and Company, New York, N. Y.

DETERMINATION OF OPTIMAL CONDITIONS FOR CULTIVATING MESENCHYMAL STEM CELLS

Khasanov Sh.Sh., Gaynazarova S.A., Abdurakhmanov J.M., Piyakina G.A., Sasmakov S.A., Azimova Sh.S.

*Acad. S.Yu. Yunusov Institute of the Chemistry of Plant Substances,
M.Ulugbek Str. 77, 100170, Tashkent, Uzbekistan; e-mail: genlab_icps@yahoo.com*

Mesenchymal stem cells (MSCs) are a type of multipotent stem cells that can differentiate into a variety of cell types, including osteoblasts (bone cells), chondrocytes (cartilage cells), myocytes (muscle cells), and adipocytes (fat cells) [1 - 2].

Mesenchymal stem cells (MSCs) hold significant potential for regenerative medicine due to their ability to differentiate into various cell types and their immunomodulatory properties [3 - 4]. However, the successful application of MSCs in clinical and research settings depends on the ability to efficiently cultivate these cells under optimal conditions. By systematically investigating factors such as media composition, temperature, oxygen levels, and growth substrates, this study seeks to optimize the in vitro environment for MSC proliferation and differentiation. This thesis aims to identify and establish the most favorable conditions for the cultivation of MSCs.

StemPro™ BM mesenchymal stem cells (MSCs) were isolated from human bone marrow (donated with informed consent).

Cells were seeded at 3×10^4 cells/cm² into 25 cm² tissue culture flasks and propagated at 37°C in a humidified culture chamber with a 5% CO₂ atmosphere, changing the culture medium every 2–3 days. All experiments used cells between passages 4 and 7 [5].

For cell culture, the following were used: StemPro™ MSC SFM (Gibco) serum-free medium, CELLStart™ Substrate (Gibco), which supports the attachment and expansion of undifferentiated colonies in serum, CTS™ DPBS (Gibco) as an auxiliary reagent, Gentamicin reagent solution (10 mg/ml), CTS™ GlutaMAX™-I (Gibco), CTS™ TrypLE™ Select enzyme (1X) for monolayer cell separation, and human plasma fibronectin (Gibco) for cell adhesion.

The use of these specialized, serum-free culture media and substrates is crucial for the maintenance and expansion of undifferentiated mesenchymal stem cells in vitro.

References:

1. Mohammadian M., Shamsasenjan K., Lotfi Nezhad P., Talebi M., Jahedi M., Nickkhah H., Minayi N., Movassagh Pour A. Mesenchymal stem cells: New aspect in cell-based regenerative therapy. *Adv. Pharm. Bull.* 2013;3:433–437. doi: 10.5681/apb.2013.070. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
2. С. И. Кривенко [и др.] Трансплантация МСК из жировой ткани: получение, стандартизация и использование / // Актуальные вопросы гематологии. № 20. С. 52– 55.
3. B. Parekkadan, J.M. Milwid, Mesenchymal stem cells as therapeutics, *Annu Rev. Biomed. Eng.* 12 (2010) 87–117.
4. P. Bianco, et al., The meaning, the sense and the significance: translating the science of mesenchymal stem cells into medicine, *Nat. Med* 19 (1) (2013) 35–42.
5. https://www.thermofisher.com/documentconnect/documentconnect.html?url=https://assets.thermofisher.com/TFSAssets%2FMSG%2Fmanuals%2FStemPro_MSC_SFM_CTS_man.pdf

SOLUBILIZATION OF LAGOCHILIN USING CYCLODEXTRINS AND THE PRODUCTION OF WATER-SOLUBLE CLATHRATES IN VARIOUS DOSAGE FORMS

Avaz Ibragimov, Jamshid Ashurov

Institute of Bioorganic Chemistry, Academy of Sciences of Uzbekistan, M. Ulugbek Str., 83, Tashkent, 700125, alex.ibragimov@inbox.ru

The natural hemostatic agent lagochilin, whose crystals exist in the form of a dihydrate, is practically insoluble in water. To obtain a water-soluble crystalline form, it was produced at 80°C in a non-solvated form. The solubility of this form is somewhat better than that of the anhydrous form, but still insufficient for practical use. Therefore, lagochilin was obtained in the form of clathrates with γ -cyclodextrin (CD), with a solubility of 22.0 mg/ml. However, for medicinal use, it is desirable to further increase its solubility.

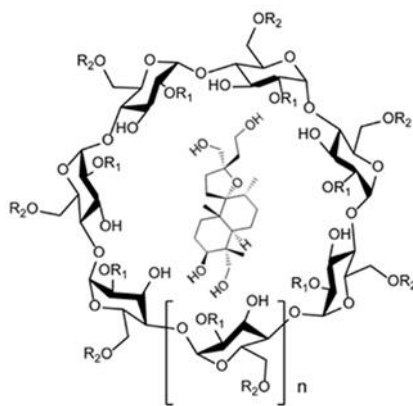


Fig. 1. Formulas of clathrates of various cyclodextrins with lagochilin. For HP- β -CD: $n=1$, $R_1=H$, $R_2=CH_2CH(OH)CH_3$ and for HP- γ -CD: $n=2$, $R_1=H$, $R_2=CH_2CH(OH)CH_3$

Therefore, we obtained more soluble complexes of lagochilin with hydroxypropyl (HP) derivatives of β -CD and γ -CD (Fig. 1), as the solubility of these CD derivatives is much higher than that of conventional cyclodextrins. Clathrates are white amorphous powders that are highly soluble in water. The solubility of the lagochilin complex with HP- β -CD is 1300 mg/ml, and with HP- γ -CD is 1500 mg/ml, meaning the solubility of the complex is significantly better than that of the original CD derivatives. Notably, using complexes with HP-CD as an example, an improvement in the solubility of lagochilin by 6500 to 7500 times was achieved. For targeted (local) delivery of lagochilin to bleeding organs, based on the solid amorphous powder of water-soluble complexes (clathrates) of lagochilin with β -CD and γ -CD, we developed the drug in the form of a spray and gel. In these forms, the obtained drugs demonstrated good biological activity

THE DEPENDENCE OF THE BIOLOGICAL ACTIVITY OF CYCLOARTANE GLYCOSIDES ON THEIR STRUCTURE

R.P. Zakirova^{1*}, Sh.Kh. Rakhimova, M.A. Agzamova

Acad. S. Y. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, e-mail: ranozakirova@mail.ru

Triterpene glycosides are a group of natural compounds whose molecules consist of an aglycone of triterpene nature and a carbohydrate part. These substances are widespread in the plant world and are found in some animal organisms – marine invertebrates.

Growth-regulating properties have been found for representatives of this class of compounds, which indicates the possible participation of these substances in the regulation of physiological and biochemical processes underlying growth and development. For some glycosides, the dependence of the activity of substances on their structure has been revealed. The class of isoprenoids (triterpenoids) includes cycloartan compounds, which were first discovered in plants of the genus *Astragalus*.

The purpose of this work was the effect of pre-sowing treatment of cucumber seeds with cycloartane glycosides on the quantitative protein content in cucumber seedlings.

Cucumber seeds were soaked in a solution of cyclosiversioside A, cyclosiversioside E, cyclosiversioside F and Astragaloside VII in $1 \times 10^{-5}\%$ concentration for 18 hours, control seeds were soaked in water.

It was found that Astragaloside VII showed the greatest growth-stimulating activity, the length of the roots and stems of the seedlings was at the level of the experimental version using the growth regulator Floraxan in the same concentration and exceeded the control version, respectively, by 36.9% and 8.5%.

The protein content in the seedling samples was determined by colorimetric method on a V-5000 Metash spectrophotometer at a wavelength of 400nm. It was revealed that the maximum protein content in the seedlings obtained by soaking with Astragaloside VII glycoside, its yield was 30.53%, and the nitrogen content was 4.88%.

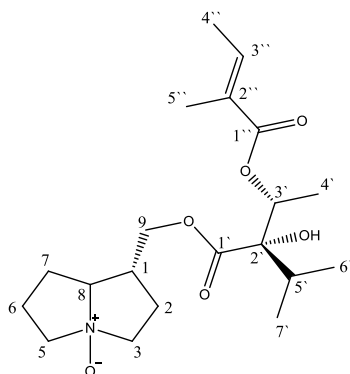
NEW ALKALOID FROM THE *LINDELOFIA MACROSTYLA* M. POPOV

R.M. Ruzibaeva, A.R. Khurramov, Kh.M. Bobakulov, N.I. Mukarramov

Acad. S.Y. Yunusov Institute of the Chemistry of Plant Substances
AS RUz, 77, Mirzo Ulugbek str, 100170, Tashkent, e-mail: ruzibayevarayhon@mail.ru

There are 5 species belonging to the *Lindelofia* genus in Central Asia. This plant is widely distributed in the mountainous regions of Tashkent, Samarkand, Fergana, Bukhara and Surkhandarya of the Republic of Uzbekistan [1]. In our previous work, four alkaloids - lindelofin, lindelofin N-oxide, O-methylarmepavine iodomethylate and 1-exo carboxypyrrolizidine and one new nescic acid (E)-2-hydroxy-2-isopropyl-3-((2-methylbut-2-enoyl)oxy)butanoic acid were isolated from the *Lindelofia macrostyla* M. Popov [2].

The dried plant sample was concentrated with 10% ammonia solution for 24 hours and filtered. The ammonia solution was extracted with dichloromethane and 2/3 of the dichloromethane was distilled. The residue was extracted with a 5% sulfuric acid solution. The aqueous part was made alkaline with an ammonia solution, then extracted with chloroform, and the sum of alkaloids dissolved in chloroform was separated. From the sum of isolated alkaloids, a new alkaloid was obtained using preparative high-performance thin layer chromatography (HPTLC). Based on the results of NMR spectroscopy and mass spectrometry analysis was established chemical structure of new alkaloid and named lindelofamine N-oxide.



Structure of lindelofamine N-oxide

Lindelofamine N-oxide was screened using Cambridge Structural Database, Scifinder, Reaxys, PubChem and confirmed as a novel alkaloid.

References

1. A.I. Vvedensky, Flora of Uzbekistan, T.5, Publishing by AS UzSSR, Tashkent, 1961, pp. 180-181.
2. R.M. Ruzibaeva, Kh.M. Bobakulov, R.Y. Okmanov, A.R. Khurramov, B. Tashkhodzhaev, N.I. Mukarramov, N.D. Abdullaev Alkaloids of the plant *Lindelofia macrostyla* M. Popov and a new unsaturated carboxylic acid. *Chem. Nat. Compd.*, reg 250/23.

CONTENTS

PLENARY PRESENTATION	3
Synthesis, identification and <i>in silico</i> study of trinitro derivative from tropic acid Eldar Abdulla Garaev, Konul Fada Huseynguliyeva, Shafa Baxish Alieva	4
The chemistry of kratom (<i>Mitragyna speciosa</i> Korth.) leaves: dispelling myths on this Malaysian indigenous medicinal plant Thiruventhan Karunakaran	5
Researches on the activities and preparation of sulforaphane from Broccoli <i>Xili Liang, Yao Zhang, Sabir Z. Nishanbaev, Yuanfeng Wu</i>	6
Biological effects of some 1-alkyl and 1-aryl tetrahydroisoquinolines and mechanisms of their action Sh.S. Azimova, E.O. Terenteva, U.B. Khamidova, M.R. Umarova, E.G. Yusupova, V.I. Vinogradova, Sh.N. Jurakulov, A.Sh. Saidov	7
Anion and cation channels as pharmacological targets Ravshan Z. Sabirov	8
Therapeutic index improvement of doxorubicin-polygalacturonans conjugate Tagayalieva N.A., Turaev A.S.	9
Effectiveness of traditional and modern methods for extracting active compounds from medicinal plants Sh.Sh. Sagdullaev, A.I. Sanoev	10
Synthesis of derivatives of 1-aryltetrahydroisoquinoline alkaloids and their biological activity Sh. N. Zhurakulov, V.I. Vinogradova	11
Collection and characterization of metabolites of mushrooms from azad jammu and kashmir, pakistan Mehmoona Sharif, Shayan Naeem, Umme Habiba Saeeda, Afshan Altaf, Usama Imtiaz and Samiullah Khan	12
Metabolomic determination of specialized metabolites using liquid chromatography – tandem mass spectrometry in <i>silene</i> species Nilufar Z. Mamadaliyeva	13
ORAL PRESENTATIONS	14
The chemical constituents and biological activities of <i>Lepidium sativum</i> seeds Yergazy Shybyray, Ulpan Amzeyeva, Aliya Nurlybekova, Haji Akber Aisa, Jun Li, Janar Jenis	15
Study on the diterpenoid alkaloids from <i>Aconitum barbatum</i> var <i>puberulum</i> and <i>Aconitum sinomontanum</i> Wenjuan Xue, Bo Zhao, Nurfida Ablajan, Jiangyu Zhao, Sh. Sh. Sagdullaev, H. A. Aisa	16
Study on the chemical constituents of <i>Piper longum</i> L. Guanghui Gou, Wenli Bao, Jun Li, Bo Zhao, Sh. Sh. Sagdullaev, H. A. Aisa	17
Preparation of liposomes from soybean phospholipids Ashirov O.N, Yarikaganova A.M, Sadullayev T.X, Piyakina G.A, Azimova Sh.S	18
Ferlapioside, new iridoid glycoside from <i>Ferula lapidosa</i> K.A. Eshbakova, Kh.I. Khasanova, Xin-Xin Li, A.U. Babekov, Ying-Jun Zhang	19
Microbial degradation of the pesticide chlorpyrifos D.I. Kosimov, L.I. Zaynitdinova, R.B. Ergashev, A.M. Mavjudova	20
Flavonoids from <i>Oxytropis macrodonta</i> plant U.M.Omanova, M.A. Agzamova, Y.J. Ishimov	21
The hypolipidemic effect of the flavonoids sum from <i>Crocus sativus</i> Narbutaeva D.A., Djuraeva D.I., Maxmudova Sh.R.	22
Effect of heat stress on concentrations of chlorophylls in cotton varieties K.M.Kuldoshova, S.B.Navruzov, A.M.Anorova, A.A.Akhunov	23
Secondary metabolites of <i>Saponaria officinalis</i> and their biological activity L.N. Ashurova, A.R. Khurramov, Kh.M. Bobakulov, D.Kh. Akramov, N.Sh. Ramazonov	24
Quantitative determination of polysaccharides from the aerial parts of <i>Capparis spinosa</i> G.E. Saidova, R.A. Botirov, A.I. Sanoev, A.Z. Sadikov, Sh.Sh. Sagdullaev	25
POSTER PRESENTATIONS	26
Chemical components of <i>Tribulus terrestris</i> meal D.R. Siddikov, A.R. Khurramov, A.A. Ganiev, T.A. Khadzhibayev, Kh.M. Bobakulov, R.M. Khalilov	27

Phytoecdysteroids of the plant of <i>Stachys byzantina</i> N.Sh.Ramazonov, U. Yu. Yusupova, D.A. Usmanov	28
Amination of lactone igalan with alkaloid cytisine D.E. Dusmatova, R.F. Mukhamatkhanova, Kh. M. Bobakulov, I.D. Sham'yanov, V. I. Vinogradova, N.D. Abdullaev	29
Components of hexane extract of <i>Chrysanthemum koreanum</i> leaves cultivated in Uzbekistan D.Sh. Tojiboeva, Kh.M. Bobakulov, R.F. Mukhamatkhanova, S.A. Sasmakov, I.D. Sham'yanov, Sh. S. Azimova, N.D. Abdullaev	30
Components of essential oils of flowers and leaves <i>Handelia trichophylla</i> D.Sh. Tojiboeva, Kh.M. Bobakulov, R.F. Mukhamatkhanova, I.D. Sham'yanov, N.D. Abdullaev	31
Antimicrobial activities of the extracts of plants species belonging to <i>Lamiaceae</i> family Z. Kabirova, A. Abdurashidov, K. Mardieva, N.Sattarova, F. Eshboev, E. Yusupova, Sh. Azimova	32
Flavonoid content in two types plants of the genus <i>heliotropium</i> of the flora of Uzbekistan S.S. Omonova ¹ , O.D. Matchanov ² , R.S. Esanov ² , S.F. Aripova	33
Volatile components of the root of <i>Perovskia scrophulariifolia</i> S.I. Atqiyayeva, Kh.M. Bobakulov, E.Kh. Botirov, B.S. Okhundedaev, S.A. Sasmakov	34
Modification of sesquiterpene lactone igalan D.E. Dusmatova, R.F. Mukhamatkhanova, A.M. Nagmatullaev, I.D. Sham'yanov, N.D. Abdullaev, A.D. Kurbanova	35
Study of <i>Perovskia angustifolia</i> root components M.U. Zhuraev, Kh.M. Bobakulov, O.K. Askarova, D.B. Turdaliev, S.A. Sasmakov, E.Kh. Botirov, Sh.S. Azimova	36
Volatile components of <i>Perovskia botschantzevii</i> roots S.Kh. Mullabaeva, Kh.M. Bobakulov, E.Kh. Botirov, D.R. Siddikov	37
Components of flowers <i>Achillea filipendulina</i> B.S. Okhundedaev, Kh.M. Bobakulov, R.F. Mukhamatkhanova, B.N. Babaev, I.D. Sham'yanov, E.Kh. Botirov, N.D. Abdullaev	38
Aminomethylation of centaureidine B.S. Okhundedaev, Kh.M. Bobakulov, A.T. Sarabekov, I.D. Sham'yanov, B.N. Babaev, S.A. Maulyanov, E.Kh. Botirov	39
Metabolites of <i>Artemisia juncea</i> aerial part B.S. Okhundedaev, Kh.M. Bobakulov, R.F. Mukhamatkhanova, S.A. Maulyanov, I.D. Sham'yanov, N.D. Abdullaev	40
Volatile compounds of <i>Crataegus songarica</i> D.R. Siddikov, Kh.M. Bobakulov, M.S. Zokirova, B.S. Okhundedaev, E.Kh. Botirov	41
Phenolic compounds <i>Crataegus songarica</i> D.R. Siddikov, Kh.M. Bobakulov, M.S. Zokirova, E.Kh. Botirov	42
Internal control systems for pcr diagnostics O. Alimuhammedova, J. Abdurakhmanov, S. Ikramov, A. Baymirzayev, Kh. Nasriddinov, D. Mansurov, Sh. Azimova	43
Study of cytotoxic activity of compounds based on bicyclic quinazoline sulphonylureas N.A. Tosheva, M.R. Umarova, U.B. Khamidova, G.A. Pyakina, S.M. Allabergenova, U.M. Yakubov, Sh. S. Azimova	44
New anti-hsv nucleoside analogues of 1,2,4-triazole-3-thione S.A. Sasmakov, J.M. Abdurakhmanov, A.A. Ziyaev, N.A. Tosheva, I.V. Fateev, I.D. Konstantinova, Sh.S. Azimova, A.I. Miroshnikov	45
Purification of recombinant escherichia coli uridine phosphorylase by ion exchange media J. Abdurakhmanov, D. Turdaliyev, Sh. Khasanov, G. Piyakina, S. Sasmakov, Sh. Azimova	46
Alkaloids of plants of the genus <i>Convolvulus</i> growing in Uzbekistan D.B. Kadirova, S.F. Aripova	47
Sterols from <i>Centaurea belangeriana</i> B.J. Komilov, Sh.Sh.Ergashev, K.A. Eshbakova,	48
Flavonoids of <i>Centaurea ugamica</i> B.J. Komilov, Z.Yu. Atajanova, K.A. Eshbakova	49
Coumarins from <i>Ferula tadshikorum</i> K.S. Juraev, B.J. Komilov, K.A. Eshbakova	50
Fatty acid isomers and essential oils of <i>Ferula</i> species growing in Uzbekistan D. T. Asilbekova, Kh. M. Bobakulov, G. Ozek, T. Ozek, A. M. Nigmatullaev	51

Triterpene glycoside from the <i>Astragalus atrovinosus</i> F.A. Kengesbaeva, A.R. Khurramov, T.N. Kaypnazarov, Kh.M. Bobakulov, N.Sh. Ramazonov	52
Triterpene glycoside of <i>Astragalus macronyx</i> T.N. Kaypnazarov, A.R. Khurramov, F.A. Kengesbaeva, Kh.M. Bobakulov, N.Sh. Ramazonov	53
Means for protecting winter wheat from <i>Schizaphis graminum rondani</i> S.M. Turaeva, P.A. Nurmakhmadova, E.O. Rakhmatov, F. Zulpanov, N.O. Panaeva, B.U. Ergashov	54
Modifications of 2-phenacylthio-5-aryl-1,3,4-oxadiazoles and 3-phenacylthio-5-(4H)-aryl-1,2,4-triazoles A.A. Ziyaev, I.F. Tozhiev, T.T. Toshmurodov	55
Effect of nitrating compounds on the quinoline alkaloid acetylhaplophyllidine A.U. Ubaydullaev, Sh.N. Zhurakulov, V.I. Vinogradova, K.K. Turgunov, A.U. Aminboev	56
Reaction of the quinoline alkaloid haplophyllidine with hydrochloride of monochloroacetic acid under different conditions A.U. Ubaydullaev, Sh.N. Zhurakulov, V.I. Vinogradova, K.K. Turgunov, A.U. Aminboev	57
About the pharmacological properties of veralosinine Yu.R. Mirzaev	58
HPLC analysis of flavonoids in wild and cultivated species of <i>Astragalus babatagi</i> R.P. Zakirova, E.R. Kurbanova, M.A. Agzamova, A.A. Janibekov, A.D. Matchanov	59
Synthesis and butylation of benzopyrimidine-4-thione F.A. Zulpanov, S.S. Egamberdiyev, A.O. Nasrullayev, D.M. Ruziboev, B.Zh. Elmuradov	60
Carbohydrates of the aerial parts of plants <i>Capparis spinosa</i> A.A. Siddikova, F.A. Kodiraliyeva, R.A. Botirov, N.B. Bekmurzayeva, A.A. Azamatov, A.Z. Sadikov, Sh.Sh. Sagdullaev	61
Sterols of <i>cousinia maracandica</i> A.F. Hamidov, A.R. Khurramov, N.Sh. Ramazonov	62
Chemotypic difference of sesquiterpenoids of the aerial part of <i>Inula helenium</i> flora of Uzbekistan D.E. Dusmatova, R.F. Mukhamatkhanova, Kh. M. Bobakulov, I.D. Sham'yanov, N.D. Abdullaev	63
Sesquiterpene lactones of flowers <i>Inula britannica</i> of flora of Uzbekistan D.E. Dusmatova, R.F. Mukhamatkhanova, V.V. Uzbekov, Kh. M. Bobakulov, I.D. Sham'yanov, N.D. Abdullaev	64
Amino acid composition of bean protein <i>Psoralea drupacea</i> Sh.Kh. Rakhimova, L.G. Mezhlumyan, R.F. Mukhamatkhanova, I.D. Sham'yanov	65
Fatty acid composition of <i>Psoralea drupacea</i> bean oil of Uzbekistan flora N.K. Yuldasheva, S.Z. Nishanbaev, R.F. Mukhamatkhanova, I.D. Sham'yanov	66
Obtaining a highly effective herbicide Rakhmatov E.O., Saidov S.S., Juraev B.B., Abdurazakov A.Sh., Elmuradov B.J.	67
Physico-chemical analysis of 5-chloro-2-methyl-1h-benzo[d]imidazole-1-ium (phosphonomethyl)glycinate Abdurazakov A.Sh., Rakhmatov E.O., Juraev B.B., Saidov S.S.	68
Determination of the amount of flavonoids quercetin-3-o-sophoroside and kaempferol-3-o-sophoroside in the dry extract of wrinkled rose petals by high-performance liquid chromatography Alimujiang, Abulizi, R.M. Xalilov, Bo Zhao, Sh.Sh. Sagdullaev	69
Chemical modification of lappaconitine alkaloid E.A. Baynazarov, Sh.Sh. Sagdullaev, Sh.N. Zhurakulov, S.A. Safarova	70
Synthesis and optimal technology for the production of biologically active amides in the series of benzimidazoles Kubayev Sh.Kh, Saidov S. S, Abdurazakov A.Sh, Karimov R.K, Elmuradov B.Zh.	71
Synthesis of biologically active diamides of benzimidazole series Kubayev Sh.Kh, Saidov S.S, Kurbonova E.R, Nurmakhmadova P.A, Abdurazakov A.Sh.	72
Synthesis of n-propargyl derivatives of 1,3-unsymmetrical ureas G. N. Kudratov, I. S. Ortikov, B. Zh. Elmuradov	73
Components of stamens and petals of <i>Crocus sativus</i> introduced in the Jizzakh region of Uzbekistan Sh.R. Makhmudova ¹ , Kh.M. Bobakulov ¹ , B.S. Okhundedaev ¹ , S.Z. Nishanbaev ¹ ,	74

Yuanfeng Wu	
On the pharmacological activity of diterpenoid alkaloids n-deacetylranaconitine, septefine and n-acetylsepaconitine F.M.Tursunkhodzhaeva, A.A.Azamatov, A.Z.Sadikov, Sh.Sh.Sagdullaev	75
About m-cholin-blocking activity of petiline Yu.R. Mirzaev	76
Reactions of the diterpene alkaloid n-deacetylappaconitine with isocyanates S.A. Safarova, Sh.N. Zhurakulov, V. I. Vinogradova, E.A. Baynazarov	77
New flavonoid glycoside from <i>Oxytropis rosea</i> Sh.A. Sulaymonov, B.J. Komilov, K. A. Eshbakova, Sh. V. Abdullayev	78
Terpenoids of the virginal period of growth of <i>Artemisia annua</i> of flora of Uzbekistan I.D. Sham'yanov, Kh.M. Bobakulov, B.S. Okhundedaev, R.F. Mukhamatkhanova, N.D. Abdullaev	79
Phenolic compounds of <i>Cistanche salsa</i> roots D. R. Siddikov, A. A. Ganiev, A. B. Bazarbaeva, Kh. M. Bobakulov, G.B. Satimov, E.Kh. Botirov	80
Biological activity polysaccharides from <i>Capparis spinosa</i> R.A. Botirov, G.E. Saidova, A.Z. Sadikov, Sh.S. Sagdullaev	81
Flavonoids from <i>Artemisia persica</i> J.F. Umaraliev, A.A. Ganiev, A. Turak, N.B. Begmatov, Zao Bo, Kh.M. Bobakulov, N.D. Abdullaev, Zhao Jiangyu	82
Phenolic compounds from <i>Artemisia persica</i> J.F. Umaraliev, A.A. Ganiev, A. Turak, N.B. Begmatov, Zao Bo, Kh.M. Bobakulov, N.D. Abdullaev, Zhao Jiangyu	83
Glucogalactan from the leaves of <i>Ficus carica</i> L. M.A. Kuronbayeva, K.S. Zhauynbayeva, R.K. Rakhmanberdieva, M.R. Mirzayeva	84
Interaction of o-phenylenediamine with aldehydes M.I.Olimova, F.O. Pulatova, B.Zh. Elmuradov	85
Proteins and amino acid composition of <i>Xylosalsola richteri</i> (Moq.) Akhani & Roalson M.A. Karlybaeva, Sh.Kh. Rakhimova, L.G. Mezhlumyan, M.T. Baltabaev	86
Synthesis of novel 1,4-isomeric 1,2,3-triazoles I.S. Ortikov, Sh.R. Khojimatova, B.Zh. Elmuradov	87
Synthesis of "amino-bridged" benzyl-quinazoline conjugates in the presence of 6h(bromo)-2,4-dichloroquinazoline and benzylamines R.Z. Khudoykulova, I. S. Ortikov, B. Zh. Elmuradov	88
Anthelmintic activity of 2-propidamizole Kubayev Sh.Kh, Saidov S.S, Abdurazakov A.Sh, Oripov A.O, Elmuradov B.Zh.	89
Selective reduction of nitro-benzimidazoles Kubayev Sh.Kh, Saidov S.S, Abdurazakov A.Sh, Elmuradov B.Zh.	90
Synthesis of 5-amino-3-aryl-4-carbonitrilpyrazole derivatives N.B. Akhmedova, I. S. Ortikov, B. Zh. Elmuradov	91
About hypotensive action of apogalantamine monomethyl ether Yu.R. Mirzaev	92
Local anesthetic effect of the 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride A.A. Azamatov, Sh.N. Zhurakulov, F.M. Tursunkhodzhaeva	93
Study of the effect of 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride on the thermal irritability of the skin A.A. Azamatov, Sh.N. Zhurakulov, F.M. Tursunkhodjayeva	94
Interaction of the 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride with substances that stimulate the central nervous system A.A. Azamatov, Sh.N. Zhurakulov, F.M. Tursunkhodzhaeva	95
Anti-hypoxia activity of the new 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride A.A. Azamatov, Sh.N. Zhurakulov, F.M. Tursunkhodzhaeva	96

Antioxidant activity of 1-(2-hydroxyphenyl)-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline hydrochloride A.A. Azamatov, D.A. Narbutayeva, U. K. Aytmuratova, A. M. Karakulova, Sh.N. Zhurakulov	97
Acute toxicity of the collection of biologically active polysaccharides from the root of <i>Capparis spinosa</i> N.B. Bekmurzayeva, A.A. Azamatov, R.A. Botirov	98
Acute toxicity of polysaccharide assemblage from the aboveground part of <i>Capparis spinosa</i> N.B. Bekmurzayeva, A.A. Azamatov, R.A. Botirov	99
Lipids of <i>Atriplex tatarica</i> leaves Ibotov Sh.Kh., Yuldasheva N.K., Gusakova S.D.	100
Polar lipids of <i>Ammodendron conollyi</i> seeds Shomuratova S.N., Yuldasheva N.K., Gusakova S.D.	101
Lipids of <i>Senna angustifolia</i> seeds Shomuratova S.N., Yuldasheva N.K., Nishanbaev S.Z., Gusakova S.D.	102
Polar lipids of the aerial parts of <i>Datisca cannabina</i> Ibragimova D.Sh., Yuldasheva N.K., Nishanbaev S.Z., Gusakova S.D.	103
Lipids of <i>Climacoptera aralensis</i> seeds and their stress-protective activity S. D. Gusakova, R.P. Zakirova, M.T. Paulanova, N.K. Yuldasheva	104
A new furocoumarin from <i>Ferula lehmannii</i> Q. S. Jurayev, K. A. Eshbakova	105
Preparation of dry extract of the aerial part of <i>Pulicaria gnaphalodes</i> and its antioxidant activity O.U.Rajabova, K.A.Eshbakova	106
Obtaining carbohydratealdimines based on pectins Adizov Sh.M., Azizov D.Z., Malikova M.Kh., Rakhmanberdyeva R.K.	107
Flavonoids of the aerial part of <i>Inula salicina</i> N.M. Yuldasheva, B.J. Komilov, K.S. Juraev, Kh.I. Khasanova, Ha Wei, K.A. Eshbakova, K.K. Turgunov	108
Isolation of the alkaloid songorine from technical waste of the plant <i>Aconitum soongoricum</i> U.Kh. Kurbanov	109
Pharmacological properties of <i>Melilotus officinalis</i> components Narbutaeva D.A., Karakulova A.M., Usmanova N.K., Tursunkhodzhaeva F.M.	110
Indicators of lipid metabolism in experimental hyperlipidemia in rabbits caused by administration of fat parenteral emulsion “Sepid” Narbutaeva D.A., Davronova Kh.A., Tursunkhodzhaeva F.M., Khudaynazarov S.K.	111
Chemical components of <i>Ferula</i> species growing in the flora of uzbekistan and kirgiziston, their citotocsic, antibacterial, antioxidant, inhibitor activity K.A. Eshbakova, Kh. I. Khasanova, Xin-Xin Li, Q.S. Jurayev ¹ , N.M. Yuldasheva, B.J.Komilov, Junli Yang, A.U. Babekov, Ying-Jun Zhang	112
Studies on the chemical constituents of <i>Ferula lapidosa</i> K.A. Eshbakova, Kh.I. Khasanova, Xin-Xin Li, A.U. Babekov, Ying-Jun Zhang, N.M. Yuldasheva	113
Comparative evaluation of the effectiveness of the anti-inflammatory effect of the sum of vitasteroids from plants <i>Datura stramonium</i> and diclofenac sodium Negmatova M.U., Egamova F.R., Syrov V.N., Yusupova S.M., Makhmudova M.M., Abdurakhmanov B.A.	114
Component composition of essential oil of <i>Salvia sarawschanica</i> aerial part M.U. Zhuraev, Kh.M. Bobakulov, S.A. Sasmakov, E.Kh. Botirov	115
Study of the toxicity and sedative effect of a dry extract isolated from <i>Melissa officinalis</i> Egamova F.R., Yusupova S.M., Abdurakhmanov B.A., Sotimov G.B., Mamatkhanova M.A.	116
Eco-phytocenotic description tsenopopoulos of <i>Ajuga turkestanica</i> (Regel) Briq A.E.Egamberdiev, A.M.Nigmatullaev, I.O'.Muqimov	117
Trends in the transformation of <i>Ajuga turkestanica</i> tsenopopulations under different eco-phytocenotic conditions A.E.Egamberdiev, A.M.Nigmatullaev, I.O'.Muqimov	118
Novel sulfonamides in the series of bicyclic quinazolines S.M. Allaberganova, U.M. Yakubov, B.Zh. Elmuradov	119

Raw material reserves of yarrow inflorescences (<i>Achillea filipendulina</i> LAM.) in the Tashkent region A.M. Nigmatullaev, D.K. Pulatova, F.F. Urmanova	120
Type selection and influencing parameters of drying the leaves of <i>Rosa rugosa</i> during the procurement of raw materials Alimujiang Abulizi, R.M. Khalilov, Zhao Jiangyu, Sh.Sh. Sagdullaev	121
Selection of adsorption resin type and eluent for purification of quercetin-3-O-sophoroside and kaempferol-3-O-sophoroside flavonoids from wrinkled rose (<i>Rosa r</i>	122
Cytotoxicity of new 2-hydrazones based on hydrazinylbenzoxazole <i>in vitro</i> M.R. Umarova, U. B. Khamidova, E.O. Terenteva, N.A. Tasheva, E.G. Yusupova, Z.Zh. Pulatova, I.S. Ortikov, B.Zh. Elmuradov, Sh. S. Azimova	123
Determination of the content of carotenoids in the root part of <i>Curcuma longa</i> L cultivated in the Republic of Uzbekistan M.R. Tursunova	124
Immunomodulatory effects of colchiprit-neo Enikeeva Z.M., Urazov N.E., Ibragimov Sh.N., Agzamova N.A.	125
Effect of glycyrrhizic acid complex with 6-benzylaminopurine on shoot development and microtuber formation in <i>in vitro</i> potato reproduction Saydullaeva Kh.T., Sobirova M.Sh., Gafurov M.B., [Kholmuratov E.G.] Nasirova G.B., Yuldashev Kh. A.	126
Quantitative determination of vitamins from the plant <i>Fritillaria severzovii</i> by HPLC N.T. Khuzhaeva, V.U. Khuzhaev, B.Y. Abduganiev	127
Flavonoids from <i>Astragalus bakaliensis</i> Artikbaeva B.R., Naubeev T.Kh., Pirniyazov A.J., Ramazonov N.Sh.	128
Chemical composition of the essential oil of the above-ground parts of <i>Haplophyllum acutifolium</i> G.M. Ikromova, O.K. Askarova, E.Kh. Botirov	129
Application of the pm6 semi-empirical method to model the dimer form of glycyrrhizic acid R.S. Esanov, A.G. Yeshimbetov, A.D. Matchanov	130
The effect of some gossipol derivatives with masga complexes on blood serum biochemical indicators N.Kh. Yakubova, L.U. Makhmudov, K.Zh. Rezhepov, N.A. Tagayalieva, M.B. Gafurov	131
Synthesis of acetylene alcohol using $ZnBr_2/i-Pr_2NEt/TGF$ complex characlytic system S.S. Abdurakhmanova, O.E. Ziyadullaev, K.M. Saliyeva	132
Synthesis and spectral analysis of bis (n-salicylidene-4,4' - diphenylamine) Ganiev B.Sh., Kholikova G.K., Mardonov U.M.	133
Anti-inflammatory effect of <i>Gnaphalium uliginosum</i> L. extract Zaripova M.R., Makhmudov L.U., Gayibov U.G., Gayibova S.N., Aripov T.F.	134
Synthesis of surface-active substance for emulsion solutions and creams A.A. Kadirov, V.G. Kalyadin ¹ , N.A. Kadirov ² , M.A. Eshmuxamedov	135
Alkynylation reaction of ketones with acetylene in the 3,3'-Ph₂BINOL-2Li/Ti(OⁱPr)₄/Et₂Zn catalytic system O.E. Ziyadullaev, G.K. Otamukhamedova, F.Kh. Buriev	136
S	137
I	138
Changes in the amount of photosynthetic pigments in cotton under hyperthermia conditions S.B. Navruzov, K.M. Kuldoshova, A.M. Anarova, A.A. Akhunov	139
The role of biostimulants in plant adaptation to stress Babaeva D.T., Shomakhamadov Sh.Sh., Kuldoshova K.M., Navruzov S.B., Khashimova N.R., Akhunov A.A.	140
Effect of NPK on total polyphenolic content and antiradical activity of medicinal plant extracts Abduazimova D.Sh., Gayibova S.N., Abdullayeva M.O., Gayibov U.G., Aripov T.F.	141
Antifungal activity of soil bacteria U.A. Iskandarova, D.I. Kosimov, L.I. Zaynitdinova	142

Determination of Se(IV) in plant and vitamin products by the voltammetric method using bismuth-modified screen printed electrodes S.D. Aronbayev, D.T. Isakova, D.M. Aronbayev	143
Properties of anion exchange materials based on polyvinyl chloride Babojonova G.K.	144
Preparation of biologically active salts of oleanolic acid with heterocyclic amino compounds Sh.M. Boboyorova, M.B. Gafurov, Kh.A. Yuldashev, R.S. Esanov	145
DPPH radical scavenging activity of <i>Gnaphalium uliginosum</i> ethanolic crude extract A.A. Bokova, T.F.Aripov	145
Effect of extracts from <i>Leonurus turkestanicus</i>, <i>Crataegus turkestanica</i>, <i>Gnaphalium uliginosum</i>, and their phytocomplex on lipid peroxidation in vitro Bokova A. A, Aripov T.F	147
Comparative study of the effects of MASGA, as well as the composition of MASGA with cysteine, methionine, and tryptophan on the functional state of mitochondria in paracetamol-induced liver injury Davron Tukhtaev, Sherali Kuziyev, Gulbakhor Umarova, Guzal Mukhammadzhanova, Suraya Dalimova, Sobir Khamraev	148
Disruptions in Plasma Hemostasis Indicators and Cytokine Levels in Experimental Adrenaline-Induced Myocarditis and Methods for Their Correction Nigora Khadamova, Sherali Kuziyev, Natalya Vypova, Gulbakhor Umarova, Guzal Mukhammadzhanova, Suraya Dalimova	149
Optimization of DNA extraction from <i>Rheum</i> L. species Mahmudova M.U., Nikitina E.V.	150
Triterpenoids of the endophytic bacteria <i>Bacillus zhangzhouensis</i> F.A. Melikuziyev, Z.O. Toshmatov, I.S. Aytenov, M.Z. Isokulov, T.A. Bozorov	151
Secondary metabolites of the endophytic bacteria <i>Bacillus zhangzhouensis</i> F.A. Melikuziyev, Z.O. Toshmatov, I.S. Aytenov, M.Z. Isokulov, T.A. Bozorov	152
Plant biostimulant for pre-sowing treatment of rice seeds Z.Sh.Mukhidova, S.Kh.Zakirov	153
Use of the electrolysis method in the synthesis of organic substances Muminov B.S., Karimov M.U., Djalilov A.T.	154
Influence of exogenous cytokinins on the level of viral infections during introducing potatoes in culture in vitro M.Sh. Sobirova, G.B. Nasirova	155
The significance of glycoalkaloid profile as selection markers of potato genotypes G.B. Nasirova., M.Sh. Sobirova., G.T. Mavlonov	156
Optimization of iron (II) sulfate dosage for wastewater treatment of hydrometallurgical plants: mechanisms of action and practical application Norbek Allayorov	157
Leveraging somatic embryogenesis to develop biotechnological plants as a source for pharmacy Rakhmanov B.K., Imamkhodjayeva A.S., Ubaydullayeva X.A., Usmonov D.E., Shermatov Sh.E., Buriev Z.T., Abdurakhmonov I.Y.	158
Ethnation of some heteratomic aldehydes using the catalytic system $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}/\text{Et}_3\text{N}/\text{Et}_2\text{O}$ M.K. Saliyeva, O.E. Ziyadullayev, O. Boytemirov, L.K.Ablakulov	159
Polysaccharides of obi-navvat peel and their prebiotic activity Siddikova Sevinch, Elova Nilufar, Eshbekov Azamat, Maulianov Solikh	160
Create a semi-solid pharmaceutical formulation of hemostatic agents F.A. Sobirova, A.D. Matchanov	161
Phytochemical analysis and antiradical activity of medicinal plant extracts Abdullaeva M.O., Gayibova S.N., Abduazimova D.Sh., Abdullayev I.Z., T.F.Aripov	162
Dynamics of accumulation of polyphenols of the <i>Pinus sylvestris</i> plant K.V. Raimova, R.R. Makhmudov, R.N. Rakhimov, N.G.Abdullajanova, Yu.I. Oshchepkova	163
Gas Chromatography-Mass Spectrometry Analysis of Hexane Fraction from Aerial Parts of <i>Limonium otolepis</i> Urmonov D.G., Ibragimov A.A.	164

Study of anti-radical activity of medicinal plants in south Fergana P.K. Turdalieva	165
X-ray analysis and Molecular docking of the ethyl 2-(4-(dimethylamino)benzoyl)-3-hydroxy-5-methylpyrazolidine-3-carboxylate Furkat N. Khayrullayev, Bako B. Umarov, Murod A. Tursunov, Jamshid M. Ashurov, Ne'mat G. Sevinchov, Maftuna J. Ruzieva, Dilobar N. Sevinchova, Bakhtiyor Sh. Ganiev	166
Development of a kinetic model of the process of extraction of biologically active substances from pomegranate peel Ziyaeva S.F., Vasina S.M., Tagirova M.A.	167
Alkaloids from <i>Annona senegalensis</i> Pers Rixsivoy Ziyayev, Sory Fofana, Kuchkar Giyasov	168
Chemical constituents and biological activity of <i>Yucca gloriosa</i> L. E. Kemertelidze, M. Benidze, A. Skhirtladze, V. Nebieridze	169
Phenol profiling of <i>Sophora japonica</i> L. flowers extracts S.A. Fatykhava, V.I. Dolgopalets, P.S. Shabunya	170
A new synthetic approach to isoquinolin(on)es through 2'-carboxamidodeoxybenzoins enaminoketone heterocyclizations K.V. Kukushkina, V.S. Moskvina, V.P. Khilya	171
Solid-phase phosphorylation of chondroitin sulfates with phosphorus (V) oxide Kozyrev S.V., Rakhimova L.Yu., Khaybrakhmanova E.A., Ponedel'kina I.Yu.	172
Beckman fragmentation of the a-ring of dihydrolupeol oxymes G.F. Krainova, V.V. Grishko	173
Synthesis, identification and <i>in silico</i> study of trinitro derivative from tropic acid from the atropin alkaloid Eldar Abdulla Garaev, Konul Fada Huseynguliyeva, Shafa Baxish Alieva	174
Synthesis and cytotoxicity of enaminones' derivatives A.A. Khudoyberdiyeva, E.O. Terenteva, U.B. Khamidova, M.R. Umarova, Sh.S. Azimova, Z.E. Urumbaeva, A.Sh. Saidov, V.I. Vinogradova	175
Biologically active substances from <i>Artemisia albida</i> L. Ayaulym Minkayeva, Akmeiir Murai, Uljan Jenis, Yasmina Ulfanova, Janar Jenis	176
Chemical composition and antimicrobial activity of the essential oil from <i>Lavandula angustifolia</i> Mill. cultivated in the collection of the MBG in the Almaty city Zh.Zh. Karzhaubekova, L.M. Grudzinskaya, R.B. Arysbaeva, A. Aliakhim	177
<i>Bacillus</i>-derived cycle lipopeptides modulate microbiome structure and enzymatic activity of soil and increase productivity of <i>Solanum tuberosum</i> Alexey S. Vasilchenko, Diana S. Dilbaryan, Darya V. Poshvina, Olga V. Domanskaya, Alexander V. Iashnikov, Anastasia V. Teslya	178
Quantitative determination of flavonoids from the aerial parts of <i>Linaria vulgaris</i> MILL. D.K. Nurkadirov, Kh.I. Itzhanova	179
Essential oil constituents of <i>Ferula persica</i> fruits E.H. Kerimli, E.A. Garayev	180
Phosphorylation of polysaccharides by phosphorous pentoxide in the presence of Na/K carbonates Rakhimova L.Yu., Kozyrev S.V., Khaybrakhmanova E.A., Ponedel'kina I.Yu.	181
Plant metabolites as promising carriers of delivering anthelmintic substances S.S. Khalikov	182
Syntheses of methylene-bridged bioflavonoids Ye.V. Antsybora, N.V. Gorbulyenko, E.K. Hlibov, V.S. Moskvina, T.V. Shokol, V.P. Khilya	183
Concept and some aspects of medical chemistry Kh.I.Hasanov, A.N.Azizova, N.M.Quliyeva, Sh.H.Gasimov, M.Y.Yusifova, R.I.İsmailova	184
Study of the solubility of dihydroquercetin in water in the presence of fulvic acids A.S. Bagaev, S.V. Nekhoroshev	185
A series of novel substituted epoxybenzo [7,8] oxocyno [4,3-<i>b</i>] pyridine derivatives: synthesis and <i>in silico</i> study of antiviral activity A.L. Stalinskaya, I.A. Pustolaikina, R.A. Muzaparov, A.F. Kurmanova, A.S. Rakhimzhanova, S.Sh. Normatov, I.V. Kulakov	186

Synthesis of furanotriterpenoids from 1,10-seco-triterpenoids I.A. Tolmacheva, M.A. Nazarov, V.V. Grishko	187
Creation of new composite materials for regenerative medicine based on collagen and silver nanoparticles Anastasia Nikitichna Tretyakova, Natalya Evgenevna Tseomashko, Alexander Yurievich Vasil'kov	188
Penicillic acid as a potential inhibitor of ftsz protein of <i>Staphylococcus aureus</i> F. Eshboev, A. Tajimuradov, O. Atabaev, Sh. Samandarov, Sh. Azimova	189
Pharmacological properties of quinoline alkaloids of the genus <i>haplophyllum</i>, growing in the surkhan-darya region, and the prospects of their application in medicine Kh.A. Rasulova, Kh.A. Rasulova	190
On the production of metabolites and derivatives of the lappaconitine alkaloid with pronounced antiarrhythmic properties D.M.Saijdjanova, D.K.Mutalova, A.I. Sanoev, Sh.N.Zhurakulov, A.Z.Sadikov, Sh.Sh. Sagdullaev	191
selection of optimal conditions for cultivation of <i>tTrichoplusia ni</i> insect cells Kopaysinova I., Gaynazarova S.A., Khasanov Sh.Sh., Abdurakhmanov J.M., Ashirov O.N., Azimova Sh.S.	192
Investigation of optimal conditions for long-term storage of <i>Helicoverpa zea</i> insect cell lines Khasanov Sh.Sh., Gaynazarova S.A., Navrozov G.R., Eshboev F.B., Sasmakov S.A., Azimova Sh.S.	193
Determination of optimal conditions for cultivating mesenchymal stem cells Khasanov Sh.Sh., Gaynazarova S.A., Abdurakhmanov J.M., Piyakina G.A., Sasmakov S.A., Azimova Sh.S.	194
Solubilization of lagochilin using cyclodextrins and the production of water-soluble clathrates in various dosage forms Avaz Ibragimov, Jamshid Ashurov	195
The dependence of the biological activity of cycloartane glycosides on their structure R.P. Zakirova, Sh.Kh. Rakhimova, M.A. Agzamova	196
New alkaloid from the <i>lindelofia macrostyla</i> m. popov R.M. Ruzibaeva, A.R. Khurramov, Kh.M. Bobakulov, N.I. Mukarramov	197

