ANTIMICROBIAL ACTIVITY OF EXTRACTS OF *IRIS HUNGARICA* AND *IRIS SIBIRICA*

[1]Kovalev V.M., [1]Mykhailenko O.O., [1]Krechun A.V., [2]Osolodchenko T.P.

[1]National University of Pharmacy, Kharkiv, Ukraine
[2]Mechnikov Institute of Microbiology and Immunology of National Medical Sciences Academy of Ukraine, Kharkiv, Ukraine

Antibacterial properties have been examined of the dry and lipophilic extracts of the leaves and rhizomes of *Iris hungarica* and *Iris sibirica*. It has been established that the dry ethanolic extracts (at the concentration 0.5 %, 1.0 %) and lipophilic extracts from leaves and rhizomes of *Iris hungarica* and *Iris sibirica* exhibit an antimicrobial activity against the test strains of microorganisms of the different taxonomic groups. Aqueous and lipophilic extracts of *Iris hungarica* and *Iris sibirica* have a weak sensitivity to the testing cultures.

Keywords: *Iris hungarica, Iris sibirica*, leaves, rhizomes, extracts antimicrobial activity.

Introduction

Infectious diseases command a large part of among the total number of pathologies in the world and are an important problem in medicine [1]. The leading role in prevention and treatment of diseases of microbial origin belongs to antibacterial chemotherapeutic agents. Advantages of antibiotics of synthetic origin are the high activity compared to phytogenic drugs. But it is known that microorganisms can release the resistance to synthetic antibiotics, so the use of drugs based on the plant materials is appropriate: phytogenic drugs more rarely induce the formation of resistance of the strains of microorganisms, they have a gentle action, can be used for a long-term, have the low cost. Therefore, it is appropriate to examine the drug plants with the aim of determination their antibacterial activity.

Iris hungarica Waldst et Kit. and *Iris sibirica* L. are the representatives of the family *Iridaceae*, genus *Iris* and they have a wide spectrum of the pharmacological activity: leaves and rhizomes of *Irises* are used as anti-inflammatory, coating, expectorant, astringent, diuretic, laxative, styptic, analgesic in the traditional medicine [2, 3]. Biologically active substances that were recovered from plants of the genus *Iris* (tectoridin, iristectorigenin B, nigracin, kaempferol, quercetin, etc.) exhibited an antitumor, antimicrobial, estrogenic, insecticidal, antiplasmatic, anticholinesterase action, they were the inhibitors of enzymes and exhibited the immunomodulatory properties, which made these plants perspective for the research study [4, 5].

Irises exhibit the antiviral and antituberculous activity due to xanthones. On basis of magniferine was created the drug "Alpizarin" (pharmaceutical center VILAR, Russian Federation) (the drug isn't at the pharmaceutical market of our country), with an antiherpetic action [6].

Analysis of the current world pharmaceutical market showed that there was a small amount of drugs and biologically active substances, comprising the raw materials of Irises: *I. versicolor*, rhizomes – «Mastodynon» (Bionorica SE, Germany), for the treatment of mastopathy [7]; *I. pseudacorus*, rhizomes – collection of M.M. Zdrenko, for the treatment of papillomatosis of bladder, antiacid gastritis, peptic ulcer of stomach (Ukraine; Russian Federation) [8]; *I. pseudacorus* – "Pancreophile" (Scientific-Production Association «International medical center», Ukraine), for the treatment of the pancreas diseases [9], *I. versicolor*is - is a homeopathic medicines "Iris-plus" (LLC «Doctor N», Russian Federation), for the treatment of the chronic pancreatitis [10]; *I. versicoloris* - homeopathic drops «Kaliris – EDAS-114» (EDAS holding public company, Russian Federation), for the treatment of gastritis, gastric ulcer, pancreatitis [11]; *I. lactea*, leaves – the therapeutic and prophylactic drugs for cancer patients: "Vitonk" (a multivitamin medicine), "Laktir" (a medicine to reduce the side effects during radiation sickness and chemotherapy) (Russian Federation) [12]. *I. germanica*, rhizomes – is a combined medication "Original great Bittner balsam" (Richard Bittner AG, Austria), a tonic [13].

The aim of the work was to obtain the dry and lipophilic extracts of leaves and rhizomes of *Iris hungarica* and *Iris sibirica*, and examination of the antibacterial activity of the obtained extracts.

Materials and Methods

Plant Material

The objects of the study were the leaves and rhizomes of *Iris hungarica* and *Iris sibirica* that were prepared during the growing season in 2014 in the M.M. Gryshko National botanical garden (Kiev, Ukraine). Voucher specimens have been deposited in the Herbarium of the Pharmacognosy Department and Botany Department, National University of Pharmacy, Kharkiv, Ukraine. The plant was identified by a Head of Department of the Ornamental plants, Senior Researcher of the National Botanical Garden n.a. M.M. Gryshko of NAS of Ukraine (Kyiv), Cand. Biol. Sci. Yu.V. Buydin.

Extraction procedure of plant for bioassay

The dry and lipophilic extracts from the leaves and rhizomes of *Irises* were used to establish the antimicrobial activity.

Method of obtaining of dry extracts: 100.0 g (precisely weighed amount) of the reduced raw material was put out with water of 1000 ml, was heated on a water bath for 2 hours in a flask under reflux. Extracts were cooled and filtered through the Buchner funnel. The remaining raw material was put out with water of volume 500 ml again and was also heated on the water bath for 2 hour. The obtained extracts were combined and concentrated on the ratotory evaporator till receiving the dry extract. The dry extract yield (%) was calculated according to the formula:

$$X = \frac{A*100}{M}$$

, where

A – a dry weight, g; M – a weight of the received raw material, g.

DOI: 10.5281/zenodo.803878

Method of obtaining of lipophilic extract: 30.0 g (precisely weighed amount) of the reduced raw material was placed in Soxhlet's extraction apparatus and put out with chloroform in an amount of 200 ± 5 ml. A receiver flask was weighed before. After the lipophilic extract was received, the overage of chloroform was distilled, and the yield of lipophilic substances was calculated by the difference in weight of the receiver flask. The contents of lipophilic substances were calculated according to the formula:

$$X = \frac{A}{B} \cdot 100\%$$, where

A – a weight of lipophilic extract, g; B – a weight of raw material, g.

Antibacterial activity

Method of study of extracts antimicrobial activity: *in vitro* antibacterial activity was determined by agar well diffusion method. According to the WHO recommendations the following test-strains were used: *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853, *Bacillus subtilis* ATCC 6633, *Proteus vulgaris* ATCC 4636, *Candida albicans* ATCC 885/653 [13]. The inoculum suspension was prepared using a Densi-La-Meter apparatus (made by PLIVA-Lachema, at the wavelength of 540 nm). The cultures were synchronized using low temperature conditions (4°C). The microbial load was 10^7 cells per 1 ml of the medium and was determined according to McFarland standard [14-15]. The 18 to 24–hour culture of microorganisms was used for the test. Mueller-Hinton agar was used ("HIMedia Laboratories Pvt. Ltd India", India) for bacteria. The strains of *Candida albicans* were cultivated using Sabouraud agar ("HIMedia Laboratories Pvt. Ltd India", India). Standard medium was prepared according to the requirements of the manufacturer [16].

Determination of antibacterial activity occurs in two layers of dense nutrient medium, poured into Petri dishes. The bottom layer has "hungry" medium (agar-agar, water, salt). The bottom layer is the substrate of 10 ml "hungry agar", which installed strictly horizontally 3 - 6 thin-walled stainless steel cylinders with a diameter of 10 mm and a height of 10 mm. Around cylinders pour the top layer consisting of a nutrient agar medium, melted and cooled to 40 ° C, which make an appropriate standard of daily test microbe culture. Pre upper layer was mixed well until smooth [17]. After freezing cylinders pull by sterile tweezers and the formed hole tested substances placed on the basis of its volume (0.25 - 0.3 ml). The amount of protection for the upper layer ranges from 14 to 16 ml. Cup are dried 30 – 40 minutes at room temperature and placed in an incubator for 18 - 24 hours. In evaluating the antibacterial properties take to account the areas of stunted growth of microorganisms under study preparation.

Method of serial dilutions was used for the examination of antibacterial properties of selected extracts. Principle of the method consists in the determination of minimal inhibitory concentration that characterizes the bacteriostatic properties of the objects of the examination. The concentration of substances was 1) 1000 μg/ml; 2) 500 μg/ml; 3) 250 μg/ml; 4) 125 μg/ml; 5) 62.5 μg/ml. To each test tube was added of 0.1 ml 10^9 microbial cells test strains. Cultured 24 hours in test tubes, where was no growth (no turbidness), determined the minimal inhibitory concentration. Did seeding on nutrient agar and identified the minimal bactericidal concentration from the last 3 test tubes, where were no turbidness [18].

Examined preparations represented the alcohol and aqueous solutions of the dry and lipophilic extracts of *Irises* in the concentration that shown in tables 1, 2. Water is the solvent for the dry extracts of Iris hungarica, for the lipophilic – is 70% ethyl alcohol. For dissolution of the dry extracts of *Iris sibirica* was used water, 70% and 96% ethyl alcohol, for lipophilic extracts – was used 70%, 96% ethyl alcohol. The concentration of the substances was 1.0 % in all experiments. In the capacity of the comparative drug was selected an alcohol solution of chlorophyllipt in the dose of 10 μg/ml («Chlorophyllipt alcohol solution 1%» 100 ml, «GNCLS» Pilot Plant).

Statistic analysis

Statistical processing of data was carried out according to the requirements of State Pharmacopoeia of Ukraine [17] using the software (Microsoft Office Excel 7.0).

Results and discussions

As a result of the conducted work it was established that the yield of the dry extracts from the raw materials of *Iris hungarica* for the rhizomes amounted 14.02 ± 0.13%; for the leaves – 24.37 ± 0.07%. The quantitative content of lipophilic substances in the rhizomes of *Iris hungarica* amounted 7.54 ± 0.04%, in the leaves – 24.5 ± 0.51%. The yield of the dry extracts of *Iris sibirica* amounted 9.63 ± 0.14% – for the leaves and 6.55 ± 0.09% - for the rhizomes.

At the determining of antibacterial activity of the examined extracts of *Iris hungarica* a diameter of growth inhibition zone is in the range from 14 to 20 mm that is illustrative of the susceptible of microorganism to these drugs (Table 1). Dry extract of the leaves of Irises causes a growth inhibition in the concentration 0.5% as related to *Escherichia coli, Pseudomonas aeruginosa, Basills subtilis, Proteus vulgaris, Candida albicans* – the diameter of growth inhibition zones is 16 – 20 mm. More pronounced effect of the drug to *Proteus vulgaris* (19.30 ± 0.09 mm), however, the drug doesn't cause a growth inhibition to *Staphylococcus aureus*. Dry extract of the leaves at the concentration 1% exhibits an effect on all groups of microorganisms - the diameter of growth inhibition is from 15 to 19 mm, and is the most susceptible to *Escherichia coli* (19.30 ± 0.02 mm). Dry extract of the rhizomes at the concentration 1% inhibits the growth of all taxonomic groups of microslides that were used – the diameter of growth inhibition zone is 13 – 16 mm. The drug has a more pronounced antimicrobial activity against *Candida albicans* (16.30 ± 0.09 mm). The lipophilic extracts of the leaves (the diameter of growth inhibition zones is 15 – 18 mm) and the rhizomes (the diameter of growth inhibition zones is 16 – 21 mm) of *Iris hungarica* exhibit a less susceptible antibacterial activity at the

DOI: 10.5281/zenodo.803878

concentration 1% to the examined microorganisms; the most susceptible microorganisms to the drugs were *Basillus subtilis*, the diameter of growth inhibition zones is 18 – 21 mm.

The dry extracts of the leaves and rhizomes of *Iris sibirica* exhibited an antibacterial activity against the all test strains of microorganisms, the diameter of growth inhibition zones was in the ranges from 16 – 20 mm and 15 – 19 mm, respectively (Table 2). The dry and lipophilic extracts exhibited susceptibility predominantly to *Candida albicans* and *Basillus subtilis* when the diameter of growth inhibition was 18 – 20 mm. The dry extracts of the leaves and rhizomes are slightly inferior to susceptibility with the solvent water and alcohol to other microorganisms, the diameter of growth inhibition zones is 15 – 19 mm. In general comparison it's shown that the drugs from the leaves of *Iris sibirica* exhibit a more antibacterial activity, the solvent is 70% alcohol. The drugs of the lipophilic extracts of the leaves and rhizomes of *Iris sibirica* exhibit the moderate antibacterial activity against the all of microorganisms, at the level of 14 – 16 mm is the diameter of growth inhibition zones.

Thus, the dry extract of the leaves of *Iris hungarica* at the concentration 1% has a more pronounced antibacterial activity than the extract of the rhizomes and is the most susceptible to gram-negative bacteria – *Escherichia coli, Proteus vulgaris, Pseudomonas aeruginosa*. At that time, as the dry extract of the rhizomes of *Iris hungarica* at the concentration 1% is more susceptible to gram-positive bacteria. The lipophilic extracts of the leaves and rhizomes were more susceptibility to gram-positive bacteria. The dry extracts of the leaves and rhizomes of *Iris sibirica* in aqueous and alcohol solutions have a more pronounced antimicrobial activity against gram-negative bacteria and fungi. The lipophilic extracts of *Iris sibirica* were more susceptible to gram-negative bacteria. In summary of the results of the examinations "technique of wells" by definition the diameters of growth zones, the antibacterial properties were presented in the lipophilic extracts of the leaves and rhizomes of *Iris hungarica* and the dry extracts of the leaves and rhizomes of *Iris sibirica*. Bacteriostatic concentrations – minimal inhibitory concentrations were determination in these extracts (Table 3).

Data that are shown in the table 3, they are clearly demonstrating that the lipophilic extracts of the leaves and rhizomes of *Iris hungarica* and the dry extracts of the leaves and rhizomes of *Iris sibirica* exhibit a bacteriostatic activity against a wide range of test strains of microorganisms and *Candida*. Minimal inhibitory concentrations for *S. aureus* ATCC 25923 was 250 μg/ml, for *E. coli* ATCC 25922 – 500 μg/ml. Against *P. aeruginosa* ATCC 27853 minimal inhibitory concentrations was 500 μg/ml for the lipophilic extract of the leaves of *Iris hungarica* and the dry extract of the leaves of *Iris sibirica* compared to the lipophilic extract of the rhizome of *Iris hungarica* and the dry extract of the rhizome of *Iris sibirica*, where minimal inhibitory concentrations was equal to 1000 μg/ml. For *P. vulgaris* ATCC 4636 – minimal inhibitory concentrations of all examined extracts were determined at the level 500 μg/ml. For *B. subtilis* ATCC 6633 minimal inhibitory concentrations is 125 μg/ml, for *C. albicans* ATCC 885/653 – is 250 μg/ml.

In sum of the results of the experimental examinations of the lipophilic extracts of the leaves and rhizomes of *Iris hungarica* and the dry extracts of the leaves and rhizomes of *Iris sibirica* can be concluded that these extracts are effective drugs against the different test strains of microorganisms and it gives an opportunity to develop a combination drug for the therapeutic use, it will improve the severity of adverse effects and will reduce a stress of chemotherapeutic drugs.

Conclusions

The dry and lipophilic extracts from the leaves and rhizomes of *Iris hungarica* and *Iris sibirica* were obtained at the first time. The antibacterial activity of the lipophilic and dry extracts of the leaves and rhizomes of *Iris hungarica* and *Iris sibirica* by the agar diffusion method and serial dilutions it was established. Alcohol drugs of Irises exhibit a pronounced antimicrobial activity against the all of taxonomic groups of microorganisms. Aqueous and lipophilic extracts of Irises exhibited a more moderate action. Thus, this examination offers an opportunity to use *Iris hungarica* and *Iris sibirica* as a raw material to produce the substances with antibacterial pharmacological effect for the further development of antimicrobial action.

References:

1. Centers for Disease, control and prevention et al. National and State Healthcare-Associated
Infections progress report (HAIs): data and statistics. 2016. 140 p.
2. Investigation of the diuretic activity of extracts from the Iris Carthaliniae and the Iris medwedevii / DI. Isayev, GM. Gurbanov, BA. Samura, VR. Kuliev // Drugs – to man, XXXIII All-Ukrainian. saint. and practical. Conf. with Intern. Specialists: April 8, 2016, mate. Conf., Kharkov. NUPh. 2016. 328 p.
3. Krechun AV, Mykchailenko OO, Kovalyov VM. Research of the chemical composition of biologically active substances of *Iris sibirica* L. // Actual questions of development of new drugs: XX International scientific and practical conference of young scientists and student, April 25-26, 2013: abstracts. Kh.: Publishing Office. 2013. P. 44.
4. In vitro evaluation of tectoridin, tectorigenin and tectorigenin sodium sulfonate on antioxidant properties / T. Han, G. Cheng, Y. Liu [et. al.] // Food and chemical toxicology. 2012. Vol. 50. Iss. 2. P. 409-414.
5. Mykchailenko OO, Kovalyov VM. Phenolic compounds of the genus *Iris* plants (*Iridaceae*) // Ceska a Slovenska farmacie. 2015. Vol. 65. Iss. 2. P. 70-77.
6. Tihonova ED,Shemeryakina TB, Socolskaya TA. Alpizarin - a modern antiviral drug preparation. Improvement of the preparation technology // Health and education in the XXI century. 2008. T. 10. №. 3. P. 395-396.
7. Gordeeva G. Application of Mastodinone with functional deviation in the reproductive system //

DOI: 10.5281/zenodo.803878

Reproductive health of a woman. 2002. T. 3. №. 12. P. 47-51.
8. Pharmacological-biochemical substantiation of practical use of some representatives of the genus *Iris L.* (review)/ LI. Tyhomirova, NG. Bazarnova, IV. Mikushyna, SV. Dolganova // Chemistry of plant raw materials. 2015. №. 3. C. 25-34.
9. Chronic pancreatitis: diagnosis and treatment issues (using drugs fitoliniyi Professor Filippov) // Guidelines. Kyiv. 2008. 31 p.
10. Homeopathic medicines (reference book for doctors and pharmacists)/ AV. Patudin, VS. Myschenko, NP. Nechaeva, LV. Cosmodemjanskiy. *M.:* Astral. 1999. 252 p.
11. A pediatric medicinal preparation containing an extract of the milk-white iris (*Iris lactea*) / SA. Minina, NI. Pryakhina, II. Chemesova, DV. Chizhikov // Pharmaceutical Chemistry J. 2008. Vol. 42. Iss. 1. P. 37-39.
12. Korpachev VV, Mosendz IA, Kovalchuk AV. Therapeutic and prophylactic use of the drug "Original Big Bittner Balm" in patients with II type diabetes. Kyiv. 2012. URL: https://medi.ru/info/5792/ (request date 01.03.2017)
19. resource]/ -Access: http://mozdocs.kiev.ua/view .p - 6958.
13. Guidelines: Studying the specific activity of antimicrobial drugs. Kyiv. 2004. 38 p.
14. McFarland J. The nephelometer: an instrument for estimating the number of bacteria in suspensions used for calculating the opsonic index and for vaccines // J. American Medical Association. 1907. Vol. 49. Iss. 14. P. 1176-1178.
15. Jorgensen JH, Turnidge JD. Susceptibility test methods: dilution and disk diffusion methods // Manual of Clinical Microbiology, Eleventh Edition. American Society of Microbiology. 2015. P. 1253-1273.
16. Harrigan WF, McCance ME. Laboratory methods in microbiology. 1st Ed. // Academic Press. 2014. 374 p.
17. State Pharmacopoeia of Ukraine / State. Enterp. "Scientific Experts pharmacopoeia center". 1st Ed., Add. 1. X.: State. Enterp. "Scientific Experts pharmacopoeia center". 2004. p. 157-158.
18. On approval guidelines "Determining the sensitivity of microorganisms to antibiotics": Decree of the Ministry of Health ofUkraineof05.04.2007. № 167 [Electronic

ANTIMICROBIAL ACTIVITY OF EXTRACTS OF *IRIS HUNGARICA* AND *IRIS SIBIRICA*

Kovalev V.M., Mykhailenko O.O., Krechun A.V., Osolodchenko T.P.

Introduction. Referring to the latest data, infectious diseases command a large part of among the total number of pathologies in the world and are an important problem in medicine. The leading role in prevention and treatment of diseases of microbial origin belongs to antibacterial chemotherapeutic agents. Advantages of antibiotics of synthetic origin are the high activity compared to phytogenic drugs. But it is known that microorganisms can release the resistance to synthetic antibiotics, so the use of drugs based on the plant materials is appropriate: phytogenic drugs more rarely induce the formation of resistance of the strains of microorganisms, they have a gentle action, can be used for a long-term, have the low cost. Therefore, it is appropriate to examine the drug plants with the aim of determination their antibacterial activity.*Iris hungarica* Waldst et Kit. and *Iris sibirica* L. are the representatives of the family *Iridaceae*, genus *Iris* and they have a wide spectrum of the pharmacological activity. Biologically active substances that were recovered from plants of the genus *Iris* (tectoridin, iristectorigenin B, nigracin, kaempferol, quercetin, etc.) exhibited an antitumor, antimicrobial, estrogenic, insecticidal, antiplasmatic, anticholinesterase action, they were the inhibitors of enzymes and exhibited the immunomodulatory properties, which made these plants perspective for the research study. Raw materials Irises are constituent components of more than 9 medicines.
Materials and Methods. The objects of the study were the leaves and rhizomes of *Iris hungarica* and *Iris sibirica* that were prepared during the growing season in 2014 in the M.M. Gryshko National botanical garden (Kiev, Ukraine). The dry and lipophilic extracts from the leaves and rhizomes of *Irises* were used to establish the antimicrobial activity. For the study of extracts antimicrobial activity was used agar well diffusion method. According to the WHO recommendations the following test-strains were used: *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853, *Bacillus subtilis* ATCC 6633, *Proteus vulgaris* ATCC 4636, *Candida albicans* ATCC 885/653. The 18 to 24–hour culture of microorganisms was used for the test. Mueller-Hinton agar was used for bacteria. The strains of *Candida albicans* were cultivated using Sabouraud agar. Method of serial dilutions was used for the examination of antibacterial properties of selected extracts. The concentration of substances was 1) 1000 μg/ml; 2) 500 μg/ml; 3) 250 μg/ml; 4) 125 μg/ml; 5) 62.5 μg/ml. To each test tube was added of 0.1 ml 10^9 microbial cells test strains. Examined preparations represented the alcohol and aqueous solutions of the dry and lipophilic extracts of *Irises* in the different concentrations. Water is the solvent for the dry extracts of Iris hungarica, for the lipophilic – is 70% ethyl alcohol. For dissolution of the dry extracts of *Iris sibirica* was used water, 70% and 96% ethyl alcohol, for lipophilic extracts – was used 70%, 96% ethyl alcohol. The concentration of the substances was 1.0 % in all experiments. In the capacity of the comparative drug was selected an alcohol solution of chlorophyllipt in the dose of 10 μg/ml («Chlorophyllipt alcohol solution 1%» 100 ml, «GNCLS» Pilot Plant). **Results and discussions**. The dry extract of the leaves of *Iris hungarica* at the concentration 1% has a more pronounced antibacterial activity than the extract of the rhizomes and is the most susceptible to gram-negative bacteria – *Escherichia coli, Proteus vulgaris, Pseudomonas aeruginosa*. At that time,

DOI: 10.5281/zenodo.803878

as the dry extract of the rhizomes of *Iris hungarica* at the concentration 1% is more susceptible to gram-positive bacteria. The lipophilic extracts of the leaves and rhizomes were more susceptibility to gram-positive bacteria. The dry extracts of the leaves and rhizomes of *Iris sibirica* in aqueous and alcohol solutions have a more pronounced antimicrobial activity against gram-negative bacteria and fungi. The lipophilic extracts of *Iris sibirica* were more susceptible to gram-negative bacteria. In summary of the results of the examinations "technique of wells" by definition the diameters of growth zones, the antibacterial properties were presented in the lipophilic extracts of the leaves and rhizomes of *Iris hungarica* and the dry extracts of the leaves and rhizomes of *Iris sibirica*. The lipophilic extracts of the leaves and rhizomes of *Iris hungarica* and the dry extracts of the leaves and rhizomes of *Iris sibirica* exhibit a bacteriostatic activity against a wide range of test strains of microorganisms and *Candida*. **Conclusions.** Antibacterial properties have been examined of the dry and lipophilic extracts of the leaves and rhizomes of *Iris hungarica* and *Iris sibirica*. It has been established that the dry ethanolic extracts and lipophilic extracts from leaves and rhizomes of *Iris hungarica* and *Iris sibirica* exhibit an antimicrobial activity against the test strains of microorganisms of the different taxonomic groups. Thus, this examination offers an opportunity to use *Iris hungarica* and *Iris sibirica* as a raw material to produce the substances with antibacterial pharmacological effect for the further development of antimicrobial action.

DOI: 10.5281/zenodo.803878

Table 1. Antimicrobial activity of extracts of *Iris hungarica* by agar diffusion method

№	Concentration	The diameters of the inhibition zones of microorganisms growth, mm, the number of tests n=3					
		Staphylococcus aureus ATCC 25923	*Escherichia coli* ATCC 25922	*Proteus vulgaris* ATCC 4636	*Pseudomonas aeruginosa* ATCC 27853	*Basillus subtilis* ATCC 6633	*Candida albicans* ATCC 653/885
dry extract of leaves							
1	1 %	18.16 ± 0.03	19.30 ± 0.02	14.60 ± 0.10	15.10 ± 0.07	19.10 ± 0.06	16.10 ± 0.20
2	0.5 %	growth	17.00 ± 0.12	19.30 ± 0.09	18.66 ± 0.10	19.66 ± 0.04	15.67 ± 0.10
3	0.25%	growth	growth	growth	growth	growth	growth
dry extract of rhizomes							
4	1 %	15.60 ± 0.12	14.60 ± 0.08	13.60 ± 0.10	13.10 ± 0.13	16.00 ± 0.12	16.30 ± 0.09
5	0.5 %	growth	growth	growth	growth	growth	growth
6	0.25%	growth	growth	growth	growth	growth	growth
lipophilic extract of leaves							
7	1%	16.30 ± 0.10	15.30 ± 0.09	16.00 ± 0.15	16.30 ± 0.08	18.00 ± 0.20	16.30 ± 0.09
lipophilic extract of rhizomes							
8	1%	19.60 ± 0.07	19.00 ± 0.12	18.30 ± 0.10	18.00 ± 0.13	21.00 ± 0.07	16.00 ± 0.15
Control							
9	10 μg/ml	18.60 ± 0.10	growth	growth	growth	growth	growth

DOI: 10.5281/zenodo.803878

Table 2. Antimicrobial activity of extracts of *Iris sibirica* by agar diffusion method

Solution	The diameters of the inhibition zones of microorganisms growth. mm. the number of tests n=3					
	Staphylococcus aureus ATCC 25923	*Escherichia coli* ATCC 25922	*Proteus vulgaris* ATCC 4636	*Pseudomonas aeruginosa* ATCC 27853	*Basillus subtilis* ATCC 6633	*Candida albicans* ATCC 653/885
dry extract of leaves						
ethanol 96%	18.60 ± 0.10	17.60 ± 0.40	17.30 ± 0.09	17.60 ± 0.02	18.60 ± 0.08	19.30 ± 0.05
ethanol 70%	19.00 ± 0.02	18.00 ± 0.18	17.60 ± 0.12	18.60 ± 0.15	20.30 ± 0.07	19.60 ± 0.12
water	17.30 ± 0.15	16.30 ± 0.20	16.00 ± 0.08	16.30 ± 0.17	19.00 ± 0.05	18.30 ± 0.14
dry extract of rhizomes						
ethanol 96%	16.60 ± 0.14	15.00 ± 0.06	16.00 ± 0.13	16.30 ± 0.09	17.60 ± 0.08	18.60 ± 0.16
ethanol 70%	17.60 ± 0.15	16.00 ± 0.09	17.30 ± 0.12	17.30 ± 0.18	19.00 ± 0.02	19.30 ± 0.10
water	16.00 ± 0.08	14.30 ± 0.11	15.00 ± 0.18	15.30 ± 0.02	16.60 ± 0.08	16.30 ± 0.12
lipophilic extract of leaves						
ethanol 96%	15.60 ± 0.10	15.00 ± 0.13	14.60 ± 0.09	15.30 ± 0.12	16.00 ± 0.08	15.60 ± 0.10
ethanol 70%	16.60 ± 0.03	16.00 ± 0.12	15.30 ± 0.15	16.30 ± 0.08	17.60 ± 0.13	16.60 ± 0.05
lipophilic extract of rhizomes						
ethanol 96%	15.00 ± 0.02	14.00 ± 0.14	15.00 ± 0.04	15.00 ± 0.18	16.60 ± 0.12	15.60 ± 0.10
ethanol 70%	15.60 ± 0.07	15.30 ± 0.15	15.60 ± 0.12	16.00 ± 0.09	17.60 ± 0.10	16.60 ± 0.15
Control						
10 µg/ml	19.00 ± 0.03	growth	growth	growth	growth	growth

DOI: 10.5281/zenodo.803878

Table 3. Minimal inhibitory concentrations of extracts of *Iris hungarica* and dry extracts of *Iris sibirica* to test - strains of microorganisms

Strains of microorganisms	**MICs,** μg/ml **of extracts**			
	Lipophilic extract of leaves of *Iris hungarica*	Lipophilic extract of rhizome of *Iris hungarica*	Dry extract of leaves of *Iris sibirica*	Dry extract of rhizome of *Iris sibirica*
S. aureus ATCC 25923	250	250	250	250
E. coli ATCC 25922	500	500	500	500
P. aeruginosa ATCC 27853	500	1000	500	1000
P. vulgaris ATCC 4636	500	500	500	500
B. subtilis ATCC 6633	125	125	250	125
C. albicans ATCC 885/653	500	250	500	250

DOI: 10.5281/zenodo.803878