UDC 615.3
DOI: 10.15587/2519-4852.2025.327879

DEVELOPMENT OF TECHNOLOGY FOR OBTAINING DRY EXTRACT «HELMINTH ART» AND THE STUDY OF ITS ANTHELMINTHIC ACTIVITY

Shaxlo Yuldasheva, Khakim Tukhtaev

The aim. *This research work is devoted to the development of an optimal method for obtaining anthelmintic dry extract «Helmint-ART» from raw materials of plants growing in Uzbekistan: aerial (aboveground) part of wormwood, pumpkin seeds, tansy flowers, garlic bulbs and to study the acute toxicity and anthelmintic activity.*
Materials and methods. *Two different methods for obtaining dry extract (DE) «Helmint-ART» from plant raw materials: the aerial part of wormwood, pumpkin seeds, tansy flowers and garlic bulbs were used. The first method: prepare an extract of plants raw materials and then prepare DE substance from them. The second method: a separate DE was obtained from each selected object and then mixed in a certain ratio. Quantitative indicators of biologically active substances were determined with high-performance liquid chromatography. The study of anthelmintic effect of the DE «Helmint-ART» was carried out on intestinal parasitosis experimental models in mice: hymenolepidosis (causative agent Hymenolepis nana) and aspiculurosis (causative agent Aspiculuris tetraptera).*
Results. *It was found that the second method for obtaining DE named "Helminth-ART" was optimal.*
Determination the "acute" toxicity showed that DE "Helminth-ART" at a dose 3000 mg/kg do not cause changes in animal's behavior and their death. Anti-cestode activity of DE "Helmint-ART" was 74.9 % and was slightly higher (statistically unreliable) than that of comparison drug Fenasal (71.2 %) and significantly exceeded that of the infusions of common tansy flowers (50.2 %), pumpkin seeds (56.8 %). Anti-nematodosis activity (90.2 %) of DE "Helminth-ART" significantly exceeded the activity of infusions of tansy flowers (68.6 %), pumpkin seeds (76.9 %), Pyrantel (80.1 %).
Conclusions. *The optimal method of the technology of the DE "Gelmint-ART" was determined based on a comparison of two methods. The second method is optimal in terms of economy of extractants, high proportion of the DE released, their quality indicators, content of the biologically active substance luteolin.*
The pronounced DE "Helmint-ART" anthelmintic effect and acceptable acute toxicity were established
Keywords: *wormwood bitter, pumpkin seed, tansy flowers, garlic, dry extract, highly effective liquid chromatography, anti-nematode, anti-cestode activity*

How to cite:
Yuldasheva, Sh., Tukhtaev, Kh. (2025). Development of technology for obtaining dry extract «Helminth ART» and the study of its anthelmintic activity. ScienceRise: Pharmaceutical Science, 2 (54), 69–77. http://doi.org/10.15587/2519-4852.2025.327879

1. Introduction

In developing countries, the most common infectious agents of humans are these helminthic infections. Helminths are organisms that live life at the expense of tissues and organs of humans, animals, plants. Helminths are multicellular worms of three taxonomic groups: cestodes tapeworms, nematodes roundworms, and trematodes flukes. They present a striking variety of life histories, from direct fecal-oral transmission (such as the common roundworm Ascaris) to development through free-living stages (such as hookworm larvae in the environment) or dependence on invertebrate vectors (such as the schistosome snail vector). Correspondingly, helminths also have various invasion routes, including through the skin (schistosomes and hookworms), by mosquito bite (filarial worms), and, most frequently, in the gastrointestinal tract. [1]. Helminthiasis causes a significant health problem with increased morbidity and, to some extent, mortality in an underdeveloped and developing country, although it may also occur in developed countries. It remains undiagnosed in many patients, and they suffer a lot due to many complications. This activity reviews the evaluation and treatment of helminthiasis and highlights the role of the interprofessional team in evaluating and treating patients with this condition [1, 2].

In Phytotherapy, plants with essential oils, bitter and other substances are used in the treatment of Parasitic Diseases. The indicated components in the plant have an antiseptic effect, interfere with the life activity of parasites, paralyze their respiratory center, stimulate the release of digestive juices and damage parasites, accelerate the motor activity of the digestive tract and show the property of anti helminthic [3].

In nowadays, the exploration of the pharmacological properties of various medicinal plants, their extracts, and individual bioactive compounds has gained significant traction within the scientific community [4]. For this reason, medicinal plant raw materials against helminth were investigated in this scientific work.

From the above, the following were selected from many plant raw materials, which are widely used in folk medicine and scientific medicine, when creating a sub-

stance of dry extract against helminths: aboveground part of wormwood bitter, pumpkin seeds, tansy flowers and a garlic bulbs.

Medicinal plants are indispensible sources of diverse types of bioactive organic compounds. One of these shrubs, *Artemisia absinthium* L. (*Asteraceae/Compositae*), commonly known as wormwood, is an erect, medium-sized herb with greenish silvery leaves and white twigs with strong aroma [5].

Artemisia absinthium L. it has been found to be used as an antihelminthic agent and as an insectoacaricide against mites [6]. In medicine, its leaves and flowering ends are used against of helminths, as an appetizer and as a means to improve digestion of the stomach [7]. It has also been studied for its antimicrobial properties and antileishmanial activity [8–10]. Wormwood herb was chosen as the object in the studies. To obtain 5 series of liquid extract, the method of repercolation was used. For the obtained extracts, the relative density and dry residue were determined according to generally accepted pharmacopoeial methods, qualitative reactions were carried out to confirm the presence of flavonoids, sesquiterpene lactones and phenolic compounds in the extract, and thin-layer chromatography was also used [11].

The Cucurbita-pumpkin species has been of great interest in medicine and pharmacology in recent years. This plant species, native to the American continent, has served in folk medicine around the world in the treatment of gastrointestinal diseases and intestinal parasites and other clinical purposes. These pharmacological effects are increasingly linked to their nutritional and phytochemical composition. Among these chemical components, carotenoids, tocopherols, phenols, terpenoids, saponins, sterols, fatty acids, functional carbohydrates, and polysaccharides are more common [12]. The technology of complex tincture based on the aboveground part of wormwood bitter, and pumpkin seeds has been developed, the qualitative and quantitative analysis of which has been studied [13].

Tansy is a plant that has many beneficial properties. Previously, tansy was used for the purpose of getting rid of intestinal parasites. Tanacetum Vulgare (Asteraceae) is used as a vermifuge in folk medicine. Studies have studied the antihelminthic nature of essential oil and extract obtained on its basis [14]. Experiments have studied the extraction of dry extract from tansy flowers and the qualitative analysis of biologically active substances in its composition [15, 16].

Garlic-Allium sativum L. leeches are a perennial leek herb in the family Liliaceae. Garlic and garlic extracts contain numerous chemical compounds, many of which have shown significant biological activities [17]. Plant extracts such as Allium sativum have yielded high results on the anti-helminth effect of extracts of antigelminth activity plants [18]. From the review of the above literature, the study of the optimal method of obtaining an anti-helminths dry extract "Helminth-ART" from plant raw materials such as aboveground part of wormwood bitter, pumpkin seeds, tansy flowers and a garlic bulbs, expressed the relevance of the research work.

Aim of the research. The Republic of Uzbekistan is rich in a stock of plant raw materials with anti-helminth properties, of which wormwood bitter, pumpkin seeds, tansy flowers and garlic are used in folk medicine and official medicine as an anti- helminth agent. This research work is devoted to the development of an optimal method for obtaining an anti-helminths dry extract "Helminth-ART" from plant raw materials such as aboveground part of wormwood bitter, pumpkin seeds, tansy flowers and garlic bulbs. And this research work is aimed at studying the anthelminthic activity of the obtained dry extract "Helminth-ART".

2. Planning (methodology) of research

The research was carried out according to the following stages:

1. Obtaining dry extracts in two different ways in the presence of different extracts from plant raw materials with anti-helminthic effects.

2. Determination of the average amount of the sum of flavonoids in the composition of the resulting dry extracts by the method of highly effective liquid chromatography.

3. Selection of the optimal technology for obtaining dry extract against helminths based on the results of the study.

4. Conducting experimental work on the determination of the antiparasitic-anthelmintic (anti-cestode and anti-nematode) activity of dry extract "Helminth-ART".

3. Materials and methods

Two different methods of obtaining the dry extract "Helminth-ART" from plant raw materials with anthelmintic properties have been studied. As plant raw materials, the following were obtained: aboveground part of wormwood bitter, pumpkin seeds, tansy flowers and a garlic bulbs.

The first method. On the recommendation of pharmacologists, prepare an extract of plant raw materials in a ratio of 1:0.75:0.5:0.25, and then prepare a substance of dry extract from them. In order to obtain substance of dry extract by this method, the pumpkin seed, previously ground and powdered in the amount of 300 g, was extracted 1 time with chloroform for 24 hours. Pumpkin oil was separated. The degreased mass is taken to dry. Then the garlic bulbs in the amount of 100 g was extracted 1 time for 24 hours with a separate chloroform. Garlic bulbs oil was isolated. The degreased mass was put to dry to add to the composition. For harvesting, a 400 g amount of aboveground part of wormwood bitter was ground in 3 mm of ground, sifted. Tansy flowers in the amount of 200 g are ground in a small amount of 3–5 mm, sifted. A crushed, sifted aboveground part of wormwood bitter and tansy flowers were placed in the percolator and a mass of degreased, dried pumpkin seeds and garlic bulbs was laid out. The collection was infused in 70 % alcohol. Was extracted by percolation. All the extracted extracts were combined and condensed in vacuum evaporator equipment (alcohol was expelled). The thick extract was dried in spray drying equipment at a pressure of 1500 °C

inlet, outlet 700 °C, pressure 0.5 MPa. In this, 110 g of dry extract was obtained.

The second method. A separate dry extract was obtained from each selected object, that is, from a aboveground part of wormwood bitter, pumpkin seeds, tansy flowers and garlic. In this case, a dry extract from the aboveground part of wormwood bitter was obtained by percolation in 70 % alcohol [19]. The technology of obtaining dry extract from pumpkin seeds has been studied in various ways in previous studies, in which the following method was considered optimal. Pumpkin seeds were ground into powder, and extracted by percolation in 70 % alcohol. Then the extract was degreased in a liquid-liquid method in gasoline, the liquid part was dried in a spray dryer, a dry extract was obtained [20]. Also, from the flowers of tansy, a dry extract was obtained by percolation in 70 % alcohol [15]. The raw materials of garlic were cleaned, ground and degreased using chloroform, and then a dry extract was separated from the degreased portion by percolation in 70 % alcohol.

In this extraction process, we degreased dry extracts. Because the oils negatively affected the quality indicators of the dry extract after it was obtained. It did not meet the requirements for flowability and moisture. After a short time, our dry extract turned into a thick extract. For this reason, when we took a dry extract, we first extracted the oils contained in them.

In the first method, degreased raw materials and ground plant raw materials were put into a single percolator, and then a dry extract was obtained from it. In the second method, dry extract was extracted from the raw materials of each plant separately. Then a dry extract against helminths was obtained from this mixture of dry extracts.

The composition of the dry extract obtained in the second method was as follows: a dry extract of aboveground part of wormwood bitter, a dry extract of pumpkin seeds, a dry extract of tansy flowers and a dry extract of garlic bulbs were mixed on the recommendation of pharmacologists in a ratio of 1:0.75:0.5:0.25. A mixture of dry extracts was prepared against helminth. This mixture was seen as a substance of dry extract against helminth.

In studies, the antihelminthic effect of phenol compounds was studied, according to which arbutin, vanilla acid and taxifolin turned out to be ineffective, while naringenin, quercetin and luteolin have high efficiency in 250 mM concentrations. Experiments with luteolin or quercetin and tannin compounds revealed for the first time the existence of synergetic antihelminth effects between the monomers of the flavonoid and the tannins [21]. Based on the data presented in the literature, the obtained substances of dry extracts were analyzed according to the quantitative indicators of flavonoids. Quantitative analysis of flavonoids in the composition of substances of dry extracts obtained in two different ways on the basis of bitter wormwood was carried out on a high-performance liquid chromatograph «Agilent 1200» by the method of high-performance liquid chromatography [22].

Experiments were performed at least 3 times, with average results obtained.

In this case, experiments to determine the flavonoids were carried out at least 3 times and carried out under the following conditions: 50 mg of the exact sample is placed in a penicillin vial, 10 ml of 70 % ethyl alcohol is added, dissolved, filtered through a membrane filter with a pore size of 0.45 microns into chromatographic vials. Chromatography is performed on an Agilent-1200 liquid chromatograph (Agilent Technologies, USA) equipped with a gradient pump and a UV detector.

Chromatographic column particles have an Agilent Eclipse XDB – C18 with a large size of 5 μm, and a size of 4.6×250 mm, excitable phase: a mixture of 0.1 % solution of triphtor acetic acid and acetonitrile (70:30); total flow rate of the elyuent is 1.0 ml/min; sample size for analysis is 20 μL; detection wavelength is 254, 320 nm.

20 μl of the solution of the test and standard samples are individually injected into the chromatograph injector.

The quantitative content of flavonoids in the dry extract is calculated relative to the peak areas of the corresponding standard substances according to the formula:

$$X = \frac{S_1 \times a_0 \times V \times 100}{S_0 \times a_1},$$

where X is the content of the calculated component, in %; S_0 is the peak area of the calculated component on the chromatogram of the standard; S_1 is the peak area of the calculated component on the chromatogram of the test sample.; a_0 is the concentration of the standard, in mg/ml; V is the volume of dissolution of the test sample, in ml; a_1 is the mass of the sample sample, in mg.

When determining the “acute” toxicity of the dry extract of “Helminth-ART”, experiments were conducted on outbred white male mice weighing 18–20 g. The dry extract of “Helminth-ART” was administered orally with an atraumatic probe in doses of 1,000, 2,000 and 3,000 mg/kg in the form of an aqueous solution. Each dose was tested on 6 mice. After a single injection of the drugs, the experimental animals were monitored for 14 days. The general condition, behavior, and death of animals in each experimental group were taken into account.

Experimental work has been carried out to determine the antiparasitic – anthelmintic (anti-cestode and anti-nematode) activity of the dry extract “Helminth-ART”. The study of the antiparasitic (anthelmintic) effect of dry extract “Helminth-ART” was carried out on experimental models of intestinal parasitosis in white mice – hymenolepidosis (the causative agent of the dwarf tapeworm Hymenolepis nana) and aspiculurosis (the causative agent Aspiculuris tetraptera (an adequate model of enterobiosis)).

The range of antiparasitic action and the effectiveness of the dry extract were determined in the following experimental models of parasitosis: aspiculurosis (sexually mature stage of Aspiculuris tetraptera oxyuride) in white mice (the latter model is used as an experimental model of enterobiosis); imaginal stage of development of dwarf tapeworm (Hymenolepis nana) in white mice. The animals were kept in a vivarium with a standard diet,

temperature and light conditions, and free access to water and feed.

The effectiveness of the dry extract was determined by the number or percentage of parasites removed – intensity efficiency (IE). Due to the difficulty or impossibility of counting the departed parasites, the average number of helminths in the dissected animals in the experimental and control groups was compared to calculate the intensity efficiency. And intensity efficiency was determined (in %) according to the formula:

$$IE=100\ (K–O)/K,$$

where K is the average number of helminths in the control group; O is the average number of helminths in the experimental group.

A model of experimental hymenolepidosis was obtained by infecting animals with 200 invasive H. nana eggs, which were injected directly into the esophagus using a syringe with a special cannula. The studied substances were injected per os with an atraumatic probe in the form of an aqueous emulsion with Arabian gum for five days (once a day) starting from the 10th day after infection. On the 15th day after infection with invasive dwarf tapeworm eggs, the animals were slaughtered by instant decapitation under light inhalation anesthesia. A 10 cm long segment of the small intestine was removed, opened in dechlorinated water and the cestodes attached to the wall of the small intestine were counted.

When mice were experimentally infected with aspiculurosis, they were injected per os with 100 invasive A. tetraptera eggs. To study the therapeutic activity of drugs at the mature stage of A. tetraptera, they were administered intragastrically on the 10th day after infection (using a syringe with a cannula). The results of therapy were recorded 3 days after the end of the course of treatment by extracting and counting mature individuals (a 10 cm long segment of the colon) with oxyuride using an MBS-1 binocular magnifier simultaneously in the experimental and control groups [23].

In both cases, the dry extract "Helminth-ART" 50 mg/kg was administered once a day for 5 days according to the previously obtained results. Each experiment had 2-3 repetitions. In all experiments, there were 6 animals in the experimental and control groups for each dose. An infusion of tansy flowers (Tanacetum Vulgare L.) 80 mg/kg for 5 days, pumpkin seeds (Cucurbita pepo L.) at a dose of 20 mg/kg for 5 days, Phenasal 30 mg/kg for 4 days (when infected with H. nana) and Pyrantel 15 mg/kg once (when infected with A. tetraptera) [24], which were also administered intragastrically in the form of aqueous solutions.

4. Result

The average amount of the sum of flavonoids contained in the substances of the prepared anti-helminths dry extract was analyzed in a highly effective liquid chromatography method. The experiments were carried out on a high-performance liquid chromatograph «Agilent 1200».

The standard substance chromatograms obtained by the highly efficient liquid chromatography method are listed in Fig. 1–3. Chromatograms of substances of the dry extract obtained by the highly efficient liquid chromatography method are given in Fig. 4, *a, b*, 5. The results are shown in Table 1.

Based on the results of the analysis, it was found that the composition of the of the substance of dry extract against helminth obtained through the first method contained an average of 0.32 mg/g of flavonoid apigenin, with a mean of 1.21 mg/g of rutin.

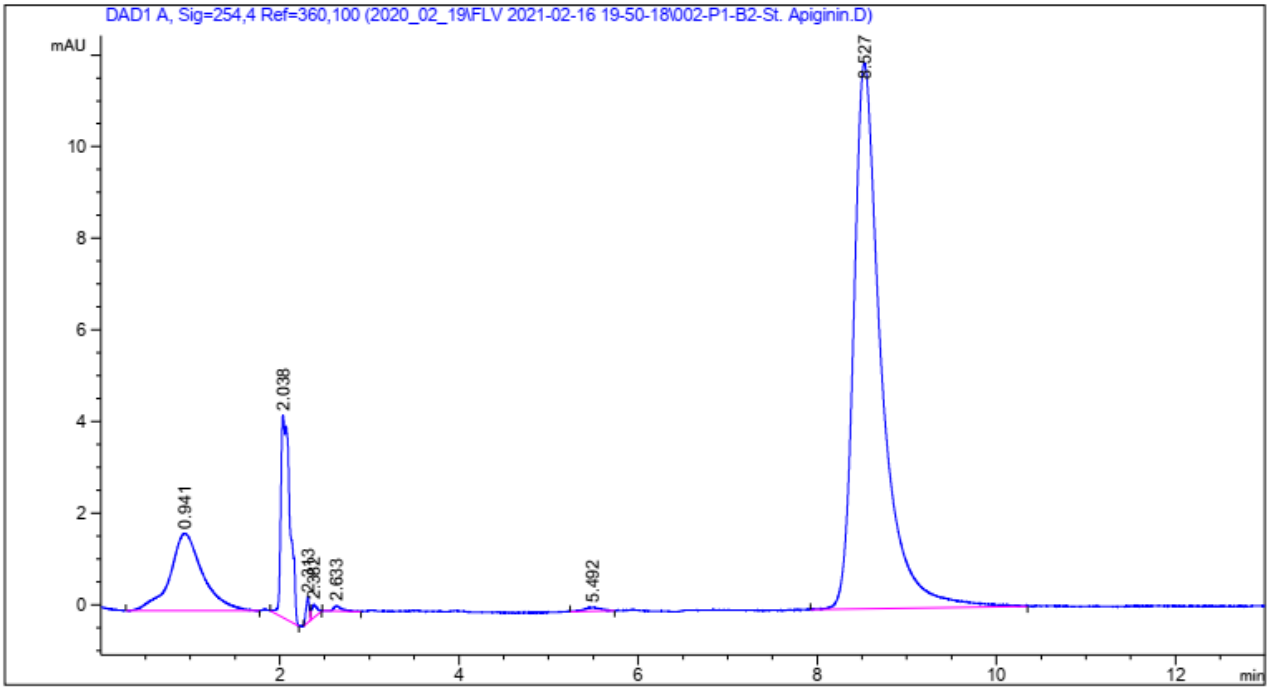


Fig. 1. Chromatogram of the standard substance apigenin

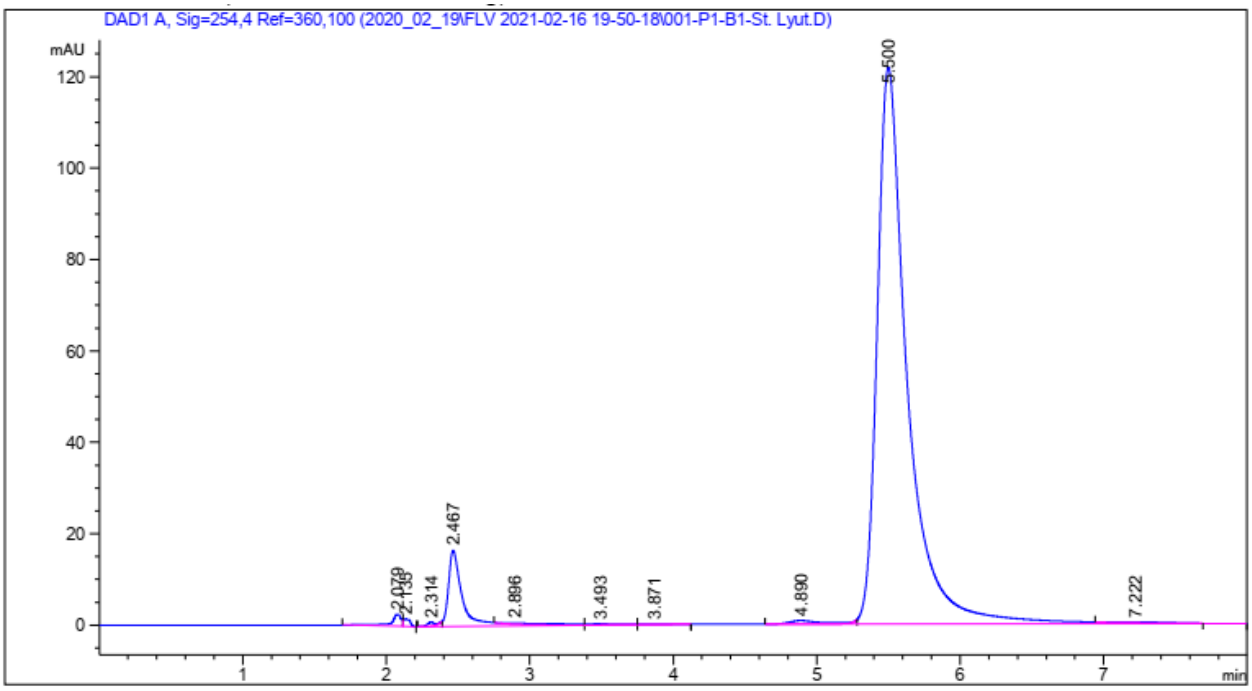


Fig. 2. Chromatogram of the standard substance luteolin

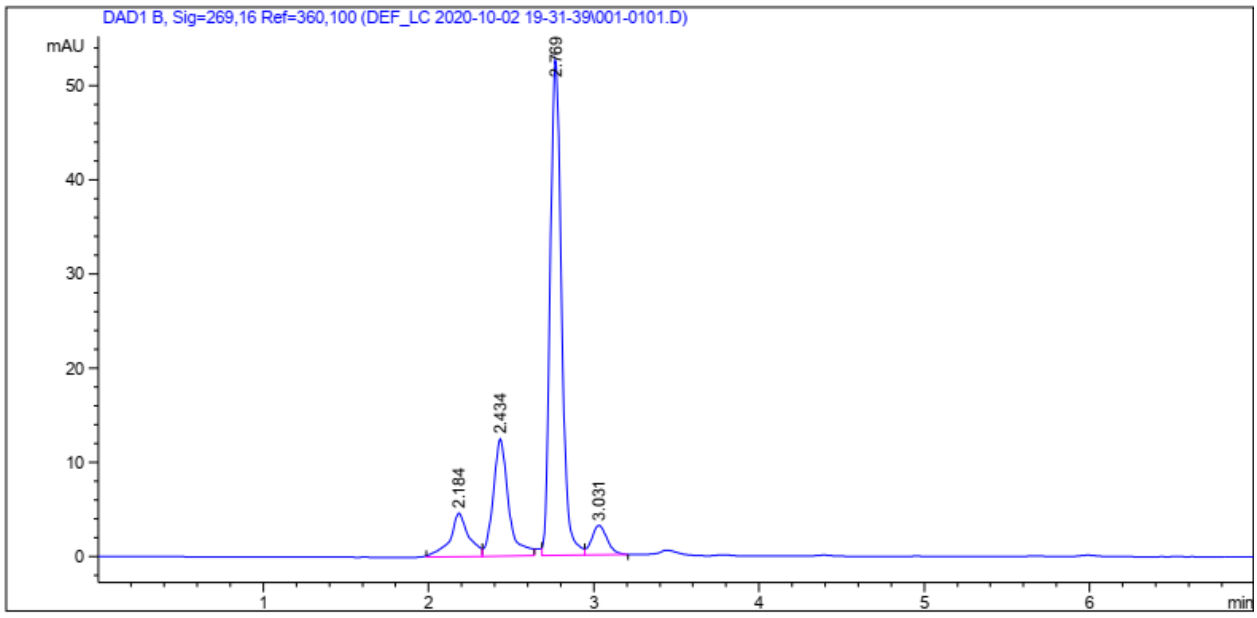


Fig. 3. Chromatogram of the standard substance rutin

Based on the results of the analysis, it was found that the of the substance of dry extract against helminth obtained through the second method contained an average of 0.11 mg/g of luteolin, with a mean of 0.7 mg/g of rutin.

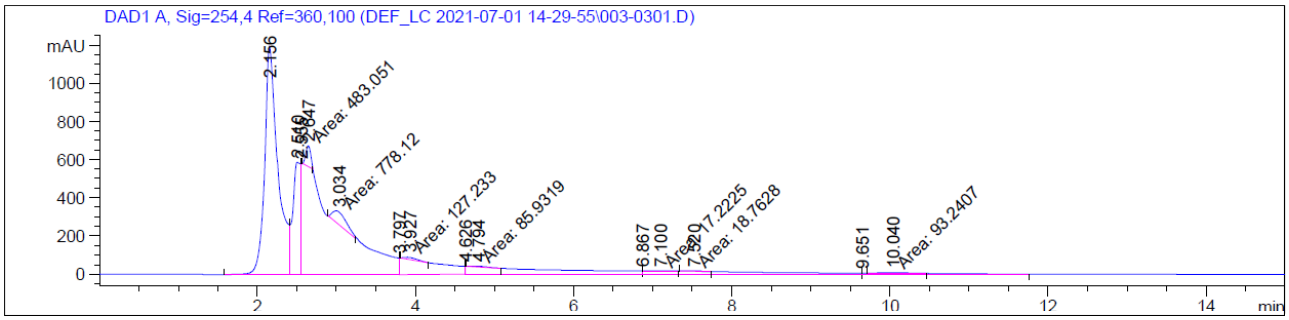
The substance of dry extract obtained in the first method was found to contain large amounts of the flavonoid apigenin and rutin, while the substance of dry extract obtained in the second method contained luteolin and rutin. The biologically active substances contained in the substance of dry extract obtained in the second method were found to have a good result on a relatively quantitative scale.

The resulting dry extracts were compared in quality indicators, flowability and moisture. After a certain period of time, it was observed that the dry extract obtained in the first method has a high moisture content, the property of flowability is lost. The dry extract obtained in the second method had a positive result in terms of moisture and flowability.

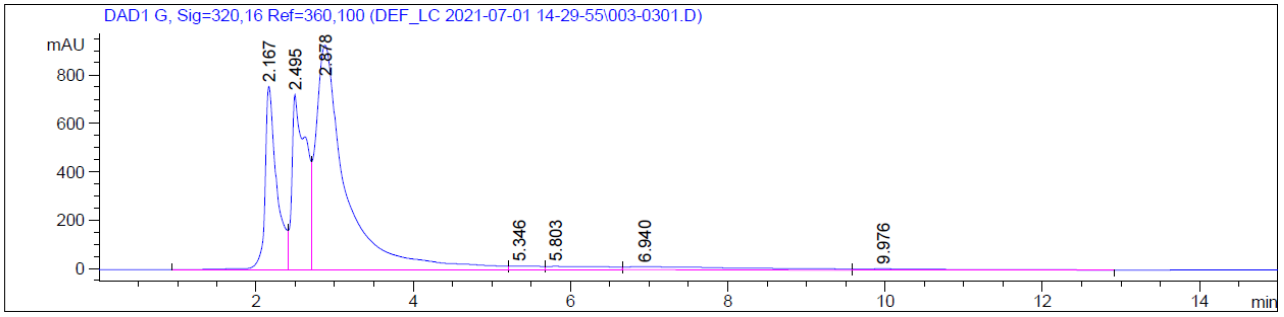
The results of the analysis of highly effective liquid chromatography of flavonoids contained in dry extract substance obtained by two methods were compared, as well as their quality indicators, in the second method it was found that the technology for obtaining dry extract substance against helminths was optimal.

The mixture of dry extracts obtained in the second method was seen as a dry extract substance against helminths, and it was named “Helminth-ART”.

Also, according to the economical use of extractants and the high proportion of products obtained, the second method was considered moderate.



a



b

Fig. 4. Chromatograms of the substance of dry extract obtained according to the first method: *a* – Chromatogram of the substance of dry extract obtained according to the first method (detector crown length 254 nm); *b* – Chromatogram of the substance of dry extract obtained according to the first method (detector crown length 320 nm)

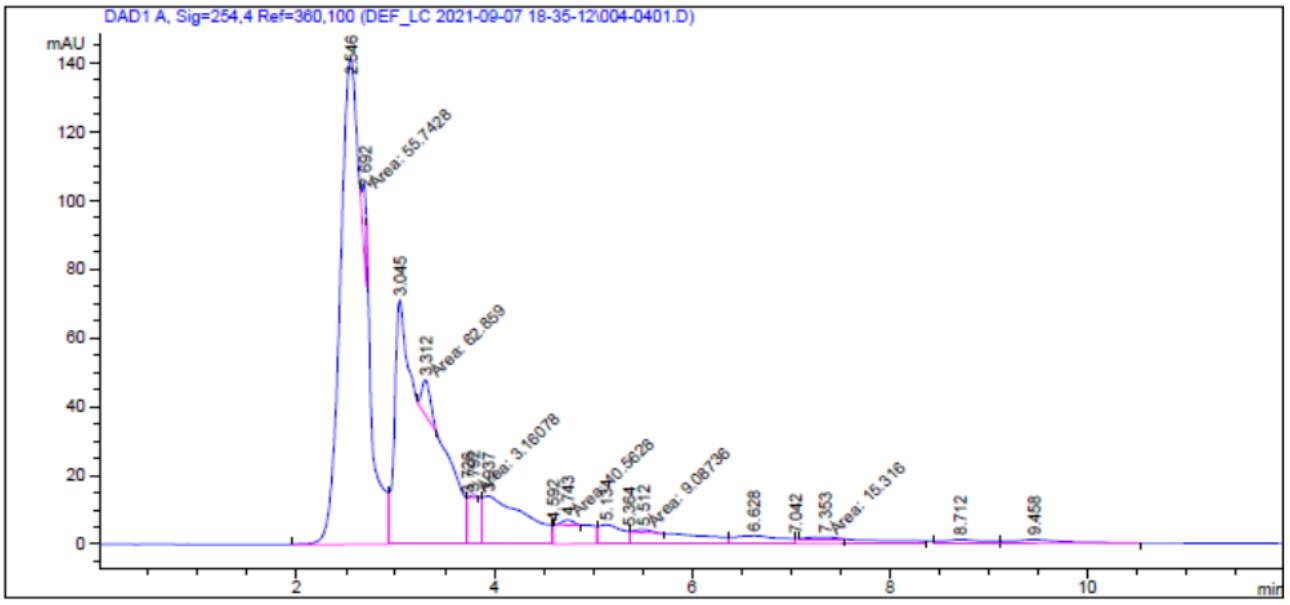


Fig. 5. Chromatogram of the substance of dry extract obtained by the second method

Table 1

Results of quantitative analysis on the method of high-performance liquid chromatography of flavonoids in the composition of of the substance of dry extract obtained in different ways

Flavonoids	Methods of research	
	The first method	The second method
	The average amount of the sum of flavonoids in the composition of dry extract substations is, (average mg/g)	
Apigenin	0.32	–
Luteolin	–	0.11
Rutin	1.21	0.7

The results of the conducted studies to determine the “acute” toxicity showed that when the dry extract “Helminth-ART” was administered at a dose of up to 30,00 mg/kg, there were no special changes in the behavior of animals and their death in the next 14 days. Calculating the average lethal dose of the dry extract proved impossible due to the absence of dead mice. It was found that in terms of acute toxicity, the dry extract “Helminth-ART”, when administered orally to mice, exceeds a dose of 3,000 mg/kg, which means it is almost non-toxic.

Scientific research has been carried out in studies to determine the cumulative properties of the dry extract "Helminth-ART". And it has been found to have no cumulative property [25].

The anthelmintic activity of the dry extract "Helminth-ART" was determined by the methods specified in the "Guidelines for the experimental (preclinical) study of new pharmacological substances" ed. Khabrieva R. U.

The results of studies of the anthelmintic activity of dry extract "Helminth-ART" showed that the drugs studied and dry extract have a certain anthelmintic effect when repeatedly introduced into the animal's body.

Thus, it was found that the intensity-effectiveness of the studied dry extract "Helminth-ART" in relation to H. nana was 74.9 %, they are almost equal in effectiveness. At the same time, their established anti-cestode activity significantly exceeded that of the comparison drugs – infusion of common tansy flowers (50.2 %), pumpkin seeds (56.8 %), and even the synthetic anti-cestode drug Phenasal (71.2 %) (Table 2).

The anti-nematodosis activity of the studied dry extract "Helminth-ART" significantly exceeded the indicators of its anticestodosis activity and amounted to 90.2 % for the dry extract in relation to A. tetraptera, which indicates its almost equal anthelmintic activity. The comparison drugs had a significantly less pronounced effect on the viability of A. tetraptera: infusion of tansy flowers – 68.6 %, pumpkin seeds – 76.9 %, synthetic anti-nematode drug Pyrantel – 80.1 % (Table 3).

Table 2

Anti-cestode activity of the studied dry extract "Helminth-ART" and comparison drugs ($M\pm m$; n=6)

Investigational drugs and dry extract	*Hymenolepis nana*	
	Number of parasites detected after autopsy	Intensity efficiency, IE (%)
The control group	24.3±1.9	–
Tanacetum Vulgare L., 80 mg/kg for 5 days	12.1±0.62	50.2
Pumpkin seeds, 20 mg/kg for 5 days	10.5±0.56	56.8
"Helminth-ART" dry extract, 50 mg/kg for 5 days	6.1±0.51*	74.9
Phenasal, 30 mg/kg 4 days	7.0±0.77*	71.2

*Note: * – Reliable for control at p<0.001.*

Table 3

Anti-nematode activity of the studied dry extract "Helminth-ART" and comparison drugs ($M\pm m$; n=6)

Investigational drugs and dry extract	*Aspiculuris tetraptera*	
	Number of parasites detected after autopsy	Intensity efficiency, IE (%)
The control group	53.8±6.0	–
Tanacetum Vulgare L., 80 mg/kg for 5 days	16.9±2.2	68.6
Pumpkin seeds, 20 mg/kg for 5 days	12.4±2.5	76.9
"Helminth-ART" dry extract, 50 mg/kg for 5 days	5.3±3.4*	90.2
Pyrantel, 15 mg/kg once	6.9±1.7*	80.1

*Note: * – reliable for control at p<0.001.*

The data obtained indicate that the tested dry extract "Helminth-ART" practically have an anthelmintic (anti-nematode and anti-cestode) effect. At the same time, the dry extract of Helminth-ART acts identically on the viability of the pathogens of these helminthiases. However, it should be emphasized that the anti-nematode activity of the dry extract "Helminth-ART" prevails over its anti-cestode activity and significantly exceeds the results obtained when using comparison drugs of both herbal and, most importantly, synthetic origin.

5. Discussion

To date, helminthiasis is very common. There are various synthetic drugs in the treatment of this disease. But, synthetic drugs with anti-helminth properties can seriously injure important organs of the body. For example, the liver organ and its activities. Therefore, we paid great attention to the use of medicinal plant raw materials in obtaining a dry extract against helminths. In this research work, aboveground part of wormwood bitter, pumpkin seed, tansy flowers and garlic were selected as raw materials. Raw materials of this medicinal plant are also used in folk medicine and official medicine as an anthelminthic agent. Biologically active substances in plant raw materials have an antiseptic effect, interfere with the life activity of parasites, paralyze their respiratory center, stimulate the release of digestive juices and damage parasites, accelerate the motor activity of the digestive tract and show the property of driving helminths [2]. A number of studies have been conducted to extract dry extract in various ways from selected plant raw materials and to identify biologically active substances contained in dry extract [7, 11, 15, 19]. Based on the results of the studies and experiments studied, the method of obtaining dry extract "Helminth-ART" from a mixture of dry extracts obtained separately from each of the selected plant raw materials was considered an optimal technology. This further strengthened the anti-helminth properties of our obtained product. Also, its pharmacological activity-properties against helminths-was studied. The studies studied the anti-helminthic properties of biologically active substances [21], pharmacological (anti-helminthic) properties of plant raw materials and products derived from them [6, 9, 10, 12, 14, 18]. But the pharmacological properties of dry extract, obtained on the basis of raw materials of our choice, against helminths, have not been studied. The developed technology of dry extract "Helminth-ART" and its pharmacological research work were carried out for the first time. And high results were obtained on the anti-helminth properties.

Practical relevance. The practical significance of this research work is aimed at providing the population with harmless and effective anti-helminth drugs. Also, such tasks as extensive study of medicinal plant raw ma-

terials, obtaining drug forms on their basis, preventing various helminthic diseases that occur during the vital activity of humans, restoring the activity of important members and positively influencing their motor activity prove the importance of this research work.

Research limitations. There have been restrictions that should be recognized in the conduct of this research work. The lack of clinical trials in the research work was one of the limitations.

Prospects for further research. Future research prospects will consist in the development of drug form technology and clinical trials from this dry extract "Helminth-ART". Also, the expansion of the range of drugs obtained on the basis of medicinal plant raw materials, which are harmless, effective and have anti-helminthic properties is a promising goal of this research work.

6. Conclusion

The optimal method of the technology of the DE "Gelmint-ART" was determined based on a comparison of two methods. The second method is optimal in terms of economy of extractants, high proportion of the DE released, their quality indicators, content of the biologically active substance luteolin.

The pronounced DE "Helmint-ART" anthelmintic effect and acceptable acute toxicity were established.

Experiments have been conducted on white male mice in determining the "acute" toxicity of dry extract "Helminth-ART". In experiments, it was found that it was almost non-toxic.

Experimental work has been carried out to determine the antiparasitic - anthelmintic (anti-cestode and anti-nematode) activity of this dry extract "Helminth-ART".

The data obtained indicate that the tested dry extract "Helminth-ART" practically have an anthelmintic (anti-nematode and anti-cestode) effect.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this article.

Funding

The study was performed without financial support.

Data availability

Data will be made available on reasonable request.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the current work.

References

1. Hotez, P. J., Brindley, P. J., Bethony, J. M., King, C. H., Pearce, E. J., Jacobson, J. (2008). Helminth infections: the great neglected tropical diseases. Journal of Clinical Investigation, 118 (4), 1311–1321. https://doi.org/10.1172/jci34261

2. Jourdan, P. M., Lamberton, P. H. L., Fenwick, A., Addiss, D. G. (2018). Soil-transmitted helminth infections. The Lancet, 391 (10117), 252–265. https://doi.org/10.1016/s0140-6736(17)31930-x

3. Yuldasheva, Sh. Kh. (2020). Razrabotka sostava y tekhnolohyy nastoiky na osnove pryrodnoho rastytelnoho sьria. Liky – liudyni. Suchasni problemy farmakoterapii i pryznachennia likarskykh zasobiv». Kharkiv: NFaU, 2, 645–646.

4. Akhmadova, G., Mirrakhimova, T., Ismoilova, G. (2024). High-quality analysis of dry extract of prickly artichoke raw material (Cynara Scolymus L.) cultivated in Uzbekistan. ScienceRise: Pharmaceutical Science, 4 (50), 60–66. https://doi.org/10.15587/2519-4852.2024.310826

5. Azizi, K., Shahidi-Hakak, F., Asgari, Q., Hatam, G. R., Fakoorziba, M. R., Miri, R., Moemenbellah-Fard, M. D. (2014). In vitro efficacy of ethanolic extract of Artemisia absinthium (Asteraceae) against Leishmania major L. using cell sensitivity and flow cytometry assays. Journal of Parasitic Diseases, 40 (3), 735–740. https://doi.org/10.1007/s12639-014-0569-5

6. Ali, S. I., Gopalakrishnan, B., Venkatesalu, V. (2018). Chicory (Cichorium intybus) and wormwood (Artemisia absinthium) extracts exhibit strong larvicidal activity against mosquito vectors of malaria, dengue fever, and filariasis. Parasitology International, 67 (6), 781–786. https://doi.org/10.1016/j.parint.2018.08.005

7. Ahamad, J., Naquvi, K., Ali, M., Mir, S. (2014). New Glycoside Esters from the Aerial Parts of Artemisia absinthium Linn. The Natural Products Journal, 3 (4), 260–267. https://doi.org/10.2174/2210315503041403281135 18

8. Fernández-Calienes Valdés, A., Mendiola Martínez, J., Scull Lizama, R., Vermeersch, M., Cos, P., Maes, L. (2008). In vitro anti-microbial activity of the Cuban medicinal plants Simarouba glauca DC, Melaleuca leucadendron L and Artemisia absinthium L. Memórias Do Instituto Oswaldo Cruz, 103 (6), 615–618. https://doi.org/10.1590/s0074-02762008000600019

9. Rocha, L. G., Almeida, J. R. G. S., Macêdo, R. O., Barbosa-Filho, J. M. (2005). A review of natural products with antileishmanial activity. Phytomedicine, 12 (6-7), 514–535. https://doi.org/10.1016/j.phymed.2003.10.006

10. Tariku, Y., Hymete, A., Hailu, A., Rohloff, J. (2011). In vitro Evaluation of Antileishmanial Activity and Toxicity of Essential Oils of Artemisia absinthium and Echinops kebericho. Chemistry & Biodiversity, 8 (4), 614–623. https://doi.org/10.1002/cbdv.201000331

11. Sushynskaia, O. A., Holiak, N. S. (2023). Technology of Obtaining Liquid Extract of Wormwood and Determination of its Quality Indicators. Recipe, 26 (4), 474–483. https://doi.org/10.34883/pi.2023.26.4.008

12. Salehi, B., Capanoglu, E., Adrar, N., Catalkaya, G., Shaheen, S., Jaffer, M. et al. (2019). Cucurbits Plants: A Key Emphasis to Its Pharmacological Potential. Molecules, 24 (10), 1854. https://doi.org/10.3390/molecules24101854

13. Iuldasheva, Sh. Kh. (2019). Tekhnologiia i otcenka kachestva slozhnoi nastoiki na osnove travy polyni gorkoi i semian tykvy. Nauka i obrazovanie v sovremennom mire. Karaganda: Akademiia "Bolashak". Bolashak Basgy, 144–146.

14. Godinho, L. S., Aleixo de Carvalho, L. S., Barbosa de Castro, C. C., Dias, M. M., Pinto, P. de F., Crotti, A. E. M. et al. (2014). Anthelmintic Activity of Crude Extract and Essential Oil ofTanacetum vulgare(Asteraceae) against Adult Worms ofSchistosoma mansoni. The Scientific World Journal, 2014, 1–9. https://doi.org/10.1155/2014/460342

15. Iuldasheva, Sh. Kh., Tykhtaev, Kh. R. (2021). Dastarbosh gullaridan kuruk ekstrakt olishning mytadil usullarini yrganish va uning sifat taxlili. Farmatcevtika zhurnali, 3, 75–84.

16. Zolotaikina, M. Yu., Hontova, T. M., Kotov, A. H., Ilyina, T. V., Kryvoruchko, O. V. (2017). Study of dry extract of tansy (Tanacetum vulgare) using the method of highperformance liquid chromatography. Der Pharma Chemica, 9 (11), 1–4.

17. Oosthuizen, C. B., Reid, A.-M., Lall, N. (2018). Garlic (Allium sativum) and Its Associated Molecules, as Medicine. Medicinal Plants for Holistic Health and Well-Being, 277–295. https://doi.org/10.1016/b978-0-12-812475-8.00009-3

18. Urban, J., Kokoska, L., Langrova, I., Matejkova, J. (2008). In VitroAnthelmintic Effects of Medicinal Plants Used in Czech Republic. Pharmaceutical Biology, 46 (10-11), 808–813. https://doi.org/10.1080/13880200802315618

19. Iuldasheva, Sh. Kh., Tykhtaev, Kh. R. (2022). Artemisia absinthium ysimlik khomashesidan kuruk ekstrakt olish tekhnologiiasi va sifat taxlili. Farmatcevtika khabarnomasi, 1, 45–51.

20. Iuldasheva, Sh. Kh., Tykhtaev, Kh. R., Sotimov, G. B. (2022). Gelmintga karshi dori vositasi tarkibiga kiruvchi kovok ururi kuruk ekstrakti mytadil tekhnologiiasini yrganish. Farmatcevtika zhurnali, 1, 113–118.

21. Klongsiriwet, C., Quijada, J., Williams, A. R., Mueller-Harvey, I., Williamson, E. M., Hoste, H. (2015). Synergistic inhibition of Haemonchus contortus exsheathment by flavonoid monomers and condensed tannins. International Journal for Parasitology: Drugs and Drug Resistance, 5 (3), 127–134. https://doi.org/10.1016/j.ijpddr.2015.06.001

22. Yuldasheva, Sh. X., Tuxtaev, X. R. (2024). Studying the Technology of Obtaining a Mixture of Dry Extracts Against Helminths. Central Asian Journal of Medical and Natural Science, 5 (3), 570–575.

23. Islamova, J. I. (2020). Pharmacological assessment of antiparasitic and prebiotic activity of plant substances of terpenoid, polyphenolic and carbohydrate nature. [Dissertation abstract of the doctor of sciences (DSc) on medical sciences].

24. State Register of medicines and medical devices and medical equipment, approved for use in medical practice of the Republic of Uzbekistan (2021). Tashkent: «MUXR PRESS», 1067.

25. Yuldasheva, Sh. X., Tuxtaev, X. R. (2024). Studies on the determination of the cumulative properties of the dry extract "Helminth-ART". European Journal of Medical Genetics and Clinical Biology, 1 (7). https://doi.org/10.61796/jmgcb.v1i7.696

Received 06.03.2025
Received in revised form 15.04.2025
Accepted 23.04.2025
Published 30.04.2025

Shaxlo Yuldasheva*, PhD, Department of Technology of Medicinal Forms, Tashkent Pharmaceutical Institute, Oybek str.,45, Tashkent, Uzbekistan, 100015

Khakim Tukhtaev, Doctor of Pharmaceutical Sciences, Professor, Department of Inorganic, Physical and Colloidal Chemistry, Tashkent Pharmaceutical Institute, Oybek str.,45, Tashkent, Uzbekistan, 100015

***Corresponding author:** Shaxlo Yuldasheva, e-mail: shaxlo.dr@gmail.com*