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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

RESERVES AND PERSPECTIVES OF USE OF USEFUL PLANTS OF THE FAMILY *ASTERACEAE* DUMORT IN SHAMAKHI AND ISMAYILLI DISTRICTS

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INTRODUCTION

Relevance and degree of development of the topic. The necessity to meet the natural needs of the rapidly growing population in modern times, including to ensure food and medicine security, as well as to adequately meet the demand for plant raw materials in other vital areas necessitated more extensive use of natural biological resources. At the same time, in many cases, biological resources, especially plant resources, are used unplanned and wastefully, and nature protection and environmental issues are not given enough attention in various urban planning and infrastructure objects construction. As a result of such an approach to the plant world, narrowing of the habitats of most useful plant species, facing of many species with serious environmental threats, their extinction, and ultimately the decline of plant biodiversity is already reaching a critical level. Recently observed climate change and global warming have been added to the list of factors that exacerbate these processes.

The current situation and the fact that nature, which is the source of life on Earth, is exposed to such threats, caused serious concern of the world community, and this concern is reflected in the Convention on "Biological Diversity" adopted by the UN in 1992.[1] Azerbaijan, which has always been active in all areas of international cooperation, joined the Convention in 2000.

Taking into account the importance of the issues specified in the Convention for our country and on the agenda, in 2006 and 2015 "The National Strategy and Action Plan on conservation and sustainable use of biodiversity in the Republic of Azerbaijan" were prepared and approved by Presidential Decrees.[2]

In these Action Plans, the protection of biodiversity in our country and the discovery of new sources of resources and their inclusion in the

[1] Azərbaycan Respublikasında bioloji müxtəlifliyin qorunması və davamlı istifadəsinə dair Milli Strategiya və Fəaliyyət Planı. Azərbaycan Respublikası Prezidentinin 2006-cı il 24 mart və 14 fevral 2015 il tarixli Sərəncamı ilə təsdiq edilmişdir.

[2] Конвенция о биологическом разнообразии. Принята на Конференции ООН. 12.06.1992 г. Рио-де-Жанейро.

economic activity cycle were assessed as an important problem and widely commented on, among other issues, the importance of strengthening and expanding the scientific and organizational basis of the efficient use of biological resources was emphasized

In connection with the shown, in terms of the need for a comprehensive study of plant biodiversity in Azerbaijan and the discovery of new sources of raw materials of economic importance, study of resources and perspectives of efficient use of useful plant species belonging to the *Asteraceae* family, which is widespread in Shamakhi-Ismayilli districts, the richest regions of the country due to plant biodiversity are an integral part of the tasks set by the state and a scientific topic of actual and practical importance.

Aims and objectives of the research. The main purpose of the research was to study the distribution area, phytocoenotic properties and raw material reserves of some useful plant species belonging to the family *Asteraceae* distributed in Shamakhi and Ismayilli districts as well as the chemical composition, antimicrobial and antifungal effects of their fatty oils.

In this regard, the following tasks have been set:

- Distribution of some useful plants belonging to the family *Asteraceae* in Shamakhi and Ismayilli districts, study of their place and role in plant communities;
- Determining the raw material reserves of the most common species;
- Obtaining fatty oils of some species and studying their component composition;
- Studying the activity of extracts obtained from plants against some microbes and fungi.

The main provisions of the dissertation defence:

- Taxonomic, biomorphological and ecological analysis of useful plants of 92 taxa (83 species and 9 subspecies) united in 56 genera of *Asteraceae* family widespread in Shamakhi and Ismayilli districts;
- Identification of new habitats for two species (*Chondrilla juncea* L. and *Inula oculus-christi* L.);
- Study of biological and operational resources of 18 species

considered to be useful, development of GIS maps and resource assessments provide a basis for their use as a raw material base;

- Fatty oils obtained from plants are promising as medicinal and nutritional supplements;
- The antibacterial and antifungal activity of some species can be used to make new drugs.

Scientific novelty of the research. For the first time, useful plants belonging to the Asteraceae family, distributed in Shamakhi and Ismayilli districts, were studied as a single community, their nomenclature and taxonomic composition were compiled, representation by 56 genera and 92 taxa (83 species and 9 subspecies) were determined and new distribution areas for two species (*Chondrilla juncea* and *Inula oculus-christi*) were found.

Taking into account forming of formations by some species(*Silybum marianum* (L.) Gaertn., *Tussilago farfara* L., *Carthamus lanatus* L., *Xeranthemum cylindraceum* Sm. and etc.), active participation of others (*Achillea nobilis* L., *Artemisia absinthium* L., *Inula aspera* Poir., *Pulicaria arabica* subsp. *hispanica* (Boiss.) Murb. and etc.) in the formation of associations, biological and operational reserves of 18 species as useful raw materials were identified, supply opportunities were assessed, GIS maps of more localization sites were compiled.

Fatty oils were extracted from the seeds of the plants *Silybum marianum*, *Arctium lappa*, *Carthamus lanatus* and *Xeranthemum cylindraceum.* It was found that they contain important linolic, oleic, palmitic, stearic, linolenic acids and other compounds.

The effect of water extracts of different parts of the plants *Arctium lappa, Xeranthemum cylindraceum, Chondrilla juncea, Echinops sphaerocephalus* and *Pulicaria arabica* subsp. *hispanica* against a number of microbes and fungi was studied, they were found to have high antibacterial and antifungal activity.

Theoretical and practical significance of the research: The information obtained as a result of studies of plants of the *Asteraceae* family, widespread in the Shamakhi and Ismayilli districts, can be used in the new edition of "Flora of Azerbaijan", as well as in the development of various fundamental scientific works on useful plants

of Azerbaijan, as well as as a tool in planning measures for the conservation and sustainable use of plant biodiversity. GIS maps of localization areas of 18 most common species, as well as information on their operational reserves and supply opportunities, can be practical tools for organizations and entrepreneurs engaged in the supply of useful raw materials of plant origin.

Recommendations for production: The plants studied can be used as a source of raw materials for the obtaining unsaturated fatty acids ω-2, ω-3, ω-6 and ω-9, which are very important for the human body, and for the preparation of food, food supplements and medicinal forms. The high antibacterial and antifungal activity of some studied species can be used as the main source of information for the development of new herbal medicines of plant origin. In addition, it can play an important role in the confectionery, canning, cosmetics industry and as a feed base in livestock.

Approbation and application: The main points of the dissertation work were highlighted at local and international conferences: the IV International Scientific Conference of Young Researchers dedicated to the 93rd anniversary of the national leader of the Azerbaijani people Heydar Aliyev (Baku, Qafqaz University, 2016), International Scientific Conference "Actual Problems of Modern Chemistry and Biology" (Ganja, 2016), the scientific conference "New Challenges in Botanical Research" dedicated to the 90th anniversary of acad. Vahid Hajiyev (Baku, 2018), Interuniversity International Congress "Higher School: Scientific Research" (Moscow, 2021).

Publication: 14 scientific works containing the main provisions of the dissertation were published, of which 10 are articles and 4 are conference materials.

Volume and structure of the dissertation: The dissertation consists of one hundred and eighty-six thousand six hundred and forty-seven characters, including introduction, 7 chapters, results, recommendations (introduction - 8070, Chapter I 34259, Chapter II 14287, Chapter III 10291, Chapter IV 14649, Chapter V 50577, Chapter VI 34696 , Chapter VII consists of 16348, results - 2368, recommendations 1102 characters). The list of cited literature covers

303 titles, of which 156 or 52% cover the last 10 years. The dissertation is illustrated with 27 tables, 48 figures, 9 maps, 1 scheme and 4 appendices.

CHAPTER I
LITERATURE REVIEW

This chapter provides an analysis of the literature data on the useful properties and use of species belonging to the family *Asteraceae* distributed in the study region.

CHAPTER II
NATURAL-GEOGRAPHICAL CONDITIONS OF SHAMAKHI-ISMAILLI DISTRICT

This chapter contains information about the relief, climate, soil and vegetation of the Shamakhi and Ismayilli districts.

CHAPTER III
MATERIALS AND METHODS OF RESEARCH

3.1. Research material

The object of research was useful plant species belonging to the family *Asteraceae,* which are widespread in Shamakhi and Ismayilli districts.

The dissertation work was carried out in the field and laboratory conditions in 2013-2020.

3.2. Research routes

During the botanical researches, routes were selected in order to determine distribution areas of useful plants in the studied areas. Field research was conducted with 7 routes on Shamakhi districts and with 5 routes on Ismayilli region with a total of 12 routes (in Shamakhi - Angikharan, Melhem, Chukhuryurd, Gizmeydan, etc., in Ismayilli - Gushenja, Zogalli, Shukurchu, Yenikend etc).

3.3. Methods of botanical research

The followings are taken as a basis when selecting routes in order to determine the distribution areas of useful plants in the studied areas:

- Materials of the Herbarium Fund of the Institute of Botany of ANAS;
- The main landscape features of the study areas characteristic forest, meadow, mountain slopes, etc. massifs and areas selection);
- Visual observation that the studied species have sufficient reserves in the study routes.

Field works were carried out on the basis of generally accepted route-recognostic methods in geobotanical research.[3]

Abundance of studied plants (on a five-point scale), projective cover and layerage in the area of grass were noted. In the description of phytocoenoses, formations and associations, B.M.Mirkin's[4] works were taken as a basis.

The sample field method was used to discover the areas where species are most common and to assess their needs.[5] [6]

Reserves of plants were studied in accordance with the rules of their collection in specific massifs and sample sites and the rules of statistical processing of materials.

The followings were used in the determination of species: "Flora of Azerbaijan"[7] "Flora of the Caucasus"[8] "Plant life of

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[3] Ипатов, В. Геоботаника / В.Ипатов, Л.Карикова, Д.Мирин − Санкт-Петербург: Издательский дом Санкт-Петербургского государственного университета, − 2010. − 252 с.

[4] Миркин, Б.М. Современная наука о растительности. / Б.М.Миркин, Л.Г.Наумова, −Москва: Логос, − 2001. − 264 с.

[5] Методика определения запасов лекарственных растений / Под ред. проф. Л.Е. Михайлов, А.Г. Сорокин. Москва: Медицинской и микробиологической промышленности, − 1986. - 50 с.

[6] Ресурсоведение лекарственных растений: (учебно-методическое пособие для вузов) / Под ред. проф. В.В. Негробов – Воронеж: «ВГУ» –2015. – 57 с.

[7] Флора Азербайджана: [в 8 томах]. – Баку: Издательство Академии наук Азербайджанской ССР, − т. 8. – 1961. − 689 с.

[8] Гроссгейм, А.А. Флора Кавказа: [в ххх томах] / А.А. Гроссгейм. – Баку: Наука, − т. 4. – 1934. −342 с.

Azerbaijan",[9] "Conspect of the flora of the Caucasus"[10] "World flora online"[11] and "Euro+med plant"[12] bases.

3.4. Methods of chemical study

Fatty oils of some species which are more widespread and with important therapeutic properties (*Silybum marianum, Carthamus lanatus, Arctium lappa* and *Xeranthemum cylindraceum*) have been studied.

In the study of the chemical composition of the oil, "HP" 6890 series gas chromatograph with flame ionization detector and gas-liquid chromatography method was applied.

The sample was prepared in accordance with State Standard 31663-2012 (GOST)[13].

The composition of the component was calculated by gas-chromatography method without taking into account the sensitivity coefficients.

The standard "Supelco 37 Component FAME Mix" method was used to determine the methyl esters of fatty acids. Physicochemical and organoleptic properties of the oil were determined by standard methods.

The approved GOSTs were used to determine the quality and suitability of the oil (GOST 31663-2012, GOST R 50457-92, GOST R 51487-99, GOST 5475-69, GOST 5478-2014, GOST 5477-2015, GOST 5472-50, GOST R 52676-2006).

3.5. Methods of biological research

The antimicrobial activity of some studied species was studied

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[9] Əsgərov, A. Azərbaycanın bitki aləmi (Ali bitkilər - Embryophyta)/ A.Əsgərov. − Bakı: TEAS Press nəşriyyat evi, − 2016. − 444 s.

[10] Конспект Флоры Кавказа: [в 3 томах]. − Санк-Петербург: Издательство КМК, − Т. 3 (1). – 2008. – 469 с.

[11] An online flora of all known plants / 2012: http:// www. Worldfloraonline.org.

[12] The information resource for Euro-Mediterraneae plant diversity / Euro+Med Plant Base, 10 March 2011: https://www.emplantbase.org/home.htm.

[13] ГОСТ 31663-2012 «Масла растительные и жиры животные. Определение методом газовой хроматографии массовой доли метиловых эфиров жырных кислот»

together with the staff of the Department of "Medical Microbiology and Immunology" of AMU, and the antifungal properties together with the staff of the laboratory "Microbial enzymes" of the Institute of Microbiology of ANAS.

The antimicrobial activity of extracts obtained from the flowers of plants *Arctium lappa* and *Xeranthemum cylindraceum* was studied by disk-diffusion method.[14][15] The laboratory strains of *Escherichia coli*, a gram-negative bacterium representatives that enters the normal microflora of the human body as a test culture and is considered a opportunistic, *Pseudomonas aeruginosa*, which has high natural resistance to antibiotics, *Klebsiella pneumoniae* which has capsule, *Staphylococcus aureus* which is the gram-positive bacteria representatives, as well as *Candida albicans*, considered one of the opportunistic mycosis pathogens were used.

The antifungal properties of extracts obtained from the plants such as *Pulicaria arabica subsp. hispanica*, *Chondrilla juncea* and *Echinops sphaerocephalus* were studied in 2 stages according[16] to the generally accepted methodology: development of fungus cultures in solid nutrient medium and growth in liquid nutrient medium with aqueous extract.

CHAPTER IV
TAXONOMIC, BIOMORPHOLOGICAL AND ECOLOGICAL ANALYSIS OF USEFUL PLANTS DISTRIBUTED IN SHAMAKHI AND ISMAILLI DISTRICTS

4.1. Taxonomic analysis of useful plants

As a result of taxonomic analysis of useful plants belonging to the family *Asteraceae,* it was determined: they are represented by 50

[14]Bauer, A.W. Antibiotic susceptibility testing by a standardized single disk method / A.W. Bauer, W.M. Kirby, J.C. Sherris [et al.] // American Journal of Clinical, −1966. v.45, №4, p. 493-496.

[15] Федорова, Ю.С. Сравнительная оценка антибактериальной активности фитопрепаратов из некоторых видов растений рода Hedysarum // − Самара:Фармацевтические науки, − 2011. № 3, − с. 210-214.

[16] Методические указания к занятиям спецпрактикума по разделу «Микология» / − Минск: Белорусский государственный университет, − 2004. – 36 с.

genera and 92 species according to the "Flora of Azerbaijan", 51 genera and 91 species in "Plant Life of Azerbaijan", 52 genera and 90 species in "Conspectus of Flora of Caucasus", 55 genera and 91 taxa (83 species, 8 subspecies) according to the "World Flora Online" classification system, 56 genera and 92 taxa (83 species, 9 subspecies) in "Euro+med plant" ("E+M") classification system.

4.2. Life forms and ecological groups of plants

Of the 92 species included in the *Asteraceae* family distributed in the Shamakhi and Ismayilli districts, 66 species (72%) are perennials (*Senecio leucanthemifolius* subsp. *vernalis* (Waldst. & Kit.), *Solidago virgaurea* L., *Caucasalia macrophylla* (M. Bieb.) B. Nord., *Tanacetum leptophyllum* (M. Bieb.) Sch. Bip.,*Mycelis muralis* (L.) Gaertn., *Jurinea arachnoidea* Bunge., *Inula helenium* L. *Echinops pungens* Trautv., *Achillea arabica* Kotschy, *Antennaria caucasica* Boriss., *Aster alpinus* L., *Kemulariella rosea* (Steven) Tamamsch. etc.), 18 species (19%) are annuals (*Lapsana communis* L., *Picnomon acarna* (L.) Cass., *Rhagadiolus edulis* Gaertn., *Sonchus asper* (L.) Hill. and etc.) and 8 species (9%) are biennials (*Arctium lappa* L., *Carlina vulgaris* L., *Cirsium echinus* (M. Bieb.) Hand.-Mazz., *C. vulgare* (Savi) Ten., *Cousinia macrocephala* C. A. Mey., *Lactuca serriola* L., *Onopordum acanthium* L. and *Silybum marianum* (L.) Gaertn.) (Figure 1).

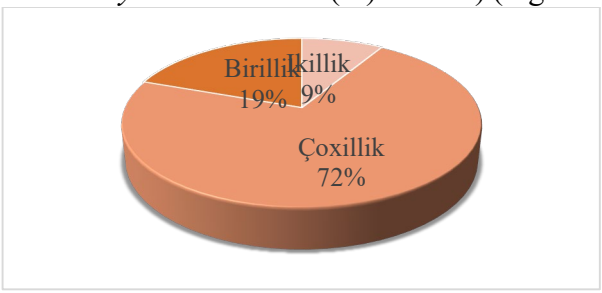


Figure 1 Distribution of useful plants according to life forms

According to the growing conditions, the studied species belong to the following ecological groups: xeromesophyte (31%), mesoxerophyte (28%), xerophyte (24%), mesophyte (12%), hygromesophyte (3%), haloxerophyte and halomesoxerophyte (1%

each).

The analysis of the distributions of the 92 taxa by zones in the areas of the studied regions was carried out and as a result it was determined that 38 (14%) of them are distributed in the lowland, 39 (14%) - in the foothills, 52 (19%) - in the lower mountain belt, 63 (23%) - in the mid-mountain belt, 27 (10%) - in the upper mountain belt, 43 (16%) - in the subalpine belt, 11 (4%) - in the alpine belt.

CHAPTER V
STUDY OF PHYTOCENOLOGICAL PROPERTIES AND RESERVES OF SOME USEFUL PLANTS OF THE FAMILY *ASTERACEAE* DISTRIBUTED IN SHAMAKHI AND ISMAILLI DISTRICTS

As the reserves were not studied in the study areas, the reserves of 18 species (*Arctium lappa* L., *Artemisia absinthium* L., *Carthamus lanatus* L., *Cichorium intybus* L., *Inula helenium* L., *Klasea quinquefolia* (Willd.) Greuter & Wagenitz etc.) belonging to 14 genera of the family *Asteraceae*, which are considered to be the most common and useful, were studied.[17][18] Eight of these species are ofsinal medicinal plants (*Achillea millefolium, Arctium lappa*, *Artemisia absinthium*, *Cichorium intybus*, *Echinops sphaerocephalus*, *Inula helenium*, *Silybum marianum*, *Tussilago farfara*). Due to the fact that the reserves were not studied in the studied regions, both surface and underground reserves and phytocenotic features of these species were studied in the framework of the study (Table 5.1).

[17] Qasımova, Ş.Ə., Mehdiyeva, N.P. Şamaxı rayonunda yayılan *Arctium lappa* L. növünün fitosenotik xüsusiyyətləri və ehtiyyatı // − Bakı: Azərbaycan Milli Elmlər Akademiyasının Botanika İnistitutunun elmi əsərləri, − 2015. № 35, − s. 92-95.

[18] Qasımova, Ş.Ə. Şamaxı və İsmayıllı rayonlarında yayılan *Cichorium intybus* L. və *Inula helenium* L. növlərinin arealı və ehtiyatı // − Bakı: Azərbaycan Milli Elmlər Akademiyasının Botanika İnistitutunun elmi əsərləri, − 2016. № 36, − s. 77-83.

Table 1

Raw material reserves of some useful plants of *Asteraceae* family widespread in Shamakhi and Ismayilli districts

Name of the species	District	Occupied area (ha)	Number of individuals in 1m² or * 10m²	The average dry mass of the surface (or underground) part of an individual (gr)	Productivity (dry raw materials) t/ha	Raw material reserves (t)		Annual supply capacity, (t)
						biological	exploitation	
1	2	3	4	5	6	7	8	9
Achillea filipendulina	Shamakhi	24	20,7±1,4	36,7±0,5	7,6±0,5	179,2±12,3	154,6	30,9
	Ismayilli	29	17,8±1,7	39,6±0,5	7,0±0,7	202,1±19	164,1	32,8
Achillea millefolium	Shamakhi	11	17,9±2,5	18,1±0,4	3,7±0,5	40,8±5,4	30,0	6,1
	Ismayilli	13	18,5±2,5	22,4±0,4	4,2±0,6	55,4±7,4	40,6	8,0
Achillea nobilis	Shamakhi	19	17,0±1,9	20,3±0,3	3,5±0,4	66,5±7,3	51,9	10,4
	Ismayilli	19	17,9±1,7	20,0±0,3	3,6±0,3	69,6±6,8	56	11,1
**Arctium lappa*	Shamakhi	13	15,6±1,7	93,8±2,1	1,5±0,2	18,9±2,1	14,7	7,4
	Ismayilli	10	17,9±1,8	179,6±2,9	3,2±0,3	32,4±3,2	26	13
Artemisia absinthium	Shamakhi	16	18,5±2,2	34,8±0,5	6,4±0,8	101,9±12	77,9	15,6
	Ismayilli	20	19,3±1,8	35,6±0,6	6,9±0,6	136,8±12,9	111	37,9

Followed by Table 5.1

1	2	3	4	5	6	7	8	9
Carthamus lanatus	Shamakhi	22	18,4±1,7	50,7±0,8	9,3±0,9	211±19,0	173	86,5
	Ismayilli	18	19,1±1,7	44,7±0,5	8,5±0,7	155,3±13,8	127,7	63,9
Chondrilla juncea	Shamakhi	15	18,9±2,7	31,7±0,6	6,0±0,8	91±12,7	65,6	13,1
	Ismayilli	33	19,2±2,3	29,6±0,5	5,7±0,7	187,2±23,5	140,2	28,0
Cichorium intybus	Shamakhi	12	12,1±1,7	24,1±0,6	2,9±0,4	37,4±4,9	27,6	5,6
	Ismayilli	10	11,6±1,4	21,7±0,6	2,5±0,3	24,8±2,7	19,4	4,0
Cichorium intybus (**underground)**	Shamakhi	12	12,1±1,7	18,9±0,4	2,3±0,3	28,6±4,0	20,6	4,1
	Ismayilli	10	11,6±1,4	19,2±0,5	2,2±0,3	22,1±2,6	16,9	3,4
**Echinops sphaeocephalus*	Shamakhi	15	17,3±1,7	57,2±0,6	1,0±0,1	14,7±1,5	11,7	2,3
	Ismayilli	15	16,7±1,6	57,6±0,6	1,0±0,1	14,2±1,4	11,4	2,3
Inula aspera	Shamakhi	19	18,2±2,3	18,5±0,5	3,4±0,4	64,4±8,3	47,8	9,6
	Ismayilli	13	17,7±2,1	19,0±0,4	3,4±0,4	43,5±5,2	33,1	6,5
Inula germanica	Shamakhi	15	17,0±2,4	18,0±0,4	3,1±0,4	46,5±6,5	33,5	6,6
	Ismayilli	9	16,9±1,6	16,7±0,3	2,8±0,3	25,3±2,5	20,3	4,1
**Inula helenium*	Shamakhi	18	11,4±1,4	175,2±3,4	2,0±0,2	36,2±4,2	27,8	5,5
	Ismayilli	16	9,2±1,1	289,3±5,8	2,7±0,3	43,9±5,1	34,9	7,1
Inula helenium* **(underground)	Shamakhi	18	11,4±1,4	155,5±2,9	1,8±0,2	32,6±3,6	25,4	5,2
	Ismayilli	16	9,2±1,1	256,9±4,3	2,4±0,3	38,9±4,5	29,9	5,9

Followed by Table 5.1

1	2	3	4	5	6	7	8	9
Pulicaria arabica subsp. hispanica	Shamakhi	28	16,8±1,6	18,8±0,3	3,1±0,3	93,9±8,4	76,5	15,4
	Ismayilli	30	16,9±1,5	17,2±0,3	2,9±0,3	87,9±7,9	72,1	14,4
Klasea quienquefolia	Shamakhi	4	11,9±1,6	33,9±0,7	4,0±0,5	16,1±2,0	12,1	2,4
	Ismayilli	4	14,1±2,0	33,1±0,6	4,7±0,7	18,7±2,7	13,3	2,7
**Silybum marianum*	Shamakhi	25	18,7±1,7	198,6±3,1	3,9±0,3	102±8,4	85,2	42,7
	Ismayilli	18	20,2±1,8	178,5±5,6	3,6±0,3	65,3±6,1	53,1	26,7
Sonchus asper	Shamakhi	20	14,1±1,9	22,6±0,5	3,2±0,4	64,7±9,2	46,3	23,2
	Ismayilli	7	13,2±2,0	25,0±1,1	3,3±0,5	23,8±3,7	16,4	8,2
Tussilago farfara	Shamakhi	27	20,1±2,3	20,1±0,3	4,0±0,5	108,3±12,6	83,1	16,6
	Ismayilli	23	19,8±2,2	19,6±0,3	3,9±0,4	88,9±9,9	69,1	13,8
Tussilago farfara **(underground)**	Shamakhi	27	20,1±2,3	33,0±0,5	6,6±0,8	178,4±20,7	137,3	27,5
	Ismayilli	23	19,8±2,2	30,9±0,5	6,1±0,7	140±15,5	109	21,8
Xeranthemum cylindraceum	Shamakhi	19	17,2±2,1	3,2±0,1	0,6±0,07	12,2±1,4	9,3	4,7
	Ismayilli	10	18,9±2,1	2,8±0,2	0,5±0,07	5,1±0,8	3,5	1,8

Depending on the operational reserve, the studied useful plants are conventionally divided into 5 groups:

1. Over 300 tons – 3 species (*Achillea filipendulina, Carthamus lanatus* and *Tussilago farfara*)

2. From 200 to 300 tons – 1 species (*Chondrilla juncea*)

3. From 100 to 200 tons – 5 species (*Achillea nobilis, Artemisia absinthium, Inula helenium, Pulicaria arabica subsp. hispanica* and *Silybum marianum*)

4. From 50 to 100 tons – 5 species (*Achillea millefolium, Cichorium intybus, Inula aspera, Inula germanica* and *Sonchus asper*)

5. Up to 50 tons – total 4 species (*Arctium lappa, Echinops sphaeocephalus, Klasea quienquefolia* and *Xeranthemum cylindraceum*).

Below are the villages where the surface operational reserves of 18 species and of underground operational reserves of 3 species are high: Shamakhi district – Malham (*Achillea filipendulina* in 8 ha 52,1t, *Pulicaria arabica* subsp. *hispanica* in 15 ha, 47,4 t, *Xeranthemum cylindraceum* in 5 ha 4,4 t), Angikharan (*Carthamus lanatus* in 10 ha 89,6 t), Madrasa (*Chondrilla juncea* in 7 ha 32,1 t), Avakhil (*Inula aspera* in 4 ha 12,6 t), Sagiyan (*Inula germanica* in 5 ha 12,7 t), Goylar (*Silybum marianum* in 9 ha 36,9 t), Chukhuryurd (*Sonchus asper* 5 in ha 13,2 t, *Cichorium intybus* 3 in ha 8,3 t (surface) and 7 t (underground)), Nagarakhana (*Inula helenium* in 5 ha11,5 t (surface) and 11 t (underground)), Ismayilli district – Talistan (*Achillea millefolium* in 4 ha 14,2 t), Zargalan (*Achillea nobilis* in 9 ha 26,1 t), Topchu (*Arctium lappa* in 3 ha 9,9 t), Ivanovka (*Artemisia absinthium* in 11 ha 58,8 t), Gurbanafandi (*Echinops sphaeocephalus* in 9 ha 6,6 t) Basgal (*Klasea quinquefolia* in 4 ha 13,3 t) and Gushanja (*Tussilago farfara* in 8 ha 22,8 t (surface) and 36,2 t (underground)).

GIS maps have been compiled based on the GPS coordinates of 18 species we have studied. As an example, Figure 2 shows a map of the areas where the species *Achillea filipendulina* Lam.*, Achillea nobilis* L.*, Inula germanica* L. and *Sonchus asper* L. have the greatest reserves in Shamakhi and Ismayilli districts.

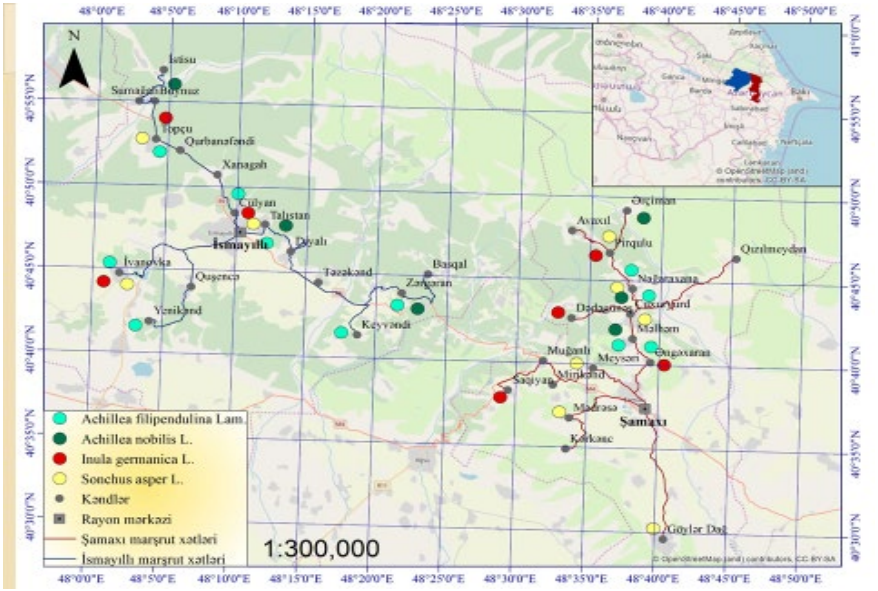


Figure 2 Map of the most common areas of the species *Achillea filipendulina* Lam., *Achillea nobilis* L., *Inula germanica* L. and *Sonchus asper* L. in Shamakhi and Ismayilli districts

As a result of the research, new distriution areas of the species *Chondrilla juncea* and *Inula oculus- christi* were determined.

Among the studied species 4 formations (Silybumeta, Tussilagoeta, Carthamuseta and Xeranthemumeta) and 39 associations (*Achillea filipendulina+Campanula bononiensis+ Cephalaria gigantea, Achillea millefolium+Rumex confertus-Plantago lanceolata, Artemisia absinthium+Tripleurospermum inodorum, Carthamus lanatus+Echinops sphaeocephalus, Chondrilla juncea+ Erigeron canadensis+Anthemis cotula, Inula aspera+ Medicago coerules+Salvia verticillata, Inula helenium+Verbascum thapsus, Xeranthemum cylindraceum+Origanum vulgare, Pulicaria arabica subsp. hispanica +Equisetum arvense +Mentha longifolia* etc.) are formed.

CHAPTER VI
STUDY OF FATTY OILS OF SOME SPECIES OF *ASTERACEAE* FAMILY

Fatty oils are widely used in various areas of daily life. They are used as a food product, in culinary, canning, baking and confectionery industries, in the production of margarine, as well as in the alif, dye, soap manufacture and perfume industries, as well as as a medicinal component in the treatment of various diseases and as a main and auxiliary raw material in other fields.

Fatty oils and component composition of some species (*Arctium lappa, Silybum marianum, Carthamus lanatus* and *Xeranthemum cylindraceum*), which are more widespread in Shamakhi and Ismayilli districts, seeds are easily collected and have large reserves, were studied

6.1. Study of the component composition of the fatty oil of the plant *Silybum marianum*

In order to obtain oil of the plant *S. marianum,* as the primary raw material, 760 g of seeds were taken and processed and 280 g of oil was obtained as a result, which was 36.8% of the primary raw material.

In the process of the study of methyl ester of fatty acid of milk thistle plant through gas-liquid chromatography method, it was determined that this oil contains myristic, palmitic, stearic, linolic, oleic, linoleic, erusic, eicosenoic acids (Figure 3).

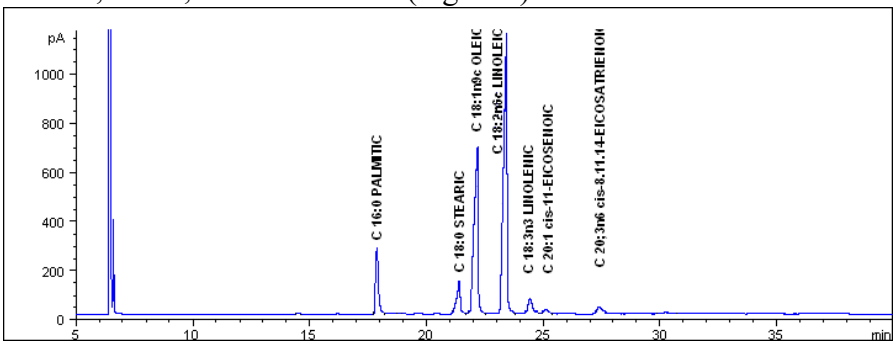


Figure 3 Gas-liquid chromatogram of methyl ester of fatty acids of fatty oil of *Silybum marianum* plant

It was found that the amount of individual fatty acids in fatty oil content is not the same. The amount of acids in the oil content varies from 0.1 to 46.1%, of which C18:2 linolic (46.1%) and C18:1 oleic (32.9%) acids predominate. The rest of fatty acids is C16:0 palmitic (9.0%), C18:0 stearic (5.6%), C18:3 linoleic (3.4%) and C22:1 erucic (2.1%) acids. In the total amount of fatty acids, eicosenoic and myristic acids are the least (0.8 and 0.1%, respectively).

The amount of free fatty acids in the fatty oil obtained from the seeds of the plant *S. marianum* is 2.5%, peroxide number - 3.9 mmol O_2/g, iodine number 116.7, saponification number 199.4, and the mass fraction of phosphorus-containing substances 208.0 mg/kg and the amount of wax was 292 mg/kg.[19]

6.2 Study of the component composition of the fatty oils of *Carthamus lanatus*

In order to obtain the oil from the plant *C. lanatus,* as the primary raw material 111 g of its seeds were taken and processed, and as a result, 37 g of oil was obtained, which was 33.3% of the primary raw material.[8]

The composition of fatty oil of the plant *C. lanatus* contains C14:0 myristic, C16:0 palmitic, C16:1 palmitoleic, C18:0 stearic, C18:2 linoleic, C18:1 oleic, C18:3 linolenic, C20:1 eicosenoic acids (Figure 4).

The amount of individual fatty acids in the composition of fatty oils is not the same, and their share varies from 0.1% to 75.2%. In this case, among fatty acids C18:2 linoleic acid (75.2%) and C18:1 oleic acid (13.3%) are more predominant. Unsaturated fatty acids in this oil content make up about 88.8% of the total amount of fatty acids. The smallest part of the oil content is C16:1 palmitolic, C18:3 linoleic, C20:1 eicosenoic, C14:0 myristic acids (0.1% each).

[19] Гасымова, Ш.А., Новрузов, Э.Н., Мехтиева, Н.П. Изучение химического состава жирного масла из семян S*ilybum marianum* (L.) Gaertn // − Барнаул: Химия растительного сырья, − 2017. №3, − с. 107-111.

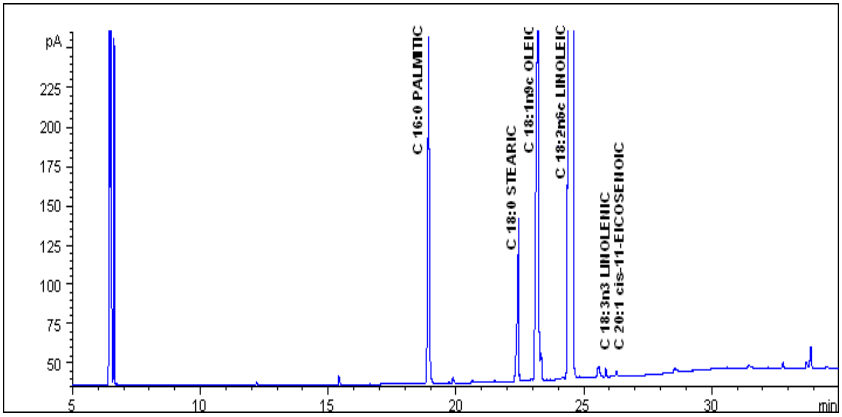


Figure 4 Gas-liquid chromatogram of methyl ether of fatty acids of fatty oil of the plants *Carthamus lanatus*

Free fatty acids in fat content are formed by the hydrolysis of triglycerides. The amount of free fatty acids in the fatty oil obtained from the seeds of the plant *C. lanatus* is 0.8%, its peroxide number is 2.1 mmol O_2/kg, iodine number is 142.5, saponification number is 192.1 and mass fraction of phosphorus-containing substances is 3.0 mg/kg.[20]

6.3 Study of the composition of the fatty oil of the plant *Arctium lappa*

In order to obtain oil from the plant *A. lappa*, as a primary raw material, 152 g of its seeds were taken and processed, and as a result, 37 g of oil was obtained, which was 24.3% of the primary raw material.

The amount of fatty acids in the oil content varies, and the share of its components varies from 0.3% to 63.6%, with linolic C18:2 (63.6%) and C18:1 oleic acid (22.6%) predominating (Figure 5).

[20] Gasimova, Sh.A. The study of chemical composition of fatty oil from *Carthamus lanatus* (L.) Boiss. seeds // Plant & Fungal Research, – 2019, 2 (1), – p. 9-14.

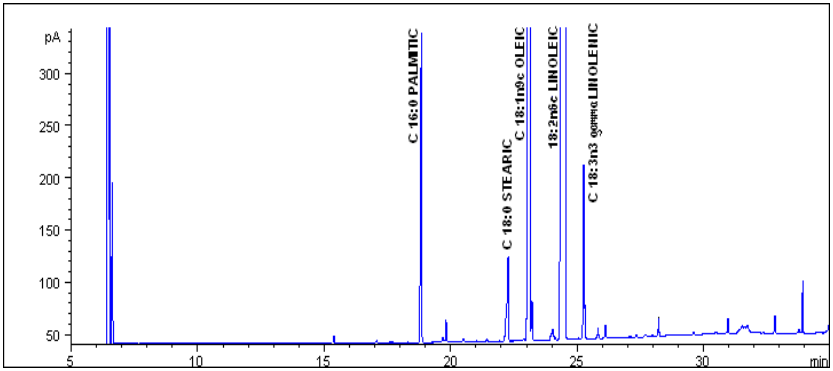


Figure 5 Gas-liquid chromatogram of methyl ether of fatty acids of fatty oil of the plants *Arctium lappa*

Unsaturated fatty acids in this oil content make up about 86.7% of the total amount of fatty acids. The rest of the fatty acids are C16:0 palmitic acid (5.4%) and C18:0 stearic acid (2.2%). In the total of fatty acids, the amount of palmitolic (0.3%), C18:3 linolenic (0.1%), C20:1 eicosenoic (0.2%), C17:0 heptadecane (margarine) (0.03%), C14:0 myristic (0.1%) acids and trans isomers (0,4%) varies in the range of 0.03% - 0,4%. As a result of the analysis of fatty oil obtained from the seeds of *A. lappa* plant, it was determined that the amount of free fatty acids in its content is 3.5%, saponification number - 190.6, peroxide number - 27.8, iodine number - 130.8, mass fraction of phosphorus-containing substances - 81 mg/kg.[21]

6.4 Study of the composition of the fatty oil of the plant *Xeranthemum cylindraceum*

In order to obtain oil of the plant *X. cylindraceum,* as a primary raw material, 55 g of its seeds were taken and processed, and as a result, 23 g of oil was obtained, which was 41.8% of the primary raw material.

In the process of studying the methyl ester of fatty acid of the

[21] Gasimova, Sh.A., Novruzov, E.N., Mehdiyeva, N.P. The study of chemıcal composıtıon of fatty oıl from the seeds of A*rctıum lappa* L. // − Bakı: Azərbaycan Milli Elimlər Akademiyasının Məruzələri, Biologiya və tibb elmləri seriyası, − 2018. №1, − s. 80-84.

plant *X. cylindraceum* by gas-liquid chromatography method, it was determined that the oil contains C14:0 myristic, C16:0 palmitic, C18:0 stearic, C18:1oleic, C18:2 linoleic, C18:3 linolenic acid, C20:1 eicosenoic, C16:1 palmitolic and C17:0 heptadecanoic (margarine) acids (Figure 6).

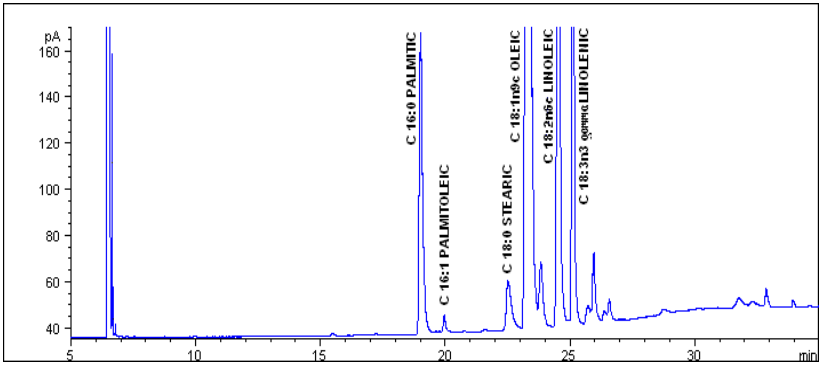


Figure 6. Gas-liquid chromatogram of methyl ester of fatty acids of fatty oils of the plant *Xeranthemum cylindraceum*

The amount of fatty acids in the oil is not the same. The amount of individual fatty acids in the total fatty acids varies from 0.03% to 55.4%. The bulk of the fatty oil of the plant *X. cylindraceum* was oleic, linoleic and linolenic acids (55.4%, 17.3% and 13.2%, respectively). The smallest part of the oil content is C16:0 palmitic (9.5%), C18:0 stearic (2.5%), C16:1 palmitoleic (0.4%), C20:1 eicosenoic (0.3%), C14:0 is myristic acid (0.06%) and C17:0 is heptadecanoic (margarine). Unsaturated fatty acids in this oil content make up about 86.6% of the total amount of fatty acids. The amount of free fatty acids in the fatty oil obtained from the seeds of the plant *X. cylindraceum* is 0.3%, the number of peroxides is 3.1 mmol O_2/kg, the number of iodine is 112.9, the number of saponification is 192.0, and the mass fraction of phosphorus-containing substances is 28.0 mg/kg. [22]

[22] Gasymova, Sh.A., Novruzov, E.N. & Mekhtieva, N.P. Chemical Composition of Fatty Oil from *Xeranthemum cylindraceum* Seeds // − New York, USA: Springer, Chemistry of Natural Compounds, − 2018. Vol. 54, No 4, p. 760–761.

CHAPTER VII
ANTIMICROBIAL AND ANTIFUNGAL PROPERTIES OF SOME SPECIES BELONGING TO THE FAMILY *ASTERACEAE*

As a result of the analysis of the world literature it was determined that, the effect of the extracts obtained from the flowers of plants *Arctium lappa* and *Xeranthemum cylindraceum* on gram-negative bacteria *Pseudomonas aeruginosa, Escherichia coli*, *Klebsiella pneumoniae, Staphylococcus aureus,* a representative of gram-positive bacteria and *Candida albicans* fungi, as well as aqueous extracts of vegetative organs and flowers of plants *Pulicaria arabica* subsp. *hispanica, Chondrilla juncea* and *Echinops sphaerocephalus* on the growth of the bacteria were not studied.

Studies have shown that *Staphylococcus aureus* bacteria are highly sensitive to the extract obtained from the flowers of the plant *A. lappa*, all dilutions of the extract significantly slowed down the growth of these bacteria. Although the extract obtained from the plant *X. Cylindraceum* has a high effect on the growth of these bacteria, its effect on the growth of bacteria was sharply reduced when it was diluted up to four times and did not prevent their growth after dilution by 8 times (Figure 7; 8).

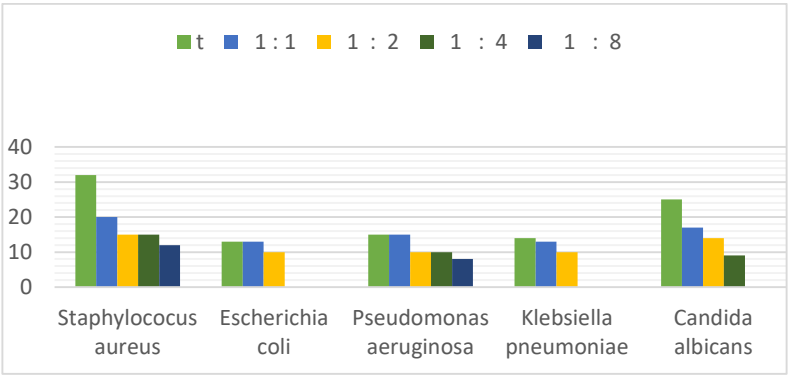


Figure 7 Effect of double dilutions (1: 1; 1: 2; 1: 4; 1:8) of extracts of flowers of *Arctium lappa* on different groups of microorganisms (in mm)

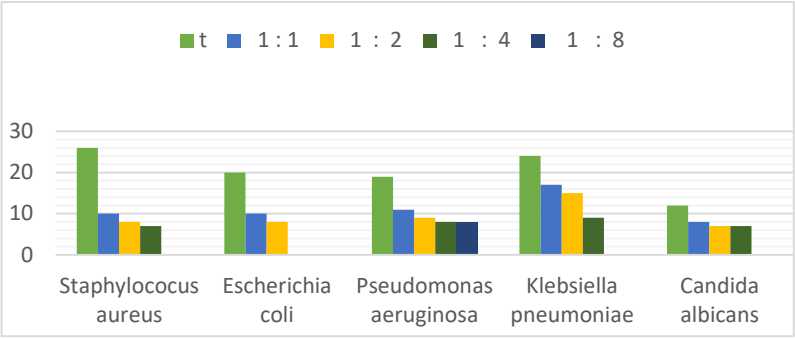


Figure 8 Effect of double dilutions (1:1; 1:2; 1:4; 1:8) of extracts obtained from the flowers of *Xeranthemum cylindraceum* on different groups of microorganisms (in mm)

Although representatives of gram-negative bacteria were less sensitive to the extract obtained from the plant *A. lappa*, the extract of the plant *X. cylindraceum* showed a relatively high sensitivity. Thus, if the diameter of the sterile area created by the affect of the extract of *A. lappa* plant is equal to 13 mm in *Escherichia coli* bacteria, this figure was 20 mm due to the effect of the extract of plant *X. cylindraceum*. Also, under the effect of extract obtained from the plant *A. lappa*, the values were 15 mm in *Pseudomonas aeruginosa* bacteria, 14 mm in *Klebsiella pneumoniae* bacteria, and under the effect of extract obtained from the plant *X. cylindraceum*, these values were 19 mm and 24 mm, respectively. The effect of *X. cylindraceum* on gram-negative bacteria is higher than that of *A. lappa*. According to these results, the diameter of the sterile area was 20 mm in *E. coli* bacteria, 19 mm in *Pseudomonas aeruginosa* bacteria, and 24 mm in *Klebsiella pneumoniae* bacteria.

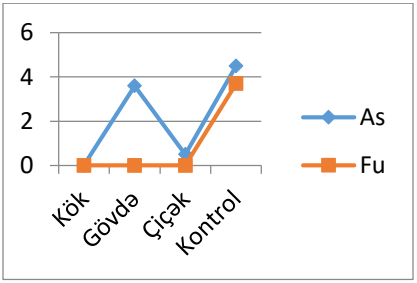
The effects of extracts obtained from the studied plants on *Candida* fungi are different. The antimycotic effect of extract of *A. lappa* is higher than that of extract obtained from *X. cylindraceum*. *A. lappa* affected the development of *Candida albicans* in the range of 25 mm. Its 1:1, 1:2 and 1:4 dilutions also inhibited the growth of *C. albicans* fungus, only a 1:8 dilution had no effect. The extract of the plant *X. cylindraceum* inhibited the growth of the fungus only in

the range of 12 mm, the mycotic effect of its dilutions was gradually weakened and was not recorded in a ratio of 1: 8.

Water extracts obtained from both vegetative and generative organs of the plant *Chondrilla juncea* had a fungicidal effect on the fungus *Fusarium oxysporum* fungus, and water extract from the roots on the fungus *Aspergillus niger* fungus.

Water extract obtained from the roots of *Echinops sphaerocephalus* has a fungistatic effect against *Fusarium oxysporum* and *Aspergillus niger* fungi, while water extract from the flowers showed more activity against *Fusarium oxysporum*.

Studies have shown that the flowers of *Pulicaria arabica subsp. hispanica.* have a more antifungal effect against the fungi *Fusarium oxysporum* and *Aspergillus niger* in a solid nutrient medium than its stem. From water extract taken separately from the stem and flower parts (5g, 10g, 15g) of the plant *P. arabica subsp. hispanica,* 1:5 ratio of water extract obtained from the stem part and 1:15 ratio of water extract obtained from flowers showed more fungistatic activity against *Fusarium oxysporum* and *Aspergillus niger* fungi (figure 9; 10). [23] [24]



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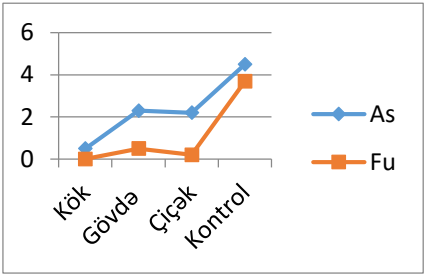
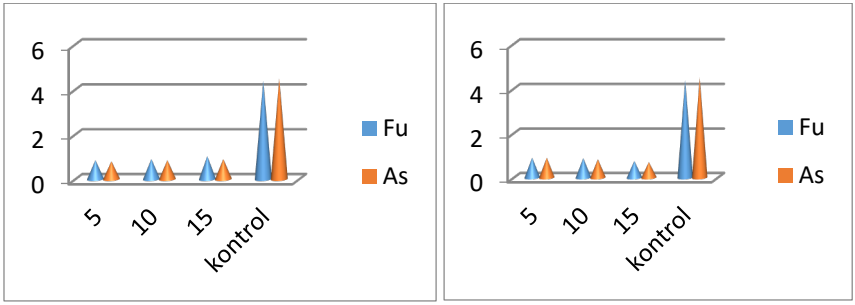


b

[23] Qasımova, Ş.Ə., Muradova, S.A., Səfərova, A.Ş. *Asteraceae* Dumort. fəsiləsinə aid olan bəzi növlərin yayılması, ehtiyatı və faydalı xüsusiyyətlərinin öyrənilməsi // − Bakı: Azərbaycan Milli Elmlər Akademiyasının xəbərləri, Biologiya və tibb elmləri seriyası, − 2018. №3, − s. 16-24.

[24] Baxışəliyeva, K.F., Qasımova, Ş.Ə. *Pulicaria dysenterica* (L.) Bernh. bitkisinin Şamaxı və İsmayıllı rayonlarında yayılması və antifunqal xüsusiyyətləri // −Bakı: Azərbaycan Milli Elmlər Akademiyasının Mikrobiologiya İnstitutunun elmi əsərləri, Mikologiya seriyası, − 2015. C.13, №1, − s. 278-281.

Figure 9 Antifungal effect of water extracts of *Chondrilla juncea* (a) and *Echinops sphaerocephalus* (b) against *Fusarium oxysporum* and *Aspergillus niger* fungal cultures (g/l)



a b

Figure 10 The effect of water extracts obtained from the stem-leaf (a) and flower (b) parts of the plant *Pulicaria arabica subsp. hispanica* (Boiss.) Murb. on the growth of *Fusarium oxysporum* and *Aspergillus niger* fungi

CONCLUSION

1. For the first time, useful plants belonging to the Asteraceae family, distributed in Shamakhi and Ismayilli districts, were studied as a single community, and their nomenclature and taxonomic spectrum were compiled. It was determined that the useful plants of the Asteraceae family in this region are represented by 56 genera, 92 taxa (83 species and 9 subspecies) according to the classification system “Euro+med plant”.
2. Most of the studied species belong to the xeromesophyte and mesoxerophyte (31 and 28%, respectively) ecological groups, herb plants by life forms, mainly perennial (72%) species. Most of these plants are found in the middle mountain belt (23%) and the least in the alpine zone (4%).
3. Some species (*Silybum marianum, Tussilago farfara, Carthamus lanatus* and *Xeranthemum cylindraceum*) form formations, while others (*Achillea nobilis, Artemisia absinthium, Inula aspera, Pulicaria arabica* subsp. *hispanica*, etc.) participate in the

formation of associations. New distribution areas for the species *Chondrilla juncea* and *Inula oculus-christi* were identified in the district.

4. The most densely growing areas of 18 widespread species were identified, their biological and operational reserves, as well as raw material supply opportunities were calculated, *Carthamus lanatus* (annual supply capacity 150,4 t), *Tussilago farfara* (79,7 t), *Silybum marianum* (69,4 t), *Achillea filipendulina* (63,7 t), *Artemisia absinthium* (53,5 t) and *Sonchus asper* (31,4 t) were assessed as a more promising source of raw materials for medicine, food, dyes, feed and etc.
5. Fatty oils were obtained from the seeds of *Silybum marianum, Arctium lappa, Carthamus lanatus* and *Xeranthemum cylindraceum* and it was determined that their amount in content of the raw material was 36.8; 24.3; 33.3; and 41.8%. The component content of fatty acids in these oils varies depending on the species. Among them are linoleic (up to 75.2%) and oleic acid (up to 55.4%) with high quantity, as well as linolenic (13.2%), palmitic (9.5%), stearin (5.5%) acids, including ericic (2.1%), eicocenoic (0.8%) and myristic (0.1%) acids with relatively small quantity.
6. Antimicrobial properties of extracts from the petals of *Arctium lappa* and *Xeranthemum cylindraceum* were studied, they were found to have high effect against *Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae* bacteria.
7. The antifungal properties of aqueous extracts of various parts of plants *Arctium lappa, Chondrilla juncea, Echinops sphaerocephalus* and *Pulicaria arabica subsp. hispanica* against *Candida albicans, Fusarium oxysporium, Aspergillus niger* fungi were studied and high fungistatic activity was identified.

PRACTICAL RECOMMENDATIONS

1. The obtained information can be included in the new edition of the "Flora of Azerbaijan" and next editions of nomenclature list "Vascular plants of Azerbaijan.
2. Information of reserves and compiled maps may be used in areas engaged in plant supply.
3. Since the fatty acids (ω -3, ω-6, ω-7, ω-9 and etc.) in the content of fatty oils obtained from the seeds of the studied species (*Silybum marianum*, *Arctium lappa, Carthamus lanatus* and *Xeranthemum cylindraceum*) are essential fatty acids, they can be used in the application of the production of both food and non-food products in terms of their suitability for use as food and medicine supplement.
4. In addition, these oils can also be used in industry as bio-diesel and fuel additives and prevent environmental problems caused by the use of fossil fuels (oil, coal, natural gas and their derivatives). In this regard, in order not to reduce the population of these species in nature, it is recommended to cultivate them in the areas where they are distributed.
5. Extracts of some species studied can be used in the preparation of new drugs due to their high effect against some bacteria and fungi.

LİST OF PUBLİSHED WORKS ON THE TOPİC OF THE DİSSERTATİON:

1. Qasımova Ş. Ə., Novruzov E. N., Mehdiyeva N. P., Böyük Qafqazın cənub-şərq rayonlarında yayılan *Asteraceae* Dumort. fəsiləsinin bəzi növlərinin faydalı xüsusiyyətləri // - Bakı: AMEA Botanika İnstitutunun elmi əsərləri, - 2014, №34, - s. 108-115.
2. Baxşəliyeva K. F., Qasımova Ş. Ə. *Pulicaria dysenterica* (L.) Bernh. bitkisinin Şamaxı və İsmayıllı rayonlarında yayılması və antifunqal xüsusiyyətləri //- Bakı: AMEA Mikrobiologiya İnstitutunun elmi əsərləri, Mikologiya seriyası, -2015, C.13, №1, - s. 278-281.
3. Qasımova Ş. Ə., Mehdiyeva N. P. Şamaxı rayonunda yayılan *Arctium lappa* L. növünün fitosenotik xüsusiyyətləri və ehtiyyatı // - Bakı: AMEA Botanika İnstitutunun elmi əsərləri, - 2015, №35, - s. 92-95.
4. Qasımova Ş. Ə. Şamaxı və İsmayıllı rayonlarında yayılan *Cichorium intybus* L. və *Inula helenium* L. növlərinin arealı və ehtiyatı // - Bakı: AMEA Botanika İnstitutunun elmi əsərləri, - 2016, №36, - s. 77-83.
5. Qasımova Ş. Ə. Şamaxı və İsmayıllı rayonlarında *Serratula quinquefolia* Bieb. ex. Willd növünün yayılması və ehtiyatının öyrənilməsi // Gənc tədqiqatçıların IV beynəlxalq elmi konfransı, - Bakı: Qafqaz universiteti, - 29-30 Aprel, - 2016, s. 310-311.
6. Qasımova Ş. Ə. Novruzov E. N. Şamaxı və İsmayıllı rayonlarında *Sonchus asper* (L) Hill və *Xeranthemum cylindraceum* Sibth. növlərinin yayılması və ehtiyatının öyrənilməsi // Müasir kimya və biologiyanın aktual problemləri Beynəlxalq elmi konfrans, - Gəncə: GDU, - 12-13 may, - 2016, - s. 53-58.
7. Гасымова Ш.А., Новрузов Э.Н., Мехтиева Н.П. Изучение химического состава жирного масла из семян S*ilybum marianum* (L.) Gaertn // - Барнаул: Химия растительного сырья, - 2017, №3, - с. 107-111.
8. Gasimova Sh. A., Novruzov E. N., Mehdiyeva N. P. The study of

chemical composition of fatty oil from the seeds of A*rctium lappa* L. // - Bakı: AMEA "MƏRUZƏLƏR"-i, Biologiya və tibb elmləri seriyası, - 2018, №1, - s. 80-84.
9. Гасымова Ш.А., Новрузов Э.Н., Мехтиева Н.П. Химический состав жирного масла из семян *Xeranthemum cylindraceum* // - Ташкент: Химия природных соединений, - 2018, №4, с. 643-644.
10. Gasymova Sh. A, Novruzov E. N. & Mekhtieva N. P. Chemical Composition of Fatty Oil from *Xeranthemum cylindraceum* Seeds. // New York, USA: Springer, Chemistry of Natural Compounds, - 2018, Vol. 54, No 4, p. 760–761.
11. Qasımova Ş.Ə. Mehdiyeva N.P. Şamaxı və İsmayıllı rayonlarında yayılan *Pulicaria dysenterica* (Stev.) növünün bioekoloji xüsusiyyətləri və ehtiyati // Botaniki tədqiqatlarda yeni çağırışlar, - Bakı: "Red N Line" MMC, -20-21 İyun, - 2018, - s. 146-148.
12. Qasımova Ş. Ə., Muradova S. A., Səfərova A. Ş. *Asteraceae* Dumort. fəsiləsinə aid olan bəzi növlərin yayılması, ehtıyatı və faydalı xüsusiyyətlərinin öyrənilməsi // - Bakı: AMEA " XƏBƏRLƏR"-i, Biologiya və tibb elmləri seriyası, -2018, №3, - s. 16-24.
13. Gasimova Sh. A. The study of chemical composition of fatty oil from *Carthamus lanatus* (L.) Boiss. seeds // Plant & Fungal Research, - 2019, 2 (1), - p. 9-14.
14. Gasimova Sh. A. Including some species of the family of *Asteraceae* Bercht. et J. Presl comparative study of the chemical composition of fatty oil from seeds // Высшая школа: Научные исследования. Межвузовский международный конгресс. Москва, 18 марта, − 2021, − с. 150-153.

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