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BIOMORPHOLOGICAL CHARACTERISTICS, PHYTOCHEMICAL COMPOSITION AND MEDICAL SIGNIFICANCE OF SPECIES BELONGING TO THE *Geranium* Tourn. ex L. GENUS

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БИОМОРФОЛОГИЧЕСКАЯ ХАРАКТЕРИСТИКА, ФИТОХИМИЧЕСКИЙ СОСТАВ И МЕДИЦИНСКОЕ ЗНАЧЕНИЕ ВИДОВ РОДА *Geranium* Tourn. ex L.

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Abstract. Geranium Tourn. ex L. is a flowering plant Genus belonging to the Geraniaceae Family. It is mainly grown as an ornamental plant in Azerbaijan. It was brought to Europe in the 17th century. Its propagation zone is South Africa. It is cultivated in many countries because it is a very valuable essential oil plant. *Geranium* is also successfully cultivated in Azerbaijan. *Geranium* essential oil is used in the perfume industry to make perfumes, soaps and face lotions. It is also used in the food industry to flavor beverages, as well as confectionery. It is also used in the preparation of medicines. Not only the leaves of the geranium plant, but also its roots, flowers and leaves are considered very good. The root of the plant contains phenols, various phenolic compounds in the upper green part, sucrose, starch and hemicellulose. The leaves and flowers are rich in phenolic carboxylic acids, vitamins, flavonoids, pigments, essential oils and carbohydrates.

Аннотация. Geranium Tourn. ex L. — род цветковых растений, принадлежащих к семейству Geraniaceae. В Азербайджане в основном выращивается как декоративное растение. В Европу он был завезен в 17 веке. Зона его распространения — Южная Африка. Его выращивают во многих странах, потому что это очень ценное эфиромасличное растение. В Азербайджане также успешно культивируют герань. Эфирное масло герани используется в парфюмерной промышленности для изготовления духов, мыла и лосьонов для лица. Она также используется в пищевой промышленности для ароматизации напитков и кондитерских изделий, в приготовлении лекарств. Используются не только листья герани, но и ее корни, цветы и листья. Корень растения содержит фенолы, различные фенольные соединения в верхней зеленой части, сахарозу, крахмал и гемицеллюлозу. Листья и цветки богаты

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фенолкарбоновыми кислотами, витаминами, флавоноидами, пигментами, эфирными маслами и углеводами.

Keywords: Geranium, ornamental plants, analysis, flowers, flavonoids.

Ключевые слова: герань, декоративные растения, анализ, цветки, флавоноиды.

Introduction

The main purpose of the article is to study the morphological features, essential oil, phytochemical composition and medical significance of some species belonging to the genus *Geranium*, introduced in Absheron and cultivated in cultural conditions.

The plant species of the genus *Geranium* consists of 422 species, including monocotyledonous, dicotyledonous and perennial species. They are mainly distributed in temperate zones, mountainous parts of tropical zones and in the east of the Mediterranean region. There are 23 species in Azerbaijan, and they are mainly cultivated as ornamental plants. It was brought to Europe in the 17th century. Its propagation zone is South Africa. The leaves of geraniums are round, narrow, with an arrow-shaped tip, plamatus (the leaves of the plant protrude from one point) — palm-shaped, the cuts can extend to the middle vein of the leaf. The leaves are divided into narrow, pointed segments in the form of palms.

The flowers are bisexual. It has 5 calyx leaves, 5 petals. The flowers are white, pink, purple or blue, and often have different veins on them. Most of the fruit has a box shape that is broken down into seeds. When the seed matures, it is divided into 5 seeds. The leaves are simple, finger-shaped, covered with hairs that secrete a little - very fragrant oil. Geranium species can grow in any soil, but the soil should not be swampy, because in this case the roots of the plant cannot receive enough oxygen. Propagation is carried out in the summer by dividing the half-ripe cuttings, seeds in the fall, and in the spring by dividing.

Figure 1. *Geranium* species

Figure 2. Leaves and flowers of *Geranium* species

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The fruit capsule consists of five cells attached to a column formed from the center. The cells form lobes of tissue in each, and these lobes gradually separate. When the fruit ripens, the beak-like stigma springs open and the seeds are scattered around.

All of the above species are perennials and generally winter-hardy and are usually grown for their attractive flowers and leaves. They are long-lived and most have palmate-shaped leaves. They grow both vertically and horizontally. Some species grow and spread vertically (rhizomes). They are usually grown from partial shade to full sun, in well-drained but moisture-retaining soils rich in humus from plant and animal remains. Other perennials grown for flowers and leaves include *G. argenteum, G. eriostemon, G. farreri, G. nodosum, G. procurrens, G. renardii, G. traversii, G. tuberosum, G. versicolor, G. wallichianum* and *G. wlassovianum*. Some of them are not winter-hardy in cold areas and are grown in special gardens such as rock gardens. The land area in the rock gardens is distinguished by the abundance of gravel, stones and rocks.

Materials and Methods

Geranium species were taken as the object of research, from which pens were made for planting. Before planting in special greenhouses in the greenhouse of the Institute of Dendrology and in the open field, sand, soil and peat were mixed in a ratio of 1: 1: 1 and planted in special greenhouses in January-February and in the experimental field in March-April. All kinds of agro-technical care rules were shown to the plants and plant samples were collected for research. The formation of the roots of the pens was compared with the greenhouse in the open field. The collected plant samples were dried using standard methods and prepared for laboratory research. The results of the analysis are given in Table 1. Various methods were used in conducting research.

Geranium is eaten by larvae of some Lepidoptera species. *Geranium* is cultivated in Azerbaijan mainly as an ornamental plant. Only one type of it is used in medicine — *Geranium collinum*. *Geranium* is a perennial herb with dense hairs and fleshy roots. In the lower part of the stem, there are fruits with 5 to 7 sections, deep finger-shaped leaves, pink-red flowers, and 5-seeded fruit. The plant blooms in June-July, the fruits ripen in August [4].

It grows in the middle and upper mountainous parts of the Greater and Lesser Caucasus in Azerbaijan - in meadows, gardens and forest edges.

The hill-like geranium growing in Azerbaijan has not been studied scientifically yet. However, the hill-like geranium, which is widespread in Uzbekistan, was chemically analyzed at the Tashkent Pharmaceutical Institute and found to contain vaccines in all its parts. In addition, the leaves contain ellagic, gallic and 3-methoxygall acids, as well as flavonoids: quercetin, kaempferol, 3, 7, 8, 4-tetrahydroxyflavone, rutin, isoquercitrin and anthocyanins. Pelargonium chloride was found in the flowers.

Due to its analgesic and sedative properties, geranium oil is also used in neurology in radicular syndrome, rheumatism, arthritis.

It is prescribed for external and internal bleeding (especially gastric bleeding). The liquid extract has a stimulating effect on the nervous system. Ibn Sina reported on the antitoxic properties of this plant against snake venom.

Results and Discussion

The roots of geranium species contain vaccines. The roots of *G. dissectum* are used as a vegetable. The roots and leaves of *G. ibericum* are black, and the flowers of *G. sylvaticum* are blue. The leaves of *G. dissectum* contain from 251.1 mg% to 457.7 mg%, and *G. tuberosum* contains 288.4 mg% of vitamin C. *Geranium* species are widespread in the foothills to the alpine grasslands. Also, one of the important conditions for studying the bioecological characteristics of ornamental and

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economically important plants and determining their application to the economy is to determine the methods of their reproduction [5].

Due to the release of essential oil, keeping it in a room creates a pleasant aura [3]. It regulates the air in the room, produces oxygen and essential oil. The oil extracted from its flowers has a whitening and toning effect. It has a very good effect on all skin types, it improves blood circulation in the skin and gives it a healthy color. It has the ability to clean the air of the environment from germs. *Geranium* is an essential oil plant. Essential oil is obtained by steam distillation of the flower and green parts of the plant.

It is used in folk medicine for diarrhea, dysentery, kidney, rheumatism, gout. The plant is placed on the stumps and used to treat them. In folk medicine, tea is brewed from the dried surface of the hill-like geranium, and it is used as an astringent and antiseptic in diarrhea and dysentery in gastrointestinal diseases. In addition, it is taken to prevent bloody sputum from the chest in lung disease. Geranium, native to South Africa, was brought to Europe as an ornamental plant. The leaves contain large amounts of essential oils. The flower, leaves and root are very good. As you rub the leaves of the geranium, you get a strange and pleasant aroma, reminiscent of the combined aroma of lemon, apple and mint. Essential oils derived from it are widely used in aromatherapy. It should also be noted that the house with geraniums does not contain moths, ticks, lice, fleas and other insects. Geranium is very useful in otitis media, laryngitis, stimulation of blood circulation, regulation of heart rhythm and heart muscle function, headaches [1]. It is possible to normalize blood pressure by placing geranium leaves on the heart [2]. An ointment made from the leaves is an excellent remedy for colds, coughs, angina and colds.

As a result of our scientific research, 2.5 mg of geranium oil was extracted from the 500 g of wet leaves grown in greenhouse at lab conditions. The composition of the obtained oils was checked on a chromatograph and given in the Table. As a result of the research, we come to the conclusion that we offer the obtained essential oils for use in the production of perfumes, creams, and various medicinal soaps.

Table

THE RESULTS OF THE ANALYSIS OF THE ESSENTIAL OIL OBTAINED FROM THE LEAVES OF THE Geranium SPECIES IN CRYSTALL-2000M GAS-LIQUID CHROMATOGRAPHY

Component	*Percentage*	*Component*	*Percentage*
Alpha-Pinene	1.144	Estragole	2.833
Beta-Pinen**e**	0.044	Myrtenol	0.769
Carene-3	0.303	Nerol	0.206
Alfa-Terpinen	0.439	Geraniol	40.769
1,8-Cineol (Eucalyptol)	4.557	Myrtenyl Acetate	0.502
gamma – Terpinen**e**	0.237	Citronellyl butyrate	0.970
Tetrahydro-2-H-Pyran	0.019	Geranyl Oleate	0.609
Terpinolen**e**	0.303	neryl acetate	0.306
Cyclohexanone-5-m-2(1-m e), -cis	6.174	Citronellyl tiglate	0.212
Linalool	8.154	Geranil acetate	0.047
Caryophyllene	2.995	Geranyl tiglate	0.722
Terpinen-4-ol	7.684	Cedrol	0.093
Citronellol	3.181	2-phenylethyl tiglate	0.735

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Отчет хроматограммы

Паспорт хроматограммы

Проект:	noname	**Колонка:**	
Название метода:	Efir	**Проба:**	Etirshah_Yeni_1
Дата и время:	20.08.2021 10:07:38	**Метод расчета:**	Абсолютная градуировка
Анализ.Хроматограмма:	50.2	**Объем, мкл:**	1
Оператор:		**Разведение:**	1
		Источник:	

Расчет по компонентам

Время, мин	Компонент	Группа	Площадь	Высота	Площадь, %	Концентрация	Ед. концентрации	Детектор
8.693	alfa-Pinen		1512.007	491.142	1.144			ПИД-1
9.077			294.150	96.848	0.222			ПИД-1
9.347	beta-Pinen		58.040	21.266	0.044			ПИД-1
9.480			282.974	59.811	0.214			ПИД-1
9.722	Carene-3		400.151	113.361	0.303			ПИД-1
9.919			565.103	189.099	0.427			ПИД-1
10.064			101.753	35.221	0.077			ПИД-1
10.270	alfa-Terpinen		580.253	181.728	0.439			ПИД-1
10.435	1,8-Cineol (Evkaliptol)		6024.842	1840.356	4.557			ПИД-1
10.676			210.549	71.933	0.159			ПИД-1
10.755			156.272	51.385	0.118			ПИД-1
11.081	gamma-Terpinen		312.941	105.426	0.237			ПИД-1
11.209			151.433	50.238	0.115			ПИД-1
11.442			33.977	12.241	0.026			ПИД-1
11.769			16.998	7.181	0.013			ПИД-1
11.886	Tetrahydro-2-H-Pyran		24.604	10.070	0.019			ПИД-1
12.012			925.686	302.478	0.700			ПИД-1
12.232			311.581	91.842	0.236			ПИД-1
12.913			26.850	10.515	0.020			ПИД-1
13.096	Terpinolen		400.695	125.531	0.303			ПИД-1
13.361			84.571	19.565	0.064			ПИД-1
13.455			77.854	27.349	0.059			ПИД-1
13.626			373.767	118.909	0.283			ПИД-1
14.018	Cyclohexanone 5-m-2 (1-m e),-cis		8162.932	2181.843	6.174			ПИД-1
14.165	linaool		10781.057	3133.941	8.154			ПИД-1
14.286			416.912	135.746	0.315			ПИД-1
14.445	Cariophyllene		3959.363	1115.481	2.995			ПИД-1
14.600			62.078	20.523	0.047			ПИД-1
14.811			132.902	29.894	0.101			ПИД-1
14.967			171.099	46.224	0.129			ПИД-1
15.045			137.997	40.249	0.104			ПИД-1
15.140			390.109	159.086	0.295			ПИД-1
15.234	Terpinen-4-ol		10158.440	2753.696	7.684			ПИД-1
15.321	Citronellol		4206.040	1220.959	3.181			ПИД-1
15.405			240.767	84.373	0.182			ПИД-1
15.561			160.301	49.019	0.121			ПИД-1
15.636			440.308	152.132	0.333			ПИД-1
15.739			104.525	30.308	0.079			ПИД-1
15.943			128.767	33.771	0.097			ПИД-1
16.011			268.090	78.411	0.203			ПИД-1
16.197	Estragole		3745.818	809.796	2.833			ПИД-1
16.394	mirtenol		1016.132	185.632	0.769			ПИД-1
16.507	Nerol		272.943	70.156	0.206			ПИД-1
16.633			1275.497	242.498	0.965			ПИД-1
16.861	geraniol		53900.832	9681.062	40.769			ПИД-1
17.101	Mirtenilacetate		664.200	117.347	0.502			ПИД-1
17.252	Citronelly butyrate		1281.866	385.539	0.970			ПИД-1
17.345			95.141	31.730	0.072			ПИД-1
17.453			590.099	191.398	0.446			ПИД-1
17.742			11052.975	3036.532	8.360			ПИД-1
17.913			75.826	19.716	0.057			ПИД-1
17.996			118.149	22.660	0.089			ПИД-1
18.273	Geranyl Oleate		804.707	264.089	0.609			ПИД-1
18.812			77.090	27.085	0.058			ПИД-1
19.173			37.864	11.576	0.029			ПИД-1
19.339			169.557	56.576	0.128			ПИД-1
19.625	nerilacetat		405.081	127.993	0.306			ПИД-1
19.731			32.684	9.956	0.025			ПИД-1
19.941	citronellyl tiglate		280.389	56.274	0.212			ПИД-1
20.055			47.652	14.673	0.036			ПИД-1
20.293	geranilacetat		61.572	16.739	0.047			ПИД-1
20.419			55.756	22.899	0.042			ПИД-1
20.544			293.636	77.149	0.222			ПИД-1
20.629			126.869	38.818	0.096			ПИД-1
20.772	Geranyl tiglate		954.191	276.478	0.722			ПИД-1
21.063			28.434	10.529	0.022			ПИД-1
21.231			180.253	50.326	0.136			ПИД-1
21.531	Cedrol		122.835	34.815	0.093			ПИД-1
21.716			107.282	29.365	0.081			ПИД-1
21.917			129.409	37.909	0.098			ПИД-1
22.030	2-phenylethyl tiglate		971.462	247.209	0.735			ПИД-1
22.477			246.708	65.939	0.187			ПИД-1
23.839			44.310	14.276	0.034			ПИД-1
24.074			93.798	22.841	0.071			ПИД-1

Figure 2. The results of the analysis of the essential oil obtained from the leaves of the Geranium species in Crystall-2000 M gas-liquid chromatography

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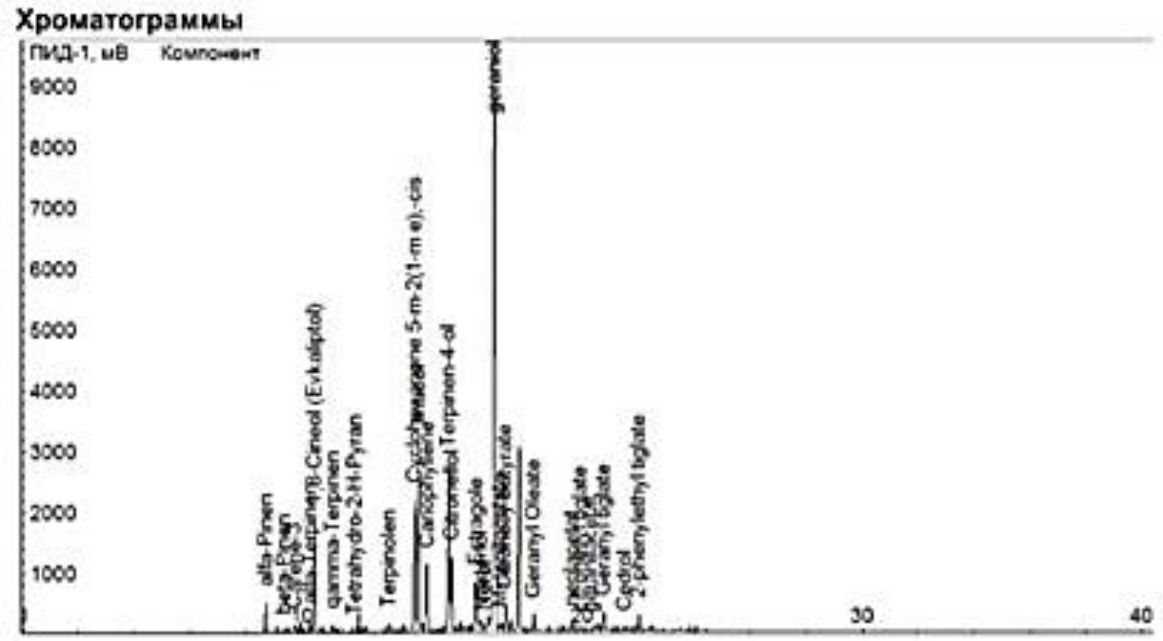

Figure 2. The results of the analysis of the essential oil obtained from the leaves of the Geranium species in Crystall-2000M gas-liquid chromatography

Conclusion

As a result of the conducted scientific research, it was found that *Geranium* species adapts well to local conditions. *Geranium* is a very productive essential oil plant. The oil was extracted from the leaves and analyzed in Crystall-2000M gas chromatography. Based on the results of the analysis, alpha-Pinene containing essential oil — 1.144%, beta-Pinene — 0.044%, Carene — 3-0.303%, alpha-Terpinene — 0.4391%, 8-Cineol (Eucalyptol) — 4.557%, gamma-Terpinene — 0.237%, Tetrahydro-2-H-Pyran — 0.019%, Terpinolene — 0.303%, Cyclohexanone-5-m-2(1-m e), -cis — 6.174%, linaool — 8.154%, Cariophyliene — 2.995 %, Terpinen-4-ol — 7.684%, Citronellol — 3.181%, Estragole — 2.833%, Myrtenol — 0.769%, Nerol — 0.206%, Geraniol — 40.769%, Myrtenilacetate — 0.502%, Citronelly butyrate — 0.970%, Geranyl Oleate — 0.609%, Nerylacetate — 0.306%, citronellyt tiglate — 0.212%, geranilacetate — 0.047%, Geranyl tigrate — 0.722%, Cedrol — 0.093%, 2-phenylethyl tiglate — 0.735% substances were detected. Regarding the use, it should be noted that geranium essential oil is used in the perfumery industry as the main ingredient of perfumes, soaps and face ointments. In the food industry, it is used for flavoring alcoholic and non-alcoholic drinks, as well as confectionery products. Geranium oil is also used in the preparation of a number of medicines.

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