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TAXONOMIC ANALYSIS, COMPOUND COMPOSITION AND PHARMACOLOGICAL PROPERTIES OF SCUTELLARIA L. TYPE SPECIES

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ABOUT ARTICLE

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Abstract: The article discusses the systematic position, distribution, species composition and medicinal value of the genus Scutellaria L., a member of the Mint family, in Central Asia and Uzbekistan. The study analyzed the literature on the bioecological properties, geographical distribution and floristic composition of the genus Scutellaria L.. The number of representatives of the genus found in the flora of Uzbekistan, their richness in biologically active substances and pharmacological properties are presented. Also, the importance of the genus species in folk medicine and modern medicine due to their richness in flavonoids, iridoids and other secondary metabolites is revealed. The relevance of the issues of conservation and rational use of rare and endemic species is substantiated.

Introduction. The sharp increase in the scale of human activity in the world is leading to a change in the diversity of biological species and ecosystems and a decrease in their number. In this regard, determining the composition of the flora and changes in it, developing measures to preserve rare and endemic species are among the urgent problems of nature protection. Various laws and resolutions are being developed to solve these problems at the republican

level. In particular, the Law of the Republic of Uzbekistan dated September 21, 2016 No. 409 “On the Protection and Use of the Flora”, the Resolution of the Cabinet of Ministers dated May 27, 2013 No. 142 “On the Action Program for Environmental Protection in the Republic of Uzbekistan for 2013-2017”, the Resolution of the President of the Republic of Uzbekistan dated April 10, 2020 No. PQ-4770 “On Measures for the Protection, Cultivation, Processing and Rational Use of Available Resources of Wild Medicinal Plants”, the Resolutions dated May 20, 2022 No. PQ-251 “On Measures for the Cultivation and Processing of Medicinal Plants and Their Widespread Use in Treatment” serves to a certain extent in achieving the intended goal.

Material and Methods. This research work analyzed scientific literature, floristic sources, and geobotanical data on the genus Scutellaria L. During the research, fundamental scientific sources such as “Opredelitel rastenii Srednei Azii”, “Flora of Uzbekistan”, “Flora of Uzbekistan” were used.

The systematic composition, geographical distribution and life forms of the species of the genus Scutellaria L. were studied based on classical floristic and taxonomic methods. The classification of S. Raunkiaer (1934) was used to determine the life forms of plants.

Also, domestic and foreign scientific articles on the medicinal properties, biologically active substances and pharmacological significance of the genus Scutellaria L. were analyzed. Comparative-analytical, systematic and statistical generalization methods were used in the study.

Results and Discussion. Scutellaria L. species belong to the Lamiaceae family, and according to their life form, Scutellaria L. species belong to the hemicryptophyte and hamephyte plant groups [12].

In "Opredelitel Rastenii Sredney Azii" 83 species of Scutellaria L. family in Central Asia (S. galericulata L., S. dubia Taliev et Sirj., S. colpodea Nevsky., S. striatella Gontsch., S.cristata M.Pop., S. navicularis Juz., S. juzepczukii Gontsch., S. litwinowii Bornm., S. luteo-coerulea Bornm., S. ramosissima M.Pop., S. intermedia M.Pop., S. glabrata Vved., S. squorrosa Nevsky., S. turgaica Juz., S. nepetoides M.Pop., S. picta Juz., S. flabellulata Juz., S. comosa Juz., S. oxystegia Juz., S. mycrodasys Juz., S. androssovii Juz., S. mesostegia Juz., S. kursanovii Pavl., S. titovii Juz., S. transiliensis Juz., S. alberti Juz., S. przewalskii Juz., S. soongorica Juz., S. krylovii Juz., S. sieversii Bge., S. adenostegia Briq., S. gontscharovii Juz., S. haematochlora Juz., S. urticifolia Juz., S. iskanderi Juz., S. pycnoclada Juz. S.cordifrons Juz., S. adsurgens M.Pop., S. phyllostachya Juz., S.haesitabunda Juz., S. supina L., S. irregularis Juz., S. knorringiae Juz., S. xanthosiphon Juz., S. oligodonta Juz., S. paulsenii Briq., S. filicaulis Rgl., S. kugarti Juz., S. popovii Vved., S. thalassica Juz., S. linczewskii Juz., S. subcordata Juz., S. subcaespitosa Pavl., S. lanipes Juz., S.

toguztoraviensis Juz., S. ocellata Juz., S. karatavica Juz., S. physocalyx Rgl.et Schmalh., S. pamirica Juz., S. microphysa Juz., S. polytricha Juz., S. jodudiana B. Fedtsch., S. schachristanica Juz., S. fedtschenkoi Bornm., S. hissarica B. Fedtsch., S. velutina Juz., S. Nevskii Juz. et Vved., S. villosissima Gontsch., S. heterotricha Juz. et Vved., S. holosericea Gontsch., S. baldshuanica Nevski., S. lipskyi Juz., S. andrachnoides Vved., S. immaculata Nevski., S.hodshakasiani R. Kam., S. megalodonta Juz., S. orbicularis Bge., S. guttata Nevski., S. poecilantha Nevski ex Juz., S. leptosiphon Nevski., S. thalassica Juz., S. rubromaculata Juz. et Vved., S. zaprjagaevii Koczk .et Zhogoleva., S. schugnanica B. Fedtsch.) are mentioned [10].

According to the information provided in "Flora of Uzbekistan", 32 species of Scutellaria L. are found in Uzbekistan (S. galericulata L., S. hissarica B.Fedtsch., S. fedtschenkoi Bornm., S. Nevskii Juz. et Vved. S. heterotricha Juz. et Vved., S. holosericea Gontsch., S. villosissima Gontsch., S. lipskyi Juz., S. baldshuanica Nevsky., S. leptosiphon Nevsky., S. immaculata Nevsky., S. guttata Nevsky., S. cristata M. Pop., S. colpodea Nevsky., S. striatella Gontsch., S. intermedia M. Pop., S. squarrosa Nevsky., S. glabrata Vved., S. ramosissima M. Pop., S. adsurgens M. Pop., S. cordifrons Juz., S. bucharica Juz., S. adenostegia Brig., Information about S. haematochlora Juz., S. pycnoclada juz., S. ocellata Juz., S. microdasys Juz., S. comosa Juz., S. filicaulis Rgl., S. Anitae Juz., S. schachristanica Juz., S. microphysa Juz. is provided. [5].

Below is the number of species of the genus Scutellaria L. distributed in some regions of Uzbekistan (Table 1).

Table 1

Number of species of the genus Scutellaria L. distributed in some regions of Uzbekistan

	By region	**Type number**	**Species name**	**Scientists who studied the area**
1	Nurota State Reserve	3	*S. ramosissima M. Pop.* *S. comosa Juz.* *S. glabrata Vved.*	N. Yu. Beshko 1999.
2	Surkhan State Reserve	5	*S. glabrata Vved.* *S. heterotricha Juz. et Vved.* *S. leptosiphon Nevski.* *S. nevski Juz. et Vved.* *S. squarrosa Nevski*	A. J. Ibragimov 2010.
3	Boysun Botanical and Geographical Region	18	*S. adonestegia Briq.* *S. colpodea Nevski.*	O. T. Turginov 2017.

			S. comosa Juz. *S. fedschenkoi Bornm.* *S. glabrata Vved.* *S. guttata Nevski & Juz.* *S. heterotricha Juz.* *S. hissarica B.Fedtsch.* *S. holosericea Gontsch.* *S. immaculata Nevski.* *S. intermedia Popov.* *S. jodudiana B.Fedtsch.* *S. leptosiphon Nevski.* *S. nevskii Juz.* *S. phyllostachya Juz.* *S. physocalyx Regel.* *S. squarrosa Nevski.* *S. pycnoclada Juz.*	
4	Malguzar Range	10	*S. comosa Juz.* *S. cordifrons Juz.* *S. galericulata L.* *S. glabrata Vved.* *S. immaculata Nevski.* *S. intermedia Popov.* *S. ramosissima M. Pop.* *S. schachristanica Juz.* *S. oxystegia Juz.* *S. squarrosa Nevski.*	D. E. Azimova 2011.
5	Southwestern Tianshan	11	*S. adenostegia Briq.* *S. adsurgens Popov.* *S. cordifrons Juz.* *S. galericulata L.* *S. haematochlora Juz.* *S. immaculata Nevski ex Juz.* *S. intermedia Popov* *S. microdasys Juz.*	K. Sh. Tojibayev 2010.

			S. pycnoclada Juz. *S. phyllostachia Juz.* *S. ramosissima Popov.*	
6	Zamin State Reserve	7	*S. galericulata L.* *S. glabrata Vved.* *S. immaculata Nevski ex Juz.* *S. physocalyx Rgl.et Schmalh.* *S. ramosissima Popov.* *S. schachristanica Juz.* *S. squarrosa Nevski.*	A.S. Esankulov 2012.
7	Bukhara Oasis	-	-	H. Q. Esanov 2017.

Bioecological characteristics of Scutellaria L. species

Scutellaria comosa Juz. Bot. Mater. coat of arms Bot. Inst. Komarova Acad. Nauk S.S.S.R. 14: 381. 1951. Khamefit. Semi-shrub. Mountainous Central Asia. It grows on the lower and middle mountain, stony and gravelly slopes. Not used. (Demurina, s.n., 1938, Azimova, n^3 66, 2012).

Scutellaria cordifrons Juz. Bot. Mater. coat of arms Bot. Inst. Komarova Acad. Nauk S.S.S.R. 14:363, 1951. Khamefit. Semi-shrub. West Tianshan-West Pamir-Aloy. Medium mountain, rocky, gravelly, soft soil. Not used. (Popov, Androsov, pº213, 1926, Azimova, pº90, 2012).

Scutellaria galericulata L. Spec. Plant. 2: 599. 1753. Hemicryptophyte. Arrow-rooted polycarp. Euro-Siberian-Ancient Mediterranean. Found in hilly, lower and middle mountain, soft soil, rocky, gravelly places. Medicinal, ephyro-oily, dye-bearing, honey-juiceous. (Beshko, Azimova, sn, 2012).

Scutellaria glabrata Vved. FI. URSS 2: 124. 1954 Hamephyte. Semi-shrub. Pamir-Aloy. Grows in middle mountain, rocky and gravelly places. Not used. (Gomolitsky, Protopopov, p83, 1934, Azimova, sn, 2011).

Scutellaria immaculata Nevsky & Zhuz. Bot. Mater. Gerb. Bot. Inst. Komarova Acad. Nauk S.S.S.R. 14: 428. 1951. Chamaephyte. Semi-shrub. Western Tien Shan-Western Pamir-Aloy. Lower and middle mountain, rocky, on rocks. Not used. (Demurina, n°155, 1937; Beshko, sn, 2012).

Scutellaria intermedia Popov Bull. Sredne. Aziatsk. Gosud. Univ. 12(Suppl).: 16. 1926. Chamaephyte. Semi-shrub. Western Tien Shan-Western Pamir-Aloy. Lower mountain, rocky and gravelly. Not used. (Beshko, s.n., 2012).

Scutellaria oxystegia Zhuz. Bot. Zhurn. S.S.S.R. 24: 431, 1939. Hamephyte. Semi-shrub. Western Tienshan-Pamir-Aloy. Grows on hilly and lower mountain, soft soil, gravelly and stony slopes. Alkaloid, ephyrooil, honey-juice. (Azimova, sn, 2011).

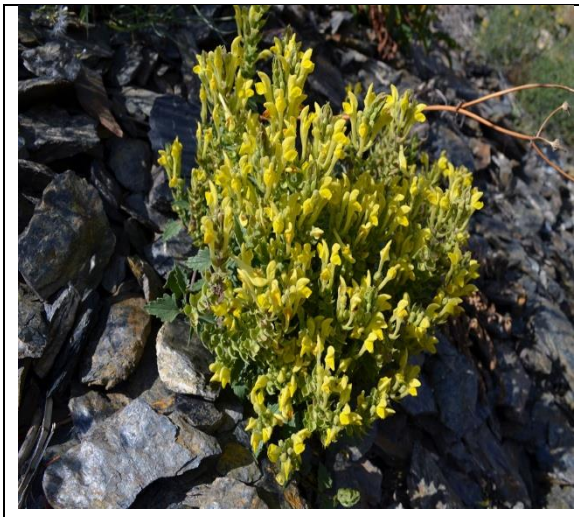
Scutellaria ramosissima Popov Bot. Mater. Gerb. Glavn. Bot. Sada R.S.F.S.R. V. 155, 1924. Hemicryptophyte. Arrow-rooted polycarp. Western Tienshan-Western Pomiroloi. Found in lower and middle mountains, on gravelly and rocky slopes, and in ravines. Not used. (Pyataeva, n°179, 1940, Azimova, sn, 2011).

Scutellaria schachristanica Juz. Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 14: 419, 1951. Hemicryptophyte. Arrow-rooted polycarp. Turkestan-molguzar. Found in mid-mountain, rocky, gravelly places. Not used. (Korotkova, Vasilkovskaya, pº1009, 1937).

Scutellaria squarrosa Nevsky. Trudy Bot. Inst. Akad. Nauk S.S.S.R., ser.

1, Fl. Sist. Vyssh. Rast. 4: 324. 1937; Hamephyte. Semi-shrub. Ko‘khiston-Hisor. Found in lower and middle mountains, in rock crevices. Not used. (Azimova, n°245, 2013) [1].

The mint family (Lamiaceae) is the most important and diverse family in the world of higher plants. The family is mostly distributed in temperate and warm climates. The mint family includes about 200 genera and 3000 species on Earth. In Central Asia, 360 species are included in 53 genera, and in Uzbekistan, 238 species belong to 39 genera. In Uzbekistan, the mint family is widespread and stands out from other families with a large number of medicinal and useful species [11]. One of such medicinal genera is the genus Scutellaria L. The genus Scutellaria L., according to its life form, mainly includes annuals, perennials and semi-shrubs. There are 360 species of this genus in the world, 138 species in the CIS countries, 89 species in Central Asia, and 36 species in Uzbekistan. Scutellaria L. is a genus of plants that contains biologically active substances, such as flavones, flavonoids, irioids, and other compounds synthesized as secondary metabolites in plants. These biologically active substances are concentrated in the roots and stems of the plant [7].



1-rasm.Scutellaria comosa 2-rasm. Scutellaria oxystegia

In Uzbekistan, plants belonging to the genus Scutellaria L. are considered a rich source of flavonoids. Their pharmacological activity is assessed by the flavonoids they contain. Flavonoids have been shown to have pharmacological properties such as strengthening blood vessel walls, activating heart rate, fighting pathogenic microorganisms, reducing the growth of malignant tumors, stimulating bile and urine production, improving liver function, preventing lipid peroxidation, treating stomach ulcers, and relieving muscle spasms [9].

Baicalin, baicalein, wogonin and other chemical compounds from the Scutellaria L. family have been found to have antibacterial and antiviral properties and are used as a medicine against AIDS, cancer, epilepsy and inflammatory diseases.

Scutellaria L. species have medicinal properties, and the resulting preparations and extracts have been used in folk medicine for various diseases, namely, as a treatment for heart disease, a sedative for the central nervous system, a blood thinner for hypertension and insomnia, a remedy for gastrointestinal diseases, diarrhea and tuberculosis, rheumatism, and gynecological diseases. Their high pharmacological activity is explained by the flavonoids they contain [8].

The wide ecological adaptation of species of the genus Scutellaria L. has allowed them to occur in various natural and geographical areas. However, the intensification of anthropogenic factors, excessive use of pastures, uncontrolled collection of medicinal plants and degradation of natural biotopes are leading to a decrease in the population of some species. It is especially important to protect endemic and rare species in situ and ex situ conditions. The introduction, cultivation and establishment of plantations of some species of the genus Scutellaria L. serve to expand the base of medicinal raw materials.

The high biological activity of flavonoids in the composition of representatives of the genus allows them to be evaluated as a promising source for the pharmaceutical industry. Therefore, in-depth study of the phytochemical composition, population status and bioecological properties of species of the genus Scutellaria L. is one of the promising scientific directions.

Conclusion. In conclusion, the genus Scutellaria L. is one of the important and promising medicinal plants of the Mint family. Representatives of this genus are widely distributed in Central Asia and Uzbekistan, and as a component of the natural flora, they play an important role in preserving biodiversity. An analysis of the literature shows that many species of the genus Scutellaria L. are found in the flora of Uzbekistan, some of which are endemic and rare.

The presence of flavonoids, flavones, iridoids and other biologically active compounds in the composition of the genus determines their high pharmacological value. These substances are important because they have anti-inflammatory, antioxidant, antibacterial, antiviral, sedative and blood pressure-regulating properties. Therefore, species of the genus Scutellaria L. are widely used in folk medicine and modern pharmacy.

Currently, as a result of anthropogenic factors, climate change, and pressure on natural ecosystems, natural reserves of some medicinal plant species are decreasing. This requires an in-depth study of the bioecological characteristics of Scutellaria L. species, the identification of their distribution areas, their introduction, and the expansion of scientific research on the protection of natural populations.

In the future, in-depth study of the phytochemical composition of species, identification of pharmacological properties of biologically active substances and their use in the creation of medicinal preparations are among the promising areas. At the same time, the conservation of rare and endemic species, protection of their gene pool and rational use of natural resources are of great importance in ensuring ecological sustainability.

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