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SYSTEMATIC ANALYSIS OF THE FLORA OF THE TALGAR, ENBEKSHIKAZAKH DISTRICTS OF THE ALMATY REGION

One of the global challenges of our time is to study the problems and preserve the biological diversity of plants. Therefore, the study of plant biodiversity in any region will always be relevant. This article presents the results of a study obtained in the course of conducting a systematic analysis of the flora of Talgar and Enbekshikazakh regions the Almaty region. It was revealed that the flora of the study area includes 114 families, of which 10 leading families make up 60.48% of the total species composition of the flora of the study area. The following families occupy the leading position in this taxonomic composition: Asteraceae (225 species, or 14.60%, 71 genus), Poaceae (132 species or 8.56%), Fabaceae – (115 species or 7.46%). The largest genera are Astragalus (44 species or 7.94%), Allium (28 species or 5.05%), Carex (27 species, 4.87%), Potentilla (23 species or 4.15%). The flora was studied with using traditional methods of floristic and geobotanical research, the main of which was route reconnaissance method. Based on the analysis of literature data, viewing of the herbarium fund of the Institute of Botany and Phytoinduction of the National Academy of Sciences of Kazakhstan, as well as their own research on the study and collection of plants in the Almaty region, a preliminary annotated list of flora was compiled, including 1541 species belonging to 554 genera and 114 families.

Key words: flora, Talgar, Enbekshikazakh districts Almaty region, systematic analysis, biodiversity of plants.

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Алматы облысының Талғар, Еңбекшіқазақ аудандарының флорасының систематикалық талдау

Біздің заманымыздың жаһандық проблемаларының бірі – өсімдіктердің биологиялық әртүрлілік мәселелерін зерттеу және оларды сақтау. Сондықтан кез келген аймақтың өсімдіктердің биологиялық әртүрлілікті зерттеу әрдайым маңызды болады. Берілген мақалада Талғар, Еңбекшіқазақ аудандары Алматы облысының флорасының систематикалық талдау жүргізгеннен кейінгі зерттеу нәтижелері келтірілген. Зерттелінген облыс флорасы 114 тұқымдастан тұратыны анықталды, оның ішіндегі 10 жетекші тұқымдас зерттелінетін территория флорасының 60,48 % құрайды. Берілген таксономикалық құрылымның жетекші орындарын келесі тұқымдастар алады: Asteraceae (225 түр, немесе 14,60 %, 71 туыс), Poaceae (132 түр немесе 8,56 %), Fabaceae – (115 түр немесе 7,46 %). Ең үлкен туыстарға Astragalus (44 түр немесе 7,94 %), Allium (28 түр немесе 5,05%), Carex (27 түр, 4,87 %), Potentilla (23 түр немесе 4,15%) жатады. Флора флористік және геоботаникалық зерттеулердің дәстүрлі әдістерін қолдана отырып зерттелінді, оның негізгісі маршруттық-рекогносцировкалық. ҒК БҒМ Ботаника және фитоиндустрия институтының гербарий фондының қарастыру арқылы, әдебиет көздерін анализдеу негізінде, сонымен қатар Алматы облысының өсімдіктерін жинау және зерттеу барысында алғашқы рет, 114 тұқымдасқа, 554 туысқа, 1541 түрден тұратын түсіндірмелі флора тізімі жасалды.

Түйін сөздер: флора, Талғар, Алматы облысының Еңбекшіқазақ аудандары, систематикалық талдау, өсімдіктердің биоалуантүрлілігі.

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Систематический анализ флоры Талгарского, Енбекшиказахского районов Алматинской области

Одной из глобальных задач современности является изучение проблем и сохранение биологического разнообразия растений. Поэтому, изучение биоразнообразия растений любого региона будет всегда актуальным. В данной статье приводятся результаты, полученные в ходе проведения систематического анализа флоры Талгарского, Енбекшиказахского районов Алматинской области. Выявлено, что флора исследуемой области включает 114 семейств, из которых 10 ведущих семейств составляют 60,48 % всего видового состава флоры изучаемой территории. Лидирующее положение в данном таксономическом составе занимают следующие семейства: Asteraceae (225 видов, или 14,60 %, 71 род), Poaceae (132 вида, или 8,56 %), Fabaceae – (115 видов, или 7,46 %). Наиболее крупными родами являются *Astragalus* (44 вида или 7,94 %), *Allium* (28 видов, или 5,05%), *Carex* (27 видов, 4,87 %), *Potentilla* (23 вида или 4,15%). Флора изучалась с использованием традиционных методов флористических исследований, основным из которых был маршрутно-рекогносцировочный. На основании анализа литературных данных, просмотра гербарного фонда Института ботаники и фито-интродукции КН МОН РК, а также собственных исследований по изучению и сбору растений в Талгарском, Енбекшиказахском районах Алматинской области впервые составлен предварительный аннотированный список флоры, включающий 1541 вид, относящийся к 554 родам и 114 семействам.

Ключевые слова: флора, Талгарский, Енбекшиказахский районы, систематический анализ, биоразнообразие растений.

Introduction

In recent years, the study of biodiversity of terrestrial plants of the Talgar and Enbekshikazakh districts of the Almaty region has been devoted to a number of scientific works and conducted numerous field studies. In 2006, Ivashchenko A.A., was published the unique book “Reserves and National parks of Kazakhstan”, which provides information about the flora and fauna of the ten nature reserves and eight national parks of the Republic, including about the Almaty state nature reserve [1-4]. In 2014-2017 within the framework of the project “Biodiversity of vascular plants of the Trans-Ili Alatau and development of recommendations for the rational use of economically valuable plants, conservation of rare and endangered species”, the authors conducted studies on the current state of flora and vegetation of the Ili Alatau (gorge Small and Big Almatinka, Remizovka, Talgar, Kaskelen, Turgen, Esik, Bertagoy, Aksai, elevated plain Big Dolan) [5-6].

Plants are a vulnerable component of biota, as they are the primary link in the food chain, play a major role in the absorption of a variety of pollutants and are constantly exposed to pollutants due to attachment to the substrate [7-11].

One of the characteristic features of the modern stage of development of society is the strengthening of anthropogenic impact on the environment. This

process is accompanied by synergistic effects and leads to the deterioration of the natural environment, which in the long term leads to a reduction in biodiversity [12-17].

In recent years, all studies on flora and vegetation have focused on the conservation of biodiversity at different levels of its structural organization (species, population, cenotic, ecosystem, landscape) [18-21]. Kazakhstan, as a party to the Convention on the conservation of biological diversity, has its obligations to conserve biological diversity [22-25]. Therefore, the aim of this work was to conduct inventory and a systematic analysis of the Talgar, Enbekshikazakh districts of the Almaty region for an annotated list of flora of the study area and to identify the biological diversity of plants.

The problem of the study and conservation of biological diversity is a global challenge of our time. This is especially important for the natural complex of the Talgar, Enbekshikazakh districts of the Almaty region.

Almaty region – the region located in the South-East of the modern Republic of Kazakhstan and borders on the East with China, in the South-with Kyrgyzstan and was Formed on March 10, 1932. The area of the region is 224 thousand sq. km Administrative Centre is Taldykorgan [26].

Almaty region, including the Talgar and Enbekshikazakh districts, is rich and diverse flora. In the plains is semi-arid and arid vegetation and

wormwood vegetation with thickets of saxaul in clay-colored. There are salt marshes. In the mountains, at an altitude of 600 meters above sea level semi-desert is replaced by a belt of dry wormwood-feather-grass steppes on chestnut soils. At altitudes of 800-1700 m above sea level there are meadows on blackearth mountain soils, at altitudes 1500-1700 m are belt subalpine meadows in combination with coniferous forests on mountain meadow soils; above 2800 m are low-grass Alpine meadows and shrubs on mountain-tundra soils.

The climate in the studied areas is sharply continental with hot summers and cold winters, with significant fluctuations in temperature not only between seasons, but also between times of day [27].

The structure of the cover is dominated by complexes of plant communities. The composition of plant communities and their distribution in space are determined by habitat conditions. The main factors determining the distribution of vegetation in space are the conditions of moisture, salinity and mechanical composition of soils, as well as geomorphological conditions.

The main part of the territory is dominated by complex communities with the domination of the wormwoods (*Artemisia terrae-albae*, *A. annua*, *A. scoparia*). Within these communities, annuals are abundant (*Eremopyrum orientale*, *Eremopyrum triticeum*, *Ceratocephala testiculata*, *Lepidium ruderales*, *Alyssum calycinum*, *Chenopodium album*). In addition to the dominant perennials, in these communities there are such perennials as *Tanacetum vulgare*, *Ferula dissecta*, *Rheum wittrockii*. Typical components of these communities are annuals-ephemera (*Eremopyrum orientale*, *E. triticeum*, *Lepidium perfoliatum*). Significant areas are occupied by phytocenoses with weed plants (*Taraxacum officinale*, *Xanthium strumarium*, *Cannabis ruderalis*, etc.).

Research materials and methods

In the field, the flora was studied using traditional methods of floristic research, the main of which was route reconnaissance.

In determining the herbarium samples were used as sources of the “Flora of Kazakhstan”, “Illustrated determinant of plants of Kazakhstan”, the definition of families and genera was carried out with the help of “Flora of Kazakhstan” [28-30].

The location of species and supraspecific categories in the flora and floristic spectrum carried out according to the system of A. L. Takhtajan [31]. The spelling of Latin names, the nomenclatural

changes of the taxa were verified in accordance with S.K. Cherepanov [32].

The most important base of analysis is systematic analysis. The systematic structure of flora is a set of species belonging to different families and genera, and the regularities of their concentration are their main characteristic.

Results and discussions

As a result of the analysis of the species composition of plants, compiled on the basis of own and literary data, the flora of the Talgar, Enbekshikazakh districts of the Almaty region includes 554 genera and 1541 species from 114 families.

Table 1 – Distribution of plants in the Talgar, Enbekshikazakh districts of the Almaty region by systematic groups

Systematic group	Number of families	Number of genus	Number of species
Horsetail	1	1	3
Ferns	7	9	11
Gymnosperms	3	6	15
Angiosperms:			
1) dicotyledonous	84	449	1224
2) monocotyledons	19	89	288
Total:	114	554	1541

The floristic spectrum of the Talgar, Enbekshikazakh districts of the Almaty region and the following systematic groups (table 1) show that the basis of the flora is floral, and the minimum part are of the horsetail, ferns and gymnosperms. The species composition of the flora of the Talgar, Enbekshikazakh districts of the Almaty region is dominated by the divisions of *Magnoliophyta*, which accounts for 1512 species (98.19%) and only a small number of species (15 or 0.97 %) belongs to *Pinophyta*, *Polypodiophyta* and *Equisetophyta* (figure 1).

The total number of dicotyledonous in the flora of the study area are 1224 species, which is 79.43% of the total number of species, and monocotyledons only 288 species or 18.69% of the total, the spore plants and gymnosperms – 29 species (1.89 %). Figure 1 shows that in the ratio of the number of monocotyledonous and dicotyledonous genera there is a tendency to increase the role of dicotyledonous, and in the ratio of the number of families it is even more evident.

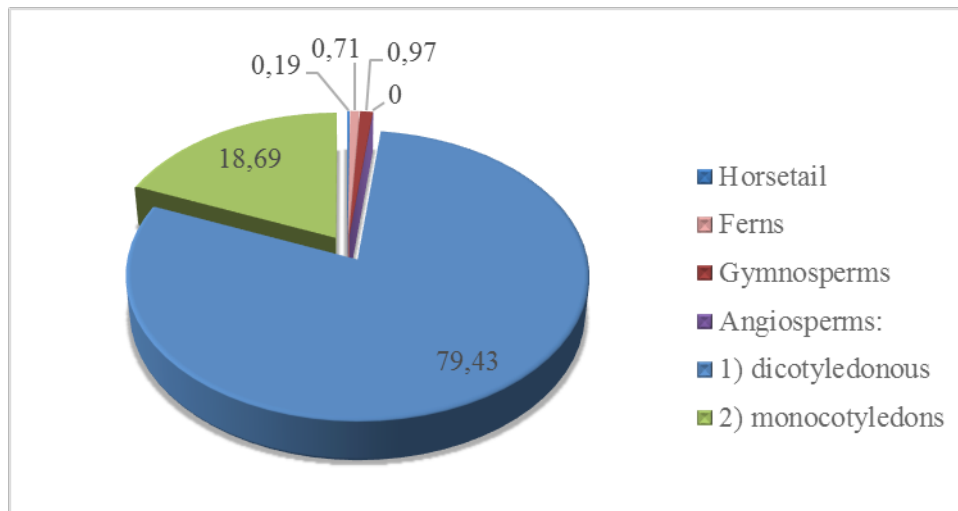


Figure 1 – Ratio of systematic groups of flora of the Talgar, Enbekshikazakh districts of the Almaty region (% of total views)

On the territory of Talgar, Enbekshikazakh districts Almaty region, 114 families of plants were identified. They are: *Equisetaceae* Rich. Ex Dc., *Athyriaceae* Alst., *Dryopteridaceae* Ching., *Aspleniaceae* Mett., *Polypodiaceae* Bercht & J. Presl., *Woodsiaceae* (Diels.) Herter, *Botrychiaceae* Horan., *Ophioglossaceae* (R. Br.) Agardh, *Pinales* Lindl., *Cupressaceae* Rich. Ex Bartl., *Ephedraceae* Dumort., *Ceratophyllaceae* S.F. Gray, *Ranunculaceae* Juss., *Berberidaceae* Juss., *Paeoniaceae* Rudolphi, *Hypericaceae* Juss., *Papaveraceae* Juss., *Hypecoaceae* (Dumort.) Willk., *Fumariaceae* Dc., *Portulacaceae* Juss., *Caryophyllaceae* Juss., *Amaranthaceae* Juss., *Chenopodiaceae* Vent., *Polygonaceae* Juss., *Limoniaceae* Ser., *Fagaceae* Dumort., *Betulaceae* S. F. Gray., *Juglandaceae* A. Rich. Ex Kunth, *Ericaceae* Juss., *Pyrolaceae* Dumort., *Monotropaceae* Nutt., *Primulaceae* Vent., *Violaceae* Batsch., *Tamaricaceae* Link, *Cistaceae* Juss., *Salicaceae* Mirb., *Cucurbitaceae* Juss., *Brassicaceae* Burnett, *Resedaceae* S.F. Gray, *Tiliaceae* Juss., *Malvaceae* Juss., *Ulmaceae* Mirb., *Moraceae* Link, *Celtidaceae* Link, *Cannabaceae* Endl., *Urticaceae* Juss., *Euphorbiaceae* Juss., *Thymelaeaceae* Juss., *Crassulaceae* Dc., *Saxifragaceae* Juss., *Grossulariaceae* Dc., *Parnassiaceae* S.F. Gray., *Rosaceae* Juss., *Lythraceae* J. St.-Hil., *Onagraceae* Juss., *Haloragaceae* R. Br., *Fabaceae* Lindl., *Aceraceae* Juss., *Rutaceae* Juss., *Zygophyllaceae* R. Br., *Linaceae* Dc. Ex S. F. Gray., *Oxalidaceae* R.Br., *Geraniaceae* Juss., *Balsaminaceae* A. Rich., *Polygalaceae* R. Br., *Celastraceae* R. Br, *Santalaceae* R. Br., *Rhamnaceae* Juss., *Elaeagnaceae* Juss., *Vitaceae* Juss., *Hydrangeaceae* Dumort., *Apiaceae*

Lindl., *Caprifoliaceae* Juss., *Viburnaceae* Rafin., *Adoxaceae* Trautv., *Valerianaceae* Batsch, *Dipsacaceae* Juss., *Rubiaceae* Juss., *Gentianaceae* Juss., *Apocynaceae* Juss., *Asclepiadaceae* R. Br., *Oleaceae* Hoffing. & Link, *Solanaceae* Juss., *Convolvulaceae* Juss., *Cuscutaceae* Dumort., *Polemoniaceae* Juss., *Boraginaceae* Juss., *Scrophulariaceae* Juss., *Orobanchaceae* Vent, *Plantaginaceae* Juss., *Verbenaceae* J.St.-Hil., *Lamiaceae* Lindl., *Callitrichaceae* Link, *Campanulaceae* Juss., *Asteraceae* Dumort., *Alismataceae* Vent., *Juncaginaceae* Rich., *Potamogetonaceae* Dumort., *Zannichelliaceae* Dumort., *Melanthiaceae* Batsch, *Iridaceae* Juss., *Liliaceae* Juss., *Asphodelaceae* Juss., *Alliaceae* J. Adardh., *Ixioliriaceae* Nakai, *Convallariaceae* Horan., *Asparagaceae* Juss., *Orchidaceae* Juss., *Juncaceae* Juss., *Cyperaceae* Juss., *Poaceae* Barnhart, *Lemnaceae* S.F. Gray, *Sparganiaceae* Rudolphi, *Typhaceae* Juss.

Traditionally, in floristic works 10 large families of plants are considered in descending order of the number of species, which is called the family spectrum of flora. Analysis of the largest families of the flora of the Talgar, Enbekshikazakh districts of the Almaty region has allowed to identify the 10 largest families in the greatest number of species.

The first ten families contain 932 species of plants, which is about 60.48% of the total number of species. Figure 2 shows the spectrum of the largest 10 families of flora of Talgar, Enbekshikazakh districts Almaty region.

The first place in the number of species and genera is occupied by the *Asteraceae* family (225

species, or 14.60 % of the total number of species, 71 genus, or 12.82% of the total number of genera), then the second place is occupied by the *Poaceae* family (8.56 % of the total number of species and 9.21% of the total number of genera). The third place is occupied by the *Fabaceae* family, which contains 21 genera (3.79%), 115 species (7.46 %). This is followed by the family *Rosaceae* – 96 species (6.23%), 28 genera (5.05%). Family *Brassicaceae* is – 82 species (5.32 %), number of

genera 44 (7.94%). The family *Ranunculaceae* contains 66 species (4.28%), 20 genera (3.61%), *Scrophulariaceae* is -60 species (3.89%), 12 genera (2.17%), *Lamiaceae* is -59 species (3.83%), 24 genera (4.33%). This is followed by the family *Caryophyllaceae*-53 species (3.44%), 21 genus (3.79%). In tenth place is the family *Cyperaceae* is – 44 species (2.86% of the total number of species), 10 genera (1.81% of the total number of genera).

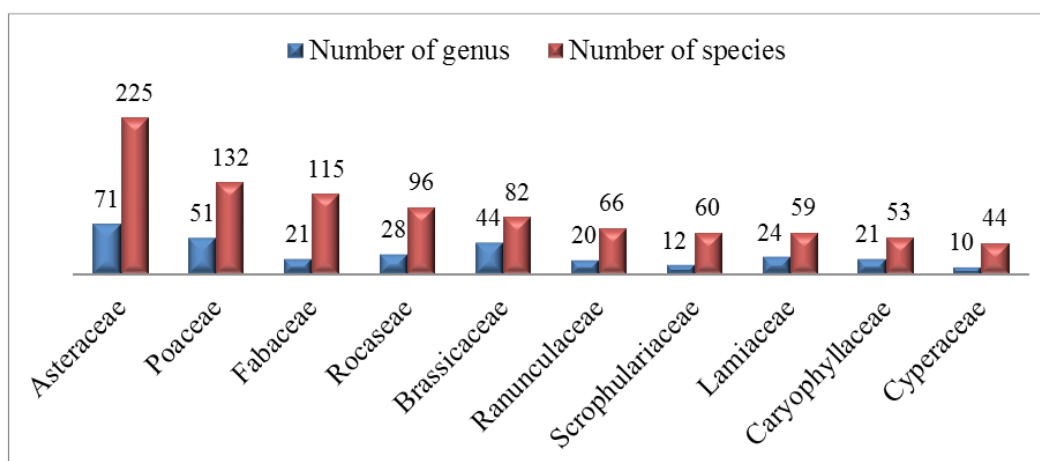


Figure 2 – Number of species and genera in 10 leading families of flora of the Talgar, Enbekshikazakh districts of the Almaty region

The above 10 families include 60.48% of the total species composition of the flora of the studied region. Other families are characterized by more low species and generic diversity.

Table 2 provides information on the number of species for the largest genera of flora of the Talgar, Enbekshikazakh districts of the Almaty region. From the table 2 shows that the largest genera are *Astragalus* (44 species or 7, 94 % of total views), *Allium* (5, 05 %), *Carex* (4.87 %), *Potentilla* (4.15%). Can also be noted genera: *Ranunculus* (3.97 % of total views), *Veronica* (3.97%), *Oxytropis* (3.79%), *Artemisia* (3. 61 %), *Taraxacum* (3.25%), and *Salix* (2.71 % of total views).

Thus, for 10 genera (1.8% of the total number of genera), there are 240 species of flora of the Talgar, Enbekshikazakh districts of the Almaty region.

Table 2 – Number of species in the largest genera of flora of the Talgar, Enbekshikazakh districts of the Almaty region

Genus	Number of species
<i>Astragalus</i>	44
<i>Allium</i>	28
<i>Carex</i>	27
<i>Potentilla</i>	23
<i>Ranunculus</i>	22
<i>Veronica</i>	22
<i>Oxytropis</i>	21
<i>Artemisia</i>	20
<i>Taraxacum</i>	18
<i>Salix</i>	15
Total: genus – 10	240

Conclusion

Based on the research and analysis of the results of the data, the following conclusions are made:

Based on the analysis of literature data, viewing the herbarium Fund of the Institute of Botany and Phytointroduction of Ministry of Education and Science Republic of Kazakhstan, as well as their own research on the study and collection of plants in the Talgar, Enbekshikazakh regions of the Almaty region for the first time compiled by a preliminary annotated list of flora, including 1541 species belonging to 554 genera and 114 families.

The first ten leading families contain 932 species and make up 60.48 % of the total species composition of the flora of the study area. The

leading position in this taxonomic composition is occupied by the following families: *Asteraceae* (225 species, or 14.60 %, 71 genus), *Poaceae* (132 species or 8.56 %), *Fabaceae* – (115 species or 7.46 %). Dominant genera are *Astragalus* (44 species or 7.94 %), *Allium* (28 species or 5.05%), *Carex* (27 species, 4.87 %), *Potentilla* (23 species or 4.15%).

Biodiversity of plants is an important characteristic of ecosystems and changes over time. Therefore, it is an indicator of the changes taking place, and its current state is the result of phenomena that occurred earlier under the influence of natural and anthropogenic factors. Thus, it is necessary to develop monitoring and forecasting of the situation in order to improve it.

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