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Family *Caryophyllaceae* in the flora of Central Kazakhstan: species composition, spreading, practical use

This article analyzes the species composition of the family *Caryophyllaceae* of the flora of Central Kazakhstan within the Karaganda and Ulytau regions, the distribution of identified taxa, ecobiomorphological features and phytoprotective status. It was revealed that the family *Caryophyllaceae* includes 80 species from 18 genera, which is 44.4% of the species flora of this family of Kazakhstan and 7.2% of the total number of species of the flora of Central Kazakhstan. The leading genera by number of species are *Silene* L. (28 species) and *Dianthus* L. (11 species). Endemic species are 2 taxa. Phytoprotective status has 1 species, which is included in rare and endangered plants of Karaganda region. In relation to moisture conditions, mesophytes (12 species) prevail among the described taxa, xeromesophytes (19 species) are in the second place, and mesoxerophytes (16 species) are in the third position. Analysis of life forms showed predominance of herbaceous perennial (60 species) and annual (16 species) forms. Among the species of the family *Caryophyllaceae*, the following economically valuable groups were noted: weedy, medicinal, poisonous, and suitable for perfumery and cosmetic purposes, ornamental, technical, fodder and honey-bearing groups.

Keywords: family *Caryophyllaceae*, flora, Central Kazakhstan, species composition, ecological groups, life forms, useful properties, phytoprotective status.

Introduction

The flora of Kazakhstan is represented by a unique species composition, which is determined by the diversity of landscapes and soil and climatic conditions. The flora of the regions is characterized by various ecological groups of plants, including every-biont and stenobiont species. According to the last data, the flora of Kazakhstan includes about 6040 species from 1118 genera, including 709 endemics and 387 species listed in the Red Book of Kazakhstan [1, 2].

The territory of Central Kazakhstan is poorly studied in terms of determining the species composition, ecobiomorphological features and economic properties of plants. When analyzing the flora of the region, it is necessary to take into account large families, one of which is *Caryophyllaceae*. This family is included in the list of the largest taxa of Kazakhstan, includes 282 species from 42 genera; among them 20 endemic species and 11 species listed in the Red Book of Kazakhstan [3, 4]. The family is cosmopolitan, but the dominant species composition grows in Central and East Asia [1].

Representatives of the family *Caryophyllaceae* participate in the formation of phytocenoses of steppe, meadow and forest zones. They are promising medicinal, ornamental, fodder crops, and also have technical and honey-bearing value. Plants are rich in biological active compounds, which have adaptogenic, tonic, antimicrobial, and antiviral properties [5–8].

Weak study of this family is connected with high variability of species; so, in particular, plants from genera are difficult to identify *Silene*, *Oberna*, *Elisanthe*, *Melandrium*, etc.

Within the framework of preparing a complete outline of the flora of Karaganda region, we analyze large families to understand their species richness, structural features, useful properties and to identify species in need of protection.

The aim of this study is to determine the current species composition of species of the family *Caryophyllaceae* and to rank them by biomorphs, ecological groups and to identify economically valuable plants.

Experimental

The species composition was analyzed on the basis of literature data [1, 2, 9–13], analysis of the herbarium fund of the Biology and Geography Department of Karaganda University named after academician E.A. Buketov (QAR), the State National Natural Park “Buiratau”, Astana (NUR) and Zhezkazgan Botanical Gar-

den, data from the Nature Museum of the Institute of Ecology of Plants and Animals, data presented on the GBIF platform, as well as the results of our own field collections.

Species names are given according to taxonomic GBIF categories (<https://www.gbif.org/>).

Ecological groups were identified on the basis of the relationship of plants to moisture conditions [14], life forms — according to the publication of I.G. Serebryakov [15], economic groups — according to reference books [5–8, 16–18].

The allocation and justification of the status of rare endangered species of the region was carried out on the basis of the own materials and works of M.S. Baitenov [3, 4], the list of rare and endangered plants of Karaganda region [19].

Results and Discussions

The territory of the Central Kazakhstan (Karaganda region) is located within the continental West Siberian steppe zone and occupies a middle position in the republic. The following floristic districts are located on the territory of the Central Kazakhstan.

Taxonomic analysis

Present days, the family *Caryophyllaceae* of the flora of Central Kazakhstan is represented by 80 species belonging to 18 genera (Table 1), which is 44.4% of the total number of species composition of this family of Kazakhstan flora and 6.45% of the total number of species of the flora of Central Kazakhstan.

Table 1

Taxonomic composition of species of family *Caryophyllaceae*

№	Genus	Total number of species in Central Kazakhstan, pcs.	Total number of species in Kazakhstan, pcs.	% of total species in Kazakhstan
1	<i>Herniaria</i> L.	2	4	50
2	<i>Spergula</i> L.	1	1	100
3	<i>Spergularia</i> (Pers.) J. & C. Presl.	5	5	100
4	<i>Holosteum</i> L.	2	2	100
5	<i>Sagina</i> L.	1	3	33,3
6	<i>Cerastium</i> L.	4	12	33,3
7	<i>Lepyrodiclis</i> Fenzl	1	2	50
8	<i>Stellaria</i> L.	6	19	31,6
9	<i>Sabulina</i> L.	3	7	42,8
10	<i>Moehringia</i> L.	1	3	33,3
11	<i>Arenaria</i> L.	4	12	33,3
12	<i>Acanthophyllum</i> C. A. Mey.	1	6	16,7
13	<i>Petrorhagia</i> (Ser. ex DC.) Link	1	1	100
14	<i>Gypsophila</i> L.	7	21	33,3
15	<i>Agrostemma</i> L.	1	1	100
16	<i>Dianthus</i> L.	11	24	45,8
17	<i>Saponaria</i> L.	1	1	100
18	<i>Silene</i> L.	28	56	50

The leading positions on species diversity are occupied by 2 genera: *Silene* L. and *Dianthus* L. Thus, genus *Silene* L. includes the following species: *S. sibirica* var. *holopetala* (Bunge) Lazkov, *S. sibirica* (L.) Pers., *S. anisoloba* Schrenk, *S. lithophila* Kar. & Kir., *S. praemixta* M. Pop., *S. chlorantha* (Willd.) Ehrh., *S. multiflora* (Ehrh.) Pers., *S. balchaschensis* Schischk., *S. gavrilovii* (Krasn.) M. Pop., *S. graminifolia* Otth, *S. karkaralensis* A. Dm. et M. Pop., *S. adenopetala* Raik., *S. incurvifolia* Kar. & Kir., *S. dichotoma* Ehrh., *S. betpakdalensis* Bajt., *S. suffrutescens* M. Bieb., *S. altaica* Pers., *S. alexandrae* B. Keller, *S. brahuica* Boiss., *S. nutans* L., and *S. repens* Patr. Taxonomic composition of representatives of the family *Caryophyllaceae*, growing on the territory of Central Kazakhstan is presented in Figure 1.

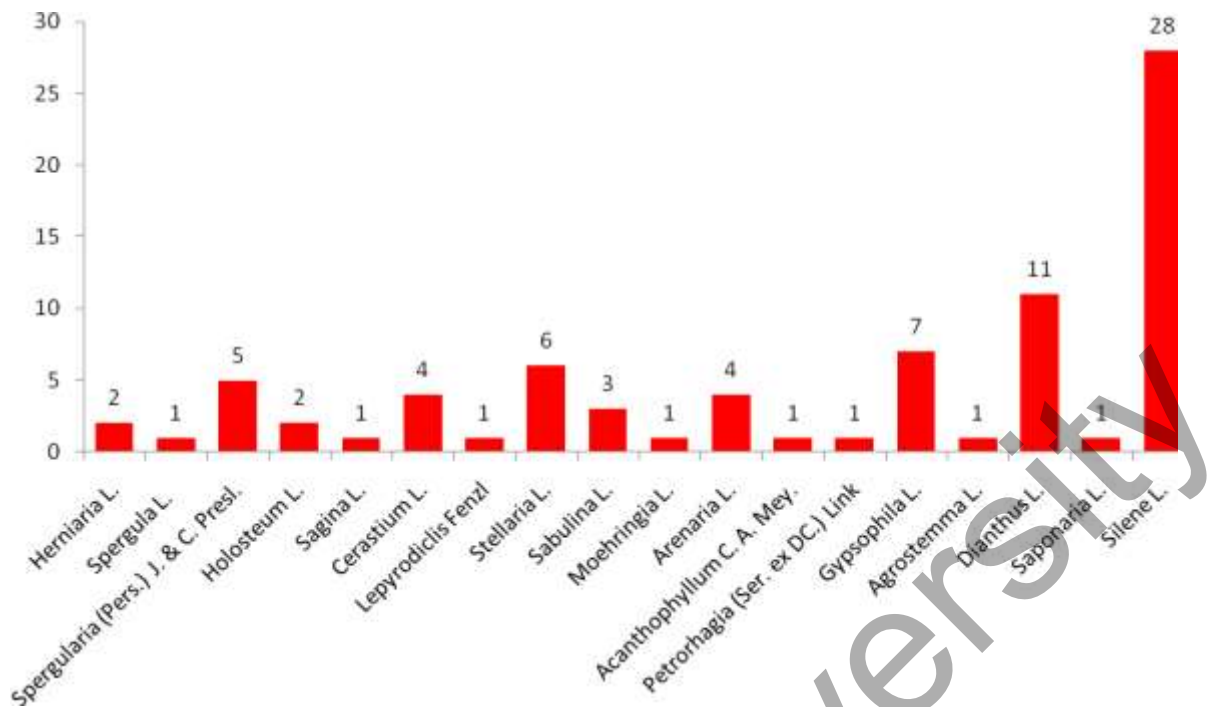


Figure 1. Numerical distribution of species in genera of the family Caryophyllaceae of the flora of Central Kazakhstan

According to the number of species, *Caryophyllaceae* are among the 10 leading families of the flora of Central Kazakhstan [17], occupying the 6th position (Table 2). Representatives of this family occupy 7.24% of the total number of species and 5.66% of the total number of genera.

Table 2

The list of the leading families by species composition of Central Kazakhstan flora

№	Family	Number of genera, pcs.	% of total number of genera	Number of species, pcs.	% of total number of species
1	<i>Asteraceae</i>	50	10,3	187	14,9
2	<i>Fabaceae</i>	22	4,6	113	9,0
3	<i>Brassicaceae</i>	44	9,1	82	6,5
4	<i>Poaceae</i>	30	6,2	81	6,5
5	<i>Chenopodiaceae</i>	24	4,9	74	5,9
6	<i>Caryophyllaceae</i>	15	3,1	57	4,5
7	<i>Lamiaceae</i>	20	4,1	50	4,0
8	<i>Boraginaceae</i>	20	4,1	49	3,9
9	<i>Apiaceae</i>	30	6,2	47	3,7
10	<i>Scrophulariaceae</i>	10	2,1	47	3,7

Among 80 species 2 endemics (*Silene holopetala* Bunge and *Silene anisoloba* Schrenk) were recorded, which is 2.5 % of the total species composition. One species (*Agrostemma chalconica*) is classified as a rare and endangered species of Karaganda region [19].

Ecological analysis

The comparative analysis of the presented species showed that the majority of species belong to the group of mesophytes — 22 taxa (27.5%), xeromesophytes — 19 taxa (23.8%), mesoxerophytes — 16 taxa (20%), xerophytes — 9 taxa (11.3%), hygrophytes — 7 taxa (8.7%) (Fig. 2).

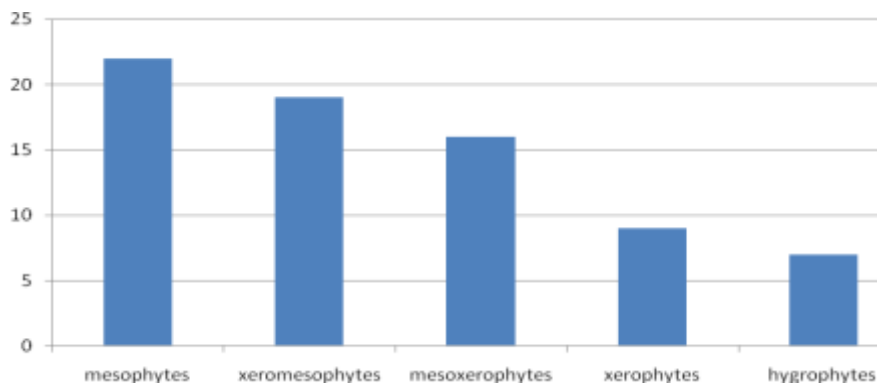


Figure 1. Ranking of representatives of the family *Caryophyllaceae*, growing on the territory of Central Kazakhstan, depending on moisture conditions

Ecobiomorphological analysis

By life form, perennial herbaceous plants predominate with 60 species (75%), annual herbs are on the 2nd position with 16 species (20%), and biennial herbs with 4 species (5%) are on the 3rd position (Fig. 2).



Figure 2. Life form of representatives of family *Caryophyllaceae* of central Kazakhstan flora

Ranking of representatives of the family by economic importance was carried out; and it was found that most species of *Caryophyllaceae* have weed value, a smaller number of species are poisonous and soap, medicinal, ornamental, technical, fodder and honey-bearing species are found (Fig. 3).

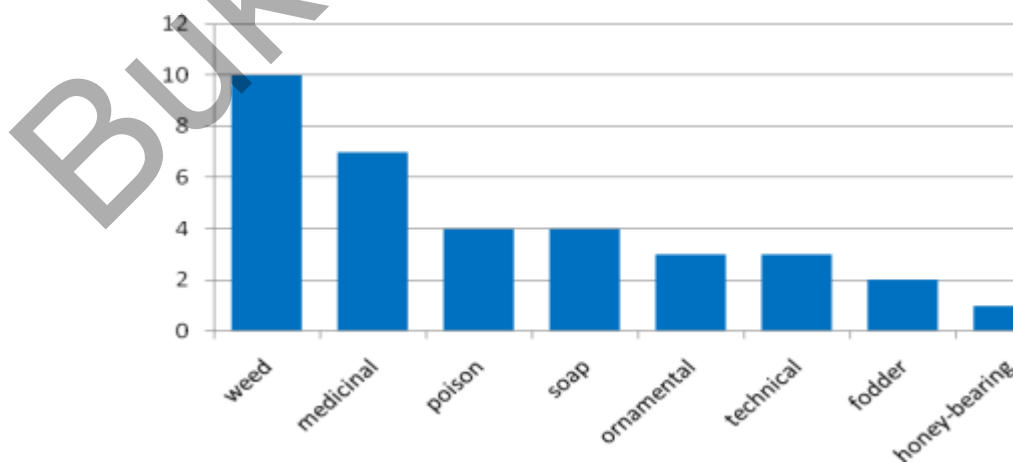


Figure 3. Practical-useful groups of species of family *Caryophyllaceae* of Central Kazakhstan flora

Thus, species of the genus *Arenaria*, *Cerastium*, *Dianthus*, *Gypsophila*, *Lychnis chalconica*, *Saponaria officinalis*, *Stellaria*, *Vaccaria hispanica* have ornamental value. The following species are used in folk and traditional medicine: *Cerastium arvense* L., *Dianthus versicolor* Fisch. ex Link, *Gypsophila paniculata* L., *Lychnis chalconica* L., *Saponaria officinalis* L., *Stellaria graminea* L., *Vaccaria hispanica* (Mill.) Rauschert.

Conclusion

Thus, on the basis of field studies, collection of information on scientific publications and analysis of the herbarium fund, it was found that 80 species of 18 genera of representatives of the family *Caryophyllaceae* grow on the territory of Central Kazakhstan. Ranking by ecological groups and life forms was carried out. Depending on moistening conditions mesophytic species prevail, perennial herbaceous plants dominate by life form. Species with weed, poisonous, medicinal, ornamental, technical, soap, fodder, honey-bearing value were identified.

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Р.Т. Мусина, М.М. Силантьева, М.Ю. Ишмуратова, Е.А. Гаврилькова,
С.У. Тлеукенова, А.Т. Нуркенова

Орталық Қазақстанның *Caryophyllaceae* тұқымдасының өкілдері: түрлік құрамы, таралуы және пайдалану мүмкіндіктері

Мақалада Қарағанды және Ұлытау облыстары шегінде Орталық Қазақстан флорасының *Caryophyllaceae* тұқымдасының түрлік құрамы, анықталған таксондардың таралуы, экобиоморфологиялық ерекшеліктері және фитокорғау мәртебесі талданған. *Caryophyllaceae* тұқымдасына 18 тұқымдастың 80 түрі кіретіні анықталды, бұл Қазақстандағы осы тұқымдастардың түрлері флорасының 44,4%-ын және Орталық Қазақстан флорасының жалпы түрлерінің 3,2%-ын құрайды. Түрлердің саны бойынша жетекші тұқымдастар — *Silene* L. (28 түр) және *Dianthus* L. (11 түр). Эндемикалық түрлер — 2 таксон. Қарағанды облысының сирек кездесетін және жойылып бара жатқан өсімдіктеріне енгізілген 1 түр фитокорғау мәртебесіне ие. Сипатталған таксондар арасында ортаның ылғалдану жағдайларына қатысты бірінші орында — мезофиттер (12 түр), екінші орында — ксеромезофиттер (19 түр), үшінші орында — мезоксерофиттер (16 түр) басым. *Caryophyllaceae* тұқымдасы түрлерінің ішінде мына экономикалық құнды топтар атап өтілді: арамшөптер, дәрілік, улы, парфюмерлік-косметикалық мақсаттарға жарамды, сәндік, техникалық, мал азықтық және балды.

Кілт сөздер: *Caryophyllaceae* тұқымдасы, флора, Орталық Қазақстан, түр құрамы, экологиялық топтар, тіршілік формалары, пайдалы қасиеттері, фитокорғау мәртебесі.

Р.Т. Мусина, М.М. Силантьева, М.Ю. Ишмуратова, Е.А. Гаврилькова,
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Представители семейства *Caryophyllaceae* Центрального Казахстана: видовой состав, распространение и возможности использования

В статье проанализирован видовой состав семейства *Caryophyllaceae* флоры Центрального Казахстана в пределах Карагандинской и Улытауской областей, распространение выявленных таксонов, экобиоморфологические особенности и фитохозяйственный статус. Определено, что в состав семейства *Caryophyllaceae* входит 80 видов из 18 родов, что составляет 44,4 % от флоры видов данного семейства Казахстана и 7,2 % от общего числа видов флоры Центрального Казахстана. Ведущими родами по численности видов являются *Silene* L. (28) и *Dianthus* L. (11 видов). Эндемичными видами являются 2 таксона. Фитохозяйственный статус имеет 1 вид, который включен в редкие и исчезающие растения Карагандинской области. По отношению к условиям увлажнения среди описанных таксонов преобладают мезофиты (12 видов), на втором месте — ксеромезофиты (19), на третьей позиции — мезоксерофиты (16 видов). Анализ жизненных форм показал преобладание травянистых многолетних (60) и однолетних (16 видов) форм. Среди видов семейства *Caryophyllaceae* отмечены следующие хозяйственно-ценные группы: сорные, лекарственные, ядовитые, пригодные для парфюмерно-косметических целей, декоративные, технические, кормовые и медоносные.

Ключевые слова: семейство *Caryophyllaceae*, флора, Центральный Казахстан, видовой состав, экологические группы, жизненные формы, полезные свойства, фитохозяйственный статус.

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