

# Botanical coverage of the leading families of medicinal flora of Kazakhstan

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**Abstract.** The work presents a comprehensive analysis of the phyto-pharmacological study of 4 fairly large families of the medicinal flora of Kazakhstan, which includes 148 medicinal species: Polygonaceae (42), Caryophyllaceae (41), Poaceae (35), Boraginaceae (30). The analyzed families contain 22 pharmacopoeial species, of which 2 species are included in the Red Book of Kazakhstan. The resource coverage of medicinal species is extremely low; stocks of raw materials were taken into account only for 10 species. The introduction coverage of medicinal plants of these families is higher than the resource one; 56 species have been cultivated, information on the yield of raw materials is available for 7 species.

## 1 Introduction

The article is of an overview nature and is based on the materials of screening of the medicinal flora of Kazakhstan according to the annotated listing of species [1]. The analyzed families are presented based on the modern understanding of the status and volume of taxa [2]. The Plantarium and The Plant List Internet resources [3, 4] were used for taxonomic adjustment.

## 2 Results

Screening of the medicinal flora of Kazakhstan showed presence of 1406 species belonging to 134 families of higher flowering plants in the territory of the Republic. Further analysis revealed 7 families leading by the number of medicinal species: Asteraceae (196 species), Rosaceae (89), Lamiaceae (78), Fabaceae (78), Ranunculaceae (75), Apiaceae (69) and Brassicaceae (63), a detailed analysis of which was given in our previous work [5]. Another 4 families unite 45–30 species each; 15 families contain 10–21 species each; 47 families – from 9 to 3 species; 22 families – 2 species each; single-species families – 35 or 26%.

This work presents an analysis of 4 families containing from 30 to 45 species of medicinal plants: Boraginaceae Juss. (30), Caryophyllaceae Juss. (41), Poaceae Barnhart (35), Polygonaceae Juss. (42).

Boraginaceae Juss. family has 30 species, 18 genera of medicinal plants in the territory of Kazakhstan. In the biomorphological spectrum, all species of the family are herbaceous plants: perennials – 13, annuals – 9, biennials – 8 species. About a third of the species have

a wide range, being represented by the Palearctic (*Anchusa officinalis* L., *Echium vulgare* L., etc.) and Holarctic (*Myosotis scorpioides* L.) species. There are 5 species with Central Asian mountain ranges (*Onosma dichroantha* Boiss., *Lappula* Moench species, etc.), grow only in Altai – 2 (*Cerintho minor* L. and *Lappula redowskii* (Hornem.) Greene), in total for the mountain systems of Altai, Tarbagatai, Tien Shan – 10, in plain steppe Kazakhstan – 3 species, 3 species – grow everywhere.

In official medicine, only 1 species is known – *Symphytum officinale* L. and others are used exclusively by traditional medicine. Raw material – grass, contains alkaloids, carbohydrates, triterpenoids, steroids, saponins, cyclitols, nitrogen-containing compounds, organic, phenol carboxylic and higher fatty acids, tannins, fatty oil. It is used as a hemostatic, emollient, wound healing, immunomodulating, antihormonal, antispasmodic, antiviral, antitumor agent. Most members of this family are characterized by the presence of saponins, alkaloids, flavonoids, coumarins, cyclitols, carbohydrates, phenolic and fatty acids and etc. They are used in the same way.

The resources of these species in the territory of Kazakhstan have not been determined. Data on the production cultivation of the species of the family have not been found in the available literature; information on the introduction is available for 7 species of this family.

For Caryophyllaceae Juss. family only 41 medicinal species (20 genera) are identified. The largest genera are *Dianthus* L. and *Stellaria* L. (6 each), eleven genera have 1 species each. In biomorphological terms, most species are herbaceous plants: perennials – 28 species (69%), annuals – 5, semi-shrubs – 2, 6 species have a mixed biomorphological type. In phytogeographical respect, most medicinal species of the family have wide ranges, species with Altai, Siberian Mountain, Central Asian Mountain and steppe types of ranges are less common.

They are used almost exclusively by traditional medicine; only 3 species are used in official medicine: *Allochrysa gypsophiloides* (Regel) Schischk, *A. paniculata* (Regel & Herder) Ovcz. & Czukav. and *Saponaria officinalis*. The species of the family are rich in ecdysteroids of various structures which have a tonic, adaptogenic, restorative effect; saponins (triterpene, steroid), which are used as an expectorant agent; a number of flavonoids are derivatives of quercetin, genin and, in small amounts, alkaloids.

Resources have been identified only for *Allochrysa gypsophiloides* [6] whose commercial thickets were found on the foothill plain of the Beltau ridge in the South Kazakhstan region.

In terms of introduction medicinal plants of this family have practically not been studied. Cultivation experiments are available for 11 species that were grown in the botanical gardens of Kazakhstan as ornamental crops. Attempts of commercial growing of *Allochrysa gypsophiloides* showed very low profitability of the plantation, although the average yield of dry *Allochrysa* root in the 4<sup>th</sup> year of cultivation reached 23.1 c/ha.

The Poaceae Barnhart family includes 35 species, 29 genera of medicinal plants in the territory of Kazakhstan (annuals – 7, perennials – 28 species). The raw material is the whole plant with roots. Species have diverse natural components and some of them may be applied as antidiabetic agents (g. *Phragmites* Adans.) [7]. Most often they are used as antiseptic, anti-inflammatory, hemostatic and sedative agents. In official medicine, 3 types are used: *Calamagrostis epigejos* (L.) Roth, *Cynodon dactylon* (L.) Pers., *Elytrigia repens* (L.) Nevski – as diuretic, anti-inflammatory, analgesic, tonic and antipyretic for pulmonary tuberculosis and a number of gastrointestinal diseases. Resources are identified for 2 species: *Agropyron cristatum* (L.) Beauv., *Phragmites australis* (Cav.) Trin. ex Steud.

In the introduction, 25 species were tested. There is no commercial development of the culture of wild medicinal cereals in Kazakhstan, but there is information on the yield of some species under the conditions of culture: *Agropyron cristatum* (L.) Gaertn. – 154 c/ha

of green mass; *Dactylis glomerata* L. – 108-280 kg/ha of green mass; *Festuca pratensis* Huds.– 142.5 kg/ha of green mass.

The family of Polygonaceae Juss. in Kazakhstan is represented by 42 species, 13 genera of medicinal plants. The largest genera are *Rumex* L. (15 species) and *Rheum* L. (7 species). Biomorphologically, most species of the family are herbaceous plants, and only 2 species, *Atraphaxis spinosa* L. and *Calligonum rubens* Mattei, are shrubs. The ecological structure of the medicinal flora of the family is characterized by the predominance of ecomorphs of the mesophilic group – 30 species, xerophilic – 12 species. In the family of 17 species with a wide range (*Rumex acetosa* L., *Fagopyrum tataricum* (L.) Gaertn. – Palearctic species, *Persicaria amphibia* (L.) Delarbre, *Polygonum aviculare* L., *Rumex crispus* L. – Holarctic, *Persicaria maculosa* Gray – cosmopolitan), the second place is occupied by species with the Central Asian mountain type of range, there are Altai and Siberian mountain species.

The raw materials are mainly roots and rhizomes. Due to the high content of tannins, organic acids and vitamins, plants of this family are used as hemostatic, astringent, vitamin, hypotensive, antiseptic agents for heart, gastrointestinal diseases, vitamin deficiencies, etc. In official medicine, 15 species of the family are used, stocks of raw materials were determined only in 7 of them: *Aconogonon coriarium* (Grig.) Soják, *Persicaria hydropiper* (L.) Spach, *Persicaria lapathifolia* (L.) Delarbre, *Persicaria bistorta* (L.) Samp., *Rheum altaicum* Losinsk., *Rumex confertus* Willd., *Rumex tianschanicus* Losinsk.ex Pavlov.

13 species of medicinal plants of this family were tested under culture conditions, data on the productivity of raw materials were determined for 4 species.

### 3 Conclusion

A comprehensive analysis of the botanical and pharmacological study of 4 fairly large families of the officinal flora of Kazakhstan (Boraginaceae Juss. (30), Caryophyllaceae Juss. (41), Poaceae Barnhart (35), Polygonaceae Juss. (42)), which unite 148 species, has been carried out. The analyzed families comprise 22 pharmacopoeial species, including such significant ones as *Allochrusa gypsophiloides*, *Saponaria officinalis*, *Persicaria species* (= *Polygonum* L.), *Rheum* and *Rumex*. The Red Book of Kazakhstan includes 2 species used in official medicine: *Allochrusa gypsophiloides* and *Rheum altaicum*. In folk medicine, a rare species, *Rheum wittrockii* C.E. Lundstr. is widely used.

The described families contain diverse biologically active components and most well-known flavonoids, coumarins, steroids, triterpenes, alkaloids and etc. *Polygonaceae* and *Caryophyllaceae* fam. species found as a source of flavonoids and saponins. In recent decades active scientific research has been carried out for studies on chemical constituents of cereals (*Poaceae* fam.) as a source of new pharmacological active components and in many plants of these systematic group have been tested and identified a range of activities as antibacterial, growth-inhibiting and antimycotic properties which makes it possible to use them in the treatment of malignant neoplasms.

The resource knowledge of medicinal species of these families is extremely low, stocks of raw materials were taken into account only for 10 species: *Allochrusa gypsophiloides*, *Agropyron cristatum*, *Phragmites australis* and 7 species of the family *Polygonaceae*, which in general constitutes less than 7% of plant species of the families under consideration.

The introduction coverage of medicinal plants of the aforementioned families is significantly higher than the resource coverage, but it is also very limited in comparison with the general introduction knowledge of medicinal plants in Kazakhstan, which, on average, is about 50%. In the botanical gardens of Kazakhstan, 56 species were grown (38% of the total number of species of the analyzed families), 1 species was tested in

commercial culture; information on the yield of raw materials in culture is available for 7 species.

## References

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