

NORTHERN TIEN SHAN MEDICINAL HERBS

ZHURSINBEKOVNA YEREKEYEVA SVETLANA¹, GENNAD'EVNA GEMEJIYEVA
NADEZHDA², BALAN IOANA MIHAELA*³

¹*Kazakh National Agrarian University, Agrobiology, Ecology*

²*RSE on the REU "Institute of Botany and Phytointroduction" CS MES RK*

³*Banat University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania"*

*Corresponding author's e-mail: ioanambalan@yahoo.com

Abstract: *Kazakh flora offers huge opportunities as a source of promising pharmaceutical forms. Generally, it is a science-intensive and highly competitive product that enjoys an increasingly large demand on the global market. Medicinal herbs are a valuable material for multipurpose quick-relief pharmacological and therapeutic phytopreparations, that does not produce any cumulative effect. We are now seeing a large-scale man-caused environmental impact that is growing dramatically, which inevitably causes a change in the existing ecosystems. Conservation and streamlined use of our planet's plant resources is a global challenge. In this connection, the conservation of Northern Tien Shan flora is one of the big challenges we are facing at the moment. Therefore, studying the flora of the underexplored regions of the Northern Tien Shan appears to be an important mission for us.*

Key words: *medicinal herbs, environmental impact, Northern Tien Shan, therapeutic phytopreparations and ecosystem.*

INTRODUCTION

The conservation and streamlined use of our country's plant resources is a current global challenge of international scale. The ongoing climate change poses a threat to natural vegetation and the human habitat itself [14, 5].

The long-term experience of studying medicinal plants suggests that the extracts there from are of low toxicity and demonstrate the required medicinal properties, while the diversity of biologically active substances secures a wide range of pharmacological effects produced by plant-based preparations [6, 16]. Currently, the official medicine gives increasingly higher priority to medicinal plants in treatment of many diseases. Therefore, the research and study of various types of medicinal plant materials is a really challenging goal [11].

Among Kazakhstan's medicinal plants, of special importance are the species whose material is used in pharmaceutical production. There are 170 such species in Kazakhstan. Those, first of all, include the most popular medicinal plants, the material whereof is directly sold to the network of pharmacies. Among them are 27 official species. As it appears from the 2013 National Medicines Registry of Kazakhstan, currently Kazakh manufacturers use only 25 species to prepare tinctures, extracts, and medicinal forms. Another 64 species of Kazakh medicinal plants are used by foreign companies. The demand for plant material among the country's pharmaceutical companies for most species growing in Kazakhstan is currently covered by utilization of natural brushwood and imports. Supplies of cultivated Kazakh species are very scarce and sporadic [11, 1, 8, 10].

MATERIALS AND METHODS

Kazakhstan is situated in the center of Eurasia and is the continent's fourth country by its area after Russia, China, and India. Most part of the area is plain, while high mountains located in the east and southeast account for as little as 10% of the country [11, 3]. The Northern Tien Shan's climate is extremely continental. It builds under circular processes developing above Kazakhstan and Northern Siberia, as well as due to altitudinal zonality that results in climatic altitudinal zones – from desert climate at the foot of the mountains to cold climate of the

highlands. The geology of Northern Tien Shan ridges is based on strongly dislocated sedimentary Paleozoic rocks represented by shales, limestones, sandstones, etc., penetrated by the intrusions of igneous rock; intermontane depressions consist of loose continental sediments.

The Northern Tien Shan's vegetation, just like its soils, conforms to the altitudinal zonality patterns. Plains surrounding mountain ridges are occupied by sagebrush and saltwort deserts followed higher by sagebrush-sod-grass steppes. Within the lowlands at 700-900m to 1200-1700m altitudes the vegetation is represented by mountain sod-grass steppes prevailed by fescue (*Festuca sulcata*) and feather grass (*Stipa capillata*, *S. Lessingiana* и др.) [16, 4, 9]. The study addressed wild-growing and cultivated species of medicinal plants of the Northern Tien Shan. The key research method used was fixed-route reconnaissance. Also, the comprehensive list of Northern Tien Shan medicinal plants was built on the basis of various floristic and specialized sources, mostly with the use of "Kazakhstan's Flora" (1956-1966), "Illustrated Index of Kazakhstan Plants" (1969-1972), and the "Kazakhstan's Wild-Growing Useful Plants" catalog (2008), multi-volume collection "USSR Plant Resources" (1984-1993), "Russia's Useful Wild-Growing Plants" (2001), Checklist of Kazakhstan's Medicinal Plants (2014), "Central Asia Plant Index", and the paper titled "USSR Cereals", families and genera were determined with the use of "Kazakhstan's Flora" of M.S. Baytenov. The spelling of Latin names, and changes in the list of taxons were checked in accordance with S.K. Cherepanov [2, 9, 13, 14].

Distribution, cultivation, and, especially, the resources of medicinal species were estimated in reliance on the papers issued by Kazakh researchers of the mid-last century, mostly represented by the scientists of the Institute of Botany and Phytointroduction of the Kazakh Ministry of Science and Education, as well as on the papers of Kazakh botanists employed by other institutions of the same specialization [10, 11].

RESEARCH RESULTS

The Kazakhstan's flora offers huge opportunities as a source of official and prospective medicinal plants represented by 1406 species of 612 genera belonging to 132 families of higher flowering plants. Also, 110 families, 436 genera, and 829 species of medicinal plants were found in the Northern Tien Shan, of which we singled out 16 leading floral families (medicinal plants), 289 genera, and 565 species [2, 11, 12]. Among the abundant medicinal plants of the Northern Tien Shan the top spot is occupied by the Asteraceae family that includes of 125 species and 52 genera. This is the most multi-genus family followed by the family of Rosaceae that includes 59 species. The third family, Lamiaceae, contains 51 species, which is 6.15% of the total species count. The fourth is the Brassicaceae family with 45 species. Those are followed by the Fabaceae with 40 species, Ranunculaceae with 38 species, and the Polygonaceae that contains 26 species. A total of 29 species were identified within the Apiaceae family. Next to it is the Chenopodiaceae family containing 28 species. Poaceae, Caryophyllaceae, and Scrophulariaceae families include 24 species each (2.89%). The Boraginaceae family is represented by 17 species, with the Crassulaceae of 13 species, followed by the Malvaceae with 12 species, and the Euphorbiaceae with 10 species (table 1) [1, 5, 11].

Figure 1. below illustrates 16 leading floral families of the Northern Tien Shan expressed in percentage of the total number of species.

As we can see from the table 1, these 16 species account for more than a half of all the genera and species (565 or 68.06%) of flora that occur in the Northern Tien Shan.

Also, 2 more families are represented by 9 species: Rubiaceae and Salicaceae; Gentianaceae and Orchidaceae, 3 families are represented by 7 species: Papaveraceae, Primulaceae and Violaceae, 3 families are represented by 6 species: Geraniaceae, Grossulariaceae and Potamogetonaceae, 11 families are represented by 5 species: Alliaceae, Aspleniaceae, Berberidaceae, Convolvulaceae, Cuscutaceae, Cyperaceae, Fumariaceae, Iridaceae, Onagraceae, Plantaginaceae, Solanaceae, 7 families are represented by 4 species: Asphodelaceae, Campanulaceae, Hypericaceae, Orobanchaceae, Pyrolaceae, Rutaceae,

Tamaricaceae, 10 families are represented by 3 species: Alismataceae, Caprifoliaceae, Dipsacaceae, Ephedraceae, Juncaceae, Lemnaceae, Liliaceae, Typhaceae, Urticaceae and Valerianaceae, 21 families are represented by 2 species: Amaranthaceae, Apocynaceae, Asclepiadaceae, Asparagaceae, Athyriaceae, Balsaminaceae, Cannabaceae, Elaeagnaceae, Equisetaceae, Frankeniaceae, Juncaginaceae, Limoniaceae, Lythraceae, Melanthiaceae, Nitrariaceae, Paeoniaceae, Polemoniaceae, Rhamnaceae, Saxifragaceae, Thymelaeaceae, Verbenaceae and Zygophyllaceae, and 35 families are represented by 1 species: Adiantaceae, Adoxaceae, Anacardiaceae, Araceae, Betulaceae, Biebersteiniaceae, Callitrichaceae, Capparaceae, Celtidaceae, Ceratophyllaceae, Cupressaceae, Datisceae, Dryopteridaceae, Ericaceae, Haloragaceae, Hippuridaceae, Huperziaceae, Hypecoaceae, Ixioliriaceae, Juglandaceae, Lentibulariaceae, Linaceae, Menyanthaceae, Monotropaceae, Moraceae, Nymphaeaceae, Oleaceae, Parnassiaceae, Peganaceae, Polygalaceae, Polypodiaceae, Portulacaceae, Sparganiaceae, and Ulmaceae [1, 2, 5, 11].

Table 1

Leading floral families (medicinal plants) of the Northern Tien Shan

	Family	Genera	Species	% of the total number of species
1	<i>Apiaceae</i>	21	29	3,49
2	<i>Asteraceae</i>	52	125	15,07
3	<i>Boraginaceae</i>	13	17	2,05
4	<i>Brassicaceae</i>	31	45	5,42
5	<i>Caryophyllaceae</i>	17	24	2,89
6	<i>Chenopodiaceae</i>	18	28	3,37
7	<i>Crassulaceae</i>	6	13	1,56
8	<i>Euphorbiaceae</i>	2	10	1,20
9	<i>Fabaceae</i>	20	40	4,82
10	<i>Lamiaceae</i>	26	51	6,15
11	<i>Malvaceae</i>	6	12	1,44
12	<i>Poaceae</i>	22	24	2,89
13	<i>Polygonaceae</i>	10	26	3,13
14	<i>Ranunculaceae</i>	14	38	4,58
15	<i>Rosaceae</i>	21	59	7,11
16	<i>Scrophulariaceae</i>	10	24	2,89
	Total:	289	565	68,06

Source: Grudzinskaya L.M., Gemejiyeva N.G., Annotirovannyi spisok lekarstvennykh rasteniy Kazakhstana: Spravochnoye izdaniye (Annotated list of medicinal plants of Kazakhstan: Reference edition), Almaty, 2014

The main studies of medicinal plants in Kazakhstan were carried out in 80-90 years of the last century, when they covered the largest number of species. In recent years, work on the determination of stocks of medicinal plants on the territory of Kazakhstan have intensified again. Only in the last 3 years, the reserves of raw materials for 47 species have been determined and redefined, first of all, economically demanded and the most significant at the present time[9, 8]. For most other medicinal plants, previously determined required resource of modern research on the refinement and evaluation of raw materials, the ecological status of their populations in the natural habitat.

Only those plant species appear on the medicinal plants list, for which confirmed published data is available with regard to the classes of biologically active substances and, first of all, regarding their therapeutic action. The status of the species under study was determined in reliance on official sources: State Pharmacopoeia of USSR, 1961-1990; State Pharmacopoeia of

the Republic of Kazakhstan 2008-2009; State Registries of Medicinal Products, State standards (GOSTs), reference books, and published pharmacopoeial articles. [3, 4, 8, 10].

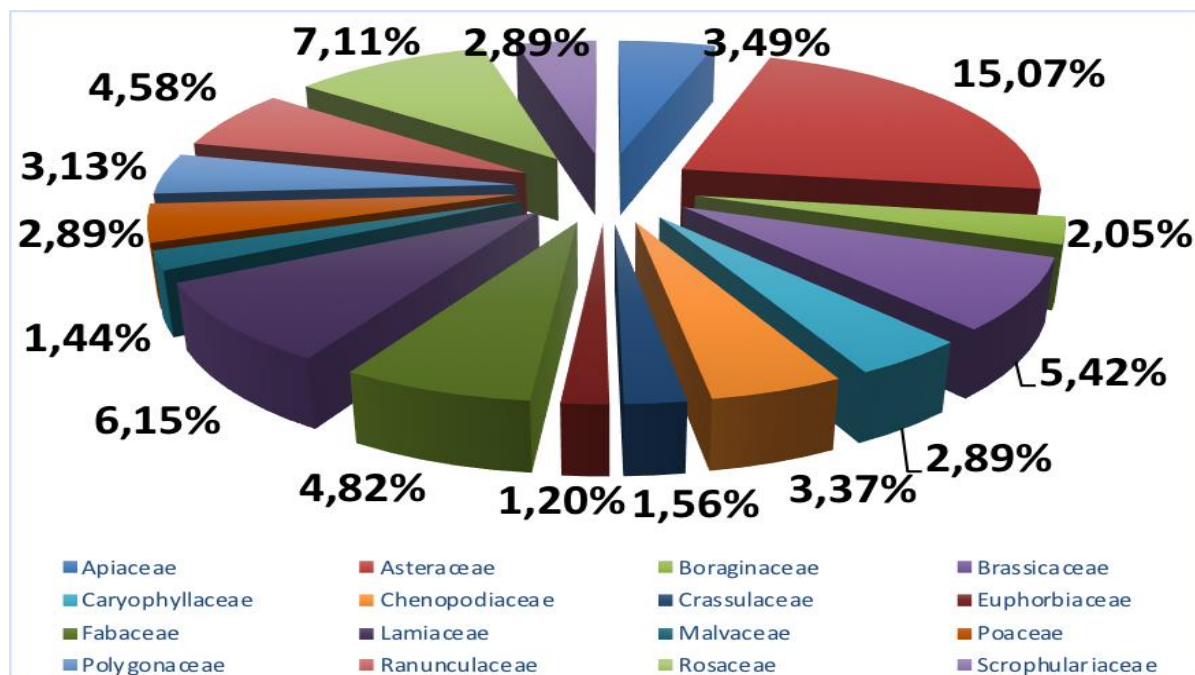


Figure 1. 16 leading floral families of the Northern Tien Shan expressed in percentage of the total number of species

Source: Grudzinskaya L.M., Gemejiyeva N.G., 2014, *Annotirovannyi spisok lekarstvennykh rasteniy Kazakhstana: Spravochnoye izdaniye (Annotated list of medicinal plants of Kazakhstan: Reference edition)*, Almaty, 2014

CONCLUSIONS

Among 1406 species of medicinal plants in Kazakhstan, only 230 species are actually used in official medicine. The types of official medicine are primarily pharmacopoeial species that were included in the State Pharmacopoeia of different years of publication - 124 species, and also-in the state Pharmacopoeia of Kazakhstan, where today there are only 29 species. To the category of official species we include plant species of the State register of medicines of Kazakhstan. It includes 92 species of medicinal plants from the list discussed here, extracts, tinctures, the fees of which are allowed for use in the territory of the Republic at the present time. The list of wild-growing medicinal plants near floral sources includes a number of strange and cultivated medicinal species (about 20), that ran wild and settled across the area so vast that the brushwood of some of them is becoming a major resource. Worth mentioning among those are such pharmacopoeial species as *Carum carvi*, *Coriandrum sativum*, *Foeniculum vulgare*, *Melissa officinalis*, etc.). Determine the distribution of medicinal plants by regions, a simplified scheme of division of Kazakhstan into parts of the world was used. The largest number of medicinal plants grows in the southern region of Kazakhstan (1037 species – 71%), the saturation of medicinal species is about 1.3 species per 1000 km². The second largest number of medicinal species – the Eastern region of the Republic, there are 933 species (64%). The saturation of medicinal species of the Eastern part of the Republic is about 3.5 species per 1000 km². In the North of the Republic grows 650 species (44%) of medicinal plants, species saturation – 1.5. In the Central desert-steppe regions of Kazakhstan grows 562 medicinal species (38%), species saturation – 0.9. In the West of the Republic – 550 species (37%), species saturation – 0

REFERENCES

- [1]. **BAYTENOV M.S. 1999, 2001**, Flora Kazakhstana (Flora of Kazakhstan). Almaty. T.1. 398 s. T.2. 280 s.
- [2]. **BAYTENOV M.S., 1985**, Vysokogornaya flora Severnogo Tyan'-Shanya (Alpine flora of the Northern Tien Shan), Almaty, 207 s.
- [3]. **CHEREPANOV S.K. 1995**, Sosudistyye rasteniya Rossii i sopredel'nykh gosudarstv (Vascular plants of Russia and adjacent states). SPb. 990 s.
- [4]. **FITONIKA 2003: LEKARSTVENNYYE RASTENIYA OTECHESTVENNOGO PROISKHOZHDENIYA, VKLYUCHENNYYE V FARMAKOPEI ROSSII I SSSR S I PO XI IZDANIYA, 2003**, (Phytonica 2003: medicinal plants of domestic origin, included in the Pharmacopoeia of Russia and the USSR from I to XI edition). – Fitonika, – www.phytonica.ru/H/pharmac_herb.html
- [5]. **GEMEJIYEVA N.G., 2012**, Alkaloidonosnyye rasteniya Kazakhstana i perspektivy ikh ispol'zovaniya (na primere Dzhungaro-Severotyan'shan'skiy provintsii)(Alkaloid plants of Kazakhstan and the perspirations of their use (on the example of Dzungaro-North Tien Shan province).). Almaty, 312 s.
- [6]. **GOLD'BERG Y.D., RAZINA T.G., 2008**, Rasteniya v kompleksnoy terapii opukholey (Plants in the complex therapy of tumors), Moskva: Izdatel'stvo RAMN, 338 s.
- [7]. **GOSUDARSTVENNAYA FARMAKOPEYA RESPUBLIKI KAZAKHSTAN** (State Pharmacopoeia of the Republic of Kazakhstan). **2008, 2009**, Izdaniye 1. Astana, T.1. 597 s. T.2. 790 s.
- [8]. **GOSUDARSTVENNYY REYESTR LEKARSTVENNYKH SREDSTV** (State Register of Medicines). **2009**, M. T.2, ch.1.
- [9]. **GOSUDARSTVENNYY REYESTR LEKARSTVENNYKH SREDSTV** (State Register of Medicines). **2000**, M., 1202 s.
- [10]. **GOSUDARSTVENNAYA FARMAKOPEYA SSSR** (State Pharmacopoeia of the USSR), **1990**, M, 11 izdaniye.
- [11]. **GRUDZINSKAYA L.M., GEMEJIYEVA N.G., 2014**, Annotirovanny spisok lekarstvennykh rasteniy Kazakhstana: Spravochnoye izdaniye (Annotated list of medicinal plants of Kazakhstan: Reference edition), Almaty, 200 s.
- [12]. **KOKEREVA I.I., 2007**, Rasteniya Dzhungarskogo i Zailiyskogo Alatau, nuzhdayushchikhsya v okhrane, Almaty, 212 s.
- [13]. **NESTEROVA C.G., OGAR' N.P., 2012**, Semeystvennyy spektr flory gor Toraygyr (Family spectrum of the flora of the Torai gy r mountains), KazNU Bulletin. Biology series №2, 7-10 s.
- [14]. **PROSKURYAKOV M.A. 2012**. Khronobiologicheskiy analiz rasteniy pri izmenenii klimata (Chronobiological analysis of plants during climate change.), Almaty, 230 s.
- [15]. **SHRETER G.K. 1995**, Lekarstvennyye rasteniya i rastitel'noye syr'ye, vklyuchennyye v otechestvennyye farmakopei (Medicinal plants and plant materials included in the domestic pharmacopoeia). Pod red. doktora farm. nauk A.F.Gammermana. –M.,120 s.
- [16]. ***, www.big-archive.ru/geography/