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The Kazakhstan medicinal flora survey in a leading families volume

It has been perfomed a comprehensive survey of botany — pharmacological research of 7 leading families of medicinal flora in Kazakhstan which combine 648 species (46 per cent of all pharmaceutical flora). The leading families encompassing the largest number of species are *Asteraceae* (196 species), *Rosaceae* (89), *Lamiaceae* и *Fabaceae* (по 78), *Ranunculaceae* (75), *Apiaceae* (69), *Brassicaceae* (63). The families to be analyzed include 109 pharmacopoeia species (some 47 per cent of all known species in Kazakhstan of official medicine) and 18 rare ones. Research on resource potential of medicinal species within analysed families has been extremely low. Out of 648 medical herbs raw materials inventory has been defined only for 88 that makes up some 3.6 % species of plants of 7 leading families, among them there are 50 species to be applied to official medicine. The introduction research of medicinal plants is substantially high than recource one. In the territory of Kazakhstan has been tested in crop about 40 per cent of the plants of families mentioned above. The features of farming techniques have been worked out only for 15 pharmacopeia species; the crop yields of medicinal plants in crop have been defined for 70 species of leading families.

Keywords: medicinal plants, floristic analysis, resources, introduction, Kazakhstan's flora.

Introduction

The flora of Kazakhstan has got some huge opportunities as a source of promising medicinal forms. The active research going on over the world in the field of chemistry of natural compounds is continually increasing the number of pharmaceutical species. In the past years in Kazakhstan, have been obtained new effective medical preparations from kazakhstani species *Aconitum* L., *Delphinium* L., *Thalictrum* L., *Leonurus* L., *Peganum* L. and others [1].

The floristic composition defines the number of vascular plants of Kazakhstan about 6000 species varying 5100 to 6000 species of genera. Our statistics is oriented to the latest findings S.A. Abdullina [2] that points out that in Kazakhstan's flora has 5658 species, 1067 genus and 159 vascular plant families.

As a result of the screening has been made an annotated list of medicinal plants of Kazakhstan which including 1406 species related to 134 families of high flowering plants that makes up a one-fourth all the species of flora in Kazakhstan [3, 4].

The greatest number of medicinal plants species include the family *Asteraceae* (196 species), *Rosaceae* (89), *Lamiaceae* (78), *Fabaceae* (78), *Ranunculaceae* (75*), Apiaceae* (69*)* and *Brassicaceae* (63). Four more families represented by 45–30 species *(Polygonaceae* (44), *Caryophyllaceae* (41), *Poaceae* (35), *Boraginaceae* (30); 15 families are containing about 10–21 species; 47 families are contains from 9 to 3 species (*Berberidaceae, Iridaceae, Papaveraceae, Solanaceae* and etc.); 22 families are presented by 2 species (*Equisetaceae, Linaceae, Nitrariaceae, Verbenaceae* and etc.); by one species represented 35 or 26 % (*Aceraceae, Capparaceae, Datiscaceae, Juglandaceae, Polypodiaceae,* and etc.). The average number of specie per family is 10.6. The largest genuses are *Artemisia* L. (40 species), *Potentilla* L. (24), *Euphorbia* L. (18). Genera *Ferula* L.*, Polygonum* L.*, Rumex* L. accounts for the equal number of species (by 15). *Astragalus* L. (14) and *Ranunculus* L. (13) are quite essential.

Analytical review generalizing the known literary and experimental taxonomical, biomorphological, phytocenological, pharmacological, resource, and plant introduction findings within the family has been carried out for 7 most important plant families.

Methodology

The literature related to the title of species belong to their families was effected by a search using the keywords of Latin name of plants and/or their synonems as well as its indegeniouse titles in local places, biological activity, phytochemistry, resource potential of wild grow species and etc. in "Science Direct", "Scopus", "Web of Science" "elibrary" databases. The taxonomy of families is having been corrected over the system APG IV [5, 6]. Genus titles are given according to the internet resource Plantarium and Plant list [7].

Productivity and yield of plant raw materials have been taking into account and under "productivity" of plants refers to the amount of raw materials or seeds obtained from one plant (min-max/average value in gramm); "yield data" the amount of raw materials or seeds per unit area [8, 9]. Resources of wild growing medicinal plants were carried by plant stock determination methodology [10].

Results and discussion

Seven leading plant families were studied which include 109 pharmacopoeia species (about 47 % of all known official medicine species in Kazakhstan) except 18 rare ones (*Aconitum talassicum* Popov*, Adonis vernalis* L.*, Prunus armeniaca* L.*, Artemisia cina* Berg ex Poljakov*, Crataegus ambigua* C.A. Mey.ex A.K. Becker*, Ferula iliensis* Krasn.ex Korovin*, Malus sieversii* (Ledeb.) M. Roem, and etc.).

Within analized families has been mentioned most of known classes of biologically active substances (flavonoids and their derivatives, alkaloid, coumarin, tanniferous plants, terpenoids as well saponin and etc).

Research on resource potential of medicinal species within analysed families has been extremely low. Out of 648 medical herbs raw materials inventory has been defined only for 88 that makes up some 3.6 % species of plants, among them there are 50 species to be applied to official medicine.

The introduction research of medicinal plants is substantially high than recource one. In the territory of Kazakhstan has been tested in crop about 40 % of the plants of families mentioned above. The features of farming techniques have been worked out only for 15 pharmacopeia species; the crop yields of medicinal plants in crop has been defined for 70 species of studied leading families.

Family ***Apiaceae*** **Lindl.** This taxon has 69 species from 41 genera which grow in the territory of Kazakhstan that makes up one-third of all the family known in the territory of the country and there are 226 species. The lurgest genera *Ferula* L. (15), *Bupleurum* L. (4), *Angelica* L. (4), *Eryngium* L. (3), 6 genera include 2 species and 31 by 1 species. All the species of family biomorphologically is herbal plants. The majority (82 %) is perennial plants, biennial plants are 6 % and annual plants are 12 %. The ecological structure of flora of this family is characterized almost by an equal number of species of ecomoph mesophilic (34 %) and xerophilous (35 %) formation. Hygrophytes and hydrophytes are shown in the small number of species, total 8 %.

Botanical and geographical survey is evidence of that among the pharmaceutical species of family the most representative are the plants with a palaearctic habitat — 15 species (*Aegopodium alpestre, Aegopodium podagraria, Falcaria vulgaris, Foeniculum vulgare, Sium latifolium* and etc.). The group of hol-arctic species is figured by 4 species: *Carum carvi, Cicuta virosa* and etc. Among the cosmopolitan there is one species only *Daucus carota*. The majority of medicinal species of family has got Mountain Middle Asian region (*Ferula transiliensis*), mountain middle Asia-Siberian (*Anthriscus sylvestris),* Mountain Siberian-Tyan Shan (*Angelica archangelica subsp. decurrens, Bupleurum longifolium, Heracleum dissectum*), Mountain Central Asian-Southern Altaian and Mountain Central Asian-Iranian mountain habitats. Only a small part of species has got some middle Central Asian-Turan and Turan habitats. As a whole, the area survey gives an evidence of a sourthern origin species has got some substantial advantages of northern ones.

In official medicine 14 species of the plants of *Apiaceae family* (*Anethum graveolens, Bupleurum longifolium, Bupleurum multinerve, Carum carvi, Conium maculatum, Coriandrum sativum, Daucus carota, Ferula foetida, Ferula sumbul, Foeniculum vulgare, Oenanthe aquatica, Pastinaca sativa, Peucedanum morisonii, Pimpinella saxifraga*) are applied in folk medicine. As a raw material is mainly serves an underground art or seeds rarely aerial part as *Conium maculatum* or *Eryngium planum*. The majority of the family species tend to accumulate mono-, sesquiterpenes, as well other metabolites of secondary biosynthesis — coumarins and their derivatives (oxi-, metoxi-, furo-, pyrancoumarins) — umbelliferone, angelicin, scopoletin and etc. Some furocourmarins are typical only for *Apiaceae* and *Rutacea* family species, for instance, suberozin, seselin, peusedanol, pimpinelin and etc. [11, 12], for some species of *Bupleurum* L. is typical to high content of flavonoid 2.0–17.9 %, but in the species of *Ferula* L. genus present flavonoids a little [13]. Plants of genus *Ferula* L. tend to accumulate sulfur-bearing compounds [14]. In the traces have been discovered simply structured alkaloids. In official medicine 16 species are applied mainly as expectorant, diuretic, analgesic, antiseptic, hemostatic agents and showing an antioxidant, antibacterial and antifungicide effect [15, 12]. Plants species having an antineoplastic effect is mainly applied in a folk medicine (16 species) including *Conium maculatum* L. which recorded in State register of medicinal preparations Kaz 2013 [16].

Raw materials inventory has been defined only at 6 out of 14 officially recognized species of this family and 1 species to be applied in experimental medicine (*Bupleurum longifolium, Bupleurum multinerve, Carum*

carvi, Conium maculatum, Ferula foetida, Ferula songarica, Peucedanum morisonii). For the majority species of studied family to be applied in an official medicine raw materials inventory has not been studied.

During introductional experiment 12 out of 14 official species grew successfully, some species quite often grow as a green garden crop; there has no data on experimental production cultivation species belong to *Apiaceae* in the territory of Kazakhstan. The productivity of raw material of 8 species of family has been defined by us when growing in the foothills of Ile Alatau mountain (*Carum carvi* 2.2–7.9/5.05 g, *Coriandrum sativum* 0.45–9.99 /5.092 g, *Eryngium planum* 4.65–7.9 /14.792 g, *Ferula songarica* …/373.1 g, *Foeniculum vulgare* 10.25–84.9 /31.017 *g, Pastinaca sativa* 3.56–19.3 /8.68 g, *Peucedanum morisonii* …/517.1 g, *Pimpinella saxifraga* 8,–21.3 /16.35 g). Altogether in terms of introduction in the areas of Kazakhstan have been tested 26 species of this family.

Family ***Asteraceae*** **Giseke.** In the territory of Kazakhstan is difined about 196 medicinal species from 74 genera that making up one-fourth of a whole family in the republic, numbering to 885 species. It is a big family in saturation by medicinal herbs. The number of taxa of families is quite high: genus *Artemisia* L. — 40 species, *Achillea* L. (9), *Saussurea* L. (9), *Inula* L. (8), *Centaurea* L. (7), *Cirsium* Hill. (6), *Serratula* L., *Senecio* L., *Tanacetum* L., *Jurinea* L., *Echinops* L. (accordantly 4–5). There are 39 genera comprising one medicinal species. The majority of family species are permanent grasses or dwarf subshrub (153 species — 71 %). Family members inhabit in the very various ecological and geographical conditions. Among them were found xerophyte, mesophytes, psychrophytes, halophytes, psammophyte and etc.

By having analyzed the flora of family in botanical and geographical elements, it is necessary to note a large number comparatively of southern origin species. They make up one-fourth of a whole massive of medicinal flora of family. Plants species with a wide natural habitat (palae-arctic, hol-arctic and cosmopolitan) are less represented: *Helichrysum arenarium, Aster alpinus, Achillea millefolium* and etc. Further, on frequency of accurence goes a group of species Altaian mountain Siberian habitat, they are common from Altai across Mountain Soongari Alatau up to the Central Asia Mountains. Northern species and plants are less found having got mountrain central Asian habitats. Steppe and desert plants of Turan group can be found less.

Species of the fam. *Asteraceae* are the most applied in pharmaceutical industry. As a raw material in pharmaceutical preparations serve areal part of plants and only at *Rhaponticum carthamoides* and species belong to *Inula* L. roots are used. Quite high content of essential oil has been found in 82 species usually it is characterized by a high content of pinene, limonene, borneol and etc. [17]. In official medicine 29 species are applied, the members of which belong to *Achillea* L., *Artemisia* L., *Centaurea* L. and *Inula* L. The richest in terpene compound and sesquiterpenoids (achimilic acids A, B, C are obtained from *Achillea millefolium* [18], di- and triterpenoids (α-fernenol, pentacyclic triterpenoid isolated from *Artemisia vulgaris*), saponins (aglycon of which in many cases are Olean). A number of the Artemisia's species (*Artemisia cina, A. scoparia, A. arenaria, A. gracilescens, A. vulgaris, A. juncea, A. glabra*) has a high antitumor effect [19].

The majority of species *Asteraceae* alkaloid bearing plants in them have been found sesquiterpene alkaloids [20], quinolinic alkaloids — echinopsidin and etc. (from *Echinops ritro)*, *Senecio* L. species highlighted senecifiline [21]. The plants are rich with coumarin for instance, scopoletin and it's derivatieves, scoparin, daphnetin, umbelliferone can be more found in genus *Artemisia* L., cikorine in *Centaurea* L. [11]. Among this family species there is a lot of flavonoid bearing plants (122 species). In *Achillea millefolium* has been discovered a high content of luteolin and its glycoside, routine, derivative apigenins, as well isorhamnetin glycoside, quercetin, kaemferol [13]. From *Calendula officinalis* polysaccharides are of more interest ((1→3)-*β*-D-galactan) as antiallergic drug. In underground part of *Inula helenium* has been found inulin (~ 40 %), which "decreases a glycose level in alloxan induced diabetes" [22].

Resources are identified for 29 species. *Artemisia* species (11) are more studied in resource potential as a plant raw material and 5 of them applied in official medicine *Artemisia absinthium*, *A. cina*, *A. glabella*, *A. 1eucodes*, *A. vulgaris* and 6 species (*Artemisia annua*, *Artemisia dracunculus*, *A. rutifolia*, *A. santolinifolia*, *A. sieversiana*, *A. terrae-albae*) in experimental medicine. Besides, raw resources are defined in 2 milfoil species (*Achillea millefolium*, *A. nobilis*), 2 immortelle species (*Helichrysum arenarium*, *H. maracandicum*) applied in official and experimental medicine.

At the same time in diversity of species widely used in official medicine, the raw resourses are not studied for *Ajania fruticulosa, Anethum graveolens, Arctium lappa, Artemisia taurica, Calendula officinalis, Centaurea cyanus, Chamomilla suaveolens, Centaurea benedicta (Cnicus benedictus), Echinops ritro, Silybum marianum, Solidago canadensis, S. virgaurea, Taraxacum officinale*.

Cultivation specifity are identified for 83 specifies (41 %) of medicinal plants of this family which mainly grew in botany gardens of Kazakhstan. Among official plants 26 species are tested — 89 %, crop capacity of the raw is defined in experimental and production conditions, a number of farming techniques has been perfected: (*Ajania fruticulosa* — 2.8–5.3 c/he (Nashenova et.al. 2011); *Artemisia annua* — up to 300 g/m^2 aerial dry [23]; *Helichrysum arenarium* — 49 g/m^2 [24]; *Inula helenium* (3–4 years) — 19.7 c/he [25]; *Rhaponticum carthamoides* — 160–250 c/he green mass, 10–15 c/he dry roots [26, 27]; *Serratula coronata* — 308.9–2381.7 g/m^2 [28]; *Tussilago farfara* L. — 3.7 c/he [29], agrotechnical works worked out for *Artemisia glabella*, *Calendula officinalis*, *Matricaria chamomilla* (*Chamomilla recutita), Inula helenium, Tanacetum vulgare*.

In the foot hill zone of Transili Alatau in the conditions of small plots cultivation defined crop yields data for 27 species belong to *Asteraceae* fam. (*Achillea millefolium* 18.25–67.81/34.17 g; *Ajania fastigiata* 19.31–193.0/106.18 g; *Ajania fruticulosa* 1.806–3.35/2.628 g; *Cota tinctoria (Anthemis tinctoria)* 5.32–38.7/21.862 g; *Arctium lappa* …/148.1 g; *Arctium tomentosum* …/268.0 g; *Artemisia absinthium* 18.4–178.2/83.9 g; *Artemisia dracunculus* 30.3–277.5/128.05 g; *Artemisia vulgaris* 53.2–784/321.69 g; *Bidens tripartita* 1.45–61.0/12.106 g; *Parasenecio hastatus* (*Cacalia hastata)* 1.2–26.5/9.535 g; *Calendula officinalis* 0.227–0.637/0.432 g; *Cyanus segetum* (*Centaurea cyanus)* 0.928–7.83/2.227 g; *Matricaria chamomilla* (*Chamomilla recutita)* 0.635–2.7/1.807 g; *Cichorium intybus* 6.0–9.1/7.5 g; *Centaurea benedicta (Cnicus benedictus)* 7.96–62.4/22.233 г; *Eupatorium cannabinum* 28.61–112.0/69.087 g; *Laphangium luteoalbum (Gnaphalium luteo-album)* 0.65–1.65/1.150 g; *Inula helenium* 55.0–536.7/189.98 g; *Tanacetum coccineum (Pyrethrum coccineum)* 3.049–10.9/6.036 g; *Pyrethrum corymbosum* 82.5–165.6/144.28 g; *Tanacetum parthenifolium (Pyrethrum parthenifolium)* 4.97–35.72/17.56 g; *Rhaponticum carthamoides* 6.8–12.4/10.271 g; *Scorzonera hispanica* …/50.1 g; *Silybum marianum* 0.93–18.72/4.355 g; *Solidago virgaurea* 4.115–37.1 /12.423 g; *Tanacetum vulgare* 9.46–78.0 /34.621 g.

Family ***Brassicaceae*** **Burnett**. In Kazakhstan 63 medicinal plants species from 30 genera that makes up about one-fourth of (24.5 %) all species of this family and numbering to 294 species in the territory of Kazakhstan. In biomorphologic spectre all species of the family are herbaceous plants. Amongh them there are 25(36 %) annual plant species; 20 (28 %) perennial plant species; 14 (21 %) biennial plants the rest family species are considered mixed biomorphological ones. The ecological structure of flora of the family differ by ecomorph mesophyll predominate — 32 species (53 %) and xerophilous — 27 (42 %). Hygrophilous and hydrophilous formation of ecomorph are presented only in 3 species (5.5 %).

It is required to underline a considerable presence of medicinal species in the family with a wide natural habitat (palaearctic, hol-arctic and cosmopolitan species). A considerable part falls into palaearctic of natural hapitat (25 species), almost half less than hol-arctic (12) and comparatively is not much (2) — to cosmopolitan. Among palaearctic can be seen *Berteroa incana, Camelina microcarpa, Cardamine impatiens, Isatis tinctorial* and etc., finaly, among cosmopolitan there is *Rorippa palustris.* Comperatively there is a lot of Turan, Altai, Siberian mountin and Central Asian mountain species. North Tyan-Shan endem is noted — *Erysimum croceum* M. Pop. (*Erysimum virgatum* Roth), which is included in "The Kazakhstan's Red Book" [30].

In the official medicine are known only 5 species (*Erysimum canescens, Erysimum cheiranthoides, Brassica juncea, Brassica nigra, Capsella bursa-pastoris*) and others have been used only by folk medicine. Most family members applied only aerial part rare — roots (*Armoracia rusticana, A. sisimbrioides*, *Megacarpaea gigantea*) or seed (as an example, *Brassica nigra* or *Sinapis arvensis*). Family members have got laxative, contraceptive, antifibrinolytic [15, 31], analgesic, antiseptic, irritant effects, as well provoking appitite, secretogogue, anti-inflammatory actions. To some species belong to *Brassicaceae* it is typical to have got thio glycoside and mustard oil.

Resources (as a raw material) are identified for 2 species (*Capsella bursa-pastoris, Erysimum siliculosum* (*Syrenia siliculosa*).

Information about cultivation available for 14 species belong to this family and harvest yield in introduction conditions determined for 2 species Erysimum *canescens* (grass) — 15–20 c/he [32]; *Erysimum czernjajevii* — 0.56–3.54 c/he [33].

Family ***Fabaceae*** **Juss**. The herbs of this family are enough presented in the territory of Kazakhstan around here 78 medicinal species grow from 27 genera making up 13 % out of all the family growing in the territory of Kazakhstan and numbering to 630 species. Very huge genera are *Astragalus* L. (14), *Lathyrus* L. (7), *Trifolium* L. (7), *Vicia* L. (7), *Glycyrrhiza* L. (5), *Thermopsis* L., *Oxytropis* L. (4)*, Caragana* Lam., *Medicago* L., *Hedysarum* L. (3), 6 genera include 2 species and 9 genuses by one species.

Astragalus L. genus species outnumbers the rest. It is a hol-arctic family and its most diversity grow within ancient mediterian sea flora area. More than third, its species (5) have got Iranian and Turan habitat (*Astrgalus filicaulis, A. alopecias, A. flexus*). Consierably less species can be seen in Altai *(Astragalus frigidus, A. glycyphyllos),* Tyan Shan *(Astragalus floccosifolius)* and Central Asian mountain Iranian type of habitats have genus (*Astragalus sieversianus*). The second place occupies quantitatively *Lathyrus* L.*,* 3 species of which grow in the boreal region of Palaearctic (*Lathyrus pratensis, L. tuberosus, L. pisiformis)*, Siberian mountain are *Lathyrus humilis* and *L.gmelinii*, sourthern Kazakhstani — *Lathyrus aphaca* and *L. cicero*, in the north-eastern part of Kazakhstan — *Lathyrus vemus*. Species belong to *Trifolium* L. and *Vicia* genera are mainly polaearctic species i.e. one can see in boreal regions of Eurasian. *Oxitropis* L. species grow both in mountain ragions of eastern part of acient Mediterranean area and temperate and cold regions of Eurasia.

Generally, in family one-fourth make up species with a wide palaearctic habitat — 21, Siberian Mountain, Altai and Altai-Iranian — 19, Iranian — Turan 5, mountain middle Asian-Iranian 3, Tyan Shan 5, western Tyan Shan 2. Species growing in the south of Kazakhstan and sand are 9, alone in northern Kazakhstan and plains are 16. In total, in this family was observed predominant of species spreading towards the north.

Biomorphologically it is a great diverse group of plants though amongh them the majority is permanent grasses and there is a lot of annuals, suffrutex and even bushes. Family species grow in diverse ecological-geographical conditions amongh them can be seen xerophyte, mesophyte, psychrophyte, halophyte, psammophyte and etc.

Pharmacologicaly it is very important family among them 15 species have been known being applied by official medicine. Legumes plant has got a wide range of pharmacological effect: expectorative, emetic, anthelmintic, anesthetic, ganglion blocking, hypotensive, hemostatic and etc., as well are applied as a source in obtaining alkaloid cytisinum from *Thermopsis alterniflora*. Most species are rich by triterpene saponines [34]. In most species found flavonoids (58 species), vitamines (28), alkaloids (29), coumarines (21) and rare steroids. Alkaloids from plants belong to *Fabaceae* presented by diverse groups as an example, cytisinum, anagirin and etc. [35]. As a source of raw material is used aerial part or roots (*Alhagi* Gagneb., *Glycyrrhiza* L.*, Hedysarum* L.).

Resources have been determined for 10 species *Alhagi maurorum* (*A. pseudalhagi*); *Glycyrrhiza glabra*; *Glycyrrhiza korshinskyi*; *Glycyrrhiza uralensis*; *Hedysarum neglectum*; *Melilotus officinalis*; *Cullen drupaceum* (*Psoralea drupacea*); *Sphaerophysa salsula*; *Thermopsis lanceolata*; *Sophora pachycarpa* (*Vexibia pachycarpa*). *Glycyrrhiza* L. species are more essential, the resources of which are well known and data over industrial resources are constantly refulfil. *Thermopsis* R. Br. and *Sophora pachycarpa (Vexibia)* species are quite widely used. Among the officially acknowledged species, recourses are not studied for *Alhagi kirghisorum*, *Glycyrrhiza echinata*, *Hedysarum alpinum*, *Medicago sativa*, *Ononis spinosa* subsp. *Hircine (Ononis arvensis)*, *Thermopsis alterniflora*.

Industrial crop has been worked out only for *Glycyrrhiza* L. species on the rest medicinal plants of the family there is introduction data only. In total, under the family introduction research has been performed for 28 species. At the foothill of Zayliyskyi Alatau we have been studied yiled data of plant raw material for 8 species (*Astragalus glycyphyllus* 64.4–243.0/108.95 g; *Genista tinctoria* 79.3–150.8/119.06 g; *Glycine max* 1.9–23.34/9.038 g; *Glycyrrhiza uralensis* …/200.6 g/m^2; *Melilotus albus* 7.8–30.2 /22.317 g; *Melilotus officinalis* 7.9–37.6/21.306 g; *Ononis spinosa* subsp. *Hircine* 30.7–148.7/75.39 g; *Thermopsis alterniflora* 11.55–127.05/76.23 g.

Family ***Lamiaceae*** **Lindl.** is presented by 78 species belong to 29 genera of medicinal plants that makes up more the one-third of all species of this family (230 species) that growing in Kazakhstan. Species abundance of families in average is 2.6. The very huge genus *Dracocephalum* L (9 species), *Salvia* L (7)*, Lagochilus* Bunge (6), *Mentha* L. (4), *Stachys* L. — 5, *Thymu*s L. (4), *Nepeta* L. (6), *Phlomoides* Moench*,* (3)*, Ziziphoza* L. (4) and *Galeopsis* L. (3), 7 genera encompass by 2 species each and those13 by one species. Biomorphologically they are perenial, annuall and biennial plants, bushes, suffrutices and dwarf semishrub. Vast majority of them are perenial plants — 55 species (65 %). Following those suffrutices — 11 (16 %), annuall plants — 8 (14 %), semis-hrub — 5 (4 %). Plants with mixed biomorphological type accounts for the rest.

The ecological structure of family is characterized by predominant of ecomorph xerophilous group (xerophytes, xero-mesophyte) — 45 species (53 %) with typical habitat in rubbly and steppe slope of desert mountains, dry stream canals, caving, sandy deserts, clay hill slopes and steep. Most them are grow in foothill plains and lowhills. A mesophyll group is presented by 34 species (47 %) growing in mountain slopes, river banks and streems. Some species clog fields and crops.

Lamiaceae comperatively combines a lot of species (25) with a wide habitat *Lamium album, L. amplexicaule* (hol-arctic type of areal); *Nepeta cataria, Melissa officinalis, Origanum vulgare* (palae-arctic). This group's species can be found almost everywhere in Kazakhstan. It is required to relate endemic species to the second one which grow in little territories. They are *Salvia trautvetteri* (Karatau), *Thymus altaicus* (Altai, Saur and Soongari Alatau).

Mountain areas of the Western Tyan Shan, Karatau, Ile and Kirgyz Alatau, Tarbagatai are richer in species of this family. Further follow Balkash and the areas of western, central and northern Kazakhstan. The desert territories of Emba, Usturt and Aral are presented poorly or not preseted at all by medicinal species of this family.

The aerial part of plants mainly serves as a raw material generative browses with leaves when budding or flowering. Biological active compounds are presented mainly by essential oils which can be found in 64 species of family. The main components of essential oils are monocyclic and acyclic mono-terpene such as menthol for species of genera *Nepeta* L. *(Shizonepeta)*, *Glechoma* L., carvone for *Nepeta* L., as well aromatic compounds for *Thymus* L. and *Origanum* L. and etc. [36]. The plants of this family are well-known volatile-oil-bearing ones, have got a spasmolytic and sedative effect as well anti-inflammatory, wound healing, cardiotonic, hemostatic actions. In official medicine 10 species are applied *Marrubium vulgare*, *Melissa officinalis*, *Mentha* x *piperita*, *Mentha suaveolens*, *Origanum vulgare*, *Phlomis herba-venti* subsp. *pungens (Ph. pungens)*, *Salvia aethiopis*, *S. sclarea*, *Stachys betoniciflora, Thymus serpyllum*.

There is some data of raw materials resources for 9 species (*Hyssopus ambiguous; Leonurus turkestanicus; Mentha longifolia; Nepeta nuda (N. pannonica); Origanum tyttanthum; O. vulgare; Salvia deserta; Thymus pulegioides subsp. pannonicus (Thymus marschallianus); Ziziphora clinopodioides*). For 9 officially approved medicinal plants have no data over studying resources as raw material *Marrubium vulgare* L., *Melissa officinalis* L., *Mentha piperita, M. suaveolens* Ehrh., *Phlomis herba-venti* subsp. *pungens* (Willd.) Maire ex De Filipps *(Ph. pungens)*, *Salvia aethiopis* L., *S. sclarea* L., *Stachys betoniciflora* Rupr., *Thymus serpyllum* L.

During introduction examination 43 species have been tested. The positive outcomes of experimental and industrial examination have been obtained for *Lagochilus hirtus* (6 centner per hectar of dry plant/grass) and *Ziziphora clinopodioides* (10.2–30.0 c/he) [26, 27]. Despite the importance of medicinal plants of this family such poor agrotechnical knowledge of the species is apparently explained by the currently sufficient natural resources of species plant raw materials of this family widespread in Kazakhstan.

At the foothill of Transili Alatau we have been studied yiled data of plant raw material for 22 species (*Clinopodium acinos (Acinos arvensis)* 9.5–90.2/25.97 g; *Stachys officinalis (Betonica officinalis)* 21.79–125.4/53.79 g; *Dracocephalum moldavica* 18.3–43.57/22.5 g; *Hyssopus seravschanicus* 10.92–63.7/37.31 g; *Lycopus europaeus* 6.9–34.5/17.25 g; *Marrubium vulgare* 2.87–26.7/10.542 g; *Melissa officinalis* 18.5–105.4/58.114 g; *Mentha longifolia* 17.35–72.75/45.025 g; *Mentha* x *piperita* 0.6–1.9 /0.9 t/he, *Origanum vulgare* 26.3–148.1/58.289 g; *Phlomoides tuberosa (Phlomis tuberosa)* …/33.7 g; *Salvia aethiopis* 33.9–622.3/241.97 g; *Salvia sclarea* 24.1–52.8/38.45 g; *Salvia verticillata* 29.6–120.5/64.81 g; *Stachys byzantina*… /392.4 g/m^2; *Teucrium scordium* 20.19–240.1/97.13 g; *Thymus karatavicus* up to 302 g/m^2; *Ziziphora clinopodioides* 1.7–16.28/9.692 g.

Family ***Ranunculaceae*** **Juss.** In the territory of Kazakhstan was noted 75 species of medicinal plants from 18 genera that makes up 42 % of total genus composition of *Ranuncluaceae* family, growing in the country and numbering to 190 species. Species abundance of families in average is 4.3 and maximum is 13 (genus *Ranunculus* L.), *Aconitum* L. — 9, *Delphinium* L. and *Thalictrum* L. — by 8, *Anemone* L. (7), *Adonis* L. (6), *Actaea* L., *Aquilegia* L. and *Pulsatilla* Mill. — by 3. One-species genus in the families is 6. In the biomorphologically they are annual, biennial herbaceous plants and liane like bushes. There are no wood forms. The majority of species (69 %) falls in perennial plants. A small part of annual plants (8 %); annual-biennial (2 %) fall in liane like bushes 5 %. The ecological structure of flora of the family is discribed by predominant of mesophilous ecomorph — 50 species (66 %); amongh mesoxerophyte there are 13 species (19 %), xerophytes — 5 (6 %), hygrophyte — 5 species.

The majority of family species (20) is widespread. *Aconitum anthora (A. anthoroideum)* species are polyarctic type of areal *Ranunculus sceleratus* — hol-arctic. On the second place settled species that spread in mountain systems of Tyan Shan and Soongari Alatau (18) *Anemone patens* subsp. *multifida (Pulsatilla multifida)*, *Ranunculus algae*. Considerable amount of Altai and Siberian mountin species (16), mountain asian (13). The rest groups are presented poorly.

The majority of family's species is mesophilous members and they are widespread in the Tyan Shan, Soongari Alatau Mountains, Altai and Tarbagatai Mountains. Some small species are spread in sourthern areas; also less ones in the areas of the Central Kazakhstan. Such territory of Kazakhstan as Caspian, Emba, Usturt, Moyinkum, Kyzyl Kum and Mangyshylak are presented poorly or not presented at all.

Roots and rhizome mainly serve as a raw material. Almost all medicinal species of family include alkaloids and more often are used in folk medicine as an antitumor drug. Official medicine uses 11 species (*Aconitum leucostomum; Aconitum soongaricum; Adonis tianschanica; Adonis vernalis; Delphinium confusum; Delphinium dictyocarpum; Delphinium elatum; Nigella damascena; Thalictrum foetidum; Thalictrum isopyroides; Thalictrum minus*). Some more 20 species of the family are studied experimentally and recommended to apply. This family species is richer in alkaloids, flavonoid, saponin and fatty oil, cyanogenic derivatives are less spreaded. The striking species of genuses *Aconitum* L., *Delphinium* L. are rich in a content of diterpine alkaloids aconitines, atisines as well alkaloids of isochinoline line berberine, palmitin. Some species can be met with a high content of cardiac glycoside cardenolids (adonitoxin, cymarin) are found in g. *Adonis* L., *Clematis*, L., *Ceratocephala*, Moench, *Actaea cimicifuga (Cimicifuga foetida)*. Cyanogenic compounds are found in *Thalictrum minus*, *Thalictrum foetidum*, *Ranunculus repens*, *Ranunculus arvensis*, *Leptopyrum fumarioides*. Official species are mainly applied to cure cardiovascular illness such as analgesic and asepsis.

Study of plant resources are defined only for 5 out of 11 acknowleged officially and 5 species applied in experimental medicine. Almost to the half acknowledged officially species of this family the raw materials resources are not studied: *Aconitum soongaricum*, *Adonis vernalis*, *Thalictrum foetidum*, *Thalictrum isopyroides*, *Thalictrum minus*, *Nigella damascena* for which mainly growing in crop (culture). *Adonis vernalis* is rare species and *Aconitum soongaricum* regardless comperatively has wide habitat don't form huge industrial massives. Moreover, population of this species is under uncontrolled use by local communities who use it as a medical preparation. It is the best to quot strictly preparation and creation of crop plantations of *A. soongaricum* in localities of their habitat. The studying the species *in vitro* systems by biotechnology methods is also perspective and promising.

The plants of this family are well studied in crop in total 48 species of this family are tested except 10 species from official ones.

Yield data of plant raw materials for years of observation in terms of foothills of Ile Alatau is defined by us for 4 species (*Aconitum leucostomum* 5.31–56.49/19.69 g; *Nigella damascena* 0.15–0.81/0.395 g; *Ranunculus acris* 5.59–19.4/14.432 g; *Thalictrum minus* 44.8–113.2/61.63 g).

Family ***Rosaceae* Juss.** presented by 89 species making up about the half (47 %) all the family one growing on the territory of Kazakhstan and numbering to around here 190 species. In modern understanding of family based on genetic principle number of genera decreased up to 23 due to transferring *Amygdalus* L., *Armeniaca* Scop., *Padus* Mill. в *Prunus* L. Very huge genera are *Potentilla* L. (24 species), *Prunus* L. (11) and *Rosa* L. (10) which make up almost the half (49 %) all tspecies of present family. Besides of them may determined *Crataegus* L. species and *Spiraea* L., 5 and 9 monotype genera in the rest the number of species vary 2 up to 4. This family members are great diverse in vital forms: they are annual, biennial and permanent grasses, bushes, undershrub and trees. The less half all the pharmaceutical species fall in herbaceous plants (43 species — 49 %), a bit more than the half — wooden-bush species (bushes — 31, trees — 15 species). The ecological structure of family flora is described by predominant of mesophilous plants — 76 species (85 %), a xerophytic group is presented by only 14 species.

About the one-third of plants of the Rosaceae family (26) is presented by species with a wide habitat (*Cotoneaster melanocarpus, Filipendula ulmaria, F. vulgaris, Agrimonia eupatoria subsp. asiatica are palaearctic, Rubus saxatilis, Geum aleppicum, Sanguisorba officinalis, Fragaria vesca* holarctic type of areal). Some less Soongari Tyan Shan species (20), Altai and Siberian Mountain (23), the Central Asian Mountain (14). The rest groups are presented slightly. For the species of family are mainly mesophilous group members, by it is accounted for their widespreading in Tyan Shan, Soongari Alatau, Altai and Tarbagatai mountains. Some less family members can be met in northern arears, even less in central Kazakhstan. Such areas of Kazakhstan as Caspian, Emba, Usturt, Aral, Kzyl Orda, Moyankum, Kyzyl kum, Turkestan, Mangyshylak are presented poorly or not presented at all. In the family there are 2 endemic species *Crategus almaatensis* and *Potentilla fedtschenkoana*.

Biological active compounds content and the field of its application in medicine this family species is very diverse. In grass species as a raw material tend to serve aerial part of plants and in woods and bushes mainly do fruits rarely bark leaves and roots. The majority of family species are applied as multivitamin

preparation many has got antiphlogistic, antipyretic, tonic, hemostatic and the like qualities and are wideapplied in falk medicine. A high content of grease oil in seeds of almonds allows applying it as a laxative [15], *Prunus dulcis (Amygdalus communis)* oil is applied as a solvent for camphor [34]. Besides it, seeds (kernel) contains a cyanogenic derivatives (glycosides) in *Prunus fruticosa, P. dulcis, Prunus padus* (*Cerasus fruticosa*, *Amygdalus communis*, *Padus avium)* as well anthocyanins, anthocyanidins, proanthocyanidins. To the family species is typical to be a high content of vitamins, flavonoids, tannes, less organic acids, coumarins, catechines, carbohydrate, essential oil, even more rarely it is noted a precence of saponins and steroids**.**

In medicine 23 species are officially applied: *Prunus dulcis (Amygdalus communis), Prunus armeniaca (Armeniaca vulgaris), Coluria geoides; Crataegus korolkowii; Crataegus sanguinea; Filipendula ulmaria; Filipendula vulgaris; Fragaria vesca; Geum urbanum; Malus sieversii, Prunus padus (Padus avium), Potentilla argentea; Potentilla erecta; Rosa acicularis; Rosa alberti; Rosa beggeriana; Rosa canina; Rosa corymbifera; Rosa fedtschenkoana; Rosa laxa; Rosa majalis; Rubus idaeus; Sanguisorba officinalis)*.

Resources are defined for 21 species except 13 species of official medicine *Agrimonia eupatoria subsp. asiatica (Agrimonia asiatica, Prunus spinosissima (Amygdalus spinosissima), Prunus armeniaca (Armeniaca vulgaris), Crataegus almaatensis, Crataegus korolkowii, Crataegus pontica, Crataegus sanguinea, Crataegus songarica, Filipendula ulmaria, Malus sieversii, Prunus padus (Padus avium), Dasiphora fruticosa (Pentaphylloides fruticosa) Rosa acicularis, Rosa alberti, Rosa beggeriana, Rosa canina, Rosa majalis, Rubus idaeus, Sanguisorba officinalis, Sorbus sibirica, Sorbus tianschanica)*.

The majority of *Rosaceae* species are well studied in culture a lot of vitamine bushes are grown in industries scale and give a constant yield of raw (fruits and berries). Totally, by region in Kazakhstan 54 medicinal plants species of this family have been introduced.

Yield data of the plant raw in crop terms is defined by us for 6 species (*Agrimonia eupatoria subsp. asiatica* 32.5–249.7/119.26 g; *Filipendula vulgaris* 30.2–130/54.46 g; *Fragaria vesca* 0.425–2.5/1.141 g; *Fragaria viridis* 0.95–1.214 /1.10 g; *Potentilla recta* 15.4–45.8/33.696 g; *Potentilla argentea* 15.98–25.44/20.53 g; *Sanquisorba minor* 70.9–100.4 /85.70 g; *Sanquisorba officinalis* 36.8–550/328.7 g.

Conclusion

A comprehensive survey has been perfomed to study botanically and pharmacologically 7 leading families of medicinal flora of Kazakhstan who combined 648 plant species that makes up 46 % of total medicinal flora of Kazakhstan. It is a least more than the half medicinal species of the republic falls in the rest 126 families. Leading families bearing the greatest number of species are *Asteraceae* (196 species)*, Rosaceae* (89), *Lamiaceae* and *Fabaceae* (each 78*), Ranunculaceae* (75), *Apiaceae* (69*)* and *Brassicaceae* (63).

Analyzed families included 109 compendial species (about 47 % total known species in Kazakhstan of official medicine), including such important ones as: *Achillea millefolium, Adonis vernalis, Artemisia absinthium, Bidens tripartita, Calendula officinalis, Matricaria chamomilla (Chamomilla recutita), Foeniculum vulgare, Glycyrrhiza uralensis, Inula helenium, Malus sieversii, Origanum vulgare, Cullen drupaceum (Psoralea drupacea), Tussilago farfara,* виды родов *Rosa* L.*, Thalictrum* L. and etc.

Among the species of families to be analyzed 18 are rare ones *Aconitum talassicum, Adonis chrysocyathus, Adonis tianschanica, Adonis vernalis, Prunus armeniaca (Armeniaca vulgaris), Artemisia cina, Astragalus glycyphyllus, Crataegus ambigua, Erysimum croceum, Ferula iliensis, Malus niedzwetzkyana, Malus sieversii, Oxytropis almaatensis, Sanicula europaea, Saussurea involucrate* the raw materials of which is very requied to pharmproduction.

Within 7 leading families has been noted a precence of the majority of well-known classes of biological active substances. Flavonoids are discovered in all presented families and for *Asteraceae, Rosaceae*, *Fabaceae* families frequently found of derivatives of quercetin, isoramnetine and kemppheroll. In a list to be analyzed are defined some 273 species (40 %) in composition of which alcaloids have been discovered, noted or identified. It is *Asteraceae* (87 species), *Ranunculaceae* (62), *Lamiaceae* (42), *Brassicaceae* (39) families and etc. As a source of valuable coumarines serve mainly *Apiaceae* family species. Terpens and their derivatives (mono-, di-, seskvi) are presented in families *Asteraceae*, *Apiaceae, Lamiaceae, Rosaceae* which besides are described by a high content of essential oils.

Literature screening has found out 56 species from 5 families (mainly: *Ranunculaceae* — 14 species, *Brassicaceae* — 12, *Lamiaceae* — 11, *Asteraceae* — 10, *Fabaceae* — 9) to be applied to cardiovascular diseases. In all the species having got cardio activitiy, have been discovered alkaloids, saponins, falonoids, as

well cordiac glycosides and cardenolids (species belong to genera *Erysimum* L., *Syrenia* Andrz. from *Brassicaceae* fam., *Adonis* L., *Thalictrum foetidum* from fam. *Ranunculaceae).*

It is very important to study species with antituberculous effect that discovered in *Artemisia cina, A. lercheana, Cirsium esculentum, Crepis tectorum, Pulicaria salviifolia, P. vulgaris, Saussurea amara, S.frolowii, S.involucrata, S.schanginiana, Senecio integrifolius* belong to fam. *Asteraceae* and *Rosaceae* (5). Similiarly, an essential oil from *Origanum vulgare* и *Mentha piperita* [37] had an antituberculous effect.

Antidiabetic effect has been discovered in *Taraxacum officinalis* (roots), *Artemisia vulgaris, Trifolium arvense, Cypripedium calceolus, Glaucium corniculatum, G.elegans, Phragmites australis, Potentilla tanacetifolia* and a number of others, main ones of which are applied in falk medicine and only two species in official medicine. Thus, as an example in roots of *Inula helenium* isolated inulin (~ 40 %) has an effect on a glycose level in blood.

To prevent allergic desease preparations from *Glycyrrhiza glabra*, *G. korshinskyi*, *G. uralensis*, *Vexibia alopecuroides* fam. *Fabaceae* as well as extracts from *Agrimonia eupatoria subsp. asiatica* from fam. *Rosaceae* [38], polysaccharides from *Calendula officinalis* from fam. *Asteraceae* [22] can be taken as an antihistamine agent.

Poorly study of chemotherapy qualities of local Kazakhstani plants especcialy endemic species will provoke experts in phytochemistry to inhance a pilot study in order to find out new sources of raw to create domestic phytopreparations. Out of 774 endems of Kazakhstan as medicinal preparations are taken about 20 species [3] is being observed poor phytochemical research of endemic species from g. *Oxytropis* L., *Crataegus* L., *Thymus* L., *Erysimum* L.

Resource research of pharmaceutical species of analized families is very low. Out of 648 herbs raw resources are defined only for 88, that makes up about 13.6 % species of plants of 7 leading families except 50 species that applied in official medicine.

Above all resource's species are taken into account in families *Rosaceae* (23.6 % pharmaceutical species of family) *Asteraceae* (14.8 %), *Ranunculaceae* (13.3 %), *Fabaceae* (12.8 %). Raw resources are defined only to 10 % of medicinal plants belong to *Apiaceae*. Species belong to g. *Artemisia* L. (11 species), *Crataegus* L. (5), *Rosa* L. (5), *Aconitum* L. (4), *Glycyrrhiza* L. (3) are more studied resoursely.

Brassicaceae family's species (3.2 % medicina species of family) resources are not studied.

Introduction research of medicinal plants within 7 families being considered is considerably high than resource one, in the territory of Kazakhstan about 40 % total mentioned herbs are tested in crop. However, findings of yielding of raw of Kazakhstani species are greatly limited, farming techniquies features in experimental sites have been worked out only to 17 compendial species, the yield data of medicinal plants in crop are defined to 80 species belong to this leading families.

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Жетекші тұқымдас көлемінде Қазақстанның дәрілік флорасын талдау

648 түрді біріктіретін (барлық дәрілік флораның 46 %), Қазақстан дәрілік флорасындағы 7 жетекші тұқымдастың ботаникалық-фармокологиялық зерттеулері жан-жақты зерттелген. Ең көп түрлер санын құрайтын жетекші тұқымдастар *Asteraceae* (196 түр), *Rosaceae* (89), *Lamiaceae* и *Fabaceae* (78-ге дейін), *Ranunculaceae* (75), *Apiaceae* (69), *Brassicaceae* (63) болып табылады. Зерттелетін түрлерге 109 фармакопеялық түрлер (Қазақстанға белгілі ресми медицинада пайдаланатын түрлердің шамамен 47 %) және 18 сирек кездесетін түр жатады. Зерттелетін дәрілік түрлердің ресурстық зерттеулері өте төмен, 648 дәрілік түрдің ішінде 88-інің шикізат қоры анықталған, бұл 7 жетекші тұқымдас өсімдік түрлерінің 13,6 % құрайды, оның ішінде 50 түрі ресми медицинада қолданылады. Дәрілік өсімдіктердің жерсіндірілуінің зерттелуі ресурстық зерттеулерге қарағанда айтарлықтай жоғары. Аталған тұқымдастардың Қазақстан аумағында шамамен 40 %-ының мәдени өсірілуі сыналды. Жетекші тұқымдастардың 70 түрінің өнімділігі мәдени өсіруде анықталып, тек 15 фармакопеялық түрдің ғана агротехникалық ерекшеліктері дамыған.

Кілт сөздер: дәрілік өсімдіктер, флоралық талдау, қор, жерсіндіру, Қазақстан флорасы.

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Анализ лекарственной флоры Казахстана в объеме ведущих семейств

В статье дан комплексный анализ ботанико-фармакологической изученности 7 ведущих семейств лекарственной флоры Казахстана, которые объединяют 648 видов (46 % всей лекарственной флоры). Ведущими семействами, содержащими наибольшее количество видов, являются *Asteraceae* (196 видов), *Rosaceae* (89), *Lamiaceae* и *Fabaceae* (по 78), *Ranunculaceae* (75), *Apiaceae* (69), *Brassicaceae* (63). Анализируемые семейства включают 109 фармакопейных видов (около 47 % всех известных в Казахстане видов официальной медицины) и 18 редких видов. Ресурсная изученность лекарственных видов анализируемых семейств очень низка. Из 648 лекарственных видов запасы сырья определялись лишь для 88, что составляет около13,6 % видов растений 7-ми ведущих семейств, в числе которых 50 видов, применяемых в официальной медицине. Интродукционная изученность лекарственных растений существенно выше, чем ресурсная. На территории Казахстана испытано в культуре около 40 % растений упомянутых выше семейств. Особенности агротехники разработаны только для 15 фармакопейных видов, урожайность лекарственных растений в культуре определена для 70 видов ведущих семейств.

Ключевые слова: лекарственные растения, флористический анализ, ресурсы, интродукция, флора Казахстана.

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