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Vitamin Plants of the Forest Flora of Kuznetskiy Alatau .

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ABSTRACT

The research has resulted in a recommended list of vitamin plants of the forest flora of Kuznetsky Alatau. For the selection of field material, a method of regular establishment of key plots and a net of expeditionary routes was used. The basis for conducting an ecological and geographical analysis was the assignment of each species by belt zone to a particular ecological and geographical group. The list includes 23 species, for each of which an ecological and geographical assignment was made and vitamin content is shown. The data on the spread of vitamin plants of Kuznetskiy Alatau through geobotanical districts, occurrence in plant communities and zone confinement is shown. Ecological and geographical analysis showed that among the vitamin plants of the forest flora of Kuznetskiy Alatau the paranasal group (12 species) prevails. A subgroup of adventitious-mountain species (6 species) shortly follows. The mountain-steppe subgroup among vitamin plants of the forest flora of Kuznetskiy Alatau is much smaller (3 species). Least of all are vitamin plants in the highland mountain and in the mountain per se subgroups. Thus, the bases of vitamin plants, and as a whole, the entire forest flora of Kuznetskiy Alatau in terms of ecological and geographical structure consists of adventitious, adventitious-mountain and mountain species.

Keywords: Kuznetskiy Alatau, forest flora, vitamins.

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INTRODUCTION

Vitamin plants are very popular nowadays. Vitamins are synthesized by plants and microorganisms. Man and animals are not able to synthesize or synthesize an insufficient amount (nicotinic acid), so they need to get them regularly from food. Compared with other nutrients (proteins, fats, carbohydrates) vitamins are necessary for the animal body in small amounts (mcg or mg per day), but are essential for normal metabolism and activity. Vitamins, not being a material for biosynthesis, are involved in all biochemical processes as unique components of cellular metabolism. The best therapeutic effect is achieved by using plant extracts containing a combination of vitamins and microelements.

The aim of our research was to identify vitamin plants of the forest flora of Kuznetskiy Alatau. To identify useful vitamin plants in the forest flora of Kuznetskiy Alatau all species depending on their application were allocated to a specific resource group or groups on the basis of the literature [1; 2; 6; 9; 10; 11; 14].

The forest flora of Kuznetskiy Alatau is home to 23 species of vitamin plants. They are the sources of vitamins: A, C, of B, K, P groups, etc. Many vitamins species belong to medicine and alimentary plants. Most of these species are in the communities of *Liliaceae* (3 types of the species *Allium*) and *Rosaceae* (species *Cotoneaster, Fragaria, Padus, Rosa, Rubus, Sorbus*) in the forest flora of Kuznetskiy Alatau. Other communities also include 1-2 plants: *Urticaceae* (*Urtica*), *Polygonaceae* (*Rumex*), *Grossulariaceae* (*Ribes*), *Elaeagnaceae* (*Hippophae*), *Apiaceae* (*Bupleurum*), *Ericaceae* (*Vaccinium*) etc.

MATERIALS AND METHODS

The vitamin plants of the forest flora of Kuznetskiy Alatau served as the subject for research. We understand forest flora as the partial forest flora of Kuznetskiy Alatau and identify as a whole the species growing in forest communities. For the selection of the field material, we employed a method of regular planting of key lots and a net of expeditionary routes that enabled a reliable estimation of the floristic richness of forest flora of the studied region [7].

The basis for ecological and geographical analysis was the allocation of each species by belt zone assignment to a particular ecological and geographical group. Isolation of eco-geographical groups was conducted on the basis of our own materials and with the aid of literature sources.

The study adopted eco-geographical groups, identified by L.I. Malyshev [5] and later supported by other botanists [4, 12, 13]. N.A. Nekratov's approach to the identification of eco-geographic subgroups, based not simply on the occurrence of certain species in the belt zone area, but taking into account their quantitative share in the vegetation was taken for the basis in the research [8].

The following eco-geographical groups and subgroups were adopted:

The high-mountain group includes species which grow mostly in high-mountain regions.

- The Artic-high-mountain subgroup has a collective character as it contains species which grow in the high-mountain zone, arctic and sub-arctic areas and some species going down to forest zone.
- The mountain-high-mountain subgroup includes species which grow mostly in high-mountain regions but going down to forest zone.

The mountain group brings together species which grow in mountains mostly lower than the high-mountain zone.

- The high-mountain-mountain subgroup includes species which grow in the mountains, but occupy some territory in the high-mountain zone.
- The mountain per se subgroup consists of species which are widespread in the forest zone.
- The mountain-steppe subgroup contains species which grow mainly in the mountain plains and occupy some territory of the forest zone and high-mountain zone.

- The adventitious-mountain subgroup includes plain-mountain species which have eco-coenotic optimum in mountain habitats.

The adventitious group brings together species which are equally widespread both on the plains and in the mountains.

The spreading of each species through Kuznetskiy Alatau by geo-botanical districts is shown in Figure 1: I –Barzas taiga, II – Kuznetsko-Alataussky high-mountain, III – Nothern-Kuznetsko-Alatausskiy pine-dark coniferous, IV – Eastern-Kuznetsko-Alatausskiy mid-mountain pine-dark coniferous, V – Balyksinskiy mountain taiga, VI – Batenevskiy low-mountain forest-steppe. The following zone assignment is used: 1 – high-mountain zone, 2 – taiga, 3 – taiga, 4 – subtaiga, 5 – forest-plain.

EXPERIMENTAL RESULTS AND DISCUSSION

There follows a list of these plants with an indication of eco-geographical groups, spreading through Kuznetskiy Alatau by geobotanical district, zone confinement and their characteristics in terms of vitamins. This text also marks the species used as officinal medicinal herbs (*).

Allium microdictyon Prokh. – Leek onion. I-V; 13. Fir, cedar-fir and mixed with birch forests, forest meadows. High-mountain-mountain (down to the plains) [6; 10]. It contains vitamins B_1, B_2, B_6, B_c,(folic acid), C (up to 270 mg%), E, P (flavonoids, 1.58%), PP (nicotinic acid), carotenoids (4.2 mg%), sulfur hydrocarbons (allicin), coumarins, saponins and volatile oil.

Allium obliquum L. – Oblique onion. IV; 4. Forest glades, meadows. Mountain per se [10]. It contains vitamins B_1, B_2, B_6, B_c, C (up to 160 мг%), E, P (0,98 %), PP, carotenoids (up to 15 мг%; lutein, zeaxanthin, β-carotene), saponins and volatile oil.

Allium stellerianum Willd. – Steller's onion. IV; 4-6. Steppe pine forests, dry slopes. Mountain-steppe [10]. It contains vitamins B_1, B_2, B_6, B_c, C, E, P, PP, carotenoids, saponins and volatile oil.

Bupleurum multinerve DC. – Hare's ear. IV; 4-6. Steppe, larch, birch, mixed forests. Eurasian. Mountain-steppe. It rises through the isolated screes up to the high part of the forest zone and high-mountain - relic location (glacial relicts) [10]. The grass contains* vitamins C (up to 180 mg%), P, carotenoids (up to 15 mg%), saponins, polyacetylene compounds, tannin and volatile oil [11].

Cotoneaster melanocarpus Fischer ex Blytt – Cotoneaster melanocarpus II-IV; 4, Sparse forests, steppes. Mountain-steppe [10]. It contains vitamins C (up to 250 mg%), P, coumarins and phenol carboxylic acids.

Fragaria vesca L. – Forrest strawberry I-V; 4, 5. Sparse forests, meadows. Adventitious [9]. Fruits* and leaves* contain vitamins B_1, B_2, B_6, B_c, C (fruits up to 50 mg%), E, P, PP, carotenoids (up to 5 mg%), organic acids, pectin and tannins, and volatile oil [11, 15, 18].

Fragaria viridis Duch. – Strawberry I-V; 4, 5. Edges of forest, sparse larch and birch forests, steppe meadows. Adventitious [6, 10]. Fruits and leaves contain vitamins B_c , C (up to 440 mg%), P, PP, carotenoids, organic acids, pectin and tannins, and volatile oil [15, 18].

Hippophae rhamnoides L. – Buckthorn family IV; 4, 5. Poplar valley forests. Adventitious [10]. Fruits* contain carotenoids (up to 10.9 mg%; α-, β-, γ-carotenes, lycopene, politsis-lycopene, zeaxanthin, fitoflyuin), vitamins B_1, B_2, B_6, B_{12}, B_c, C (up to 270 mg%), E, K P, PP, fatty oil (up to 13.7%), pectin, triterpenoids, sterols, phospholipids and organic acids [11, 17].

Padus avium Miller – Bird cherry I-IV; 4, 5. Fir, birch and fir, larch and birch forests. Adventitious [9]. The study identified carotenoids, vitamin C (up to 280 mg%), P, E, fatty oil, pectin, and tannins, organic acids and their derivatives in the fruits* [11, 16].

Primula macrocalyx Bunge – Primrose macrocalix II, IV; 1, 4, 5. Larch, larch and birch forests, forest and subalpine meadows. Adventitious-mountain [9, 10]. The leaves are rich in vitamin C (up to 5.9%), and contain carotenoids, flavonoids, saponins and volatile oil.

Pulmonaria mollis Wulfen ex Hornem. – Hairy Lungwort. Birch and fir, larch and birch, aspen and birch forests, forest meadows. Adventitious-mountain [9, 10]. Carotenoids, vitamins C, F, tannins, saponins and polysaccharides were found in the leaves.

Ribes glabellum (Trautv. et Meyer) Hedl. – Naked currant. Forests, shores. Adventitious [9]. The fruits contain vitamins B_1, B_2, B_6, B_c, C (up to300 mg%), P, carotenoids, organic acids and pectin [1, 3].

Ribes nigrum L. – Black currant. Fir, cedar and birch and fir, larch and birch forests. Adventitious-mountain [9; 10]. B_1, B_2, B_6, B_c, vitamin C (up to 570 mg%), D, E, K, P, PP, carotenoids, organic acids, volatile oils, pectin and tannins were found in the fruits* [11, 17, 18].

Rosa acicularis Lindley – Wild roses II, IV; 2-5. Mixed, coniferous, pine and birch forests, meadows, rivers' banks. Adventitious [10]. The fruits* of wild roses contain vitamins B_1, B_2, B_c, C (up to 5.2%), E, K, P, PP, carotenoids (up to 10 mg%; α-, β-, γ-carotenes, lycopene), organic acids , tannins and pectin, and fatty oil [3, 11].

Rosa majalis Herrm. – Cinnamon rose I-VI; 4, 5. Conifer, birch, mixed forests, forest and meadows. Adventitious [10].

Rubus idaeus L. – Raspberry I-IV; 2-5. Fir, cedar and birch and fir, birch and larch forests, forest meadows. Adventitious [9]. Vitamins B_1, B_2 (0.012 mg%), B_6, B_c (6 mg%) and C (up to 45 mg%), P, PP (up to 0.6 mg%), E, carotenoids (0.3-0.6 mg%), organic (up to 2%) and triterpene acids, pectin, tannins and nitrogenous compounds were found in the fruits* [11, 18].

Rumex thyrsiflorus Fingerh. – Pyramidal sorrel I-VI; 3-6. Meadows, forest fields, sparse forests. Adventitious [10]. It contains vitamins B_1, C (up to 90 mg%), P, PP, carotenoids, anthraquinones, tannins and organic acids.

Sorbus sibirica Hedl. – Siberian rowan I-V; 1-4. Pine and fir and birch, aspen, pine and fir, larch and birch forests. Adventitious-mountain [10]. Carotenoids (up to 20 mg%), vitamin B_2 (70 mg%), B_c, C (200 mg%), E (4.4 mg%), K, P, PP, organic acids, triterpene compounds and pectin [3, 11].

Thalictrum simplex L. – Common meadow rue IV; 2, 4. Sparse forests, meadows. Adventitious [9]. It contains vitamin C (up to 570 mg%), carotenoids, triterpene saponins of lanostane and cycloartane row, alkaloids of isoquinoline raw , flavonoids and coumarins.

Urtica dioica L. – Stinging nettle I-VI; 2-5. Forests, rivers' banks, and meadows. Adventitious (weed) [10]. The leaves accumulate vitamins B_1, B_2, B_5 (pantothenic acid), B_c, C (up to 270 mg%), H (biotin), K (200 mg%), P, carotenoids (up to 50 mg%), phenol carboxylic acids and tannins [11].

Vaccinium uliginosum L. s. str. – Blueberry II, IV; 1, 2. Waterlogged woods, moss bogs, tundra. Adventitious [9]. The berries contain vitamin C (up to 50 mg%), P (up to 170 mg%) PP (up to 0.28 mg%), carotenoids (0.25 mg%), tannins and pectin, and simple phenols (arbutin) [20].

Vaccinium vitis-idaea L. s. str. – Cowberry II, IV,V; 1-4. Coniferous and mixed forests, high-mountain tundra. Adventitious [9]. The leaves* and fruits contain carotenoids (0.1%), vitamin B_2 (0.13 mg), and C (up to 30 mg%), P, PP, iridoids, simple phenols (hydroquinone, arbutin), coumarins and tannins [11, 17].

Viburnum opulus L. – Guelder rose I-IV; 4. Birch and fir forests. Adventitious [9]. The fruits * and bark * contain vitamins B_2, B_6, B_c, C (up to 80 mg%), E, F, K_1 (up to 30 mcg/g), P, PP, carotenoids (up to 20 mg%), phenol carbonic and triterpene acids, tannin and pectin, and amino acids [11, 19].

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CONCLUSIONS

Eco-geographical analysis showed that among the vitamin plants of the forest flora of Kuznetskiy Alatau the adventitious group (12 species) prevails: *Fragaria vesca* L., *F. viridis* Duch., *Hippophae rhamnoides* L., *Padus avium* Miller., *Ribes glabellum* (Trautv. et Meyer) Hedl., *Rosa acicularis* Lindley, *Rosa majalis* Herrm., *Rubus idaeus* L., *Rumex thyrsiflorus* Fingerh., *Thalictrum simplex* L., *Urtica dioica* L., *Viburnum opulus* L., moreover these species accumulate different vitamins in large quantities. The large number of adventitious species is caused by the direct junction in the north to the area of research of the West Siberian Plain. The subgroup of adventitious-mountain species (6 species) follows closely, which is determined by the ecological conditions of the forest relatively close to the plains, valleys and mountain areas. This is a group of ecologically plastic species living on the plains - the foothills - and the lowlands to highlands: *Primula macrocalyx* Bunge, *Pulmonaria mollis* Wulfen ex Hornem., *Ribes nigrum* L., *Sorbus sibirica* Hedl., *Vaccinium uliginosum* L. s. str., *Vaccinium vitis-idaea* L. s. str. This group is also rich in vitamins, but with lesser variety. The number of mountain-steppe subgroup species among vitamin plants of the forest flora of Kuznetskiy Alatau is much smaller (3 species), and it is due to contact with the flora of the Minusinsk basin. The mountain-steppe species include: *Allium stellerianum* Willd., *Bupleurum multinerve* DC., *Cotoneaster melanocarpus* Fischer ex Blytt. The smallest number of vitamin plants is in the high-mountain-mountain (*Allium microdictyon*) and in the mountain per se subgroups (*Allium obliquum*). This means that forest species are occasionally encountered in a lower band of high mountains.

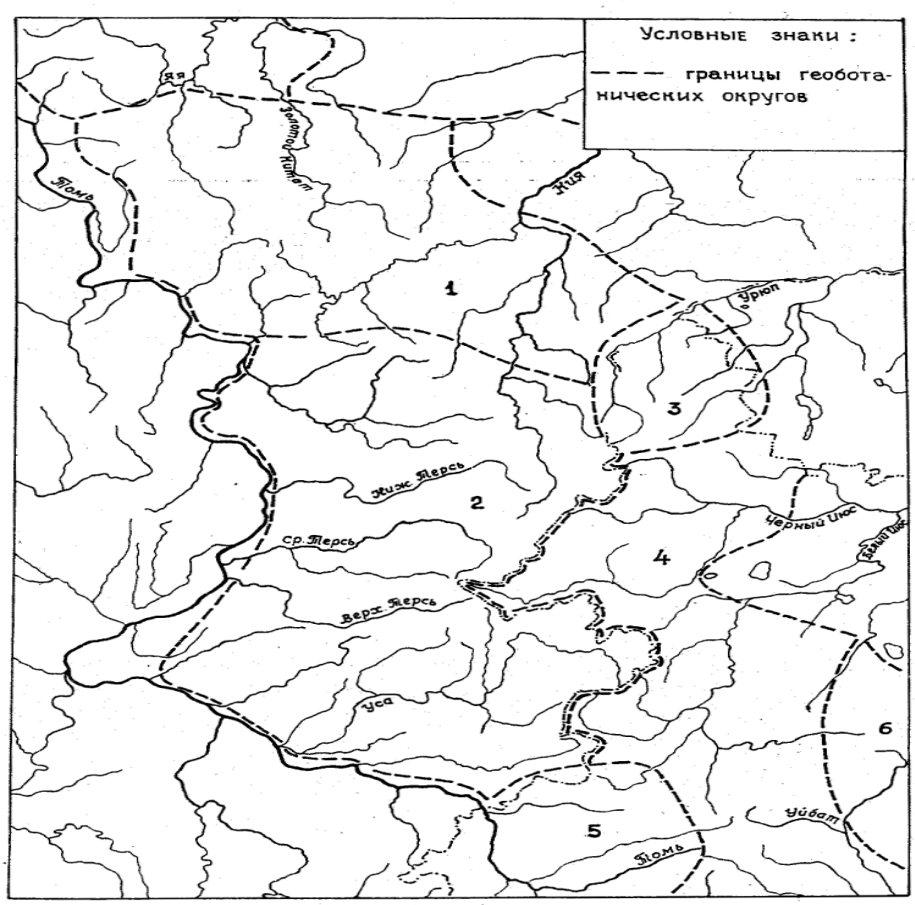

Figure 1: Scheme of geo-botanical districts of Kuznetskiy Alatau

Figure captions:

1 – Barzas taiga, 2 – Kuznetsko-Alatausskiy high-mountains, 3 – Northern-Kuznetsko-Alatausskiy pine-dark coniferous, 4 – Eastern-Kuznetsko-Alatausskiy mid-mountain pine-dark coniferous, 5 – Balyksinskiy mountain taiga, 6 – Batenevskiy low-mountain forest-steppe.

Thus, adventitious, adventitious-mountain and mountain species make up the basis of the vitamin plants, and as a whole, the entire forest flora of Kuznetskiy Alatau in terms of ecological and geographical structure. However, the adventitious species cannot be considered an exclusively plain species, since they live both on the plains and in the mountains.

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