

T.A. Vdovina, O.A. Lagus*, E.A. Isakova, A.A. Vinokurov

Altai Botanical Garden, Ridder, Kazakhstan

*Corresponding author: lelik_ridder@mail.ru

State of coenopopulations of wild berry plants in the territory of Kazakhstan Altai

In the article studies on the state of the coenopopulations: *Rosa acicularis* Lindl., *Rosa spinosissima* L., *Lonicera altaica* Pall., *Ribes nigrum* L., *Ribes petraeum* Wulfen, which have high resource indicators and significant areas were presented. The studies were conducted on the territory of the Kazakhstan Altai in the geographical areas of South-West Altai, South Altai. For each coenopopulation, data were obtained on the nature of distribution, occupied area, phytocenotic characteristics, general and age condition of plants and their biodiversity.

Keywords: coenopopulation, phytocenosis, area, productivity, variation.

Introduction

The problem of preserving the genetic potential of fruit-berry plants, its practical introduction into culture, use in modern breeding is one of the basic foundations in the creation of new varieties, forms and hybrids. The need to study the genetic potential of wild fruit-berry plants and create a gene pool of a new assortment is dictated by the fact that due to climate change, anthropogenic impact on biocenoses, their ranges are sharply reduced, up to the threat of complete extinction. The research is due to Kazakhstan's need to assess the current state of fruit-berry plants to solve the problem of food security, to carry out monitoring for scientifically substantiated security measures.

In various regions of Kazakhstan, there is a need to develop and create scientific and practical foundations of regional collection funds and nurseries, which will satisfy the growing demand for sustainable crops for certain soil and climatic conditions of fruit-berry plants. Earlier, the study concerned the introduction of foreign fruit-berry plants in various regions of Kazakhstan, while the species composition of the natural flora of wild fruit-berry plants is little studied and its resource potential is practically not assessed.

A comprehensive study of berry plants is essential for solving issues of ecology, phytocenology, floristry, population biology and environmental protection [1, 2].

Experimental

The objects of the research were coenopopulations of wild berry plants in the territory of the Kazakhstan Altai from the genera *Ribes*, *Lonicera*, *Rosa*. The locations with geographical reference of GPS coordinates and areas of 8 coenopopulations for 5 species of berry plants were established — *Rosa acicularis* Lindl., *Rosa spinosissima* L., *Lonicera altaica* Pall., *Ribes nigrum* L., *Ribes petraeum* Wulfen.

When assessing the current state of the studied plant species, the methodological guidelines developed by V.N. Golubev and E.F. Molchanov (1978) were used [3]. The description of phytocenoses was carried out using generally accepted geobotanical methods of T.A. Rabotnov [4]. In biomorphological studies, ecological-morphological classifications of life forms by I.G. Serebryakov [5] were used. During determining the projective cover, the method of determining the average projective cover, generally accepted in resource studies by S.N. Kozyakov [6] was used.

Results and Discussion

***Rosa acicularis* Lindl.** Two locations have been identified in the foothills of the Ubinsky ridge in the valley of the Zhuravlikha River, the vicinity of the village of Krolchatnik and the foothills of the Ubinsky ridge, Osinovsky pass, the vicinity of the village of Zimovye in the territory of the South-West Altai (Kazakhstan Altai).

1) Foothills of the Ubinsky ridge, valley of the Zhuravlikha river, environs of the village of Krolchatnik, area 95 ha, N50.33333; E88.183333, 913 m above sea level. Plant distribution over the area is single bushes

or separate groups of 12–17 individuals of different ages. Total projective cover is 04–06. The forest stand is represented by *Populus laurifolia* Ledeb., *Populus tremula* L. The shrub layer is formed by *Viburnum opulus* L., *Prunus padus* L., *Crataegus chlorosarca* Maxim., *Rosa acicularis* Lindl. The grass stand is thinned out and includes 25 species of vascular plants (*Angelica decurrens* (Ledeb.) B.Fedtsch., *Dactylis glomerata* L., *Festuca drymeja* Mert. & W.D.J. Koch, *Festuca rubra* L., *Poa palustris* L., etc.). Bushes are from 0.7 m to 1.8 m high with a large number of overgrowing shoots. Productivity is from 80 to 210 g/bush. Hypanthia color variation is revealed from yellowish-orange to dark cherry and crimson, with orange and orange-red colors predominating. A large spread in hypanthia weight is noted from 1.23 to 2.90 g, in length from 1.8 to 2.6 cm, in width from 1.0 to 2.0 cm. Fruit shape: bottle-shaped, oval, elongated; sweetish taste with a pleasant sourness. Juicy is pulp with mealy inclusions. A difference in the number of seeds in the fruit was revealed: from 24 to 48 pcs.

2) Foothills of the Ubinsky ridge, Osinovsky pass, vicinity of the village of Zimovye. The population is located in the foothills of the Ubinsky ridge, near the village of Zimovye, with an area of 20 hectares along the road of the long Osinovsky pass in front of the village of Zimovye, with a length of 3 km, N50.31422; E82.85234, 795 m above sea level. The total projective cover is 12 %. The distribution of rose hips is diffuse and in continuous clumps under the canopy of tall trees: *Abies sibirica* Lindl., *Populus laurifolia* Ledeb., *Betula pendula* Roth., *Sorbus aucuparia* L., *Sorbus aucuparia* subsp. *glabrata* (Wimm. & Grab.) Hedl. The dominants of the herbaceous cover are represented by *Dactylis glomerata* L., *Poa pratensis* L., *Festuca rubra* L., *Elymus repens* (L.) Gould. (Fig. 1, 2).



Figure 1. Fruiting of *Rosa acicularis*



Figure 2. Fragment of the *Rosa acicularis* phytocenosis

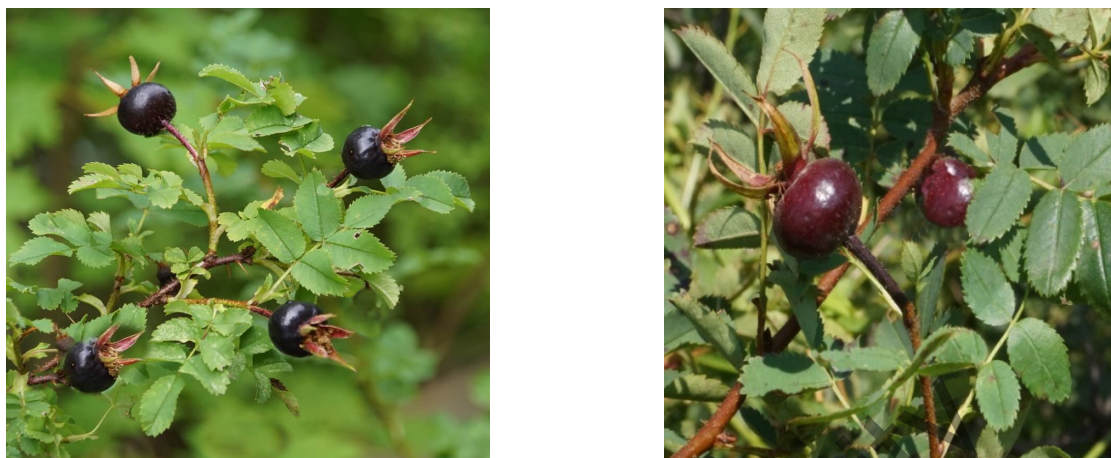
Rosehip bushes are from 0.1 m to 2.2 m high. The bushes are in excellent condition, the maximum shoot-forming capacity is 4-5 zero shoots. The following differences have been established in the size of the hypanthia: length from 2.2 cm to 2.7 cm, width from 1.1 cm to 1.6 cm, weight from 0.97 to 2.26 g.

***Rosa spinosissima* L.** Two populations were examined in the foothills of the Ivanovsky ridge in the territory of Southwestern Altai (Kazakhstan Altai).

Foothills of the Ivanovsky Ridge, south-eastern slope of Belkina Mountain, N50.34222; E83.55111, 848 m above sea level. The population occupies 15 hectares, located mainly in open areas, in the area of the Ridder meteorological station. The spatial structure of the population is diffuse, less often diffuse-group, 1.7 m² — 25 m². The projective cover fluctuates from 18 to 23 %. The density of generative shoots per 10 m² is 30–60 pcs. The condition of the plants is good; there are no broken or dry shoots. Shoot growth is from 8 to 17 cm. The level of resistance to unfavorable factors of the winter period is quite high. Signs of freezing are practically not noted.

The accompanying plants are mainly shrubs: *Spiraea trilobata* L., *Cotoneaster melanocarpus* Fisch. ex Blytt. The herbaceous cover is represented by *Geranium pretense* L., *Potentilla aurea* L., *Bunias orientalis* L., *Fragaria viridis* Duchesne etc. The number of renewal shoots per bush is 2-3 pcs. The shape of the hypanthia is round and flat-round. The weight varies from 1.3 g to 3.57 g, hypanthia with a weight of 2.35 g

prevail. The variation coefficient was 20.4 %, the level of variability is average. The length and width of the hypanthia vary from 1.1 to 1.4 cm and from 1.4 to 1.9 cm, respectively. For the size of the fruits, the variation coefficient for length was 11.8 %, for width 8.0 %. The color is black and dark-brown (Fig. 3). The yield is from 70 to 220 g/bush. The beginning of ripening is noted in mid-September.



A

B

Figure 3. Variation in fruit color; A — black, B — brownish

1) Foothills of the Ivanovsky Ridge, Gromatushinskoye Gorge, N50.30544; E83.55047, 935 m above sea level. The area is 33 hectares. It grows in open areas, reaching the border of the mixed forest. This population is characterized by good phytocenotic indicators for bush density, the number of generative shoots per 10 m² from 25 to 55 pcs. Maintenance and dispersal is carried out due to active root-sucker propagation, replacing old individuals with clonal young ones. The general condition of the plants is good; the increment of overgrowing shoots is quite high 10–21 cm. There are no signs of freezing. The number of renewal shoots per bush is 2-3 pcs. Productivity from 80 to 245 g/bush. Mass ripening of fruits is noted in mid-September. Hypanthia weight is 1.92 g.

The phytocenosis consists of coniferous (*Larix sibirica* Ledeb., *Pinus sylvestris* L.), deciduous (*Sorbus aucuparia* subsp. *glabrata* (Wimm. & Grab.) Hedl.), shrub (*Sibiraea laevigata* (L.) Maxim., *Cotoneaster melanocarpus* Fisch. ex Blytt., *Ribes nigrum* L., *Ribes rubrum* L., *Rubus idaeus* L.) plants. From the herbaceous plants *Paeonia anomala* L., *Trollius altaicus* C.A. Mey., *Anemone altaica* Fisch. ex C.A. Mey., *Pulmonaria mollis* Wulfen ex Hornem., *Heracleum dissectum* Ledeb., *Rumex acetosa* L., *Equisetum arvense* L. and others are noted. There are 54 species of vascular plants in total.

***Lonicera altaica* Pall.** Two populations were examined in the territory of the Kazakh Altai (Southern Altai, Southwestern Altai).

1) Foothills of the Kurchumsky ridge, northwestern coast of Lake Markakol, environs of the abolished village of Verkhnyaya Yelovka, Kurchumsky district (Southern Altai), N48.80668; E85.66083, 1513 m above sea level. Area is 18 hectares. In the larch forest, plants are found singly, sparsely, in groups in open clearings. The age of plants in the population is 40–50 years, the vitality of individuals is satisfactory. Vegetative regeneration of plants is absent. In this population, forms with large fruits of 0.8-1.0 g, elongated-ovoid in shape with a yield of 1.1-1.6 kg/bush were identified. Ripening of fruits is extended.

The phytocenosis consists of conifers (*Larix sibirica* Ledeb., *Picea obovate* Ledeb., *Abies sibirica* Lindl), deciduous trees (*Populus laurifolia* Ledeb., *Populus nigra* L., *Betula pendula* Roth, *Sorbus aucuparia* subsp. *glabra* (Wimm. & Grab.) Hedl.), shrubs (*Rosa spinosissima* L., prickly *Rosa acicularis* Lindl., *Ribes atropurpureum* C.A. Mey., *Ribes nigrum* L.). The grass stand is mixed grass and cereal, formed by 47 species of vascular plants.

1) Ivanovsky Ridge, northwestern slope, Palevaya Yama tract, buffer zone of the West Altai State Nature Reserve, N50.36584; E83.93598, 1112 m above sea level. The area is 48 hectares in the mixed forest belt. Mountain-meadow soils, with a developed profile up to 40 cm. Plants are 1.4–1.6 m high. Productivity varies from 0.8–1.3 kg / bush. Plants with an average fruit weight of 0.5–0.7 g predominate. The age of

plants in this population is from 42 to 50 years, there are many plants with old branches with hanging bark in the bush. Vegetative renewal of plants is absent.

The tree layer is represented by *Populus laurifolia* Ledeb., *Sorbus aucuparia* subsp. *glabra* (Wimm. & Grab.) Hedl., *Betula pendula* Roth), shrub layer — *Cotoneaster melanocarpus* Fisch. ex Blytt., *Rosa acicularis* Lindl., *Rubus idaeus* L. The herbage is forb-grass, well developed, represented by 52 species of vascular plants (*Angelica sylvestris* L., *Dactylis glomerata* L., *Festuca altissima* All., *Festuca rubra* L., *Poa palustris* L., *Aconitum leucostomum* Worosch., *Filipendula ulmaria* (L.) Maxim., *Origanum vulgare* L., *Hypericum perforatum* L., etc.).

***Ribes nigrum* L.** The population was examined in the territory of the Southern Altai (Kazakhstan Altai) on the northwestern coast of Lake Markakol, N48.80668; E85.66083, 1513 m above sea level. The dispersal of plants on moist soils along streams flowing into the lake. It is found singly and in strips. The tree stand is represented by *Populus laurifolia* Ledeb., *Populus nigra* L., *Betula pendula* Roth, *Sorbus aucuparia* subsp. *glabra* (Wimm. & Grab.) Hedl., *Larix sibirica* Ledeb., *Picea obovata* Ledeb., *Abies sibirica* Lindl. Among the shrubs, *Rosa spinosissima* L., *Rosa acicularis* Lindl., *Rubus idaeus* L. are noted; the herbage is mixed grass and cereal, formed from 56 species of vascular plants (*Angelica sylvestris* L., *Dactylis glomerata* L., *Festuca rubra* L., *Festuca drymeja* Mert. & W.D.J. Koch, *Poa palustris* L., etc.).

The bushes are spreading, 0.7–1.0 m high. The cluster is medium-sized, 4–6 cm, the number of berries in it is from 3 to 8 pcs., on average 5 pcs. The population is dominated by individuals with average berry sizes from 0.3 g to 0.6 g, the weight of the largest berry is 0.8 g. The berries ripen in the first ten days of August. The yield is from 0.5 to 2.0 kg/bush (Fig. 4).



Figure 4. Fruit-bearing blackcurrant bush (A), blackcurrant berry cluster in the vicinity of Lake Markakol (B)

***Ribes petraeum* Wulfen.** The population is located at the foot of the Ivanovsky ridge, in the area of the first forest cordon, 50.35472; 84.24833, m above sea level 1756 m. It grows under the canopy of dark coniferous forest as single bushes, in open clearings — in groups.

The forest stand is represented by *Abies sibirica* Lindl., *Pinus sibirica* Lodd., *Betula pendula* Roth, the shrub layer in this coenopopulation is represented by the following species: *Prunus padus* L., *Crataegus chlorosarca* Maxim., *Salix viminalis* L., *Rosa spinosissima* L., *R. acicularis* Lindl., *Cotoneaster melanocarpus* Fisch. The most widespread in the herbaceous cover are: *Origanum vulgare* L., *Bupleurum longifolium* L., *Hypericum perforatum* L., *Filipendula ulmaria* (L.), *Trollius altaicus* C.A. Mey., *Elymus repens* (L.) Gould, *Artemisia glauca* Pall. ex Willd., *Allium microdictyon* Prokh., *Aconitum leucostomum* Worosch. Plants of this population are characterized by erect bushes, 0.7 to 1.2 m high. Almost all forms have a compact, long brush, the number of berries is from 3 to 12 (8) pcs. The berries are not uniform, the ratio of large to small berries is 2.5-2.6. Most of the forms growing here have medium berries of 0.31 g, variations are from 0.26 g to 0.50 g. The weight of the largest berry is 1 g. The berries ripen later, in the third decade of August — early September. The yield is from 1.7 to 2.2 kg/bush.

Conclusion

As a result of the expedition work, the current state of the coenopopulations of *Rosa acicularis* Lindl., *Rosa spinosissima* L., *Lonicera altaica* Pall., *Ribes nigrum* L., *Ribes petraeum* Wulfen, *Rosa acicularis* Lindl. was obtained. The studies allowed us to conclude that they are stable in existence due to their resistance to unfavorable factors of the winter period, natural regeneration, the presence of individuals of different ages in good condition of plants, and morphological diversity.

Acknowledgements

The article was prepared in accordance with program BR21882166 “Scientific and practical foundations for the reproduction, conservation, and use of fruit and berry plants of the natural flora of Western, Eastern, Central and Northern Kazakhstan to ensure food security” (2023–2025).

References

- 1 Коробкова Т.С. Оценка ресурсных видов ягодных растений среднетаежной подзоны Якутии / Т.С. Коробкова // Евразийский союз ученых. — 2017. — № 11–1 (44). — С. 22–25.
- 2 Шевелев С.Л. Основные пищевые и лекарственные растительные ресурсы лесов Средней Сибири / С.Л. Шевелев, В.Н. Невзоров. — Красноярск, 2017. — 174 с.
- 3 Голубев В.Н. Методические указания к популяционно-количественному и эколого-биологическому изучению редких, исчезающих и эндемичных растений Крыма / В.Н. Голубев, Е.Ф. Мочанов. — Ялта: ГНБС, 1978. — 42 с.
- 4 Работнов Т.А. Фитоценология / Т.А. Работнов. — М., 1992. — 353 с.
- 5 Серебряков И.Г. Экологическая морфология растений: жизненные формы покрытосеменных и хвойных / И.Г. Серебряков. — М.: Высш. шк., 1962. — 379 с.
- 6 Козяков С.Н. Методика определения проективного покрытия дикорастущих кустарников плодовых растений и их продуктивности / С.Н. Козяков, А.Ф. Черкасов // Методы изучения ресурсов дикорастущих полезных растений. — М., 1972. — Т. 1. — С. 53–63.

Т.А. Вдовина, О.А. Лагус, Е.А. Исакова, А.А. Винокуров

Қазақстандық Алтай аумағындағы жабайы жеміс өсімдіктерінің ценопопуляцияларының жай-күйі

Мақалада *Rosa acicularis* Lindl., *Rosa spinosissima* L., *Lonicera altaica* Pall., *Ribes nigrum* L., *Ribes petraeum* Wulfen ценопопуляция жағдайы туралы зерттеулер келтірілген, олар жоғары ресурстық көрсеткіштерге және айтарлықтай аудандарға ие. Зерттеулер Қазақстандық Алтай аумағының Оңтүстік-Батыс Алтай, Оңтүстік Алтай географиялық аймақтарында жүргізілді. Әрбір ценопопуляция үшін таралу үлгісі, алып жатқан аумағы, фитоценодикалық сипаттамалары, өсімдіктердің жалпы және жас жағдайы және олардың биоәртүрлілігі туралы мәліметтер алынды.

Кілт сөздер: ценопопуляция, фитоценоз, ауданы, өнімділігі, өзгергіштігі.

Т.А. Вдовина, О.А. Лагус, Е.А. Исакова, А.А. Винокуров

Состояние ценопопуляций диких плодовых растений на территории Казахстанского Алтая

В статье представлены исследования состояния ценопопуляций: *Rosa acicularis* Lindl., *Rosa spinosissima* L., *Lonicera altaica* Pall., *Ribes nigrum* L., *Ribes petraeum* Wulfen, которые имеют высокие ресурсные показатели и значительные площади. Исследования проводились на территории Казахстанского Алтая в географических зонах Юго-Западного Алтая, Южного Алтая. Для каждой ценопопуляции получены данные о характере распространения, занимаемой площади, фитоценологических характеристиках, общем и возрастном состоянии растений и их биоразнообразии.

Ключевые слова: ценопопуляция, фитоценоз, площадь, продуктивность, изменчивость.

References

- 1 Korobkova, T.S. (2017). Otsenka resursnykh vidov yagodnykh rastenii srednetaezhnoi podzony Yakutii [Assessment of resource species of berry plants of the middle taiga subzone of Yakutia]. *Evrasiiskii soiuz uchenykh — Eurasian Union of Scientists*, 11–1(44), 22–25 [in Russian].
- 2 Shevelev, S.L., & Nevzorov, V.N. (2017). *Osnovnye pishchevye i lekarstvennye rastitelnye resursy lesov Srednei Sibiri [The main food and medicinal plant resources of the forests of Central Siberia]*. Krasnoiar'sk [in Russian].
- 3 Golubev, V.N., & Molchanov, E.F. (1978). *Metodicheskie ukazaniia k populiatsionno-kolichestvennomu i ekologo-biologicheskomu izucheniiu redkikh, ischezaiushchikh i endemichnykh rastenii Kryma [Methodical instructions for the population-quantitative and ecological-biological study of rare, endangered and endemic plants of Crimea]*. Yalta [in Russian].
- 4 Rabortnov, T.A. (1992). *Fitotsenologiya [Phytocenology]*. Moscow [in Russian].
- 5 Serebryakov, I.G. (1962). *Ekologicheskaiia morfologiia rastenii: zhiznennye formy pokrytosemennykh i khvoinykh [Ecological morphology of plants: Life forms of angiosperms and conifers]*. Moscow: Vysshaiia shkola [in Russian].
- 6 Kozyakov, S. N. & Cherkasov, A. F. (1972). Metodika opredeleniia proektivnogo pokrytiia dikorastushchikh kustarnikov plodovykh rastenii i ikh produktivnosti [Methodology for determining the projective cover of wild shrub berry plants and their productivity]. *Metody izucheniia resursov dikorastushchikh poleznykh rastenii — Methods of studying resources of wild useful plants, 1*, 53–63. Moscow [in Russian].

Information about the authors

Vdovina Tatyana Afanasyevna — Candidate of biological science, Leading researcher, Altai Botanical Garden, Ridder, Kazakhstan; e-mail: tvdovina2017@mail.ru;

Lagus Olga Anatolyevna — Researcher, Altai Botanical Garden, Ridder, Kazakhstan; e-mail: lelik_ridder1994@mail.ru;

Isakova Elena Alekseyevna — Master, Senior researcher, Altai Botanical Garden, Ridder, Kazakhstan; e-mail: lana12378@bk.ru;

Vinokurov Andrey Andreevich — Senior researcher, Altai Botanical Garden, Ridder, Kazakhstan; e-mail: anvin64@mail.ru.