

DOI: 10.22363/2313-2310-2026-34-1-26-36

EDN: YXYIFE

UDC 581.95+581.5

Research article / Научная статья

## New Locations of a Rare Species *Ostrya Carpinifolia* Scop. in the Western Caucasus

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**Abstract.** The research presents the results of a range study of the rare hop hornbeam species *Ostrya carpinifolia* Scop. In addition to clarifying data on the species' growth in known habitats, two populations previously unreported were discovered on the Skalisty and Pastbishchny Ridges. One of these populations consists of isolated individuals on the rocky slopes of the Shakhan Ridge. The second population, the largest known in the Western Caucasus, was discovered on the Chernomorsky Ridge, at an altitude of over 800 m above sea level. A total of 107 specimen were recorded, with a trunk diameter of up to 46 cm at an altitude of 1.3 m. This area serves as a refugium for *O. carpinifolia* in the Western Caucasus. It is necessary to promptly introduce data on new locations of this rare species into scientific circulation to prepare the fourth edition of the Red Data Book of the Krasnodar region and to continue monitoring the populations to develop a conservation strategy for this rare species in the wild.

**Keywords:** flora, Red Data Book, rare plants, vascular plants, Skalisty Ridge, floristic finds, endemic species

**Acknowledgements and Funding.** The authors are grateful to V.V. Krylenko and M.V. Krylenko for their help in organizing and conducting the field research.

**Authors' contribution.** *I.V. Rudenko* — conceptualization, formal analysis, investigation, writing — original draft. *N.A. Pikalova* — methodology, investigation. *A.M. Aleynikova* — visualization. All authors have read and approved the final version of the manuscript.

**Article history:** received 19.09.2025; revised 14.10.2025; accepted 26.11.2025.

**Conflicts of interest.** The authors declare no conflicts of interest.

**For citation:** Rudenko IV, Pikalova NA, Aleynikova AM. New locations of a rare species *Ostrya carpinifolia* Scop. in the Western Caucasus. *RUDN Journal of Ecology and Life Safety*. 2026;34(1):26–36. <http://doi.org/10.22363/2313-2310-2026-34-1-26-36> EDN: YXYIFE

## Новые местонахождения редкого вида *Ostrya carpinifolia* Scop. на Западном Кавказе

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**Аннотация.** Приведены результаты исследования ареала редкого вида хмелеграба обыкновенного *Ostrya carpinifolia* Scop. Помимо уточнения данных о произрастании вида в известных местообитаниях на Скалистом и Пастбищном хребтах обнаружено две популяции, ранее не указанные в литературных источниках. Одна из них представлена единичными особями на каменистых склонах хр. Шахан. Вторая популяция, самая крупная из известных на Западном Кавказе, обнаружена на Черноморском хребте, на высоте более 800 м над ур. м. Зафиксировано 107 экз., диаметр ствола на высоте 1,3 м достигает 46 см. Данная территория выступает рефугиумом для *O. carpinifolia* на Западном Кавказе. Необходимо оперативное введение в научный оборот данных о новых местонахождениях редкого вида для подготовки четвертого издания Красной книги Краснодарского края и продолжение мониторинга популяций для выработки стратегии сохранения редкого вида в естественных условиях.

**Ключевые слова:** флора, Красная книга, редкие растения, сосудистые растения, Скалистый хребет, флористические находки, эндемы

**Вклад авторов.** Руденко И.В. — концептуализация, формальный анализ, проведение исследования, создание черновика рукописи. Пикалова Н.А. — методология, проведение исследования. Алейникова А.М. — визуализация. Все авторы ознакомлены с окончательной версией статьи и одобрили ее.

**Благодарности и финансирование.** Авторы выражают признательность В.В. Крыленко и М.В. Крыленко за помощь в организации и проведении экспедиционных исследований.

**История статьи:** поступила в редакцию 19.09.2025; доработана после рецензирования 14.10.2025; принята к публикации 26.11.2025.

**Заявление о конфликте интересов.** Авторы заявляют об отсутствии конфликта интересов.

**Для цитирования:** Руденко И.В., Пикалова Н.А., Алейникова А.М. Новые местонахождения редкого вида *Ostrya carpinifolia* Scop. на Западном Кавказе // Вестник Российского университета дружбы народов. Серия: Экология и безопасность жизнедеятельности. 2026. Т. 34. № 1. С. 26–36. <http://doi.org/10.22363/2313-2310-2026-34-1-26-36> EDN: YXYFFE

### Introduction

Within the northern macro-slope of the Greater Caucasus, the Skalisty Ridge extends subparallel to the Main Caucasian Ridge. The western part of it is divided into massive rivers, such as Belaya, Malaya and Bolshaya Lava, Urup, Bolshoy

Zelenchuk. Absolute heights on this site reach 1751 m (c. Bolshe, the basin r. Bolshoy Zelenchuk). The rocky ridge is dominated by thick layers of Jurassic and Cretaceous sediments: limestone, dolomite, ash, sandstone and shale (Figure 1). The ridge is characterized by karstic processes, widespread caves [1].



**Figure 1.** Skalisty Ridge, the Urup river basin, southern edge of the Bolshoy Shelokh range

Source: the photo was taken by I.V. Rudenko.

The relief of the Skalisty ridge is represented by the following features: the southern slope is very steep (up to 50–60° and more), steep, often forms rock walls hundreds of meters high; the northern slope is flat, long, steep, one-sided [2]. The rocky ridge plays an important role as a climatic barrier due to the sharp contrast of the slopes' wetness, it is of great importance as a watershed, fresh water source, area with high biological and landscape diversity, as well as recreational object.

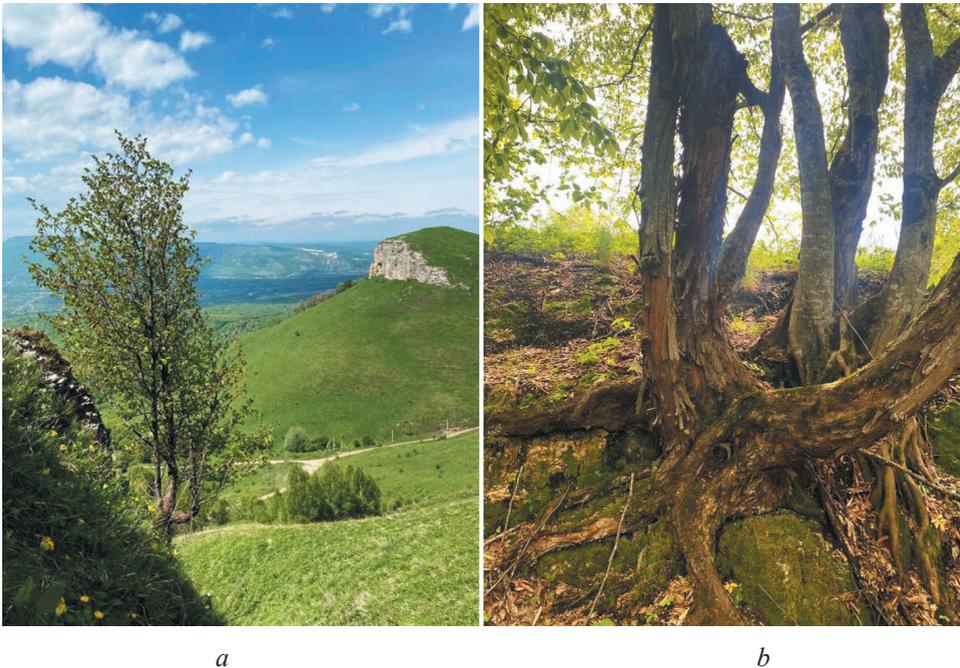
Southern slopes represented by rock exposures and debris with fragmented vegetation. On the northern and eastern slopes, as well as on levelled areas of zonal type of vegetation stand broad-leaved forests with predominance of oak, beech, burl, maple. Fairly large areas are occupied by medium and low mountain grasslands, mostly steeped with separate sections of mountain grasslands [3]. According to the botanical-geographical zoning of J.L. Menicky, the border of the Western Caucasus

runs along the western branches of the Greater Caucasus, the eastern — on the Kuban-Ter and Kuban-Kumski watersheds, the southern — on the watershed of the Main Caucasian Ridge, and the northern — on the foothills of the st. Varenkovskay to Kursavki [4].

The aim of this study is to supplement available information on the rare and protected *O. carpinifolia* habitat in the Western Caucasus for conservation of the species in natural conditions.

### Materials and methods

Material collected in 2023–2025. during explorations in the spring-summer period on the territory of the Krasnodar Territory, the Republic of Adygea and the Karachaevo-Cherkese Republic. The studies were conducted in the middle mountain belt of the Western Caucasus, mostly on the Scalisty ridge. Walking routes covered the entire western part of the investigated ridge from the basin r. Belaya to r. Bolshoy Zelenchuk. Also explored Pastbishchny Ridge (basins of the rivers Belaya, Bolshaya and Malaya Laba, Urup), Peredovoy Ridge (mountains Bolshoy and Maly Thach, West and East Aecekhbok, Malaya Bambaki, Kapustin Balk), Main Caucasus Ridge (mount. Fisht) (Figure 2).



**Figure 2.** *O. carpinifolia* habitats in the Western Caucasus:  
*a* — Skalisty Ridge, Shahan II, area under the rocky surface of the remnant;  
*b* — Pastbishchny Ridge, forest community dominated by *Fagus orientalis*

Source: the photo was taken by I.V. Rudenko.

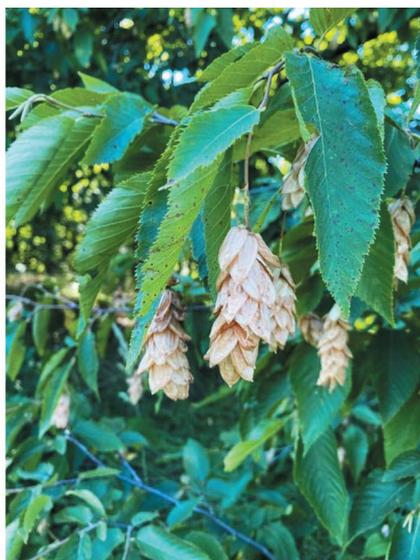
For individuals found, the diameter of the stem was measured at 1.3 m ( $d_{1,3}$ ) with accuracy to whole centimeters [5], and the number and characteristics of habitats were indicated. In preparation of the publication, materials from the digital herbarium of Moscow State University (MW), the herbarium of Kuban State University, online resources “Plantarium»<sup>1</sup> и iNaturalist<sup>2</sup>. Photographs of detected plants with precise coordinates and range of geo-reference accuracy are publicly available on the iNaturalist portal in observation format and exported to the GBIF global biodiversity information system [6].

## Results and discussion

*Ostrya carpinifolia* Scop. (1771) — Humerus common: shrub or deciduous woody plant with ovate-oblong leaves (Figure 3) reaching 25 m in height [7]. Prefers rocks, grows on limestone substrates, well tolerates dryness of the soil, occurs in forest enclosures and stony slopes.



*a*



*b*

**Figure 3.** Generative organs of *Ostrya carpinifolia*, Black Sea Range, near Akhmetovskaya st.:  
*a* — corymbose inflorescences; *b* — fruits

Source: the photo was taken by N.A. Pikalova.

Refers to ancient species, sporadically distributed, limited distribution due to stenosis and narrow ecological valence. Relatively large clusters form up to 300 m

<sup>1</sup> Plantarium. Plants and lichens of Russia and neighboring countries: an open online atlas and a plant identifier. Available from: [www.plantarium.ru](http://www.plantarium.ru) (accessed: 10.09.2025).

<sup>2</sup> iNaturalist. Available from: [https://www.inaturalist.org/observations?iconic\\_taxa=Plantae&nelat=44.34196546313074&nelng=41.519702433681914&subview=map&swlat=43.95174348348722&swlng=39.885486125088164&taxon\\_id=334194&verifiable=any](https://www.inaturalist.org/observations?iconic_taxa=Plantae&nelat=44.34196546313074&nelng=41.519702433681914&subview=map&swlat=43.95174348348722&swlng=39.885486125088164&taxon_id=334194&verifiable=any) (accessed: 31.08.2025).

above ur. m. , above is usually found as a unit, most often grown in the communities of oak, ash, burl and beech [8].

According to some data, a taxon is classified as a tertiary relationship [9; 10]. We also share the point of view of A.G. Yelenevsky, V.I. Radygina and A.S. Granova: relic species is a historical component of flora whose range is far removed from similar species and for which there is a discrepancy between modern conditions and its needs [11; 12]. On the one hand, other species preserved to date *Ostrya* are geographically remote from the Caucasus: *O. virginiana* (Mill.) K. Koch is common in America, *Ostrya trichocarpa* D. Fang & Y.S. Wang and *Ostrya rehderiana* Chun in China, *Ostrya japonica* Sarg. in Japan, China and Korea. But, on the other hand, to the genus *Ostrya* Scop. closely related to *Carpinus* L. and *Corylus* L., which are widely distributed in the Caucasus (with *Carpinus* and *Ostrya* differ only in plumage structure) [12]. Thus, the genus *Ostrya* is not a relic, but is characterized as an ancient species because it has Arcto-Tertiary origin.

Taxon described in Italy, is found in Asia Minor, the Eastern Mediterranean, in the Caucasus [9]. In the Russian Federation it is found on the North Caucasus and the Black Sea coast, from Tuapse to r. Psou [13]. In the Western Caucasus protected at regional and federal levels, included in the Red Book of the Russian Federation (2024) with environmental protection status 2 EN – Dwindling and/or disappearing species on the IUCN scale EN B2ab(iii,iv,v), on the IUCN Red List – LC и III environmental priority [7], Red Book of the Krasnodar Region (2017) with the status 2 EN “Endangered” [14], of the Republic of Adygea (2023) 1 B, endangered [15], Karachay-Cherkessia (2024) 2 a, dwindling species with local distribution in the region [16].

Several sources indicate the occurrence of *O. carpinifolia* in the western Caucasus. In the Outline of Flora of the Caucasus is marked for the Belo-Labin and Urup-Teberdin regions of the Western Caucasus [4]. A.S. Zernov indicates in the boundaries of the Abinskiy and Mykopsky Floristic regions of the North-West Caucasus [8], as well as in the Dzheguta and Uchkulan (without confirmation) regions of the Karachay-Cherkessia Republic [17]. Taxon cultivation in the Belo-Labin region of the Western Caucasus and the Mycoptic region of the North-Western Caucasus is confirmed by herbal collections in the Republic of Adygea — reg. v. Hamishki (MW0659981) и ridge Pshekish (MW0659982). Location in the Urup-Teberdi region of the Western Caucasus and the Dzheguta region of the Karachaevo-Cherkessia Republic is confirmed by herbarium collections of A.S. Zernov, southern slope of the Pastbishchensy Ridge, between. Ust-Dzheguta and v. Nova Dzheguta (MW0659988), as well as in the Krasnodar region, r. Urup, reg. v. Ilych (MW1006250). In the Red Book of the Krasnodar region in the Western Caucasus, the taxon is marked for Dzhuga, Fisht, Crystal, str. Vodopadny, Kapustin Balk and ridge Gerpegem (Skalisty Ridge) [14]. In the Red Book of the Republic of Adygea

in the Western Caucasus *O. carpinifolia* is reported for the city Bolshoy Thach; mount. Fisht; ridge Azish-Tau, Lago Naki plateau; valleys of the rivers Dah and Tsitsa; Skalisty ridge, ridge Una-Koz, reg. v. Kamenomostsky, st. Dakhovskaya, v. Pobeda [15].

Based on typical places of growth, the routes were planned along the Skallistos ridge from v. Kamenomostsky to r. Bolshoy Zelenchuk. In addition, known and potentially possible places of taxon production were investigated in adjacent territories: in the Pastbishchny, Peredovoy and Main Caucasus Ridges. The total length of walking routes exceeded 500 km. The locations indicated are shown from west to east, the number of the observation point on the map corresponds to the number of the habitat indicated in the text.

According to the studies carried out, *O. carpinifolia* could not be found in mount. Fisht, city Bolshoy Thach and Kapustin beam. Despite being a woody plant, it usually grows in hard-to-reach places, most often on rocks, remains and cracks.

### Populations of *O. carpinifolia* in known growing areas

1) R. Adygea, ridge Asish-Tau, south-eastern slope, 44°7'11.028"N 40°1'59.484"E, the forest boundary *Abies nordmanniana* (Steven) Spach and *Fagus orientalis* Lipsky, over a rocky slope, 1532 m above sea level, 23.V 2025, 9 specimen with a barrel diameter of 9 to 24 cm (Figure 4).

2) R. Adygea, ridge Asish-Tau, Ved'min hill, above the Nezhnaya cave, 44°9'25.920"N 40°4'25.752"E, rocky slope, 1351 m above sea level, 4.VII 2024, 12 specimen with trunk diameter of 8 to 16 cm.

3) R. Adygea, ridge Skalisty, ridge Una-Koz, southern slope, 44°14'21.480"N 40°14'14.820"E, on the rocks and remains, 993 m above sea level, 5.VII 2024, 24.V 2025. The site of ridge Una-Koz from v. Kamenomostsky to v. Pobeda was investigated, a total of 23 specimen. Of them 6 single individuals between p. Kamenomostsky and rural locality Dakhovskaya, on the rocks above the slope, stem diameter up to 14 cm. Also noted is the population of 17 specimen near the rock Chertov palets with d1.3 from 9 to 18 cm. In recent years, the rock has gained popularity among tourists, especially after the opening of the cable car to the ridge Una-Koz in 2014. Because the path is narrow and behind the trees are convenient to get to the viewing area, growing near the trail on the remains of the trees are depressed. There are also 4 adult dead *O. carpinifolia* with a trunk diameter of 14 to 19 cm.

4) The Krasnodar region, ridge Skalisty, ridge Gerpegem, southwest slope, 44°8'14.748"N 40°44'49.848"E, in crevices between rocks and on rocks, 1165 m above sea level, 4.VII 2024, 3 specimen with a trunk diameter of 6–15 cm.

5) The Krasnodar region, Otradnevsky District, North macroslope of the ridge Skalisty, Utug rock, southwest slope exposure,  $44^{\circ}3'45.144''\text{N}$   $41^{\circ}20'32.136''\text{E}$ , on the rock, 772 m above sea level, 23.VI 2024, was found by V.V. Krylenko in a joint expedition with the authors<sup>3</sup>, 1 specimen with a trunk diameter of 11 cm [18].

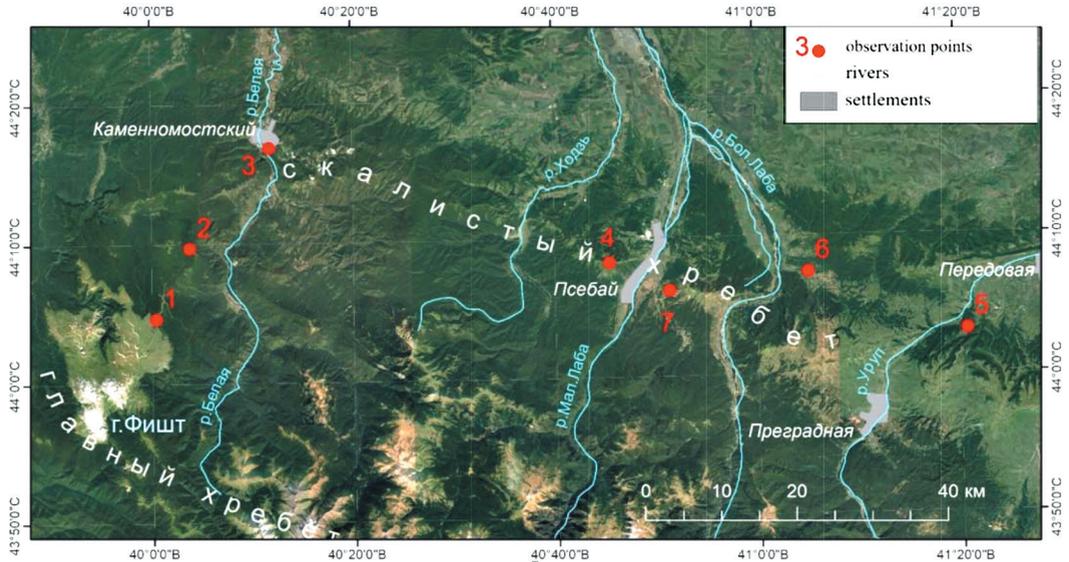


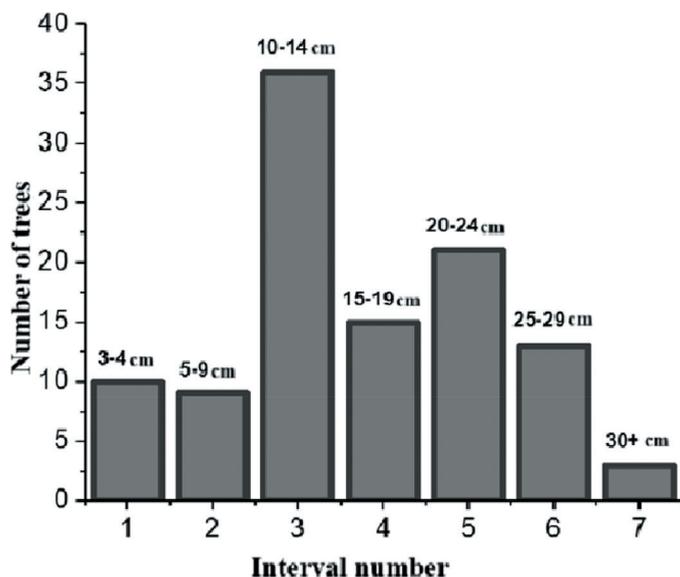
Figure 4. Habitat map of *O. carpinifolia* in the study area

Source: compiled by A.M. Aleynikova using Landsat satellite imagery.

### New locations of *O. carpinifolia* in the Western Caucasus

6) The Krasnodar region, Labin district, ridge Pastbishchny, ridge Chernomorsky,  $44^{\circ}7'11.712''\text{N}$   $41^{\circ}6'3.672''\text{E}$ , in the forest *Fagus orientalis* and at the base, south, southeast and east exposure of the slope, above lake Krugloe, 833 m above sea level, 14.VII 2024, 107 specimen. According to the analyzed data, it is the largest population of known in the Western Caucasus. In this biotope, *O. carpinifolia* acts as an edificator together with *Fagus orientalis*, grows on the limestone slope and in the ravines above the lake, the largest trees are marked in the forest, stem diameter reaches 46 cm (the largest exes.  $d_{1.3} = 46$  cm, 35 cm and 31 cm). There are 38 trees on the edge of the forest, the remaining 69 grow in the forest on the slope above the lake. Found individuals by stem diameter divided into 7 intervals (Figure 5): 1 interval — 3–4 cm (10 sp.), 2 interval — 5–9 cm (9 sp.), 3 interval — 10–14 cm (36 sp.), 4 interval — 15–19 cm (15 sp.), 5 interval — 20–24 cm (21 sp.), 6 interval — 25–29 cm (13 sp.), 7 interval — over 30 cm (3 sp.).

<sup>3</sup> iNaturalist. Available from: <https://www.inaturalist.org/observations/226444701> (accessed: 10.09.2025).



**Figure 5.** Distribution of the number of *O. carpinifolia* individuals on the Chernomorsky Range, depending on the trunk diameter at a height of 1.3 m

Source: compiled by I.V. Rudenko, N.A. Pikalova, A.M. Aleynikova.

The diagram (Figure 5) shows that the largest number of individuals has a stem diameter of 10–14 cm and 20–24 cm. And, according to our data, large trees (20+ cm) are widespread in the forest on the slope, and smaller specimens (up to 20 cm) mainly grow in the gorges and at the ravine, where competition is lower. It should be noted that the population is recorded on a limestone slope at an altitude of more than 800 m above sea level, although usually large clusters of *O. carpinifolia* are fixed up to 300 m [8]. The discovered population is within the boundaries of a nature monument of regional importance “Lake Krugloe”, but the species was not included in the material of the comprehensive ecological survey of the territory at the establishment of OFIT [19].

7) The Krasnodar region, Mostovskaya district, ridge Skalisty, ridge Shakhan: 44°6'29.124"N 40°53'4.164"E, Shakhan 2nd, western exposure of the slope, in cracks on the stony slope, 1149 m above sea level, 10.V 2025, 6 sp. with trunk diameter from 6 to 13 cm; Shakhan 3rd, southwest slope exposure, 44°6'13.428"N 40°53'24.936"E, under the rock surface of the remains, on the rocks, 1097 m above sea level, 17.VII 2025, 3 sp. with trunk diameter 7 cm, 7 cm and 18 cm. In this biotope, *O. carpinifolia* liked remains, cracks and steep rocky slopes, represented by short single trees. Other tree taxa are found only in the lowlands under the rocks. In the rock exposures and in the cracks of 2nd and 3rd Shahans prevail *Rhamnus erythroxylodes* Hoffmanns., *Astragalus somcheticus* K.Koch, *Seseli petraeum* M.Bieb., *Echinops sphaerocephalus* L., *Campanula pendula* M.Bieb., *Scrophularia rupestris* M.Bieb. ex Willd., *Juniperus communis* L. et al.

## Conclusion

The conducted studies allow to summarize and complement the range of *O. carpinifolia* in the Western Caucasus. In addition to the clarification of data on the occurrence of the species in known habitats, two populations previously not mentioned in literature have been found on the Scalisty ridge. One of them has been presented by 9 sp. on the stony slopes of the ridge Shakhan. As in all previously known places of growth, here *O. carpinifolia* is associated with limestone slopes, it occurs unitarily on rocks and in crevices. The second population was found on the Chernomorsky ridge, within the boundaries of the regional nature monument “Lake Krugloe”. It is the largest population of known in the Western Caucasus, in which there are 107 sp. at altitude more 800 m above sea level. This area is a refugium for *O. carpinifolia* in the western Caucasus. There is a need for the rapid introduction of new rare species sites into scientific circulation to prepare the fourth edition of the Red Book of the Krasnodar region and continue population monitoring for conservation of the rare species in natural conditions.

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