

NEW AND RARE LICHENS FOR RUSSIA AND THE CAUCASUS FROM HIGH MOUNTAINOUS DAGESTAN (EAST CAUCASUS)

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Five species of lichenized ascomycetes are reported from high mountainous Dagestan. *Acarospora laqueata*, *Lecania ochronigra* and *Protoparmelia placentifformis* are new to Russia and the Caucasus (the last two). *Anamylopsora pulcherrima* is the first record of the genus and species for the North Caucasus. *Buellia centralis* is the first record for the Caucasus and second for Russia. Our records considerably extended information about geography and ecology of presented species especially the very rare species *Buellia centralis*, *Lecania ochronigra* and *Protoparmelia placentifformis*. The characteristic features of specimens with information of their morphology, anatomy, ecology and world distribution are given.

Key words: Caucasus, floristical studies, lichens, new records, rare species, Russia

INTRODUCTION

Exploration of biodiversity in mountainous ecosystems is an important fundamental direction. Dagestan is located in the Caucasus biodiversity hot-spot. It is the southernmost part of Russia, situated along the western shore of the Caspian Sea (Fig. 1A). Most of the republic is mountainous, with the Caucasus Mountains on the south. The highest point is the Bazardyuzy Mountain (4466 m). The climate is hot and dry in summer but the winters are hard in the mountain areas. Large areas of the mountains on the South are devoid of vegetation, but through the gorges of the rivers birch and pine forests grow. In semi-arid conditions in the northern part of the republic is dominated by *Artemisia* sp. Foothills are covered by communities of *Quercus petraea*, *Q. pubescens* and by steppe vegetation in the lower parts (Akayev *et al.* 1996).

The Republic of Dagestan is intensively studied in terms of lichenofloristical surveys. Due to its diverse geomorphology and altitudinal range (from –26 to 4466 m a.s.l.), it harbours a species-rich mosaic of vegetation ranging from xerophilous to alpine (e.g. mountainous dry pine forests, mesophytic deciduous forests, steppes, and semi-deserts) above which is subnival and nival zone with glaciers and snowfields. This is reflected on the lichen diversity.

The lichens of the subnival and nival zones are absolutely not studied here. This is a gap in knowledge that needs to be filled. The present paper adds further information to our knowledge on lichens of high mountainous Dagestan and the entire Caucasus.

MATERIAL AND METHODS

Study area

The study areas are situated in high mountainous part of Dagestan (Fig. 1B). The first site studied, i.e. the northwestern part of the Samurskiy ridge (the summits are the Kuru-dag (3831 m) and the Kurapdag (3770 m) mountains), is located in sand-slate highlands (Fig. 1C). The climate is temperate continental; the average annual air humidity is 66%; the average annual rainfall is 600

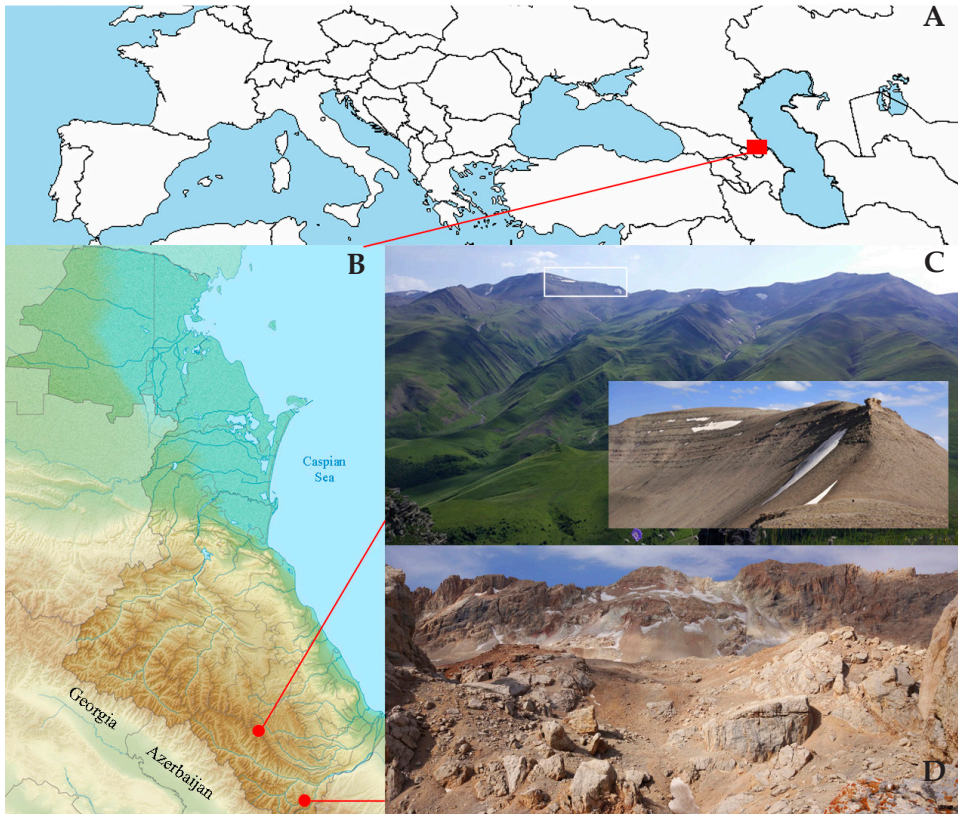


Fig. 1. The study area. A = location of Dagestan; B = investigated sites; C = west part of the Samurskiy ridge with the Kurapdag peak; D = east slope of the Shalbuздag Mountain

mm; the average annual temperature is 6.5 °C with absolute minimum of –26 °C in January (average is –4 °C), and absolute maximum of 38 °C in August (average is 12.5 °C). Most of the territory are covered by alpine and subalpine meadows, but above 3000 m the meadows are changed by rocky wasteland. The second site studied is the Shalbudzag Mountain. It is a limestone rocky mountain with the highest point of 4142 m (Fig. 1D). The mountain slopes are covered by subalpine and alpine vegetation. Above 3000 m the continuous herbal and soil cover is absent. Higher than 3600 m mainly on northern slopes the snowfields and small glaciers are preserved. The temperature and humidity indicators are similar to the first site (Akayev *et al.* 1996).

Methods

Specimens were collected during a short field work on spurs of the Samurskiy ridge and the Shalbudzag Mountain in July 2017. Morphological and microscopical investigations were done by light microscopy and with the use of routine spot tests (KOH, IKI, $C_6H_4(NH_2)_2$, $Ca(ClO)_2$, HNO_3 and UV light) in Komarov Botanical Institute RAS. The geographical coordinates (WGS-84) and altitudes of each locality were measured by hand-held GPS navigator. The examined materials are deposited in the herbarium of Mountain Botanical Garden of DSC RAS (DAG).

RESULTS

Acarospora laqueata Stizenb., in Flagey, Revue Mycol. 14: 73 (1892)
(Fig. 2)

The specimen forming a rosette thallus up to 6 cm diam., areolate, with distinct brown marginal lobes. Upper surface with strong white or grey-white pruina. Lobes up to 2.3 mm long and 1.2 mm wide, adpressed, expanded on the ends and incised, often wrinkled and without pruina. Areoles angular, up to 1 mm wide, with white pruina mainly on margins of areoles. Apothecia immersed 1–2 per areole, without thalline margin. Disc up to 0.5 mm diam., concave, rounded or angular, reddish brown. Epithymenium light brown; hymenium hyaline 120 µm; hypothecium colourless or greyish 100 µm, granular; exciple inconspicuous. Asci 72–85 × 15–17 µm, 100-spored. Ascospores 4–5.5 × 2–3 µm, ellipsoid. All spot tests are negative. Hymenium I+ blue.

Differs from *A. cervina* by the distinctly lobed thallus and a protruding rim along the lobes and areoles formed by the densely white pruina.

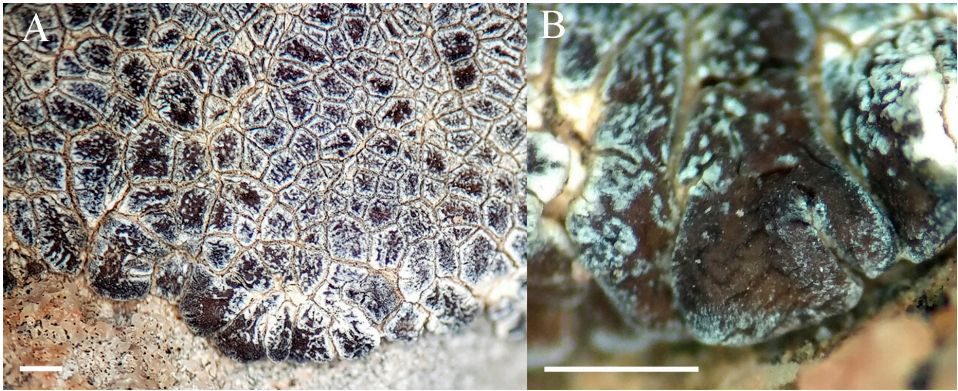


Fig. 2. *Acarospora laqueata*. A = thallus; B = marginal lobe. Scale bars: 1 mm

Specimen examined: Russia, Dagestan, Dokuzparinkiy district, Shalbuzdag Mountain, on calcareous rocks in subnival zone, N 41° 48' 18.5", E 47° 22' 48.6", alt. 3600 m, coll.: A. B. Ismailov, 24.07.2017 (DAG 0962).

The species was described from Algeria and widespread in dry continental areas from the Iberian Peninsula to the Tian Shan. It is the first record for Russia and the North Caucasus. Nearest location known from Armenia (Harutyunyan and Mayrhofer 2009).

World distribution: Europe (France, Italy, Spain, Switzerland), Asia (Armenia, Syria, Iraq, Israel, Jordan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan), North Africa (Algeria, Morocco, Tunisia) (Harutyunyan and Mayrhofer 2009, John *et al.* 2004, Temina *et al.* 2005).

Anamylopsora pulcherrima (Vain.) Timdal, Mycotaxon 42: 250 (1991). – *Lecidea pulcherrima* Vain., Acta Horti Petropolitani 10 (2): 561 (1888) (Fig. 3)

Detailed description is given by Timdal (1991). Our specimen has a typical characteristic thallus: upper surface cream-coloured, shiny, epruinose; central squamules up to 2 mm diam., marginal lobes crenulate, up to 3 mm width, more or less white pruinose mainly on tips of lobes. Single apothecia up to 1.2 mm diam., sometimes forming conglomerates up to 6 mm diam. Epithymenium brownish; hymenium colourless, 75 µm; hypothecium pale brown with crystals. Ascospores 8–11 × 6.5–7.5 µm. Cortex K+ orange, C–, Pd–. Medulla K–, C–, Pd+ yellow.

Positive medulla reaction with Pd, negative cortex reaction with Pd and cream-coloured thallus differ the Dagestan specimen from the Siberian one. Our specimen is similar to the one described from Turkmenistan.

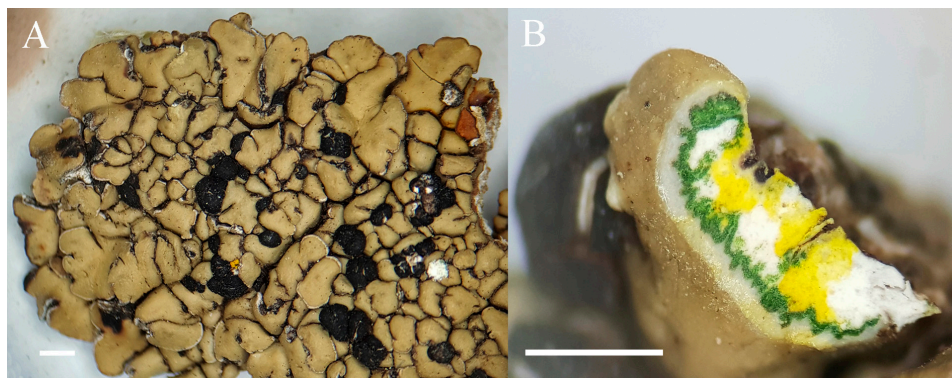


Fig. 3. *Anamylopsora pulcherrima*. A = thallus; B = reaction of medulla with Pd. Scale bars: 1 mm

Specimen examined: Russia, Dagestan, Agulskiy district, neighbourhood of Chirag village, on carbonised sandstone rocks among alpine vegetation, N 41° 48' 41.6", E 47° 25' 17.9", alt. 2400 m, coll.: A. B. Ismailov, 20.07.2017 (DAG 0961).

The species was described from Turkmenistan. It is the first record of the genus and species for the North Caucasus. Nearest location known from South Azerbaijan (Barkhalov 1964). In Russia this species is known from Siberia and from the Far East (Urbanavichus 2010). It has wide distribution in continental areas of the Northern Hemisphere.

World distribution – North America (Alaska); Asia: Armenia, Azerbaijan (as *Psora pulcherrima*), Russia, Tajikistan (as *Psora pulcherrima*), Mongolia, China, Nepal (Barkhalov 1964, Harutyunyan and Mayrhofer 2009, Kudratov and Mayrhofer 2002, Timdal 1991).

Buellia centralis H. Magn., Lichens from Central Asia 1: 147 (1940)
(Fig. 4)

Thallus crustose, areolate, deeply cracked, with marginal lobes. Cortex yellowish green, scabrous, slightly pruinose. Areoles 0.4–0.7 mm wide, convex, some cracked. Apothecia 0.3–1 mm in diam., mainly on margins of areoles in the cracks, young ones angular, mature ones roundish, often with slightly whitish pruinose disc. Epithemium brownish with yellow crystals; hymenium colourless or light brown, 80 µm high; hypothecium dark brown. Asci 43 µm. Ascospores *Buellia*-type, 13–15(17.5) × 6.2–7.5 µm. All spot tests negative.

Specimens examined: a) Russia, Dagestan, Agulskiy district, neighbourhood of Chirag village, on carbonised sandstone rocks among alpine vegetation, N 41° 49' 29.2", E 47°

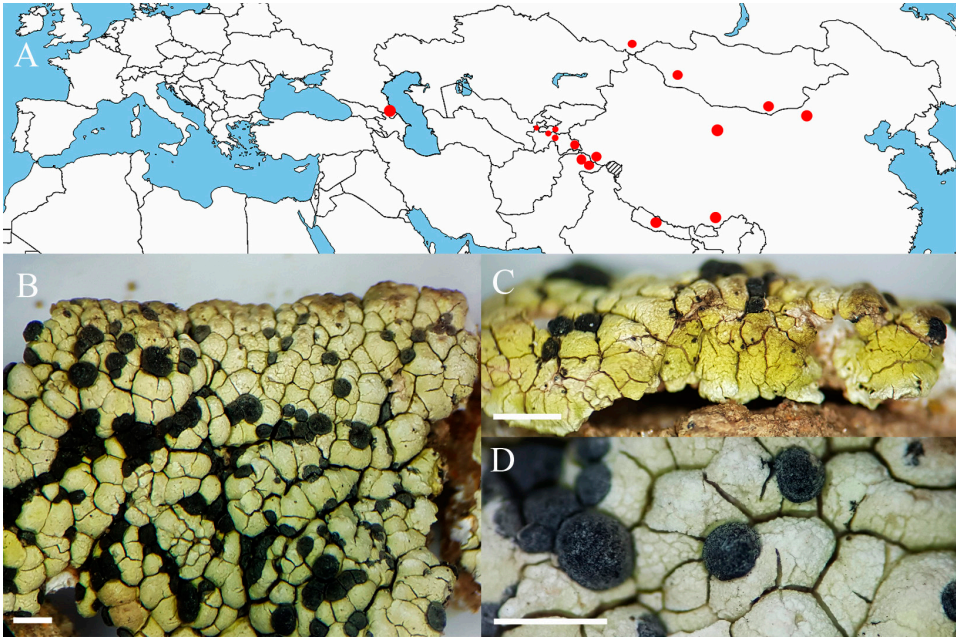


Fig. 4. *Buellia centralis*. A = world distribution; B = habitus; C = marginal lobes; D = part of thallus with apothecia. Scale bars: 1 mm

25' 53.6", alt. 2650 m, coll.: A. B. Ismailov, 20.07.2017 (DAG 0963); b) Ibid., on carbonised sandstone rocks among alpine vegetation, N 41° 48' 41.6", E 47° 25' 17.9", alt. 2400 m, coll.: A. B. Ismailov, 20.07.2017 (DAG 0968).

A rare species described from China. It is the first record for the Caucasus and the second for Russia. The location in Dagestan is the westernmost in its world distribution. Nearest locality known from Tajikistan (Obermayer *et al.* 2004).

World distribution – Asia: Russia (Altai: Sedelnikova 2013), Tajikistan, Mongolia, Pakistan, China, Nepal (Obermayer *et al.* 2004).

Lecania ochronigra J. Steiner, Ann. Mycol. 8: 236 (1910)
(Fig. 5)

Thallus small, up to 1 cm diam., cracked-areolate, thin, cream coloured to ochraceous. Apothecia 0.3–0.7 mm diam. immersed in areoles, with distinct thallus margin. Disc black with slightly white pruina. Epihymenium 20–25 µm, dark brown, K+ violet, HNO₃+ red; hymenium not inspersed, 47–52 µm, colourless; hypothecium 28–33 µm colourless. Asci 5–8 spored. Ascospores 1-septate, 10–13 × 5–6 µm. All spot tests on cortex are negative.

Specimen examined: Russia, Dagestan, Agulskiy district, neighbourhood of Chirag village, on sandstone rocks among alpine vegetation, N 41° 49' 02.5", E 47° 25' 46.3", alt. 2550 m, coll.: A. B. Ismailov, 20.07.2017 (DAG 0964).

Very rare Asian species described from Iran and known only from some localities. It is the first record for Russia and for the Caucasus. There is the northernmost location of the species in its world distribution. Nearest location known from Iran (Steiner 1910).

World distribution – Asia: Iran (Steiner 1910), Tajikistan (Kudratov and Mayrhofer 2002), Afghanistan (Poelt and Wirth 1968).

Protoparmelia placentiformis (J. Steiner) Poelt, in Poelt and Leuckert, Nova Hedwigia 52 (1–2): 59 (1991). – *Lecanora placentiformis* J. Steiner, Ann. Mycol. 8: 233 (1910)

(Fig. 6)

Thallus areolate (like squamulose), more or less placoid, 2–3 cm diam., light brown. Central areoles 0.5–1.2 mm diam., lateral elongated up to 1.8

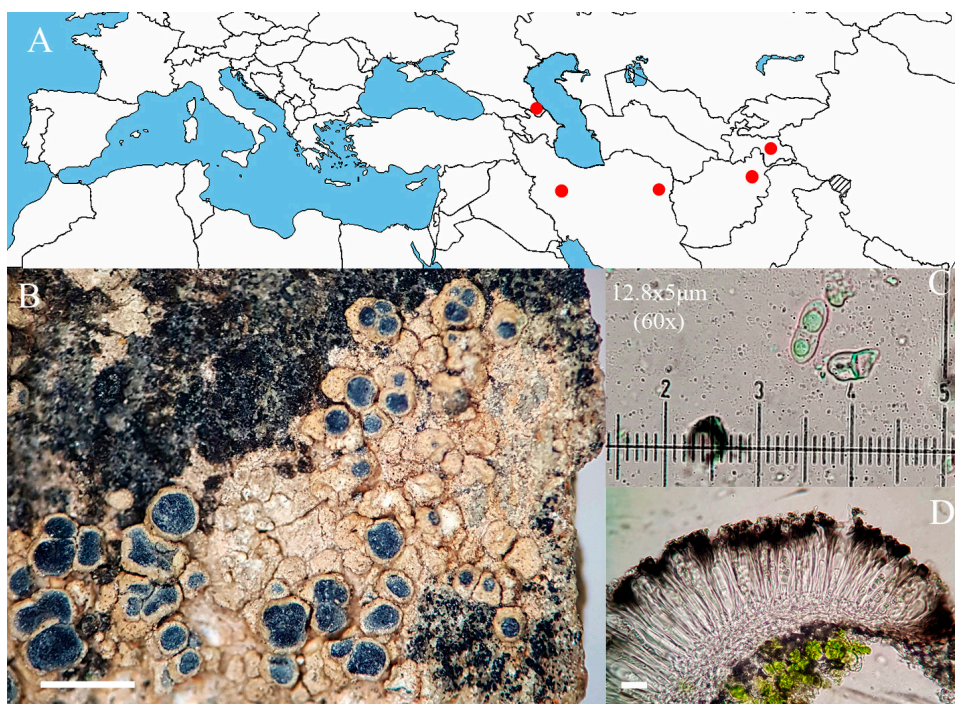


Fig. 5. *Lecania ochronigra*. A = world distribution; B = habitus (scale bar 1 mm); C = ascospore; D = section of apothecia (scale bar 15 μ m)

mm long. Apothecia lecanorine up to 1.5 mm diam. Epihymenium brownish; hymenium $42\ \mu\text{m}$, colourless; hypothecium colourless. Asci $30\ \mu\text{m}$, 8-spored. Ascospores simple, $8\text{--}10 \times 5\text{--}6\ \mu\text{m}$. Cortex K+ yellow turning to red, C-, Pd-. Medulla Pd+ yellow to light orange, C-, K-.

Specimens examined: a) Russia, Dagestan, Agulskiy district, neighbourhood of Chirag village, on carbonised sandstone rocks with *Dimelaena oreina* and *Aspicilia* sp., among alpine vegetation, N $41^\circ 48' 41.6''$, E $47^\circ 25' 17.9''$, alt. 2400 m, coll.: A. B. Ismailov, 20.07.2017 (DAG 0965); b) Ibid., on sandstone rocks with *Aspicilia* sp., among alpine vegetation, N $41^\circ 49' 02.5''$, E $47^\circ 25' 46.3''$, alt. 2550 m, coll.: A. B. Ismailov, 20.07.2017 (DAG 0967).

Very rare species described from Iran and occurs in arid mountainous parts of South Europe and Asia where known only from some localities. It is the first record for Russia and the Caucasus. Nearest location known from Iran (Szatala 1940).

World distribution – Europe: Italy (Nimis 2016), Macedonia (Poelt and Leuckert 1991); Asia: Iran (Szatala 1940), Afghanistan (Poelt and Wirth 1968), Pakistan (Poelt 1961).

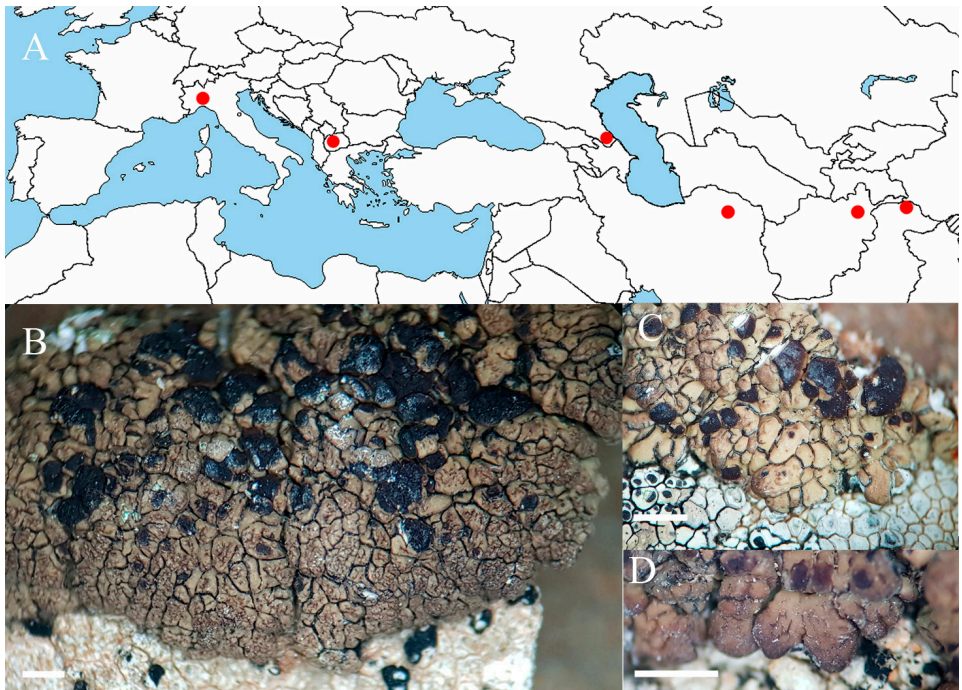


Fig. 6. *Protoparmelia placentiformis*. A = world distribution; B = habitus; C = part of thallus; D = lateral lobes. Scale bars: 1 mm

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