

ORTHOTRICHUM DAGESTANICUM SP. NOV. (ORTHOTRICHACEAE, MUSCI) –  
A NEW SPECIES FROM DAGESTAN (EASTERN CAUCASUS)

ORTHOTRICHUM DAGESTANICUM SP. NOV. (ORTHOTRICHACEAE, MUSCI) –  
НОВЫЙ ВИД ИЗ ДАГЕСТАНА (ВОСТОЧНЫЙ КАВКАЗ)

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Abstract

A new saxicolous *Orthotrichum* species, *O. dagestanicum* sp. nov. is described from the southern part of Dagestan Republic (Eastern Caucasus). The combination of hyaline and serrulate leaf apices composed of elongate thick-walled cells, strongly 8-ribbed capsules, immersed stomata that are not strongly covered by subsidiary cells, and paired exostome teeth indicate its affinity to *O. vittii* F.Lara et al., endemic of Iberian Peninsula, and *O. garrettii* Grout & Flowers from U.S.A., Utah. However, 8 non-appendiculate endostome segments differ it from both species.

Резюме

Представлен новый скальный вид *Orthotrichum*, *O. dagestanicum* sp. nov. из южной части Дагестана (Восточный Кавказ). Наличие гиалинового волоска и мелкозубчатой верхушки листа, образованной удлинёнными толстостенными клетками, сильно ребристые коробочки, погруженные устьица, слабо прикрытые побочными клетками и парные зубцы экзостомы указывают на его сходство с *O. vittii* F.Lara et al., эндемиком Пиренейского полуострова, и *O. garrettii* Grout & Flowers из штата Юта в США. При этом 8 сегментов эндостомы без придатков отличают его от обоих видов.

KEYWORDS: Bryophyta, Dagestan, new species, *Orthotrichum*, taxonomy

In the course of exploration Dagestan moss flora the first author visited its southern part in May 2010. An unusual saxicolous *Orthotrichum* with hyaline leaf apices and strongly 8-ribbed urns was collected in the Samur River valley near Akhty settlement. Until now only one species of the genus with hyaline hair-point, *O. diaphanum*, has been known in Russia, but it readily differs from these Dagestani plants. Several species of *Orthotrichum* with hyaline leaf apices have recently been described from the Mediterranean area and Central Europe: *O. leblebicii* Erdag, Kürschner & Parolly and *O. vittii* F. Lara, Garileti & Mazimpaka (Lara et al., 1999; Erdag et al., 2004), but they also do not fit the Dagestani plants in all the morphological characters.

*Orthotrichum dagestanicum* Fedosov & Ignatova sp. nov. Figs. 1, 2a-c, 3

A pluribus speciebus generis *Orthotrichum* apice hyaline, capsula valde costato et endostomo dentibus bini concrescentibus, a *O. vittii* cellulis laevis vel sublaevis habitu saxoso, a *O. garrettii* cellulis exothecio angustioribus, ab ambis speciebus endostomo segmentis 8 sine appendiculis differt.

Type: RUSSIA, Dagestan Republic, Akhty Distr., Samur River Valley 3 km east of Akhty Settlement (41°45'00"N – 47°46'90"E), 1000 m alt., on limestone boulder, 21.V.2010, Fedosov #10-2-146 (holotype MW; isotypes MHA, LE, H).

Plants small, green to dark green or brownish, in compact tufts. Stems 0.6-0.8 cm, poorly branched, slightly tomentose in lower part.

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Leaves loosely appressed or erecto-patent when dry, widely spreading when moist, (2.0-)2.5-3.2 (-3.5)×(0.45-)0.6-0.8(-1.0) mm, ovate-lanceolate, acuminate, rarely acute, with more or less differentiated yellowish to hyaline apices 0.15-0.3 mm long, often recurved when dry; costa green, strong in proximal part of leaf, occupying 1/5–1/3 of leaf base, 95-120 µm wide at base, moderately tapering to about 60 µm in median part and getting inconspicuous in distal 1/4 of leaf (especially in upper leaves), ending just below leaf apex, smooth on both sides; lamina unistratose, margins entire to papillose-crenulate distally, strongly serrate at apex, broadly revolute in middle part of leaf, strongly recurved almost to the apex on both sides; upper laminal cells (13-)15-20(-25)×15-20 µm, quadrate to short rectangular, occasionally with admixture of transversely rectangular cells, moderately thick-walled, smooth or with scattered tiny simple papillae, cells of the apical part of leaf 24-40×6-10 µm, elongate, yellowish, gradually becoming hyaline to the apex, strongly thick-walled, forming yellowish to hyaline leaf tips; median laminal cells 17-25×17-25 µm, isodiametric, subquadrate, rounded-hexagonal to almost hexagonal, thin-walled, smooth or with simple papillae; basal laminal cells (28-)35-52 (-60)×12-16 µm, rectangular, with moderately thickened walls, smooth, basal marginal cells quadrate, 11-15×13-15 µm, thin-walled or with slightly incrassate transverse walls. Cladoautoicous. Perichaetial leaves similar to stem leaves. Setae 0.8-1 mm long, spirally twisted when dry. Capsules emergent, oblong to oblong-cylindric, 1.8-2.0 mm long, pale brown, with 8 deep furrows and more intensively colored red-brown ribs, urns more or less gradually tapering to the seta, slightly constricted below mouth; exothecial cells in upper part of capsule rectangular, in furrows thin-walled, in ribs broader, with thicker walls. Stomata in central and lower part of urn, immersed, half covered by subsidiary cells. Peristome double, prostome not observed. Exostome teeth orange to brownish, in 8 pairs, rarely partly splitted when mature, ca. 220 µm long, in-

curved when wet, reflexed and appressed to urn wall when dry, outer surface reticulate and papillose, inner surface indistinctly rugose; endostome of 8 strong filiform incurved segments ca. 170 µm long, uniseriate distally, mostly biseriate proximally, widened at base, orange to brownish, outer surface smooth, inner surface smooth to rugose. Operculum slightly convex, with short beak, with purple rim below. Calyptra campanulate, opaque, pale-yellowish, with dark-brown apices and 8 sharp plicae, naked, smooth, somewhat lacinate at base. Spores papillose, 12-20 µm. Cylindrical propagulae frequent, composed of 4-9 transverse rectangular cells with moderately thickened brownish walls.

**Ecology.** *Orthotrichum dagestanicum* is known from a single locality, on xeric slope with steppe vegetation with scattered shrubs on the terrace of the Samur River valley. Plants were abundant on limestone boulders, at 0.3-0.6 m above ground, on fine soil in fissures, usually under shrub canopy, associated with *O. anomalum* and *O. diaphanum*.

*Specimens examined.* RUSSIA, Dagestan Republic, Akhtynsky Distr., Samur River Valley 3 km east of Akhty settlement (41°45'00"N – 47°46'90"E), 1000 m alt., on limestone boulder cracks, 21.V.2010, *Fedosov* ##10-2-147, 10-2-148 (MW).

#### DISCUSSION

The diagnostic characters of new species include rare gametophytic characters, the hyaline leaf apex and almost smooth laminal cells (papillae not on each cell), and also a complex of sporophytic characters, including strongly ribbed capsule, with ribs colored much darker comparatively with the rest of the urn, moderately covered immersed stomata, paired exostome teeth reflexed after spore release when dry and tightly appressed to urn, and 8 endostome segments.

The hyaline leaf apices are the main differential character of *Orthotrichum diaphanum*, *O. vittii*, *O. garretii*, *O. leblebicii*.

*Orthotrichum diaphanum* Brid., the most widespread and subcosmopolite species, well known for having a hyaline hair-point; is similar

Fig. 1. *Orthotrichum dagestanicum* sp. nov. (from holotype: Dagestan, *Fedosov* #10-2-146, MW) 1-2 – habit, dry; 3 – calyptra; 4 – gemmae; 5 – part of peristome; 6 – segment of endostome; 7 – stoma, 8 – exothecial cells; 9-10 – leaf transverse sections; 11-13 – leaves; 14 – median laminal cells; 15-16 – upper leaf cells; 17 – basal laminal cells. Scale bars: Scale bars: 2 mm for 1-3; 1 mm for 11-13; 100 µm for 4-10, 14-17.

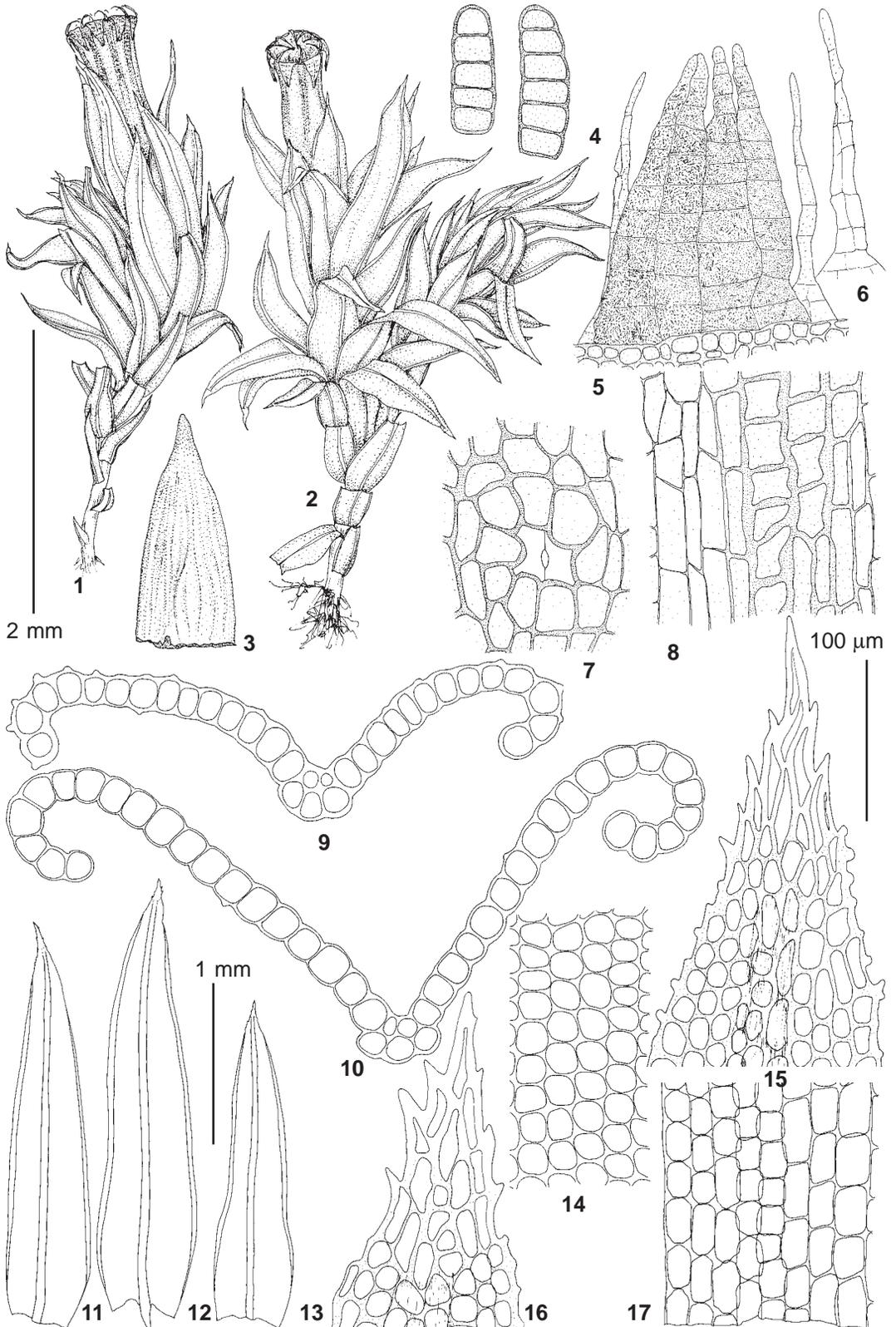




Fig. 2. Capsules of *Orthotrichum* species: a-c: *O. dagestanicum* sp. nov. (from holotype: Dagestan, 21.V.2010, Fedosov #10-2-146, MW); d-e: *O. pumilum* Sw. (Volgograd Province, 5.VIII.1991, Suragina s.n., MHA); f-g: *O. diaphanum* Brid. (Krasnodar Territory, Ignatov & Ignatova #05-415, MHA).

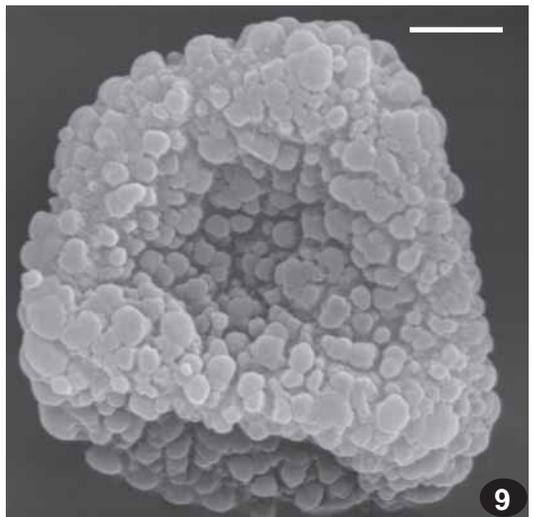
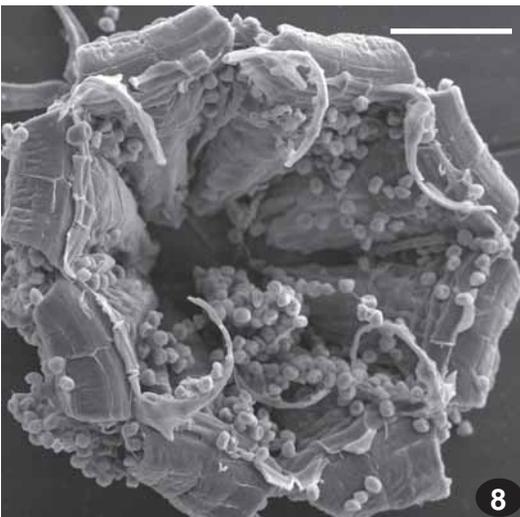
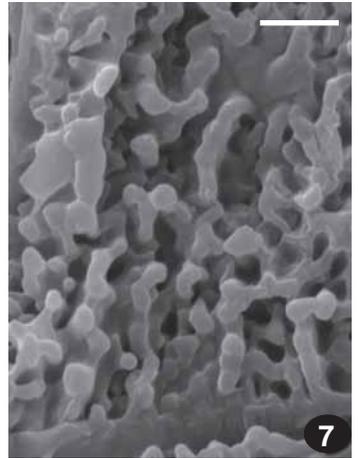
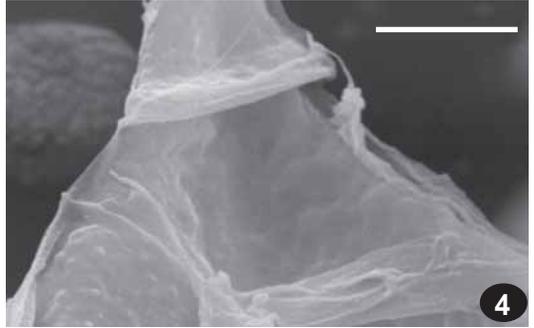
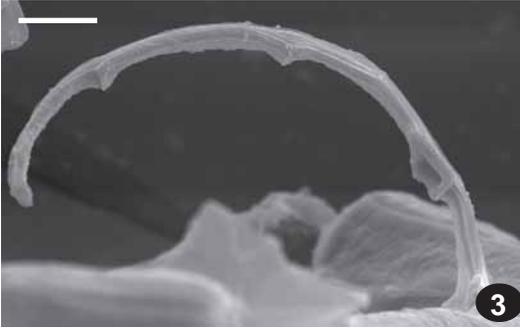
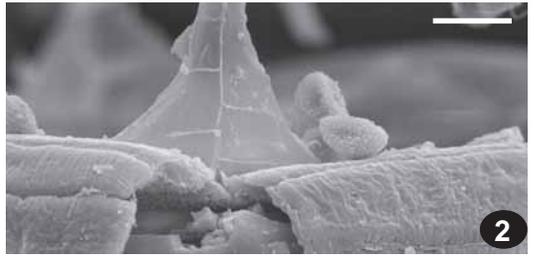
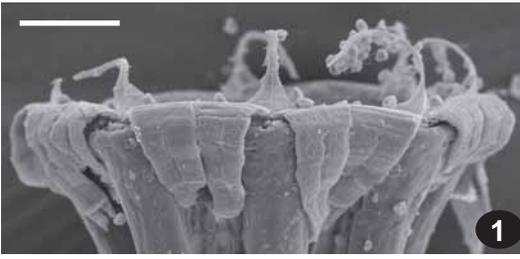
to *O. dagestanicum* in cryptoporous stomata, moderately covered by subsidiary cells, large and almost smooth laminal cells. However, it differs from *O. dagestanicum* by (1) sharply delimited, long, finely denticulate hyaline awns vs. gradually becoming hyaline, relatively short, triangular, coarsely dentate apices; (2) weakly ribbed urns with only slightly darker ribs vs. strongly ribbed urn with reddish brown ribs and deep furrows; (3) 16 not paired exostome teeth spreading in open capsule vs. 8-paired teeth, reflexed and appressed to urn wall; (4) 16 endostome segments vs. 8; and (5) calyptra varying from often hairy (hairs few) to naked vs. always naked.

*Orthotrichum garrettii* Grout & Flowers, judging from description and illustrations of Flowers (1973) resembles *O. dagestanicum* in yellowish to hyaline leaf tips composed by thick-walled cells and dentate at margin, cryptoporous

stomata covered by subsidiary cells in a similar extent, and epilithic ecology. However, *O. garrettii* differs in (1) regularly low papillose laminal cells; (2) exostome teeth paired shortly after dehiscence, becoming free with age, narrow (like in *O. diaphanum*), papillose versus remaining in pairs after spore release, smooth; (3) 16 strongly appendiculate endostome segments vs. 8 not appendiculate; (4) calyptra often hairy in upper part vs. always naked.

*Orthotrichum vittii*, recently described from the Iberian Peninsula (Lara et al., 1999), is similar to *O. dagestanicum* in naked calyptra, and hyaline hair-point that sometimes is similar although being variable from short and coarsely dentate to long and finely denticulate, as in *O. diaphanum*. However, *O. vittii* differs in (1) weakly ribbed urns with only slightly darker ribs vs. strongly ribbed urn with deep furrows and reddish-brown ribs; (2)

Fig. 3. *Orthotrichum dagestanicum* sp. nov. (from holotype: Dagestan, Fedosov 10-2-146, MW): 1, 8 – peristome; 2 – base of endostome segment from outside; 3 – endostome segment, lateral view; 4 – base of endostome segment from inside; 5 – inner surface of exostome tooth; 6-7 – outer surface of exostome teeth; 9 – spore. Scale bars: 100  $\mu$ m for 1, 8; 20  $\mu$ m for 2-3; 10  $\mu$ m for 4-6; 3  $\mu$ m for 7, 9.



variable exostome teeth, paired to unpaired and reflexed to spreading after spore release, vs. distinctly 8-paired, reflexed and appressed to urn, (3) distinctly papillose inner surface of exostome teeth vs. nearly smooth one, and (4) 16 always appendiculate endostome segments vs. 8 not appendiculate ones.

*Orthotrichum leblebicii* Erdag et al., one more species with hyaline leaf apices, similar to ones of *O. dagestanicum* & *O. vittii*, recently described from southern Turkey (Erdag et al., 2004), also shares with *O. dagestanicum* strongly ribbed urns, 8 paired exostome teeth, recurved and appressed to urn then dry, and naked calyptra. These species can be distinguished from *O. dagestanicum* due to (1) smaller leaf cells (13-15(-22)×10-15(-20) μm) with simple papillae vs. mainly smooth; (2) superficial stomata vs. immersed ones; (3) teeth densely papillose vs. smooth; (4) endostome segments 16 vs. 8.

In the combination of sporophytic characters *Orthotrichum dagestanicum* is most similar to *O. pumilum* among Caucasian species. Both species share strongly ribbed urns, ribs strongly darker than the rest of the urn, exostome teeth remain paired after spore release and tightly appressed to urn wall, 8 endostome segments; calyptra always naked. Laminal cells in *O. pumilum* usually have low papillae, sometimes inconspicuous. However, this species is distinguished by acute to subobtuse leaf apex, apical cells not differentiated or occasionally 1-3 uppermost cells yellowish, rhombic, thin-walled, forming short apiculus, and uppermost leaf margins entire.

The affinity of *O. dagestanicum* can be understood in a number of ways, depending on the evaluation of the hyaline leaf apices. Though very rare in the genus, it is clear by now that it originated more than once, as it has been found in phanerophorous *O. leblebicii*. Somewhat similar morphological trends were observed in *O. pallens* Bruch ex Brid. in Anabar Plateau (East Siberian Subarctic), in a xeric and very cold climate. Most plants of *O. pallens* there have serrate leaf apiculus, partly composed of elongate hyaline thin-walled cells. Thus, the origin of *O. dagestanicum* from *O. pumilum* might give one explanation.

At the same time, *O. pumilum* is a widespread species, but, to our knowledge, has never been reported to possess a hyaline hair-point, although its upper cells might be somewhat colourless. Thus the origin from hyaline hair-pointed species, *O. garrettii*, *O. vittii* and *O. diaphanum* should also be considered. Among them, the two former species are more similar to *O. dagestanicum* in the structure of leaf apices. Interestingly, all three taxa, *O. dagestanicum*, *O. vittii* and *O. garrettii* are known in Circum-Thetian Subkingdom (Frey & Kürschner, 1983, 1988) exactly at 40-42 N. lat., being separated by 4500 and 10000 km.

So, three possibilities seem have to be considered: (1) either *O. dagestanicum*, *O. vittii* and *O. garrettii* are remnants of the previously widely distributed ancestor, or (2) climate or some other factors at this latitude induced hyaline-pointed leaves in various groups of *Orthotrichum*, or (3) conditions along this latitude are in favour of hybridization, so *O. diaphanum* may efficiently cross with other species of the genus.

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