

# Bryophyte flora of the projected Utrish nature reserve (North-West Caucasus, Russia)

E. A. Ignatova<sup>1</sup>, M. S. Ignatov<sup>2</sup>, A. P. Seregin<sup>1</sup>, T. V. Akatova<sup>3</sup>, N. A. Konstantinova<sup>4</sup>

## Бриофлора планируемого Утришского заповедника (Северо-Западный Кавказ, Россия)

E. A. Игнатова<sup>1</sup>, М. С. Игнатов<sup>2</sup>, А. П. Серегин<sup>1</sup>, Т. В. Акатова<sup>3</sup>, Н. А. Константинова<sup>4</sup>

<sup>1</sup> – Department of Geobotany, Biological Faculty, Moscow State University, Moscow 119992

Russia – Россия 119992, Москва, Московский государственный университет, Биологический факультет, каф. геоботаники

<sup>2</sup> – Main Botanical Garden of Russian Academy of Sciences, Botanicheskaya 4, Moscow 127276

Russia – Россия 127276, Москва, Ботаническая 4, Главный ботанический сад РАН

<sup>3</sup> – Maikop Branch of Caucasian Nature Biosphere Reserve, Sovetskaya str., 187, Maikop, Adygea

Republic 385000 Russia – Россия 385000, Республика Адыгея, Майкоп, Советская 187, Кавказский государственный природный биосферный заповедник, Майкопское отделение

<sup>4</sup> – Polar-Alpine Botanical Garden-Institute of Kola Sci. Center of RAS, Kirovsk-6, Murmansk

Province 184256 Russia – Россия 184256, Мурманская область, Кировск-6, Полярно-альпийский ботанический сад-институт Кольского НЦ РАН

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Bryophyte flora of the territory of the projected Utrish Nature Reserve is studied (NW Caucasus, Black Sea coastal zone between Anapa and Novorossiysk, 44°41–45'N – 37°24–32'E). This area partly includes xeric open forests formed by *Juniperus excelsa*, *J. oxycedrus* and *Pistacia mutica*, rich in rare species, that are known in Russia only or almost only in this area: *Zygodon rupestris*, *Syntrichia laevipila*, *Dicranoweisia cirrata*, *Pleurochaete squarrosa*, *Tortula inermis*. Some other species are also known in Russia only within this area: *Seligeria recurvata*, *Tortella flavovirens*, *Rhynchostegiella curvoiseta*. Interestingly, many species common at the Black Sea coast SE of Tuapse are rare or totally absent here. Altogether, bryophyte flora includes 119 mosses and 9 hepatics.

Проведена инвентаризация бриофлоры территории планируемого Утришского заповедника (Черноморское побережье между Анапой и Новороссийском, 44°41–45'N – 37°24–32'E). Уникальный комплекс можжевельново-фисташковых редколесий обуславливает произрастание здесь ряда видов, нигде или практически нигде более в России не встречающихся: *Zygodon rupestris*, *Syntrichia laevipila*, *Dicranoweisia cirrata*, *Pleurochaete squarrosa*, *Tortula inermis*. На данной территории находятся единственные в России популяции *Seligeria recurvata*, *Tortella flavovirens*, *Rhynchostegiella curvoiseta*. Обсуждаются резкие отличия бриофлоры данного места от весьма близко расположенных участков побережья юго-восточнее Туапсе. В целом флора насчитывает 119 видов мхов и 9 печеночников.

### INTRODUCTION

The bryological exploration of the territory of Russian part of Caucasus started in 19<sup>th</sup> century, and to the end of that century resulted in fundamental “Musci Caucasicus” by Brotherus (1892). A number of bryologists worked in the area later, but more or less complete local floras were revealed only in a few places in the Russian part of Caucasus: Teberda Reserve (Ignatova & al., 1990), Caucasian Reserve (Akatova, 2002; Ignatov & al., 2002); Ossetian Reserve (Abramova & Komzha, 2000); Kabardino-Balkarian Republic (Kharzinov & al., 2004). Information about other parts of Caucasus is scattered in numerous publications and difficult to overview. The area near

Arkhipo-Osipovka and Abrau-Dyurso was rather well collected by I.I. Abramov & A.L. Abramova (LE), but their results were never published. This area attracted our attention because strict protection is planned here, thus its inventory is important for conservational purposes.

## STUDY AREA

The territory is situated on the Caucasian coast of the Black Sea in the Abrau Peninsula between Novorossiysk and Anapa. Flora was studied in the area ca. 50 km<sup>2</sup> in the borders of the projected Utrish State Reserve (Fig. 1). This is 12 km of the Black Sea coast, situated on the foot of south-faced slope of Navagir Range, a northwestern most range of the Great Caucasus system.

Navagir Range is formed of flysch layer 250–350 m thick, which is a combination of maritime carbonate sedimentary rocks accumulated in lower Palaeogene (i.e. carbonate argillite with frequent interlayers of sandstone and aleurolite). The lower stratum of the Upper Cretaceous consists of carbonate marl with interlayers of limestone, aleurolite and clay. It can be observed in the brook valleys. Valley bottoms are filled in with the alluvial deposits up to 15 m thick.

Cliffed coast of Utrish area is formed by abrasion. Presence of dislocated beds faced to the coast and clay interlayers leads to combined rockfalls and landslides caused by seismic and gravitation processes. These phenomena are powerful, but rare. Pseudolagoons are formed between landslide masses on the foot of coastal slopes, cut by single strand from sea. The hugest ancient landslide mass forms Cape of Malyj Utrish. The mass slipped down from nearby Mt. Lysaya.

South-faced slope of Navagir Range is cut with six narrow gorges, or «shchel» (Fig. 1). Navagir Range reaches elevations up to 500 m, thus the height of slopes in the distal parts of gorges is 300–350 m. The length of the gorges is 3–8 km, the distance between their mouths is 2–2,5 km. The beds of the gorges are full of water in winter and early spring and become dry afterwards. Brooks are permanent in Vodopadnaya Shchel, Mokraya Shchel, and Topolnaya Shchel.

Closed drainage basin of fresh-water Sukhoy Liman Lake (area ca. 100 ha in spring) is situated nearby the headwaters of Bazovaya Shchel. Altitude of basin bottom is 280 m. The basin is characterized by temperate (less arid) climate. Several spring brooks aliment the lake.

## CLIMATE

Climate of the Abrau Peninsula is sub-Mediterranean, characterized by a relatively mild and rainy winters without stable snow cover and hot dry summers. The cold air masses penetrate frequently in winter, and summer minimum of rains is less pronounced than in the typical Mediterranean areas. Average temperature in the coast is +1°C in January and +23°C in July. Precipitation is ca. 500–600 mm with stressed winter maximum.

## VEGETATION

Altitudinal differentiation forms two belts of natural vegetation, but the borders of plant communities are mosaic. Slope aspect and steepness also differentiate plant communities.

The vegetation of the lower altitudinal belt (0–200 m alt. on south-faced slopes) is represented by relic ecosystems of arid sub-Mediterranean forests, which occur in Russia only in the narrow strip of Black Sea Coast from Anapa to Tuapse. These forests in sparsely populated Utrish area are still in (semi-)natural condition. The following formations are most common: *Juniperus oxycedrus*, *J. excelsa*, *J. foetidissima*, *Pistacia mutica*, *Quercus pubescens*, *Carpinus orientalis*, *Paliurus spina-christi*. Bryophytes are mostly on trunks: *Leucodon sciuroides* is the commonest, often the only species on many trunks. *Orthotrichum diaphanum*, *O. affine*, *Zygodon rupestris*, *Syntrichia virescens*, and *S. laevipila* are also not rare, sometimes *Hypnum cupressiforme*, *Homalothecium sericeum*, and *Anomodon viticulosus* are present in more shady places; *Weissia* spp., *Bryum capillare* occur on soil in open places, and *Pleurochete squarrosa* is common among scattered grasses.

The vegetation of the upper altitudinal belt (150–500 m alt., but it goes down to 50 m alt. at

gorge bottoms) is represented by broad-leaved forests with sparse herbaceous cover. Forest formations of *Fagus orientalis*, *Carpinus caucasica*, *C. orientalis*, *Quercus petraea*, *Fraxinus excelsior* s.l. are predominate here over less distributed forests of *Acer laetum*, *Tilia begoniifolia*, etc.

There is a sufficient difference between a relatively well-lightened *Quercus petraea* and *Carpinus* forests, and a rather dark *Fagus* forests. The former are more diverse in bryophytes. *Anomodon viticulosus* is the most abundant on trunk bases; *Homalothecium philippeanum*, *H. sericeum*, *Hypnum cupressiforme* are also common; on soil there are *Brachythecium rutabulum*, *Oxyrrhynchium hians*, *Brachytheciastrum velutinum*, *Cirriphyllum crassinervium*, etc.

*Fagus* forests are quite different: *Hypnum cupressiforme* is the commonest, it dominates on trunks and logs; *Orthotrichum striatum* (trunks and twigs), *Brachytheciastrum velutinum* (on soil) are very common, and *Tortula subulata*, *Isothecium alopecuroides*, and *Neckera complanata* are abundant at places. Interestingly, *Pterigynandrum*, a common moss in beech forests at a little higher altitudes in Caucasus is extremely rare here.

Wet rocks and cliffs are numerous at gorge bottoms. As usually, these habitats are the most diverse in bryophytes. *Eucladium verticillatum*, *Rhynchostegium confertum*, *Cirriphyllum crassinervium*, *Trichostomum brachydontium* are rather common here; *Isothecium myosuroides*, *Rhynchostegium rotundifolium*, *Rhynchostegiella curviseta*, *R. tenella*, and *Seligeria recurvata* are rather abundant in some gorges. *Cratoneuron filicinum* is the commonest along streams, and *Platyhypnidium riparioides* occurs in running water of more or less permanent streams.

Rocks on open places and in not very dense woods are covered by *Grimmia pulvinata*, *Orthotrichum anomalum*, *Schistidium crassipilum*, and *Tortula muralis*, etc.

## FIELD STUDIES

The area has been explored by Seregin in 2004 (June), Ignatova, Ignatov & Seregin in 2005 (early May), and Akatova in 2004 (August). Collections of mosses were mainly identified by Ignatova and Ignatov, and Bryum has been verified by V.I. Zolotov; collections of hepatics were studied by Konstantinova. Collections are in MW (the most complete set) and MHA (almost complete set, excepting few unique specimens).

## LIST OF SPECIES

Annotation is started from the species frequency: Com – common; Sp – sporadic; Rr – rare; Un – Unique. Then the locality names are given, according to abbreviations in Fig. 1. In the end of an annotation one or few specimens are listed for each species (started with #05 – collections of Ignatov & Ignatova; started with M- – collections of Seregin), and S+ means sporophyte presence.

## MOSSES

*Amblystegium serpens* (Hedw.) B.S.G. – Sp: L, 2T, N, M, SL; 20–280 m alt.; at bases of *Acer* and *Fraxinus*, on rotten logs, on soil along a road in forest, and on vertical surface of cliff. #05-84, 05-440. S+.

*Anomodon attenuatus* (Hedw.) Hueb. – Sp: L, 1T, 2T, 3T, N, M; 50–200 m alt.; on trunk bases and exserted roots of *Fagus* and *Carpinus*, once on rock outcrops in forest; much rarer than *A. viticulosus*, and avoiding xeric habitats, being confined mainly to the narrower parts of gorges. #05-74, 05-460.

*A. longifolius* (Brid.) Hartm. – Un: 2T; 130 m alt.; on aleurolite outcrops along a stream. #05-35.

*A. viticulosus* (Hedw.) Hook. et Tayl. – Com: in all gorges and on slopes to the sea, although in more xeric sites less abundant. 20–280 m alt.; on trunk bases of broad-leaved trees, occasionally on *Juniperus*, also on rock outcrops and separate boulders, and in forest sometimes just on eroded soil (on slopes, both steep and very gentle), especially on slopes to streams; rather rare on decaying logs. #05-56, 05-622. S+.

*Atrichum undulatum* (Hedw.) P.Beauv. – Rr: SL, 270–280 m alt.; in *Fagus* and *Carpinus* forest, in

- several places not far from road, in few places in abundance; V (uppermost course), 350 m alt.; along a road in *Pinus+Quercus* forest. #05-17, 05-542. S+.
- Antitrichia curtispindula* (Hedw.) Brid. – Un: L, 140 m alt.; open *Quercus pubescens* forest on steep slope, on soil, several large tufts. #05-89.
- Barbula convoluta* Hedw. – Rr: found in three places: 1) MU, 5 m alt., on rocky slope to sea in open *Pistacia +Juniperus* stand; 2) at the junction of 2T and 3T, 70 m alt., on gravelly place (man-made) on meadow; 3) strongly trampled edge of road near SL, wet place. #05-497, 05-501, M-669. S+.
- B. unguiculata* Hedw. – Com: 5–400 m alt.; relatively frequent in shady gorges on wet rock walls along streams, on various rock outcrops in forests and rather open slopes, both on rocks and on fine soil upon rocks, on soil along roads and in grasslands, at the bank of Sukhoi Liman Lake, and in disturbed places in village and at sea shore. #05-218, 05-516. S+.
- Brachytheciastrum velutinum* (Hedw.) Ignatov et Huttunen – Com: 20–450 m alt. Very common in *Fagus* and *Carpinus* forests, where it is often the most abundant species, forming pure carpets on many square meters; also on rocks, fallen logs and tree bases, in various forests, including xeric open stands. #05-370, 05-429. S+. Plants from tree trunks sometimes have very narrow leaves, approaching to *B. velutinum* var. *salicinum* (Schimp.) Ochyra & Zarnowiec (for example: 1T, SL, 120–280 m alt.; #05-653, 05-455), but we are not certain about the status of this taxon. S+.
- Brachythecium campestre* (Mull. Hal.) B.S.G. – Un: SL, 250 m alt.; on soil along a road in open beech forest. #05-536.
- B. rivulare* B.S.G. – Rr: 1T, 140–160 m alt; along banks of streams, on soil and rocks. #05-199, 05-274.
- B. rutabulum* (Hedw.) B.S.G. – Com: 20–430 m alt.; in *Fagus* and *Carpinus* forests, more rarely in xeric communities, also along streams on soil and rocks, and on tree bases and rotten logs. #05-46, 05-652. S+.
- B. salebrosum* (Web. et Mohr) B.S.G. – Un: SL, 250 m alt.; in *Fagus* forest, on soil along a road. #05-535.
- Bryum argenteum* Hedw. – Sp: MU, SL, and many places on slope to sea; 5–340 m alt.; on soil and rocks in open stands and also on disturbed places at sea shore, #05-502, 05-643.
- B. bicolor* Dicks. – Rr: NR, 320–360 m alt.; on gravel along a road across steppe slope, in open oak stand, and also in *Fraxinus* forest, on relatively shady soil. M-615, M-624, #05-677.
- B. caespiticium* Hedw. – Rr: MU, M, Sh, NR; 5–50 m alt.; disturbed places at village edge, on soil and above semi-decayed wool (sic!), and also on soil in dry stream bed in rather open place. #05-503, 05-657. S+.
- B. capillare* Hedw. – Sp: 1T, 2T, N, SH; 5–360 m alt.; on soil and gravel, as well as on organic deposits, on dry rocky slopes and in the forest. #05-14, 05-606. S+.
- B. moravicum* Podp. (*B. laevifilum* Syed) – Sp: L, 1T, 2T, 3T, M, SL; 30–270 m alt.; in xeric open stands and in *Fagus+Carpinus* forests, at trunk bases, exerted roots of trees and on soil in partial shade; occasionally on boulders and aleurolite outcrops along streams. #05-98, 05-495.
- B. mildeanum* Jur. – Un: NR (“Navagirskiye Polyany”), 300 m alt.; on rocky soil along a road across grassland. #05-307.
- B. radiculosum* Brid. – Un: MU, 5 m alt.; on heavily disturbed meadow at sea shore. #05-589.
- B. rubens* Mitt. – Un: SL, 280 m alt.; on wet soil on meadow at low lake bank. #05-383.
- B. turbinatum* (Hedw.) Turn. – Un: V, 25 m alt.; on wet argillites near waterfall. # 05-564.
- B. torquescens* Bruch et De Not. – Un: MU, 20 m alt.; *Juniperus+Pistacia* stand, on gravelly soil along a trail. #05-195. S+.
- Campylidium sommerfeltii* (Myr.) Ochyra – Rr: 1T, 3T, N, M; 60–150 m alt.; in *Caprinus orientalis* forests at gorge bottoms; on rock outcrops and separate rocks along a road in forest. #05-92, 05-152.
- Ceratodon purpureus* (Hedw.) Brid. – Rr: SL, 200–340 m alt.; on bare soil and gravel along a road across grassland and open forest, and on meadow at lake bank, in relatively damp habitats. #05-306, M-620. S+.
- Cirriphyllum crassinervium* (Tayl.) Loeske et Fleisch. – Com: 20–400 m alt.; rather common in forests

of *Fagus*, *Carpinus betulus*, *C. orientalis*, *Quercus petraea*, especially in relatively wet parts of gorges, where it is the most frequent moss on soil at places; occasionally occurs in open xeric forests, on soil, exserted roots of trees, rock outcrops; sporadic also on soil and rocks at stream banks. #05-133, 05-376. S+.

*Cratoneuron filicinum* (Hedw.) Spruce – Com: 50–200 m alt.; in all gorges, often in abundance, on wet rocks along stream banks to partly submerged in running water of streams, on wet cliffs, etc. #05-267, 05-700. S+.

*Crossidium squamiferum* (Viv.) Jur. var. *pottioideum* (De Not.) Monk. – Un: L, 40 m alt.; open stand of *Quercus pubescens* and *Juniperus excelsa*, south-faced xeric rock outcrop, in crevices. #05-124. S+.

*Ctenidium molluscum* (Hedw.) Mitt. – Un: 2T, 120 m alt.; shady forest at gorge bottom, on wet argillite rocks. M-491.

*Dicranella heteromalla* (Hedw.) Schimp. – Un: NR, 400 m alt.; on subvertical soil banks along a road in shady *Quercus petraea* forest. #05-279.

*Dicranoweisia cirrata* (Hedw.) Lindb. ex Milde – Sp: slopes to the sea between L and V, 20–300 m alt.; in xeric *Juniperus* (pure and mixed with *Quercus pubescens* and *Pistacia*) stands, usually on fallen logs of *Juniperus*, or occasionally on its very old standing trunks; seems can be found in relevant habitats throughout the coastal zone, but sometimes only after expanded search. #05-1, 05-386. S+.

*Dicranum scoparium* Hedw. – Un: Sh-SL, 270 m alt.; in *Carpinus* forest, on soil bank along a road. #05-309.

*Didymodon fallax* (Hedw.) Zander – Rr: 1T, 3T, M; 80–200 m alt.; on argillite outcrops and occasionally on soil close to them along streams at gorge bottoms. #05-489, 05-695.

*D. rigidulus* Hedw. – Sp: V, Sh, L, M, slopes to the sea; 10–150 m alt.; on rock outcrops, boulders, rarely on soil in open xeric forests, along roads, and occasionally in more dense *Fagus*+*Carpinus* forests. #05-380, 05-478.

*D. tophaceus* (Brid.) Lisa – Rr: V, 5–25 m alt.; on permanently seeping cliffs near waterfall and schist cliffs on sea shore; M, 50–130 m alt.; on rock outcrops and rocky bottom of narrow gorge. #05-588, 05-683.

*Drepanocladus aduncus* (Hedw.) Warnst. – Un: SL, 260 m alt., wet area at the lake shore, on soil. M-599.

*Encalypta streptocarpa* Hedw. – Rr: M, 120–130 m alt; in narrow gorge, on argillite cliffs at its bottom. #05-696, 05-704.

*E. vulgaris* Hedw. – Un: MU, 100 m alt.; on xeric slopes with scattered *Juniperus*, on soil on steep rocky slope. #05-9. S+.

*Eucladium verticillatum* (Brid.) B.S.G. – Sp: V, 1T, 2T, M; 10–140 m alt.; very abundant at gorge bottoms near waterfalls and on wet limestone and argillite outcrops, occasionally on separate rocks. This tufa-forming moss often builds large conic or irregularly-shaped deposits in permanently seeping places. #05-856, 05-680. S+.

*Fissidens bryoides* Hedw. – Rr: 1T, M; 70–140 m alt.; on soil and rocks in wet shady places at gorge bottoms. #05-75, 05-708. S+. Our material is very variable in leaf shape, raising a problem of its separation from the next species; we are not quite certain in all our identifications of plants in this group.

*F. gracilifolius* Brugg.-Nann. et Nyh. – Sp: L, M, N, 1T, 2T; 20–150 m alt.; on aleurolites and calcareous tufa beside streams at gorge bottoms. #05-99; 05-122. S+.

*F. taxifolius* Hedw. – Rr: L, 1T; 130–135 m alt.; on soil in open deciduous forest on steep slope and on soil bank along a stream. #05-127, 05-185.

*Funaria hygrometrica* Hedw. – Sp: V, Sh, SL, MU, slope to sea between N & M; 2–280 m alt.; on rather damp soil on disturbed places, old fire-places, and once on concrete hedge along a road. #05-540, 05-593. S+.

*Grimmia laevigata* (Brid.) Brid. – Un: slope to sea between B and Sh, 170 m alt.; *Quercus*+*Juniperus* open stand, on small opening, over one big boulder. #05-366.

*G. pulvinata* (Hedw.) Sm. – Com: throughout the territory, 5–400 m alt.; on boulders and rock outcrops in open places and not very dense *Juniperus*, *Quercus* and *Carpinus* forests. #05-413,

05-568. S+.

*G. tergestina* Tomm. ex B.S.G. – Rr: MU, 80 m alt., on limestone boulder; between B & Sh on slope to the sea, 170 m alt, *Quercus*+*Juniperus* open stand, on small opening, all over one big boulder. #05-23, 05-367. S+.

*Gymnostomum aeruginosum* Sm. – Rr: 3T, 200 m alt.; moist rocks near stream and waterfall; L, 10 m alt.; in niches of cliffs along sea shore. #05-265, 05-603.

*Habrodon perpusillus* (De Not.) Lindb. – Un: M, 150 m alt.; *Fagus*+*Carpinus* forest, on trunk of recently fallen *Fraxinus*, at about 5 m from its base. #05-613.

*Hedwigia ciliata* (Hedw.) P.Beauv. – Un: B, 140 m alt.; in xeric open forest on slope to the sea, on boulder. #05-223. S+.

*Homalothecium lutescens* (Hedw.) Robins. – Rr: NR, 400 m alt., in *Quercus petraea* forest, on soil along a road; N, 80 m alt., in *Carpinus orientalis* forest, on gravel along a road. #05-80, 05-356. S+.

*H. philippeanum* (Spruce) B.S.G. – Rr: 2T, 3T, 120–150 m alt.; in *Carpinus* forest with *Fagus* and *Fraxinus*, on rock outcrops and at base of *Fagus* trunk. #05-301, M-490.

*H. sericeum* (Hedw.) B.S.G. – Com: throughout the territory, 10–400 m alt.; in xeric open forests on slopes to the sea, in *Carpinus*, *Fagus* and *Quercus* forests, as well as in open places; at bases of tree trunks (including *Juniperus*), exerted roots of trees, fresh logs, rock outcrops and separate boulders, occasionally on soil. One of the commonest epiphytes, ranging from quite xeric to relatively humid habitats. #05-37, 05-445. S+.

*Homomallium incurvatum* (Brid.) Loeske – Sp: SL, Sh, 1T, 2T, 3T; 120–340 m alt.; on rocks in *Carpinus*, *Fagus*, and *Fraxinus* forests; in general a rather rare species, but in one locality in *Fagus* forest it was recorded almost on every rock, including small scattered pieces. #05-285, 05-642. S+.

*Hygroamblystegium varium* (Hedw.) Monk. – Rr: V, 1T, 2T, 3T; 70–200 m alt.; on soil banks and rocks near streams, sometimes on trunk bases and rotten logs of *Fagus*, *Carpinus*, *Tilia*, *Acer*. #05-145, 05-183.

*Hypnum cupressiforme* Hedw. – Com: throughout the territory, 5–400 m alt.; locally the most abundant moss species, especially in beech forests; also common in xeric *Quercus*+*Pistacia* stands, in *Carpinus* and mixed broad-leaved forests; growing on trunk bases, exerted roots, rocks, and sometimes just on soil, at places covering huge areas by pure carpet (especially along Navagirsky Range); often forming pure mats on fallen trunks (especially on rather fresh ones) of all trees except *Juniperus*, and on stumps. #05-238, 05-600. S+.

*Isothecium alopecuroides* (Dubois) Isov. – Sp: SL, 1T, 2T; 130–280 m alt.; on trunk bases in forests of *Fagus* and *Carpinus orientalis*; on separate boulders and once on cliffs at a stream bank. #05-44, 05-578.

*I. myosuroides* Brid. – Sp: L, 1T, N, M; 60–150 m alt.; in *Carpinus* and *Fagus*+*Carpinus* forests, on rocks, occasionally on soil on steep banks to streams; only once found in abundance on a relatively dry high cliffs along a permanent stream in Mokraya Shchel. #05-168, 05-672.

*Leptodictyum riparium* (Hedw.) Warnst. – Un: SL; 280 m alt.; relatively wet meadow at the lake shore, among dense grasses. #05-365a.

*Leptodon smithii* (Hedw.) Web. et Mohr – Sp: very unevenly distributed: common and abundant in Mokraya Shchel (M), at 10–150 m alt., growing on tree trunks and occasionally on rocks (at gorge bottom and also on slopes to at least 70 m above bottom); in other places it was found by a small tufts on one tree (V, 50 m alt.), or two trees (N, 30–60 m alt.), on rocks and *Carpinus orientalis* trunk on the top of Mt. Lysaya (MU, 320 m alt.); and once on old *Juniperus* on slope to sea (100 m alt.). #05-69, 05-660. S+.

*Leskea polycarpa* Hedw. – Rr: SL, 280 m alt., on rather thin *Ulmus* trunk; NR, 380 m alt., on soil along a small road in *Carpinus* forest. #05-280, 05-332. S+.

*Leucodon sciuroides* (Hedw.) Schwaegr. – Com: throughout the territory, 5–400 m alt.; one of the most common mosses in mesic and especially in xeric forests, composed by *Juniperus*, *Pistacia*, *Quercus*, *Carpinus*, *Fraxinus* and other broad-leaved trees; also on rotten logs, rock outcrops, boulders. #05-27, 05-388.

*Neckera besseri* (Lob.) Jur. – Com: Sh, L, 1T, 2T, 3T, N, SL; 50–280 m alt.; *Fagus*+*Carpinus* forests in

- gorges, growing on trunk bases, exserted roots, and also on wet shaded rocks. #05-32, 05-461.
- N. complanata* (Hedw.) Hueb. – Com: 1T, 2T, M, SL; 80–340 m alt.; in *Carpinus*, *Fagus*, and *Fraxinus* forests, on tree trunks and on rocks. #05-174, 05-635.
- N. crispa* Hedw. – Un: 2T, 80 m alt.; on aleurolite outcrops near stream at gorge bottom. #05-62.
- Orthotrichum affine* Schrad. ex Brid. – Com: throughout the territory, 5–400 m alt. In xeric vegetation on slopes to sea, as well as in *Fagus* and *Carpinus* forests in gorges, and various open stands; on trunks of *Carpinus*, *Fagus*, *Rhamnus*, *Prunus*, *Fraxinus*, *Pistacia*, *Quercus*, *Salix*. #05-295, 05-575.
- O. anomalum* Hedw. – Com: SL, MU, Sh, L; 5–240 m alt.; in xeric open *Juniperus*+*Pistacia* stands, open *Quercus* and *Carpinus* forests, on rocks, once on stump. #05-398, 05-507.
- O. diaphanum* Brid. – Com: throughout the coastal zone, 100–150(–200) m alt., on trunks of broad-leaved trees and *Juniperus*. #05-334, 05-494.
- O. obtusifolium* Brid. – Rr: between MU & L, 5 m alt., on *Fraxinus* in open xeric forest; SL, 280 m alt., on *Prunus spinosa*, in open place. #05-194, 05-497.
- O. pallens* Bruch ex Brid. – Sp: SL, L, 2T; 10–280 m alt.; in mesic forests, on trunks of *Fagus*, *Carpinus*, *Fraxinus*, *Corylus*. #05-541, 05-487.
- O. pumilum* Sw. – Sp: V, Sh, L, 2T, 3T; 5–200 m alt.; on trunks of *Fraxinus*, *Carpinus*, *Pistacia*, *Acer* and once on rocks. #05-611, 05-259.
- O. striatum* Hedw. – Com: throughout the territory, 70–340 m alt.; the most common species of the genus in beech forests, and not rare also in forests of *Carpinus* spp. and *Quercus robur*, on trunks of *Carpinus*, *Fagus*, *Fraxinus*, *Quercus*, *Corylus*. #05-190, 05-573.
- Oxyrrhynchium hians* (Hedw.) Loeske – Com: throughout the territory, 10–400 m alt.; the most common species on soil in *Carpinus orientalis* and *Carpinus*+*Quercus* forests, and sometimes in *Fagus* forests; especially abundant on soil and rocks near streams; not rare among grasses on meadows among forest, along roads in forest, on damp soil on steep slopes in forest, etc. #05-479, 05-654.
- Oxystegus tenuirostris* (Hook. et Tayl.) A.J.E. Smith – Sp: MU, Sh, L, 1T, 2T, 10–120 m; in open xeric stands and in *Fagus*+*Carpinus* forests; on rock outcrops, separate boulders, exserted roots of *Carpinus* and *Acer*. #05-178, 05-397.
- Palamocladium euchloron* (Mull. Hal.) Wijk et Marg. – Sp: L, 1T, 3T, M; 50–180 m alt.; of rocks and soil on steep slopes, at cliff bases, more rarely on bases of trunks of broad-leaved trees; rather common only in 1T (at about 150 m alt.), in other places in small quantity. #05-112, 05-226.
- Physcomitrella patens* (Hedw.) B.S.G. – Un: NR, 430 m alt.; on soil near almost permanent puddle on a road in forest. M-600.
- Plagiomnium cuspidatum* (Hedw.) T.Kop. – Rr: 1T, 2T; 120 m alt.; in *Fagus*+*Carpinus* forest, on rocks, on soil along old road and on rock outcrop at stream bank. #05-48, 05-151.
- P. rostratum* (Schrad.) T.Kop. – Un: 2T, 80 m alt.; in *Fagus*+*Carpinus* forest, on soil in upper part of steep eroded slope in forest. #05-85.
- Platyhypnidium riparioides* (Hedw.) Dicks. – Sp: V, 1T, 2T; 80–150 m alt.; not very common, but locally abundant on rocks in and close to streams and on wet rocks aside waterfalls, avoiding temporarily dried places. #05-40, 05-585.
- Pleuridium subulatum* (Hedw.) Rabenh. – Un: SL, 250 m alt.; on loamy soil near road, among scattered shrubs at forest edge. #05-709.
- Pleurochaete squarrosa* (Brid.) Lindb. – Com: 5–360 m alt.; in coastal zone (up to 100 m) usually quite abundant on soil (including gravelly soil) in xeric open forests, especially along trails and paths, and in grasslands; outside coastal zone found only on steppe slope with scattered xeric oak stand at NR (Navagyrskie Polyany), 300–360 m alt., along a road. #05-396, 05-433.
- Pohlia wahlenbergii* (Web. et Mohr) Andrews – Rr: V, M, 1T, NR, 25–430 m alt.; on wet rocks and soil along streams and near big almost permanent puddles on forest road. #05-550, 05-679.
- Pterigynandrum filiforme* Hedw. – Rr: SL, 3T, 260–300 m alt.; on *Fagus* and *Tilia* trunks in forest, #05-610, 05-684.
- Pterygoneurum ovatum* (Hedw.) Dix. – Rr: MU (Mt. Lysaya), slope to sea east of B, SL; 80–250 m alt.; on soil in *Quercus*+*Juniperus* stands. #05-4, 05-224.

- Rhynchostegiella curviseta* (Brid.) Limpr. – Sp: V, 2T, 3T, M; 70–200 m alt.; along permanent or almost permanent streams at gorge bottoms, on rocks and cliff bases. #05-627, 05-705.
- R. tenella* (Dicks.) Limpr. – Sp: 1T, 2T, 3T, M; 30–130 m alt.; in *Carpinus* forests on slopes, and near streams at gorge bottoms, on rocks and cliff bases, sometimes forming extensive carpets, occasionally on rotten logs. #05-270, 05-651.
- R. teneriffae* (Mont.) Dirkse et Bouman – Un: 2T; 120 m alt.; in *Fagus+Carpinus* forest, on small boulders. #05-247.
- Rhynchostegium confertum* (Dicks.) B.S.G. – Com: 20–340 m alt.; throughout the territory, especially at gorge bottoms and in *Fagus* and *Carpinus* forests on lower part of slopes, on rock outcrops, cliff bases, separate boulders, occasionally on rotten logs. #05-430, 05-628.
- R. megapolitanum* (Web. et Mohr) B.S.G. – Rr: between L and N, 10–20 m alt.; SL, 280 m alt.; on soil, usually close to trails, among grasses (mesic to rather xeric places). #05-365, 05-519.
- R. murale* (Hedw.) B.S.G. – Rr: 1T, 3T; 170–200 m alt.; on rock outcrops and rocks along streams at gorge bottoms. #05-142, 05-480.
- R. rotundifolium* (Brid.) B.S.G. – Sp: 1T, 2T, 3T, M; 70–200 m alt.; not common, but in abundance at places on wet rocks along streams, more rarely on separate boulders, and once at base of *Fraxinus*. #05-163, 05-712.
- Schistidium apocarpum* (Hedw.) B.S.G. – Un: 1T, 150 m alt.; on rock outcrops at gorge bottom. #05-162.
- S. brunnescens* Limpr. – Un: V; 25 m alt.; dry rocks in scattered *Juniperus* stand. #05-528.
- S. crassipilum* Blom – Com: 10–400 m alt.; throughout the territory, on rocky substrates (usually on separate boulders) in xeric open stands on slope to the sea and other kinds of not dense broad-leaved forests; once found on *Fraxinus* base. #05-414, 05-451, M-564.
- S. elegantulum* Blom – Rr: 3T, M; 50–150 m alt.; on rocks in *Fagus+Carpinus* forest and at stream bank. #05-140, 05-658.
- Sciuro-hypnum flotovianum* (Sendtn.) Ignatov et Huttunen – Rr: SL, 300 m alt.; in shady *Carpinus* forest, on wet fine soil and on limestone gravel; 3T, 120–130 m alt.; *Fagus+Quercus* forest on slope, on rocks not far from the stream and at base of *Tilia* trunk. M-663, #05-286.
- Scorpiurium circinatum* (Brid.) Fleisch. et Loeske – Rr. MU, Sh, L, N; 20–80 m alt.; on soil in xeric open stands and open *Carpinus* forests, sometimes along trails and on *Fraxinus* trunks, and in one place (Navagirskaya Shchel) in abundance along the median part of rarely used forest ground road. #05-19, 05-67.
- Seligeria recurvata* (Hedw.) B.S.G. – Sp: V, 1T, 2T, L, M, NR, 20–350 m alt.; on tile-like debris of argillite and limestone outcrops, usually at strongly to moderately shaded gorge bottoms, and occasionally in various forests, including even *Quercus robur+Juniperus* stands. #05-106, 05-674.
- Syntrichia intermedia* Brid. – Rr: between SL and Sh, 220 m alt., on rock outcrops in forest near road; L, 40 m alt., in xeric open stand on south-faced slope, on rock outcrops, in crevices. #05-102, 05-344.
- S. laevipila* (Brid.) Schultz – Sp: 5–60 m alt.; throughout slopes to sea, at places not rare, on trunks of *Quercus*, *Pistacia*, *Juniperus* in xeric open stands. #05-68, 05-598.
- S. ruralis* (Hedw.) Web. et Mohr – Sp: V, MU, SL, NR, L; 5–360 m alt.; on soil in xeric open stands, in grasslands, on dry slopes almost without vegetation, on rock outcrops, strongly trampled place in village, and once at base of *Quercus* trunk. #05-591, 05-594.
- S. sinensis* (Mull. Hal.) Ochyra – Un: V, 25 m alt.; open *Juniperus* stand, on rocks in opening. #05-604.
- S. virescens* (De Not.) Ochyra – Sp: MU, L, between SL and Sh, slope to sea between B and MU; 5–210 m alt.; scattered, but at places abundant in open xeric stands and *Carpinus* forests, on trunks of *Quercus*, *Fraxinus*, *Juniperus*, and once on rocks (in mesic forest). #05-206, 05-439.
- Taxiphyllum densifolium* (Lindb. ex Broth.) Reim. – Rr: 1T, N; 120–160 m alt.; in *Carpinus* forests at gorge bottoms, on rocks and cliff bases close to streams. #05-111, 05-158.
- Thamnobryum alopecurum* (Hedw.) Gangulee – Un: 2T, 140 m alt.; on argillite outcrops at stream bank at gorge bottom. #05-57.
- Thuidium recognitum* (Hedw.) Lindb. – Un: Sh, 70 m alt.; in *Fraxinus+Quercus+Carpinus* forest, on

*Fraxinus* trunk. M-552.

*Tortella flavovirens* (Bruch) Broth. – Rr: between V and B, 5 m alt.; on shores of two small lakes (slightly salty, according to halophyte species) just behind gravely beach of sea, on soil among *Carex* and *Juncus*. #05-584.

*T. tortuosa* (Hedw.) Limpr. – Com: 5–300 m alt.; throughout the territory, usually on mesic to xeric rocks, occasionally on limestone gravel, on old brick hedge, at bases of *Quercus* and *Juniperus* trunks; from open places and open stands to *Carpinus* and *Carpinus+Fagus* forests. #05-119, 05-506.

*Tortula acaulon* (With.) Zander (*Phascum cupsidatum* Hedw.) – Sp: MU, SL, L, N, NR; 5–440 m alt.; xeric open stands, in openings, occasionally in *Quercus petraea* forest; on soil along roads and trails, and among not very dense grasses. #05-470, 05-539.

*T. inermis* (Brid.) Mont. – Rr: Sh, L, M; 40–220 m alt.; in open xeric stands, on rock outcrops, on ledges and in crevices. M-574, M-569.

*T. lanceola* Zander – Rr: slope to sea between N and M, 50 m alt.; on soil along a road in *Pistacia+Juniperus+Quercus pubescens* stand. #05-730.

*T. muralis* Hedw. – Com: 10–300 m alt.; throughout the territory, on xeric to mesic rocks, both in open and sheltered places; also on old brick hedge, concrete blocks, once at base of *Quercus*. #05-469, 05-692.

*T. subulata* Hedw. – Com: SL, L, M; 40–280 m alt.; on soil and rocks in *Fagus* and *Carpinus* forests, locally in abundance. #05-350, 05-690.

*T. truncata* (Hedw.) Mitt. – Un: SL, 280 m alt.; on damp soil among grasses, on meadow at lake shore. #06-268.

*Trichostomum brachydontium* Bruch – Rr: V, Sh, 2T, 60–80 m alt.; on rocks near streams, once on gravel along a road in shady forest. #05-58, 05-582.

*T. crispulum* Bruch – Rr: M, 120 m alt., on rocks in narrow gorge; NR, 340 m alt.; *Fagus+Carpinus* forest, on dry rocks along a road; NR (Navagirskie Polyany), 340 m alt., on gravel along a road, place permanently seeping (in May – June) by small spring. #05-450, M-617.

*Weissia brachycarpa* (Nees et Hornsch.) Jur. – Sp: SL, NR, L, between B and Sh; 30–400 m alt.; xeric open stands, in open *Quercus petraea* forest, on rocky and gravely slopes (on soil between rocks), in rock crevices. #05-121, 05-390.

*W. controversa* Hedw. – Sp: V, between B and Sh, MU; 15–200 m alt.; xeric open stands, open *Quercus robur* stand, open slopes; on soil, especially on vertical banks at bases of boulders. #05-8, 05-560.

*W. levieri* (Limpr.) Kindb. – Sp: V, MU, between L and N; 5–15 m alt.; on soil near roads and among rocks on open xeric slope. #05-515, 05-432.

*Zygodon rupestris* Schimp. – Com: 5–220 m alt.; throughout the coastal zone, on open xeric slopes, and rarely in more mesic broad-leaved forests; collected from trunks of *Juniperus*, *Pistacia*, *Quercus*, *Fagus*, *Fraxinus*, *Carpinus orientalis*, occasionally on fresh logs. #05-205, 05-375.

#### HEPATICS

*Conocephalum conicum* (L.) Und. – Sp: 2T, 130 m alt.; on wet soil and rocks along a stream at gorge bottom. #05-29.

*Frullania dilatata* (L.) Dum. – Com: 10–340 m alt.; especially common in coastal zone on trunks of almost all trees; also in gorges at lower elevation, in relatively open forests; occasionally on rocks. #05-338, 05-107.

*Lejeunea cavifolia* (Ehrh.) Lindb. – Un: M, 120 m alt., on argillite cliffs in left ravine. # 05-698.

*Marchantia polymorpha* L. – Un: M, 50 m alt.; on wet soil along a stream in *Fagus* and *Quercus* forest. #06-29.

*Metzgeria furcata* (L.) Dumort. – Sp: NR, SL, 2T, 100–340 m alt.; in moderately open *Fagus* and *Fagus+Carpinus* forest, on trunks of both trees; occasionally on *Fraxinus*. #05-29.

*Pellia endiviifolia* (Dicks.) Dumort. – Rr: 1T, 2T, 100–150 m alt.; on wet soil and calcareous rocks, at stream bank at gorge bottom. #05-192, 05-217.

- Plagiochila porelloides* (Nees) Lindenb. – Un: 2T, 130 m alt.; on wet aleurolites along a stream at gorge bottom. #05-53.
- Porella platyphylla* (L.) Pfeiff – Com: 20–350 m alt.; on trunks of most broad-leaved trees, mostly in relatively mesic forests in gorges, but more rarely also in xeric forests on slope to the sea. #05-154, 05-336.
- Radula complanata* (L.) Dumort. – Com: SL, Sh, L, 1T, 2T, 3T, M; 40–340 m alt.; in mesic forests, on trunks and occasionally on exserted roots of *Fagus*, *Carpinus*, *Fraxinus*, and also on rocks. #05-456, M-663.

## DISCUSSION

Altogether 119 mosses and 9 hepatics have been found in Utrish area, that is similar to territories of about the same size and level of exploration situated in about 150–200 km to the SE along the coast of Black Sea: Gagra (Ignatov & Ignatova, 1989) and Khosta (Ignatov & al., 2002).

A number of species that occur in Gagra, Khosta, and Utrish are confined in Russia mostly to the coastal zone of Black Sea and absent (or otherwise very rare) in the rest of Russian part of Caucasus: *Leptodon smithii*, *Rhynchostegium confertum*, *R. tenella*, *Scorpiurium circinatum*, *Sciurohypnum flotovianum*, *Cirriphyllum crassinerviium*, *Eucladium verticillatum*.

The surprising fact is that many species which are very common in Khosta and Gagra, 100–150 km along the coast to the south-east from Utrish are rare or absent in the studied territory. *Palamocladium euchloron*, *Anomodon attenuatus* were found in Utrish as rare or sporadic species; *Thamnobryum alopecuroides*, *Neckera crispa*, *Ctenidium molluscum*, *Homalothecium phillipeanum* were collected in a single place each; *Leucodon immersus*, *Homalia trichomanoides* and *Metzgeria conjugata* are totally absent in Utrish area.

At the same time, there is a number of species that are present and sometimes even quite common in Utrish area, while they are never found (or very rare) to the SE. Five former species of the following list are reported here for Russia for the first time (see however comments under *Dicranoweisia cirrata* and *Seligeria recurvata*).

## SPECIES NEW TO RUSSIA

*Dicranoweisia cirrata* is widespread in Mediterranean (eastward to Georgia, Turkey, and Israel) and more oceanic part of Europe and disjunct in Western North America. It was reported from Russia several times, but we failed to find in herbaria any correctly identified specimens. In Caucasus, *D. cirrata* was known only from Georgia (two collections: one in Abkhasia (1893, Radde, LE) and one in Adzharia (1975, Pocs, LE)) and recently this species was found in Khosta: on *Cupressus* trees along streets (2001, Ignatov & Ignatova, MHA, MW), but never in more or less natural forests in that area. In Utrish area *Dicranoweisia cirrata* grows mostly in natural *Pistacia*+*Juniperus*+*Quercus pubescens* forests and open *Juniperus* stands, at 5–200(–300) m alt. In the majority of populations there are abundant sporophytes.

*Rhynchostegiella curviseta* is widespread in Atlantic Europe and Mediterranean region (Europe, Africa, West Asian countries including Turkey and Iraq), but never reported for Caucasus before.

*Tortella flavovirens* is distributed in Atlantic and Central Europe and in Mediterranean countries including Turkey and Lebanon. Our record is the first one for Caucasus; *T. flavovirens* grows on slightly salty soils around small lakes on a sea shore, this habitat is rather typical for the species.

*Seligeria recurvata* was reported from Russia many times, but recent revisions (Gos, Goldberg, and ourselves) revealed that all specimens belong in fact to *S. campylopoda*. The closest locality of real *S. recurvata* is in Georgia (LE). Thus, the Utrish population of this species represents the only known locality in Russia. This species occurs in Europe and have been reported from other regions of the world, but its distribution has to be revised.

*Tortula inermis* is known from Georgia, Armenia and Azerbaijan (LE), but not from Russia. This species is common in Mediterranean region, and known also in Central Europe, Crimea,

Middle Asia and North America.

SPECIES RARE IN RUSSIA

*Habrodon perpusillus* was known previously in Russia (and the whole Caucasus) by the single recent collection from Adler, ca. 150 km to the south-east from the present locality (Ignatova & Ignatov, 2003).

*Zygodon rupestris* – the distribution of this species in Russia is obscure. Siberian collections were treated as *Z. rupestris* by Ignatov & Lewinsky-Haapasaari (1994), but later it was found that East Siberian *Zygodon* has peristomate capsules (Ignatov & al., 1999), and thus it was referred to a separate species, *Z. sibiricus*. The western border of this species is unclear, as west of the Yenissei River the plants have been never found with sporophytes. Typical *Z. rupestris* is characterized by eperistomate capsule; it is known with sporophytes in South Europe, the area phytogeographically more closely related to the studied part of Caucasus than Siberia. Other Russian collections of *Z. rupestris* are from Abrau-Dyurso and Arkhipo-Osipovka (Abramov & Abramova, LE), ca. 10 and 100 from Utrish respectively.

*Pleurochaete squarrosa* – similarly to the former species, it was collected in Abrau-Dyurso and Arkhipo-Osipovka (Abramov & Abramova, LE); thus, the coastal zone of Black Sea from Anapa to Arkhipo-Osipovka is the only region where this mainly European species occurs in Russia. This species is known also in Ukraine in Crimean Peninsula.

*Rhynchostegium megapolitanum* – Caucasus is the only region where this species is known in Russia, but besides Black Sea coastal zone, it was found, according to specimens in LE, also in Dagestan (Derbent) and in the lowland part of Krasnodarskij Territory, Gulkevichi District (Otrado-Kubanskoe).

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FIGURES

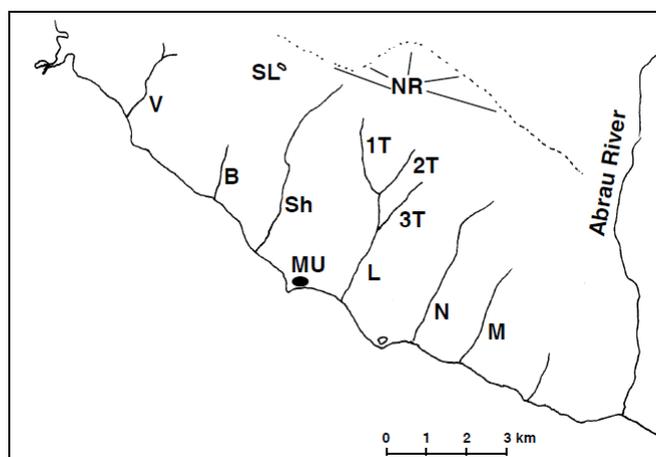


Fig. 1. Collecting localities – места сбора мхов:

- V – Vodopadnaya Shchel – Водопадная Щель  
B – Bazovaya Shchel – Базовая Щель  
Sh – Shirokaya Shchel – Широкая Щель  
L – Lobanova Shchel – Лобанова Щель  
1T – Pervaya Topolnaya Shchel – Первая Топольная Щель  
2T – Vtoraya Topolnaya Shchel – Вторая Топольная Щель  
3T – Tretya Topolnaya Shchel – Третья Топольная Щель  
N – Navagirskaya Shchel – Навагирская Щель  
M – Mokraya Shchel – Мокрая Щель  
NR – Navagir Range – гребень хребта Навагир  
SL – Sukhoj Liman Lake – озеро Сухой Лиман  
MU – Malyy Utrish – пос. Малый Утриш

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