

BRYOPHYTES OF THE KHOSTA' TAXUS AND BUXUS FOREST  
(WESTERN CAUCASUS, RUSSIA)

МОХООБРАЗНЫЕ ХОСТИНСКОЙ ТИСО-САМШИТОВОЙ РОЩИ  
(ЗАПАДНЫЙ КАВКАЗ, РОССИЯ)

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Abstract

The bryoflora of Khosta' *Taxus* and *Buxus* forest (strictly protected area, a part of Caucasian State Reserve) is described. This is the only strictly protected area in coastal zone of Black Sea in Russia. 28 species of liverworts and 100 mosses were revealed. Among them are many species, which were never found in Russian Caucasus far from the Black Sea, e. g. *Leptodon smithii*, *Eurhynchium flotovianum*, *Kindbergia praelonga*, *Plasteurhynchium striatulum*, *Pseudoscleropodium purum*, *Scorpiurium circinatum*, *Oxyrrhynchium schleicheri*, *O. pumilum*, *Rhynchostegiella teneriffae*. An overview of vegetation is given, along with the circumscription of characteristic bryophyte groups of the most widespread habitat types.

Резюме

Описана бриофлора Хостинской тисо-самшитовой рощи, заповедного участка Кавказского государственного заповедника и единственной заповедной территории России, находящейся на Черноморском побережье Кавказа. В ее составе выявлено 28 видов печеночников и 100 видов мхов. Среди них много редких видов, строго приуроченных к причерноморской зоне, в т. ч. *Leptodon smithii*, *Eurhynchium flotovianum*, *Kindbergia praelonga*, *Plasteurhynchium striatulum*, *Pseudoscleropodium purum*, *Scorpiurium circinatum*, *Oxyrrhynchium schleicheri*, *O. pumilum*, *Rhynchostegiella teneriffae*. Также дан общий очерк растительности рощи, с указанием типичных видов мохообразных для наиболее распространенных биотопов.

Khosta' *Taxus* & *Buxus* Forest (KTBF) is a separate branch of Caucasian State Nature Reserve, protected since 1930. This area is not connected with the main territory of the reserve, which is situated mostly in Middle and Upper mountain belts of Caucasus. Contrary to this, KTBF is in the coastal area of the Black Sea, ranging from 40 to 520 m elev. Its southern part is ca. 2 km from the coast, and the whole area is 1.8 km from West to East, and 2.5 km from South to North, occupying 301.3 hectare (43°30'N–39°52'E). The territory of KTBF includes the narrow canyon of Khosta River, a

rather strong current of 10-20 m wide, and southern slope of Bolshoi Akhun Mountain.

The area of the KTBF is underlaid by limestones, having quite a number of cliffs and rock outcrops, and small rocks are scattered throughout the forest. Soils are mostly humus carbonate and brown weakly podzolic clayish ones, and typically cover limestones only by 35-50 cm (Lazuk, 1960).

Climate is wet temperate, called sometimes as wet subtropical (cf. Gulisashvili, 1964). According to the data of meteorological station of Sochi (20 km NW from KTBF, at 78 m elev.),

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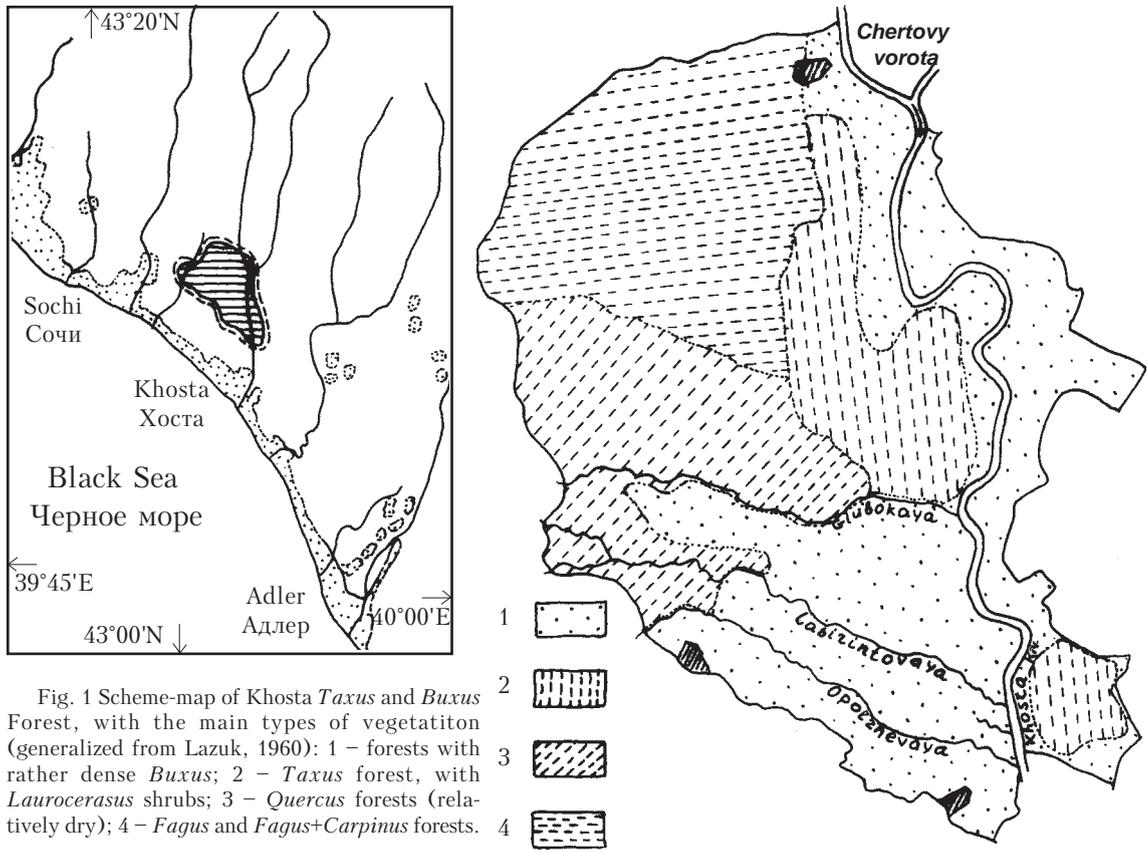


Fig. 1 Scheme-map of Khosta *Taxus* and *Buxus* Forest, with the main types of vegetation (generalized from Lazuk, 1960): 1 – forests with rather dense *Buxus*; 2 – *Taxus* forest, with *Laurocerasus* shrubs; 3 – *Quercus* forests (relatively dry); 4 – *Fagus* and *Fagus*+*Carpinus* forests.

mean annual temperature is 13.8°–14.5°C, mean temperature of the coldest month, January, is +5.3°C, frost is rare, minimal temperature record is –12°C; mean temperature of the warmest month, August, is 22.8°C; the temperature sometimes rising up to 35°C, and in summer time dry periods happen time by time. Mean annual precipitation is 1393 mm, with the maximum in autumn and winter. Snow is rare, lasting for few hours to few days. Mean relative humidity in upper part of slope within the KTBF is 72%, in canyon on Khosta River and ravines – 90% (Lazuk, 1960; Gulisashvili, 1964).

The main forest types of the KTBF were described by Lazuk (1960), who classified them by dominant trees. In regard to bryophyte vegetation two main types are contrasting: more wet forests with *Buxus colchica* Pojark., that reaches usually 6 (-8) m tall and forms rather dense second canopy layer, and more dry forests, without *Buxus*. The forest types with *Buxus* cover about a half of KTBF, 158.5 hectare.

More wet forests occur on steep slopes of

Khosta River Canyon, from 50 to 250-300 m elev. The first canopy layer at 45.8 hectare is dominated by *Taxus baccata* L. (in many places trees are more than 1 m thick, some tests showed their age above 1000 year). In the rest part upper canopy layer is formed by *Quercus hartwissiana* Stev., *Q. iberica* Stev., *Q. calcarea* Troitz., *Fagus orientalis* Lipsky, *Carpinus betulus* L., *Fraxinus excelsior* L., *Tilia caucasica* Rupr., *Acer laetum* C.A.Mey., *A. campestre* L., *A. pseudoplatanus* L., *Ostrya carpinifolia* Scop. [in more wet types more common are *Fraxinus*, *Tilia*, *Acer*, in more dry – *Quercus* and *Carpinus*]. Among shrubs the most common are *Laurocerasus officinalis* M.Roem., *Ilex colchica* Pojark., *Hedera colchica* C.Koch, *Staphylea colchica* Stev. *Tamus communis* L., *Arachne colchica* Pojark., *Smilax excelsa* L., etc. Among herbs the most common are *Ruscus colchicus* P.F.Yeo, *R. ponticus* Woronow ex Grossh., *Epimedium colchicum* (Boiss.) Trautv.

More dry forests are more common at 300-500 m elev. Species of oak dominate here, and

among shrubs are *Cotinus coggygria* Scop., *Paliurus spina-christi* Mill., *Cornus mas* L., etc.

Naturally, bryophytes are more diverse and abundant in more wet forests with *Buxus*. However rather hard and smooth surface of trunk of *Buxus* itself is not suitable for very many species. The most common on *Buxus* trunks and twigs are *Neckera crispa*, *N. complanata*, *Metzgeria furcata*, *Frullania dilatata*, *Radula complanata*, *Hypnum cupressiforme*, more rare are *Isothecium alopecuroides*, *Homalothecium sericeum*, *Ulota crispa*, *Porella platyphylla*; at trunk bases are common *Thamnobryum alopecuroides*, *Isothecium myosuroides* and *Eurhynchium flotovianum*, sometimes *Ctenidium molluscum*, *Fissidens dubius*. More rich in bryophytes species are thick trunks of *Fraxinus*, *Tilia*, *Acer* and *Quercus iberica* – besides the listed species, here are common *Palamocladium euchloron*, *Anomodon viticulosus*, *Isothecium myosuroides*, *Leucodon immersus*.

In general *Buxus* stands are quite dark. In some places, where light is more available, i. e. on slopes of ravines and in forest around big tree falls, epiphytic vegetation is immediately progressing, but mostly due to the increase in abundance of only two species, *Neckera crispa* and *N. complanata*, which are copiously hanging from every twig in such places. In such relatively open places in forest epiphytic Orthotrichaceae occur, which otherwise can be found only at forest edges or high above ground in canopy (judging from the fallen trees).

In more dry forest types the abundance of *Neckera crispa*, *Thamnobryum alopecuroides*, *Palamocladium euchloron* is suddenly decreasing, and dominating roles in epiphytic synusia shifted to *Anomodon attenuatus*, *A. viticulosus*, *Leucodon immersus*, *Frullania* spp., *Pterigynandrum filiforme*, *Leptodon smithii*. The latter species was never found in wet types of forest at ground level, but some collections were made from the fallen trees, at 6-8 m above ground, e. g. above *Buxus* canopy. The epiphytic bryophytes are abundant in the Khosta River valley up to the ultimate twigs in canopy, i.e. up to 25-30 m, as can be easily seen on the dead and still standing trees.

Wet forest types are interesting in two more aspects: (1) *Eurhynchium striatum*, usually a ground species, climbing to *Buxus* shrubs and sometimes spreading further along its twigs;

(2) some species manage to grow as epiphyllous plants: *Neckera complanata* tightly attached to leaves of *Buxus*, spreading from twig to twig, and sometimes *Cololejeunea rosettiana* and young plants of *Frullania dilatata* and *Hypnum cupressiforme* were found on surface of living leaves of *Hedera*. This *Cololejeunea* species was found occasionally spreading along branches and leaves of *Thamnobryum*.

Somewhat peculiar in epiphytes is the old *Fagus* forest on gentle slope in the NE part of the reserve ("Chertovy vorota"). Here at places trunk bases are covered by abundant *Antitrichia curtispindula* and *Bazzania trilobata*, which are absent in other parts of the KTBF.

Rotten logs in more shady and moderately wet types of forests are covered by thin, but dense mats of *Hypnum cupressiforme*. The most strongly decayed wood (especially that of *Taxus*), has *Tetraphis*, *Leucobryum juniperoides*, sometimes *Plagiothecium nemorale*, and one – *Heterophyllum affine*. Hepatics are very rare on rotten wood in the southern part of the reserve, but more diverse in its northern part, near "Chertovy vorota". Only in this part we found *Bazzania trilobata*, *Calypogeia fissa*, *Cephalozia catenulata*, *Lepidozia reptans*, *Odontoschisma denudatum*.

Ground vegetation is composed mainly by flowering plants in more dry and sunny oak forests, while more wet and dark vegetation with *Buxus* has very few vascular plant species, unable to compete with shade-tolerant mosses. In especially shady places are common *Fissidens taxifolius*, *F. bryoides*, *Oxyrrhynchium pumilum*, *Taxiphyllum densifolium*. Somewhat better lightened spots within *Buxus* stands typically have *Plagiomnium undulatum* and *Eurhynchium striatum*. These two latter species in recently opened places form sometimes very thick and extensive mats. On small rocks exerted here and there in forests with *Buxus* are rather common *Plasteurhynchium striatulum*, sometimes *Oxyrrhynchium hians*, *Eurhynchium striatum*, *E. flotovianum*. More big rock outcrops have *Eucladium verticillatum*, *Trichostomum brachydontium*, *Southbya tophacea* and *Leiocolea turbinata*, as well as almost all the species occurring on tree trunks.

The public admission to the reserve is allowed in two places. One is a viewpoint near "Chertovy

Vorota”, and another is a ecological circle trail in SW part of the KTBF, about 1.5 km long. This trail is made of concrete, and its sides are rich in bryophytes, and some weedy species have been found only or mostly here and close to administration building in the same part of the reserve.

#### EXPLORATION OF THE BRYOFLORA OF THE KTBF

The first data on the bryoflora of KTBF appeared in publication of Alper (1960), basing on collection of 1938, made by her and subsequently identified by I. I. Abramov. The list included 20 species (without annotations). Then many collections in the area has been done in 1950 by I. Palamarchuk and they were identified by A. L. Abramova and deposited in LE, but not published, except one species, *Plasteurhynchium striatulum*, published by Abramova & Abramov (1979), which finding was considered especially interesting.

Herbarium of the Caucasian Reserve includes also a number of unpublished collections of Vasilyeva, made in 1935, and occasional collections of Akatova made in 1980-1990s.

In 2002 Akatova, Ignatov and Ignatova undertook extensive bryological exploration of the territory of the KTBF, collected about 500 specimens, deposited: mosses – in MHA, MW and the herbarium of the reserve; hepatics – in KPABG and MHA. The data in the following list are based also on field observations during this field work.

#### HEPATICEAE

##### PELLIACEAE

*Pellia endiviifolia* (Dicks.) Dum. – “Chertovy Vorota”, subvertical soil banks along trail on steep slope in beech forest.

*P. neesiana* (Gott.) Limpr. – Rare, in habitats similar to previous species.

##### ANEURACEAE

*Riccardia multifida* (L.) S.Gray – At exserted root across wet trail.

##### METZGERIACEAE

*Metzgeria conjugata* Lindb. – Rather common in *Buxus* stands on slope to Khosta River, on trunks, exserted roots, occasionally on soil and on *Hedera* stems.

*M. furcata* (L.) Dum. – Quite common on trunks of *Buxus* and deciduous trees in more wet types of forests.

##### JUNGERMANNIACEAE

*Leiocolea turbinata* (Raddi) Buch – On wet and

shaded basal parts of limestone cliffs (on rocks and lithosoil) in canyon of Khosta River and Labirintovaya and Glubokaya Ravines.

*Jungermannia atrovirens* Dum. – On concrete blocks along channel in the valley of Khosta River.

##### GEOCALYCACEAE

*Lophocolea heterophylla* (Schrad.) Dum. – Rather rare on rotten wood throughout the reserve.

##### PLAGIOCHILACEAE

*Pedinophyllum interruptum* (Nees) Lindb. – Sporadic on limestone cliffs.

*Plagiochila porelloides* (Torrey ex Nees) Lindenb. – “Chertovy Vorota”, subvertical soil banks along trail on steep slope in beech forest.

##### ARNELLIACEAE

*Southbya tophacea* (Spruce) Spruce – Noticeable liverwort, relatively constantly found on wet and shaded basal parts of limestone cliffs (on rocks and lithosoil) in southern part of the reserve; often associated with *Leiocolea turbinata*. Four collections from limestone cliffs.

##### LEPIDOZIACEAE

*Bazzania trilobata* (L.) S. Gray – In one limited area in old beech forest at bases of several trunks and rather fresh fallen logs (near “Chertovy Vorota”).

*Lepidozia reptans* (L.) Dum. – “Chertovy Vorota”, beech forest, on rotten stump with *Tetraphis*.

##### CALYPOGEIACEAE

*Calypogeia fissa* (L.) Raddi – Scattered on soil banks and strongly decayed logs, especially of *Taxus* (Labirintovaya ravine, “Chertovy Vorota”).

##### CEPALOZIACEAE

*Cephalozia catenulata* (Hueb.) Lindb. – “Chertovy Vorota”, old beech forest, of rotten logs and stumps, 3 collections.

*C. lunulifolia* (Dum.) Dum. – in the same locality as previous species, with *Odontoschisma denudatum* and *Lophocolea heterophylla*.

*Odontoschisma denudatum* (Mart.) Dum. [with gemmae] – “Chertovy Vorota”, old beech forest, on rotten wood, with *Cephalozia catenulata*.

##### CEPHALOZIELLACEAE

*Cephaloziella turneri* (Hook.) K. Muell. – “Chertovy Vorota”, subvertical soil bank at a trail (with *Calypogeia fissa*).

##### RADULACEAE

*Radula lindenbergiana* Gottsche ex C.Hartm. – Common throughout KTBF on *Buxus* and deciduous trees.

##### PORELLACEAE

*Porella platyphylla* (L.) Pfeiff. – In more dry types of forests in southern part of the reserve and at Akhunskij Range, on trunks of *Acer*, *Quercus*, *Fraxinus*, *Carpinus*.

## JUBULACEAE

*Jubula huchinsiae* (Hook.) Dum. spp. *javanica* (Steph.) Verd. – *Buxus* stand, on soil near trail, mixed with *Calypogeia fissa*.

*Frullania dilatata* (L.) Dum. – Rather common in the southern part of the reserve on trunks of *Fagus*, *Fraxinus* and *Carpinus*.

*F. tamariscii* (L.) Dum. – On *Buxus* in *Buxus* stands and on *Fagus* (near “Chertovy Vorota”).

## LEJEUNEACEAE

*Cololejeunea calcarea* (Libert.) Schiffn. – Cliffs in canyon (“Labirintovaya”).

*C. rossetiana* (C. Mass.) Schiffn. – On cliffs, concrete blocks of bridge, base of *Fraxinus* trunk, upon fronds of *Thamnobryum*. Scattered throughout southern part of the reserve.

*Lejeunea cavifolia* (Ehrh.) Lindb. – In wet *Buxus* stand upon *Oxyrrhynchium pumilum* tuft (Khosta River canyon); at base of limestone cliffs, under overhangs on rocks (Akhunskij Range).

## MARCHANTIACEAE

*Marchantia polymorpha* L. – On exposed rocks in Khosta River valley and in Opolznevaya Ravine.

## CONOCEPHALACEAE

*Conocephalum conicum* (L.) Und. – In few places on grevelly land-slides in ravines and on subvertical soil banks along trail on steep slope in beech forest.

## MOSESSES

## POLYTRICHACEAE

*Atrichum undulatum* (Hedw.) P. Beauv. – In the southern part rare, on more wet soil along paths in forest. In northern part more common on steep landslides along old roads in forest and on slopes of ravine.

## TETRAPHIDACEAE

*Tetraphis pellucida* Hedw. – Rare, in more wet forest communities, on strongly decayed wood, especially of *Taxus*.

## FUNARIACEAE

*Funaria hygrometrica* Hedw. – The only collection on rocky wall in a village near “Chertovy Vorota”.

## DICRANACEAE

*Dicranella varia* (Hedw.) Schimp. – On wet and soft loamy banks at the base of slope to Khosta River; in few places, but there in abundance. Also on wet and soft limestone banks at the road along southern border of the reserve.

*Dicranum scoparium* Hedw. – In southern part of the reserve rare, on big logs of *Fagus* under *Buxus* canopy. In the northern part more common on decayed wood in *Fagus* and *Taxus* stands.

*D. viride* (Sull. et Lesq.) Lindb. – Once collected on decayed wood in beech forest (near “Chertovy Vorota”).

*Orthodicranum montanum* (Hedw.) Loeske – On decayed logs, in the northern part sporadically, in the southern part just one finding.

## LEUCOBRYACEAE

*Leucobryum juniperoideum* (Brid.) C. Muell. – Sporadic in southern part of the reserve, more common in the northern, on rotten logs and stumps.

## FISSIDENTACEAE

*Fissidens bryoides* Hedw. – On bare soil in forests, motly in relatively wet places.

*F. dubius* P. Beauv. – Along the Khosta River and Labirintovaya ravine, on wet limestones, in several places; once collected at base of *Fraxinus* in broad-leaved forest with *Buxus*.

*F. gracilifolius* Brugg.-Nann. et Nyh. (*F. minutulus* auct.) – Sporadic on wet shaded limestones, and sometimes on soil in the Khosta River valley, Labirintovaya, and other places in the southern part of KTBFB.

*F. taxifolius* Hedw. – The most common species of the genus, constantly occurring in forests with dense *Buxus*, tolerating to temporary drying and deep shade (in drier stands one of two mosses, another being *Oxyrrhynchium pumilum*). Also not rare on wet limestones.

## DITRICHACEAE

*Ceratodon purpureus* (Hedw.) Brid. – On asphalt trail near the main entrance.

## POTTIACEAE

*Barbula unguiculata* Hedw. – One collection on relatively dry rock outcrop in Labirintovaya Ravine and a number of collections in secondary habitats: on concrete walls of the reserve buildings and on soil on disturbed places along the border.

*Didymodon fallax* (Hedw.) Zander – Sporadically on wet cliffs in narrow part or Khosta River valley, also in ravines and on rocks in dry brook beds.

*D. spadiceus* (Mitt.) Limpr. – Khosta River, on soil at river bank, 10.VIII. 2000, coll. Akatova.

*Eucladium verticillatum* (Brid.) B.S.G. – Very common on wet and dripping limestones; tolerant to deep shade.

*Gymnostomum aeruginosum* Sm. – rather common on moderately wet limestone cliffs, usually with *Eucladium verticillatum*; occasionally on concrete blocks along channel and the dam of Khosta River.

*Oxystegus tenuirostris* (Hook. et Tayl.) A.J.E. Smith – In many places on concrete of the main trail and along channels, on limestone of wall of old fortress, sometimes on landslides in ravines.

*Tortella tortuosa* (Hedw.) Limpr. – Dry cliffs on the South-faced slope (Akhunskij Range), and also on fallen *Fagus* (at ca. 10 m above ground) in ravine.

*Tortula muralis* Hedw. – Rare, on rocky wall in a village near “Chertovy Vorota” and on rocks in

forest along southern border of the reserve and in Akhunskij Range.

*Trichostomum brachydontium* Bruch – Very common on mesic, moderately shaded limestones throughout the reserve.

#### CINCLIDOTACEAE

*Cinclidotus fontinalioides* (Hedw.) P.Beauv. – On rocks and cliffs along the Khosta River, in temporarily flooded places. In low water periods up to 1, rarer 2 m above the water, on wet cliffs sometimes forming pure continuous mats many meter long.

#### GRIMMIACEAE

*Grimmia pulvinata* (Hedw.) Sm. – On concrete wall near the Vistapoint and along road at the north-western border of the reserve (on Akhunskij Range).

*Schistidium apocarpum* (Hedw.) B.S.G. – On rather well exposed rocks along the Khosta River, at 1-2 m above water.

*S. elegantulum* Blom – Sporadic on rocks in broad-leaved forests.

#### ORTHOTRICHACEAE

*Orthotrichum affine* Brid. – Akhunskij Range, mesoxeric oak forest, on *Carpinus orientalis*.

*O. anomalum* Hedw. – In more open places among rather wet forest: near vistapoint and near old fortress.

*O. lyellii* Hook. et Tayl. – At the edge of forest along the western border of the reserve, on *Carpinus*, *Fraxinus* and *Morus* trees, and in oak forest at Akhunskij Range, on fallen trunk.

*O. patens* Bruch ex Brid. – On fallen trunk of *Fraxinus* near old fortress and on twigs of *Cotinus* (Akhunskij Range).

*O. pumilum* Sw. – On standing and recently fallen trunks of *Carpinus*, *Fagus*, and *Morus*.

*O. stramineum* Hornsch. ex Brid. – Akhunskij Range, on inclined trunk of *Acer* and on *Laurocerasus*.

*O. striatum* Hedw. – Two findings: on fallen *Fraxinus* (Khosta River canyon) and of trunk of *Carpinus* (Akhunskij Range).

*Ulota crispa* (Hedw.) Brid. – Moderately common in tree canopies (judging from fallen trunks), and also on trunks of deciduous trees and on shrubs (*Laurocerasus* and *Stapelia*) in rather open places (opening after big tree falls).

#### MEESIACEAE

*Leptobryum pyriforme* (Hedw.) Wils. – near buildings, on soil.

#### BRYACEAE

*Bryum argenteum* Hedw. – In few places on concrete near the reserve buildings.

*B. bimum* (Brid.) Turn. – On concrete fence in a village near “Chertovy vorota”

*B. caespiticium* Hedw. – On soil along a channel in a village at the western border of KTBF.

*B. capillare* Hedw. – Three collections: on limestones in ravine and rock outcrops on steep slope, and also on trunk, in relatively open place in forest.

*B. kunzei* Hoppe et Hornsch. – On soil near the main entrance.

*Pohlia wahlenbergii* (Web. et Mohr) Andrews – On wet and soft loam banks near Khosta River and in Opolznevaya ravine on slope of ravine. Also on disturbed places, but very rare.

#### MNIACEAE

*Mnium stellare* Hedw. – Landslide along a path on steep slope in the forest (more or less abundant).

*Plagiomnium affine* (Bland.) T.Kop. – In better illuminated places in the forest, rare in the south-eastern part of the reserve, sporadic – in the northern.

*P. rostratum* (Schrad.) T.Kop. – Rather rare on limestones, fallen logs near a brook, on sides of concrete trail, and on soil at a path side.

*P. undulatum* (Hedw.) T.Kop. – Very common on soil and sometimes on rocks in relatively wet forests, especially in better illuminated spots. At moderately wet places with more scattered trees (after partial cuttings) this species dominates in many tens of square meter. Occasionally also on rotten logs and tree bases.

*Rhizomnium punctatum* (Hedw.) T.Kop. – In one place near small waterfall in Opolznevaya ravine, on very wet rotten log.

#### FONTINALIACEAE

*Fontinalis antipyretica* Hedw. – One collection in Khosta River, in fast current.

#### LEPTODONTACEAE

*Leptodon smithii* (Hedw.) Web. et Mohr – Not rare in relatively dry *Quercus* and *Carpinus* forests (Akhunskij Range, also at the southern border of the reserve), on trunks of most species of deciduous trees. In forests with *Buxus* it occurs in canopy layer (found on fallen *Fraxinus* at 6-8 m above ground).

#### CRYPHAEACEAE

\**Cryphaea heteromalla* (Hedw.) Mohr – This species was known in Russia in the single locality in Adler, dendropark “Yuzhnye Kultury”, there it has been collected only once in 1957 (Shishkova, LE; see also Ignatov & Czerdantseva, 1995). We were able to find it in 2002 in that place, but growing in rather few trees of *Fagus*, *Acer* and *Tilia*. The area of this park is exposed to strong winds and the tornado of 2001 fell about the half of trees in the park. Thus we decided to transplant a few *Cryphaea* individuals to the border area of KTBF, to Akhunskij Range, attaching them to *Quercus*, *Fraxinus* and *Carpinus* trunks in dry type of forest. The results of this experiment shall be reported in the future.

## LEUCODONTACEAE

*Antitrichia curtipendula* (Hedw.) Brid. – Found only near “Chertovy Vorota” but in many places, growing mostly on recently fallen *Fraxinus* and *Fagus*, both in canopy and at ground level, more rarely at bases of old standing trees, among other mosses.

*Leucodon immersus* Lindb. – Very common on trunks of broad-leaved trees, especially in more dry types of forests. In forests with *Buxus* it occurs mostly in canopy level.

*L. sciuroides* (Hedw.) Schwaegr. – This species is impossible to delimit from the previous one without sporophytes. Plants with sporophytes were found only once: on fallen *Fraxinus*, in canopy part of trunk.

## ANOMODONTACEAE

*Anomodon attenuatus* (Hedw.) Hueb. – Very common on trunks of broad-leaved trees, and rarely also on *Taxus*. More abundant in dry and open forests. Not rare on limestone outcrops.

*A. longifolius* (Brid.) Hartm. – Two localities on rather open limestone cliffs, in one place abundant.

*A. viticulosus* (Hedw.) Hook. et Tayl. – Very common on trunks (mostly near their bases) of broad-leaved trees, but especially abundant in more dry *Carpinus* and *Quercus* forest (Akhunskij Range). Also common on limestones, and occasionally on concrete side of trail.

## NECKERACEAE

*Neckera besseri* Lob. – Sporadic on wet limestones in Khosta River valley and deep ravines. Some collections agree better with description of *Homalia webbiana* (Mont.) Schimp. (He, 1997), but the occurrence of this species in Caucasus needs further confirmation.

*N. complanata* (Hedw.) Hueb. – One of the commonest species on trunks of all trees, on branches and up to very thin twigs hanging and sometimes creeping upon *Buxus* leaves. Also very common on rocks. It grows upon substrate or hangs, especially in wetter habitats like in ravines and narrow canyon of Khosta River.

*N. crispa* Hedw. – Another commonest species, growing in the same habitats as the previous one and sometimes also on fallen logs and tree bases, as well as on the upper surfaces of rocks. Very abundant in wet types of forests; in dry oak forest rare (but in small quantities everywhere).

*N. pumila* Hedw. – The only collection on fallen trunk of *Fagus* in *Buxus* stand (southern part of Stezova trail). In LE is one specimens collected close to northern border of KTBF “Intershed of Western and Eastern Khosta Rivers, *Fagus* forest, 14.VIII.1930, coll. Ukhanov”.

## THAMNOBRYACEAE

*Thamnobryum alopecurum* (Hedw.) Gang. – Very common on moderately to very shaded rocks, not

rare on tree bases and sometimes just on soil in rather shaded *Buxus* stands.

## LEMBOPHYLLACEAE

*Isothecium alopecuroides* (Dubois) Isov. – Very common on trunks of deciduous trees and *Taxus*, usually at and near bases, also on rocks.

*I. myosuroides* (Dubois) Isov. – Sporadic to common, usually on trunk bases and upper surfaces of inclined trunks and above fallen trees, in relatively wet types of forests.

## PTERIGINANDRACEAE

*Pterigynandrum filiforme* Hedw. – Relatively common in rather dry *Quercus* and *Carpinus* forests on Akhunskij Range. In other parts of the reserve found only once, near “Chertovy vorota”, on fallen log in rather open beech forest.

## THUIDIACEAE

*Thuidium tamariscinum* (Hedw.) B.S.G. – Only two collections: 1) on dry shrubby slope to Khosta River, with *Pseudoscleropodium purum*; 2) on dry rock outcrops in “Labirint”.

## AMBLYSTEGIACEAE

*Amblystegium serpens* (Hedw.) B.S.G. – Rather common on sides of the concrete trail, walls of old buildings and channels, on concrete blocks along road at the reserve border.

*A. varium* (Hedw.) Lindb. – On concrete blocks of dam at Khosta River, and along a channel at southern border of the reserve.

*Cratoneuron filicinum* (Hedw.) Spruce – Wet cliffs near Khosta River and in small stream on calcareous rocks (near “Chertovy vorota”).

*Hygrohypnum luridum* (Hedw.) Jenn. – On rocks on the gravelly bar of Khosta River and along streams; also on concrete walls of channels in southern part of the reserve. Rare.

## BRACHYTHECIACEAE

*Brachythecium mildeanum* (Schimp.) Schimp. ex Milde – On grassy meadow along the southern and western border of the reserve, and on meadow near “Chertovy vorota”.

*B. populeum* (Hedw.) B.S.G. – On concrete blocks near Khosta River in southern part of KTBF.

*B. rivulare* B.S.G. – Rare on bottoms of ravines, on rocks, soil and fallen logs and on rocks at Khosta River bank.

*B. rotaeanum* De Not. – On concrete blocks near Khosta River in southern part of KTBF.

*B. rutabulum* (Hedw.) B.S.G. – Sporadic in more wet types of forests, on strongly decayed logs, occasionally on soil, trunk bases, concrete blocks and sides on main (concrete) trail.

*B. velutinum* (Hedw.) B.S.G. – Only in one place, along the trail on Akhunskij Range, on soil in relatively dry *Quercus* forests.

- Eurhynchium crassinervium* (Wils.) Schimp. – In general is rather sporadic, preferring relatively dry soil banks on slopes in moderately shady forests; in few places rather abundant on soil, exerted tree roots and rock outcrops in relatively open places in forest. Occasionally grows on concrete on side of main trail.
- E. flotovianum* (Sendtn.) Kartt. – Rather common at trunk bases in more wet forest with *Buxus*; more abundant in better illuminated habitats. Not rare also on rock outcrops, sometimes on soil in dry habitats.
- E. pulchellum* (Hedw.) Jenn. – On rocks in *Buxus* forest (between Glubokaya and Labirintovaya ravines).
- E. striatum* (Hedw.) Schimp. – One of commonest species on soil in wet to moderately wet forests (with *Plagiomnium undulatum* often forming extensive carpets); in more humid environments climbs to trunks of broad-leaved trees and *Buxus*, sometimes spreading also along twigs of the latter. Also on rocks and cliffs.
- Homalothecium sericeum* (Hedw.) B.S.G. – Very common in the neighbouring areas (in more open stands), but in the reserve is a rather rare species, or maybe more common at canopy level – collected several times on fallen trunks high above ground, and few collections in more dry open forests on trunks and on wet, diffusely illuminated cliffs. Rather rare at trunk bases of deciduous trees and *Taxus*, and occasionally on rocks and concrete blocks.
- Kindbergia praelonga* (Hedw.) Ochyra (*Eurhynchium praelongum* (Hedw.) B.S.G.) – one collection on wet soil in forest with *Buxus*.
- Oxyrrhynchium hians* (Hedw.) Loeske (= *Eurhynchium hians* (Hedw.) Sande Lac.) – Not rare on bare soil and rocks in rather shady forests; occasionally on concrete trail sides.
- O. pumilum* (Wils.) Loeske (= *Eurhynchium pumilum* (Wils.) Schimp.) – One of the most shade-tolerant species, commonly occurring (with *Fissidens taxifolius*) on bare soil spots in dark *Buxus* stands. Also common in deep niches of rock outcrops, as well as many other places on rocks and soil.
- O. schleicheri* (Hedw. f.) Jur. – In one place, in abundance: “Chertovy Vorota”, old beech forest, on soil banks along old road and at exerted roots on slope.
- Palamocladium euchloron* (C. Muell.) Wijk et Marg. – Very common on trunks of broad-leaved trees and on *Buxus*, and also on cliffs. In more humid environments climbs on thin twigs of *Buxus*, stems of *Hedera*, and pendent from cliffs.
- Plasteurhynchium striatulum* (Spruce) Fleisch. (= *Eurhynchium striatulum* (Spruce) B. S. G.) – Sporadically throughout the reserve on soil and rocks, and occasionally on trunks, but the most common on relatively low small rocks in dense, shady *Buxus* stands.
- Platyhypnidium riparioides* (Hedw.) Dix. – Common on limestones on bottoms of ravines, banks of Khosta River, on concrete of the main trail and channels.
- Pseudoscleropodium purum* (Hedw.) Fleisch. ex Broth. – The only collection on well lightened place on dry shrubby slope (upper part of cliffy, S-facing slope of Khosta canyon near the Vistapoint).
- Rhynchostegiella tenella* (Hedw.) Limpr. – On dry and moderately dry limestones and also on standing and recently fallen trunks; in many places usually in small quantities.
- R. teneriffae* (Montagne) Dirkse & Bouman (= *R. jacquinii* (Garov.) Limpr., *R. teesdalei* (B. S. G.) Limpr.) – On constantly wet and periodically, after heavy rains, overflowed limestones on bottom of big ravines (Labirintovaya, Opolznevaya and Glubokaya ravines), in abundance, and in few places on wet limestones in the lower slope to Khosta River, and on concrete of main trail.
- Rhynchostegium confertum* (Dicks.) B. S. G. – On concrete blocks near Khosta River, along a road at the border of the reserve, and on side of main trail of KTBF.
- Scorpiurium circinatum* (Brid.) Fleisch. et Loeske (*Eurhynchium circinatum* (Brid.) B.S.G.) – On relatively dry limestones, open to moderately shaded. Found in a number of places throughout the reserve on steep places of general slope of the valley, as well as on ravine slopes, but almost always in small quantities.

## CTENIDIACEAE

- Ctenidium molluscum* (Hedw.) Mitt. – Very common on wet shaded to rather open cliffs along Khosta River; sporadically occurs in many other places: on soil in *Buxus* stands (always on slopes), on sides of concrete trail, rarely at trunk bases.

## PLAGIOTHECIACEAE

- Herzogiella seligeri* (Brid.) Iwats. – Sporadic on strongly decayed wood (primarily of *Taxus*), in more wet types of forest.
- Isopterygiopsis pulchella* (Hedw.) Iwats. – Akhunskiy Range, on rather open cliff under overhang.
- Orthothecium intricatum* (C. Hartm.) B. S. G. – Few collections in small quantities on wet shaded limestone cliffs in Khosta River valley.
- Plagiothecium nemorale* (Mitt.) Jaeg. – Sporadic on strongly decayed fallen trunks (side and overhanging surfaces), wet humus in lower parts of slopes of ravines, soil banks near old roads.

## HYPNACEAE S. L.

- Heterophyllum affine* (Hook. ex Kunth) Fleisch. – one collection of strongly decayed big log of *Fagus*, on slope to Labirintovaya ravine.

*Hypnum cupressiforme* Hedw. – Very common on trunks, fallen logs (in relatively wet and shaded forests often forming pure covers upon fallen *Fagus* trunks), also on rocks.

*Platygyrium repens* (Brid.) B. S. G. – Two collections on old fallen log in rather dry oak forest (Akhunskij Range) and on rather thin trunk of *Tilia* tree in the same area.

*Pylaisia polyantha* (Hedw.) Schimp. – one collection on concrete fence of road (upper end of Akhunskaya trail).

*Taxiphyllum densifolium* (Lindb. ex Broth.) Reim. – Quite common of bare soil in more wet forest types with *Buxus*, also on exserted roots and rocks; not rarely grows in pure tufts of several square decimeter.

#### DOUBTFUL RECOREDS

Alper (1960) reported, among others, two species, *Myurella julacea* and *Trichostomum crispilum*. These species are not rare in Caucasus, but typically at higher elevations. We failed to find any specimens in the herbarium of the reserve, LE, and MW.

#### DISCUSSION

The territory of the KTBF is fairly small, but it is extremely important for the moss conservation and protection in Russia. This is the only strictly protected area in the Black Sea coastal area. This area has a relatively mild climate, suitable enough for a number of more southern and more oceanic bryophytes and vascular plant species, which are absent in any other parts of Russia. Quite a number of moss species do not occur even in the main part of the Caucasian Reserve, which is separated from the sea by at least 10 km. Among these strictly coastal species in this area are *Orthotrichum lyellii*, *O. patens*, *Taxiphyllum densifolium*, *Rhynchostegiella teneriffae*, *R. tenella*, *Oxyrrhynchium pumilum*, *O. schleicheri*, *Kindbergia praelonga*, *Scorpiurium circinatum*, *Eurhynchium flotovianum*.

Another peculiarity of the bryoflora of KTBF is the abundance of species, confined in their distribution in Russia mostly to the lower elevations of Caucasus. This group includes such species as *Thamnobryum alopecurum*, *Palamocladium euchloron*, *Neckera crispa*, *Isothecium myosuroides*, *Plasteurhynchium striatulum*, *Leptodon smithii*, *Eurhynchium striatum*, *Leucobryum juniperoideum*, *Leucodon immersus*, *Antitrichia curtipendula*, *Eurhynchium crassinervium*, etc.

Among hepatics there is one species, *Cephaloziella turneri*, which is apparently new for Russia. Previously this species was known in Georgia (Chikovani, 1986). Some more hepatic species, such as *Cololejeunea calcarea*, *C. rosettiana*, *Southbya tophacea*, *Pedinophyllum interruptum*, *Bazzania trilobata*, *Leiocollea turbinata*, as far as we know their distribution in Caucasus, occur mainly in the coastal zone and lower mountain belt (at least they were not found in Teberda Reserve, where lowermost elevation is 1350 m, Ignatova & al., 1990). Both species of *Cololejeunea* and *Southbya* are known in Russia in Caucasus only.

Most of bryophytes restricted to the coastal zone are widely distributed in south Europe, sometimes reaching along Atlantic coast to Great Britain and Scandinavia.

The noticeable fact is the very rare occurrence of mosses of Dicranaceae, Ditrichaceae and Polytrichaceae. We failed to find such species common in neighbouring areas of Caucasus, as *Ditrichum heteromallum* (Hedw.) Britt., *Distichium capillaceum* (Hedw.) B. S. G., *Diphyscium foliosum* (Hedw.) Mohr, *Pogonatum aloides* (Hedw.) P. Beauv., *Serpoleska subtilis* (Hedw.) Loeske, *Seligeria pusilla* (Hedw.) B. S. G., *Syntrichia ruralis* (Hedw.) Web. et Mohr, *Pohlia cruda* (Hedw.) Lindb., *Homalothecium philippeanum* (Spruce) B. S. G., *Tortula subulata* Hedw. Some other species common in the southern slope of Caucasus at 400-1000 m elev., are very rare in Khosta, for example *Brachythecium velutinum*, *B. populeum*, *Pterigynandrum filiforme*.

Though the area of KTBF is under protection now, some rare species are represented by rather small populations, so the thorough monitoring of their state is needed. Also, the developing of more efficient protection is necessary, because the area is surrounded by rapidly growing villages and the area itself is attractive to illegal visitors, which at present are difficult to control.

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