

MOSSES OF TSUDAKHAR (DAGESTAN, CAUCASUS)

МХИ ОКРЕСТНОСТЕЙ ЦУДАХАРА (ДАГЕСТАН, КАВКАЗ)

ASYAT S. ABAKAROVA¹, VLADIMIR E. FEDOSOV² & GALINA YA. DOROSHINA³

АСИЯТ С. АБАКАРОВА¹, ВЛАДИМИР Э. ФЕДОСОВ², ГАЛИНА Я. ДОРОШИНА³

Abstract

Moss flora of Tsudakhar Biological Station vicinity and State Nature Monument «Carpinus forest» in Dagestan is studied. 111 species are revealed and this rather low diversity is explained by xeric climatic conditions. At the same time, the flora includes several rare and interesting species: *Indusiella thianschanica*, *Jaffueliobryum latifolium*, *Orthotrichum dagestanicum* common with Middle and Central Asia. In Europe these species are restricted to the Caucasus, and Dagestan is the only place where *Indusiella* and *Orthotrichum dagestanicum* are known in Europe. Widespread tropical *Pseudosymblypharis bombayensis* is another rare species, which is known in Europe only in Dagestan. *Lindbergia grandiretis* is a species with restricted distribution in Caucasus and South Siberia.

Резюме

Исследована флора мхов окрестностей Цудахарской биологической станции и памятника природы «Грабовая роща», в ее составе выявлено 111 видов. Низкое разнообразие бриофлоры, обусловленное засушливым климатом, в то же время сочетается с большим количеством редких и интересных видов. Здесь найдены общие со Средней и Центральной Азией *Jaffueliobryum latifolium*, *Indusiella thianschanica* и *Orthotrichum dagestanicum*. В Европе эти виды известны только на Кавказе, причем для двух последних Дагестан – единственный регион, в котором они известны в Европе. Выявленный в Цудахаре широко распространенный тропический вид, *Pseudosymblypharis bombayensis*, также известен в Европе только из Дагестана. Найдена также *Lindbergia grandiretis*, распространенная помимо Кавказа еще и в засушливых районах Сибири.

KEYWORDS: moss flora, Dagestan Republic, Caucasus, xeric species, Asiatic species, biogeography

INTRODUCTION

Flora of the East Caucasus and particularly Dagestan Republic is rich both in terms of number of species and diverse geographical elements, including Ancient-Mediterranean and Iran-Turanian species and numerous Caucasian and local endemics (Murtazaliev, 2010; Takhtajan, 1986; Omarova, 2014).

Active bryofloristic studies in the territory of Dagestan Republic had started quite recently, but yielded in a number of newly described species and interesting records of strongly disjunct species (Ellis *et al.*, 2013; Fedosov, 2010; Fedosov *et al.*, 2010; Fedosov & Ignatova, 2010; Fedosov, 2011; Ignatov *et al.*, 2010), but only one local moss flora was more or less completely studied (Ignatov *et al.*, 2010). Some expeditions to Tsudakhar Biological Station of Mountain Botanical Garden provided numerous collections, summarized in the present paper.

STUDY AREA

Like previously studied in Dagestan Gunib Area, Tsudakhar is situated in so-called Inner Mountain Dag-

estan, a strongly dissected mountain area with numerous deep depressions and river valleys, within the altitudinal range of 700-2500 m (Fig. 1). In terms of rock composition it is subdivided into two parts, composed by calcareous rocks (limestones, dolomites, marls, etc.) and by schists (Chilikina & Shiffers, 1962). Tsudakhar biological station (42°19-20'N – 47°09-10'E, alt = 900-1300 m) is situated in the calcareous area.

Mountain ridges situated westward collect moisture bringing by winds from Atlantic and thus provide xeric climatic conditions in the study territory. The annual precipitation is only 260–350 mm. Mean annual temperature is +9.6°C, while mean January $t = -2.9^\circ\text{C}$ and mean August $t = +20.7$. High daily amplitude of temperature is characteristic for the local climatic condition.

The Tsudakhar biological station is situated in wide depression among low mountain spurs of Chekulabek Ridge in Sana Creek valley (Kasikumukhskoe Koysu River Basin). The area is surrounded by high xeric rocky slopes (Figs. 2-7).

¹ – Горный ботанический сад Дагестанского научного центра Российской академии наук, ул. М. Гаджиева, 45, Махачкала, Республика Дагестан, 367000, Россия – Mountain Botanical Garden of the Dagestan Scientific Centre of Russian Academy of Sciences, 45 Gadgiev Street, Makhachkala, Republic Dagestan, 367000, Russia; e-mail: asya_abakarova@list.ru

² – Biological Faculty, Moscow State University, Moscow 119991 Russia – Россия 119991 Москва, Московский государственный университет, Биологический факультет, каф. геоботаники; e-mail: fedosov_v@mail.ru

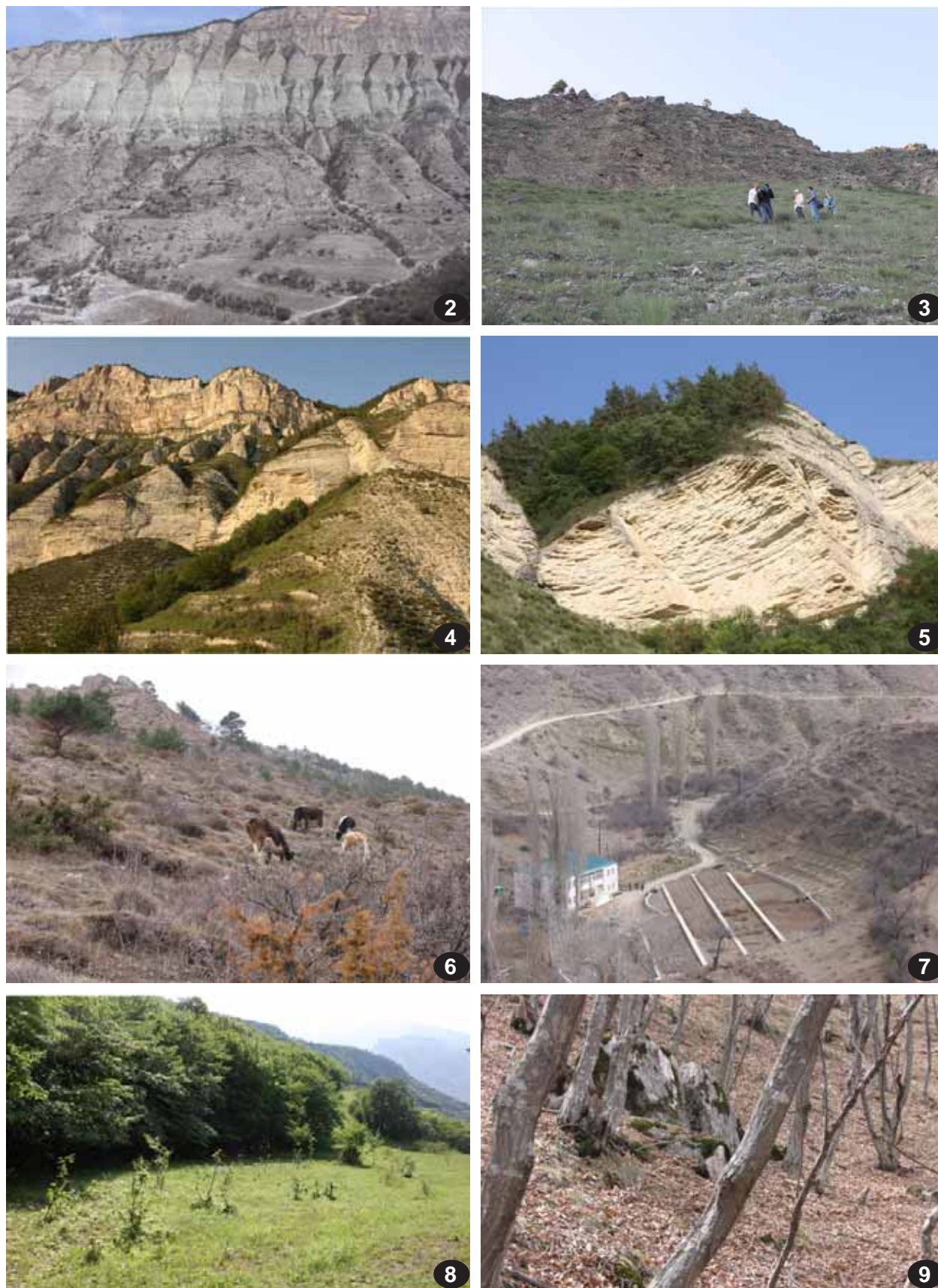
³ – V. L. Komarov Botanical Institute Rus. Acad. Sci., Prof. Popov Str., 2, St. Petersburg, 197376 Russia – Россия 197376 Санкт-Петербург, ул. Проф. Попова, 2, Ботанический институт им. В.Л. Комарова РАН; e-mail: marushka-le@mail.ru



Fig. 1. Study area.

Table 1. Species list: C – *Carpinus* wood, N- and S-facing open slopes.

	C	N	S
<i>Abietinella abietina</i>	+	+	
<i>Aloina rigida</i>		+	
<i>Amblystegium serpens</i>	+	+	
<i>Anoetangium handelii</i>			+
<i>Anomodon viticulosus</i>	+	+	+
<i>Barbula convoluta</i>		+	
<i>B. unguiculata</i>	+		
<i>Brachythecium campestre</i>	+		
<i>B. cirrosum</i>		+	
<i>B. mildeanum</i>		+	
<i>B. salebrosum</i>	+		
<i>Bryoerythrophyllum recurvirostrum</i>		+	
<i>Bryum argenteum</i>	+		
<i>B. caespiticium</i>		+	
<i>B. moravicum</i>	+		
<i>Calliergonella lindbergii</i>		+	
<i>Campyliadelphus chrysophyllus</i>	+	+	
<i>Campylidium calcareum</i>	+	+	
<i>Ceratodon purpureus</i>	+		
<i>Cratoneuron filicinum</i>		+	
<i>Crossidium squamigerum</i>			+
<i>Dicranum dispersum</i>	+		
<i>Didymodon rigidulus</i>		+	
<i>D. validus</i>	+	+	
<i>Distichium capillaceum</i>	+	+	
<i>Ditrichum flexicaule</i>		+	
<i>Encalypta pilifera</i>			+
<i>E. procera</i>	+	+	
<i>E. trachymitria</i>		+	
<i>Entodon concinnus</i>	+	+	
<i>E. schleicheri</i>		+	
<i>Entosthodon muhlenbergii</i>			+
<i>Fissidens bryoides</i>	+		
<i>F. dubius</i>	+	+	
<i>F. exiguus</i>		+	
<i>Funaria hygrometrica</i>	+	+	
<i>Grimmia anodon</i>		+	
<i>G. laevigata</i>			+
<i>G. pulvinata</i>		+	
<i>G. tergestina</i>			+
<i>Gymnostomum aeruginosum</i>		+	
<i>G. calcareum</i>		+	
<i>Homalothecium sericeum</i>		+	+
<i>Homomallium incurvatum</i>	+	+	
<i>Hypnum cupressiforme</i>		+	
<i>Indusiella thianschanica</i>			+
<i>Jaffueliobryum latifolium</i>			+
<i>Leucodon immersus</i>	+		
<i>L. sciuroides</i>	+		
<i>Lindbergia gradiretis</i>	+		
<i>Microbryum curvicollus</i>			+
<i>Mnium lycopodioides</i>	+		
<i>M. stellare</i>	+		
<i>Molendoa scliephackei</i>	+		
<i>M. sendmeriana</i>			+
<i>Myurella sibirica</i>		+	
<i>Neckera bessereri</i>		+	
<i>Orthotrichum affine</i>		+	
<i>O. anomalum</i>	+	+	
<i>O. dagestanicum</i>		+	
<i>O. diaphanum</i>	+	+	+
<i>O. obtusifolium</i>		+	
<i>O. pallens</i>		+	
<i>O. pumilum</i>		+	
<i>O. sordidum</i>		+	
<i>O. speciosum</i>		+	
<i>O. stramineum</i>		+	
<i>O. striatum</i>		+	
<i>Oxyrrhynchium hians</i>	+	+	
<i>Plagiomnium rostratum</i>	+	+	
<i>P. undulatum</i>		+	
<i>Pseudoleskeella catenulata</i>		+	
<i>P. nervosa</i>	+		
<i>P. tectorum</i>		+	
<i>Pseudosymblypharis bombayensis</i>		+	
<i>Pterygoneurum ovatum</i>		+	
<i>P. subsessile</i>		+	
<i>Pylaisia polyantha</i>	+	+	
<i>Rhodobryum ontariense</i>	+		
<i>Rhytidium rugosum</i>		+	
<i>Schistidium apocarpum</i>		+	
<i>S. crassipilum</i>		+	
<i>S. helveticum</i>		+	
<i>S. robustum</i>	+	+	
<i>Seligeria pusilla</i>	+		
<i>Stereodon vaucheri</i>		+	
<i>Syntrichia ruralis</i>		+	
<i>S. sinensis</i>		+	
<i>Taxiphyllum wissgrillii</i>		+	
<i>Thuidium assimile</i>		+	
<i>Timmia bavarica</i>	+	+	
<i>Tortella inclinata</i>	+		
<i>T. tortuosa</i>	+		
<i>Tortula acaulon</i>		+	
<i>T. atrovirens</i>		+	
<i>T. inermis</i>			+
<i>T. lanceola</i>		+	+
<i>T. modica</i>		+	
<i>T. mucronifolia</i>	+	+	
<i>T. muralis</i>		+	+
<i>T. protobryoides</i>		+	
<i>Trachycystis ussuriensis</i>	+		
<i>Trichostomum brachydontium</i>		+	
<i>T. crispulum</i>		+	
<i>Weissia brachycarpa</i>		+	+
<i>W. controversa</i>		+	
<i>W. levieri</i>		+	+
<i>W. longifolia</i>		+	
<i>W. rostellata</i>		+	



Figs. 2-9. Study area: 2-5: S-facing slope; 6:N-facing slope; 7: biostation in Sana Creek Valley; 8-9: *Carpinus* forest.

On dry south-facing slopes steppe communities occur, dominated with *Botriochloa ischaemum*, *Salvia canescens*, *Onobrychys bobrovii*, *Stipa dagestanica*, *Allium albidum*, *Sedum oppositifolium*, *Sempervivum caucasicum*, *Carex huetiana*, *Artemisia dagestanica*, *A. galodendron*, *Helianthemum dagestanicum*, *Satureja subdentata*, etc. (Murtazaliev, 2009; Murtazaliev & Guseynova, 2014).

Steppe communities alternate with polydominant montane xerophyte shrubs where *Rosa canina*, *R. spinosissima*, *Crataegus pseudoheterophylla*, *Berberis vulgaris*, *Spiraea hypericifolia*, *Artemisia salsoloides*, *A. marschalliana*, *Thymus dagestanicus*, *Onobrychis cornuta*, *Astragalus haesitabundus*, *A. alexandrii*, *A. onobrychioides*, *A. bungeanus*, etc. are common.

Steep north-facing slopes are covered by open petrophyte communities with *Teucrium chamaedrys*, *T. polium*, *Salvia canescens*, *S. verticillata*, *Gypsophila tenuifolia*, *Onobrychis cornuta*, *Astragalus alexandrii*, *A. fissuralis*, where also rare shrubs of *Rosa canina* and *Juniperus oblonga* occur (Asadulaev et al., 2013).

Pastures with strong grazing pressure have communities of *Cirsium* spp., *Euphorbia* spp., *Meniocus* spp., *Taraxacum* spp. On sandy slopes, *Iris timofejewii*, a rare xerophytic species and endemic of the Dagestan, grows.

The nature monument "Carpinus forest" (42°20' N; 47°10' E) occurs on the northern and north-eastern slopes of Chekulabek Ridge with altitudinal range 1150-1300 m. This forest occupies an area of ca. 5 hectares. This is a *Carpinus caucasica* dominated forest with admixture of *Tilia cordata* and shrub layer composed of *Euonymus verrucosus*, *Spiraea hypericifolia*, *Rosa pimpinellifolia* and *Cotoneaster meyeri*, but in many places lacking any shrubs as well as herbs (Fig. 9).

BRYOPHYTE EXPLORATION

Since 2011 the territory was studied in the course of several short excursions by authors, once together with M.S. Ignatov and N.A. Konstantinova (in 2011). Totally ca. 500 specimens were studied, they are kept in MW, MHA and LE. List of species revealed in the vicinity of the Tsudakhar biological station is provided in table 1, where species presence is shown separately for South-facing (Figs. 2-5), North-facing (Figs. 6-7) open slopes of Sana River valley and *Carpinus* forest (Figs. 8-9). Nomenclature follows Ignatov, Afonina, Ignatova et al. (2006).

The list includes 111 species, which might be considered not so many for the mountain area with numerous rocky habitats. However considering small area studied and xeric climatic conditions this number seems to be rather close to its real diversity.

The main interest of the flora is that despite of a low overall diversity it includes many rare and phytogeographically noticeable species.

Two of them, *Indusiella thianschanica* and *Lindbergia grandiretis*, are included in Red Data Book of Russian Federation (Bardunov, 2008). In this publication the

latter species is named *Lindbergia brachyptera*, but recent revision has shown that the latter species does not occur in Russia and specimens referred to it have to be considered as *Lindbergia grandiretis* (Ignatova et al., 2010), previously considered as a synonym of *L. brachyptera*, but obviously is distinct by both morphology and molecular markers. Regardless this nomenclatural issue, it is a very rare species in the Caucasus, requiring protection.

For *Indusiella*, Dagestan is the only region where it occurs not only for the Caucasus, and also for the whole Europe in definition given by Hill et al. (2006).

In Central Asia, the area where *Indusiella* is common in deserts (Ignatov et al., 2004), it usually grows associated with *Tortula atrovirens*, *Jaffueliobryum latifolium*, *Syntrichia submontana*¹. In Europe two latter species occur only in the Caucasus. *Jaffueliobryum* also was found in Actoprac xeric depression in Kabardino-Balkaria (Kharzinov et al., 2006) and in Stavropol Territory (Doroshina, 2008).

Orthotrichum dagestanicum, the species described only few years ago (Fedosov & Ignatova, 2010), also represents Asiatic relationships in the moss flora of Dagestan. An exploration of the Middle Asian moss flora by V. Plášek revealed that *O. dagestanicum* is rather common in Kyrgyzstan, in central Tian-Shan Mountains, i.e. 2500 km eastward from Dagestan (Ellis et al., 2015).

Among species found in Tsudakhar there also is widespread tropical species, *Pseudosymblypharis bombayensis*, previously revealed in Gunib Plateau (Ignatova et al., 2012). It is another example of a species known in Europe only in Dagestan.

All these data indicate an outstanding phytogeographic boundary that separates Dagestan from the rest north Caucasus. This territory will obviously bring many new discoveries.

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¹ – *Syntrichia submontana* is revealed in Europe only recently (Afonina et al., 2014) and so far is known here only in the Caucasus. It is not found in Tsudakhar yet, but likely will be revealed in this area or nearby after intensional search.

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