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Biodiversity of lichens and lichenicolous fungi of Mt Bol'šoj Thač (NW Caucasus) and its vicinity

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Abstract

The Bol'šoj Thač region (Russian Federation: Republic of Adygeâ) is characterised by a remarkably high diversity of its lichen flora. With more than 400 taxa of lichens and lichenicolous fungi being reported so far, it contains an important part of the lichens known from the NW Caucasus Mts. A considerable number of species was documented for the NW Caucasus, in some cases for the entire Caucasus, for the first time, among them several first records for the territory of the Russian Federation. Due to the presence of wood stands hardly influenced by forestry measures and the absence of air pollution, the Bol'šoj Thač region has a model character for natural European forest ecosystems. The area represents a refuge for lichen species that have, due to environmental pollution and forestry, disappeared from large regions within Europe. Ten of the eleven lichen species of the Red Data Book of Russia that are known from the Caucasus have been found in the study area, that comes up to 24 % of Russia's Red Data Book lichens. Due to the relatively low elevation compared with the Caucasian Biosphere Reserve, biogeographical peculiarities of the Caucasus are well represented. For the preservation of the taxa that are remarkable from the ecological and biogeographical points of view, virgin forest stands in moist valleys are of special importance.

Zusammenfassung

Biodiversität der Flechten und flechtenbewohnenden Pilze des Berges Bol'šoj Thač (NW Kaukasus) und seiner Umgebung – Die Flechtenflora im Umfeld des Berges Bol'šoj Tchač (Russische Föderation: Republik Adygeâ) zeichnet sich durch eine große Vielfalt aus. Mit bisher dokumentierten über 400 Taxa von Flechten und lichenicolen Pilzen umfaßt sie einen bedeutenden Teil der aus dem NW-Kaukasus überhaupt bekannten Sippen. Eine beträchtliche Zahl von Arten konnte erstmals für den NW-Kaukasus bzw. Kaukasus nachgewiesen werden, darunter verschiedene Erstnachweise für das Gebiet der Russischen Föderation. Durch das Vorhandensein forstlich wenig oder nicht beeinflußter Waldbestände unter Absenz von Schadstoffeinträgen besitzt das Gebiet Modellcharakter für natürliche europäische Waldökosysteme. So finden sich zahlreiche in Europa durch Immissionseinflüsse und forstwirtschaftliche Eingriffe großräumig zurückgegangene Sippen. Im Gebiet sind 10 der 11 aus dem Kaukasus bekannten Flechtenarten des Roten Buches der Russischen Föderation vertreten, bzw. 24 % aller Rotbuchflechten Rußlands. Durch die im Vergleich zum Kaukasischen Biosphärenreservat relativ geringe Höhenlage sind auch biogeographische Besonderheiten des Kaukasus gut repräsentiert. Für die Erhaltung der ökologisch und biogeographisch besonders bemerkenswerten Sippen sind vor allem ursprüngliche Waldbestände in feuchten Tälern von Bedeutung.

Резюме

Биоразнообразие лишайников и лихенофильных грибов г. Большой Тхач (сев.-зап. Кавказ) и своих окрестностей – Район г. Бол. Тхач (Российская Федерация: Республика Адыгея) характеризуется высоким разнообразием своей лихенофлоры. До сих пор более чем 400 таксонов лишайников и лихенофильных грибов были найдены, это является значительной частью всей известной лихенофлоры северо-западного Кавказа. Многие виды были найдены в первый раз на северо-западном Кавказе или Кавказе, в том числе виды, которые до сих пор не были известны из России. В результате присутствия лесов не подверженных влиянию или находящихся под небольшим влиянием лесопользования, при одновременном отсутствии загрязнения воздуха, район г. Бол. Тхач является модельным для природных европейских лесных экосистем. Многие из представленных здесь видов лишайников исчезли из большинства регионов Европы в результате загрязнения окружающей среды и лесопользования. В районе г. Бол. Тхача были найдены 10 из 11 известных с Кавказа краснокнижных лишайников России, это 24 % всех краснокнижных лишайников Российской Федерации. Из-за относительно малой высоты н. у. м. в сравнении с Кавказским Заповедником, в окрестностях г. Бол. Тхач биогеографические особенности Кавказа хорошо представлены. Наиболее важным для сохранения видов, примечательных с точки зрения экологии и биогеографии, являются нетронутые леса во влажных долинах.

Keywords: World Nature Heritage, Western Caucasus, nature protection

1. Introduction

The studies presented below were initiated in 1997 when the question of protecting the Bol'šoj Thač region became pressing. They provided basic information on the significance of protecting this area from a lichenological point of view. After the foundation of the Bol'šoj Thač Nature Park they were continued. In the meantime the results regarding species composition have been published in detail in a number of papers. The aim of the paper presented here is to discuss these results mainly focussing on the importance of the considered area for the preservation of lichenological biodiversity on a larger scale and the measures that are necessary to guarantee this preservation.

2. Materials and methods

The study area comprises the surroundings of Mt Bol'šoj Thač in the NW Caucasus (Russian Federation: Republic of Adygeâ, 44°02'40''N – 40°26'E) (Fig. 1). The field work was carried out during excursions, each of them lasting about 3 weeks in the years 1997 – 1999, 2001 – 2005 and 2007. They mainly took place in the summer months (usually between June and September), but in May in 2004. The basic study sites are shown in Fig. 2; they are characterised in detail in Otte (2001, 2004, 2007a).

The collected material was deposited in GLM and in the author's own herbarium, respectively. The determination methods are described in detail by Otte (2007a).

The appendix of this volume contains a complete list of the lichens and lichenicolous fungi observed in the study area; for author citations of the taxa mentioned here in the text, see there.

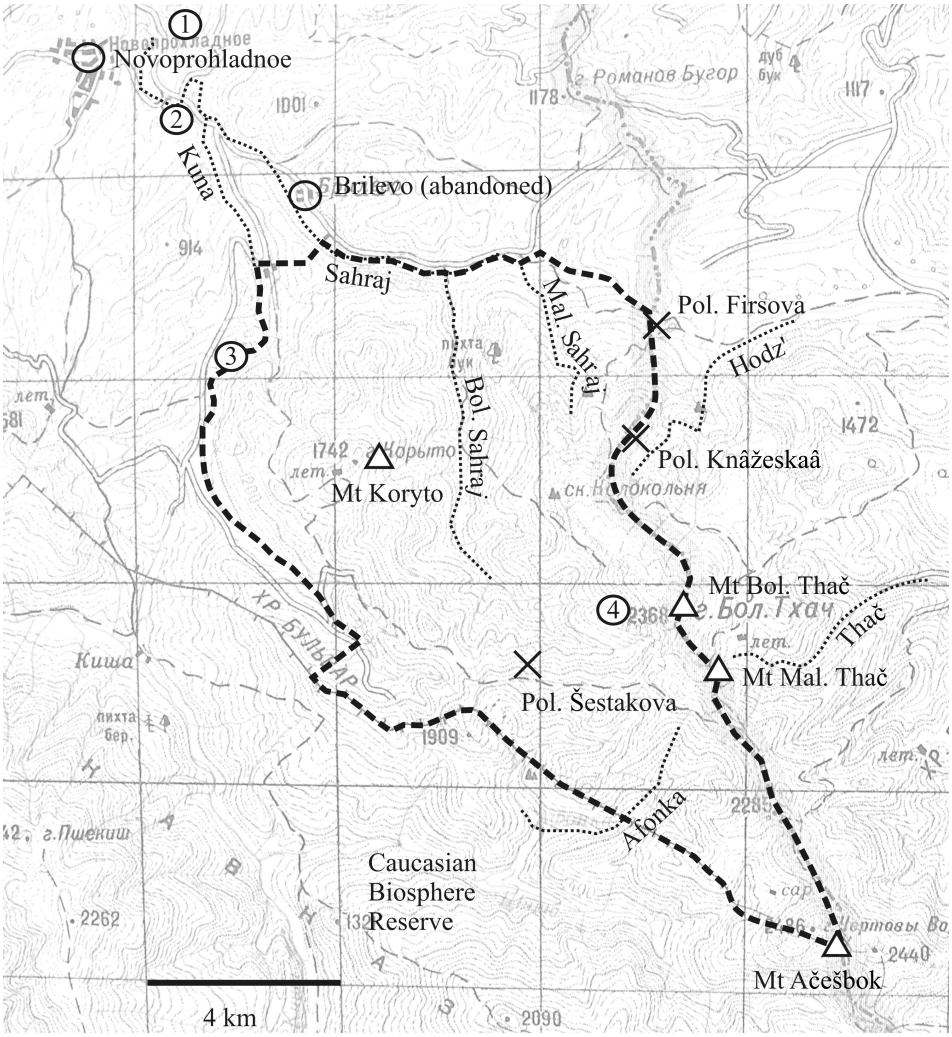
The importance of the area for the preservation of lichenological biodiversity was estimated regarding the regional and the European scale based on literature studies considering rareness and endangerdness of the species. Necessities for protection measures are derived from the occurrence of the according taxa.

Fig. 1 Location of the study area (circle)

3. Results

3.1. Biodiversity

At present, more than 400 lichen species and a number of lichenicolous fungi have been documented in the study area (OTTE 2001, 2004, 2007a, b; see appendix). Quantitatively, that comes up to 75 % of the species number of lichens that was reported by KRIVOROTOV (1995) for the whole NW Caucasus based on historical data and his own collections. Qualitatively, many taxa were found that were not previously known from the NW Caucasus (OTTE 2004, 2007a, b). Among them are also first records for Russia. In only a few cases was it possible to clarify the latter question due to the lack of a checklist. However, the most recent issues of the Russian Lichen Flora allow an estimation regarding taxa of the families considered there. They also show that many species were not as yet known from the Caucasus (see below).



① Mt Šibaba
② rapids »Man'kin Šum«
③ rocks »Krasnye Skalki«
④ refuge »Vetrennyj«
border of the nature park »Bol'šoj Thač«
rivers
Pol. = meadow (Polâna)

Fig. 2 The study area with the main study sites. Map background: Topografičeskaâ Karta Krasnodarskij Kraj, Respublika Adygeâ 1 : 200 000. 439 CÈVKF, Moskva 1996.

3.2. Red Data Book species

Among the species of lichens and lichenicolous fungi found in the study area there are a number of taxa that have been included in Red Data Books. These are

a) from the Red Data Book of the Russian Federation (Krasnaâ Kniga Rossii 2005):

Leptogium burnetiae: in the lower mountain belt widespread on tree trunks covered with bryophytes,

Leptogium hildenbrandii: margins of the meadow Polâna Firsova, on *Populus tremula*; along Sahraj valley, on tops of hills and ridges in thermophile oak stands (e.g. Mt Šibaba near Novoprohladnoe),

Lobaria amplissima: in forest stands that are not or only weakly affected by forestry, especially in the middle mountain belt (beech belt) on old deciduous trees,

Lobaria pulmonaria: in forest stands that are not or only weakly affected by forestry, from the middle mountain belt (beech belt) to the upper montane belt (fir belt) and occasionally up to the subalpine belt on old deciduous trees (in and above the fir belt on *Acer trautvetteri*),

Menegazzia terebrata: in deciduous forests, particularly in moist valleys on *Alnus incana*, also in beech forests that are not or only weakly influenced by forestry,

Nephromopsis laureri: 1 record (headwaters of the river Thač, on *Betula*),

Parmotrema arnoldii: 1 record (Afonka valley),

Parmotrema reticulatum [sub *Rimelia* r.]: 2 records: valley of the river Mal. Sahraj, on *Fagus*; above rapids »Man'kin Šum« 2 km E of the village Novoprohladnoe, on *Carpinus,*

Pyxine sorediata: valleys of the rivers Mal. Sahraj and Bol. Sahraj, on *Fagus*, rare,

Usnea florida: preferably in the lower mountain belts (oak belt and beech belt) on twigs of deciduous trees, widespread.

It is remarkable that this includes 10 of 11 (or 91 %) of all Russian Red Data Book lichens that are known to occur in the Caucasus (except for the Black Sea coast and the steppe foreland) or 10 of 42 = 24 % of the Russian Red Data Book lichens altogether.

b) Furthermore from the Red Data Book of Adygeâ (Krasnaâ Kniga Respubliki Adygeâ 2000):

Chaenothecopsis consociata: 1 record (valley of the river Afonka),

Cybebe gracilenta [sub *Coniocybe g.*]: 1 record (valley of the river Hodz'),

Lecanora mughicola: 1 record (clapboards of the refuge Vetrennyj),

Melanelia fuliginosa: in the mountain forests widespread on deciduous trees, also on *Abies,*

Ramalina fraxinea: on deciduous trees, scattered, e.g.: below the meadow Polâna Knâževskaâ, on *Acer trautvetteri* and *Sorbus aucuparia*; near the refuge Vetrennyj on *Salix*; ridge between Mt Afonka and Mt Malyj Thač, on *Acer trautvetteri,*

Ramalina sinensis [sub *R.* »*asahina*« = *R. asahinana*]: widespread in the lower and middle mountain forest belt of the study area, preferably on twigs of deciduous trees,

Usnea articulata: in the fir belt widespread on branches and twigs of *Abies.*

Krasnaâ Kniga Respubliki Adygeâ (2000) also mentions *Usnea distincta* Motyka. According to Opredelitel' lišajnikov Rossii (1996) this is probably a synonym of *U. glabrescens* that is widespread in the lower and middle mountain belts of the study area.

Furthermore, »*Bryoria jubatus* (L.) Brodo & D. Hawksw.« is mentioned in Krasnaâ Kniga Respubliki Adygeâ (2000), and »*Brioria jubatus* (L.) Ach.« in Krasnaâ Kniga Respubliki Adygeâ (1997). This probably means *Alectoria jubata* (L.) Ach., which is a nomen ambiguum and has therefore been declared as a nomen rejicendum (BRODO & HAWKSWORTH 1977, JØRGENSEN et al. 1994, GREUTER et al. 2000). *Alectoria jubata* auct. p. p. is synonym to *Bryoria fuscescens*; a species that is common in the coniferous forests of the upper mountain belt of the study area.

3.3. Further rare, endangered or otherwise remarkable species

Besides the species that are explicitly considered as endangered and declared as protected by the Red Data Books of Russia or Adygeâ, the study area shelters a high number of lichen occurrences which are to be considered as remarkable in a larger scale.

On the one hand, due to the absence of anthropogenic pollutants (Umweltbundesamt 1997) with a ± neutral pH of the precipitation (see PUČIK & MOROZOVA 1994 regarding the Teberda Reserve, which is situated 125 km ESE of the study area), a considerable number of lichens can be observed that have disappeared or become extremely rare in large regions of Europe due to air pollution. These are namely species sensitive to acidification, particularly lichens with cyanobacteria such as e.g. *Collema flaccidum*, *C. furfuraceum*, *C. nigrescens*, *C. fasciculare*, *C. fragrans*, *C. subflaccidum*, *Leptogium cyanescens*, *L. saturninum* and the Red Data Book species of the genus *Leptogium* (Ach.) Gray mentioned above, *Nephroma helveticum*, *N. parile*, *N. resupinatum*, *Pannaria conoplea*, *P. rubiginosa*, *Degelia plumbea*, *Parmeliella triptophylla*, furthermore other neutrophilous and subneutrophilous epiphytes such as *Anaptychia ciliaris*, *Bacidia incompta*, *B. rosella*, *Caloplaca flavorubescens*, *Gyalecta ulmi*, *G. truncigena*, *Sclerophora nivea* as well as further epiphytes sensitive to immissions of pollutants such as *Melanelia exasperata*, *Ochrolechia pallescens*, *Pyrenula laevigata*, *Phaeophyscia ciliata*, *Rinodina polyspora* and namely the genera *Bryoria* Brodo & D. Hawksw. and *Usnea* Dill. ex Adanson that are well represented in the area with many species, including the Red Data Book species mentioned above.

On the other hand there are »indicators of ecological continuity« (ROSE 1976, 1992) in the remnants of forest stands that have not or only slightly been influenced by forestry, where at least some old trees from the ancient stock have survived. Besides the Red Data Book species of the genus *Lobaria* (Schreber) Hoffm. mentioned above these are *L. scrobiculata* as well as *Sticta sylvatica* and *S. fuliginosa*. Our observations in the region outside the vicinity of Mt Bol'šoj Thač have shown that this is not the typical situation in the NW Caucasus. In most of the places large areas of the forests have been cut down and now consist of coppice-like woodland where the only old trunks are those of fruit trees, which have been spared. In the oak forest belt a similar situation can also be encountred in the Thač region; cohesive stands without human impact are nearly lacking, but on single old trees peculiarities such as e.g. *Bactrospora dryina* and *Caloplaca lucifuga* can be found.

Many species that can still be found (in part more or less frequently) in the study area have become so rare and endangered in Europe that they have been included into the Red Data Book of Macrolichens of the European Union (SERUSIAUX 1989). These are *Bryoria smithii*, *B. kuemmerleana*, *Cetraria sepincola*, *Degelia plumbea*, *Flavopunctelia soredica*, *Fuscopannaria praetermissa*, *F. saubinetii*, *Hypogymnia austerodes*, *Hypotrachyna*

endochlora, *Lobaria amplissima*, *L. scrobiculata*, *Nephroma helveticum*, *Nephromopsis laureri*, *Pannaria conoplea*, *P. rubiginosa*, *Parmeliella parvula*, *Parmotrema arnoldii*, *P. stuppeum*, *Peltigera venosa*, *Phaeophyscia kairamoi*, *Punctelia perreticulata*, *Pyxine sorediata*, *Ramalina obtusata*, *R. roesleri*, *R. sinensis*, *R. thrausta*, *Sticta fuliginosa*, *S. sylvatica*, *Usnea articulata* and *U. longissima*.

A considerable number of species has evidently hitherto not been observed anywhere else in Caucasia. In the recently published 8th volume of the Russian Lichen Flora (Opredelitel' lišajnikov Rossii 2003), which contains the families Bacidiaceae, Mycobilimbiaceae, Rhizocarpaceae and Trapeliaceae, and in the 9th volume (Opredelitel' lišajnikov Rossii 2004) dealing with the Fuscideaceae and Teloschistaceae, and that traditionally consider the whole former Soviet territory, *Bacidia circumspecta*, *B. fraxinea*, *B. subincompta*, *Bilimbia lobulata*, *Caloplaca cerinelloides*, *C. chrysophthalma*, *C. latzelii, C. lucifuga, Cliostomum corrugatum*, *Toninia alutacea*, *Mycobilimbia carneoalbida*, and *Rhizocarpon atroflavescens*, which were found in Bol'šoj Thač region, had not been previously mentioned from the Caucasus. They are also lacking in BARHALOV's (1983) Caucasian lichen flora. Furthermore, according to the cited volume of the »Opredelitel«, *Trapelia corticola*, *Caloplaca latzelii* and *Caloplaca lucifuga* seem to have not been known before from the whole of Russia. For the majority of the families it was not possible to judge this question with this topicality. Until now *Bacidia suffusa* was only known from eastern North America (see OTTE 2007b).

Remarkable findings are also among the lichenicolous fungi. According to Žurbenko (in litt.) *Taeniolella punctata* and *Vouauxiomyces truncatus* are first records for Russia.

Finally, there is a number of species that are remarkable from a biogeographical point of view. As was pointed out by OTTE (2004, 2007a), the Bol'šoj Thač region houses several lichens whose global distribution is concentrated on the eastern sides of Eurasia and North America respectively, and which are absent or very rare in Europe. These are namely *Phaeophyscia rubropulchra*, *Ph. erythrocardia*, *Pyxine sorediata*, *Lecanora thysanophora*, *Myelochroa aurulenta*, *M. metarevoluta*, *Ramalina conduplicans*, *Bacidia suffusa*. Most of them are not known elsewhere in the NW Caucasus.

4. Discussion

Constitutional features causing the high biodiversity of the lichen flora of the study area are doubtlessly the diverse natural conditions: the diversity of stands in a submeridional mountain area that contains several altitudinal belts from oak forests in the lower montane belt via montane beech and fir forests up to subalpine pine and birch woodlands and open alpine grasslands (see OTTE 2007c in this volume). The high diversity of species is also supported by the diversity of rock substrata (limestone and siliceous rocks) and certainly the oceanic climate conditions due to the proximity to the Black Sea.

On a smaller scale of consideration, the diversity of human utilisation (several kinds of forestry, fruit orchards, pastures) contributes to the lichen diversity as well.

Compared with similar regions in Europe, most noteworthy is the fact that the high lichen diversity is documented not only for historical times, but also contemporarily. The coincidence of virgin forests with unpolluted environments is a very remarkable feature of the study area that enables the occurrence of a high number of lichens that are threatened in Europe. Compared with Europe it is of special interest that even in the deciduous forest belt

(viz. down to the beech belt) there are some stands with only limited or absent human impact in Bol'šoj Thač region. This explains the often abundant occurrence of lichens highly threatened in Europe in the study area. In Europe the very few virgin forest remnants that are situated south of the boreal zone and below the upper montane belt are more or less under influence of pollutants. Even in the famous Białowieża virgin forest reserve in eastern Poland, which is situated rather remotely from sources of environmental pollutants, many sensitive lichens have totally disappeared, and others have become less vital due to the wide-ranging air pollution in Europe (CIEŚLIŃSKI & TOBOLEWSKI 1988). That makes the forests of the study area all that more important for the preservation of the biodiversity of Europe's lichens and a unique model region for the study of unaffected cryptogamic vegetation of European type. As was shown by PETTERSSON et al. (1995) in undisturbed compared with anthropogenically disturbed boreal coniferous forest systems of Scandinavia, the epiphytic cryptogamic synusia hold a central role in the functionality of natural forest ecosystems. There are few chances to study such questions in deciduous forest systems in Europe due to the lack of undisturbed deciduous forests, but the Bol'šoj Thač region offers this opportunity.

Particular attention should be given to the lichenicolous fungi. They often specifically depend on certain host lichens and are therefore rarer and more threatened than the lichens themselves. The rich lichen flora of the study area supports a remarkable diversity of lichenicolous fungi which have been only partly identified as yet.

The most remarkable floristic element in the lichen flora of Bol'šoj Thač region consists of the species with an »eastern distribution affinity« lacking or very rare in Europe and mainly occurring in East Asia and/or eastern North America. Their distribution pattern is accurately that of the so-called »Tertiary relicts« among the vascular plants. This pattern is interpreted differently (e.g., JÄGER 1968, MEUSEL & JÄGER 1989: ecogeographical vs. the conventional historical explanations). The occurrences of lichens of this global distribution type in the study area are concentrated in moist valleys of the lower montane belt (see OTTE 2004, 2007a and discussion there). This belt is well represented in the Bol'šoj Thač region; a fact that must be pointed out because according to AKATOVA (2004), who studied the bryophyte flora of the Caucasian Reserve, the biogeographically remarkable elements are strongly under-represented there compared with arctic-alpine species due to the extension of the Caucasian Reserve predominantly in the upper mountain belts.

Altogether, from a lichenological point of view, the vicinity of Mt Bol'šoj Thač must be considered as a very valuable part of the World Heritage Site Western Caucasus. The protection of undisturbed woodlands in moist valleys seems particularly important.

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6. References

AKATOVA, T. V. (2004): Listostebel'nye mhi Kavkazskogo zapovednika (Zapadnyj Kavkaz). – Avtoreferat dissertacii, RAN, Glavnyj botaničeskij sad im. N. V. Cicina. Moskva, 20 pp.

BARHALOV, Š. O. (1983): Flora lišajnikov Kavkaza. – Elm, Baku, 338 pp.

BRODO, I. M. & D. L. HAWKSWORTH (1977): *Alectoria* and allied genera in North America. – Opera Bot. **42**: 1 – 164

CIEŚLIŃSKI, S. & Z. TOBOLEWSKI (1988): Porosty (Lichenes) Puszczy Białowieskiej i jej zachodniego przedpola. – Phytocoenosis **1**: 1 – 216

GREUTER, W., J. MCNEILL, F. R. BARRIE, H.-M. BURDET, V. DEMOULIN, T. F. FILGUEIRAS, D. H. NICOLSON, P. C. SILVA, J. E. SKOG, P. TREHANE, N. J. TURLAND & D. L. HAWKSWORTH (2000): International Code of Botanical Nomenclature (St. Louis Code) adopted by the Sixteenth International Botanical Congress St Louis, Missouri, July-August 1999. Electronic version of the original English text, last updated April 20, 2003. – [http://www.bgbm.fu-berlin.de/iapt/nomenclature/code/SaintLouis/0000St.Luistitle.htm] (last access 19 December, 2005)

JÄGER, E. (1968): Die pflanzengeographische Ozeanitätsgliederung der Holarktis und die Ozeanitätsbindung der Pflanzenareale. – Feddes Repert. **79**: 157 – 335

JØRGENSEN, P. M., P. W. JAMES & C. E. JARVIS (1994): Linnaean lichen names and their typification. – Bot. J. Linn. Soc. **115**: 261 – 405

Krasnaâ Kniga Respubliki Adygeâ (1997): Informacionnyj bûlleten'. – Ed. by Ministerstvo ohrany okružaûšej sredy i prirodnyh resursov RA. Majkop, 20 pp.

Krasnaâ Kniga Respubliki Adygeâ (2000): Ed. by Ministerstvo ohrany okružaûšej sredy i prirodnyh resursov RA. Majkop.

Krasnaâ Kniga Rossii (2005): Perečen' ob"ektov rastitel'nogo mira, zanesennyh v Krasnuû Knigu Rossijskoj Federacii [http://www.redbook.ru/article414.html]

KRIVOROTOV, S. B. (1995): Lišajniki i lišajnikovye gruppirovki severo-zapadnogo Kavkaza i predkavkaz'â. Florističeskij i èkologičeskij analiz. – Krasnodar, 204 pp.

MEUSEL, H. & E. J. JÄGER (1989): Ecogeographical differentiation of the Submediterranean deciduous forest flora. – Plant Syst. Evol. **162**: 315 – 329

Opredelitel' lišajnikov Rossii (1996): Vol. 6. – Nauka, Sankt-Peterburg, 203 pp.

– (2003): Vol. 8. – Nauka, Sankt-Peterburg, 278 pp.

– (2004): Vol. 9. – Nauka, Sankt-Peterburg, 338 pp.

OTTE, V. (2001): Flechten und Moose im Gebiet des Bolschoi Tchatsch (NW-Kaukasus) – eine erste Übersicht, ergänzt durch einige von D. Benkert bestimmte Pezizales. – Feddes Repert. **112** (7 – 8): 565 – 582

– (2004): Flechten, Moose und lichenicole Pilze aus dem nordwestlichen Kaukasus – erster Nachtrag. – Feddes Repert. **115** (1 – 2): 155 – 163

– (2007a): Flechten, lichenicole Pilze und Moose aus dem Nordwest-Kaukasus – zweiter Nachtrag. – Herzogia **20**: 221 – 237

– (2007b): *Bacidia suffusa* (Lichenes: Bacidiaceae) in Adygheya (Caucasus), the first record outside America. – Abh. Ber. Naturkundemus. Görlitz **78** (2): 141 – 145

– (2007c): Vegetation and flora of vascular plants in the vicinity of Mt Bol'šoj Thač (NW Caucasus) and the effects of human interference. – Abh. Ber. Naturkundemus. Görlitz **79** (1): 85 – 95

Pettersson, R. B., J. P. Ball, K.-E. Renhorn, P.-A. Esseen & K. Sjöberg (1995): Invertebrate communities in boreal forest canopies as influenced by forestry and lichens with implications for passerine birds. – Biol. Conserv. **74**: 57 – 63

Pučik, M̂. L. & O. V. Morozova (1994): Kislotnost' atmosfernyh osadkov v Teberdinskom Gosudarstvennom zapovednike. – In: Kavkazskij Gosudarstvennyj Biosfernyj Zapovednik (ed.): Itogi i perspektivy ekologičeskogo monitoringa v zapovednikah. Materialy naučnoj konferencii posvâsennoj 70-letiû organizacii Kavkazskogo zapovednika. Soči: 138 – 139

Rose, F. (1976): Lichenological indicators of age and environmental continuity in woodlands. – In: Brown, D. H., D. L. Hawksworth & R. H. Bailey (eds): Lichenology: Progress and Problems. – London: 279 – 307

Rose, F. (1992): Temperate forest management: its effects on bryophyte and lichen floras and habitats. – In: Bates, J. W. & A. M. Farmer (eds): Bryophytes and Lichens in a Changing Environment. – Oxford: 211 – 233

Serusiaux, E. (1989): Liste Rouge des Macrolichens dans la Communauté Européenne. – Liège.

Umweltbundesamt (1997): Daten zur Umwelt. Der Zustand der Umwelt in Deutschland. – Ausgabe 1997, Berlin, 570 pp.

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Lichens and lichenicolous fungi found so far in the vicinity of Mt Bol. Thač[1], compiled from the available data by Volker Otte

Acarospora fuscata (Ach.) Th. Fr. (4)
Acarospora glaucocarpa (Wahlenb. ex Ach.) Körb. (4)
Acarospora macrospora (Hepp) A. Massal. ex Bagl. (1)
Acrocordia gemmata (Ach.) A. Massal. (1)
Agonimia tristicula (Nyl.) Zahlbr. (2)
Allocetraria madreporiformis (Ach.) Kärnefelt & A. Thell (1)
Amandinea punctata (Hoffm.) Coppins & Scheid. (1)
Anaptychia bryorum Poelt (4)
Anaptychia ciliaris (L.) Körb. (1)
Anisomeridium biforme (Borrer) R. C. Harris (2)
Arthonia byssacea (Weigel) Almq. (1)
Arthonia caesia (Flot.) Körb. (4)
Arthonia cinnabarina (DC.) Wallr. (4)
Arthonia dispersa (Schrad.) Nyl. (2)
Arthonia fuliginosa (Turner & Borrer) Flot. (4)
Arthonia punctiformis Ach. (4)
Arthonia radiata (Pers.) Ach. (1)
Arthonia spadicea Leight. (2)
Arthopyrenia analepta (Ach.) A. Massal. non auct. (4)
Arthothelium spectabile Flot. ex A. Massal. (2)
Arthrorhaphis alpina (Schaer.) R. Sant. (1)
Aspicilia cinerea (L.) Körb. (4)
Bacidia biatorina (Körb.) Vain. (4)
Bacidia circumspecta (Nyl. ex Vain.) Malme (4)
Bacidia fraxinea Lönnr. (2)
Bacidia friesiana (Hepp) Körb. (4)
Bacidia incompta (Borrer ex Hook.) Anzi (1)
Bacidia laurocerasi (Delise ex Duby) Zahlbr. (4)
Bacidia polychroa (Th. Fr.) Körb. (1)
Bacidia rosella (Pers.) De Not. (1)
Bacidia rubella (Hoffm.) A. Massal. (1)
Bacidia subincompta (Nyl.) Arnold (4)
Bacidia suffusa (Fr.) A. Schneid. (3, 4)
Bacidina phacodes (Körb.) Vězda (2)
Bactrospora dryina (Ach.) A. Massal. (2)
Baeomyces rufus (Huds.) Rebent. (1)
Belonia herculina (Rehm) Keissl. (1)
Biatora efflorescens (Hedl.) Räsänen (4)
Biatora longispora Lendemer & Printzen (4; 7: det. Printzen)
Bilimbia lobulata (Sommerf.) Hafellner & Coppins (2: as *Mycobilimbia l.*)
Bilimbia sabuletorum (Schreb.) Arnold (1: as *Mycobilimbia s.*)
Botryolepraria lesdainii (Hue) Canals et al. (4)
Brodoa intestiniformis (Vill.) Goward (1)
Bryoria bicolor (Ehrh.) Brodo & D. Hawksw. (1)
Bryoria capillaris (Ach.) Brodo & D. Hawksw. (1)
Bryoria fuscescens (Gyeln.) Brodo & D. Hawksw. (1)
Bryoria implexa (Hoffm.) Brodo & D. Hawksw. (1)
Bryoria kuemmerleana (Gyeln.) Brodo & D. Hawksw. (4)
Bryoria nadvornikiana (Gyeln.) Brodo & D. Hawksw. (2)
Bryoria smithii (Du Rietz) Brodo & D. Hawksw. (1)
Buellia disciformis (Fr.) Mudd (2)
Buellia erubescens Arnold (4)
Buellia griseovirens (Turner & Borrer ex Sm.) Almb. (4)
Buellia schaereri De Not. (1)
Calicium abietinum Pers. (2)
Calicium lenticulare Ach. (2)
Calicium quercinum Pers. (1)
Calicium salicinum Pers. (1)
Calicium trabinellum (Ach.) Ach. (2)
Caloplaca alociza (A. Massal.) Mig. (2)
Caloplaca ammiospila (Wahlenb.) H. Olivier (1)
Caloplaca arenaria (Pers.) Müll. Arg. (1)
Caloplaca biatorina (A. Massal.) J. Steiner (2)
Caloplaca cerina (Ehrh. ex Hedw.) Th. Fr. var. *cerina* (1)
Caloplaca cerinelloides (Erichsen) Poelt (2)
Caloplaca chalybaea (Fr.) Müll. Arg. (1)
Caloplaca chryosophthalma Degel. (4)
Caloplaca cirrochroa (Ach.) Th. Fr. (1)
Caloplaca epiphyta Lynge (4)
Caloplaca flavorubescens (Huds.) J. R. Laundon (1)
Caloplaca herbidella (Hue) H. Magn. (1)
Caloplaca holocarpa (Hoffm.) Wade (2)
Caloplaca hungarica H. Magn. (4)
Caloplaca lucifuga G. Thor (4)
Caloplaca saxicola (Hoffm.) Nordin (1)
Caloplaca xantholyta (Nyl.) Jatta (4)
Candelaria concolor (Dicks.) Stein (1)

[1] For a map of the study area see Fig. 2 on page 87 in this volume

Candelariella lutella (Vain.) Räsänen (4)
Candelariella reflexa (Nyl.) Lettau (1)
Candelariella unilocularis
sensu Nimis non (Elenkin) Nimis (4)
Candelariella xanthostigma
(Pers. ex Ach.) Lettau (4)
Catapyrenium cinereum (Pers.) Körb. (2)
Catillaria minuta (Schaer.) Lettau (1)
Catillaria nigroclavata (Nyl.) Schuler (4)
Catinaria atropurpurea
(Schaer.) Vězda & Poelt (2)
Cetraria ericetorum Opiz (1)
Cetraria islandica (L.) Ach. (1)
Cetraria muricata (Ach.) Eckfeldt (1)
Cetraria sepincola (Ehrh.) Ach. (1)
Cetrelia cetrarioides (Delise ex Duby) W. L. Culb. & C. F. Culb. (1)
Cetrelia chicitae (W. L. Culb.) W. L. Culb. & C. F. Culb. (2)
Cetrelia olivetorum (Nyl.) W. L. Culb. & C. F. Culb. (1)
Chaenotheca brunneola (Ach.) Müll. Arg. (4)
Chaenotheca chrysocephala (Turner ex Ach.) Th. Fr. (1)
Chaenotheca furfuracea (L.) Tibell (1)
Chaenotheca hispidula (Ach.) Zahlbr. (1)
Chaenotheca phaeocephala (Turner) Th. Fr. (4)
Chaenotheca stemonea (Ach.) Müll. Arg. (2)
Chaenotheca trichialis (Ach.) Th. Fr. (1)
Chaenothecopsis rubescens Vain. (4)
Chaenothecopsis viridialba (Kremp.) A. F. W. Schmidt (4)
Chrysothrix candelaris (L.) J. R. Laundon (1)
Cladonia arbuscula (Wallr.) Flot. ssp. *arbuscula* (1)
Cladonia arbuscula ssp. *mitis* (Sandst.) Ruoss (1)
Cladonia arbuscula ssp. *squarrosa* (Wallr.) Ruoss (1)
Cladonia caespiticia (Pers.) Flörke (1)
Cladonia cenotea (Ach.) Schaer. (1)
Cladonia coccifera (L.) Willd. (3)
Cladonia coniocraea (Flörke) Spreng. (1)
Cladonia convoluta (Lam.) Cout. (1)
Cladonia digitata (L.) Hoffm. (1)
Cladonia furcata (Huds.) Schrad. (4)
Cladonia furcata ssp. *subrangiformis* (Sandst.) Abbayes (2)
Cladonia gracilis (L.) Willd. (3)
Cladonia macilenta Hoffm. (3)
Cladonia macroceras (Delise) Ahti (2)
Cladonia parasitica (Hoffm.) Hoffm. (4)
Cladonia pleurota (Flörke) Schaer. (3)
Cladonia pyxidata ssp. *pocillum* (Ach.) A. E. Dahl (1)
Cladonia pyxidata (L.) Hoffm. ssp. *pyxidata* (4)
Cladonia rangiferina (L.) Weber ex F. H. Wigg. (4)
Cladonia squamosa (Scop.) Hoffm. (1)
Cladonia sulphurina (Michx.) Fr. (3)
Cladonia symphycarpia (Flörke) Fr. (2)
Cliostomum corrugatum (Ach.: Fr.) Fr. (1)
Collema auriforme (With.) Coppins & J. R. Laundon (2)
Collema cristatum (L.) Weber ex F. H. Wigg. (1)
Collema fasciculare (L.) Weber ex F. H. Wigg. (2)
Collema flaccidum (Ach.) Ach. (1)
Collema fragrans (Sm.) Ach. (2)
Collema furfuraceum (Arnold) Du Rietz (1)
Collema fuscovirens (With.) J. R. Laundon (1)
Collema limosum (Ach.) Ach. (1)
Collema multipartitum Sm. (2)
Collema nigrescens (Huds.) DC. (1)
Collema polycarpon Hoffm. (1)
Collema subflaccidum Degel. (4)
Collema tenax (Sw.) Ach. emend. Degel. (2)
Collema undulatum Laurer ex Flot. (2)
Cornicularia normoerica (Gunnerus) Du Rietz (1)
Cybebe gracilenta (Ach.) Tibell (4)
Cyphelium tigillare (Ach.) Ach. (1)
Degelia plumbea (Lightf.) P. M. Jørg. & P. James (4)
Dermatocarpon intestiniforme (Körb.) Hasse (4)
Dermatocarpon miniatum (L.) W. Mann (4)
Dimelaena oreina (Ach.) Norm. (4)
Dimerella lutea (Dicks.) Trevis. (1)
Dimerella pineti (Schrad.) Vězda (1)
Diploschistes gypsaceus (Ach.) Zahlbr. (1)
Diploschistes muscorum (Scop.) R. Sant. (1)
Diplotomma venustum Körb. (2: as *Buellia v.*)
Dirina stenhammarii (Stenh.) Poelt & Follmann (4)
Evernia divaricata (L.) Ach. (1)
Evernia mesomorpha Nyl. (2)
Evernia prunastri (L.) Ach. (1)
Farnoldia jurana (Schaer.) Hertel (4)
Flavocetraria cucullata (Bellardi) Kärnefelt & A. Thell (1)
Flavocetraria nivalis (L.) Kärnefelt & A. Thell (1)

Flavoparmelia caperata (L.) Hale (1)
Flavopunctelia soredica (Nyl.) Hale (1)
Fulgensia fulgens (Sw.) Elenkin (1)
Fulgensia schistidii (Anzi) Poelt (1)
Fuscopannaria praetermissa (Nyl.) P. M. Jørg. (4)
Fuscopannaria saubinetii (Mont.) P. M. Jørg. (4)
Graphis scripta (L.) Ach. (1)
Gyalecta jenensis (Batsch) Zahlbr. (1)
Gyalecta truncigena (Ach.) Hepp (2)
Gyalecta ulmi (Sw.) Zahlbr. (1)
Heterodermia speciosa (Wulfen) Trevis. (2)
Hyperphyscia adglutinata (Flörke) H. Mayrhofer & Poelt (2)
Hypocenomyce scalaris (Ach. ex Lilj.) M. Choisy (1)
Hypogymnia austerodes (Nyl.) Räsänen (4)
Hypogymnia bitteri (Lynge) Ahti (1)
Hypogymnia farinacea Zopf (1)
Hypogymnia physodes (L.) Nyl. (1)
Hypogymnia tubulosa (Schaer.) Hav. (1)
Hypogymnia vittata (Ach.) Parrique (1)
Hypotrachyna afrorevoluta (Krog & Swinscow) Krog & Swinscow (4)
Hypotrachyna endochlora (Leighton) Hale (1)
Hypotrachyna revoluta (Flörke) Hale (2)
Icmadophila ericetorum (L.) Zahlbr. (1)
Imshaugia aleurites (Ach.) S. L. F. Mey. (1)
Lecania cyrtella (Ach.) Th. Fr. (1)
Lecania dubitans (Nyl.) A. L. Sm. (1)
Lecania naegelii (Hepp) Diederich & van den Boom (4)
Lecanora agardhiana Ach. (2)
Lecanora albella (Pers.) Ach. (1)
Lecanora allophana (Ach.) Nyl. (1)
Lecanora argentata (Ach.) Malme (2)
Lecanora campestris (Schaer.) Hue (2)
Lecanora carpinea (L.) Vain. (1)
Lecanora cenisia Ach. (4)
Lecanora chlarotera Nyl. (2)
Lecanora cinereofusca H. Magn. (2)
Lecanora circumborealis Brodo & Vitik. (2)
Lecanora crenulata (Dicks.) Hook. (1)
Lecanora epibryon (Ach.) Ach. var. *epibryon* (1)
Lecanora glabrata (Ach.) Malme (4)
Lecanora horiza (Ach.) Linds. (1)
Lecanora intricata (Ach.) Ach. (1)
Lecanora laxa (Śliwa & Wetmore) Printzen (4)
Lecanora leuckertiana Zedda (4)
Lecanora mughicola Nyl. (4)
Lecanora muralis (Schreb.) Rabenh. s. l. (1)
Lecanora praesistens Nyl. (2)
Lecanora rupicola (L.) Zahlbr. (4)
Lecanora stenotropa Nyl. (2)
Lecanora subintricata (Nyl.) Th. Fr. (4)
Lecanora subrugosa Nyl. (2)
Lecanora symmicta (Ach.) Ach. (1)
Lecanora thysanophora R. C. Harris (2)
Lecanora varia (Hoffm.) Ach. (2)
Lecidea lapicida (Ach.) Ach. var. *pantherina* (DC.) Ach. (4)
Lecidella anomaloides (A. Massal.) Hertel & A. Kilias (6)
Lecidella carpathica Körb. (4)
Lecidella elaeochroma (Ach.) M. Choisy (4)
Lempholemma cladodes (Tuck.) Zahlbr. (4)
Lepraria incana (L.) Ach. (6, det. Bayerová)
Lepraria lobificans Nyl. (4)
Leptogium burnetiae Dodge (1)
Leptogium cyanescens (Pers.) Körb. (1)
Leptogium gelatinosum (With.) J. R. Laundon (1)
Leptogium hildenbrandii (Garov.) Nyl. (1)
Leptogium intermedium (Arnold) Arnold (4)
Leptogium lichenoides (L.) Zahlbr. (2)
Leptogium saturninum (Dicks.) Nyl. (1)
Leucocarpia dictyospora (Orange) R. Sant. (4)
Lichenomphalina umbellifera (L.: Fr.) Redhead et al. (1: as *Omphalina u*.)
Lobaria amplissima (Scop.) Forssell (1)
Lobaria pulmonaria (L.) Hoffm. (1)
Lobaria scrobiculata (Scop.) DC. (1)
Lobothallia radiosa (Hoffm.) Hafellner (4)
Maronea constans (Nyl.) Hepp (4)
Megalaria laureri (Hepp ex Th. Fr.) Hafellner (2)
Megaspora verrucosa (Ach.) Hafellner & V. Wirth (1)
Melanelia disjuncta (Erichsen) Essl. (1)
Melanelixia fuliginosa (Fr. ex Duby) O. Blanco et al. (1: as *Melanelia glabratula*)
Melanelixia glabra (Schaer.) O. Blanco et al. (1: as *Melanelia g*.)
Melanelixia subargentifera (Nyl.) O. Blanco et al. (2: as *Melanelia* s.)
Melanelixia subaurifera (Nyl.) O. Blanco et al. (1: as *Melanelia s*.)
Melanohalea exasperata (De Not.) O. Blanco et al. (1: as *Melanelia e*.)
Melanohalea exasperatula (Nyl.) O. Blanco et al. (1: as *Melanelia e*.)
Melaspilea gibberulosa (Ach.) Zwackh (1)
Menegazzia terebrata (Hoffm.) A. Massal. (1)

Micarea peliocarpa (Anzi) Coppins & R. Sant. (1)
Micarea prasina Fr. (4)
Multiclavula mucida (Pers.) R. H. Petersen (4)
Mycobilimbia carneoalbida (Müll. Arg.) Vitik. et al. (1)
Mycobilimbia epixanthoides (Nyl.) Vitik. et al. (4)
Mycobilimbia lurida (Ach.) Hafellner & Türk (4)
Mycobilimbia sanguineoatra (Wulfen) Kalb & Hafellner (1)
Mycocalicium subtile (Pers.) Szatala (4)
Mycomicrothelia wallrothii (Hepp) D. Hawksw. (4)
Myelochroa aurulenta (Tuck.) Elix & Hale (4)
Myelochroa metarevoluta (Asahina) Elix & Hale (4)
Nephroma helveticum Ach. (1)
Nephroma parile (Ach.) Ach. (1)
Nephroma resupinatum (L.) Ach. (1)
Normandina pulchella (Borrer) Nyl. (2)
Ochrolechia androgyna (Hoffm.) Arnold (2)
Ochrolechia arborea (Kreyer) Almb. (2)
Ochrolechia balcanica Verseghy (4)
Ochrolechia pallescens (L.) A. Massal. (1)
Ochrolechia szatalaensis Verseghy (4)
Ochrolechia turneri (Sm.) Hasselrot (4)
Opegrapha dolomitica (Arnold) Clauzade & Cl. Roux ex Torrente & Egea (4)
Opegrapha ochrocheila Nyl. (4)
Opegrapha rufescens Pers. (4)
Opegrapha varia Pers. (1)
Opegrapha vermicellifera (Kunze) J. R. Laundon (2)
Opegrapha viridis (Ach.) Nyl. (1)
Opegrapha vulgata (Ach.) Ach. (1)
Opegrapha vulgata var. *subseridella* Nyl. (2)
Ophioparma ventosa (L.) Norman (1)
Pachyphiale fagicola (Hepp) Zwackh (4)
Pannaria conoplea (Pers.) Bory (1)
Pannaria rubiginosa (Thunb.) Delise (2)
Parmelia barrenoae Divakar et al. (4)
Parmelia ernstiae Feuerer & A. Thell (6, conf. Feuerer)
Parmelia omphalodes (L.) Ach. (1)
Parmelia saxatilis (L.) Ach. (1)
Parmelia submontana Nádv. ex Hale (1)
Parmelia sulcata Taylor (1)
Parmeliella parvula P. M. Jørg. (4)
Parmeliella triptophylla (Ach.) Müll. Arg. (1)
Parmelina pastillifera (Harm.) Hale (1)
Parmelina quercina (Willd.) Hale (1)
Parmelina quercina var. *carporrhizans* (Taylor) V. Wirth (2)
Parmelina tiliacea (Hoffm.) Hale (1)
Parmeliopsis ambigua (Wulfen) Nyl. (1)
Parmotrema arnoldii (Du Rietz) Hale (1)
Parmotrema perlatum (Huds.) M. Choisy (1: as *P. chinense*)
Parmotrema reticulatum (Taylor) M. Choisy (2: as *Rimelia r.*)
Parmotrema stuppeum (Taylor) Hale (1)
Peltigera aphthosa (L.) Willd. (1)
Peltigera canina (L.) Willd. (4)
Peltigera collina (Ach.) Röhl. (1)
Peltigera degenii Gyeln. (1)
Peltigera didactyla (With.) J. R. Laundon (4)
Peltigera elisabethae Gyeln. (4)
Peltigera horizontalis (Huds.) Baumg. (1)
Peltigera lepidophora (Nyl. ex Vain.) Bitter (4)
Peltigera leucophlebia (Nyl.) Gyeln. (1)
Peltigera neckeri Hepp ex Müll. Arg. (1)
Peltigera polydactylon (Neck.) Hoffm. (4)
Peltigera praetextata (Flörke ex Sommerf.) Vain. (1)
Peltigera rufescens (Weiss) Humb. (4)
Peltigera venosa (L.) Baumg. (1)
Pertusaria albescens (Huds.) M. Choisy & Werner (1)
Pertusaria alpina Hepp ex Ahles (4)
Pertusaria amara (Ach.) Nyl. (1)
Pertusaria aspergilla (Ach.) J. R. Laundon (1)
Pertusaria caucasica Erichsen (2)
Pertusaria coccodes (Ach.) Nyl. (1)
Pertusaria constricta Erichsen (4)
Pertusaria corallina (L.) Arnold (4)
Pertusaria coronata (Ach.) Th. Fr. (4)
Pertusaria flavida (DC.) J. R. Laundon (4)
Pertusaria glomerata (Ach.) Schaer. (2)
Pertusaria hemisphaerica (Flörke) Erichsen (2)
Pertusaria lactea (L.) Arnold (1)
Pertusaria leioplaca DC. (1)
Pertusaria trachythallina Erichsen (2)
Pertusaria waghornei Hulting (4)
Petractis clausa (Hoffm.) Kremp. (1)
Phaeophyscia adiastola (Essl.) Essl. (4)
Phaeophyscia chloantha (Ach.) Moberg (2)
Phaeophyscia ciliata (Hoffm.) Moberg (2)
Phaeophyscia endococcina (Körb.) Moberg (6)
Phaeophyscia endophoenicea (Harm.) Moberg (1)
Phaeophyscia erythrocardia (Tuck.) Essl. (4)
Phaeophyscia hispidula (Ach.) Essl. (1)
Phaeophyscia kairamoi (Vainio) Moberg (2)
Phaeophyscia orbicularis (Neck.) Moberg (1)

Phaeophyscia pusilloides (Zahlbr.) Essl. (1)
Phaeophyscia rubropulchra (Degel.) Essl. (1)
Phaeophyscia sciastra (Ach.) Moberg (6)
Phaeorrhiza nimbosa (Fr.) H. Mayrhofer & Poelt (2)
Phlyctis agelaea (Ach.) Flot. (2)
Phlyctis argena (Spreng.) Flot. (2)
Physcia adscendens (Th. Fr.) H. Olivier (1)
Physcia aipolia (Ehrh. ex Humb.) Fürnr. (1)
Physcia caesia (Hoffm.) Fürnr. (4)
Physcia phaea (Tuck.) J. W. Thomson (4)
Physcia stellaris (L.) Nyl. (1)
Physcia tenella (Scop.) DC. (4)
Physconia detersa (Nyl.) Poelt (1)
Physconia distorta (With.) J. R. Laundon (1)
Physconia muscigena (Ach.) Poelt (1)
Physconia perisidiosa (Erichsen) Moberg (1)
Placocarpus schaereri (Fr.) Breuss (1)
Placynthiella icmalea (Ach.) Coppins & P. James (2)
Placynthium filiforme (Garov.) M. Choisy (2)
Placynthium nigrum (Huds.) Gray (1)
Platismatia glauca (L.) W. L. Culb. & C. F. Culb. (1)
Polyblastia ventulosa Grummann (4)
Porina aenea (Wallr.) Zahlbr. (1)
Porpidia albocaerulescens (Wulfen) Hertel & Knoph (4)
Porpidia crustulata (Ach.) Hertel & Knoph (4)
Porpidia macrocarpa (DC.) Hertel & A. J. Schwab (2)
Porpidia speirea (Ach.) Kremp. (4)
Protoblastenia calva (Dicks.) Zahlbr. (2)
Protoblastenia incrustans (DC.) J. Steiner (4)
Protoblastenia rupestris (Scop.) J. Steiner (4)
Protopannaria pezizoides (Weber ex F. H. Wigg.) P. M. Jørg. & S. Ekman (4)
Protoparmelia badia (Hoffm.) Hafellner (6)
Pseudephebe pubescens (L.) M. Choisy (4)
Pseudevernia furfuracea (L.) Zopf (1)
Psora crenata (Th. Tayl.) Reinke (1)
Punctelia jeckeri (Roum.) Kalb (2: as *P. ulophylla*)
Punctelia perreticulata (Räsänen) G. Wilh. & Ladd (4)
Punctelia subrudecta (Nyl.) Krog (2)
Pycnora praestabilis (Nyl.) Hafellner (4)
Pyrenula coryli A. Massal. (4)
Pyrenula laevigata (Pers.) Arnold (1)
Pyrenula nitida (Weigel) Ach. (1)
Pyrenula nitidella (Flörke ex Schaer.) Müll. Arg. (4)
Pyxine sorediata (Ach.) Mont. (2)
Ramalina baltica Lettau (4)
Ramalina calicaris (L.) Fr. (1)
Ramalina conduplicans Vain. (4)
Ramalina dilacerata (Hoffm.) Hoffm. (2)
Ramalina farinacea (L.) Ach. (1)
Ramalina fraxinea (L.) Ach. (1)
Ramalina obtusata (Arnold) Bitter (1)
Ramalina panizzei De Not. (4)
Ramalina pollinaria (Westr.) Ach. (1)
Ramalina polymorpha (Lilj.) Ach. (1)
Ramalina roesleri (Hochst. ex Schaer.) Hue (2)
Ramalina sinensis Jatta (2)
Rhizocarpon atroflavescens Lynge (4)
Rhizocarpon disporum (Nägeli ex Hepp) Müll. Arg. (4)
Rhizocarpon geographicum (L.) DC. (2)
Rhizocarpon umbilicatum (Ramond) Flagey (1)
Rhizoplaca chrysoleuca (Sm.) Zopf (4)
Rhizoplaca melanophthalma (DC.) Leuckert & Poelt (4)
Rinodina bischoffii (Hepp) A. Massal. (2)
Rinodina confragosa (Ach.) Körb. (4)
Rinodina degeliana Coppins (4)
Rinodina exigua (Ach.) Gray (4)
Rinodina griseosoralifera Coppins (4)
Rinodina immersa (Körb.) Arnold (2)
Rinodina isidioides (Borrer) H. Olivier (2)
Rinodina polyspora Th. Fr. (4)
Rinodina septentrionalis Malme (4)
Rinodina sophodes (Ach.) A. Massal. (4)
Rinodina turfacea (Wahlenb.) Körb. (4)
Sarcogyne pusilla Anzi (4)
Sclerophora pallida (Pers.) Y. J. Yao & Spooner (4)
Scoliciosporum chlorococcum (Graewe ex Stenh.) Vězda (2)
Scoliciosporum umbrinum (Ach.) Arnold (1)
Solorina bispora Nyl. (4)
Solorina saccata (L.) Ach. (1)
Squamarina cartilaginea (With.) P. James (1)
Stenocybe pullatula (Ach.) Stein (6)
Sticta fuliginosa (Dicks.) Ach. (1)
Sticta sylvatica (Huds.) Ach. (1)
Strigula stigmatella (Ach.) R. C. Harris (1)
Tephromela atra (Huds.) Hafellner (2)
Thamnolia vermicularis var. *subuliformis* (Ehrh.) Schaer. (1)
Thamnoloia vermicularis (Sw.) Ach. ex Schaer. var. *vermicularis* (4)
Thelidium zwackhii (Hepp) A. Massal. (6)
Thelotrema lepadinum (Ach.) Ach. (1)

Toninia alutacea (Anzi) Jatta (1)
Toninia candida (Weber) Th. Fr. (2)
Toninia opuntioides (Vill.) Timdal (2)
Toninia sedifolia (Scop.) Timdal (2)
Trapelia corticola Coppins & P. James (2)
Trapeliopsis flexuosa (Fr.) Coppins & P. James (4)
Trapeliopsis granulosa (Hoffm.) Lumbsch (4)
Tuckermannopsis chlorophylla (Willd.) Hale (1)
Tuckneraria laureri (Kremp.) Randl. & Thell (1)
Umbilicaria crustulosa (Ach.) Frey (4)
Umbilicaria cylindrica (L.) Delise ex Duby (1)
Umbilicaria deusta (L.) Baumg. (1)
Umbilicaria nylanderiana (Zahlbr.) H. Magn. (4)
Umbilicaria polyphylla (L.) Baumg. (6)
Umbilicaria vellea (L.) Hoffm. (4)
Usnea articulata (L.) Hoffm. (1)
Usnea barbata (L.) Weber ex F. H. Wigg. (6)
Usnea cavernosa Tuck. (1)
Usnea ceratina Ach. (1)
Usnea chaetophora Stirt. (4)
Usnea filipendula Stirt. (1)
Usnea florida (L.) Weber ex F. H. Wigg. (2)
Usnea fulvoreagens (Räsänen) Räsänen (2)
Usnea glabrata (Ach.) Vain. (2)
Usnea glabrescens (Nyl. ex Vain.) Vain. (4)
Usnea hirta (L.) Weber ex F. H. Wigg. (2)
Usnea lapponica Vain. (4)
Usnea longissima Ach. (1)
Usnea rigida (Ach.) Motyka (1)
Usnea scabrata Nyl. (2)
Usnea silesiaca Motyka (4)
Usnea subfloridana Stirt. (2)
Usnea wasmuthii Räsänen (4)
Verrucaria dufourii DC. (6)
Vulpicida pinastri (Scop.) J.-E. Mattson & M. J. Lai (1)
Xanthomendoza fallax (Hepp) Søchting et al. (2: as *Xanthoria f.*)
Xanthomendoza ulophyllodes (Räsänen) Søchting et al. (2: as *Xanthoria u.*)
Xanthoparmelia conspersa (Ach.) Hale (1)
Xanthoparmelia stenophylla (Ach.) Ahti & D. Hawksw. (4)
Xanthoria candelaria (L.) Th. Fr. (4)
Xanthoria elegans (Link) Th. Fr. (1)
Xanthoria parietina (L.) Th. Fr. (1)
Xylographa parallela (Ach.) Fr. (4)

Lichenicolous fungi

Abrothallus bertianus De Not. (4)
Chaenothecopsis consociata (Nádv.) A. F. W. Schmidt (1)
Chaenothecopsis ochroleuca (Körb.) Tibell (2)
Dactylospora lobariella (Nyl.) Hafellner (4)
Dactylospora parasitica (Flörke ex Spreng.) Zopf (2)
Microcalicium disseminatum (Ach.) Vain. (2)
Muellerella hospitans Stizenb. (2)
Phacopsis oxyspora (Tul.) Triebel & Rambold (4)
Phoma lichenis Pass. (4)
Plectocarpon lichenum (Sommerf.) D. Hawksw. (4)
Pyrenidium actinellum Nyl. (2)
Sphinctrina turbinata (Pers.) De Not. (2)
Stigmidium microspilum (Körb.) D. Hawksw. (4)
Stigmidium schaereri (A. Massal.) Trevis. (2)
Taeniolella phaeophysciae D. Hawksw. (4)
Taeniolella punctata M. S. Christ. & D. Hawksw. (2)
Vouauxiomyces truncatus (de Lesd.) Dyko & D. Hawksw. (2)

Data sources

(1) Otte, V. (2001): Flechten und Moose im Gebiet des Bolschoi Tchatsch (NW-Kaukasus) – eine erste Übersicht, ergänzt durch einige von D. Benkert bestimmte Pezizales. – Feddes Repert. **112**: 565 – 582

(2) Otte, V. (2004): Flechten, Moose und lichenicole Pilze aus dem nordwestlichen Kaukasus – erster Nachtrag. – Feddes Repertorium **115** (1 – 2): 155 – 163

(3) Otte, V.: collections of I. Brunk 08/2005, det. V. Otte

(4) Otte, V. (2007): Flechten, lichenicole Pilze und Moose aus dem Nordwest-Kaukasus – zweiter Nachtrag. – Herzogia **20**: 221 – 237

(5) Otte, V. (2007): *Bacidia suffusa* (Lichenes: Bacidiaceae) in Adygheya (Caucasus), the first record outside America. – Abh. Ber. Naturkundemus. Görlitz **78** (2): 141 – 145

(6) Otte, V. (ined.)

(7) Printzen, Ch. & V. Otte (2005): *Biatora longispora*, new to Europe, and a revised key to European and Macaronesian *Biatora* species. – Graphis Scripa **17** (2): 56 – 61

Fig. A2-54

Fig. A2-55

Fig. A2-56

Fig. A2-57

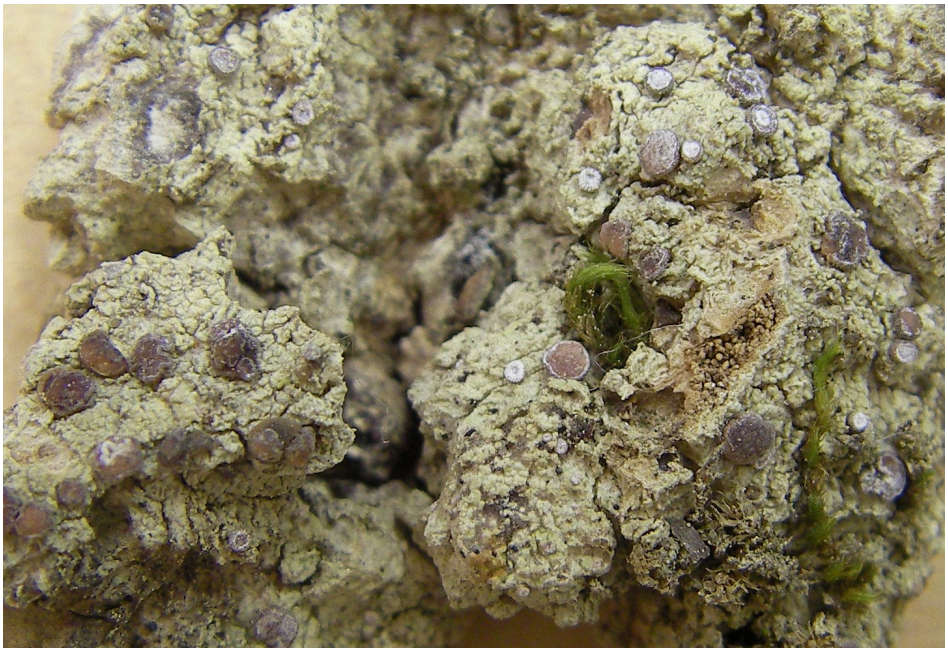

Fig. A2-58

Fig. A2-59

Fig. A2-54 Beard lichens are common in the upper mountain forest belt of the study area (near the Polâna Šestakova, *Abies* branch with *Bryoria capillaris* and other lichens, August 2007, Photo: V. Otte)

Abb. A2-54 Bartflechten sind eine gewöhnliche Erscheinung in der oberen Bergwaldstufe des Untersuchungsgebietes (nahe der Polâna Šestakova, *Abies*-Ast mit *Bryoria capillaris* und anderen Flechten, August 2007, Foto: V. Otte)

Илл. A2-54 Бородатые лишайники в области исследования являются обычным явлением в верхнем горно-лесном поясе (возле поляны Шестакова, пихтовый (*Abies*) сук с *Bryoria capillaris* и другими лишайниками, август 2007 г., фото: Ф. Отте)

Fig. A2-55 *Ramalina conduplicans* was hitherto only known from East Asia and the Himalayas. In the study area it occurs scattered in the lower and middle mountain forest belts, particularly in moist valleys (valley of the Malyj Sahraj, floodplain of the river, alder forest, on *Alnus incana*, August 2007, Photo: V. Otte).

Abb. A2-55 *Ramalina conduplicans* war bisher nur aus Ostasien und dem Himalaja bekannt. Im Untersuchungsgebiet ist sie zerstreut in der unteren und mittleren Bergwaldstufe anzutreffen, besonders in feuchten Tälern (Tal des Malyj Sahraj, Bachaue, Erlenwald, an *Alnus incana*, August 2007, Foto: V. Otte).

Илл. A2-55 *Ramalina conduplicans* до сих пор была известна только в восточной Азии и в Гималаях. В области исследования она встречается рассеянно в нижнем и среднем горно-лесных поясах, в частности во влажных долинах (долина р. Малый Сахрай, ольшаник в пойме реки, на *Alnus incana*, август 2007 г., фото: Ф. Отте).

Fig. A2-56, A2-57 While *Phaeophyscia rubropulchra* (Photo above) is common in the beech belt of the study area, its fertile »sister species« *Ph. erythrocardia* (Photo below) was found only in the Afonka valley. Both behave as »Tertiary relicts« with a preference for areas with warm and simultaneously moist summers and are therefore very rare or absent in Europe. (*Ph. rubropulchra*: herbarium specimen GLM-L-15520, on *Fagus orientalis* near the rapids Man'kin Šum, leg. V. Otte August 2003; *Ph. erythrocardia*: herbarium specimen GLM-L-23089, on *Acer* in the Afonka valley at 1250 m a.s.l., leg. V. Otte August 2005; Photo: V. Otte)

Abb. A2-56, A2-57 Während *Phaeophyscia rubropulchra* (Foto oben) in der Buchenwaldstufe des Untersuchungsgebietes eine gewöhnliche Erscheinung ist, wurde ihre fertile »Schwesterart« *Ph. erythrocardia* (Foto unten) nur im Afonkatal gefunden. Beide verhalten sich wie »Tertiärrelikte« mit Bevorzugung von Gebieten mit warmen und zugleich feuchten Sommern und sind daher in Europa sehr selten oder fehlen dort ganz. (*Ph. rubropulchra*: Herbarbeleg GLM-L-15520, an *Fagus orientalis* nahe dem Wasserfall Man'kin Šum, leg. V. Otte August 2003; *Ph. erythrocardia*: Herbarbeleg GLM-L-23089, an *Acer* im Afonkatal auf 1250 m ü. NN, leg. V. Otte August 2005; Foto: V. Otte)

Илл. A2-56, A2-57 Если *Phaeophyscia rubropulchra* (верхний снимок) обычна для букового пояса в области исследования; то её плодородная »видовая-родственница« *Ph. erythrocardia* (нижний снимок) была найдена только в долине р. Афонка. Обе ведут себя как реликты третичного периода, предпочитают области с тёплым и одновременно влажным летом и поэтому в Европе встречаются очень редко или вообще отсутствуют. (*Ph. rubropulchra*: гербарный образец GLM-L-15520, на *Fagus orientalis* возле водопада Манькин Шум, сбор Ф. Отте август 2003 г.; *Ph. erythrocardia*: гербарный образец GLM-L-23089, на *Acer* в долине р. Афонка на 1250 м н. у. м., сбор Ф. Отте август 2005 г.; фото: Ф. Отте)

Fig. A2-58 *Bacidia suffusa* was hitherto only known from eastern North America (near the rapids Man'kin Šum, on *Fraxinus*, herbarium specimen GLM-L-15516, leg. V. Otte August 2003, Photo: V. Otte)

Abb. A2-58 *Bacidia suffusa* war bisher nur aus dem östlichen Nordamerika bekannt (nahe dem Wasserfall Man'kin Šum, an *Fraxinus*, Herbarexemplar GLM-L-l5516, leg. V. Otte August 2003, Foto: V. Otte)

Илл. A2-58 *Bacidia suffusa* была до сих пор известна только на востоке Северной Америки (возле водопада Манькин Шум, на *Fraxinus*, гербарный образец GLM-L-15516, сбор Ф. Отте август 2007 г., фото: Ф. Отте)

Fig. A2-59 *Lecanora thysanophora* can be found everywhere in the beech belt of the study area. It was described only some years ago from eastern North America and evidently also belongs to the species with an affinity to the summer-moist climate type characteristic to the eastern sides of the continents with parts of Caucasia as the most important outpost in western Eurasia (between Mt Koryto and the Kuna valley, 1300 m, August 2007, Photo: V. Otte).

Abb. A2-59 *Lecanora thysanophora* ist in der Buchenwaldstufe des Untersuchungsgebietes allgegenwärtig. Sie wurde erst vor wenigen Jahren aus dem östlichen Nordamerika beschrieben und gehört offenbar ebenfalls zu den Arten, die das sommerfeuchte Klima auf den Ostseiten der Kontinente bevorzugen und ihren wichtigsten Vorposten innerhalb Westeurasiens im Kaukasus besitzen (zwischen dem Berge Koryto und dem Kunatal, 1300 m, August 2007, Foto: V. Otte).

Илл. A2-59 *Lecanora thysanophora* в области исследования встречается повсеместно в поясе букняка. Она была описана буквально несколько лет назад на востоке Северной Америки и очевидно принадлежит к видам, тоже предпочитающих климат с влажным летом, характерным для восточных частей континентов, и нашедщих на Кавказе свой самый значимый форпост в пределах западной Евразии (между г. Корыто и долиной р. Куна, 1300 м н. у. м., август 2007 г., фото: Ф. Отте).