Abh. Ber. Naturkundemus. Görlitz	Band 79 Heft 1	S. 85 – 95	2007

ISSN 0373-7586

Vegetation and flora of vascular plants in the vicinity of Mt Bol'šoj Thač (NW Caucasus) and the effects of human interference

VOLKER OTTE

University of Potsdam and State Museum of Natural History, Görlitz

Abstract

The area of study is characterised by multifaceted vegetation and flora in several altitudinal belts. These include virgin forests from the fir belt downward to the beech belt, and species of the Red Data Books of Russia and Adygeâ. Special attention has to be paid to the protection of virgin forests of the lower mountain belt, which are a peculiarity over a wide area as a consequence of forestry in most regions. Diverse, probably ancient open vegetation areas in the mountain forest belt are now in a wood succession process as a result of abandonment of their use. For their preservation, a moderate utilisation by mowing and pasture would be favourable. Among the threatened species, the occurrence of *Steveniella satyroides* is remarkable, which belongs to category »1« of the Red Data Book of Russia. It was observed only outside the borders of the Nature Park »Bol'šoj Thač«.

Zusammenfassung

Über Vegetation und Flora der Gefäßpflanzen im Umfeld des Berges Bol'šoj Thač (NW-Kaukasus) und deren anthropogene Beeinflussung – Das Untersuchungsgebiet ist durch eine vielfältige Vegetation und Flora in verschiedenen Höhenstufen ausgezeichnet. Hierzu zählen unberührte Waldbestände von der Tannen- bis herab in die Buchenwaldstufe und Pflanzenarten der Roten Bücher Rußlands und Adygeâs. Besonderes Augenmerk erfordert die Erhaltung der Urwälder vor allem der tieferen Lagen, da diese großräumig eine Besonderheit darstellen. Artenreiche, eventuell jahrhundertealte Offenlandbereiche in der Bergwaldstufe unterliegen zur Zeit infolge Nutzungsaufgabe einer progessiven Sukzession. Zu ihrer Erhaltung wäre eine mäßige Nutzung als Wiesen und Weiden günstig. Unter den Vorkommen gefährdeter Arten ist jenes von *Steveniella satyroides* besonders hervorzuheben, die der Kategorie »1« des Roten Buches der Pflanzen Rußlands angehört. Sie wurde nur außerhalb der Grenzen des Naturparkes »Bol'šoj Thač« beobachtet.

Резюме

О флоре и растительности сосудистых растений в окрестностях г. Большой Тхач (сев.-зап. Кавказ) и антропогенном воздействии на них – Район исследований характеризутся разнообразием растительности и флоры в разных высотных поясах. К ним относятся и нетронутые леса от пояса пихтарников вниз до пояса букняков с многочисленными видами Красных книг России и Адыгеи. Особенное внимание

требует сохранение девственных лесов прежде всего, нижнего горного пояса, поскольку они являются особенностью в результате интенсивного лесопользования в остальных регионах. Вероятно многовековые поляны в горнолесном поясе с богатым разнообразием видов как раз находятся в процессе лесной сукцессии, происходящем в настоящее время в результате окончания их использования. Для сохранения их было бы полезным организовать их умеренное использование для сенокоса и выпаса скота. Среди видов находящихся под угрозой *Steveniella satyroides* особенно замечательна, занесенная в категорию »1« Красной Книги Растений России. Она была наблюдена только вне Природного Парка »Большой Тхач«.

Keywords: World Heritage Site Western Caucasus, biodiversity, protection

1. Introduction

This paper aims at giving an overview on vascular plant flora and vegetation in the vicinity of Mt Bol'šoj Thač as defined below. In general, the author's own observations on this topic have the character of background studies regarding habitat characterisation of the lichen vegetation (see Otte 2007 in this volume). Detailed investigations on vascular plant vegetation have not been done by the author. However, a number of papers have dealt with special problems of the vegetation of the study area during the last years (see below).

2. Materials and methods

The study area comprises the vicinity of Mt Bol'šoj Thač (44°02'40"N – 40°26'E) in the World Heritage Site »Western Caucasus« (Russian Federation: Republic of Adygeâ) (Fig. 1).

Fig. 1 Location of the study area (circle)

»Vicinity« is defined here as the area from Mt Bol'šoj Thač (2368 m) down to the village of Novoprohladnoe (650 m) ca. 18 km NW and up to Mt Ačešbok (Čertovy Vorota, 2486 m) ca. 6 km SE, including the valleys of the rivers Bol'šoj Sahraj, Malyj Sahraj, Sahraj and Kuna, the headwaters of the rivers Afonka, Thač and Hodz' and the mountain ridge that leads SW of river Bol'šoj Sahraj from Mt Malyj Thač via the meadow Polâna Šestakova to Mt Koryto (Fig. 2).

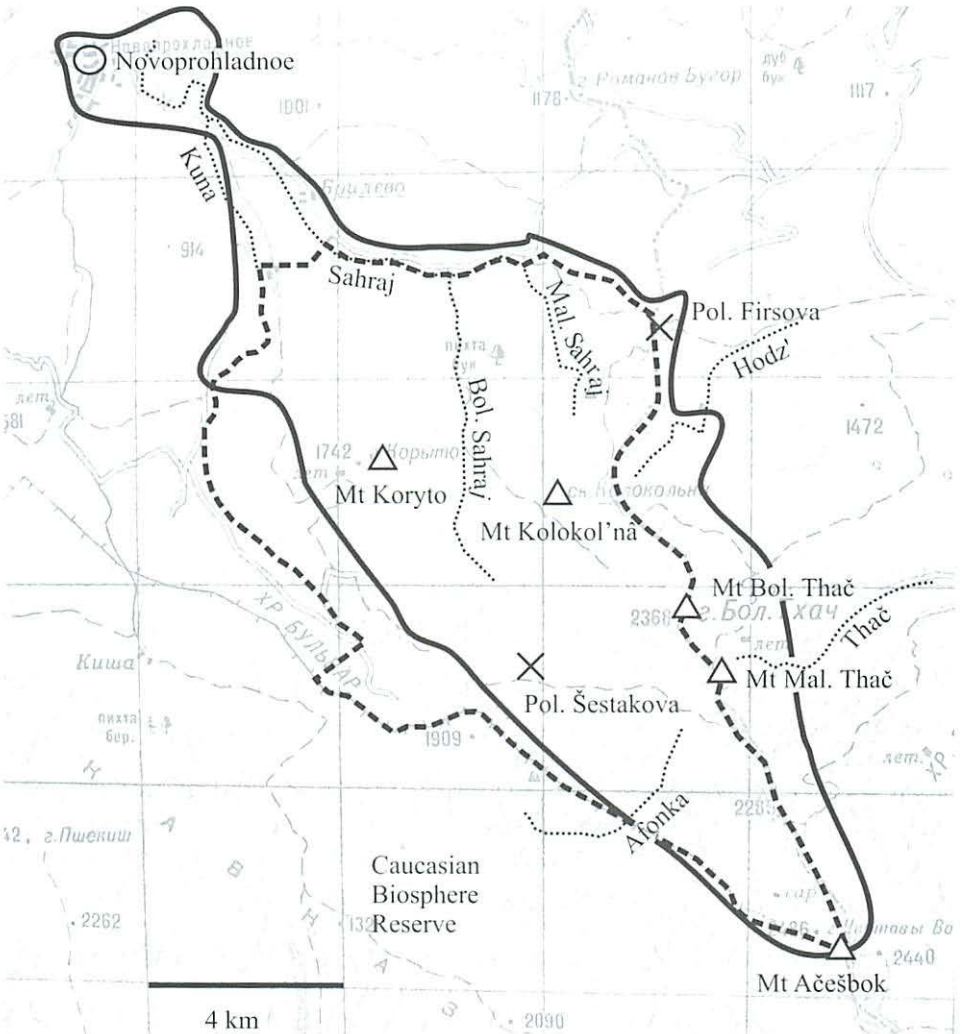

Fig. 2 The study area with indication of the main excursion routes and collection points. Map background: Topografičeskaâ Karta Krasnodarskij Kraj, Respublika Adygeâ 1 : 200 000. 439 CÈVKF, Moskva 1996.

Field observations were carried out on excursions, each lasting three weeks in the years 1997 – 1999, 2001 – 2005 and 2007. They mainly took place in the summer months (usually between June and September), apart from 2004, in which it was in May.

They concerned the general appearance of the vegetation of the several altitudinal belts and the question whether modifications due to natural properties of the stands or human impact were evident. Additionally, the papers of HOFFMANN (1996), AHRNS (1997, 1999), SCHMID (1997), ERMOLAEVA (2004), RÄTZEL & UHLICH (2004), FRANCUZOV (s. a.), FROSCH (2007a) and KUMMER (2007) were utilised. The determination of the plants followed GALUŠKO (1978 – 1980). Herbarium specimens of many plants were collected and deposited in GLM or in the author's own herbarium.

Appendix 1 of this booklet contains a complete list of the vascular plants observed in the study area; for author citations of the taxa mentioned here in the text, see there.

For the estimation of man-made influences, own observations have been complemented by literature studies, particularly concerning the history of land use in the area.

3. Results

3.1. Biogeographical allocation, altitudinal zonation and basic vegetation units

The area is situated in the submeridional floristic zone, in the western Caucasian floristic province of the eastern Submediterranean floristic region (MEUSEL & JÄGER 1992) and therefore biogeographically belongs to Europe.

Its vegetation can be roughly divided into altitudinal belts in the following manner:

– Submontane oak (*Quercus* spec.) forest belt of the promontories and the lower mountain belt; in the Sahraj valley up to approx. 850 m a.s.l. A number of forest associations can be observed there and the slopes not exposed to the south are dominated by other wood species rather than oak (*Carpinus*, shrubs, see FROSCH 2007a).

– Montane beech (*Fagus orientalis*) forest belt, above the oak belt, up to approx. 1400 m a.s.l.; in its upper part with a growing percentage of fir (*Abies nordmanniana*).

– Upper montane fir belt, above the beech belt, up to approx. 1700 m a.s.l. FRANCUZOV (s. a.) describes some forest associations here.

– Subalpine belt, above the fir belt: pine (*Pinus kochiana*) forest on southern slopes, on ridges and on recumbent debris below the abruption of the Thač massif; stands with *Betula* spec., *Sorbus aucuparia* and *Rhododendron caucasicum*, often rich in perennial herbs, at the northern slopes and on deeper soil overlays; timberline at approx. 2000 m a.s.l.

– Alpine belt with meadows, rock vegetation and vegetation of erosion channels long covered with snow above 2000 m a.s.l. ERMOLAEVA (2004) gives a conspectus of the plant associations observed here.

Besides the predominating vegetation units of the single altitudinal belts there are alder (*Alnus incana*) forests along the rivers (originally particularly well developed in the Bol'šoj Sahraj valley; now considerably reduced there due to the spate of 2002), ravine forests with *Ulmus glabra* and *Acer pseudoplatanus* (e.g. in the Afonka valley), debris vegetation and several anthropogenic substitution units, namely as pastures and meadows (called »polânas« when they have an insular character amongst forests). Due to the relief, repeatedly an

inversion of the altitudinal belts can be observed, with thermophile oak stands on south-facing slopes up to nearly 1000 m a.s.l. above deep ravines with fir forest on their ground (e.g. ridge »Krasnye Skalki« above the Kuna valley).

3.2. Aspects of the vegetation history of the NW Caucasus

In past and recent times the stands have undergone changes to different degrees which are strongly connected to human activities. Until the resettlement of the indigenous Adygè people in the 19th century (Caucasian War) vast areas in the mountains of NW Caucasus were deforested and covered with meadows, pastures and acres. Woodlands had survived only along the Caucasian Main Ridge and in inaccessible places. However, within the agricultural areas wood had specifically been protected or planted as a measure against erosion, wind and desiccation (KANTARIÀ 1989).

In the following times the promontories were settled by the Cossac people, which was a process happening much slower than in the Kuban lowlands. So even though wood was used irregularly the woodland-covered areas grew until the end of the 19th century. During the Russian conquest the relation between open stands and woodlands was 9 : 1 whereas today the inverse relation is found. For instance the area between the rivers Psekups and Belaâ is covered with oak forests of equal age to a high degree, originating from the time of the displacement of the Adygè people (GRUDZINSKAÀ 1953, HAUG 2000, IVANOV et al. 2000). According to Karataev (pers. comm.), until today not a single oak has been found that would have been older than 150 years. Altogether 1.5 Mio Adygè were banished abroad and 150 000 were obliged to relocate from the mountains to the lowlands (NAURZOV 1997). Between the rivers Belaâ and Laba, where the study area is situated, the banishment of the Abadzeh clan that had been domiciled there was carried out in 1861 (ibidem).

It is unknown to what extent the oak forests of the lower mountain belt, which probably originate from the first tree generation on the abandoned pastures of the Adygè people, already represent the climax vegetation. The difficulties in the regeneration of oak within the forests (ALENT'EV 1994, KRIVOŠEÀ et al. 1994) do not support the presumption of these oak forests already being the climax. In the middle mountain belt sometimes single old oaks amongst dense younger beech forests witness the progressive succession on former more open habitats (see GRUDZINSKAÀ 1953, Fig. 14).

In the past as well as today the population density was lower in the higher mountains than in the forelands (see KUMYKOV 1996, map 19). Particularly in the fir belt unutilised virgin forests could be found (ORLOV 1951), as described by RADDE (1899) from the route Psebaj-Soči. Since the 1930s, the utilisation of the forests of the northern Caucasus has been considerably extended, which has led to over-utilisation in many places, accompanied by strong soil erosion (SUKAČEV & ZONN 1953, KALESNIK 1968). Today the green cover of the northern Caucasian mountains in wide areas consists of coppice-like stands of thin stems, amongst which the only older trunks are those of some fruit trees that had been spared in the past due to legal regulations. This is very evident in the valley of river Malaâ Laba, which is situated east of the study area. In contrast in the study area there are some difficulties for usage due to the karst relief. Also its temporary affiliation to the Caucasian Reserve is certainly responsible for the fact that down to relatively low positions (beech belt) there are some places hardly influenced by forestry, where at the most only some thick fir trunks were gained with helicopters.

Around the village of Novoprohladnoe the landscape structures were enriched by pasturing that supported some open places intermixed with the forests. Also in the subalpine and alpine belts of the study area the influence of the former pasturing is evident by thinning out of the subalpine groves or their rolling back to steep slopes, development of large bosks of *Rhododendron caucasicum*, cattle trails with open soil and an accumulation of pasture weeds as *Veratrum lobelianum*, *Cirsium* spec., *Urtica dioica*, *Rumex alpinus*, till the development of *Rumex*-dominated associations at the lairs of the cattle. Moreover, also within the mountain forest belt (beech and fir belts) amongst the slopes there are some even places that are open as a result of pasturing that had taken place there until a few years ago. Deforestation due to pasturing is, however, to a lesser extent in the study area than can be observed in other parts of the greater region. In contrast, the route from Malyj Bambak ridge 20 km ESE of the study area to Mt Malyj Thač, which was visited in 1998, leads over large distances through a landscape that is downwards deeply deforested and partly strongly eroded, with only small groups of pines or single individuals, which are however vital and give an indication to the potential vegetation.

3.3. Contemporary human impact on the vegetation

Until now, the extent of forestry has mainly been influenced by the accessibility of the forest stands: The most intensive cut has taken place in the lower belts and along the forest roads in the valleys. Accordingly, within the study area the oak belt shows particularly strong signs of usage. In most places in the Sahraj valley old oaks have been preserved as solitary trees only, especially in the hardly accessible upper parts of the slopes. Vast parts of the region are covered with coppice-like stands of *Carpinus*, *Corylus*, *Acer* species (*A. campestre*, *A. platanoides*, *A. cappadocicum*) on former clear-cut areas. Up to the beech belt along the forest roads such coppices can be found in the lower part of the slopes, while above it in the valleys of the river Sahraj and its tributaries old beeches can often be found already. Thus, in the beech and fir belts the preservation of forest stands that had not been completely clear-cut is slightly better than in other parts of the northern Caucasus that were visited by us (e.g. the area east of Mt Malyj Thač to the Malyj Bambak ridge, where the unaffected woodlands between the clear-cut zone below and the pastured zone above are markedly narrowed or have already disappeared).

This cannot conceal the fact that also in the study area extraction of wood has taken place on a large scale, as is witnessed by forest roads up to Mt Kolokol'nâ and to the meadow Polâna Firsova and by a dense network of forest aisles built by tracked vehicles up to the places mentioned above. Nonetheless, even in these parts one encounters older trees which have survived because of their irregular growth or difficulties in accessing them due to the relief. The younger trees generally have been preserved leading to close forests even on used expanses.

Due to the karst relief in the closer Thač area, forest stands or parts of them have often remained unexploited and can be considered as real virgin forests. This principally applies to the fir belt. Due to the creation of the Nature Park »Bol'šoj Thač« in the meantime, forest stands down to the beech belt were taken out of utilisation. Additionally, the destruction of the forest roads in the valley of the river Bol'šoj Sahraj by the heavy spate in the summer of 2002

now ensures the absence of usage in this area. However, on the other hand in the summer of 2003 wood was extracted from the surroundings of the Polâna Firsova in the usual way with heavy tracked vehicles despite the protection status.

Pasturing has much declined recently. On the Bol'šoj Thač massif pasturing (that was observed by us still in 1997) does not take place any more, resulting already in an expansion of subalpine groves (birch) at places which are currently predominantly occupied by open alps and rock vegetation. Also on the »polânas« (meadows and pastures within the forests) of the montane belt pasturing has ceased; e.g. the Polâna Firsova is beginning to become recolonised by *Populus tremula* shoots emerging from its margins.

Around the village of Novoprohladnoe the cattle of the local population still has its pastures, which locally supports a landscape with scanty tree and shrub cover intermixed with open places. Recently, the local population seems to have changed their point of view and see their new prospective in the economically more attractive tourism and evidently there is a decrease in the number of cattle. In the first half of the study period cattle was regularly encountered by us in the forests around the village. In the last few years this was the exception and according to FROSCH (2007a) it is not presently necessary to pasture the few cattle individuals in the forest, because they can find enough feed in the village itself.

3.4. Floristic diversity

The study area is distinguished by a high floristic diversity. The more than 650 species of vascular plants recorded until now (HOFFMANN 1996, SCHMID 1997, AHRNS 1999, RÄTZEL & UHLICH 2004, FROSCH 2007a, Fürstenow in litt., herb. Otte, herb. Rätzel, herb. Kummer & GLM; see also KUMMER 2007 in this volume, ERMOLAEVA 2004[1], FRANCUZOV s. a. – see appendix) are only a part of the diversity that is really present. Whole ecological (e.g. spring geophytes) and also taxonomic groups (namely families rich in species as Apiaceae, Asteraceae) are recorded very insufficiently as yet.

In many cases the allocation of the material still demands closer taxonomic studies; many taxonomic groups are still insufficiently known. For example, RÄTZEL & UHLICH (2004) were able to describe a number of taxa of the genus *Orobanche* from the study area that had been unknown to science until then. On the other hand, recent taxonomic work on certain groups has led to a reduction of the number of the accepted taxa (ELENEVSKIJ & KURANOVA 2000), compared e.g. with GALUŠKO (1978 – 80). AHRNS (1999) was able to show by a number of examples that several »Caucasian endemites« belong to the synonymy of more widespread taxa. For many genera a thorough taxonomic revision will be necessary until it will be possible to give reliable statement about certain numbers of the taxa present in the study area. As an example the genus *Cephalaria* should be mentioned here.

[1] Unfortunately, in this paper that contains a large number of relevés from the NW Caucasus, the localities of the relevés are documented only in a few cases. Thus, only two of them could be assigned to our study area.

3.5. Red Data Book species

A part of the vascular plant diversity of the study area are threatened and protected species. These are:

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

(in brackets: threat category)

Anacamptis pyramidalis (3), *Anemone blanda* (3), *Atropa bella-donna* (2), *Cephalanthera damasonium* (3), *Cephalanthera longifolium* (3), *Cephalanthera rubra* (3), *Colchicum umbrosum* (2), *Cyclamen coum* (3), *Dactylorhiza urvilleana* (3), *Epipogium aphyllum* (2), *Festuca sommieri* (3), *Galanthus nivalis* subsp. *caucasicus* (sub *G. caucasicus*) (3), *Iris aphylla* (2), *Limodorum abortivum* (3), *Ophrys scolopax* subsp. *oestrifera* (sub *O. oestrifera*) (2), *Orchis mascula* (3), *Orchis militaris* (3), *Orchis purpurea* (3), *Orchis tridentata* (3), *Ostrya carpinifolia* (2), *Paeonia daurica* subsp. *coriifolia* (sub *P. caucasica*) (3), *Steveniella satyroides* (1), *Taxus baccata* (2), *Traunsteinera sphaerica* (3)

b) Additionally from the Red Data Book of the Republic of Adygeâ (Krasnaâ Kniga Respubliki Adygeâ 1997):

Asperula abchasica, Berberis vulgaris, Cystopteris montana, Daphne circassica, Daphne pseudosericea, Goodyera repens, Gymnocarpium robertianum, Ilex colchica, Pinguicula vulgaris, Polystichum lonchitis, Rubus caucasicus, Thymus majkopiensis, Ulmus glabra, Ulmus laevis, Ulmus minor (sub *U. carpinifolia*).

In most cases, special endangerments and necessities of protection are not evident, but they have not been explored by us specifically. *Orchis tridentata* is concentrated on meadow and pasture land around the village of Novoprohladnoe and at most of its stands probably depends on the continuation of the management system. In the case of *Ilex colchica*, presumably the conservation of the beech forests colonised by it is important. This species seems to be very rare in Ciscaucasia (see GROSSGEJM 1962, map 125). *Ulmus glabra* is strongly affected by the Dutch Elm Disease, at present even in remote virgin forest stands (e.g. Afonka valley).

It must be noted that some of the most threatened species were observed only outside the Nature Park. This concerns namely *Steveniella satyroides,* a species of category »1« of the Red Data Book of Russia. It was observed exclusively at Mt Šibaba near the village of Novoprohladnoe. There it occurs in an old oak forest that had not been affected by the intensive logging period of the 20th century (see FROSCH 2007b in this volume). Also some species of category »2« of Russia's Red Data book (*Ophrys scolopax* subsp. *oestrifera*, *Iris aphylla*, *Colchicum umbrosum*, *Ostrya carpinifolia*) and many of the species of category »3« have been found by us only outside the Nature Park.

4. Discussion

The eastern Submediterranean is the part of Europe with the highest biodiversity in vascular plants; it houses a considerable number of »Tertiary relicts« (MEUSEL et al. 1965, MEUSEL & JÄGER 1989). This is particularly true for Caucasia, where many endemic taxa have developed since the Tertiary age (MAI 1995).

From this regional diversity pool, many taxa find their place within the study area, whose rich natural environment with a high number of ecological niches in several altitudinal belts from submontane to alpine stands on limestone as well as on siliceous material supports a

high floristic diversity. In contrast to the situation of the cryptogamic plants (see OTTE 2007 in this volume), of the vascular plants, the endemic ones play an important role in this diversity.

It is enhanced further by the activities of man who has affected the vegetation for more than 6000 years now and who has formed specific living conditions for plants of open stands like meadows and pastures created by him. Pasturing is the oldest kind of land use in the area and has been practiced there for thousands of years (KANTARIÂ 1989). Resulting from this, a high relevance of the study area for the conservation of biodiversity on a European scale is evident. This is emphasised by its inclusion into the World Heritage Site Western Caucasus.

At the moment, threats to this diversity could arise from the socio-economic changes that have taken place during the last years and that are currently continuing: Cattle-breeding has considerably decreased both on a larger and on an individual scale. On the larger scale, it is evident that subalpine pastures as well as the »polânas« amongst the forests are already in a successional process of natural afforestation. In this way, the open vegetation types determined by culture will disappear in these places. Since the number of sufficiently even places suitable for pasture is very limited in the mountain forest belt, it is very likely that already the Adygè people had pastured their cattle on the same places. The high floristic diversity of the »polânas« could therefore be a result of a considerable age and their disappearance could lead to irreversible losses. In this respect, the disappearance of the montane »polânas« is more problematical than that of the subalpine pastures, because their flora is more discrete.

In the village of Novoprohladnoe it seems that a growing percentage of the population is re-orienting itself from subsistence agriculture to the economically more attractive field of tourism. Presently, at least within the village, the vegetation is still formed by pasture, while in the forests around the village the influence of pasture has decreased already. It seems possible that the day is approaching when the characteristic landscape of the region formed by traditional agriculture must be preserved by special programmes of landscape conservation as in other countries which have experienced similar developments during the last few decades.

5. Acknowledgements

The author is indebted to the Society »Umwelt & Bildung e. V.« (Gosen/Eberswalde), to V. & L. Karataev (Majkop) and to the Adygè State University (Majkop) who made it possible to perform the studies presented here. Kristin Meier (Potsdam) is thanked for improvement of the English of this paper and Kathrin Wiegand (Staatliches Museum für Naturkunde Görlitz) for graphic design assistance.

6. References

AHRNS, CH. (1997): Vorschlag für eine Grobkonzeption zur Ausweisung als Schutzgebiet. – Mscr., Umwelt & Bildung e. V., Gosen., 12 pp.

– (1999): Kurzbeitrag zur Flora des nordwestlichsten Kaukasus. – Schlechtendalia **2**: 61 – 69

ALENT'EV, P. N. (1994): Problemy vosstanovleniâ dubrav Adygei. – In: Nauka – Adygee. Materialy naučno-praktičeskoj konferencii učenyh Adygei (14 – 16 aprelâ 1993 g.). Majkop: 141 – 145

ELENEVSKIJ, A. G. & N. G. KURANOVA (2000): Taksonomičeskij obzor roda *Cruciata* Mill. (Rubiaceae). – Nov. Sist. Vyss. Rast. **32**: 152 – 162

ERMOLAEVA, O. Û. (2004): Sintaksonomiâ rastitel'nosti vysokogornyh izvesnâkovyh massivov Zapadnogo Kavkaza. – PhD thesis, Rostovskij Gosudarstvennyj Universitet, Rostov-na-Donu. http://orel3.rsl.ru/dissert/EBD_1160_ermolaevaOU.pdf

FRANCUZOV, A. A. (s. a.): Fitocenotičeskaâ harakteristika bukovo-pihtovyh lesov v bassejne reki Sahraj. – Mskr., Majkop, 12 pp.

FROSCH, B. (2007a): Vegetationszusammensetzung, ökologische Charakterisierung und Nutzungsgeschichte submontaner Waldgesellschaften im Nordwestkaukasus. – Diploma thesis, Carl-von Ossietzky-Universität Oldenburg, 124 pp.

– (2007b): Floristic composition, ecological characterisation and land-use history of submontane forests in the north-western Caucasus. – Abh. Ber. Naturkundemus. **79** (1): 97 – 114

GALUŠKO, A. I. (1978 – 80): Flora Severnogo Kavkaza. Vol. 1 – 3. – Rostov University, Rostov, 316, 350 & 326 pp.

GROSSGEJM, A. A. (1962): Flora Kavkaza. Tom VI. – 2nd edition. Academy of Sciences of the USSR, Moskva, Leningrad, 424 pp.

GRUDZINSKAÂ, I. A. (1953): Širokolistvennye lesa predgorij severo-zapadnogo Kavkaza. – In: SUKAČEV, V. N. & S. V. ZONN (eds): Širokolistvennye lesa severo-zapadnogo Kavkaza. Moskva: 5 – 186

HAUG, A. A. (2000): K izučeniû flory i rastitel'nosti poluostrova Abrau. – In: IVANOV, A. N., O. A. LEONT'EVA & E. G. SUSLOVA (eds): Priroda poluostrova Abrau. Landšafty, rastitel'nost' i životnoe naselenije. Sbornik naučnyh trudov. – Moskovskij Gosudarstvennyj Universitet im. M. V. Lomonosova. Geografičeskij fakul'tet, Moskva: 43 – 53

HOFFMANN, Ch. (1996): Floristische und vegetationskundliche Untersuchungen im Gebiet um den Bolschoi Tchatsch. – Mscr., Umwelt & Bildung e. V., Gosen, 14 pp.

IVANOV, A. N., Û. N. BOČKAREV, D. N. KOZLOV & A. A. HAUG (2000): Osnovnye čerty prirody poluostrova Abrau. – In: IVANOV, A. N., O. A. LEONT'EVA & E. G. SUSLOVA (eds): Priroda poluostrova Abrau. Landšafty, rastitel'nost' i životnoe naselenie. Sbornik naučnyh trudov. – Moskovskij Gosudarstvennyj Universitet im. M. V. Lomonosova. Geografičeskij fakul'tet, Moskva: 4 – 14

KALESNIK, S. V. (1968): Rossijskaâ Federaciâ. Evropejskij ûgo-vostok. Povolž'e, Severnyj Kavkaz. – Sovetskij Soûz. Geografičeskoe opisanie v 22 tomah. – Mysl', Moskva, 798 pp.

KANTARIÂ, M. V. (1989): Ekologičeskie aspekty tradicionnoj hozâjstvennoj kul'tury narodov severnogo Kavkaza. – Mecniereba, Tbilisi, 274 pp.

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

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

KRIVOŠEÂ, A. N., G. T. BELENKO, A. A. GOJDENKO & A. V. KALININA (1994): Problemy lesopol'zovaniâ i lesovosstanovleniâ v lesah severnogo Kavkaza i Adygei. – In: Nauka – Adygee. Materialy naučno-praktičeskoj konferencii učenyh Adygei (14 – 16 aprelâ 1993 g.). Meoty, Majkop: 146 – 151

KUMMER, V. (2007): Einige Aspekte der Pilzflora im Bol'šoj-Thač-Gebiet (NW-Kaukasus). – Abh. Ber. Naturkundemus. Görlitz **79** (1): 141 – 165

KUMYKOV, E. T. (1996): Istoriâ Adygov v kartah s drevnejših vremen do serediny XIX veka. – El-Fa, Nal'čik, 10 maps in jacket.

MAI, D. H. (1995): Tertiäre Vegetationsgeschichte Europas. Methoden und Ergebnisse. – Gustav Fischer Verlag, Jena/Stuttgart/New York, 691 pp.

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

– & – (1992): Vergleichende Chorologie der zentraleuropäischen Flora. Part 3., 2 Vols. – Gustav Fischer Verlag, Jena/Stuttgart/New York, 333 + 267 pp.

–, – & E. WEINERT (1965): Vergleichende Chorologie der zentraleuropäischen Flora. Vol. 1, Text. – Gustav Fischer Verlag Jena, 583 pp.

NAURZOV, V. V. (1997): Istoriâ kavkazskoj vojny. – Majkop, 26 pp.

ORLOV, A. Â. (1951): Temnohvojnye lesa severnogo Kavkaza. – Academy of Sciences of the USSR, Moskva, 256 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**: 565 – 582

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

– (2007): Biodiversity of lichens and lichenicolous fungi of Mt Bol'šoj Thač (NW Caucasus) and its vicinity. – Abh. Ber. Naturkundemus. Görlitz **79** (1): 131 – 140

RADDE, G. (1899): Grundzüge der Pflanzenverbreitung in den Kaukasusländern von der unteren Wolga über den Manytsch-Scheider bis zur Scheitelfläche Hocharmeniens. – Engelmann, Leipzig, 500 pp.

RÄTZEL, S. & H. UHLICH (2004): *Orobanche benkertii* sp. nova (Orobanchaceae Vent.) und weitere *Orobanche*-Sippen aus dem Nordwest-Kaukasus. – Feddes Repert. **115**: 189 – 211

SCHMID, D. (1997): Botanische Betrachtungen während der Exkursion zum Bol'soj Tchac/Nordkaukasus 14. Juni – 15. Juli 1997. – Mscr., Umwelt & Bildung e. V., Gosen, 16 pp.

SUKAČEV, V. N. & S. V. ZONN. (1953): Širokolistvennye lesa severo-zapadnogo Kavkaza. – Academy of Sciences of the USSR, Moskva, 383 pp.

Manuscript accepted: 8 October 2007

Author's address:

Dr Volker Otte
Universität Potsdam
Inst. f. Biochemie und Biologie
Lehrstuhl für Biozönoseforschung und Spezielle Botanik
Maulbeerallee 1
14469 Potsdam
email: Volker.Otte@uni-potsdam.de