

A contribution to the lichen mycota of old beech forests in Bulgaria

Leo Spier^{1*}, Klaas van Dort² & Örjan Fritz³

¹Kon. Arthurpad 8, 3813 HD Amersfoort, The Netherlands

²Leeuweriksweide 186, 6708 LN Wageningen, The Netherlands

³Southern Swedish Forest Research Centre, Box 49, SE-23053 ALNARP, Sweden

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Abstract. In 2007 the epiphytic and epixylic lichen mycota of old beech forests in Bulgaria was investigated: 138 lichen species were found, of which 30 are reported as new to Bulgaria: *Acrocordia cavata*, *Bacidia arceutina*, *B. incompta*, *B. neosquamulosa*, *Biatoridium monasteriense*, *Caloplaca lucifuga*, *Cetrelia monachorum*, *Chaenotheca brachypoda*, *C. chlorella*, *C. hispidula*, *Cladonia parasitica*, *Flavoparmelia soredians*, *Hypotrachyna afrorevoluta*, *Lopadium disciforme*, *Megalaria grossa*, *Menegazzia terebrata*, *Micarea micrococca*, *M. prasina*, *Omphalina ericetorum*, *Opegrapha rufescens*, *O. vermicellifera*, *Pertusaria pustulata*, *Phaeocalicium polyporaeum*, *Placynthiella icmalea*, *Ramalina baltica*, *Rinodina efflorescens*, *Schismatomma decolorans*, *S. pericleum*, *Strigula stigmatella* and *Usnea esperantiana*; several of these are rare in Europe: *Caloplaca lucifuga*, *Cladonia parasitica*, *Megalaria grossa*, *Pertusaria pustulata* and *Strigula stigmatella*.

Key words: ancient woodland, beech forest, dead wood, lichen diversity

Introduction

Within the European research project NATMAN (Nature-based Management of beech in Europe, a multifunctional approach to forestry) over 1500 logs of *Fagus sylvatica* have been investigated in Belgium, Denmark, The Netherlands, Hungary, Slovenia and Spain (Ódor *et al.* 2005, 2006). From 19 to 26 October 2007 an international group of cryptogam specialists studied fungi, bryophytes and lichens in forests in the Central Balkan National Park and Strandzha Nature Park. This study focused mainly on dead beech wood, but living *Fagus* and *Quercus* trees were also investigated. This paper is a contribution to an inventory of lichens in Bulgarian old beech forests. The records are compared with recent literature on Bulgarian lichens (Mayrhofer *et al.* 2005; Otte 2005; Vondrák 2006; Vondrák & Slavíkova-Bayerová 2006).

Methods

The standard NATMAN methodology (Ódor & van Hees 2004; Ódor *et al.* 2005) was used to sample c. 200 pieces of beech course woody debris (CWD); lichens on both wood and bark were identified. Species data have been added to a European database and will be used to evaluate beech-CWD as a habitat for wildlife, i.e. biodiversity. Nomenclature follows Santesson *et al.* (2004) and Coppins (2002).

Site descriptions

Extensive natural beech forests cover the northern slopes of the Balkan Range located within the Central Balkan National Park (<http://www.visitcentralbalkan.net>, www.centralbalkannationalparks.org). Old beech and fir dominated

*Corresponding author: e-mail: leo.spier@lemar.demon.nl

forests with a multilayered canopy and a high amount of dead wood are well preserved in the reserves Boatin and Severen Dzhendem (Raev *et al.* 2005).

Boatin Reserve (B) is located in the Cherni Osum River valley near Divchevoto. Old stands in the northern part of the reserve to the east of the Kordela parking, 850 m a.s.l. (UTM 35 T 275893 47432/ N42.80939 E24.25905) were investigated. The site consists of c. 200 year-old, tall *Fagus* forests on calcareous soil along a brook. *Salvia glutinosa*, *Lunaria rediviva*, *Polystichum aculeatum*, *Brachypodium sylvaticum*, *Prenanthes purpurea* and *Asarum europaeum* occur in the undergrowth.

Tsarichina Reserve (T) lies to the west of the city of Troyan, not far from the village of Ribaritsa (UTM 35 T 285502 4741940/ N42.79997 E24.37696). *Fagus* stands with some *Abies alba* along a steep winding path in the northwestern part of the reserve as well as along a small river on the reserve border in the northeastern part were investigated. *Tanacetum corymbosum*, *Primula elatior* and *Luzula luzuloides* indicate more or less neutral soil properties. In Severen Dzhendem Reserve (SD), c. 10 km south to the village of Apriltsi, a very old *Fagetum* was visited along the brook near Vidimsko Pruskalo on the northern slopes of Mount Botev (2376 m). Boulders and rocks are covered with *Paraleucobryum longifolium* and other acidic species.

Strandzha Nature Park is a vast wooded area, more than 5300 ha, in the southeastern tip of Bulgaria along the Turkish border (<http://www.discoverstrandja.com/nature/>; <http://www.visitmalkotarnovo.net/>). The climate of this region is influenced by the Black Sea and therefore shows a Mediterranean character. *Fagus sylvatica* is replaced by *F. orientalis* (Tzonev *et al.* 2006). Locally monospecific stands have developed a shrub layer of evergreen pontic species: *Laurocerasus officinalis*, *Ilex colchica*, *Rhododendron ponticum* and *Daphne pontica*. Frequently *Fagus orientalis* forms mixed stands with *Quercus* species, especially *Q. frainetto*. These mixed woods contain shrubs such as *Mespilus germanica*, *Carpinus orientalis*, *Sorbus torminalis* and *S. domestica*. In the species-rich undergrowth, *Cyclamen coum*, *Crocus pulchellus*, *Salvia forskaliensis*, *Ruscus aculeatus*, *R. hypoglossum* and *Trachystemon orientalis* are common (Uzunova & Uzunov 2006).

The eastern part of the Nature Park includes the protected area Marina Reka, a very sheltered valley with many pontic elements, and the Silkosiya Reserve (396.5 ha), both situated north of the village of Kosti. Kamuka, a protected site with a mixed oak stand and *Cistus* heathland in the vicinity of a Thracian sanctuary along the road to Gramatikovo, was also investigated. In the west, Sredoka Reserve (607.8 ha), lying to the north of the town of Malko Turnovo, consists of mixed *Quercus* wood with *Cistus incanus* heath, *Erica arborea* and other species with a Mediterranean distribution. *Fagus orientalis* is restricted to sheltered valleys.

Results

In all, 138 lichen species (Table 1) were found, of which 30 species had not been reported from Bulgaria (cf. Mayrhofer *et al.* 2005). Most species were found in the Sredoka Reserve.

Seven old forest indicators were found: *Lobaria pulmonaria*, *Megalaria grossa*, *Menegazzia terebrata*, *Nephroma laevigatum*, *N. parile* and *Pertusaria pustulata*. These are characteristic species of the *Lobarion*, a restricted, pollution sensitive and declining lichen community of old forest stands (Klement 1955; Barkman 1958; Richardson 1992; Rose 1992; Gilbert 2000), very sensitive to air pollution and therefore restricted to undisturbed and unpolluted environments. Nitrophilous *Xanthorion* species, e.g. *Candelariella reflexa*, *Lecidella elaeochroma*, *Melanelia subaurifera*, *Phaeophyscia orbicularis*, *Physcia adscendens*, *P. tenella*, *Xanthoria parietina* and *X. polycarpa*, occur in very small quantities. In comparison to the western Europe, these indicators are very rare in Bulgarian woods.

Hypotrachyna afrorevoluta (Krog & Swinscow) Krog & Swinscow has been recently recognized in Switzerland (Clerc 2006), France (Masson 2005) and The Netherlands (Spier *et al.* 2007), as well as Belgium, Austria and Britain. The epixylic lichen community shows a considerable similarity to these on logs in the Czech Republic (Jansová & Zdenek 2006).

Table 1. Species recorded at different sites in Bulgaria in October 2007^a

	Centr. Balkan Natl. Park			Strandzha Nat. Park				Q ^b
	1 ^a	2	3	4	5	6	7	
* <i>Acrocordia cavata</i>				x	x			
<i>Acrocordia gemmata</i>	x	x			x		x	Q
<i>Anaptychia ciliaris</i>				x	x		x	Q
<i>Arthonia radiata</i>	x			x	x	x	x	F
* <i>Bacidia arceutina</i>					x			Q
* <i>Bacidia incompta</i>	x							F
* <i>Bacidia neosquamulosa</i>	x							F
<i>Baomyces rufus</i>						x		S
* <i>Biatoridium monasteriense</i>	x							Sa, F

Table 1. (Continued)

	Centr. Balkan Natl. Park			Strandzha Nat. Park			
	1 ^a	2	3	4	5	6	7
<i>Buellia erubescens</i>						x	Q
<i>Calcium abietinum</i>	x			x		x	W, F
<i>Calicium salicinum</i>				x			Q
* <i>Caloplaca lucifuga</i>				x			Q
<i>Caloplaca obscurella</i>						x	M
<i>Candelariella reflexa</i>	x						F
<i>Candelariella xanthostigma</i>				x	x		F
<i>Cetrelia cetrariooides</i> s. lat.					x		F
* <i>Cetrelia monachorum</i> ^{O & M}	x						F
<i>Cetrelia olivetorum</i>	x		x				F
* <i>Chaenotheca brachypoda</i>	x						C
* <i>Chaenotheca chlorella</i>				x			Q
* <i>Chaenotheca hispidula</i>				x	x		Q
<i>Chaenotheca trichialis</i>						x	Q
<i>Chrysothrix candelaris</i>				x		x	Q, F
<i>Cladonia caespiticia</i>		x			x		S
<i>Cladonia chlorophaea</i>						x	F
<i>Cladonia coniocraea</i>	x	x		x	x	x	F
<i>Cladonia digitata</i>				x			F
<i>Cladonia fimbriata</i>		x		x	x	x	Q
<i>Cladonia foliacea</i>						x	S
<i>Cladonia furcata</i>	x					x	Q
<i>Cladonia macilenta</i>					x	x	Q
* <i>Cladonia parasitica</i>						x	W
<i>Cladonia squamosa</i>				x			R/m
<i>Cladonia uncialis</i>				x			R/m
<i>Collema flaccidum</i>	x				x		F
<i>Collema subflaccidum</i>	x						F
<i>Dermatocarpon luridum</i>		x					R
<i>Evernia prunastri</i>	x	x		x	x	x	F, Q
<i>Flavoparmelia caperata</i>	x	x	x	x	x	x	F
* <i>Flavoparmelia soredians</i>	x			x	x		F
<i>Fuscopannaria leucophaea</i>		x					R
<i>Graphis scripta</i>	x	x		x	x	x	F
<i>Gyalecta ulmi</i>				x	x	x	Q
<i>Haematomma ochroleucum</i>				x	x		F
<i>Hypogymnia physodes</i>	x				x	x	Q, F
* <i>Hypotrachyna afrorevoluta</i>		x					F
<i>Hypotrachyna revoluta</i>	x						F
<i>Lasallia pustulata</i>		x		x			R
<i>Lecanora albella</i>					x	x	F
<i>Lecanora allophana</i>						x	Q
<i>Lecanora argentata</i>	x	x	x				F
<i>Lecanora chlarotera</i>	x	x		x	x	x	F
<i>Lecanora expallens</i>	x	x		x	x	x	F, P

Table 1. (Continued)

	Centr. Balkan Natl. Park			Strandzha Nat. Park				
	1 ^a	2	3	4	5	6	7	
<i>Lecanora glabrata</i>	x	x	x	x	x		x	F
<i>Laecanora symmicta</i>					x			Q
<i>Lecidella elaeochroma</i>	x	x		x	x	x	x	F
<i>Lepraria incana</i>	x	x			x		x	F
<i>Lepraria lobificans</i>	x	x	x				x	F
<i>Leptogium cyanescens</i>	x		x					F
<i>Leptogium lichenoides</i>	x	x	x	x	x			F, Q
<i>Lobaria pulmonaria</i>	x	x	x	x	x		x	F, Q, OF
* <i>Lopadium disciforme</i>	x				x			F
* <i>Megalaria grossa</i>				x				Q, OF
<i>Megalaria laureri</i>	x			x	x		x	F
<i>Melanelia exasperatula</i>					x			Q
<i>Melanelia fuliginosa</i>	x	x		x	x	x	x	Q
<i>Melanelia subaurifera</i>							x	A, Q
* <i>Menegazzia terebrata</i>		x	x					F, OF
* <i>Micarea micrococca</i>						x		W
* <i>Micarea prasina</i>	x					x		W
<i>Mycocalicium subtile</i>	x	x						F, C
<i>Nephroma laevigatum</i>							x	Q, OF
<i>Nephroma parile</i>	x	x						F, OF
<i>Normandina pulchella</i>	x							F
<i>Ochrolechia androgyna</i>		x			x		x	F
* <i>Omphalina ericetorum</i>							x	F
<i>Opegrapha atra</i>					x			F
* <i>Opegrapha rufescens</i>	x				x			Q
<i>Opegrapha varia</i>	x	x			x			F
* <i>Opegrapha vermicellifera</i>	x			x			x	F, Q
<i>Opegrapha viridis</i>	x					x		F, OF
<i>Opegrapha vulgata</i>					x		x	F
<i>Parmelia saxatilis</i>		x		x				R
<i>Parmelia submontana</i>		x						Q
<i>Parmelia sulcata</i>	x	x	x	x	x	x	x	F
<i>Parmeliella triptophylla</i>	x						x	F, Q
<i>Parmelina pastillifera</i>	x		x					F
<i>Parmelina tiliacea</i>				x			x	Q
<i>Parmotrema chinense</i>		x	x			x	x	F, R, S
<i>Peltigera collina</i>		x						R
<i>Peltigera leucophlebia</i>							x	S
<i>Peltigera horizontalis</i>	x	x	x				x	F, Q, R, S
<i>Peltigera lactucifolia</i>	x							F
<i>Peltigera praetextata</i>	x	x	x	x	x	x	x	F, Q
<i>Peltigera rufescens</i>		x					x	Q, S
<i>Pertusaria albescens</i>	x	x		x	x	x	x	F
<i>Pertusaria amara</i>		x		x	x		x	F, Q
<i>Pertusaria coccodes</i>						x		Q

Table 1. (Continued)

	Centr. Balkan Natl. Park			Strandzha Nat. Park				
	1 ^a	2	3	4	5	6	7	
<i>Pertusaria coronata</i>		x						F
<i>Pertusaria flava</i>		x		x	x	x	x	Q
<i>Pertusaria hemisphaerica</i>				x		x	x	F
<i>Pertusaria hymenea</i>					x		x	F
<i>Pertusaria leioplaca</i>				x			x	F
<i>Pertusaria pertusa</i>	x	x		x	x	x	x	F
* <i>Pertusaria pustulata</i>	x				x			F, OF
* <i>Phaeocalicium polyporaeum</i>						x		Tri
<i>Phaeophyscia endophoenicea</i>	x						x	F
<i>Phaeophyscia orbicularis</i>				x			x	Q
<i>Phlyctis agelaea</i>				x	x		x	F, C
<i>Phlyctis argena</i>	x	x	x	x	x	x	x	F, C
<i>Physcia adscendens</i>				x				Q
<i>Physcia aipolia</i>				x				Q
<i>Physcia tenella</i>				x				Q
<i>Physconia distorta</i>				x	x			Q
<i>Physconia enteroxantha</i>				x	x	x	x	Q
* <i>Placynthella icmalea</i>	x							F (M.micr.)
<i>Platismatia glauca</i>			x					F
<i>Pleurosticta acetabulum</i>				x				Q
<i>Pseudevernia furfuracea</i>			x	x				Q
<i>Pseudosagedia aenea</i>	x				x			F
<i>Pyrenula nitida</i>	x	x	x	x	x	x	x	F, C
* <i>Ramalina baltica</i>		x		x		x		Q
<i>Ramalina calicaris</i>							x	Q
<i>Ramalina farinacea</i>	x	x	x	x	x	x	x	F, Q
<i>Ramalina fastigiata</i>				x				Q
<i>Ramalina pollinaria</i>				x				R
* <i>Rinodina efflorescens</i>						x		F
* <i>Schismatomma decolorans</i>					x		x	Q
* <i>Schismatomma periculeum</i>				x				Q
* <i>Strigula stigmatella</i>	x							F
<i>Thelotrema lepadinum</i>	x							F
<i>Trapelia coarctata</i>						x	x	R
<i>Usnea chaetophora</i>		x						F
* <i>Usnea esperantiana</i>		x						Q
<i>Usnea subfloridana</i>		x						Q
<i>Xanthoria parietina</i>							x	P
<i>Xanthoparmelia conspersa</i>	x						x	R
<i>Xanthoparmelia somloensis</i>	x			x				R
<i>Xylographa parallela</i>	x							W

^a 1. Boatin. 2. Tsarichina. 3. Severen Djendem. 4. Kamuka. 5. Silkosia. 6. Marina Reka. 7. Sredoka^b C: *Carpinus*, F: *Fagus*, M: *Malus*, P: *Populus*, Q: *Quercus*, R: rock, S: soil, Sa: *Sambucus*, Tri: *Trichaptum*, W: wood, OF: Old Forest

*new to Bulgaria

O & M sensu Obermayer & Mayrhofer (2007)

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