

## New and interesting lichen records from old-growth forest stands in the German National Park Bayerischer Wald

by

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With 2 tables

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**Abstract:** The lichen flora of some old-growth forests in the Nationalpark Bayerischer Wald (Bavaria, Germany) was studied during two days in the field. *Cheiromycina flabelliformis* and *Macentina dictyospora* are reported as new to Germany. Other new country records are: *Cheiromycina flabelliformis* for France, Romania and Slovakia, and *Pertusariapupillaris* and *Rinodina efflorescens* for the Czech Republic. *Lecidea albofuscescens*, *L. nylanderi*, *Thelocarpon superellum* and *Trapeliopsis glaucolepidea*, listed as extinct in Germany (RL 0), were refound. In addition, the critically endangered (RL 1) species *Bacidia circumspecta*, *B. incompta*, *Biatora carneoalbida*, *Chaenothecaxyloxa*, *Chaenothecopsis pusilla*, *Gyalecta flotowii*, *G. ulmi*, *Lobaria pulmonaria*, *Micarea myriocarpa*, *M. turfosa*, *Mycoblastus alpinus*, *Parmeliella triptophylla*, *Sclerophora peronella* and *Sphaerophorus globosus* are reported. *Fuscidea pusilla*, *Gyalecta derivata*, *Lecanactis umbrina*, *Micarea myriocarpa*, *Pertusariapupillaris*, *Placynthiella dasaea*, *Psilolechia clavulifera*, *Rinodina efflorescens* and *Trapeliopsis glaucolepidea* are presumably new to Bavaria. *Bacidia circumspecta*, *B. incompta*, *B. subincompta*, *Bacidina arnoldiana*, *Biatora sphaeroidiza*, *Chaenotheca xyloxa*, *Chaenothecopsis pusilla*, *Lecanora exspersa*, *L. ramulicola*, *L. thysanophora*, *Lecidea albofuscescens*, *L. erythrophaea*, *L. leprarioides*, *L. nylanderi*, *Lepraria jackii*, *Micarea turfosa*,

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*Ropalospora viridis*, *Scoliciosporum sarothamni*, *Steinia geophana*, *Strangospora ochrophora*, *Thelocarpon superellum*, *Trapelia corticola* and *Trapeliopsis gelatinosa* are for the first time reported from the Bavarian Forest. The distribution, ecology and conservational status of rare species and of those new for Germany are briefly discussed. The importance of old-growth forests for the maintenance of biodiversity is clearly illustrated by the results of this field-study. It is also evident that the lichen flora of Central European spruce forests is in need of more intensive studies.

**Zusammenfassung:** Die Flechtenflora einiger Altwald-Standorte im Nationalpark Bayerischer Wald (Bayern, Deutschland) wurde an zwei Tagen im Gelände studiert. *Cheiromycina flabelliformis* und *Macentina dictyospora* werden als neu für Deutschland gemeldet. Weiter werden als Neufunde gemeldet: *Cheiromycina flabelliformis* für Frankreich, Rumänien und die Slowakei, und *Pertusaria pupillaris* sowie *Rinodina efflorescens* für die Tschechische Republik. Die in Deutschland als ausgestorben (RL 0) angegebenen *Lecidea albofuscescens*, *L. nylanderii*, *Thelocarpon superellum* und *Trapeliopsis glaucolepidea* wurden wiedergefunden. Zusätzlich werden die stark gefährdeten (RL 1) Arten *Bacidia circumspeta*, *B. incompta*, *Biatora carneoalbida*, *Chaenotheca xyloxena*, *Chaenothecopsis pusilla*, *Gyalecta flotowii*, *G. ulmi*, *Lobaria pulmonaria*, *Micarea myriocarpa*, *M. turfosa*, *Mycoblastus alpinus*, *Parmeliella triptophylla*, *Sclerophora peronella* und *Sphaerophorus globosus* gemeldet. *Fuscidea pusilla*, *Gyalecta derivata*, *Lecanactis umbrina*, *Micarea myriocarpa*, *Pertusaria pupillaris*, *Placynthiella dasaea*, *Psilolechia clavulifera*, *Rinodina efflorescens* und *Trapeliopsis glaucolepidea* sind vermutlich neu für Bayern. *Bacidia circumspeta*, *B. incompta*, *B. subincompta*, *Bacidina arnoldiana*, *Biatora sphaeroidiza*, *Chaenotheca xyloxena*, *Chaenothecopsis pusilla*, *Lecanora exspersa*, *L. ramulicola*, *L. thysanophora*, *Lecidea albofuscescens*, *L. erythrophaea*, *L. leprarioides*, *L. nylanderii*, *Lepraria jackii*, *Micarea turfosa*, *Ropalospora viridis*, *Scoliciosporum sarothamni*, *Steinia geophana*, *Strangospora ochrophora*, *Thelocarpon superellum*, *Trapelia corticola* und *Trapeliopsis gelatinosa* werden zum ersten Mal aus dem Bayerischen Wald gemeldet. Verbreitung, Ökologie und Gefährdungsgrad der seltenen und für Deutschland neuen Arten werden kurz diskutiert. Die Bedeutung von Altwaldreservaten für die Erhaltung der Biodiversität wird durch die Ergebnisse dieser Geländestudie klar unterstrichen. Weitere, intensivere Untersuchungen zur Erfassung der Flechtenflora zentral-europäischer Fichtenwälder sind notwendig.

## Introduction

The Bohemian Forest (Bayerisch-Böhmischer Wald, –umava) represents a single geomorphological-geological unit belonging to the so-called Bohemian massif. It forms a natural border between the Czech Republic and Germany and extends southward into Austria. The mountain range is geologically relatively uniform and consists mainly of acidic rocks like granit, gneiss and mica schist. It is part of the main continental water divide between the North Sea and the Black Sea. The highest elevation, “Großer Arber”, reaches 1456 m. Due to several factors, among them poor, acidic soils and rather harsh climatic conditions (annual mean temperature between 2-6.5°C), the area has historically been thinly populated. The inaccessibility of the area with steep mountain slopes and glacier cirques made large-scale forestry difficult. In recent times the remoteness of the area was supported by the political situation after World War II, as it left the Bohemian Forest at the periphery between the Eastern and Western Blocks. As a consequence of all these factors the area is covered by the biggest uninterrupted forest range in Central Europe.

Despite its remoteness the area is by no means unaffected by human activities. Like in other parts of Central Europe, the Bohemian forests were for a long time used in various ways, e.g. for hunting, bee-keeping or gathering and logging of wood (fuel wood, timber wood, resonance wood for musical instruments or for the glass industry). Forest inventories carried out around the middle of the 19<sup>th</sup> century in the Czech

parts of the area, showed that virgin forests did no longer exist by that time. Throughout the 19<sup>th</sup> century heavy storms caused extended wind-breaks in spruce monocultures which had replaced natural mixed forests in different parts of the area. These windbreaks usually developed into breeding-grounds for bark-beetle calamities. In order to minimize the damage and the financial losses of forest-owners, thousands of hectares of forest were clear-cut.

Despite all these disturbances, the Bohemian Forest and adjoining areas still house remnants of well-preserved European old-growth forests. One of the oldest nature reserves in Europe – the virgin forest of Žofín (Novohradské hory Mts.) was put under protection by count Buquoy in 1838, the famous old-growth forest of Boubín (= Kubany) was protected since 1858 by its owner, Fürst von Schwarzenberg. Other examples of old-growth forests are Stožec in the Czech part or Höllbachgespreng on the German side of the border.

### **The Nationalpark Bayerischer Wald**

In 1970 ca. 13.000 ha of forest on the German side were designated as a national park (“Nationalpark Bayerischer Wald”). In 1981 the national park gained the status of a Biosphere Reserve. In 1997 the park was extended to the north and now comprises 24.250 ha. On its north-eastern side the area is bordered by the Czech national park “Šumava” with a total area of roughly 69.000 ha.

Climatically the national park is situated at the border between oceanic and continental influence. During summer the area is affected by high pressure areas to the west and humid air from the Mediterranean, causing relatively high precipitation. In winter the Bohemian Forest is under alternating influence of low pressure areas from the Adriatic Sea and Central European high pressure areas. Thus, long, snow-rich winters alternate with cool, humid summers. In general, precipitation is relatively high and ranges from 1200-2000 mm. At higher elevations around 50% of it falls as snow, and snow cover may last from September/October until May/June. The highest snow cover is recorded in February, when the monthly average ranged between 150 cm (Gr. Falkenstein, 1307 m) and 66 cm (Waldhäuser, 945 m). Fog is an important climatic factor that varies largely with altitude. Near Mt. Großer Falkenstein a yearly average of 226 days with fog is recorded while Waldhäuser has only 108 foggy days per year. Monthly average temperatures vary between -5.2°C in January and 11.7°C in July (Gr. Falkenstein) or -4.2°C and 14.0°C (Waldhäuser, 945 m) (Noack 1979). Frequent temperature inversions together with wet soils cause unfavourable growing conditions in valley bottoms.

More than 98% of the park area is covered by forests. Between 700 m and ca. 1200 m elevation mountain slopes were originally covered by a mixed forest with dominating *Abies alba* and *Fagus sylvatica*. *Acer pseudoplatanus* and *Sorbus aucuparia* are often intermixed, more rarely, and mostly on boulder slopes, *Acer platanoides*, *Fraxinus excelsior*, *Tilia platyphyllos* or *Ulmus glabra*. As a result of forest management *Picea abies* is nowadays widely intermixed and more or less replaces *Abies* in most stands. Above 1150-1200 m *Fagus* is unable to grow, and the mixed forest is replaced by

almost pure spruce stands. Because of low minimal temperatures, late spring frosts and wet soils, valley bottoms between 700-900 m are also unfavourable for beech and are covered by boggy spruce forests with intermixed *Betula pubescens* and *Frangula alnus*. Large areas, especially upland plateaus above 1100 m, are covered by peat bogs in places surrounded by light stands of *Pinus × pseudopumilio*.

### Material and methods

The lichen flora of the following four forest stands within the national park was investigated during two days in the field: 200-250 year old (Hierlmeier 1998) *Abies-Fagus* forest with numerous spruce in nature reserve "Mittelsteighütte" NE of "Zwieselerwaldhaus", old-growth *Abies-Fagus* forest in nature reserve "Höllbachgespreng" E of Mt. "Großer Falkenstein", stand of *Acer pseudoplatanus* and *Fraxinus excelsior* at "Hochschachtenriegel" on the W slope of Mt. Großer Falkenstein, *Picea* forest and *Abies-Fagus* forest between creek "Rachelbach" and eastern slope of Mt. "Großer Rachel". Specimens were collected for microscopical and chemical (TLC, HPLC, spot test) investigation. In some cases only field notes were made. Specimens collected by the first author (marked CP in appendix) are deposited in M, specimens marked TT are in BG.

The Red List Categories cited below are quotations from Wirth et al. (1996) and are not congruent with IUCN categories as the criteria of the two systems differ. The categories cited below translate as follows: RL 0 = extinct (or not reported for at least 10 years in spite of search), RL 1 = threatened with extinction, RL 2 = strongly endangered, RL 3 = endangered. These categories only refer to a species' status within Germany.

### Noteworthy lichen records

#### *Abscuditella lignicola* Vězda & Pišút

A frequent but very inconspicuous species. The first German record (originating from the area but outside the national park) was published in Bresinsky et al. (1995). The same specimen and two additional German collections were later mentioned by Palice (1999). *Abscuditella lignicola* grows preferably on decaying wood, bark, mosses or polypores in humid, shaded places. It occurs in undisturbed as well as in disturbed habitats.

On bark of young *Ulmus glabra* near a brook, together with *Micarea peliocarpa*.

#### *Arthonia spadicea* Leighton

First mentioned for the area by Bresinsky et al. (1995). The species is widespread in Europe and occurs mostly at the base of deciduous trees in humid localities. RL 3, formerly also redlisted in Sweden, where Arup et al. (1997) concluded that this status is not justified. *Arthonia spadicea* possibly indicates ecological continuity. Second record for the Bavarian Forest.

On bark of *Acer pseudoplatanus*.

#### *Arthrorhaphis aeruginosa* R. Sant. & Tønsberg

This recently described species is lichenicolous on *Cladonia* species (Santesson & Tønsberg 1994), especially on the primary squamules. *Arthrorhaphis aeruginosa* is

known from Europe and the Pacific northwest of North America (Santesson & Tønsberg 1994). In Europe it is particularly common in the north, but it has previously also been found in the central parts, e.g., in France (Étayo & Diederich 1998), Germany (Türk & Wunder 1999), Austria (Berger 1999, Tønsberg et al. 2001) and the Czech Republic (Kocourková 2000). Second record for Germany.

On *Cladonia* sp. on the upper part of a horizontal, decorticate log at about 1150-1160 m altitude.

*Bacidia circumspecta* (Nyl. ex Vain.) Malme

Rare in Central and Western Europe. In Germany RL 1. *Bacidia circumspecta* is typically found on deciduous trees mostly in old woodlands. On the Czech side it was collected in more or less undisturbed habitats (e.g. Palice 1998). However, in Scandinavia, its suitability as an old-growth indicator was questioned by Tibell (1992) and according to Holien (1998) it might tolerate small-scale forestry. New for the Bavarian Forest.

On bark of old *Fagus*.

*Bacidia incompta* (Borrer ex Hooker) Anzi

Typically on subneutral and basic bark of deciduous trees. RL 1, Coppins (1992a) mentions a decline in Britain due to the demise of *Ulmus*. On the Czech side *B. incompta* has so far only been collected in old-growth deciduous and mixed forests (see e.g. Vězda 1995). New for the Bavarian Forest.

On weathered bark of *Acer pseudoplatanus*.

*Bacidia subincompta* (Nyl.) Arnold

A typical species of (old) woodlands, only occasionally in open habitats. RL 2 and rarely recorded in Bavaria, but one of the most frequent species of the genus *Bacidia* in —mava (the Czech part of the Bohemian Forest) where it grows mainly on bark of deciduous trees both in natural and managed forests, and even on solitary trees in abandoned villages and along little used roads. Based on Czech collections its occurrence in the area was postulated by Printzen (1997). New for the Bavarian Forest.

On a rotten stump of *Fagus*.

*Bacidina arnoldiana* (Körber) V. Wirth & Vězda

A toxitolerant species with a broad ecology occurring on calcareous rocks and bark of deciduous and coniferous trees. According to Wirth (1995) the species' range is expanding. New for the Bavarian Forest, where it was probably overlooked.

On a rotten trunk of *Fagus*.

*Biatora carneoalbida* (Müll. Arg.) Coppins

Rather common in Finland and eastern Scandinavia, but very rare in Central and Western Europe. RL 1. Mostly on mosses and bark at the base of old deciduous trees. Previous records of *Biatora sphaeroides* (Dicks.) Körb. from the area probably refer to *B. carneoalbida* as indicated by Wirth (1995), who notes only the occurrence of the latter species in the Bavarian Forest.

On bark of old *Fagus*.

*Biatora chrysantha* (Zahlbr.) Printzen

Widespread but rather local in suboceanic and oceanic Europe and North America (Printzen & Tønsgaard 1999), but extending eastward into the Carpathian Mts and taiga-forests in the Komi Republic in the northeastern part of European Russia (Hermansson et al. 1998; under *B. gyrophorica*). RL 3, first reported from the area by Printzen (1997). *Biatora chrysantha* overgrows mosses and bark on tree trunks in humid, more or less undisturbed woodlands. The species is ecologically more demanding in eastern parts of its range. High morphological and ecological variability of *B. chrysantha*, possibly involving two different species, has recently been reported from Western North America by Printzen & Tønsgaard (1999). The same variability seems to be present in European collections, but does not seem to be supported by ecological differences here.

Overgrowing mosses and bark on a *Fagus* trunks and roots and mosses over bark of *Acer pseudoplatanus*.

*Biatora fallax* Hepp

Previously thought to be extinct in Germany (RL 0), but refound by Palice (Printzen & Palice 1998), this is the second report from the Bavarian Forest and the first for the National Park. More collections are known from the Czech side of the border. The species occurs mostly on rough bark at the base of old trees (but may grow on younger trees as well) in humid woodland sites.

At the base of *Fagus sylvatica* near a creek and on weathering bark of a *Fagus* snag in a corrie.

*Biatora sphaeroidiza* (Vain.) Printzen & Holien

First reported for Germany (Baden-Württemberg) by Printzen & Palice (1999). Second and third German record and first record for the Bavarian Forest. The species is confined to bark or twigs of young trees in very humid, ± undisturbed forest stands.

On the base of *Fagus sylvatica* and on bark of young *Acer pseudoplatanus*.

*Chaenotheca brachypoda* (Ach.) Tibell

First mentioned from the area by Hilitzer (1929) and not reported since, generally rare in Germany (RL 2), more common in Scandinavia and also reported as widespread

in the southern and central taiga (Hermansson et al. 1998). In Central Europe *C. brachypoda* occurs mainly on wood and in bark crevices in humid, ± undisturbed forests. According to Tibell (1992) it is no old-growth indicator in Sweden.

On wood of old *Fagus*.

Additional locality: GERMANY: Baden-Württemberg, Schwäbische Alb (Mittlere Alb), Bad Urach, mouth of Föhrental valley, wood of a stump, 510 m, 17.IV.1998, — Bayerová, J. Halda & Z. Palice 1093 (hb. Palice).

*Chaenotheca xyloxena* Nád.v.

Very rare and threatened with extinction in Germany (RL 1). Widely distributed in both hemispheres. Previously reported from the Czech side of the border, but new for the Bavarian Forest.

On naked wood and moribund wood of a conifer stump.

*Chaenothecopsis pusilla* (Ach.) Alb. Schmidt

In Germany the species occurs mostly on wood of old trees, often conifers, in undisturbed woodlands. Listed as threatened with extinction (RL 1) in Germany, but rather frequent on the Czech side of the border (most records so far unpublished) and thus likely to be overlooked. Cf. Tibell (1999), who mentions only few collections from Denmark, Norway and Finland, while the species is “not uncommon” in Sweden. Widely distributed in both hemispheres. New for the Bavarian Forest.

On a standing, rotten trunk of spruce, on beech, and overgrowing algae on dry peat.

Additional localities: CZECH REPUBLIC: SW Bohemia, —umava Mts., Kvilda - “U pomníčku”, wood of decaying stump, 1000 m, 3.IX.1995, Z. Palice (hb. Palice). S Bohemia, —umava Mts., Volary: Mt. Jelení vrch, decaying wood of standing *Fagus*, 900 m, 25.IX.1994, Z. Palice (hb. Palice). S Bohemia, —umava Mts., the Vltava valley, Pěkná: boggy forest with prevailing *Pinus rotundata*, over algae on overhanging side of naked peat among roots of eradicated tree, 735 m, 15.X.1998, J. Kocourková & Z. Palice 1508 (hb. Palice).

*Cheiomycina flabelliformis* B. Sutton

A widespread but rarely collected species, which seems to be associated with humid coniferous forests, where it often accompanies *Biatora* species. The species is redlisted in Sweden, but may be widely overlooked. Hermansson et al. (1998) mention its infrequent occurrence in humid deciduous and mixed forests in north eastern European Russia. Within Central Europe hitherto only reported from Austria (Hawksworth & Poelt 1986) and the Czech Republic (Halda 1999). First records for France, Germany, Romania and Slovakia. At the base of *Acer platanoides*, *A. pseudoplatanus*, *Fagus sylvatica* (bark and wood), *Fraxinus excelsior*, *Picea abies*, *Sorbus aucuparia*, on young *Ulmus glabra*.

Additional localities: AUSTRIA: Mühlviertel, Mt. Bärenstein - NNE slope, *Sorbus*, 890 m, 5.VIII.1997, Z. Palice (hb. Palice). CZECH REPUBLIC: W Bohemia, —umava Mts., Železná Ruda: Mt. Jezerní hora - the forested top part, climatic spruce forest, 1330-1340 m, 24.V.1996, Z. Palice (hb. Palice, together with *Lecidea betulicola*). WNW of Železná Ruda, Revier Eisenstein, bottom of valley of brook Svarožná (Büchel-Bach), along the NE brook bank, 0.5 km ESE of German-Czech border at border stone 33, 49°09' N, 13°11' E, 850-900 m, 12.X.1999, T. Tønsberg 28158 (BG). W Bohemia, —umava Mts., Prášíly: Mt. Ždanidla - S slope, young managed stand with *Fagus* and *Picea* predominant, *Fagus*, 1100-1150 m, 10.VII.1998, Z. Palice 563 & C. Printzen (hb. Palice). S Bohemia, —umava Mts., N slope of Mt. Plechý (Plöckenstein), ca. 7 km WSW of Nová Pec, ca. 1 km W of lake "Plešné jezero", ca. 1250 m, 48°47' N, 13°51'30" E, mixed forest of *Picea* and *Sorbus aucuparia* on a boulder slope, 7.VIII.1996, J. Halda, Z. Palice & C. Printzen (hb. Printzen). S Bohemia, —umava Mts., Volary: glacial cirque of Plešné jezero lake - N part (a periodic brook SW of the "pseudocorrie"), 48°46'35" N, 13°51'45" E, 1130 m, 28.VI.1999, Z. Palice 1651 (hb. Palice). S Bohemia, —umava Mts., Volary, at forest roadside below Mt. Spáleníště (near České Žleby), 850 m, 24.V.1995, Z. Palice (hb. Palice, hb. Printzen). S Bohemia, —umava Mts., Volary, Stožec: E slope of the hill "Na vrchu" [873,8], a young managed mixed forest below "Továrná cesta" (a forest trail), 1.3 km SW of Černý Kříž (railway station), 825-830 m, 27.I.2001, Z. Palice 4613, 4632 (hb. Palice). S Bohemia, —umava Mts., Záhvozdí: Mt. Černý les - W slope, ca. 48°50' N, 13°58' E, at the forest road-side, 830 m, 14.IV.2000, Z. Palice 5048 et al. (hb. Palice). FRANCE: Dépt. Cantal, SW of Murat, Forêt Domeniale de Murat, 2.5 km E of Plomb du Cantal, open *Picea* forest with scattered *Larix*, 1320 m, 31.VII.1998, P. van den Boom 20883 [together with *Lecidea betulicola*] (hb. van den Boom). GERMANY: Bayern, Oberbayern, Schützenhöll S Leonhardstein, spruce-beech-mountain maple forest on boulder slope, ca. 1100 m, 19.VI.1999, C. Printzen (hb. Printzen). ROMANIA: Bihor Mts., Padiș area, ca. 0.5 km NNW of Cabana Padiș at blue and red tourist footpath, 46°36'30" N, 22°54' E, decorticated part of *Fagus* in *Picea* forest, 1300 m, 27.VII.1998, —Bayerová, J. Halda & Z. Palice 775 (hb. Palice). SLOVAKIA: W Carpathians, Vysoké Tatry Mts., Starý Smokovec: spruce forest above confluence of Veľ'ký and Malý Studený potok brooks, 49°10' N, 20°13' E, *Picea*, 1300 m, 13.VI.1998, Z. Palice 503 (hb. Palice).

### *Dimerella pineti* (Schrader ex Ach.) Vězda

A widespread and common species, that was overlooked in the area until Bresinsky et al. (1995) first reported it. Occurs mostly at the base of trees. Second record for the Bavarian Forest.

On *Fagus sylvatica*.

### *Fuscidea pusilla* Tønsberg

This is a species of smooth bark of deciduous trees known from Europe and Pacific North America (Tønsberg 1993b). Apparently new for Bavaria, but probably common and overlooked.

On *Fagus sylvatica* and the base of a young *Picea abies*.

Additional locality: GERMANY: Bayern, Niederbayern, Nationalpark Bayerischer Wald, W-Hang des Lusen, ca. 1.5 km W des Gipfels, 1180 m, 9.VIII.1996, C. Printzen (M).

*Gyalecta derivata* (Nyl.) H. Olivier

A rare species throughout Europe, earlier reported from the Czech side of the border (Palice 1998). The few known collections were most commonly from bark-crevices of deciduous trees. Apparently new for Bavaria.

On weathering bark of *Fagus* snag.

*Gyalecta flotowii* Körb.

A rare (RL 1) species occurring mostly in bark crevices of old trees in humid woodlands. Within the area the species seems to be confined to old-growth forests (Macher 1992). In southern Sweden *G. flotowii* is also regarded as an indicator of long ecological continuity by Arup et al. (1997).

On dry bark of old *Fagus*.

*Gyalecta ulmi* (Sw.) Zahlbr.

Like the preceding species rare (RL 1) and declining within the area. According to Macher (1992) and Arup et al. (1997) the species occurs only in forest stands with a long ecological continuity.

On dry bark of old *Fagus*.

*Hypocenomyce caradocensis* (Leighton ex Nyl.) P. James & G. Schneider

Widespread and relatively toxitolerant species of bark and wood in montane coniferous forests. First reported for the Bavarian Forest by Bresinsky et al. (1995). Wirth (1995) indicates that *H. caradocensis* might be spreading in Southwest Germany.

On bark of *Picea abies*.

*Lecanactis umbrina* Coppins & P. James

Typically under sheltered overhangs of siliceous rocks in cool and humid old woodlands, but occurrences are very local. Apparently new for Bavaria.

*Lecanora exspersa* Nyl.

Recently recorded from Austria (Türk & Poelt 1993, Hinteregger 1994), Germany (Türk & Wunder 1991), Montenegro (Vězda 2000) and Slovakia (Guttová & Palice, in prep.). New for the Bavarian Forest.

Corticolous on *Fagus sylvatica* in river valley.

*Lecanora ramulicola* (H. Magn. in Hillmann) Printzen & P. May ined.

A species unrecognized by most authors and put into synonymy of *L. symmetrica*, to which it is closely related (Printzen & May in press). Mainly growing on dead twigs of conifers, preferably *Pinus*. It is currently known from Central Europe and Eastern North America. On twigs of *Picea* at a forest edge.

*Lecanora thysanophora* R.C. Harris

A recently described species (Harris et al. 2001), already recorded as new to Europe from southernmost Germany by Tønsberg (1999b). Also known from Austria where it is quite common (Tønsberg et al. 2001). Second record for Germany. New for the Bavarian Forest.

Corticolous on *Fagus sylvatica* in river valley.

*Lecidea albofuscescens* Nyl.

A widespread species of humid, cool coniferous forests known also from Northern Europe, north eastern European Russia (Hermansson et al. 1998) and oceanic parts of Eastern and Western North America. In Finland and Sweden *L. albofuscescens* frequently accompanies *Biatora* species at tree bases. On Newfoundland it is one of the most frequent species on bark of *Abies balsamea*. Recorded as extinct for Germany (RL 0), and also rare in Austria (Türk & Hafellner 1999). In the Czech Republic reported only once from Sudeten (Jizerské hory - Isergebirge) by Nádvořík (1961), but unsuccessfully searched for on the Czech side of the Bohemian Forest in –umava. New for the Bavarian Forest.

On *Fagus sylvatica* in spruce forest.

*Lecidea erythrophaea* Flörke ex Sommerf.

Rarely collected in Central Europe and redlisted in Germany (RL 2). *Lecidea erythrophaea* is also reported from northern, eastern and western Europe, where it is found on deciduous trees in humid woodlands. New for the Bavarian Forest.

On *Acer pseudoplatanus*.

*Lecidea leprarioides* Tønsberg

The species is generally rare and in Central Europe was formerly reported from the Czech part of the Bohemian Forest (Hilitzer 1926), Bavaria and Niedersachsen (Grumann 1963; all under *Lecidea turgidula* f. *pulveracea*). Recently, Wirth (1999) published a record from Baden-Württemberg. The species is also known from northern Europe (Tønsberg 1992, Vitikainen et al. 1997), including the northeastern part of European Russia (Hermansson et al. 1998), and from Pacific North America (Tønsberg

1993a). This together with the new records published here indicate that it is a widespread, partly overlooked species. *Lecidea leprarioides* is typically found in humid coniferous forests, where it grows on bark and (rotten) wood of conifers. According to Holien (1998) the species might tolerate small-scale forestry. First record for the Bavarian Forest.

On a rotten stump of *Picea abies*.

Additional localities: CZECH REPUBLIC: S Bohemia, —umava Mts., Stožec: a small peat-bog 0,5 km N of the village, 760 m, wood of *Pinus rotundata*, 24.IV.1994, Z. Palice (hb. Palice); Ibid., Volary: Mt. Plechý, climax spruce forest, 1360 m, wood of *Picea*, 1.XI.1995, Z. Palice (hb. Palice); Ibid., 1300m, bark of *Picea*, 14.IX.1997, Z. Palice (hb. Palice); Ibid.: glacial cirque of Plešné jezero lake - N part, 1130-1150 m, wood of *Picea*, 9.VII.1998, Z. Palice 510 & C. Printzen (hb. Palice).

*Lecidea nylanderii* (Anzi) Th. Fr.

Thought to be extinct (RL 0) in Germany and redlisted in Austria (Türk & Hafellner 1999). In the Czech Republic so far reported only from one locality (Hilitzer 1924, 1925) in central Bohemia. *Lecidea nylanderii* is typically found on acidic bark and wood of conifers (*Pinus*, *Picea*, *Juniperus*) or *Betula* in old woodlands. Common in taiga-forests in the northeastern part of European Russia (Hermansson et al. 1998), southern Norway (Tønberg 1992) and the Czech part of the Bohemian Forest, where it occurs both in woods and on solitary trees, mostly in small patches among other crustaceous lichens. It may even belong to the dominating epiphytic lichens there, e.g. on pine trunks in thin boggy pine forests (taiga-like stands). Overlooked in Central Europe perhaps because it is mostly sterile. New for the Bavarian Forest.

On *Acer platanoides* and *Salix caprea*.

Additional localities: CZECH REPUBLIC: S Bohemia, —umava Mts., Volary, Nové Údolí: an abandoned village “Krásná Hora”, 48°51'10" N, 13°46'10" E, solitary trees along road-side, 900-950 m, *Sorbus*, 4.IV.1999, Z. Palice 1999 (hb. Palice). —umava Mts., Volary, Černý Kříž: Mt. Jelení vrch (ca. 3 km SSW of Černý Kříž), 48°50'05-10" N, 13°51'20-25" E, remnants of beech forest on E slope, 850 m, *Fagus*, 13.V.2000, Z. Palice 3906 (hb. Palice). S Bohemia, —umava Mts., Nová Pec: nature reserve Houska near railway-stop Ovesná, 735 m, *Pinus rotundata*, 3.V.1997, Z. Palice (hb. Palice, cum apoth.!). Ibid. 8.VIII.1998, Z. Palice 826 (hb. Palice).

*Lepraria elobata* Tønberg

Species of the genus *Lepraria* were often not thoroughly distinguished formerly. It is thus possible that this and the following species were subsumed under *L. incana* by Macher (1992). *Lepraria elobata* is widespread and common in Europe and also known from Pacific North America (Tønberg 1998). Although hitherto only reported from the area by Hierlmeier (1998) our results indicate that it might be the most common *Lepraria* within the national park, being found in three of the visited localities. In Norway it is widespread and grows on ± acidic bark in a wide variety of habitats from sea-level to 1050 m (Tønberg 1992).

Corticolous on roots of *Fagus sylvatica* on bank of a brook and trunks of *Acer pseudoplatanus*, *Fagus* and *Picea abies*.

*Lepraria jackii* Tønsberg

A slightly rarer species than *L. elobata* with a preference for more acidic substrata. New for the Bavarian Forest.

Corticolous on trunks of *Acer pseudoplatanus* and *Fagus sylvatica*.

*Lobaria pulmonaria* (L.) Hoffm.

A widespread, but declining species in (sub)oceanic parts of Europe, North America and Asia. The species is threatened with extinction in Germany (RL 1), though it may be locally abundant as in parts of the Bavarian Alps. In Western and Central Europe *L. pulmonaria* is an indicator of ecological continuity. In montane regions the species prefers *Fagus* and *Acer pseudoplatanus* as substrate. Within the national park it is found in undisturbed beech-fir forests (Macher 1992).

Among mosses together with *Nephroma parile* and *Normandina pulchella* on an old *Fagus* stump.

*Loxospora cismonica* (Beltram.) Hafellner

Known only from Central Europe and North America, but obviously missing from Northern Europe, this species is only found in extremely humid, cool and undisturbed forest stands. It is mostly found on old *Abies* in spruce-fir and fir-beech forests. *Loxospora cismonica* is endangered (RL 2) in Germany and also redlisted in Austria (Türk & Hafellner 1999). Poelt (1966, 1972) cites the species from more localities in the Bavarian Forest, but at present it seems to be very rare in the area. In last years intensive search for the species on the Czech side of the border has been in vain. The only Czech record dates back to Hilitzer (1924). On *Fagus sylvatica* with *Loxospora elatina* and *Mycoblastus alpinus* as close associates.

*Macentina dictyospora* A. Orange

The species was described from Sweden fairly recently (Orange 1991) and has since been found in the Czech Republic, Finland, Slovakia, Spain, Switzerland, North America (Longán & Gómez-Bolea 1998; Palice 1999) and Ukraine (Zelenko 2000), indicating that it is widely overlooked. Although its ecological amplitude seems to be wide, within the area *M. dictyospora* prefers undisturbed habitats, where it is found on decaying organic substrates. First record for Germany.

On weathering bark of *Fagus* trunk.

*Menegazzia terebrata* (Hoffm.) A. Massal.

A widespread species in oceanic and suboceanic parts of the Northern Hemisphere. In Central Europe it is confined to undisturbed forest stands with a cool oceanic

climate. Endangered (RL 2) in Germany and Austria. In the Czech Republic *M. terebrata* is almost extinct in most of the area, surviving only in isolated populations in well preserved forests near the German (—umava) and Austrian border (Novohradské hory) (cf. Liška et al. 1996).

On bark of *Fagus* near a brook.

*Micarea myriocarpa* V. Wirth & Vězda ex Coppins

Rarely collected in Central and Northern Europe, but reported as frequent in Britain (Coppins 1992b), indicating that it might be overlooked. Also known from Pacific North America (Tønsberg 1999a). The species grows in dry underhangs of e.g. road cuttings or eradicated trees on rocks, soil and plant roots. In Germany *M. myriocarpa* is listed as threatened with extinction (RL 1). Apparently new for Bavaria.

On bark of exposed tree roots, on *Fagus*-root in shaded, dry cavity and on dry roots of an uprooted tree.

*Micarea turfosa* (A. Massal.) Du Rietz

The species is rarely collected (RL 1) but widely distributed in the Northern Hemisphere. It was previously known from the Czech side of the border (Palice, unpubl.), where it often covers naked turf, decaying bryophytes and plant debris in open peat-bogs. It may more rarely also grow on moist wood. New for the Bavarian Forest.

On a semi-immersed rotten trunk on a lakeshore and naked wood.

*Mycoblastus alpinus* (Fr.) Th. Fr. ex Hellb.

Widely distributed in Europe and North America (see e.g. Tønsberg 1993a) but of rather scattered occurrence. Although rather vague in its choice of substratum, in Central Europe *Mycoblastus alpinus* occurs mainly in humid spruce and fir forests. Its rarity in southwestern Norway and on the British Isles further indicate historical affinities with coniferous forests. In Germany the species is threatened with extinction (RL 1). First report for the area since Hillmann (1943).

On *Fagus sylvatica* and *Picea abies*.

Additional localities: CZECH REPUBLIC: SW Bohemia, —umava Mts., Prášily: N-facing slope above the Laka jezero lake (49°06'29" N, 13°19'31" E), a climatic spruce forest, 1150 m, 16.VI.2000, Z. Palice 4073 (hb. Palice). S Bohemia, —umava Mts., Volary: Mt. Plechý - E slope, S part of the glacial cirque of Plešné jezero lake, 48°46'30" N, 13°51'35" E, 1150 m, 29.V.1998, Z. Palice 1524 (hb. Palice). Ibid.: 9.VII.1998, Z. Palice 517 & C. Printzen (hb. Palice). S Bohemia, —umava Mts., Volary: Mt. Plechý - light boggy spruce forest below "Rakouská louka" peat-bog, 48°46'30" N, 13°50'45" E, 1280-1320 m, 18.X.1999, J. Halda & Z. Palice 4206 (hb. Palice). ROMANIA: Huedin, Mt. Vlădeasa [1838], *Picea* forest in a saddle ca. 2-2,5 km S of the top, 46°45' N, 22°58' E, 1450 m, 23.VII.1998, — Bayerová, J. Halda & Z. Palice 739 (hb. Palice).

*Mycoblastus fucatus* (Stirt.) Zahlbr.

A common and widespread species of wood and smooth tree bark in humid forests known from Europe and North America (Tønberg 1993a). First reported from the area by Bresinsky et al. (1995). *Mycoblastus fucatus* seems to tolerate disturbance and is regarded as spreading in southwest Germany by Wirth (1995). Second report for the Bavarian Forest.

Corticulous on *Picea abies* and *Sorbus aucuparia*, and lignicolous on log of *P. abies*.

*Parmeliella triptophylla* (Ach.) Müll. Arg.

Widespread in oceanic parts of the Northern Hemisphere and rather common in oceanic Scandinavia, but increasingly rare (RL 1) in Central Europe. *Parmeliella triptophylla* typically occurs on mossy or ± rotten bark of deciduous trees in very humid montane forest stands.

On *Acer pseudoplatanus* and on weathering bark of a *Fagus* snag.

Additional locality: GERMANY: Niederbayern, Bayerisch-Böhmischer Wald: Mt. Bayerisch Plöckenstein (= Trojmezná hora), just ca. 20-40m from the border with the Czech Republic, ca. 48°46'15" N, 13°50'15" E, climatic spruce forest, *Sorbus*, 1340 m, 29.V.1998, Z. Palice 1624 (hb. Palice).

*Pertusaria pupillaris* (Nyl.) Th. Fr.

Widespread but scattered in Europe and also reported from North America (Tønberg 1993a). According to Tibell (1992) *P. pupillaris* is an old growth indicator of boreal forests. It is also reported to be associated with ancient woodlands by Purvis & James (1992). The species grows on lignum and smooth tree bark. Apparently new for Bavaria and the Czech Republic.

On bark of *Acer pseudoplatanus* and *Sorbus aucuparia*.

Additional localities: CZECH REPUBLIC: W Bohemia, —umava Mts., Železná Ruda: a small valley of one of tributaries of the Debrník brook, 49°07'08-09" N, 13°14'45" E, 750-760 m, 11.VII.1998, C. Printzen & Z. Palice 602 (hb. Palice). SW Bohemia, —umava Mts., the Vydra valley between Antýgl and Hálkova chata chalet, ca. 49°06' N, 13°31' E, 870 m, 17.X.1998, J. Halda & Z. Palice 1520 (hb. Palice). S Bohemia, —umava Mts., Prachatic: the Blanice valley, ca. 0,5 km up the stream of the Hus castle-ruin, 48°57'40" N, 13°56' 10" E, 740 m, 16.IX.1997, Z. Palice 187 (hb. Palice). S Bohemia, —umava Mts., Volary: glacial cirque of Plešné jezero lake - E part, 48°46'30" N, 13°51'50" E, 1100 m, 16.VI.1996, Z. Palice 188 (hb. Palice). S Bohemia, —umava Mts., Volary, Stožec: N-NNE slope of hill "Na vrchu" [873,8], a managed spruce forest with occasional deciduous trees, along "Tovární cesta" (forest trail), ca. 1,5 km E of Stožec (railway station), 830 m, 27.I.2001, Z. Palice 4619 (hb. Palice).

*Placynthiella dasaea* (Stirt.) Tønberg

Widely distributed in Europe and North America (Tønberg 1998), but rarely reported, perhaps due to confusion with *P. icmalea*. The species was recently reported from

Germany by Sérusiaux et al. (1999). *Placynthiella dasaea* tolerates disturbance and pollution, and occurs mainly on somewhat acidic bark of trees as well as on wood and plant debris. Apparently new for Bavaria (cf. Sérusiaux et al. 1999), but likely to be frequently overlooked or misidentified. From the Czech Republic recorded for the first time by Halda (2001) from Eastern Bohemia.

On *Picea abies*.

Additional localities: CZECH REPUBLIC: S Bohemia, –umava Mts., Volary: a managed spruce forest W of Černý Kříž, wood of *Betula*, 780-800 m, 24.VIII.1995, Z. Palice (hb. Palice).

*Psilolechia clavulifera* (Nyl.) Coppins

With a similar ecology as *Micarea myriocarpa*, with which it is often associated. Frequent in the Czech part (Palice 1999) of the Bohemian forest but apparently new for Bavaria.

On roots of *Picea abies* and dry root of an uprooted tree.

*Rinodina efflorescens* Malme

Widespread in Europe and North America (Wong & Brodo 1990, Goward & Thor 1992, Hermansson et al. 1998) but frequently overlooked. Only few specimens are known from Germany. *Rinodina efflorescens* prefers acidic bark in somewhat light but humid forest stands. Apparently new for Bavaria and the Czech Republic.

Corticolous on *Acer pseudoplatanus*.

Additional locality: CZECH REPUBLIC: W Bohemia, –umava Mts., Železná Ruda, an alley of old trees in unnamed wooded valley by green tourist footpath between crossroads “Debrník” and state border with Germany, 49°07'17" N, 13°14'05" E, 770-780 m, 12.X.1999, leg. J. Halda, J. Liška, Z. Palice 2673, C. Printzen, T. Tønsberg & A. Vězda (hb. Palice). Ibid., T. Tønsberg 28178 (BG).

*Ropalospora viridis* (Tønsberg) Tønsberg

Widespread and rather common throughout western Europe extending eastward to Estonia and Slovakia. Also known from the Komi Republic in the northeastern part of European Russia (Hermansson et al. 1998) and North America (Tønsberg 1993a). Wirth (1995) indicates that the species is expanding its range. *Ropalospora viridis* is a species of smooth, acidic bark in humid, cool forest sites. New for the Bavarian Forest. From the Czech Republic reported only once (Vězda 1999). More so far unpublished collections from the Czech Republic probably belong to this species. Their identity, however, should be checked by TLC.

Corticolous on trunks of *Acer pseudoplatanus*, *Fagus sylvatica* and *Salix caprea*.

*Sclerophora peronella* (Ach.) Tibell

A rare species following the distribution of temperate deciduous forests and occurring in southern Scandinavia, Central Europe, mountains of Southern Europe (e.g. Calabria), Great Britain and North America. In Germany threatened with extinction (RL 1). *Sclerophora peronella* occurs preferably on wood and old bark of deciduous trees in humid, shaded localities. Tibell (1992) lists the species as an indicator of ecological continuity and Holien (1998) regards it as a possible old-growth indicator. First record for the area since Hilitzer (1929).

On wood in hollow trunk of living *Acer pseudoplatanus*.

*Scoliciosporum sarothamni* (Vain.) Vězda

Rarely collected in Central and northern Europe but perhaps overlooked. E.g. rather common on smooth-barked street roadside in Bergen, Norway (unpubl.). Also known from North America (Tønsberg 1995). *Scoliciosporum sarothamni* occurs on ± acidic bark of deciduous trees or shrubs. Reported for the Czech side of the area by Vězda (1978), but new for the Bavarian Forest.

Corticolous on twigs of *Malus* in a garden.

Additional locality: CZECH REPUBLIC: S Bohemia, —umava Mts., Volary, Černý Kříž, ca. 0.5-0.6 km NNW from the railway station, edge of planted spruce forest with young *Alnus incana* intermixed, on dead branch of *Alnus*, 740 m, 25.XII.1997, Z. Palice 172 (hb. Palice, UPS).

*Sphaerophorus globosus* (Hudson) Vain.

Widely distributed in oceanic parts of Europe, Asia and the Americas, but declining in Central Europe (RL 1). *Sphaerophorus globosus* grows chiefly on mossy rocks or trunks of old trees in humid localities. In Central Europe it is more or less restricted to forests sites and it is associated with ancient woodlands in South England (Rose 1992). Only recently noted to grow on German territory of the Bohemian Forest by Liška et al. (1996) from slopes of Mt. Rachel near the border with the Czech Republic, this is the second record for the area since Wirth (1972).

On bark of *Fagus* and *Picea*.

*Steinia geophana* (Nyl.) B. Stein

An inconspicuous and frequently overlooked species known from scattered localities in Europe and North America. It grows on a variety of ± ephemeral or artificial substrates like disturbed soils, decaying wood or old leather. New for the Bavarian Forest.

On hard wood semi-immersed in a brook.

*Strangospora ochrophora* (Nyl.) R. Anderson

In scattered localities over Europe and North America, perhaps overlooked. First

report for the Bavarian Forest. The species prefers subneutral bark of deciduous trees in ± well lit situations. Second record for the Bavarian Forest.

On dry bark of *Sambucus racemosa* at road-side.

*Thelocarpon superellum* Nyl.

Very rarely collected in Europe and North America. In Germany the species was hitherto only recorded from Baden-Württemberg but is listed as extinct (RL 0) by Wirth et al. (1996). *Thelocarpon superellum* occurs mainly on soil and stones often overgrown by algae. The specimen from the Czech side of the Bohemian Forest reported by Kocourková-Horáková (1998) exhibits a similar ecology, growing on semi-immersed wood at a lake-shore. New for the Bavarian Forest.

On hard wood in brook subject to inundation.

*Trapelia corticola* Coppins & P. James

An inconspicuous, mostly sterile species known from (sub)oceanic Europe, North and South America. From Germany it was reported only recently by Printzen (1995: Bayern) and Palice (1999: Baden-Württemberg). It grows preferably on acidic, rough bark and wood in humid woodlands. New for the Bavarian Forest.

On relatively young *Alnus incana* and on trunks of *Fagus sylvatica*.

Additional localities: GERMANY: Bayern, Niederbayern, Nationalpark Bayerischer Wald, Tal des Baches “Große Deffernick” N des Großen Falkenstein, ca. 830 m.

*Trapeliopsis gelatinosa* (Flörke) Coppins & P. James

Widely distributed in Europe and North America but of scattered occurrence. *Trapeliopsis gelatinosa* grows on ± ephemeral substrates like sandy or peaty soils of roadcuttings and is presumably often overlooked. In Germany it is considered as endangered (RL 2). New for the Bavarian Forest.

On a rotten stump of *Picea abies* as well as on roots of eradicated tree and naked humus.

*Trapeliopsis glaucolepidea* (Nyl.) G. Schneider

Widely distributed and hitherto reported from Europe, Africa and South America. The species was recently synonymized with *T. percrenata* (Nyl.) G. Schneider (Palice 1999). It is relatively common in suitable habitats in the Czech part of the Bohemian Forest, where it occurs predominantly on peat, detritus and wood in humid spruce forests and boggy stands of *Pinus rotundata* and *P. silvestris*. The species was regarded as extinct in Germany and Austria (RL 0), but has now been refound in both countries (Palice 1999, who also gives a detailed description of the ecology). Apparently new for Bavaria.

On turf.

## Discussion

Our species list (appendix) is very incomplete and biased and therefore difficult to evaluate. Apart from the fact that corticolous species are over-represented in the data, the short time in the field necessitated concentration on “interesting”, i.e. small and frequently overlooked, species. Common and conspicuous species were in most cases not noted in the short time available, so that the real species numbers are considerably higher for all localities.

The high numbers for Höllbachgespreng and Rachelsee as compared to the other stands are remarkable, but are in part due to more intensive studies. However, the ecological importance of both localities can be clearly deduced from the high number of rare and endangered lichens found occurring there.

Apart from *Lecidea albofuscescens*, *L. nylanderi*, *Thelocarpon superellum* and *Trapeliopsis glaucolepidea* two more species regarded as extinct in Germany (RL 0) were recently refound on the area of the national park: *Biatora fallax* (Printzen & Palice 1999) and *B. ocelliformis* (Printzen 1997). This and the 33 new records for the area – 2 of them new to Germany – illustrate the poor floristic coverage of the German lichen flora when compared with other European countries. It should be borne in mind that the data presented here are the result of just a few hours of field-studies. Furthermore, 55 species are known from the Czech side of the border, which have not yet been reported from German territory (most of them in Palice 1999). This figure represents almost 10% of the known lichen flora of the national park. It must be concluded, that our knowledge about the lichen flora of Bavaria is at present only rudimentary, although the variable geology, topography and vegetation suggest, that it could be one of the richest and most interesting areas in Central Europe.

Apart from mere floristic considerations this has an impact on conservational questions as well. Many of the species reported here were assigned high conservational status in the current Red List of German lichens (Wirth et al. 1996). But as long as the floristic coverage of different parts of Germany is so unequal and detailed information on the occurrence of many species is missing, the conservational status of these species cannot really be assessed. At present one can speculate that corticolous species with an eastern distribution are generally overrated simply because their prime habitats, montane forests of Bavaria, are poorly studied. As an example, the slightly eastern *Biatora efflorescens* is rated as strongly endangered (RL 2), while the more demanding and generally rarer, suboceanic *B. chrysantha* is only rated as endangered (RL 3). In the Bohemian Forest the former species is almost ubiquitous and is the only species besides *Lecanora conizaeoides* and *Mycoblastus fucatus* that has been recorded in 4 of 5 investigated localities.

A number of forest inhabiting lichens have been found to be more or less completely restricted to old-growth stands. Dependency on special substrata like dead wood or rough bark of old trees, microclimatical conditions not met in younger forest stands (Rose 1992) or, more recently, limited dispersal abilities (Sillett et al. 2000), have been made responsible for this behaviour. Whatever the reasons, the correlation between certain species and old-growth forests are clear enough to permit their use

Table 1: Potential old-growth indicators found in the area and the number of sites, from which they are reported

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<i>Arthonia spadicea</i>	2
<i>Bacidia circumspecta</i>	1
<i>Bacidia incompta</i>	1
<i>Biatora sphaeroidiza</i>	2
<i>Chaenotheca brachypoda</i>	1
<i>Chaenothecopsis pusilla</i>	1
<i>Cyphelium inquinans</i>	2
<i>Gyalecta flotowii</i>	1
<i>Gyalecta ulmi</i>	1
<i>Hypogymnia vittata</i>	1
<i>Lecidea nylanderii</i>	2
<i>Lobaria pulmonaria</i>	1
<i>Loxospora cismonica</i>	1
<i>Menegazzia terebrata</i>	1
<i>Nephroma parvum</i>	1
<i>Normandina pulchella</i>	1
<i>Parmeliella triptophylla</i>	1
<i>Pertusaria pupillaris</i>	1
<i>Pyrenula nitida</i>	1
<i>Sclerophora peronella</i>	1
<i>Sphaerophorus globosus</i>	1
<i>Thelotrema lepadinum</i>	2

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as indicators of ecological continuity. Regional indices have been devised for Great Britain and western France (Rose 1976, 1992), Sweden (Tibell 1992) and Eastern North America (Selva 1994). Because of variations in the lichen flora and the fact that ecological requirements of lichen species vary in different parts of their range, none of these indices is directly transferrable to Central Europe. Tab. 1 shows 22 species of our complete list, which have been cited as indicators of forest continuity by other authors (besides the above mentioned e.g. Arup & Ekman 1997, Nitare 2000, Wirth 1995). 17 species were only found in one locality, while five were growing in two. Only one and two species respectively were found in the localities Mittelsteighütte and Hochschachtenriegel, while we found nine in Höllbachgespreng and 14 around Rachelsee. The importance of the last two localities in terms of lichen biodiversity could be inferred from these numbers alone. However, separate and statistically sound investigations are necessary to assess the suitability of these species as old-growth indicators in Central Europe.

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Table 2: Species list

Abbreviations: JH = Josef Halda, ZP = Zdeněk Palice, CP = Christian Printzen, TT = Tor Tønsberg, AV = Antonín Věžda, “§” recorded in 1996; Records in brackets = field identification, no herbarium specimen; „\*” species new for the Bavarian Forest; “†” lichenicolous fungus

Species	Mittelsteig- hütte	Höllbach- gespreng	Hochschach- tenriegel	Rachelsee	Großer Filz	Remarks
<i>Absconditella lignicola</i>		ZP				
<i>Amandinea punctata</i>				ZP		
<i>Arthonia didyma</i>				JH, ZP		RL G
<i>Arthonia leucopellaea</i>	JH		JH	ZP	(ZP)	RL 2
<i>Arthonia spadicea</i>		ZP		JH		RL 3
<i>Arthonia vinosa</i>	CP					RL 2
*† <i>Arthrorhaphis aeruginosa</i>				TT		2. record for Germany
<i>Arthrorhaphis grisea</i>				ZP		
* <i>Bacidia circumspecta</i>				ZP		RL 1
* <i>Bacidia incompta</i>				ZP		RL 1
<i>Bacidia rubella</i>				JH, ZP		RL 2
* <i>Bacidia subincompta</i>				CP		RL 2
* <i>Bacidina arnoldiana</i>				CP		
<i>Bacidina phacodes</i>	ZP					RL 2
<i>Biatora carneoalbida</i>		ZP				RL 1
<i>Biatora chrysantha</i>		TT	CP, TT	ZP, TT		RL 3
<i>Biatora eflourescens</i>	TT	CP, JH, TT, ZP	CP, TT	CP, TT, ZP		RL 2
<i>Biatora fallax</i>				CP, ZP		RL 0
<i>Biatora helvola</i>		CP	CP, TT	CP, ZP		RL 2
<i>Biatora ocelliformis</i>		CP	CP	ZP		RL 0 (s. Printzen 1997)
* <i>Biatora sphaeroidiza</i>		CP, ZP, TT		TT		2. and 3. record for Germany
<i>Buellia griseovirens</i>	TT					
<i>Buellia schaeferi</i>				ZP		RL 3
<i>Calicium glaucellum</i>				CP		RL 3
<i>Calicium salicinum</i>		CP, JH		CP, JH		RL
<i>Cetrelia olivetorum</i>				CP		RL 3
<i>Chaenotheca brachypoda</i>		ZP				1. record since 1929, RL 2
<i>Chaenotheca brunneola</i>	JH			AV, CP		RL 2
<i>Chaenotheca ferruginea</i>		CP		(CP)		
<i>Chaenotheca trichialis</i>	JH	JH				RL 2
* <i>Chaenotheca xyloxena</i>	JH, ZP					RL 1
*† <i>Chaenothecopsis pusilla</i>				CP, JH		RL 1
† <i>Chaenothecopsis pusiola</i>	ZP					
<i>Chrysothrix chlorina</i>		TT				1. record since 1972
<i>Cheiomycina flabelliformis</i>			CP §			New for Germany
<i>Cladonia digitata</i>				JH		
<i>Cladonia macilenta</i>				TT		
<i>Cladonia sulphurina</i>				JH		RL 3
<i>Cyphelium inquinans</i>		CP, ZP		JH, CP, ZP		RL 2
<i>Dimerella pineti</i>		JH, ZP	TT			
<i>Fellhanera subtilis</i>				CP, ZP, TT		1. record since 1972, RL G RL R
<i>Fuscidea maculosa</i>		ZP				
<i>Fuscidea pusilla</i>				TT		
<i>Graphis scripta</i>		CP		TT		RL 3
<i>Gyalecta derivata</i>				ZP		
<i>Gyalecta flotowii</i>		ZP				RL 1
<i>Gyalecta ulmi</i>		ZP				RL 1

Species	Mittelsteig- hütte	Höllbach- gespreng	Hochschach- tenriegel	Rachelsee	Großer Filz	Remarks
<i>*Hypocomyce caradocensis</i>		JH		CP		
<i>Hypogymnia farinacea</i>				CP, JH		RL 3
<i>Hypogymnia physodes</i>				(CP)		
<i>Hypogymnia vittata</i>				ZP		RL 3
<i>Lecanactis abietina</i>	JH			JH		RL 2
<i>Lecanactis latebrarum</i>		TT				
<i>Lecanactis umbrina</i>		ZP, TT				
<i>Lecanora argentata</i>			CP			RL 2
<i>Lecanora conizaeoides</i>	TT	TT	TT	CP		
<i>Lecanora expallens</i>		CP				
<i>*Lecanora exspersa</i>		TT				
<i>Lecanora pulcaris</i>				CP		
<i>Lecanora ramulicola</i> ined.				CP		
<i>Lecanora symmicta</i>				CP		RL 3
<i>Lecanora thysanophora</i>		TT				2. German record
<i>*Lecidea albofuscescens</i>				CP		RL 0
<i>*Lecidea erythrophaea</i>		CP				RL 2
<i>*Lecidea leprarioides</i>				CP		
<i>*Lecidea nylanderii</i>	TT		CP			RL 0
<i>Lecidea pullata</i>		TT	TT	CP, TT		RL 3
<i>Lecidella elaeochroma</i>		CP	CP	CP, ZP		RL 3
<i>Lepraria elobata</i>		CP, TT	TT	TT		
<i>Lepraria incana</i>				TT		
<i>*Lepraria jackii</i>		CP	TT			
<i>Lobaria pulmonaria</i>				(CP)		RL 1
<i>Loxospora cismonica</i>				TT		RL 2
<i>Loxospora elatina</i>	TT		TT	ZP, TT		
<i>*Macentina dictyospora</i>				ZP		New for Germany
<i>Menegazzia terebrata</i>		ZP				RL 2
<i>Micarea lignaria</i>		CP§, JH, ZP				
<i>Micarea myriocarpa</i>		ZP, TT				RL 1
<i>Micarea peliocarpa</i>		ZP		CP		1. record since 1972, RL 2
<i>Micarea prasina</i>	ZP, TT		TT		(ZP)	
<i>*Micarea turfosa</i>				CP, ZP		RL 1
<i>Mycoblastus alpinus</i>				CP, TT		1. record since 1943, RL 1
<i>Mycoblastus fucatus</i>	JH	TT	TT	TT		
<i>Mycoblastus sanguinarius</i>		JH		JH		RL 3
<i>Nephroma parvile</i>				(CP)		RL 2
<i>Normandina pulchella</i>				(CP)		RL 3
<i>Ochrolechia androgyna</i> s.1.		TT		JH, ZP		RL 3
<i>Ochrolechia androgyna</i> B			TT			
<i>Ochrolechia androgyna</i> C			TT			
<i>Ochrolechia microstictoides</i>				ZP		
<i>Opegrapha varia</i>	JH	CP, ZP				RL 2
<i>Parmelia saxatilis</i>		JH		(CP)		
<i>Parmeliella triptophylla</i>				ZP		RL 1
<i>Parmeliopsis ambigua</i>				(CP)		
<i>Peltigera praetextata</i>				CP		RL 3
<i>Pertusaria albescens</i>				(CP)		RL 3
<i>Pertusaria amara</i>	JH			(CP)		RL 3
<i>Pertusaria coccodes</i>	TT			CP, TT		RL 3
<i>Pertusaria coronata</i>		TT		ZP		RL 2
<i>Pertusaria hemisphaerica</i>		CP, TT		(CP)		RL 2
<i>Pertusaria pupillaris</i>			TT			
<i>Phlyctis argena</i>		TT				

Species	Mittelsteig- hütte	Höllbach- gespreng	Hochschach- tenriegel	Rachelsee	Großer Filz	Remarks
<i>Placynthiella dasaea</i>			TT			
<i>Placynthiella icmalea</i>					(ZP)	
<i>Platismatia glauca</i>				(CP)		
<i>Porpidia tuberculosa</i>				ZP		
<i>Protoparmelia badia</i>		JH				RL 3
<i>Protothelenella corrosa</i>		AV				1. record since 1975, RL 3
<i>Psilolechia clavulifera</i>				ZP		
<i>Pyrenula nitida</i>				CP		RL 2
<i>Rhizocarpon lecanorinum</i>		ZP				1. record since 1972
<i>Rinodina efflorescens</i>			TT	CP		
* <i>Ropalospora viridis</i>	TT	TT	TT			
<i>Sclerophora peronella</i>				ZP		1. record since 1929, RL 1
* <i>Scoliciosporum sarothamni</i>	TT					
<i>Sphaerophorus globosus</i>		AV,ZP				RL 1
* <i>Steinia geophana</i>		ZP				RLG
* <i>Strangospora ochrophora</i>			ZP			
<i>Strigula stigmatella</i>		CP		ZP		RL 2
* <i>Thelocarpon superellum</i>		ZP				RL 0
<i>Thelotrema lepadinum</i>		CP,TT		CP		RL 2
<i>Trapelia coarctata</i>				JH		
* <i>Trapelia corticola</i>		TT				
* <i>Trapeliopsis gelatinosa</i>				CP,ZP		RL 2
<i>Trapeliopsis glaucolepidea</i>					(ZP)	RL 0
<i>Vulpicida pinastri</i>				JH		RL 3

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