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Diversity of lichens and lichenicolous fungi in a primeval heathland and adjacent managed forest in southern Netherlands (Groote Heide and 't Leenderbos)

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Abstract: A detailed lichenological survey of a nature reserve and surrounding areas in one of the most southern parts of the province Noord-Brabant (The Netherlands) has been undertaken from 1984 to 2008. This survey treats the biodiversity of the terricolous, corticolous, lignicolous, foliicolous and saxicolous lichens as well as lichenicolous fungi of an area of 25 km^2. In all, 215 sites, mainly conifer woodland and heathland habitats and their surrounding areas, were investigated, making this the most extensive lichenological survey ever made in this part of The Netherlands. During the survey, 221 taxa (196 lichens, four allied fungi and 21 lichenicolous fungi) were recorded, including *Bacidia polychroa*, *Buelliella physciicola* and *Micarea farinosa* which are new to The Netherlands. A site with foliicolous lichens has been found for the first time in The Netherlands, being the most northern locality in western Europe.

Zusammenfassung: Eine Bestandsaufnahme der Flechten und flechtenbewohnenden Pilze in einem Naturschutzgebiet im Südosten der Niederlande wird vorgelegt. Die Übersicht ist das Resultat von Studien der Autoren von 1984 bis 2008. Die Studie berücksichtigt terri-, corti-, ligni-, folii-, saxicole Flechten sowie lichenicole Pilze aus einem Gebiet von 25 km^2. Mit insgesamt 215 Aufnahmeflächen ist dies die umfangreichste Erhebung, die je in diesem relativ kleinen Gebiet der Niederlande gemacht wurde. 221 Taxa (196 Flechten, 4 assoziierte Pilze und 21 flechtenbewohnende Pilze) konnten nachgewiesen werden. *Bacidia polychroa*, *Buelliella physciicola* und *Micarea farinosa* sind neu für die Niederlande. Eine Lokalität mit foliicolen Flechten wurde das erste Mal in den Niederlanden gefunden. Es ist der nördlichste Fundort in Westeuropa.

Detailed inventories of lichens and lichenicolous fungi for 25 grid squares (each 1 × 1 km^2), in the south of The Netherlands, province Noord-Brabant, situated between 51°22'-51°17'N and 5°29'-5°33'E (Fig. 1), were undertaken. The major habitat of the study area (25 km^2), which lies mainly between 22 and 30 m s. m., is a conifer forest, 't Leenderbos, as well as the neighbouring southern part consisting of a heathland with the status of a nature reserve. The study area, delimited by the Belgian border to the south, a secondary road to the north, an open agriculture landscape with the stream Tongelreep to the west and a small village, Leenderstrijp, to the east, is situated within a highly urbanized region (see Figs. 2, 3). Eindhoven, a city with c. 200000 inhabitants, lies c. 15 km N of the area

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and a smaller village, Valkenswaard (c. 31000 inhabitants), lies within a distance of c. 3 km, in the NW.

The climate conditions are the same as published for another survey in the province Noord-Brabant by VAN DEN BOOM (2004).

According to local history sources (unpublished reports), from the Middle Ages to 1900, the entire study area was a *Calluna* heathland completely covered with low sandy dunes. After 1900, planting with *Pinus sylvestris* started, at first in a small amount, with a more intensive planting between 1932 and 1941 in connection with an employment project. The purpose of wood production was sprag for coal-mines. Some important smaller heathlands have been saved at that time, including a Pingo (a hydrolaccolith), "Klein Hasselsven" (see Fig. 4). In the northwestern part of the study area, a fish-nursery has been laid out in the 20th century. In fact, during the 20th century, the study area exhibits two major habitats, an extensive *Pinus* forest and a rather extensive heathland. Nowadays, the whole area has a more recreational purpose with a lot of footpaths, bridle-paths and cycling-tracks.

Biodiversity is demonstrated by the occurrence of a wide array of species, growing on a wide range of substrata in the study area. The area is dominated by conifer forests and *Calluna* heathlands, with vascular plants such as *Carex lasiocarpa*, *Lycopodium clavatum, Menyanthes trifoliata,* and *Ranunculus lingua*, however the most common one is *Molinia caerulea*. Further common vascular plants occurring throughout the area are species such as *Agrostis vinealis*, *Calluna vulgaris*, *Corynephorus canescens* and *Nardus stricta.* Disturbed places are accompanied by extensive populations of *Urtica dioica* and *Rubus fructicosus* s. l. A study about bryophytes has been made by VAN MELICK (1988), in which 139 mosses and 46 liverworts are presented, with important records such as *Ptilium crista-castrensis*, *Leptodontium flexifolium*, *Lophozia badensis* and *L. perssonii.* Extensive studies about birds, insects or mammals have never been published. There is no history in lichenology at all in this area. Today, epiphytic, terricolous and lignicolous lichens are well represented, but saxicolous species are less frequent being found on concrete bridges and posts as well as brick walls scattered throughout the area. Foliicolous lichens are very rare and only known from one site, being the only known locality in the country. The 221 taxa of lichens, allied fungi and lichenicolous fungi listed below, were compiled by the authors over a 24-year period. Some unidentified lichenicolous fungi (including undescribed species) have been found and are in need of further study.

This is the first survey of lichens and lichenicolous fungi ever made in this part of The Netherlands. Nearly all records published here are first records for the 25 grids, several are new for the province Noord-Brabant and three species are new for the country, viz. *Bacidia polychroa*, *Buelliella physciicola* and *Micarea farinosa*. Records previously published for the study area include *Psoroglaena abscondita* (as *Macentina abscondita*) and *Stereocaulon saxatile* (BOOM 2000), *Bacidia brandii* (COPPINS & BOOM 2002), *Micarea subviridescens* (BOOM 2003), *Micarea subcinerea* (BOOM & BRAND 2004), *Cladonia borealis* and several more common species in BOOM (1997).

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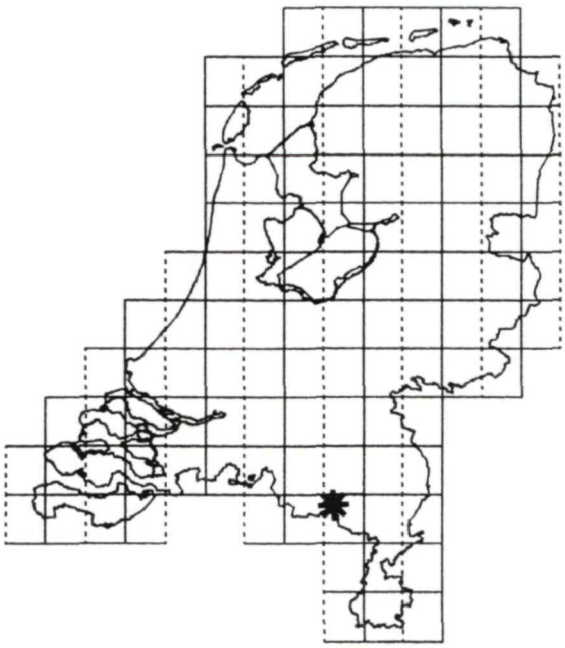

Fig. 1. Location of the study area in The Netherlands.

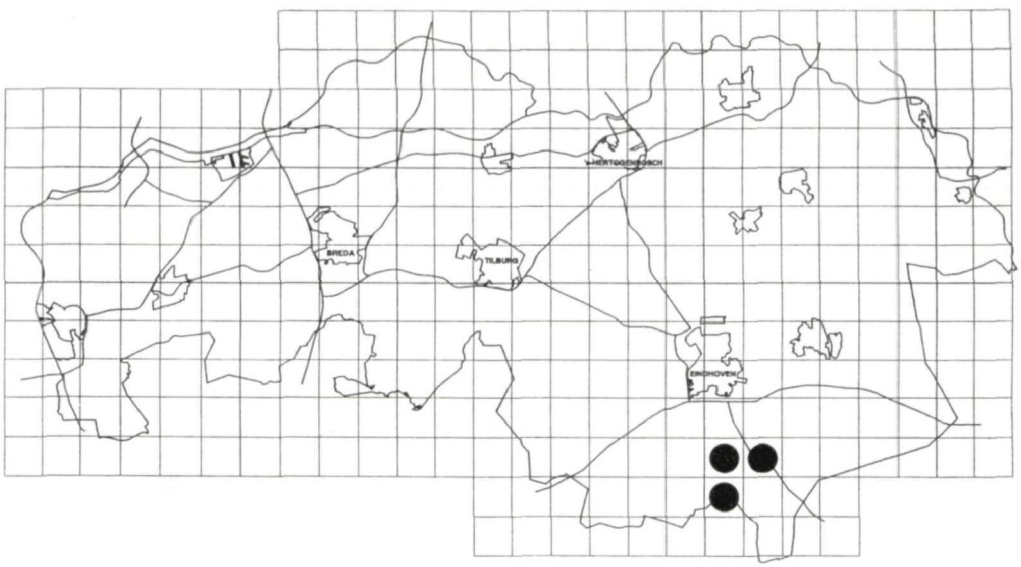

Fig. 2. Schematic map of the survey area showing the grid ref. of 5 × 5 km with the position of the collecting sites in the province Noord-Brabant. Lines are main roads.

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Methods

During more than two decades (1984-2008), two major habitats have been sampled and the accompanying vegetation noted. Lichens, allied fungi and lichenicolous fungi were recorded from 25 grids (each 1 × 1 km²). In average c. eight spots for each grid were visited and investigated exhaustively, depending on the actual richness in lichens. The distance between each site varied from c. (50-)100 to 250 m. Some sites were surveyed nearby some years later for a second time, or even for a somewhat different habitat. Vascular plants and most dominant bryophytes were recorded. From all recorded species the complete range of substrata on which they occur, including all their habitats are given in the species list.

From 215 spots, c. 2600 samples of lichens and lichenicolous fungi were recorded; c. 1500 specimens were collected and deposited in the herbarium of the first author. For each spot, a species list and ecological notes were made. All data is databased in Access. Some duplicates are in the private herbarium of MAARTEN BRAND.

Air-dried specimens were examined anatomically and morphologically with a stereo-microscope and a light microscope. For some specimens, the standard microchemical methods have been used according to ORANGE & al. (2001). The collected specimens have been studied mostly according to WIRTH (1995) and PURVIS & al. (1992). Nomenclature of lichens follows HAFELLNER & TÜRK (2001) and COPPINS (2002). For lichenicolous fungi HAWKSWORH (2003) and DIEDERICH & SÉRUSIAUX (2000) were consulted. Red List species are mentioned in Table 2. Notes on phytogeography of lichens generally follow WIRTH (1995). In the course of the survey, several specimens have been checked by specialists (see acknowledgements). The occurrence and distribution of lichens and lichenicolous fungi in The Netherlands have been taken from the "BLWG Dutch Lichen Atlas online" published by the Dutch Bryological and Lichenological Society [http://www.blwg.nl/lichatlas/].

Study area

The study area has partly the status of a nature reserve, and although formerly it was an homogenous *Calluna* heathland, most of the northern half is a conifer forest named "'t Leenderbos". The southern part, c. 3 km² is still a heathland "Groote Heide". In this latter area, a lot of *Cladonia* species were found, and the solitary *Quercus robur* trees scattered throughout are suitable phorophytes. Some trees carried c. 25 lichen species, which were mainly on the branches. Although the *Juniperus communis* trees are poor in lichen growth, they are an important element in the landscape being endangered in the area for a long time.

The extensive conifer forest in the northern part consists mainly of *Pinus sylvestris* and sometimes *P. nigra* plantations. They are homogenous and contain a rather poor undergrowth. Common plant species here are *Deschampsia flexuosa*, *Dryopteris dilatata,* and *D. carthusiana*. Even bryopytes such as *Pohlia nutans*, *Campylopus* spec. and *Dicranum* spec. occur (VAN MELICK 1988). However, the lichen flora is very poorly developed in this kind of habitat. Even small forests (plantations) with *Larix decidua*, *Picea abies, Quercus rubra* or mature *Pseudotsuga menziesii* contain a very limited lichen flora. The most very common species have been found in the more open *Larix* forest where twigs are the suitable substrate for lichens.

In the eastern side, there is a small damp (alluvial) *Salix* woodland with a Salicion cinereae community, the margin of which consists of *Betula* and young *Quercus* trees as buffer to the dry *Pinus* forest in the surrounding. A second *Salix* woodland, developed in recent times, has been found in the southwestern most part of the area, just nearby the monastery Achelse Kluis. Small *Populus* plantations are present at the west side, along the stream Tongelreep partly mixed with *Quercus rubra* and *Prunus* shrubs. Roadside trees and trees and shrubs at the outer rim of forests are important phorophytes for corticolous lichens communities. *Quercus robur* and *Betula* trees are the most important

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phorophytes in the study area, carrying 64 and 59 different species, respectively. The five most common species in the study area are *Parmelia sulcata* (97 times recorded), *Physcia tenella* (88), *Hypogymnia physodes* (77), *Lepraria incana* (77), and *Candelariella reflexa* (70).

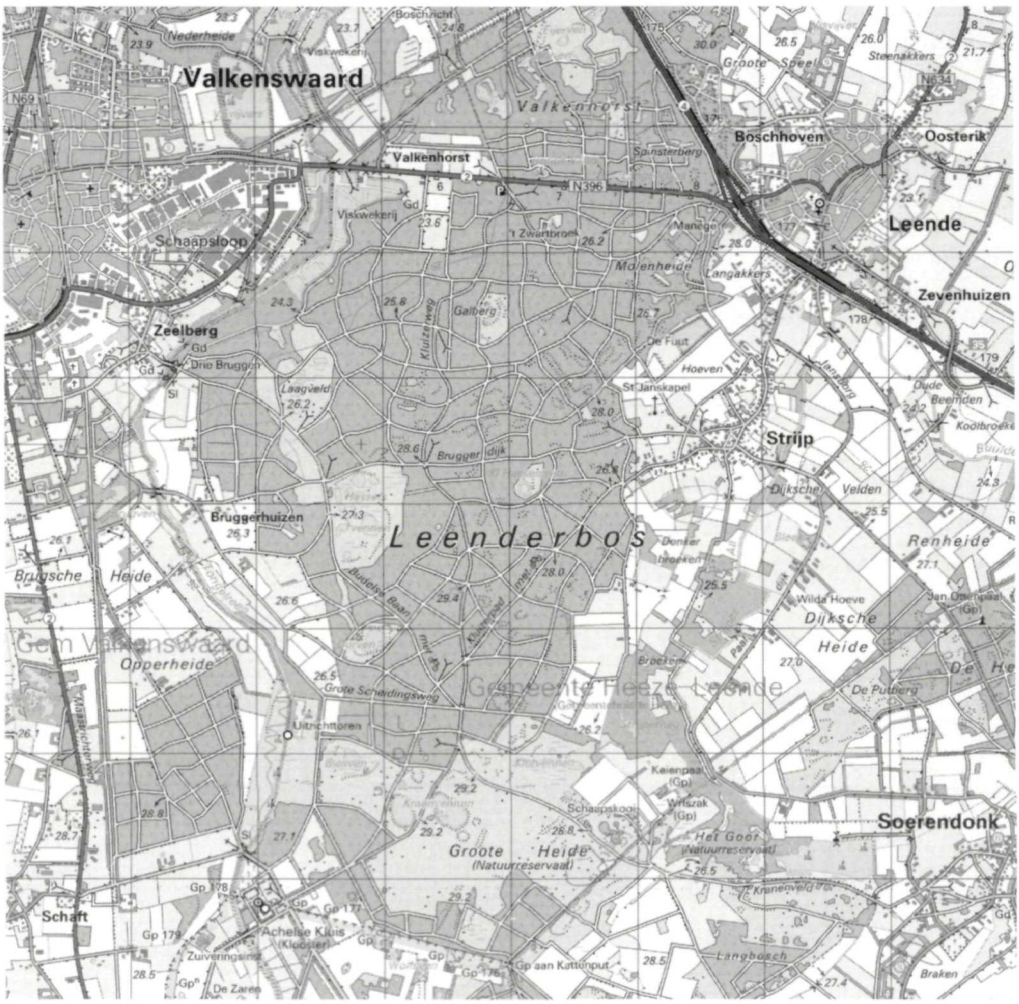

Fig. 3. Detailed map 1 : 50000 showing the study area, including the forests and heathlands (Topografische ondergrond © Kadaster, Emmen).

Recently, in a slowly way the conifer forests are going to be replaced by deciduous forests, and even open places in and alongside conifer forests are created. The purpose is to preserve and to recover the native vegetation. The study area has been indicated as a habitat of international importance by the European Union and should be protected by the state. Nowadays the heathlands are grazed by sheep. In the study area, in total there are c. 300 of a special breed of sheep, only known from southern Netherlands and northern Belgium, called "Kempense heideschapen".

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Results

1. Epiphytic communities in forests

Especially the conifer forests such as *Pinus*, *Picea* and *Pseudotsuga* are very poor in epiphytic lichens, mostly only *Lecanora conizaeoides,* or no lichens at all, have been found. *Micarea micrococca*, *Micarea viridileprosa* with the parasite *Nectriopsis micareae,* and *Placynthiella dasaea* are the only species which are able to colonize on rotting fallen trunks within such habitats. *Larix* forests which are more open and well lit, appear more suitable habitats with sometimes a rather high quantity of nitrophilous lichen flora, including species of the Xanthorion such as *Buellia griseovirens*, *Candelariella reflexa*, *Parmelia* s. l., *Physcia* spec. and *Xanthoria* spec. However the foothpats in these forests are much more interesting, because at the edge of the forests, the more open places, often occupied by *Betula*, *Quercus*, *Robinia* and *Sorbus* trees or shrubs, can have more important lichen communities, including *Diploicia canescens*, *Jamesiella anastomosans*, *Normandina pulchella*, *Platismatia glauca*, several species of *Parmelia* s. l., *Ramalina farinacea* and *Rinodina pityrea*. The two Salicion cinereae communities are rather interesting, especially the most southern one. It accommodates *Bacidina delicata*, abundantly fertile. It is the only locality where *Physcia aipolia* was found and even the only habitat with fertile specimens of *Halecania viridescens*.

2. Epiphytic communities on free-standing or roadside trees

Especially the surrounding areas, just outside the forests, contain many roadside trees, but many solitary trees are also present along the cycle tracks, foothpaths or on parking-lots. Although the Xanthorion is dominated in most situations with very common species, such as *Candelariella reflexa*, *Physcia adscendens*, *P. tenella, Xanthoria parietina,* and *X. polycarpa*, these trees are the best phorophytes for the rare species, such as *Catillaria nigroclavata*, *Diploicia canescens*, *Lecania naegelii*, *Physcia clementei* and *Pleurosticta acetabulum*. Many solitary *Quercus robur* trees are scattered all over the heathlands. Especially their branches accommodate sometimes rather rich lichen communities, with often more than 20 species on one tree.

3. Foliicolous communities

In the northern part of the study area outstanding shrubs of *Rhododendron* have been found.

Here, a rather well developed foliicolous lichens community is present with two *Bacidina* species (*B. chloroticula, B. neosquamulosa*), three species of *Fellhanera* (*F. bouteillei, F. subtilis, F. viridisorediata*), and *Fellhaneropsis myrtillicola*. The latter two where rather abundant on some leaves and *F. viridisorediata* was found with several apothecia. This is the first report of foliicolous lichens in The Netherlands as well as the most northern site with such a lichen community in western Europe. Previously the most northern locality of foliicolous species was the "Haute-Meuse", where eight species have been found growing on living leaves of *Buxus sempervirens* (VAN DEN BOOM & SÉRUSIAUX 1996).

4. Terricolous communities with lichens on stumps

The terricolous flora is rather well developed and most interesting in smaller heathlands among the northern conifer forests. The most interesting site is Galberg (see

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Fig. 5), where *Stereocaulon saxatile* has been found in an excellent condition in the year 1987. Nowadays there are only very small thalli present. In the most southern part of the study area, a hilly heathland area accommodates some well developed populations of *Stereocaulon saxatile* and *Cladonia borealis,* and in small amounts *Micarea subcinerea* and *Stereocaulon condensatum*, both being rather rare in The Netherlands. In open woodlands, *Cetraria islandica* was abundantly present in the past, but now it is extinct.

Many times, stumps have been found in open heathlands and although they can support interesting lichen communities, in only a few occasions we found *Absconditella sphagnorum* and *A. pauxillum*.

5. Saxicolous communities

Relatively few saxicolous species are recorded because of the limited variety of suitable substrata. 36 species is the result of inventarisation on mortar, concrete and a few brick walls. The genera *Caloplaca*, *Lecanora* and *Verrucaria* are present with some very common species. More interesting is the genus *Porpidia*, present with two species, *P. soredizodes*, not a rare species in the province, and *P. crustulata,* a Red List species rare in The Netherlands and not yet reported from the province. It grew on a low brick wall of a bridge over a brooklet.

6. Other habitats

At the rim of forests, occasionally solitary or grouped, *Sambucus nigra* shrubs are found. This phorophyte accommodates sometimes well developed lichen communities, with more rare species such as *Bacidia polychroa*, *Lecania cyrtellina* and *Psoroglaena abscondita*. The latter is a Red List species and very rare in The Netherlands.

7. Data and comments on most interesting species

***Absconditella* aff. *lignicola* VĚZDA & PIŠÚT**

The genus *Absconditella* is represented within the study area by three species. Most common is *A. sphagnorum*, while *A. pauxilla* has been found two times, and the third one is most probably related to *A. lignicola*. However, the apothecia are pinkish and the 3-septate ascospores are widely fusiform, with clearly pointed ends and relatively long (12-18 × 4-5 µm). Similar collections are also known from the Czech Rebublic (Z. PALICE, pers. comm.).

Specimens examined: SW of Leende, 't Leenderbos, W side of main path, open place along *Pinus* wood, stumps of *Picea,* on rotting stump and on rotting wood, grid ref. 57.25.14, 24. 4. 2000, P. VAN DEN BOOM 24284, 24293 (herbarium V. D. BOOM).

***Absconditella sphagnorum* VĚZDA & POELT**

Absconditella sphagnorum is rather common in the eastern part of the province Noord-Brabant and in the study area, it was collected at least three times. It is always found on rotting wood of fallen trunks and more rarely on stumps. It was not reported from the province before. Most of the characters are similar to specimens found in the northern part of the country where it grows terricolous, on peat and rarely on rotting wood. The only difference to the terricolous or muscicolous specimens are the ascospores. The terricolous material from northern Netherlands contains ellipsoid 1(-2) septate spores of 9.5-13 × 3.4-4.0 µm, sometimes the spores are widely fusiform. The

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material collected in the study area has widely fusiform 1(-2) septate spores of 8-12 × 2.5-3.5 µm, mostly widely fusiform and rarely ellipsoid. We regard these differences as normal variation within the species concept. However, further study, especially genetic analysis is needed to prove if one or two species are involved.

Specimens examined: W of Leende, Molenheide, W of Molenberg, open sand dune area, open place in *Pinus* forest, on rotting fallen *Pinus* trunk, grid. ref. 57.16.21, 23. 8. 2006, P. & B. VAN DEN BOOM 36976 (herbarium V. D. BOOM); SSW of Leende, Groote Heide, N rim of *Calluna* heathland, W of 'main road', path in E-W direction, along *Pinus* forest, on rotting fallen trunk, grid. ref. 57.25.24, 28. 12. 2008, P. VAN DEN BOOM 41420 (herbarium V. D. BOOM); SSW of Leende, Groote Heide, N of unpaved road, *Calluna* heathland with dunes and scattered trees, on rotting wood, grid. ref. 57.25.25, 29. 10. 2005, P. & B. VAN DEN BOOM 35681 (herbarium V. D. BOOM).

***Bacidia polychroa* (TH. FR.) KÖRB.**

It is widely distributed throughout Europe and not a rare species in Central Europe. For example, it is mentioned from several parts of Germany (SCHOLZ 2000) but previously not known from Benelux and new for The Netherlands.

Specimen examined: SE of Valkenswaard, NE of Zeelberg, near log-cabin, mixed forest and path along stream with *Sambucus*, on twigs of *Sambucus*, grid. ref. 57.15.32, 24. 10. 2005, P. & B. VAN DEN BOOM 35640 (herbarium V. D. BOOM, herbarium BRAND).

***Buelliella physciicola* POELT & HAFELLNER**

In the study area it was abundantly present in only one locality, on one tree. It is rarely mentioned from the neighbouring countries, Germany (SCHOLZ 2000) and Luxembourg (DIEDERICH & SÉRUSIAUX 2000). New for The Netherlands.

Specimen examined: SSE of Valkenswaard, 't Leenderbos, Bruggerhuizen, S of unpaved road, some *Populus* trees in meadow near farm, on *Populus*, on *Phaeophyscia orbicularis*, grid ref. 57.15.52, 28. 10. 2006, P. & B. VAN DEN BOOM 37304 (herbarium V. D. BOOM).

***Caloplaca holocarpa* (HOFFM.) A. E. WADE**

This species is not rare in The Netherlands and known from the most western and northern rim of the province Noord-Brabant. However in this SE part of the province, more than 1500 localities have been investigated and nevertheless, *C. holocarpa* has never been found here before.

Specimen examined: NW of Leende, Boschhoven, E edge of *Pinus* forest, with some *Sambucus* shrubs and *Quercus robur* at roadside, on *Sambucus*, grid ref. 57.16.21, 8. 3. 2008, P. VAN DEN BOOM 39626 (herbarium V. D. BOOM).

***Cetraria islandica* (L.) ACH.**

Although this species is known from many inland localities in The Netherlands, the known populations are seriously threatened. In the study area it became extinct during this study. The first record is from 1984, at that time it was found in rather healthy and in rather extensive populations, but in 1987 the last specimens have been seen and they were in poor condition already. During excursions some years later not a single specimen could be found in the same area.

Specimens examined: SW of Leende, Leenderbos, hilly *Pinus* wood with grassy and mossy places, terricolous in small open places in a *Pinus Quercus* forest, grid. ref. 57.15.45, 17. 10. 1984, P. & B. VAN DEN BOOM 1439 (herbarium V. D. BOOM); - ibid. 21. 6. 1987, P. & B. VAN DEN BOOM 5651 (herbarium V. D. BOOM).

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Fig. 4. View of the Pingo Klein Hasselsven, showing the eastern part of the circular fen.

Fig. 5. View of Galberg, the heathland with *Juniperus communis*.

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***Clypeococcum hypocenomycis* D. HAWKSW.**
Although this species is probably not rare in The Netherlands, there are only a few records known and these are the first records for the province.

Specimens examined: SW of Leende, 't Leenderbos, W of Heggerdijk, SW of farm, path along *Pinus* forest and field, on *Betula*, on *Hypocenomyce scalaris*, grid ref. 57.15.55, 9. 11. 2006, P. & B. VAN DEN BOOM 37015 (herbarium V. D. BOOM); SW of Leende, 't Leenderbos, NE side of Dorven, edge of *Pinus* forest and *Calluna* heathland, mixed trees, on *Betula*, on *Hypocenomyce scalaris*, grid. ref. 57.15.54, 21. 4. 2007, P. & B. VAN DEN BOOM 37512 (herbarium V. D. BOOM).

***Fellhaneropsis myrtillicola* (ERICHSEN) SÉRUS. & COPPINS**
The encountered population is unique in the country because it was found here foliicolous. This Red List species is rare in The Netherlands and previously known from two provinces (Utrecht and Drenthe), so it is new for the province Noord-Brabant. In Belgium it is known from leaves and twigs of *Buxus*, needles and twigs of *Picea*, branches of *Calluna* and *Vaccinium* (DIEDERICH & SÉRUSIAUX 2000).

Specimen examined: E of Valkenswaard, 't Leenderbos, forest with *Quercus robur*, *Fagus sylvatica* and *Rhododendron*, on leaf of *Rhododendron*, 15. 12. 2007, P. & B. VAN DEN BOOM 38877 (herbarium V. D. BOOM).

***Hypotrachyna afrorevoluta* (KROG & SWINSCOW) KROG & SWINSCOW and *H. revoluta* (FLÖRKE) HALE s. str.**
During the last few years it was clear that *Hypotrachyna afrorevoluta* was present and recognizable in the study area. All the years before it was recorded under the name *H. revoluta*. From all the collecting material, 16 specimens appeared to belong to *H. afrorevoluta* and 14 specimens belong to *H. revoluta* s. str. The number of remaining field observations are 17. Sometimes, both species appeared well developed and forming thalli up to c. 15 cm in diam.

***Micarea farinosa* COPPINS & APTROOT**
This *Micarea* was found on overhanging soil along a ditch, in a wooded area. It was clearly growing on soil. It was found eight years ago. Recently it was described from Great Britain, so it is the first record for The Netherlands and also for continental Europe.

Specimen examined: W of Leende, S of Valkenhorst, ditch between two *Pinus* forests, on overhanging sandy soil along a ditch, 18. 8. 1999, P. VAN DEN BOOM 23515 (herbarium V. D. BOOM, herbarium BRAND).

***Stereocaulon condensatum* HOFFM.**
This species is a member of the Red List and although it is known from several localities in southern, central and northeastern parts of the country, it is a rare and vulnerable species. In the study area only small populations were found.

Specimens examined: W of Maarheeze, W of Soerendonk, Groote Heide, hilly *Calluna* heathland, terricolous, grid ref. 57.25.35, 19. 6. 1987, P. VAN DEN BOOM s. n. (herbarium V. D. BOOM); - ibid. 21. 6. 2000, P. & B. VAN DEN BOOM 24609 (herbarium V. D. BOOM); - ibid. 22. 9. 2001, P. & B. VAN DEN BOOM 27957, M. & D. BRAND 57255 (herbarium V. D. BOOM, herbarium BRAND).

***Stereocaulon saxatile* MAGN.**
This Red List species is very rare in the country. At the beginning of our study it was abundantly present in the northern heathlands and found in well developed populations. However, only very few and poorly developed populations are still present. This

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species is seriously endangered.

Specimens examined: WSW of Leende, 't Leenderbos, Galberg, hilly *Calluna* heathland, *Juniperus*, *Quercus* trees and stumps, terricolous, grid ref. 57.15.34, 28. 2. 1987, P. VAN DEN BOOM 4491 (herbarium V. D. BOOM); - ibid. 19. 3. 2005, P. & B. VAN DEN BOOM 34649 (herbarium V. D. BOOM); W of Maarheeze, W of Soerendonk, Groote Heide, hilly *Calluna* heathland, terricolous, grid ref. 57.25.35, 19. 6. 1987, P. VAN DEN BOOM 5637 (herbarium V. D. BOOM); - ibid. 21. 6. 2000, P. & B. VAN DEN BOOM 24608, 24612 (herbarium V. D. BOOM); - ibid. 22. 9. 2001, P. & B. VAN DEN BOOM, M. & D. BRAND 57253 (herbarium BRAND).

8. Phytogeographic notes

The lichens and allied fungi were subdivided into seven phytoclimatical groups, based on their latitudinal and longitudinal ranges in Europe, according to WIRTH (1995) and NIMIS & TRETIACH (1995), with the exception of one additional group, "intermediate element". This includes species with a limited distribution, mainly known from Central Europe only. The rather mild climate in connection with the strict lowland situated area with a strong oceanic influence results in the high percentage of the temperate element (see Table 1). It is formed by wide-ranging species that occur from Artic (or Boreal) to Mediterranean areas. Others are species with a more limited distribution. There is no data available regarding phytogeography for lichenicolous fungi.

Table 1. Frequences of lichen taxa of main phytoclimatic groups

Widespread temperate element	51.0 %
Southern temperate element	19.0 %
Northern temperate element	13.5 %
Intermediate element	10.0 %
Northern subatlantic element	3.0 %
Widespread subatlantic element	1.0 %
Others	2.5 %

Endemic lichens have not been found.

9. Discussion

Lichen biodiversity is rather high in the investigated area and yielded in total 196 lichen taxa, more than 25 % of the known species in The Netherlands, of which 117 are recorded epiphytic, 36 saxicolous, 45 terricolous, 54 lignicolous (including stumps). However, eight species, which are less substrate specific, have been found epiphytic, terricolous as well as lignicolous. 78 macrolichens, 118 microlichens and 21 lichenicolous fungi are known from the area. The most rare lichen species in the country, occurring in the study area and currently known in this province only, are *Absconditella pauxilla*, *Bacidia polychroa*, *Hypogymnia farinacea*, and *Micarea farinosa*. Red List species (APTROOT & al. 1998) found during our study, including new findings of lichens for the country, are listed in Table 2.

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Table 2. Red List (lichen) species with the number of records

Absconditella pauxilla	2
Bacidia polychroa	1
Bryoria fuscescens	2
Cetraria islandica	3
Cladonia cornuta	1
Cladonia pulvinata	16
Cladonia strepsilis	4
Cladonia zopfii	22
Fellhanera subtilis	4
Fellhaneropsis myrtillicola	1
Fuscidea lightfootii	3
Lecania cyrtellina	1
Lecania naegelii	3
Micarea farinosa	1
Micarea subcinerea	1
Normandina pulchella	2
Parmelina tiliacea	2
Physcia aipolia	1
Physcia clementei	2
Piccolia ochrophora	2
Platismatia glauca	7
Porpidia crustulata	1
Rinodina pityrea	3
Stereocaulon condensatum	2
Stereocaulon saxatile	2
Usnea hirta	2
Vezdaea acicularis	1

Lichenicolous fungi are not comprehensively studied in The Netherlands by specialists, so this group was much neglected in the past. *Buelliella physiicola* is new to the country and species which are rare according to the recent checklist (Dutch Bryological and Lichenological Society [http://www.blwg.nl/lichatlas/]) and partly common in the study area, are *Arthonia phaeophysciae*, *Cladoniicola staurospora*, *Clypeococcum hypocenomycis*, *Lichenoconium erodens, L. lecanorae*, *L. xanthoriae, Lichenodiplis lecanorae*, *Marchandiobasidium aurantiacum*, *Pronectria oligospora*, *Psammina stipitata, Syzygospora physciacearum, Taeniolella phaeophysciae*, *Trichonectria rubefaciens* and *Tubeufia heterodermiae*. They are most probably overlooked.

One of the most remarkable species is *Cetraria islandica*. It is a Red List species and currently rare and endangered in the country. During the beginning of this study it was a rather common species in one grid and collected in 1987 in open forests. Thalli where abundantly present and sometimes c. 10 cm. However, *C. islandica* was the most dominating species, covering sometimes many m^2 in this locality until the fifties (forester, pers. comm.). We are sure that this species is now (2008) extinct. Another phenomenon is the occurrence of an unexpected foliicolous lichen community. Six lichen species were

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found growing on leaves of *Rhododendron*. Previously the most northern known locality in western Europe was the valley of the Meuse in Belgium (BOOM & SÉRUSIAUX (1996).

In terms of bioclimate, the area is clearly homogeneous, so there is no gradient determining the distribution of species within the area. The medium large city (Eindhoven), N of the area with a lot of industrial activities and the dominating agriculture (intensive factory farming), eastern, western and southern alongside the area, have a significant influence all over the area. The pollution of the air with ammonia and other pollutants has a negative effect on the lichen vegetation. This nutrient enrichment is shown by the dominating amount of nitrophilous species. Even the quality of the native terricolous vegetation is strongly delimited by *Molinia caerulea*, the most dominating vascular plant.

Recreation is another factor with negative influence. The area is partly accessible for cars or other motor traffic, on a few unpaved roads. The paved road (N-S) throughout the centre of the area is not accessible for motor traffic, just for bicycles. Beside that, there are several bicycle-trails which cause a lot of tourist activities throughout the whole year.

10. Annotated species list

Legends of the species list

The number after the species name means: total number of records.
Abbreviations:

Habitats:

cf	*Picea* forest
ch	open dry *Calluna* heathland
db	± damp *Betula* woodland
ds	damp *Salix* woodland
fh	free standing tree in heathland
mp	mixed trees at parking lot
mw	mixed woodland
pb	*Pinus Betula* forest
pf	*Pinus* forest
pq	*Pinus Quercus* forest
ps	*Pseudotsuga* forest
ra	rim along forest
rf	roadside or fieldside

Phytogeography:

alp	alpine
arct	arctic
atl	atlantic
bor	boreal
mieur	central Europe
med	mediterranean
mo	montane
submed	submediterranean
subatl	subatlantic
subbor	subboreal
subco	subcontinental

Substrata:

b	brick
c	concrete or cement
rw	(rotting) wood (trunk or branch)
s	acidic stones terricolous
st	stump
t	terricolous
wp	wood of fence post
Ac	*Acer platanoides*
Ae	*Aesculus hippocastanum*
Ap	*Acer pseudoplatanus*
An	*Alnus glutinosa*
Be	*Betula* spp.
Ca	*Castanea sativa*
Cr	*Carpinus betulus*

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Cv *Calluna vulgaris*
Cn *Cornus* spec.
Co *Corylus avellana*
Fa *Fagus sylvatica*
Ju *Juniperus communis*
La *Larix decidua*
Ma *Malus* spec.
My *Myrica gale*
Pc *Picea abies*
Pn *Pinus sylvestris*
Po *Populus* spp.
Pr *Prunus* spec.
Ps *Pseudotsuga menziesii*
Py *Pyrus* spec.
Qr *Quercus robur*
Qa *Quercus rubra*
Rd *Rhododendron* spec.
Rh *Rhus* spec.
Ro *Robinia pseudacacia*
Sa *Salix* spp.
Sm *Sambucus nigra*
So *Sorbus aucuparia*
Ti *Tilia* spec.
Va *Vaccinium*

(f) fertile
\+ not clearly lichenized species

Absconditella aff. *lignicola* VĚZDA & PIŠÚT 2 ra; rw, st; mieur
Absconditella pauxilla VEZDA & VIVANT 2 ch; rw; mieur, atl
Absconditella sphagnorum VĚZDA 3 ra; rw; bor-mieur
Amandinea punctata (HOFFM.) COPPINS & SCHEID. 59 ch, fh, mp, pb, pf, ra, rf; Aa, Be, Cr, La, Pc, Pn, Po, Qa, Qr, Sa, Sm, Ti, rw; (arct-)bor-med
Anisomeridium polypori (ELLIS & EVERH.) M. E. BARR 4 ds, mw; Po, Sa, Sm; mieur, subatl-med
Arthonia muscigena TH. FR. 1 ch; st; mieur-submed
+*Arthonia punctiformis* ACH. 5 ch, mw, ra; Be, My; subbor-med
Arthonia radiata (PERS.) ACH. 2 ch, mw, ra; Pr, Qr; (sub)bor-med
Arthonia spadicea LEIGHT. 1 mw; st; subbor-submed. mo
+*Arthopyrenia punctiformis* A. MASSAL. 6 ch, mw; Be, Qr; bor-med
Bacidia adastra SPARRIUS & APTROOT 2 mw, rf; Pr, Sm; mieur
Bacidia brandii COPPINS & VAN DEN BOOM 3 ch, ra; Pc, st; mieur, subatl
Bacidia polychroa (TH. FR.) KÖRB. 1 ra; Sm; mieur, subatl-submed(-med)
Bacidina arnoldiana (KÖRB.) V. WIRTH & VĚZDA 19 ch, ds, mp, mw, ra, rf; Pc, Po, Pr, Qr, Sa, st, t, w; mieur-med
Bacidina chloroticula (NYL.) VĚZDA & POELT 2 mf, ra; Rd, st; (subbor-)submed
Bacidina delicata (LEIGHT.) V. WIRTH & VĚZDA 3 ds, mp, ra; Pc, Qr, Sa; mieur-submed
Bacidina neosquamulosa (APTROOT & VAN HERK) EKMAN 11 ch, ds, mw, ra, rf; Be, Pc, Pr, Rd, Sa, Sm, Va; mieur, atl
Baeomyces rufus (HUDS.) REBENT. 5 ch, ra; t; bor-submed
Bilimbia sabuletorum (SCHREB.) ARNOLD 2 ra; b; bor-med
Bryoria fuscescens (GYELN.) BRODO & D. HAWKSW. 2 ch; st; bor-med, mo
Buellia griseovirens (TURNER & BORRER ex SM.) ALMB. 14 ch, ds, fh, mp, mw, ds, ra, rf; Be, La, Po, Pr, Qa, Qr, Sa; subbor-mieur, subatl-med
Caloplaca citrina (HOFFM.) TH. FR. 5 ra, rf; b, c; bor-med
Caloplaca decipiens (ARNOLD) BLOMB. & FORSS. 1 rf; c; (subbor-)mieur-med(mo), (subco)
Caloplaca dichroa ARUP 1 ra; c; bor-mieur
Caloplaca flavocitrina (NYL.) H. OLIVIER 6 ra, rf; c; subbor-med
Caloplaca holocarpa (HOFFM.) A. E. WADE 1 ra; Sm; arct-med

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Caloplaca lithophila H. MAGN 7 ra, rf; c; arct-med
Caloplaca obscurella (J. LAHM) TH. FR. 3 ra, rf; Qr, Sm; (subbor)mieur-med
Caloplaca phlogina (ACH.) FLAGEY 2 rf; Po; mieur-med?
Caloplaca saxicola (HOFFM.) NORDIN 1 rf; c; bor-med
Candelaria concolor (DICKS.) STEIN 29 ds, fh, mw, ra, rf; Ac, Apl, Be, Pc, Po, Qr, Ro, Sa, Sm, Sr; subbor-med(mo)
Candelariella aurella (HOFFM.) ZAHLBR 14 ch, ra; c; arct-med
Candelariella reflexa (NYL.) LETTAU 70 ch, mw, ds, fh, pb, pq, ra, rf; Ac, Be, La, Pc, Pn, Po, Pr, Qr, Ro, Sa, Sm, Ti; mieur-med
Candelariella vitellina (HOFFM.) MÜLL. ARG. 6 ch, ra, rf; Qa, b, c; arct-med
Candelariella xanthostigma (ACH.) LETTAU 2 ch, ra; Qr, Sm; (arct)bor-med
Catillaria chalybeia (BORRER) A. MASSAL. 2 ra, rf; b, c; bor(atl)-mieur-med(mo)
Catillaria nigroclavata (NYL.) SCHULER 6 mp, ra, rf; Be, Po, Qa, Qr; subbor-med
Cetraria aculeata (SCHREB.) FR. 16 ch, ra; t; bor-med, mo
Cetraria islandica (L.) ACH. 3 mw; t; arct-mieur(-med, mo)
Cetraria muricata (ACH.) ECKFELDT 2 ch; t; arct-med, alp
Chaenotheca ferruginea (TURNER ex ACH.) MIG. 1 pf; Qr; bor-med, mo
Chaenotheca trichialis (ACH.) TH. FR. 1 pf; Pn; bor-med, mo
+*Chaenothecopsis savonia* (RÄSÄNEN) TIBELL 2 mw, ra; rw, st; bor-mieur
Cladonia borealis S. STENROOS 2 ch; t; arct-mieur(mo)
Cladonia caespiticia (PERS.) FLÖRKE 5 mw, ra, rf; t; mieur, subatl-submed(-med, mo)
Cladonia cervicornis (ACH.) FLOTOW 20 ch; t; bor-med, subatl
Cladonia chlorophaea (FLORKE ex SOMMERF.) SPRENGEL s.s. 7 ch, mw, pf, ra; Be, Qr, rw, t; arct-med
Cladonia coccifera (L.) WILLD. 32 ch, mw, pf, ra, rf; st, t; (s')bor(subatl)-mieur(subatl)-med, mo
Cladonia coniocraea (FLÖRKE) SPRENGEL 23 cf, ch, ds, mw, pf, ra, rf; Be, Pc, Po, Qr, Sa, rw, s, st, t; bor-submed(-med)
Cladonia cornuta (L.) HOFFM. 1 ch; st; (arct-)bor-mieur, mo
Cladonia crispata (ACH.) FLOTOW var. *cetrariiformis* 20 ch; st, t; arct-mieur
Cladonia cryptochlorophaea ASAH. 13 ch, mw, ra; Be, st, t; subbor-mieur, subatl
Cladonia digitata (L.) HOFFM. 3 mp, pf, ra; Be, st; bor-med
Cladonia fimbriata (L.) FR. 15 ch, ds, fh, mw, ra; Be, Pc, Pn, Pr, Qr, rw, st, s, t; (arct)bor-med
Cladonia floerkeana (FR.) FLÖRKE 42 ch, db, fh, mw, pf, ra, rf; Be, rw, st, t; subbor-submed
Cladonia foliacea (HUDS.) WILLD. 18 ch; t; mieur, subatl-med
Cladonia furcata (HUDS.) SCHRAD. 7 ch, mw, pf, ra, rf; t; bor-med
Cladonia glauca FLÖRKE 16 ch, mw, pf, ra; Be, rw, st, t; (subbor-)mieur
Cladonia gracilis (L.) WILLD. 21 ch, db, ra, pf; st, t; arct-submed, mo
Cladonia humilis (WITH.) J. R. LAUNDON 3 ra, rf; st, t; mieur-med, subatl
Cladonia macilenta HOFFM. s. l. ch, db, ds, mw, pb, pf, ra, rf; Be, rw, st, t; subbor-submed(-med)
Cladonia bacillaris (LEIGHT.) ARNOLD 48
Cladonia macilenta HOFFM. s. str. 3
Cladonia merochlorophaea ASAH. 19 ch, db, ds, mw, pf, ra; Be, rw, st, t; arct-mieur (submed)

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Cladonia mitis (SANDST.) HUSTICH 7 ch, pf, pq, rw; t; arct-mieur(-submed, mo)
Cladonia monomorpha APTROOT, SIPMAN & VAN HERK 5 ch; t; mieur-med
Cladonia novochlorophaea (SIPMAN) BRODO & AHTI 3 ch, pf, rw; rw, t; bor-mieur (med, mo)
Cladonia ochrochlora FLÖRKE 2 mw, ra; st; bor-med
Cladonia portentosa (DUF.) FOLLM. 42 ch, mw, pb, pf, pq, ra; Qr, st, t; mieur-(s)med, subatl
Cladonia pulvinata (SANDST.) VAN HERK & APTROOT 16 ch; rw, t; mieur, atl-med
Cladonia ramulosa (WITH.) LAUNDON 35 ch, db, mw, pf, pq, ra, rf; Be, Qr, Ro, rw, st, t; (subbor-)mieur, subatl-submed, subatl(-med)
Cladonia rei SCHAERER 3 ch, rw; t, disturbed places; subbor-mieur
Cladonia scabriuscula (DELISE) NYL. 1 ra; t; bor-mieur, subatl
Cladonia strepsilis (ACH.) GROGNOT 4 ch; t; (bor, atl-)mieur, subatl-submed
Cladonia subulata (L.) WEBER ex WIGG. 18 ch, db, mw, pf, ra, rf; Be, st, t; bor-med
Cladonia verticillata (HOFFM.) SCHAER. 2 ch; t; arct-med
Cladonia zopfii VAIN. 22 ch; t; bor-mieur, subatl
Coenogonium pineti (SCHRAD. ex ACH.) LÜCKING & KALB 18 cf, ds, mw, pf, pq, ra; Be, Pc, Pn, Po, Qr, Ro, Sa, st; bor, atl-med
+*Cyrtidula quercus* (A. MASSAL.) MINKS 2 fh; Co, Qr; mieur-submed
Diploicia canescens (DICKS.) ANZI 4 ra, rf; Be, La, Sm; mieur, subatl-med
Evernia prunastri (L.) ACH. 42 db, ds, fh, mw, pf, ra; Be, La, Pc, Pr, Qr, Sa, rw, st; bor-med
Fellhanera bouteillei (DESM.) VĚZDA 1 mw; Rd; mieur, subatl-med, mo
Fellhanera subtilis (VĚZDA) DIEDERICH & SÉRUS. 4 mw, ra; Pc, Rd; subbor-mieur, subatl
Fellhanera viridisorediata APROOT, BRAND & SPIER 24 ch, ds, mw, ra; Be, La, Pc, Pn, Pr, Rd, Ro, Sa, rw; mieur, atl
Fellhaneropsis myrtillicola (ERICHS.) SÉRUS. & COPPINS 1 mw; Rd; mieur-med
Flavoparmelia caperata (L.) HALE 55 ch, fh, db, ds, mw, pf, ra, rf; An, Be, La, Po, Qr, Sa, Sm, rw, st; subbor(subatl)-med
Flavoparmelia soredians (NYL.) HALE 18 ch, ds, fh, mw, ra; Be, Pn, Po, Qr, Sa, rw; mieur-med
Fuscidea lightfootii (SM.) COPPINS & P. JAMES 3 ds, rf; Qr, Sa; mieur, atl(subatl)-submed(-med)
Halecania viridescens COPPINS & P. JAMES 4 ds, mw, ra, rf; Co, Qa, Sa, st; (f) mieur, atl-submed, atl
Hyperphyscia adglutinata (FLÖRKE) H. MAYRHOFER & POELT 13 ch, mw, ra, rf; La, Po, Qr, Sa, Sm; mieur, subatl-med
Hypocenomyce scalaris (ACH.) CHOISY 15 ch, db, mw, pf, ra; Be; bor-med (mo)
Hypogymnia farinacea ZOPF 12 ch, mw, ra, rf; Be, La, Pr, Qr, rw; subbor-med, upper mo
Hypogymnia physodes (L.) NYL. 77 ch, ds, mw, pf, ra, rf; Be, Ca, La, Pn, Qr, Sa, So, rw, st, wp, t; arct-med
Hypogymnia tubulosa (SCHAER.) HAV. 29 ch, db, ds, mw, pf, ra; Be, Qr, Sa, st; bor-med
Hypotrachyna afrorevoluta (KROG & SWINSCOW) KROG & SWINSCOW 16 ch, ds, fh, mw, ra, rf; Pn, Qr, Qa; mieur-med?
Hypotrachyna revoluta (FLÖRKE) HALE 14 ch, mp, mw, ds, pf, ra, rf; Be, Ca, Cr, La, Pn, Po, Qr, Ro, Sr, Sa, rw, st; mieur, subatl-med

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Jamesiella anastomosans (P. JAMES & VĚZDA) LÜCKING, SÉRUS. & VĚZDA 20 ds, fh, ra; Be, Fa, Qr, Sa; mieur-med, (sub-)atl
Lecania cyrtella (ACH.) TH. FR. 11 ch, mp, mw, fh, pf, ra, rf; Be, Fa, Po, Sm, st; subbor-med
Lecania cyrtellina (NYL.) SANDST. 1 ra; Sm; bor-med
Lecania erysibe (ACH.) MUDD 2 rf; c; subbor-med
Lecania naegelii (HEPP) DIEDERICH & VAN DEN BOOM 2 ra, rf; Po, Sm; subbor-med
Lecania rabenhorstii (HEPP) ARNOLD 2 ra; c; subbor-mieur, subatl(-med)
Lecanora albescens (HOFFM.) BRANTH & ROSTR. 10 ra; c; bor-med
Lecanora barkmaniana APTROOT & VAN HERK 24 ch, ds, mp, mw, fh, ra, rf; An, Po, Qa, Qr, Sa, st; mieur, atl
Lecanora campestris (SCHAERER) HUE 1 ra; c; bor-med
Lecanora carpinea (L.) VAIN. 17 ch, fh, mw, ra, rf; Po, Qa, Qr, Sm, rw; bor-med
Lecanora chlarotera NYL. 19 ch, mw, fh, ra, rf; Be, Po, Pr, Qa, Qr, Sa, Sr, Ti, rw; bor-med
Lecanora conizaeoides CROMB. 42 ch, db, fh, pf, ra; Be, Ju, La, Pc, Po, Pn, Pc, Ps, Qr, rw, st; (bor-)mieur-submed
Lecanora dispersa (PERS.) SOMMERF. 22 mp, mw, fh, ra, rf; Be, Po, Pn, Qr, Sa, c, s, st; arct-med
Lecanora expallens ACH. 14 ch, ds, fh, mp, mw, ra, rf; Be, Ca, Po, Pn, Qr, Sm; subbor, subatl-med
Lecanora hagenii (ACH.) ACH. 18 ch, ds, mw, mp, fh, rf; Be, Po, Qa, Qr, Sa, Sm, rw; bor-med
Lecanora muralis (SCHREB.) RABENH. 11 ch, fh, ra, rf; Py, b, c, st; arct-med
Lecanora polytropa (EHRH. ex HOFFM.) RABENH.1 ra; b; arct-med
Lecanora pulicaris (PERS.) ACH. 2 ra, rf; Qa, Qr; bor-med, mo
Lecanora saligna (SCHRAD.) ZAHLBR. 28 ch, db, fh, mw, ra, rf; Be, Pc, Pn, Qr, rw, st, wp; bor-med, mo
Lecanora semipallida SPRENG 4 ra; c; bor-submed, atl
Lecanora symmicta (ACH.) ACH. 19 ch, ds, fh, mp, mw, ra; Be, Pn, Pr, Qr, Ti, rw, st; bor-med
Lecidea fuscoatra (L.) ACH. 1 ra; rw; subbor-med
Lecidella achristotera (NYL.) HERTEL & LEUCKERT 37 ch, ds, fh, mp, mw, pq, rarf; Ae, An, Be, La, Po, Pr, Qr, Ro, Sa, Sm, Ti, wp; mieur?
Lecidella scabra (TAYLOR) HERTEL & LEUCKERT 4 rf; Qa, Qr, b; subbor(subatl)-med
Lecidella stigmatea (ACH.) HERTEL & LEUCKERT 9 ra, rf; c, plastic; arct-med
Lepraria incana (L.) ACH. 77 cf, ch, db, ds, fh, mp, mw, pb, pf, pq, ra, rf; An, Be, Ca, La, Pn, Po, Ps, Ro, Qa, Qr, Sa, rw, s, st; bor-med
Lepraria jackii TØNSBERG 1 ra; t; bor-mieur(mo)
Lepraria lobificans NYL. 4 ds, rf; Be, Qa, Sa; bor-med
Lepraria rigidula (B. DE LESD.) TØNSBERG 3 ch, fh, ra; Be, Qr; subbor-med
Melanelia elegantula (ZAHLBR.) ESSL. 1 ch, fh; Qr; mieur-med
Melanelia exasperatula (NYL.) ESSL. 18 ch, ds, fh, mw, ra; La, Pc, Pn, Qr, Sr, st; bor-med
Melanelia fuliginosa (FR. ex DUBY) ESSL. subsp. *glabratula* (LAMY) COPPINS 4 ds, mw, ra; Po, Qr, Sa; bor-med

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Melanelia subaurifera (NYL.) ESSL. 55 ch, db, ds, fh, mw, pb, pf, ra, rf; Be, La, Pn, Po, Pr, Qr, Rd, Sa, rw, st; bor-submed
Micarea botryoides (NYL.) COPPINS 1 ra; t; (subbor-)mieur, subatl(-med)
Micarea denigrata (FR.) HEDL. 34 ch, fh, mw, pf, ra, rf; Be, Ju, Pc, Pn, Pr, Qr, rw, st; bor-med
Micarea farinosa COPPINS & APTROOT 1 ra; t; mieur, atl
Micarea micrococca (KÖRB.) GAMS ex COPPINS 14 ch, ds, mw, mp, pf, pq, ps, ra; Be, La, Ps, Qr, Sa, rw, st; subbor-mieur?
Micarea misella (NYL.) HEDL. 6 ds, mw, ra; rw, st; bor-submed, mo(-med, mo)
Micarea nitschkeana (J. LAHM ex RABENH.) HARM. 10 ch, ra; Ca, Cv, (subbor-) mieur(submed, mo)
Micarea prasina FR. 6 ch, mp, pf, ra; Be, Qr, rw, st, t; bor-med(mo)
Micarea subcinerea BRAND & VAN DEN BOOM 1 ch; t; mieur, atl
Micarea subviridescens (NYL.) HEDL. 1 ra; t; mieur-med, atl?
Micarea viridileprosa COPPINS & VAN DEN BOOM 37 ch, ds, mp, mw, pb, pf, pq, ps, ra, rf; Be, Pn, Ps, Ro, Qr, rw, st, t; mieur-submed
Normandina pulchella (BORRER) NYL. 2 mw, ra; Fa, Qa; subbor-med
Parmelia saxatilis (L.) ACH. 4 ch, fh, rf; Be, Qr; arct-med, mo
Parmelia sulcata TAYLOR 97 ch, mw, ds, fh, mp, pf, ra, rf; An, Be, La, Pc, Pn, Po, Pr, Ro, Qa, Qr, Sa, Sm, rw, st; arct-med
Parmelina tiliacea (HOFFM.) HALE 2 ch, ds; Sa, st; (subbor-)mieur-med
Parmeliopsis ambigua (WULFEN) NYL. 10 ch, db, fh, mw, ra; Be, Qr, st; bor-med, mo (med, mo)
Parmotrema perlatum (ESCHW.) M. CHOISY 36 ch, db, ds, fh, mw, ra, rf; Be, La, Po, Pr, Ro, Qa, Qr, Sa, Sm, rw, t; mieur, subatl-med(mo/subatl)
Peltigera didactyla (WITH.) J. R. LAUNDON 1 ch; t; arct-med
Phaeophyscia nigricans (FLÖRKE) MOBERG 3 mp, rf; Ac, Po, Qr; bor-med
Phaeophyscia orbicularis (NECK.) MOBERG 38 ch, ds, fh, mp, mw, ra, rf; An, Be, Po, Qa, Qr, Sa, Sm, b, c, st; bor-med
Phlyctis argena (SPRENG.) FLOT. 3 ra, rf; Qa, Qr; subbor-med
Physcia adscendens (FR.) H. OLIVIER 54 ch, ds, fh, mp, mw, pb, pf, ra, rf; An, Be, La, Pn, Po, Qa, Qr, Ro, So, Sa, Sm, c, s, st; bor-med
Physcia aipolia (EHRH. ex HUMB.) FÜRNR. 1 ds; Sa; bor-med(mo)
Physcia caesia (HOFFM.) FÜRNR. 15 ch, mp, ra, rf; Po, Qa, Qr, b, c, st; arct-med
Physcia clementei (TURNER) MAAS GEEST. 1 rf; Qa; mieur, atl-med, subatl
Physcia dubia (HOFFM.) LETTAU 1 rf; Qr; arct-submed
Physcia stellaris (L.) NYL. 8 ch, fh, mw, ra; Po, Qr, Sm, st; bor-med(mo)
Physcia tenella (SCOP.) DC. 88 ch, db, ds, fh, mp, mw, pb, pf, ra, rf; Ac, An, Be, La, Ma, Pc, Pn, Po, Qr, Sa, Sm, So, Ti, rw, st; (arct-)bor-med
Physcia tribacioides NYL. 1 rf; So; mieur-med,atl
Physconia grisea (LAM.) POELT 5 ds, mw, ra, rf; Ac, Po, Qr, Sa, Sm; mieur-med
Piccolia ochrophora (NYL.) HAFELLNER 2 ra, rf; Po, Sm; bor-med
Placynthiella dasaea (STIRTON) TØNSBERG 55 cf, ch, db, fh, mw, pf, ps, ra; Be, Pc, Pn, Ps, Qr, Ro, rw, st, t; bor-med
Placynthiella icmalea (ACH.) COPPINS & P. JAMES 16 ch, db, pb, pf, ra; rw, t; bor-med
Placynthiella oligotropha (LAUNDON) COPPINS & P. JAMES 11 ch, ra; t; bor-mieur
Placynthiella uliginosa (SCHRADER) COPPINS & P. JAMES 11 ch, ra; t; arct-med, mo

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Platismatia glauca (L.) CULB. & C. CULB. 7 ch, db, pf, ra; Be, Qr, st; bor-mieur-med, mo
Pleurosticta acetabulum (NECKER) ELIX & LUMBSCH 1 mp; Ae; (subbor-)mieur-med
Porpidia crustulata (ACH.) HERTEL & KNOPH 1 rf ; b; bor-med(mo)
Porpidia soredizodes (LAMY ex NYL.) LAUNDON 2 ra, rf; b, s; bor-med
Pseudevernia furfuracea (L.) ZOPF 12 ch, db, ds, fh, pf, ra; Be, Ca, Qr, rw, st; bor-med, mo
Psilolechia clavulifera (NYL.) COPPINS 1 ra; t; subbor-mieur
Psilolechia leprosa COPPINS & PURVIS 1 ra; b; bor-med
Psilolechia lucida (ACH.) M. CHOISY 3 ra; b, s, st; subbor-mieur, subatl-submed(-med)
Psoroglaena abscondita (COPPINS & VĚZDA) HAFELLNER & TÜRK 1 ch, fh; Sm; (bor) mieur
Punctelia borreri (SM.) KROG 12 ch, ds, fh, mw, ra, rf; Ac, Pr, Qr, Sa, So; mieur-med (subatl)
Punctelia jeckeri (ROUM.) KALB 39 ch, fh, mw, ds, ra, rf; Be, La, Pc, Po, Qr, Sa, So, rw; mieur-med
Punctelia subrudecta (NYL.) KROG 49 ch, mw, ds, fh, mp, ra, rf; Be, La, Po, Pr, Qr, Sa, So, Sm, rw, st; mieur-med(subatl)
Ramalina farinacea (L.) ACH. 23 ch, ds, fh, mw, fh, ra, rf; Be, La, Po, Qr, Sa, So, rw, st; bor-med
Ramonia interjecta COPPINS 4 ds, mw, ra; Sa, Sm; subbor-mieur
Rinodina oleae BAGL. 5 mw, ra, rf; Be, Po, c; subbor-med
Rinodina pityrea ROPIN & H. MAYRHOFER 3 mw, ra, rf; Be, Fa, Po; (f); subbor-med?
Sarcogyne regularis KÖRB. 3 mw, ra; c; arct-med
Scoliciosporum gallurae VĚZDA & POELT 4 ch, ds, fh, ra; Qr, Sa, Sm; subbor-med
Scoliciosporum umbrinum (ACH.) ARNOLD 2 ra, rf; b, s; bor-med
Stereocaulon condensatum HOFFM. 2 ch; t; bor-mieur
Stereocaulon saxatile H. MAGN. 4 ch; t; bor-mieur, subatl
Strangospora pinicola (A. MASSAL.) KÖRB. 7 ra, rf; An, Be, Po, Qr, rw; mieur
Thelocarpon impressellum NYL.1 ra; t; bor-mieur
Thelocarpon lichenicola (FUCKEL) POELT & HAFELLNER 1 ra; t; subbor-mieur
Trapelia coarctata (SM.) CHOISY 2 ra; b, s; bor-med, mo
Trapeliopsis flexuosa (FR.) COPPINS & P. JAMES 28 ch, db, fh, mw, pf, ra; Be, Pn, Sa, rw, st, t; bor-med
Trapeliopsis gelatinosa (FLÖRKE) COPPINS & P. JAMES 1 pf; t; subbor-mieur
Trapeliopsis granulosa (HOFFM.) LUMBSCH 44 ch, db, ds, fh, ra, rf; Be, Ju, Pn, Qr, Sa, st, t; arct-submed, mo(-med, mo)
Trapeliopsis pseudogranulosa COPPINS & P. JAMES 1 mw; st; bor-submed
Usnea hirta (L.) F. H. WIGG. 2 ch, fh; Qr; bor-mieur(med, mo)
Verrucaria macrostoma DUFOUR ex DC. 1 ra; c; mieur-med
Verrucaria muralis ACH. 5 ch, ra; b, c; (arct-)bor-med
Verrucaria ochrostoma (BORRER ex LEIGHT.) TREVIS. 1 ra; c; mieur, subatl?
Verrucaria viridula (SCHRAD.) ACH. 1 ra; b; bor-med
Vezdaea acicularis COPPINS 1 ra; t; mieur
Vezdaea retigera POELT & DÖBBELER 2 ra; t; (subbor-)mieur
Xanthoria candelaria (L.) TH. FR. 11 ch, fh, mw, ra, rf; Qr, Sm, rw; arct-med
Xanthoria parietina (L.) TH. FR. 64 ch, mp, mw, ds, fh, pf, ra, rf; Ae, Be, Cr, La, Pc, Po, Pr, Qa, Qr, Ro, Sa, Sm, Ti, Ul, rw, c, s; bor-med

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Xanthoria polycarpa (HOFFM) TH. FR. ex RIEBER 54 ch, ds, fh, mp, pf, ra, rf; An, Be, La, Pc, Pn, Po, Pr, Qr, Ro, Sa, Sm, So,Ti, rw; bor-submed

Lichenicolous fungi

Arthonia phaeophysciae GRUBE & MATZER 5 mw, ra, rf; Po, Sm; on *Phaeophyscia orbicularis*

Athelia arachnoidea (BERK.) JÜLICH 15 ch, ds, fh, mw, rf; Be, La, Po, Qr, Sa, Sm, t; on *Bacidia* spp., *Cladonia* spec., *Cladonia caespiticia*, *Lecanora conizaeoides*, *Lepraria incana*, *Physcia* spp., *Xanthoria parietina*

Buelliella physiicola POELT & HAFELLNER 1 ra; Po; on *Phaeophyscia orbicularis*

Cladoniicola staurospora DIEDERICH, VAN DEN BOOM & APTROOT 4 ch; t, rw, on *Cladonia* spp.

Clypeococcum hypocenomycis D. HAWKSW. 2 ra; Be; on *Hypocenomyce scalaris*

Illosporiopsis christiansenii (B. L. BRADY & D. HAWKSW.) D. HAWKSW. 1 ds; Sa, on *Physcia tenella*

Lichenoconium erodens M. S. CHRIST. & D. HAWKSW. 11 ch, fh, mw, ra, rf; Be, Po, Qr, t; on *Cladonia* spp., *Parmelia sulcata*, *Punctelia subrudecta*

Lichenoconium lecanorae (JAAP) D. HAWKSW. 1 pf; Pn; on *Lecanora conizaeoides*

Lichenoconium xanthoriae M. S. CHRIST. 3 ch fh, ra; La, Sm; on *Xanthoria polycarpa*

Lichenodiplis lecanorae (VOUAUX) DYKO & D. HAWKSW. 10 ch, fh, mw, pf, ra; Be, Ju, Pc, Qr, rw, st; on *Lecanora saligna*

Marchandiobasidium aurantiacum DIEDERICH & SCHULTHEIS 7 ds, mw, ra, rf; Qa, Qr, Sa, Sm; on *Physcia adscendens*, *P. tenella*, *Xanthoria parietina*

Muellerella lichenicola (SOMMERF.) D. HAWKSW. 1 ra; c; on *Verrucaria* spec.

Nectriopsis micareae DIEDERICH, VAN DEN BOOM & ERNST 7 mw, pf, ps, ra; Ps, rw, st; on *Micarea viridileprosa*

Paranectria oropensis (CES.) D. HAWKSW. & PIROZ. 10 ds, mp, mw, ra, rf; Ac, Po, Qr, Sa, Sm, Sr; on *Candelariella reflexa*, *Lepraria incana*, *Physcia tenella*

Pronectria oligospora LOWEN & ROGERSON var. *octospora* ETAYO 6 ch, fh, ds, ra; Be, La, Qa, Qr, Sa; on *Punctelia subrudecta*

Psammina stipitata SACC. & ROUSSEAU ex E. BOMMER & M. ROUSSEAU 1 mw; Sm; on unidentified crust

Syzygospora physciacearum DIEDERICH 6 ch, ds, fh, ra; Qr, Sa, Sr; on *Physcia tenella*

Taeniolella phaeophysciae D. HAWKSW. 1 rf; Po; on *Phaeophyscia orbicularis*

Trichonectria rubefaciens (ELLIS & EVERH.) DIEDERICH & SCHROERS 10 ch, ds, fh, mw, ra; Po, Pr, Qr, Sa; on *Parmelia sulcata*

Tubeufia heterodermiae ETAYO 16 ch, ds, fh, mw, ra, rf; An, La, Qr, Sa; on *Physcia adscendens*, *P. tenella*

Xanthoriicola physciae (KALCHBR.) D. HAWKSW. 9 ch, fh, ra, rf; Qr, Sm, Sr; on *Xanthoria parietina*

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