

New or interesting records of lichen-forming and lichenicolous fungi from Lower Saxony, Germany

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Abstract: HAUCK, M., DE BRUYN, U., WIRTH, V., SPARRIUS, L., THÜS, H. & PREUSSING, M. 2009. New or interesting records of lichen-forming and lichenicolous fungi from Lower Saxony, Germany. – *Herzogia* 22: 109–116.

Records of 38 species of lichen-forming ascomycete species and one lichenicolous fungus from Lower Saxony are presented. *Lecania atrynoides* and *Opegrapha confluens* are new to Germany, as are 15 species to Lower Saxony.

Zusammenfassung: HAUCK, M., DE BRUYN, U., WIRTH, V., SPARRIUS, L., THÜS, H. & PREUSSING, M. 2009. Neue oder bemerkenswerte Funde von flechtenbildenden und flechtenbewohnenden Pilzen aus Niedersachsen, Deutschland. – *Herzogia* 22: 109–116.

Funde von 38 Arten lichenisierter Ascomyceten und einem lichenicolen Pilz aus Niedersachsen werden vorgestellt. *Lecania atrynoides* und *Opegrapha confluens* sind Neufunde für Deutschland, weitere 15 Arten sind neu für Niedersachsen.

Key words: Lichenized fungi, biodiversity.

Introduction

More than a decade ago, HAUCK (1996) published a first survey of the lichen flora of Lower Saxony, Germany. Lower Saxony is of special interest for biodiversity studies in Germany, because the range of habitats occurring in this state covers the shore of the North Sea as well as the high-montane mountain ranges of the Harz Mountains. Several pieces of work on the lichen flora of Lower Saxony have been published since 1996, including studies from the coastal lowlands in the northwest (DE BRUYN 2000, 2001, 2005a, 2007a, b, DE BRUYN et al. 2000, 2005, 2008, HOMM & DE BRUYN 2000), from the south-western lowlands (APTROOT & BRAND 1996, DE BRUYN 2005b), from the old moraine landscape of north-eastern lower Saxony (HAUCK 1998, ERNST & HANSTEIN 2001, THÜS 2001, BOCH & SPARRIUS 2006, DE BRUYN & DETHLEFS 2008), and from the Solling Mountains in the southern parts of the state (BARTSCH & WAGNER 2003, WAGNER 2008). In the present paper, we compile records of lichen-forming and lichenicolous fungi, which have either not been reported for Lower Saxony or a major part of this state before or which have not been found in Lower Saxony for an extended period prior to the present findings.

Study area

Lower Saxony (Niedersachsen) can roughly be divided into the lowlands covering the northern two thirds of the state and the southern hill and mountain country. The eastern lowlands con-

sist of old moraine landscape (Lüneburger Heide, Wendland), whereas the western lowlands are old moraine landscape and partly marshes that have not been touched by late Pleistocenic glaciations (Weser-Ems Area). The East Frisian Islands are located off the coast of the western lowlands. Important landscape units of southern lower Saxony include the Weser-Leine Hill Country and the Harz Mountains. The Weser-Leine Hill Country is primarily formed by low mountain ridges of calcareous rock or more rarely sandstone. The latter is especially found in the Solling Mountains, which represent the highest elevations of Weser-Leine Hill Country not exceeding, however, 528 m. The Harz Mountains consisting of Paleozoic rock and reaching an altitude of 971 m on their highest Lower Saxonian summit are characterized by a considerably colder and wetter climate than the rest of Lower Saxony.

Material

Specimens of the cited records are deposited at BM (H. Thüs), KR (V. Wirth), STU (M. Preußing) as well as in the private herbaria of U. de Bruyn, M. Hauck and L. Sparrius.

List of species

Abconditella sphagnum Vězda & Poelt – 3308/3, western lowlands, Emsland, Rülertwist, Provinzialmoor, 1998, L. Sparrius.

On rotten stump of blackish and almost completely decomposed wood in heathland. The 2-celled ascospores ($13 \times 4 \mu\text{m}$) separate the specimen from *A. lignicola*. The apothecia of *A. delutula*, which also has 2-celled spores of similar size, are more minute than those in the cited collection (0.3 mm in diameter). New to Lower Saxony.

Acrocordia conoidea (Fr.) Körb. – 4127/3, Harz Mountains, Hübichenstein NW Bad Grund, 2004, V. Wirth & V. John.

On calcareous rock. Previous findings from Lower Saxony are from the 19th and the early 20th century from the Weser-Leine Hill Country west of the Harz Mountains (LAHM 1885, RÜGGERBERG 1911).

Agonimia tristicula (Nyl.) Zahlbr. – 4127/3, Harz Mountains, Hübichenstein NW Bad Grund, 2004, V. Wirth & V. John.

On calcareous rock. First certain record for Lower Saxony. THIEL & SPRIBILLE (2007) published “*A. cf. tristicula*” from the sandstone rocks near Göttingen, Weser-Leine Hill Country. It is likely that the taxon has been much overlooked and it might be fairly common.

Agonimia vouauxii (de Lesd.) M.Brand & Diederich – 2210/3, East Frisian Islands, Baltrum, 2008, U. de Bruyn, conf. A. Aptroot.

On turf within the sea spray zone with *Plantago coronopus*. It is an easily overlooked species most likely not rare in comparable habitats on the East Frisian Islands. DOLNIK et al. (2008) already published *A. vouauxii* from the sea spray zone of the Baltic Sea in Schleswig-Holstein. New to Lower Saxony.

Arthonia phaeobaea (Norman) Norman – 2213/2, East Frisian Islands, Wangerooge, 2008, U. de Bruyn, conf. A. Aptroot.

On siliceous rock of sea dyke in upper littoral zone with *Acarospora smaragdula*, *Caloplaca maritima*, and *Lecanora helicopsis*. Another recent record of *A. phaeobaea* from granite of a sea dyke of the island was made on the territory of the state of Hamburg (ERNST 1993).

Arthrorhaphis citrinella (Ach.) Poelt – 4229/1, Harz Mountains, Hahnenkleeklippen, 2004, V. Wirth.

In boulder field of siliceous rock. Published records from Lower Saxony from the lowlands (“not rare in heathlands”, SANDSTEDE 1912) and from the Solling Mountains (BECKHAUS 1855) date back to the 19th and early 20th century. In 1987, *A. citrinella* was found in the eastern Harz Mountains (Benneckenstein) in Sachsen-Anhalt (SCHOLZ 1991).

- Arthrorhaphis grisea*** Th.Fr. – 4229/1, Harz Mountains, Achtermannshöhe, 2004, M. Hauck & V. John.
Parasite of *Baeomyces rufus*, on siliceous rock. Already collected from southern Lower Saxony by Beckhaus in the Solling Mountains in the 19th century (HAUCK 1996).
- Bacidia adastr***a Sparrius & Aptroot – 4425/4, Weser-Leine Hill Country, Göttingen, Old Botanical Garden, 2009, M. Hauck.
On trunk base of *Acer pseudoplatanus* with *Phaeophyscia orbicularis*. New to southern Lower Saxony, but already reported for the state's northern lowlands (DE BRUYN et al. 2005, BOCH & SPARRIUS 2006); probably common.
- Bacidina delicata*** (Larbal. ex Leight.) V.Wirth & Vězda – 4229/1, Harz Mountains, Hahnenkleeklippen, 2004, M. Hauck. 4329/1, Harz Mountains, Oderhaus, V. Wirth.
On trunks of *Acer pseudoplatanus*. First records for southern Lower Saxony. Already published from north-western Lower Saxony (DE BRUYN 2000, DE BRUYN et al. 2000) and perhaps not rare throughout the state.
- Caloplaca britannica*** R.Sant. – 3814/4, Osnabrück Hill Country, Bad Laer, church, 2007, U. de Bruyn.
On church wall made of limestone. New to the hill country of southern Lower Saxony. Apparently widespread in the coastal lowlands, where *C. britannica* has recently first been published for Lower Saxony (DE BRUYN 2007a, DE BRUYN et al. 2005). The circumscription of the taxon follows VAN HERK & APTROOT (2004).
- Caloplaca cirrochroa*** (Ach.) Th.Fr. – 4127/3, Harz Mountains, Hübichenstein NW Bad Grund, 2004, V. Wirth & V. John.
On calcareous rock. A published record of the species by KLEMENT (1961) was not included in HAUCK (1996), because it is probably based on a misidentification.
- Caloplaca marina*** (Wedd.) Zahlbr. – 2209/3, East Frisian Islands, Norderney, harbor, 2008, U. de Bruyn. 2211/3, East Frisian Islands, Langeoog, harbor, 2008, U. de Bruyn.
In tidal zone on siliceous rocks. Published records (HAUCK 1996) of *C. marina* refer to the species pair *C. marina* and *C. maritima* (ARUP 1997). The majority of recent collections along the coastal line of Lower Saxony and all checked herbarium collections belong to *C. maritima*. Following the circumscriptions of *C. marina* and *C. maritima* by ARUP (1997), the cited specimens represent the first record of *C. marina* s.str. in Lower Saxony. In contrast to *C. maritima*, *C. marina* seems to be rare along the coast of Lower Saxony.
- Catillaria atomarioides*** (Müll.Arg.) H.Kilias – 2210/3, East Frisian Islands, Baltrum, 2008, U. de Bruyn, conf. A. Aptroot.
On brick of small footpath in dunes with *Buellia aethalea* and *Candelariella vitellina*. New to Lower Saxony.
- Lecania atrynoides*** M.Knowles – 2208/4, East Frisian Islands, Norderney, 2008, U. de Bruyn, conf. A. Aptroot.
On sandstone rocks of sea dyke in upper littoral zone with *Lecanora helicopsis* and *Caloplaca maritima*. Known from similar habitats in the Netherlands (VAN HERK & APTROOT 2004). New to Germany.
- Lecanora semipallida*** H.Magn. – 3814/4, Osnabrück Hill Country, Bad Laer, church, 2007, U. de Bruyn.
On church wall made of limestone. New to the hill country of southern Lower Saxony, but probably common. The species was not separated from *L. dispersa* (Pers.) Röhl. until recently. *Lecanora semipallida* was already known from the lowlands of northern Lower Saxony (DE BRUYN et al. 2005, 2008, DE BRUYN 2007a, b). Records of '*L. flotoviana*' by DE BRUYN et al. (2005, 2008) and DE BRUYN (2007a, b) do not refer to *L. flotoviana* Spreng. (ŠLIWA 2007), but fall in the range of variation of *L. semipallida*.
- Lecidea commaculans*** Nyl. – 4229/1, Harz Mountains, Hahnenkleeklippen, 2004, V. Wirth.
In boulder field of siliceous rock. New to Lower Saxony.
- Leptogium gelatinosum*** (With.) J.R.Laundon. – 2208/4, East Frisian Islands, Norderney, 2008, U. de Bruyn.
On loamy sand of young dunes in disturbed dune valley with *Collema crispum* and *C. tenax*. The last published records from the lowlands of Lower Saxony date back to the early 20th century (SANDSTEDTE

1912, ERICHSEN 1957). Records of *L. gelatinosum* from the lowland region of Lower Saxony are limited to the East Frisian Islands.

Micarea peliocarpa (Anzi) Coppins & R.Sant. – 4229/1, Harz Mountains, Achtermannshöhe, 2004, V. Wirth.

On trunk base of *Sorbus aucuparia* near boulder field. New to southern Lower Saxony. All records from Lower Saxony published so far refer to the lowlands of the northern part of the state. SCHOLZ (1991) published several records of *M. peliocarpa* from the eastern Harz Mountains from soil and siliceous rock.

Normandina pulchella (Borrer) Nyl. – 3814/4, Osnabrück Hill Country, Teutoburger Wald, Kleiner Berg NE Bad Laer, 2007, U. de Bruyn.

On trunk of old *Fraxinus* on south-exposed forest edge together with *Candelaria concolor* and the liverwort *Frullania dilatata*. First records for the hill country of southern Lower Saxony. Previously only known from the coastal lowlands, but not found for several decades (HAUCK 1996).

Opegrapha confluens (Ach.) Stizenb. – 2208/4, East Frisian Islands, Norderney, 2008, U. de Bruyn, conf. A. Aptroot.

On sandstone rocks of sea dyke in upper littoral zone with *Lecania atrynoides*. *Opegrapha confluens* is a taxon within the *O. calcarea* group. It is characteristic for siliceous rocks in the upper littoral zone of sea dykes and described in detail in VAN HERK & APTROOT (2004). New record to Germany. The record of *O. chevallieri* from Neuwerk by ERNST (1993) may also refer to *O. confluens*; the specimen was not checked.

Opegrapha dolomiticola Clauzade & C.Roux ex Egea & Torrente – 4127/3, Harz Mountains, Hübichenstein NW Bad Grund, 2004, V. Wirth & V. John.

On calcareous rock. First record for Lower Saxony. *Opegrapha dolomiticola* was already published from the north-eastern Harz Mountains (Sachsen-Anhalt) by SCHOLZ (1991).

Parmelia serrana A.Crespo, M.C. Molina & D.Hawksw. – 3209/3, western lowlands, Emsland, Borkener Paradies NE Versen, 1998, L. Sparrius.

On bark of *Quercus* on sand dunes in the valley of the River Ems. New to Lower Saxony; probably the northernmost record of this species, which was recently separated from *P. saxatilis* (MOLINA et al. 2004).

Peltigera neckeri Hepp ex Müll.Arg. – 2209/3, East Frisian Islands, Norderney, 2008, U. de Bruyn. 2210/4, East Frisian Islands, Baltrum, 2008, U. de Bruyn. 2307/1, East Frisian Islands, Juist, 2006, U. de Bruyn.

On north-exposed slopes in dune grasslands of young dunes (“grey dunes”) on calcareous sand, sometimes associated with *P. canina*. Probably often overlooked for *P. hymenina*. ERICHSEN (1957) already published a record of *P. neckeri* from the coastal lowlands of mainland-Lower Saxony.

Physcia clementei (Turner) Lyngby – 3115/2, western lowlands, Wildeshäuser Geest, Engelmannsbäke SW Wildeshausen, 2007, U. de Bruyn.

On bark of young *Acer* in yard, one healthy thallus associated with *Physcia tenella* and *Xanthoria parietina*. *Physcia clementei* was thought to be extinct in Germany; the species was not recorded from Lower Saxony since SANDSTEDE (1912), who found it in the same area. *Physcia clementei* is showing a strong increase in adjacent Netherlands (VAN HERK & APTROOT 2004) within the last decade.

Pleopsidium chlorophanum (Wahlenb.) Zopf – 2208/4, East Frisian Islands, Norderney, 2008, U. de Bruyn, conf. A. Aptroot, M. Hauck & V. Wirth.

On siliceous rock with iron entrapment of gravestone in churchyard with *Rhizocarpon geographicum*. New to Lower Saxony and to the German lowlands. Previous records originate from southern Germany where *P. chlorophanum* primarily occurs on siliceous rock at high mountain sites, but also rarely on gravestones and buildings (WIRTH 1995).

Polyblastia philaea Zschacke – 3625/1, Weser-Leine Hill Country, clay pit NE Anderten, 1998, M. Hauck.

Locally abundant on open soil of a slope in an abandoned clay pit. New to Lower Saxony.

Polysporina simplex (Davies) Vězda – 3814/4, Osnabrück Hill Country, Teutoburger Wald, Kleiner Berg NE Bad Laer, 2007, U. de Bruyn.

On siliceous rock of monument. First record from the hill country of southern Lower Saxony. Recently, repeatedly found in the lowlands of northern Saxony (APTROOT & BRAND 1996, DE BRUYN 2005a, 2007a, b, DE BRUYN et al. 2005, 2008), probably much overlooked.

Porina borreri (Trevis.) D.Hawksw. & P.James – 2916/2, western lowlands, Delmenhorster Geest, woodland site Hasbruch E Oldenburg, 2005, U. de Bruyn.

At an ancient woodland site (former pasture woodland) on smooth bark of *Carpinus* below major wound of the trunk, together with *Porina aenea* and *P. leptalea*. Second recent record for Germany; the other recent record is also from an ancient woodland in Lower Saxony (DE BRUYN 2005b).

Protoblastenia incrustans (DC.) J.Steiner – 4127/3, Harz Mountains, Hübichenstein NW Bad Grund, 2004, V. Wirth & V. John.

On calcareous rock. *Protoblastenia incrustans* was already published for Lower Saxony by RÜGGERBERG (1911) and LAMPE & KLEMENT (1958). The voucher of the latter authors in GOET turned out to belong to *Clauzadea*, while a sample of *P. incrustans* is lacking in Rüggeberg's collection at GOET. Thus, *P. incrustans* was not accepted for the lichen flora of Lower Saxony by HAUCK (1996).

Protothelenella corrosa (Körb.) H.Mayrhofer & Poelt – 4229/1, Harz Mountains, Achtermannshöhe, 2004, V. Wirth.

On siliceous rock. Earlier records of the species from Lower Saxony, also from the Harz Mountains, were published by ZSCHACKE (1934) and one record was confirmed by MAYRHOFFER & POELT (1985).

Ramalina capitata (Ach.) Nyl. – 4123/2, Weser-Leine Hill Country, W of Stadtoldendorf, E of Negenborn, 2003, M. Preußing, conf. V. Wirth.

Well developed and abundant on sandstone slabs of a roof of an old barn in agricultural area. New to southern Lower Saxony. *Ramalina capitata* was already known from a prehistoric stone monument in the coastal lowlands of Lower Saxony (SANDSTEDTE 1912, DIECKHOFF 1931), where it has last been recorded in the early 20th century.

Stereocaulon evolutum Graewe – 2815/1, western lowlands, Oldenburgische Geest, Oldenburg City, graveyard, 2006, U. de Bruyn.

A single well developed thallus on gravestone of siliceous rock of a war grave monument. Previously only known from the south-western part of the lowlands of northern Lower Saxony from the early 20th century (ERICHSEN 1957).

Stereocaulon pileatum Ach. – 3127/1, eastern lowlands, Lüneburger Heide, Südheide between Fassberg and Unterlüß, 2007, U. de Bruyn.

On iron-rich erratic boulder in open heathland. Already known from Lower Saxony from the Harz Mountains from the early 20th century (SCHOLZ 1991). BOCH & SPARRIUS (2009) recently also discovered *S. pileatum* in north-eastern Lower Saxony.

Stigmidium marinum (Deakin) Swinscow – 2415/3, western lowlands, North Sea coast east of Wilhelmshaven, Butjadingen, Eckwarderhörne, 2006, U. de Bruyn.

Lichenicolous fungus on *Wahlenbergiella mucosa* (= *Verrucaria mucosa* Wahlenb.; GUEIDAN et al. 2009). On brick in mid-littoral zone of old sea dyke, associated with *Collemopsisidium halodytes* or *sublitorale*, with which *S. marinum* is easily confused (VAN HERK & APTROOT 2004). The status in Lower Saxony was uncertain.

Verrucaria elaeina Borrer – 4122/4, Weser-Leine Hill Country, Solling, Hasselbachtal, E Holzminden, 2005, H. Thüs.

On the outer (!) surface of a shaded concrete pipe, together with *V. dolosa*. First record from Lower Saxony. The name *V. elaeina* auct. has been used for various amphibious lichens in the past. *Verrucaria elaeina* Borrer, however, is not a freshwater lichen and only rarely found in the vicinity of water-courses (ORANGE 2000). It typically grows on shaded vertical rocks at localities with high air humidity. This lichen is closely related to *V. praetermissa* and some specimens can be difficult to distinguish (see ORANGE 2000 and THÜS & SCHULTZ 2008 for diagnostic characters). The specimens from Lower

Saxony have been checked by their ITS sequences. *Verrucaria elaeina* has recently also been found in Hessen (Odenwald: CEZANNE et al. 2008, Villmar/Lahntal: Thüs unpublished), Rhineland Palatinate (St. Goar/Rhine Valley: Thüs unpublished) and in Northrhine Westphalia (Mettmann/Neandertal: Thüs unpublished). It may be generally more widespread than previously thought in climatically mild regions.

Verrucaria fusconigrescens Nyl. – 2211/3, East Frisian Islands, Langeoog, 2008, U. de Bruyn, conf. A. Aptroot.

On sandstone rocks of sea dyke in upper littoral zone. Known from similar habitats in the Netherlands (VAN HERK & APTROOT 2004). New to Lower Saxony.

Verrucaria sublobulata Eitner ex Servit – 4122/4, Weser-Leine Hill Country, Solling, Hasselbachtal, E Holzminden, 2005, H. Thüs.

On periodically inundated rocks with alkaline to slightly acidic surface. There had been much confusion about the identity of this taxon until most recently and it can be difficult to distinguish from mechanical hybrids of *V. hydrela* and *Bacidina inundata* (THÜS & SCHULTZ 2008). *Verrucaria sublobulata*, however, was also found in watercourses where *B. inundata* was completely absent and recent molecular studies have shown that the species is clearly distinct from *V. hydrela* (Thüs in prep.). The combination of a non-subgelatinous thallus, an arrangement of the photobiont cells in small aggregated groups, small and more or less immersed perithecia with an involucrellum which is fading in its lower parts and rather short ascospores (16–20 µm) help to distinguish *V. sublobulata* from other freshwater species of *Verrucaria* (for a detailed description and photographs of the type specimen of *V. sublobulata* confer THÜS & SCHULTZ 2008). Specimens from the Hasselbachtal were checked by their ITS sequences. Samples of *V. sublobulata* from the Harz Mountains (leg. H. Ullrich) refer to *V. hydrela* (THÜS 2002).

Wahlenbergiella mucosa (Wahlenb.) Gueidan & Thüs (syn.: *Verrucaria mucosa* Wahlenb.) – 2118/1, western lowlands, Cuxhaven, harbor, 2008, U. de Bruyn. 2211/3, East Frisian Islands, Langeoog, harbor, 2003, U. de Bruyn. 2414/2, western lowlands, Wilhelmshaven north of harbor, 2003, H. Thüs. 2414/4, western lowlands, Wilhelmshaven, harbor, 2008, U. de Bruyn. 2415/3, western lowlands, North Sea coast east of Wilhelmshaven, Butjadingen, Eckwarderhörne, 2006, U. de Bruyn.

On brick or rock in mid-littoral zone of old sea dyke together with *Collempsidium halodytes* or *sublitorale*. Published data in SCHWERDTNER (1996) from the German North Sea Coast most likely also include records from Lower Saxony. The localities Wilhelmshaven, Eckwarderhörne and Cuxhaven were already mentioned by SANDSTEDE (1912). The current occurrence of *W. mucosa* at the sites compiled in SANDSTEDE (1912) primarily depends on the persistence of suitable substrata. *Wahlenbergiella mucosa* is capable of rapidly colonizing newly built sea dykes as found, e.g., on the island of Langeroog.

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References

- APTROOT, A. & BRAND, A. M. 1996. Lichenen van de voorjaarsexcursie 1995 naar Bramsche, Niedersachsen. – *Buxbaumia* **39**: 41–46.
- ARUP, U. 1997. *Caloplaca maritima*, a misunderstood species in western Europe. – *Lichenologist* **29**: 503–512.
- BARTSCH, L. & WAGNER, H.-G. 2003. *Porpidia alboacuerulescens* – neu für Niedersachsen. – *Herzogia* **16**: 275–276.
- BECKHAUS, C. F. L. 1855. Beiträge zur Kryptogamen-Flora Westphalens. III. Lichinosae. – *Verhandlungen des Naturhistorischen Vereins der preußischen Rheinlande und Westphalens* **13**: 18–28.
- BOCH, S. & SPARRIUS, L. 2006. Neue und interessante Flechtenfunde aus den Landkreisen Lüneburg und Lüchow-Dannenberg (Nordost-Niedersachsen, Deutschland). – *Herzogia* **19**: 77–83.
- BOCH, S. & SPARRIUS, L. 2009. Die Flechtenflora der Granitblöcke am Lüneburger Hafenbecken und des „Göhrdeschlacht“-Denkmals. – *Jahrbuch des Naturwissenschaftlichen Vereins im Fürstentum Lüneburg* (in press).
- DE BRUYN, U. 2000. Zur aktuellen Verbreitung epiphytischer Flechten im nördlichen Weser-Ems-Gebiet. – *Oldenburger Jahrbuch* **100**: 281–318.

- DE BRUYN, U. 2001. Zur aktuellen Verbreitung epiphytisch auftretender lichenicoler und nicht lichenisierter flechten-ähnlicher Pilze im nördlichen Weser-Ems-Gebiet. – *Drosera* 2001: 183–188.
- DE BRUYN, U. 2005a. Veränderungen der Flechtenflora der Insel Spiekeroog. – *Drosera* 2005: 75–88.
- DE BRUYN, U. 2005b. Zur Moos- und Flechtenflora des Bentheimer Waldes. – *Osnabrücker Naturwissenschaftliche Mitteilungen* 30/31: 67–78.
- DE BRUYN, U. 2007a. Gesteinsflechten alter Kirchhöfe im Landkreis Wesermarsch (Niedersachsen, Weser-Ems-Gebiet). – *Herzogia* 20: 145–58.
- DE BRUYN, U. 2007b. Die Flechten des Botanischen Gartens Oldenburg. – *Oldenburger Jahrbuch* 107: 337–48.
- DE BRUYN, U. 2008. Die Flechten der Ostfriesischen Inseln (Lichenes). – *Schriftenreihe Nationalpark Niedersächsisches Wattenmeer* 11: 73–80.
- DE BRUYN, U. & DETHLEFS, B. 2008. Bemerkenswerte neue Nachweise von Bartflechten in der Südheide. – *Floristische Notizen aus der Lüneburger Heide* 16: 31–35.
- DE BRUYN, U., APTROOT, A. & VAN HERK, K. 2000. Lichenized and lichenicolous fungi new to the flora of North West Germany. – *Herzogia* 14: 218–221.
- DE BRUYN, U., APTROOT, A., HOMM, T. & SIPMAN, H. J. M. 2008. Ergebnisse eines Flechten-Kartierungstreffens im Elbe-Weser-Dreieck (Nordwest-Niedersachsen). – *Aktuelle Lichenologische Mitteilungen, Neue Folge* 15: 4–13.
- DE BRUYN, U., APTROOT, A., SPARRIUS, L. & LINDERS, H.-W. 2005. Ergebnisse eines Flechten-Kartierungstreffens in Ostfriesland (Nordwest-Niedersachsen). – *Aktuelle Lichenologische Mitteilungen, Neue Folge* 14: 18–29.
- CEZANNE, R., EICHLER, M., HOHMANN, M.-L., & WIRTH, V. 2008. Die Flechten des Odenwaldes. – *Andrias* 17: 1–520.
- DIECKHOFF, H. 1931. Beiträge zu einer Flechtenflora von Wesermünde. – *Schriften des Vereins für Naturkunde an der Unterweser* 2: 41–54.
- DOLNIK, C., ABEL, H., DE BRUYN, U., VAN DORT, K., GNÜCHTEL, A., NEUMANN, P., STOLLEY, G. & ZIMMER, D. 2008. *Lecanora zosteræ* und andere interessante Flechtenfunde aus Schleswig-Holstein. – *Kieler Notizen zur Pflanzenkunde* 36: 9–23.
- ERICHSEN, C. F. E. 1957. Flechtenflora von Nordwestdeutschland. – Stuttgart: Fischer.
- ERNST, G. 1993. Flechtenflora der Nordseeinsel Neuwerk – 1891 bis 1992. – *Berichte des Botanischen Vereins Hamburg* 13: 100–110.
- ERNST, G. & HANSTEIN, U. 2001. Epiphytische Flechten im Forstamt Sellhorn – Naturschutzgebiet Lüneburger Heide. – *NNA-Berichte* 2001 (2): 28–85.
- GUEIDAN, C., SAVI, S., THÜS, H., ROUX, C., KELLER, C., TIBELL, L., PRIETO, M., HEIDMARSSON, S., BREUSS, O., ORANGE, A., FRÖBERG, L., WYNN, A. A., NAVARRO-ROSINÉS, P., KRZEWICKA, B., PYKÄLÄ, J., GRUBE, M. & LUTZONI, F. 2009. Generic classification of the Verrucariaceae (Ascomycota) based on molecular and morphological evidence: recent progress and remaining challenges. – *Taxon* 58: 184–208.
- HAUCK, M. 1996. Die Flechten Niedersachsens. Bestand, Ökologie, Gefährdung und Naturschutz. – *Naturschutz und Landschaftspflege in Niedersachsen* 36: 1–208.
- HAUCK, M. 1998. Die Flechtenflora der Gemeinde Amt Neuhaus (Nordost-Niedersachsen). – *Tuexenia* 18: 451–461.
- HOMM, T. & DE BRUYN, U. 2000. Moose und Flechten im Naturschutzgebiet „Hasbruch“, einer Naturwaldparzelle in einer ehemaligen Hudelandschaft in Nordwestdeutschland. – *Herzogia* 14: 171–194.
- KLEMENT, O. 1961. Die Flechtenvegetation des Deisters. – *Berichte der Naturhistorischen Gesellschaft zu Hannover* 105: 23–30.
- LAHM, G. 1885. Zusammenstellung der in Westfalen beobachteten Flechten unter Berücksichtigung der Rheinprovinz. – Münster: Coppenrath.
- LAMPE, W. & KLEMENT, O. 1958. Die Flechtenvegetation zwischen Oker und Leine im Raume von Hildesheim bis zum Harzrand. – *Zeitschrift des Museums zu Hildesheim, Neue Folge* 12: 1–77.
- MAYRHOFER, H. & POELT, J. 1985. Die Flechtengattung *Microglæna* sensu Zahlbruckner in Europa. – *Herzogia* 7: 13–79.
- MOLINA, M. C., CRESPO, A., BLANCO, O., LUMBSCH, H. T. & HAWKSWORTH, D. L. 2004. Phylogenetic relationships and species concepts in *Parmelia* s. str. (Parmeliaceae) inferred from nuclear ITS rDNA and β -tubulin sequences. – *Lichenologist* 36: 37–54.
- ORANGE, A. 2000. *Verrucaria elaeina*, a misunderstood European lichen. – *Lichenologist* 32: 411–422.
- RÜGGERBERG, H. 1911. Die Lichenen des östlichen Weserberglandes. – *Jahresberichte des Niedersächsischen Botanischen Vereins* 3: 1–82.
- SANDSTEDE, H. 1912. Die Flechten des nordwestdeutschen Tieflandes und der deutschen Nordseeinseln. – *Abhandlungen des Naturwissenschaftlichen Vereins zu Bremen* 21: 9–243.
- ŚLIWA, L. 2007. *Lecanora semipallida*, the correct name for *L. xanthostoma*, and a reappraisal of *L. flotoviana* (Lecanoraceae, Ascomycotina). – *Polish Journal of Botany* 52: 71–79.
- SCHOLZ, P. 1991. Untersuchungen zur Flechtenflora des Harzes. – Dissertation, Halle.

- SCHWERTNER, H. 1996. Flechtenarten des anthropogenen Hartsubstrates entlang der norddeutschen Küste und der Flüsse Weser und Elbe. – Abhandlungen des Naturwissenschaftlichen Vereins zu Bremen **43**: 503–514.
- THIEL, H. & SPRIBILLE, T. 2007. Lichens and bryophytes on shaded sandstone outcrops used for rock climbing in the vicinity of Göttingen (southern Lower Saxony, Germany). – *Herzogia* **20**: 159–177.
- THÜS, H. 2001. Die Flechtenflora des NSG Kalkberg in Lüneburg. – Jahrbuch des Naturwissenschaftlichen Vereins im Fürstentum Lüneburg **42**: 189–204.
- THÜS, H. 2002. Taxonomie, Verbreitung und Ökologie silicoler Süßwasserflechten im außeralpinen Mitteleuropa. – *Bibliotheca Lichenologica* **83**: 1–214.
- THÜS, H. & SCHULTZ, M. 2008. Fungi Part 1: Lichens. – In: BÜDEL, B., GÄRTNER, G., KRIENITZ, L., PREISIG, H. R. & SCHAGERL, M. (eds.) *Freshwater flora of central Europe*. Volume 21/1. – Heidelberg: Spektrum.
- VAN HERK, C. M. & APTROOT, A. 2004. *Veldgids korstmossen*. – Utrecht: KNNV Uitgeverij.
- WAGNER, H.-G. 2008. Erstnachweis von *Arthopyrenia carneobrunneola* für das europäische Festland. – *Herzogia* **21**: 239–242.
- WIRTH, V. 1995. *Die Flechten Baden-Württembergs*. 2. Aufl. – Stuttgart: Ulmer.
- ZSCHACKE, H. 1933–34. *Epigloeaceae, Verrucariaceae und Dermatocarpaceae*. – Dr. L. Rabenhorst's Kryptogamen-Flora von Deutschland, Österreich und der Schweiz. 2. Aufl., Band 9, Abteilung 1, Teil 1: 44–695.

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