A synopsis of bryophyte-lichen syntaxa in the Netherlands

Authors: Schrijvers-Gonlag, Marcel, and van Dort, Klaas

Source: Lindbergia, 2023(1)

Published By: Dutch Bryological and Lichenological Society and Nordic Bryological Society

URL: https://doi.org/10.25227/linbg.24635

A synopsis of bryophyte-lichen syntaxa in the Netherlands

Marcel Schrijvers-Gonlag[1] and Klaas van Dort[2]

[1]Inland Norway University of Applied Sciences, Campus Evenstad, Koppang, Norway
[2]Forestfun, Wageningen, the Netherlands

Correspondence: Marcel Schrijvers-Gonlag (marcel.schrijversgonlag@inn.no)

Lindbergia
2023: e24635
doi: 10.25227/linbg.24635
Subject Editor: Heinjo During
Editor-in-Chief: Nils Cronberg
Accepted 4 April 2023

We present a first complete overview of the bryophyte-lichen syntaxa in the Netherlands, including diagnostic species and Red List status of vegetations representing each (sub)association. The classification is based on more than 5000 Dutch vegetation relevés, the majority recorded after the year 2000. Whenever appropriate, we integrated bryophyte and lichen syntaxonomy. The Dutch list of bryolichenosociological units consists of 168 syntaxa: 16 classes, 27 orders, 37 alliances, 82 associations and 6 subassociations. We present synoptic tables of 13 newly described syntaxa: two alliances, nine associations and two subassociations. Finally, we present ranges of the abiotic habitat variables moisture, light availabilty, nutrient richness and acidity on class level, based on estimated values of diagnostic species of individual associations in each class.

Keywords: Bryophytes, lichens, syntaxonomy, phytosociology, bryolichenosociology, the Netherlands

Introduction

Syntaxonomic work on plants in the Netherlands started shortly before 1930 (Sýkora and Sýkora 1987). Few years later some young syntaxonomists developed an ardent bryological interest (Harmsen 1999). However, when Beijerinck (1934) published a booklet entitled '*Sphagnum en Sphagnetum*' the term *Sphagnetum* – though labeled as an 'independent association' – was not used in a standardised syntaxonomic way. In early Dutch syntaxonomical literature several bryophyte and lichen species were mentioned as important diagnostic (character or differential) species, e.g. the liverworts *Fossombronia dumortieri* (today *F. foveolata*) and *F. wondraczeki* (today *F. wondraczekii*) (*Cicendietum filiformis* Allorge '22, *Nanocyperion flavescentis* W.Koch '26), the mosses *Brachythecium rivulare* and *Philonotis fontana* (*Cardamineto-Montion* Br.-Bl. '26) and the lichens *Cladonia uncialis*, *C. squamosa*, *C. gracilis*, *C. chlorophaea*, *C. sylvatica* (today *C. arbuscula*) and *Cornicularia aculeata* (today *Cetraria aculeata*) (*Ericetum tetralicis* Schwickerath '33 *cladonietosum* Tx. '37, *Rhynchosporion albae* W.Koch '26) (Westhoff et al. 1942). Publications on bryosociological and lichenosociological studies remained scarce in the Netherlands until Barkman published his voluminous study on phytosociology of cryptogamic epiphytes in Europe (Barkman

1958). In later years, most Dutch bryosociological studies focused on non-epiphytic communities, e.g. thatched roofs (Ringelberg-Giesen 1958), springs and rivulets (Maas 1959, Weeda 1994), inland dunes and heaths (Touw 1963, 1969, Hovenkamp 1975), coastal dunes (Boerboom 1960, Coesel 1963, During 1973, Bruin et al. 1999), peat banks (Barkman 1989), and epilithic communities (Kruijsen 1982, Greven 1990). Considerably less Dutch lichenosociological studies were published during this period, Barkman (1969), Masselink (1994) and Spier and Aptroot (2000). At the end of the twentieth century, the vegetation in the Netherlands was phytosociologically described in detail (Schaminée et al. 1995a, 1995b, 1996, 1998, Stortelder et al. 1999), and updated in 2017 (Schaminée et al. 2017). In the latter six publications, 46 classes were described, the vast majority of associations dominated by vascular plants, although many bryophytes and some lichens and algae were incorporated as diagnostic species. Incidentally, bryophyte-dominated syntaxa were incorporated within vascular plant classes, e.g. *Pellio-Conocephaletum* Maas 1959 and *Pellio endiviifiliae-Cratoneuretum commutati* Rivola 1982 (*Montio-Cardaminetea* Braun-Blanquet et Tüxen 1943), *Didymodon recurvirostris-Tortella flavovirens*-ass. – today *Tortello-Bryoerythrophylletum* Boerboom 1960 (*Koelerio-Corynephoretea* Klika in Klika et Novák 1941), and *Sphagnetalia medii* Kästner et Flössner 1933 (preferred over *Sphagnetalia magellanici* Kästner et Flössner 1933 as *Sphagnum magellanicum* is not present in Europe; Hassel et al. 2018) (*Oxycocco-Sphagnetea* Braun-Blanquet et Tüxen ex Westhoff et al. 1946) (Maas 1959, Boerboom 1960, Schaminée et al. 1995b, 1996, 2017). Shortly before 2000, Siebel and Van Dort published a list of bryophyte syntaxa which were known from the Netherlands (Van Dort and Siebel 1995, Siebel and Van Dort 1999). No such lists existed for lichen syntaxa at that time.

Many authors studied vegetation communities dominated by bryophytes separately from lichen-dominated communities (for example, bryophyte communities: Demaret 1939, Von Hübschmann 1953, 1986, Philippi 1965, Lecointe 1978, Messe 1982, Drehwald and Preising 1991, Dierßen 2001, Bardat and Hauguel 2002, Schlüsslmayr 2005, Marstaller 2006, Schubert 2009; lichen communities: Klement 1955, Massé 1964, Delzenne-Van Haluwyn 1976; James et al. 1977, Wirth 1980, 1995, Roux 1981, Drehwald 1993, Schubert and Stordeur 2011). However, these two species groups have not always been separated strictly, as expressed by the name of the cryptogam class *Cladonio digitatae-Lepidozietea reptantis* Ježek and Vondráček 1962, a class including an alliance with diagnostic bryophyte species (*Tetraphidion pellucidae* Von Krusenstjerna 1945) and an alliance with diagnostic lichen species (*Cladonion coniocraeae* Duvigneaud ex James et al. 1977). One of the arguments against the separate treatment of bryophyte syntaxa and lichen syntaxa is that some lichen groups show a strong ecological (notably the genus *Peltigera*) or physiological (particularly the genera *Leptogium*, *Collema*, *Parmeliella*; Barkman 1958) resemblance with bryophytes. Barkman (1958), though keeping lichen syntaxa apart from bryophyte syntaxa, even placed an alliance characterized by at least 19 lichen taxa *Lobarion pulmonariae* in a bryophyte order *Neckeretalia pumilae* on ecological and physiological grounds. Recently, Mucina and colleagues (2016) published separate lists of vascular plant communities, bryophyte communities, lichen communities and algal communities of Europe, based on Braun-Blanquet syntaxonomy. However, they state that "an important future task will be combining bryophyte and lichen (and algal) communities into one consistent syntaxonomic system" (Mucina et al. 2016).

Since Barkman's publication in 1958, both species presences and frequencies have changed. For example, bryophyte species density in Dutch forests has increased considerably in the period 1984–1994 (Dirkse and Martakis 1998). The classification of Dutch vegetation relevés, the majority recorded after the year 2000, resulted in the first complete overview of bryophyte-lichen syntaxa of the Netherlands (Van Dort et al. 2017). When appropriate, we joined previously described bryophyte and lichen phytosociological units. Our bryolichenosociological study included synoptic tables and ecological information (Van Dort et al. 2017). Additionally, we used actualized distribution data and Red List status of character species (Aptroot et al. 2011, Siebel et al. 2013, BLWG 2017) to assess the distribution, trend, rarity and Red List status of vegetations representing each (sub)association on a national level (Schrijvers-Gonlag et al. 2018). In the current paper, we present the full list of current Dutch bryophyte-lichen syntaxa and for each (sub)association the Red List status of corresponding vegetations. To put the bryophyte-lichen vegetation in the Netherlands in an international context, we make some comparisons with syntaxa elsewhere in Europe. We present synoptic tables for 13 newly described syntaxa. Additionally, we present graphical information about the abiotic habitat variables moisture, light availabilty, nutrient richness and acidity for each class.

The bryophyte-lichen syntaxa of the Netherlands

We selected more than 5000 relevés from the Netherlands, based on Braun-Blanquet syntaxonomy and the majority recorded in the period 2000–2017, to compile our syntaxonomic lists. Our main goal was to produce a scientifically based overview of bryophyte-lichen vegetation useful for both scientists and nature managers in the field (as illustrated by Haveman and De Ronde (2021): "the proof of the classification is in its usage"). For this reason, we simplified syntaxon names whenever appropriate. As an example, we renamed the *T. pellucidae* Von Krusenstjerna 1945 to the simpler form *Tetraphidion* Von Krusenstjerna 1945 as only one *Tetraphis* species *Tetraphis pellucida* is known in Europe, leaving no room for confusion. Therefore, the epithet '*pellucidae*' is not neccessary in the name of the alliance to interpret the syntaxon correctly. On the other hand, we used the name *Rhizocarpetalia geographici* Klement 1949 instead of the proposed valid name *Rhizocarpetalia* Klement 1949 (with the addition *nom. conserv. propos.* in Mucina et al. 2016),

to prevent confusion with the *Rhizocarpetalia reducti* Wirth 1980 (*Rhizocarpetalia obscurati* Wirth 1980 in Mucina et al. 2016).

Many bryophyte and lichen species share the same habitat and substrate and are subject to the same (a)biotic conditions. Therefore, whenever possible, we integrated bryophyte and lichen syntaxonomy. As a result, our choice of syntaxa and syntaxon names fits the Dutch situation well but is not always in accordance with the International Code of Phytosociological Nomenclature (ICPN) (Weber et al. 2000). To illustrate this, we combined the 'bryophyte class' *Frullanio dilatatae-Leucodontetea sciuroidis* Mohan 1978 and the 'lichen class' *Physcietea* Tomaselli and De Micheli 1952 into one integrated class divided into the bryophyte-dominated order *Orthotrichetalia* Hadač in Klika and Hadač 1944 (originating from the *Frullanio-Leucodontetea*) and the lichen-dominated order *Physcietalia* Hadač in Klika and Hadač 1944 (originating from the *Physcietea*). According to the ICPN, the new name should be: *Physcietea* Tomaselli and De Micheli 1952. As in our integrated class both bryophyte and lichen species play a more or less equally important role, we combined both the original class names into the new name *Orthotricho-Physcietea* Tomaselli and De Micheli 1952 (Fig. 1), although not valid according to the ICPN. Why we chose to follow the ICPN in specific cases, and why we chose to divert from it in many other cases, is extensively explained in Schrijvers-Gonlag (2019). We aimed at easy-to-use names for our syntaxa. Haveman (2016) quotes the famous Shakespeare sentence '*What's in a name? that which we call a rose By any other name would smell as sweet*' (Shakespeare 1597) to illustrate that plant names are just code words to facilitate communication among humans. The same is valid for syntaxa: names are just names, as stated in the ICPN: "Names are only labels and, as such, they can never be wholly adequate. [...] It is far more important to know exactly what is meant by a name than to find one that seems in every respect to be characteristic" (Weber et al. 2000).

Figure 1. A *Physcietalia* vegetation with a large cover of *Orthotrichetalia* moss species, or an *Orthotrichetalia* vegetation invaded by *Physcietalia* lichen species? We prefer an integrated approach with both bryophytes and lichens included: several moss species (*Lewinskya speciosa*, *Nyholmiella obtusifolia* (both species formerly in the genus *Orthotrichum*, hence the name *Orthotrichetalia*; Goffinet et al. 2004, Sawicki et al. 2010, Lara et al. 2016), *Pylaisia polyantha*) and many lichen species (*Athallia pyracea*, *Caloplaca cerina*, *Candelariella xanthostigma*, *Myriolecis dispersa*, *Phaeophyscia orbicularis*, *Physcia adscendens*, *P. aipolia*, *P. stellaris*, *Toniniopsis subincompta*, *Xanthoria parietina*) were identified in an *Orthotricho-Physcietea* vegetation on a *Populus tremula* trunk (Koppang, Norway 2020). Photo: Marcel Schrijvers-Gonlag. The length of the scale bar (white piece of paper) is 10.0 cm.

The list with Dutch bryophyte-lichen syntaxa (Table 1) consists of 11 former classes (Mucina et al. 2016) existing of mainly bryophyte or lichen species, supplemented with five classes where existing bryophyte and lichen classes have been integrated, often merged at order level: *Hymenelio lacustris-Fontinalietea antipyreticae*, *Verrucario nigrescentis-Schistidietea crassipili*, *Racomitrio heterostichi-Rhizocarpetea geographici*, *Orthotricho-Physcietea* and *Ceratodonto purpurei-Polytrichetea piliferi*. The overview includes 168 syntaxa: 16 classes, 27 orders, 37 alliances, 82 associations and 6 subassociations (Table 1). From these, 13 are new syntaxa and described in detail (with the addition 'nov. hoc loco' in Van Dort et al. (2017): two alliances, nine associations and two subassociations (further down: New syntaxa). As 46 tracheophyte-dominated classes have been described in the Netherlands recently (Introduction), the 16 bryophyte-lichen-dominated classes in Table 1 are numbered 47–62.

Dutch bryophyte-lichen syntaxa in an international context

Our classification is based on recent national data and European classifications. For each syntaxon, the set of diagnostic species reflects the conditions of the Netherlands, but the allocation may also fit other European lowland regions with temperate climatic influences. Here, we make some comparisons with syntaxa elsewhere in Europe.

Our classification of epiphytic syntaxa broadly follows Barkman's study of cryptogamic epiphytes in Europe (Barkman 1958). Barkman limited himself to the level of order but he discussed two possible ways of grouping his nine epiphytic orders into four classes. However, he refrained from drawing up 'premature' classes, leaving the final decisions about ecological criteria and the selection of faithful species to future phytosociologists (Barkman 1958). Much research has been done in recent years. Although our knowledge of floristic affinities between syntaxa is still far from being complete, it seems appropriate to publish an updated overview based on contemporary data. However, it should be kept in mind, that a comprehensive, stable phytosociological system is largely a matter of wishful thinking. In modern times, environmental factors (below) and changes in land use lead to rapid changes in the floristic composition of assocations, so adaptations, or additions, of the syntaxonomic units will

Table 1. Bryophyte-lichen syntaxa in the Netherlands. Red List status for vegetations representing syntaxa at association or subassociation level is given (Van Dort et al. 2017, Schrijvers-Gonlag et al. 2018). Classes (in bold) are numbered 47–62, succeeding 46 classes which have been described previously (text). When a syntaxon name does not correspond with the International Code of Phytosociological Nomenclature (Weber et al. 2000) its 'valid name' (the name according to Weber et al. 2000; Mucina et al. 2016) is given between parentheses []. If a syntaxon name is valid, but Mucina et al. (2016) propose a different name, this is also indicated between parentheses, with the addition '*nom. conserv. propos.* (Mucina et al. 2016)'. C: character species, D: differential species. Red List status of corresponding vegetations (RL): LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered, EX = Extinct (categories according to The IUCN Red List, iucnredlist.org).

47	**Hymenelio lacustris-Fontinalietea antipyreticae Philippi 1956** [Platyhypnidio-Fontinalietea antipyreticae Philippi 1956] – C: *Amblystegium fluviatile, Oxyrrhynchium speciosum, Fontinalis antipyretica, Rhynchostegiella curviseta*
47A	*Hymenelietalia lacustris* Drehwald 1993 [*Hydroverrucarietalia* Černohorský and Hadač ex Klement 1955] – C: *Verrucaria hydrophila*, D: *Verrucaria aquatilis, V. Praetermissa*
47Aa	*Hydropunctarion rheitrophilae* Coste 2011 [*Verrucarion rheitrophilae* Coste 2011 ord. nov.]
47Aa1	*Hydropunctarietum rheitrophilae* Coste 2011 [*Verrucarietum rheitrophilae* Coste 2011 ass. prov. nov.] – C: *Hydropunctaria rheitrophila*, *Hildenbrandia rivularis*, D: *Cratoneuron filicinum* – RL: EN
47Ab	*Verrucarion praetermissae* Černohorský and Hadač ex Wirth 1972 [*Aspicilion lacustris* Klement 1950]
47Ab1	*Porpidietum hydrophilae* Ullrich 1962 nom. mut. propos. [*Lecideetum hydrophilae* Ullrich 1962] – C: *Staurothele frustulenta, Scytinium plicatile, Pterygiopsis neglecta, Aquacidia viridifarinosa, Verrucaria aethiobola, Caloplaca chlorina, Porocyphus coccodes, Bacidina inundata*, D: *Gyalolechia flavovirescens* – RL: LC
47B	*Brachythecietalia plumosi* Philippi 1956 [*Hygrohypnetalia* Krajina 1933] – D: *Leptodictyum riparium*
47Ba	*Racomitrion acicularis* Von Krusenstjerna 1945
47Ba1	*Chiloscypho rivularis-Scapanietum undulatae* Philippi 1956 – C: *Scapania undulataIa*, D: *Mnium hornum, Chiloscyphus polyanthos* – RL: EN
47C	*Leptodictyetalia riparii* Philippi 1956 – D: *Leptodictyum riparium*
47Ca	*Cinclidotion fontinaloidis* Philippi 1956
47Ca1	*Fissidentetum fontani* Von Krusenstjerna ex Von Hübschmann 1953 [*Octodiceratetum juliani* Von Krusenstjerna ex Von Hübschmann 1953] – C: *Octodiceras fontanum* – RL: LC
47Ca2	*Cinclidotetum fontinaloidis* Gams ex Von Hübschmann 1953 – D: *Leskea polycarpa* – RL: LC
47Ca2a	*Cinclidotetum fontinaloidis* Gams ex Von Hübschmann 1953 *cinclidotetosum danubici* Siebel 2017 subass. nov. – D: *Cinclidotus riparius, C. danubicus* – RL: LC
47Ca2b	*Cinclidotetum fontinaloidis* Gams ex Von Hübschmann 1953 *leskeetosum polycarpae* Van Gennip 2017 subass. nov. – D: *Cinclidotus fontinaloides, Schistidium platyphyllum, Didymodon sinuosus, D. nicholsonii, Orthotrichum cupulatum, Dialytrichia mucronata* var. *mucronata, Syntrichia latifolia* – RL: LC
47Ca3	*Leptodictyo-Fissidentetum crassipedis* Allorge ex Philippi 1956 [*Leptodictyo riparii-Fissidentetum crassipedis* Allorge ex Philippi 1956] – C: *Fissidens crassipes, F. arnoldii*, D: *Dichodontium pellucidum, Conocephalum conicum* – RL: LC
47Cb	*Rhynchostegion riparioidis* Waldheim ex Von Hübschmann 1957 [*Platyhypnidion rusciformis* Philippi 1956]
47Cb1	*Rhynchostegietum riparioidis* Gams ex Von Hübschmann 1953 [*Oxyrrhynchietum rusciformis* Gams ex Von Hübschmann 1953] – C: *Rhynchostegium riparioides, Hygrohypnum luridum, Amblystegium tenax, Rhynchostegiella teneriffae*, D: *Cirriphyllum crassinervium, Brachythecium plumosum* – RL: LC
48	***Hydropunctarietea maurae*** Drehwald 1993 [*Verrucarietea maurae* Drehwald 1993] – C: *Flavoplaca maritima*
48A	*Hydropunctarietalia maurae* Drehwald 1993 [*Verrucarietalia maurae* Drehwald 1993]
48Aa	*Flavoplacion marinae* Klement 1955 [*Caloplacion marinae* Klement 1955]
48Aa1	*Flavoplacetum marinae* Du Rietz ex Klement 1955 [*Caloplacetum marinae* Du Rietz ex Klement 1955] – C: *Lecanora helicopis, Flavoplaca marina, Variospora thallincola*, D: *Verrucaria fusconigrescens, Circinaria leprosescens* – RL: LC
48Aa2	*Hildenbrandio-Wahlenbergielletum mucosae* Den Hartog 1959 [*Hildenbrandtieto-Verrucarietum mucosae* Den Hartog 1959] – C: *Verrucaria halizoa*, *Wahlenbergiella mucosa*, *Collemopsidium halodytes*, *Hildenbrandia rubra*, *Stigmidium marinum* – RL: VU
48Aa3	*Hydropunctarietum maurae* Du Rietz ex Klement 1955 [*Verrucarietum maurae* Du Rietz ex Klement 1955] – C: *Verrucaria erichsenii*, *Hydropunctaria maura*, D: *Wahlenbergiella striatula*, *Verrucaria fusconigrescens* – RL: EN
48Aa4	*Lecanoretum zosterae* Van Dort 2017 ass. nov. – C: *Lecanora zosterae*, D: *Lecanora hagenii, Bacidina saxenii, Lecania rabenhorstii, Diplotomma hedinii* – RL: LC
49	***Verrucario nigrescentis-Schistidietea crassipili* Ježek and Veondráček 1962** [*Schistidietea apocarpi* Ježek and Vondráček 1962]- C: *Lecanora dispersa, Lecanora albescens, Verrucaria nigrescens, Tortula muralis, Lecanora muralis, Candelariella aurella, Flavoplaca flavocitrina, Lecidella stigmatea*, D: *Candelariella vitellina, Phaeophyscia orbicularis*
49A	*Schistidietalia* Ježek and Vondráček 1962 [*Schistidietalia apocarpi* Ježek and Vondráček 1962]
49Aa	*Schistidion* Ježek and Vondráček 1962 [*Grimmion tergestinae* Šmarda 1947]
49Aa1	*Orthotricho anomali-Grimmietum pulvinatae* Stodiek 1937 – C: *Grimmia pulvinata, Bryum radiculosum, Orthotrichum anomalum, Schistidium crassipilum*, D: *Bryum argenteum* – RL: LC
49B	*Verrucarietalia nigrescentis* Klement 1950
49Ba	*Circinarion calcareae* Albertson ex Roux 1978 [*Aspicilion calcareae* Albertson ex Roux 1978]
49Ba1	*Circinarietum contortae* Kaiser ex Klement 1955 [Aspicilietum contortae Kaiser ex Klement 1955] – C: *Circinaria contorta, Sarcogyne regularis, Protoblastenia rupestris, Placynthium nigrum, Circinaria calcarea, Catillaria lenticularis* – RL: LC
49Bb	*Calogayion decipientis* Klement 1950 [*Caloplacion decipientis* Klement 1950]
49Bb1	*Flavoplacetum citrinae* Beschel ex Klement 1955 [*Caloplacetum citrinae* Beschel ex Klement 1955] – C: *Flavoplaca citrina* – RL: LC

49Bb2	*Calogayetum pusillae* (Du Rietz 1925) Kaiser 1926 [*Caloplacetum saxicolae* (Du Rietz 1925) Kaiser 1926] – C: *Calogaya pusilla, Lecania erysibe, Calogaya decipiens* – RL: LC
49Bb3	*Xanthorietum calcicolae* Beschel in Klement 1955 *nom. mut. propos.* [*Xanthorietum aureolae* Beschel in Klement 1955] – C: *Lecanora campestris, Xanthoria calcicola* – RL: LC
49Bc	*Lecanorion pannonicae* Van Gennip 2017 all. nov.
49Bc1	*Lecanoretum pannonicae* Van Gennip 2017 *ass. nov.* – C: *Lecanora pannonica, Flavoplaca ruderum, Lecanora antiqua*, D: *Lecanora sulphurea, Dirina massiliensis, Diploicia canescens, Tephromela atra* – RL: LC
50	***Racomitrio heterostichi-Rhizocarpetea geographici* Neumayr 1971** [*Racomitrietea heterostichi* Neumayr 1971] – C: *Candelariella vitellina, Lecanora polytropa, Scoliciosporum umbrinum, Porpidia tuberculosa, Trapelia coarctata, Acarospora fuscata*
50A	*Racomitrietalia heterostichi* Philippi 1956 [*Grimmietalia commutatae* Šmarda and Vaněk in Šmarda 1947]
50Aa	*Hedwigion ciliatae* Philippi 1956 [*Grimmion commutatae* Von Krusenstjerna 1945]
50Aa1	*Hedwigietum ciliatae* Allorge ex Vanden Berghen 1953 [*Hedwigietum albicantis* Allorge ex Vanden Berghen 1953] – C: *Grimmia trichophylla, Andreaea rupestris, Racomitrium heterostichum, Hedwigia stellata, Hedwigia ciliata, Grimmia hartmanii, Racomitrium fasciculare, Aspicilia verrucigera* – RL: CE
50B	*Rhizocarpetalia geographici* Klement 1949 [*Physcietalia sciastrae* Hadač in Šmarda 1947 nom. ambig. rejic. propos.; *Rhizocarpetalia* Klement 1949 nom. conserv. propos. (Mucina et al. 2016)]
50Ba	*Xanthoparmelion conspersae* Hadač in Klika and Hadač 1944 [*Parmelion conspersae* Hadač in Klika and Hadač 1944] – C: *Lecanora intricata, Tephromela atra, Aspicilia grisea*, D: *Physcia caesia, Buellia aethalea*
50Ba1	*Xanthoparmelietum conspersae* Hilitzer 1925 [*Parmelietum conspersae* Hilitzer 1925] – C: *Pertusaria lactescens, Xanthoparmelia conspersa, Xanthoparmelia loxodes, Lecanora rupicola, Rhizocarpon geographicum, Rhizocarpon riparium, Aspicilia simoensis, Xanthoparmelia delisei, Xanthoparmelia protomatrae, Xanthoparmelia verruculifera, Xanthoparmelia mougeotii*, D: *Polysporina simplex, Parmelia saxatilis, Rhizocarpon reductum, Aspicilia cinerea, Acarospora nitrophila, Acarospora veronensis, Lecanora sulphurea, Lecidea plana, Lecidea promixta, Rhizocarpon lecanorinum, Rhizocarpon richardii* – RL: VU
50Ba2	*Ramalinetum siliquosae* (Du Rietz) Follmann 1973 [*Ramalinetum scopularis* Klement 1955] – C: *Schistidium maritimum, Anaptychia runcinata, Ramalina siliquosa, Pertusaria pseudocorallina*, D: *Circinaria leprosescens, Lecanora albescens, Catillaria nigroclavata, Blastenia crenularia, Flavoplaca arcis, Arthonia calcarea, Hydropunctaria maura, Lecanora hagenii* – RL: CE
50C	*Rhizocarpetalia reducti* Wirth 1980 [*R. obscurati* Wirth 1980]
50Ca	*Porpidion tuberculosae* Wirth 1972 *nom. mut. propos.* [*Lecideion tumidae* Wirth 1972]
50Ca1	*Porpidietum crustulatae* Duvigneaud ex Klement 1947 nom. mut. propos. [*Lecideetum crustulatae* Duvigneaud ex Klement 1947] – C: *Leiomonis erratica, Leiomonis lynceola, Porpidia crustulata, Micarea lithinella*, D: *Placynthiella icmalea, Trapelia obtegens* – RL: LC
50Ca2	*Porpidietum soredizodis* Van Gennip 2017 *ass. nov.* – C: *Porpidia soredizodes, Stereocaulon vesuvianum, Trapelia placodioides, Lecidella scabra*, D: *Verrucaria nigrescens, Catillaria chalybeia, Tortula muralis, Lecidella stigmatea, Lecanora dispersa, Lecanora campestris, Myriospora rufescens, Verrucaria muralis* – RL: LC
51	***Chrysotrichetea chlorinae* Wirth 1972** nom. mut. propos. [*Leprarietea chlorinae* Wirth 1972] – C: *Psilolechia lucida, Psilolechia leprosa, Bryostigma muscigena*, D: *Haematomma ochroleucum, Dendrographa decolorans, Pachnolepia pruinata*
51A	*Chrysotrichetalia chlorinae* Hadač ex Wirth 1972 nom. mut. propos. [*Leprarietalia chlorinae* Hadač ex Wirth 1972]
51Aa	*Chrysotrichion chlorinae* Šmarda and Hadač ex Wirth 1972 nom. mut. propos. [*Crocynion membranaceae* Klement 1950; *Leprarion chlorinae* Šmarda and Hadač ex Wirth 1972 nom. conserv. propos. (Mucina et al. 2016)]
51Aa1	*Psilolechietum lucidae* Schade ex Klement 1950 *nom. mut. propos.* [*Lecideetum lucidae* Schade ex Klement 1950] – RL: LC
51Ab	*Cystocoleion ebenei* Wirth 1972 nom. mut. propos. [*Cystocoleion nigri* Wirth 1972]
51Ab1	*Gyrographetum gyrocarpae* Wirth 1969 [*Opegraphetum horistico-gyrocarpae* Wirth 1969] – C: *Dirina massiliensis, Lepraria vouauxii, Gyrographa gyrocarpa, Botryolepraria lesdainii, Leproplaca chrysodeta, Alyxoria mougeotti, Opegrapha areniseda* – RL: LC
52	***Hypogymnietea physodis* Follmann 1974** – C: *Hypogymnia physodes, Parmelia sulcata, Evernia prunastri, Melanelixia subaurifera, Buellia griseovirens, Flavoparmelia caperata, Hypogymnia tubulosa*
52A	*Hypogymnietalia physodo-tubulosae* Barkman 1958 nom. mut. propos. [*Alectorietalia* Dahl and Hadač in Klika and Hadač 1944]
52Aa	*Hypogymnion physodis* Von Krusenstjerna 1945 nom. mut. propos. [*Physodion* Von Krusenstjerna 1945; *Parmelion physodis* Von Krusenstjerna 1945 *nom. corr. propos.* (Mucina et al. 2016)] – C: *Ochrolechia microstictoides, Lecanora aitema*, D: *Parmelia saxatilis, Pyrrhospora quernea, Melanelixia glabratula, Melanohalea laciniatula, Polycauliona candelaria, Melanohalea elegantula, Parmotrema perlatum*
52Aa1	*Hypotrachynetum revolutae* Almborn ex Klement 1955 nom. mut. propos. [*Parmelietum revolutae* Almborn ex Klement 1955] – C: *Hypotrachyna revoluta* – RL: LC
52Aa2	*Parmeliopsidetum ambiguae* Hilitzer 1925 – C: *Parmeliopsis ambigua, Violella fucata* – RL: LC
52Aa3	*Pertusarietum amarae* Hilitzer 1925 – C: *Pertusaria amara, Pertusaria pertusa, Ochrolechia subviridis, Ochrolechia androgyna* – RL: VU
52Aa4	*Protoparmelietum oleaginae* Van Dort and Van Herk 2017 ass. nov. – C: *Protoparmelia oleagina, Protoparmelia hypotremella, Sphinctrina anglica, Lecanora pulicaris, Lecanora sinuosa* – RL: VU
52Aa5	*Pseudevernietum furfuraceae* Hilitzer 1925 nom. mut. propos. [*Parmelietum furfuraceae* Hilitzer 1925] – C: *Pseudevernia furfuracea, Platismatia glauca, Tuckermanopsis chlorophylla* – RL: VU
52Aa6	*Usneetum filipendulae* Hilitzer 1925 [*Alectorio-Usneetum dasypogae* Hilitzer 1925] – C: *Usnea subfloridana, Usnea hirta* – RL: CE

52B	*Lecanoretalia conizaeoidis* Barkman 1958 nom. mut. propos. [*Lecanoretalia variae* Barkman 1958]
52Ba	*Lecanorion conizaeoidis* Barkman 1958 nom. mut. propos. [*Lecanorion variae* Barkman 1958] – C: *Lecanora aitema*
52Ba1	*Lecanoretum conizaeoidis* Barkman 1958 nom. mut. propos. [*Lecanoretum pityreae* Barkman 1958] – C: *Lecanora conizaeoides* – RL: NT
53	***Orthotricho-Physcietea* Tomaselli and De Micheli 1952** [*Physcietea* Tomaselli and De Micheli 1952] – C: *Physcia tenella, Candelariella reflexa, Orthotrichum affine, Orthotrichum diaphanum, Rhynchostegium confertum* (growing epiphytic), *Bacidina adastra, Ulota bruchii, Orthotrichum lyellii, Orthotrichum pulchellum, Orthotrichum tenellum*, D: *Xanthoria parietina, Polycauliona polycarpa*
53A	*Orthotrichetalia* Hadač in Klika and Hadač 1944
53Aa	*Syntrichion laevipilae* Ochsner 1928 – D: *Frullania dilatata, Ulota phyllantha, Cryphaea heteromalla*
53Aa1	*Syntrichietum laevipilae* Ochsner 1928 – C: *Syntrichia papillosa, Syntrichia laevipila, Zygodon viridissimus, Radula complanata, Metzgeria furcata, Leucodon sciuroides, Orthotrichum pumilum, Pylaisia polyantha, Orthotrichum striatum, Orthotrichum speciosum, Orthotrichum obtusifolium, Zygodon conoideus, Orthotrichum rogeri, Orthotrichum patens* – RL: LC
53B	*Physcietalia* Hadač in Klika and Hadač 1944 – D: *Amandinea punctata*
53Ba	*Ramalinion farinaceae* Van Dort and Van Herk 2017 all. nov. – C: *Ramalina farinacea*, D: *Haematomma ochroleucum, Lepraria incana, Polycauliona candelaria, Diploicia canescens, Dendrographa decolorans, Buellia griseovirens, Lecanora compallens, Pyrrhospora quernea, Parmelina tiliacea*
53Ba1	*Pertusarietum coccodis* Van Dort and Van Herk 2017 ass. nov. – C: *Pertusaria coccodes, Pertusaria albescens* – RL: LC
53Ba2	*Pleurostictetum* Ochsner 1928 [*Parmelietum acetabuli* Ochsner 1928] – C*: Pleurosticta acetabulum* – RL: VU
53Ba3	*Ramalinetum fastigiatae* Duvigneaud 1942 – C: *Ramalina fastigiata, Ramalina fraxinea* – RL: LC
53Ba4	*Ramalinetum lacerae* Duvigneaud 1942 [*Ramalinetum duriaei* Duvigneaud 1942] – C: *Ramalina lacera* – RL: EN
53Bb	*Xanthorion parietinae* Ochsner 1928 – D: *Phaeophyscia orbicularis, Physcia adscendens, Punctelia subrudecta, Punctelia jeckeri*
53Bb1	*Flavoplacetum phloginae* Barkman 1958 [*Caloplacetum phloginae* Barkman 1958] – C: *Flavoplaca citrina* s.l. (*F. citrina* var. *phlogina*, *F. flavocitrina*), *Lecania cyrtellina, Athallia holocarpa* (growing epiphytic), *Rinodina pityrea, Lecania cyrtella*, D: *Rinodina oleae, Tortula muralis* – RL: LC
53Bb2	*Physcietum adscendentis* Frey and Ochsner 1926 – D: *Physconia grisea, Candelaria concolor* – RL: LC
54	***Arthonio-Lecidelletea elaeochromae*** Drehwald 1993 – C: *Lecanora expallens, Arthonia radiata*
54A	*Graphidetalia* Hadač in Klika and Hadač 1944
54Aa	*Graphidion* Ochsner ex Felföldy 1941 [*Graphidion scriptae* Ochsner ex Felföldy 1941] – C: *Arthonia spadicea, Porina aenea, Porina leptalea*, D: *Coenogonium pineti, Lepraria finkii, Lepraria incana, Metzgeria furcata*
54Aa1	*Graphidetum* Hilitzer 1925 [*Graphidetum scriptae* Hilitzer 1925] – C: *Graphis scripta, Arthonia ruana, Phaeographis inusta* – RL: LC
54Aa2	*Pyrenuletum nitidae* Hilitzer 1925 – C: *Pertusaria leioplaca, Pertusaria hymenea, Enterographa crassa, Pyrenula nitida, Lecanora hybocarpa* – RL: LC
54Aa3	*Thelotrematetum lepadini* Hilitzer 1925 – C: *Thelotrema lepadinum* – RL: VU
54Ab	*Lecanorion carpineae* Ochsner 1928 *corr.* Barkman 1958 – C*: Lecidella elaeochroma, Lecanora chlarotera* – D: *Xanthoria parietina, Physcia tenella, Amandinea punctata, Polycauliona polycarpa, Lecanora hagenii*
54Ab1	*Lecanoretum carpineae* Hilitzer 1925 corr. Barkman 1958 – C: *Lecanora carpinea, Lecanora subcarpinea* – RL: LC
54Ab2	*Lecanoretum symmictae* Klement 1953 – C: *Lecanora symmicta, Strangospora pinicola* – RL: LC
54Ab3	*Naetrocymbetum* James, Hawksworth and Rose 1977 [*Arthopyrenietum punctiformis* James, Hawksworth and Rose 1977] – C: *Naetrocymbe punctiformis, Arthonia punctiformis* – RL: LC
55	***Calicio-Chrysotrichetea candelaris* Wirth ex** Drehwald 1993 [*Leprarietea candelaris* Wirth 1980] – C: *Chaenotheca trichialis, Chrysothrix candelaris, Chaenotheca chrysocephala, Chaenotheca stemonea, Calicium salicinum, Chaenotheca chlorella*
55A	*Calicio-Chrysotrichetalia candelaris* Wirth ex Drehwald 1993 [*Leprarietalia* Barkman 1958]
55Aa	*Calicion viridis* Černohorský and Hadač in Klika and Hadač 1944 nom. mut. propos. [*Calicion hyperelli* Černohorský and Hadač in Klika and Hadač 1944]
55Aa1	*Calicietum viridis* Hilitzer 1925 *nom. mut. propos*. [*Calicietum hyperelli* Hilitzer 1925] – C: *Calicium viride, Calicium adspersum* – RL: LC
55Aa2	*Chaenothecetum ferrugineae* Barkman 1958 nom. mut. propos. [*Chaenothecetum melanophaeae* Barkman 1958] – C: *Chaenotheca ferruginea* – RL: LC
55Aa3	*Lecanactidetum abietinae* Hilitzer 1925 – C: *Lecanactis abietina* – RL: LC
55Aa4	*Pachnolepietum pruinatae* Almborn 1948 [*Arthonietum impolitae* Almborn 1948] – C: *Pachnolepia pruinata* – RL: LC
56	***Neckeretea complanatae* Marstaller 1986** nom. conserv. propos. (Mucina et al. 2016) [*Hypnetea cupressiformis* Ježek and Vondráček 1962] – C: *Leskea polycarpa, Homalia trichomanoides, Scleropodium cespitans*, probably *Bryum moravicum*, D: *Homalothecium sericeum*
56A	*Leskeetalia polycarpae* Lecointe 1976 [*Orthotrichetalia* Hadač in Klika and Hadač 1944]
56Aa	*Leskeion polycarpae* Barkman 1958 – C: *Dialytrichia mucronata* var. *fragilifolia, Didymodon sinuosus*, D: *Leptodictyum riparium*
56Aa1	*Fissidentetum gymnandri* Van Dort and Weeda 2017 ass. nov. – C: *Fissidens gymnandrus*, D: *Lophocolea bidentata, Brachythecium mildeanum, Oxyrrhynchium hians, Timmia megapolitana, Chiloscyphus polyanthos, Fissidens taxifolius, Amblystegium varium, Rhizomnium punctatum, Lunularia cruciata* – RL: LC
56Aa2	*Syntrichio latifoliae-Leskeetum polycarpae* Von Hübschmann 1952 – C: *Syntrichia latifolia*, D: *Orthotrichum diaphanum, Orthotrichum affine, Ceratodon purpureus, Syntrichia papillosa* – RL: LC

56B	*Neckeretalia complanatae* Ježek and Vondráček 1962
56Ba	*Neckerion complanatae* Šmarda and Hadač ex Klika 1948 nom. conserv. propos. (Mucina et al. 2016) [*Drepanion cupressiformis* Ochsner 1928] – C: *Neckera complanata*
56Ba1	*Sciurohypno populei-Anomodontetum viticulosi* Van Dort and Weeda 2017 ass. nov. - C: *Anomodon viticulosus, Thamnobryum alopecurum, Isothecium alopecuroides, Peltigera praetextata, Porella platyphylla, Anomodon attenuatus*, D: *Lepraria finkii, Plagiothecium nemorale, Brachythecium populeum, Metzgeria furcata, Anisomeridium polypori, Brachythecium salebrosum, Lepraria incana, Mnium hornum, Lophocolea heterophylla, Brachythecium velutinum, Plagiomnium cuspidatum, Brachythecium reflexum* – RL: VU
56Ba2	*Neckero complanatae-Plasteurhynchietum* Cortini Pedrotti 1988 [*Anomodonto viticulosi-Leucodontetum sciuroidis* Wiśniewski 1930] – C: *Plasteurhynchium striatulum*, D: *Cirriphyllum crassinervium, Rhynchostegium murale, Brachythecium glareosum, Neckera crispa, Rhynchostegium rotundifolium* – RL: NT
57	***Cladonio digitatae-Lepidozietea reptantis* Ježek and Vondráček 1962** – C: *Cladonia coniocraea, Lophocolea heterophylla, Dicranum montanum, Dicranoweisia cirrata, Orthodontium lineare*, D: *Dicranum scoparium, Mnium hornum, Cladonia chlorophaea, Plagiothecium laetum* s.l. (including var. *curvifolium*)
57A	*Dicranetalia scoparii* Barkman 1958
57Aa	*Dicrano-Hypnion andoi* Barkman 1958 [*Dicrano scoparii-Hypnion filiformis* Barkman 1958]
57Aa1	*Dicrano-Hypnetum andoi* Barkman 1949 [*Dicrano scoparii-Hypnetum filiformis* Barkman 1949) – C: *Dicranum tauricum, Hypnum andoi* – RL: LC
57Aa2	*Mnio horni-Isothecietum myosuroidis* Barkman 1958 – C: *Isothecium myosuroides* – RL: LC
57B	*Lophocoleetalia heterophyllae* Barkman 1958 – C: *Campylopus flexuosus*
57Ba	*Cladonion coniocraeae* Duvigneaud ex James et al. 1977 – D: *Trapeliopsis granulosa, Cladonia macilenta, Cladonia fimbriata, Cladonia grayi, Cladonia ramulosa, Cladonia glauca, Cladonia floerkeana*
57Ba1	*Cladonietum digitatae* Van Dort 2017 ass. nov. – C: *Cladonia polydactyla, Cladonia digitata, Cladonia incrassata, Cladonia parasitica*, D: *Lichenomphalia umbellifera, Lichenomphalia hudsoniana* – RL: LC
57Ba2	*Hypocenomycetum scalaris* Hilitzer 1925 [*Psoretum ostreatae* Hilitzer 1925] – C: *Hypocenomyce scalaris* – RL: LC
57Ba3	*Pohlio-Leptodontietum flexifolii* Barkman and Ringelberg-Giesen 1959 [*Pohlio nutantis-Leptodontietum flexifolii* Barkman and Ringelberg-Giesen 1959] – C: *Leptodontium flexifolium*, D: *Pohlia nutans, Ceratodon purpureus, Polytrichum piliferum* – RL: NT
57Ba4	*Trapeliopsidetum flexuosae* Van Dort 2017 ass. nov. – C: *Trapeliopsis flexuosa*, D: *Placynthiella icmalea* – RL: LC
57Bb	*Tetraphidion* Von Krusenstjerna 1945 [*Tetraphidion pellucidae* von Krusenstjerna 1945] – C: *Herzogiella seligeri*
57Bb1	*Aulacomnietum androgyni* Von Krusenstjerna 1945 – C: *Aulacomnium androgynum* – RL: LC
57Bb2	*Leucobryo-Tetraphidetum* Barkman 1958 – C: *T. pellucida, Lepidozia reptans* – RL: LC
57Bb2a	*Leucobryo-Tetraphidetum typicum* Barkman 1958 – D: *Leucobryum glaucum, Barbilophozia attenuata, Dicranodontium denudatum* – RL: LC
57Bb2b	*Leucobryo-Tetraphidetum nowellietosum* (Koppe 1955) Cornelissen and Karssemeijer 1987 – D: *Nowellia curvifolia, Cephalozia connivens, Lophozia ventricosa, Riccardia latifrons, Odontoschisma denudatum, Cephalozia lunulifolia* – RL: LC
58	***Fellhaneretea bouteillei* Bricaud and Roux in Bricaud et al. 2009** – C: *Fellhanera bouteillei*
58A	*Fellhaneretalia bouteillei* Bricaud and Roux in Bricaud et al. 2009
58Aa	*Fellhanerion bouteillei* Bricaud and Roux in Bricaud et al. 2009
58Aa1	*Neocolero bouteillei-Fellhaneretum bouteillei* Bricaud and Roux in Bricaud et al. 2009 – C: *Fellhaneropsis vezdae* – RL: NT
58Aa2	'*Fellhaneropsidetum rhododendri*' (provisional association, more data needed) – C: *Fellhaneropsis rhododendri* – RL: NT
59	***Ceratodonto purpurei-Polytrichetea piliferi* Mohan 1978** – C: *Polytrichum piliferum, Cladonia coccifera, Cladonia macilenta, Campylopus introflexus, Campylopus pyriformis, Cladonia floerkeana, Cladonia grayi, Cladonia ramulosa, Cephaloziella divaricata, Ceratodon purpureus*
59A	*Peltigeretalia* Klement 1949
59Aa	*Baeomycetion rufi* Klement 1952 – C: *Baeomyces rufus, Cladonia callosa*
59Aa1	*Dibaeidetum baeomycetis* Paus 1997 – C: *Dibaeis baeomyces* – RL: EN
59Aa2	*Placynthielletum uliginosae* Langerfeldt ex Klement 1955 [*Lecideetum uliginosae* Langerfeldt ex Klement 1955] – C: *Placynthiella uliginosa, Placynthiella dasaea, Placynthiella oligotropha*, D: *Placynthiella icmalea, Trapeliopsis granulosa* – RL: EN
59Ab	*Cladonion rei* Paus 1997 – C: *Cladonia furcata, Cladonia subulata*
59Ab1	*Cladonietum rei* Paus 1997 – C: *Cladonia rei, Cladonia humilis, Cladonia scabriuscula, Peltigera didactyla, Cladonia cariosa, Peltigera rufescens*, D: *Brachythecium albicans, Polytrichum juniperinum, Hypnum cupressiforme, Barbula convoluta, Bryum argenteum* – RL: LC
59B	*Polytrichetalia piliferi* Von Hübschmann 1975
59Ba	*Polytrichion piliferi* Šmarda 1947 – C: *Cetraria aculeata, Cladonia foliacea, Cladonia arbuscula, Stereocaulon condensatum*
59Ba1	*Cladonietum zopfii* Krieger 1937 nom. mut. propos. [*Cladonietum destrictae* Krieger 1937] – C: *Cladonia verticillata, Cladonia crispata, Cladonia pulvinata, Cladonia zopfii, Cladonia strepsilis, Cladonia monomorpha, Cladonia gracilis, Cladonia portentosa, Cladonia cervicornis, Pycnothelia papillaria, Stereocaulon saxatile, Cladonia uncialis, Cladonia borealis* – RL: VU
60	***Dicranelletea heteromallae* Mohan 1978** [*Cladonio digitatae-Lepidozietea reptantis* Ježek and Vondráček 1962 nom. conserv. propos. (Mucina et al. 2016)] – C: *Dicranella heteromalla, Ditrichum heteromallum, Diplophyllum obtusifolium, Diplophyllum albicans*, D: *Atrichum undulatum, Polytrichum formosum, Pohlia nutans*
60A	*Dicranelletalia heteromallae* Philippi 1956 [*Diplophylletalia albicantis* Philippi 1963 nom. conserv. propos. (Mucina et al. 2016)]

60Aa	*Dicranellion heteromallae* Philippi 1963 nom. conserv. propos. (Mucina et al. 2016) [*Pogonato urnigeri-Atrichion undulati* Von Krusenstjerna 1945] – C: *Pseudotaxiphyllum elegans, Trapeliopsis pseudogranulosa*, D: *Mnium hornum, Dicranum scoparium, Lepraria incana, Lepraria finkii*
60Aa1	*Bartramietum pomiformis* Von Krusenstjerna 1945 – C: *Bartramia pomiformis*, D: *Aulacomnium androgynum* – RL: CE
60Aa2	*Calypogeietum muellerianae* Philippi 1963 – C: *Calypogeia muelleriana, Kurzia sylvatica*, D: *T. pellucida, Cephalozia bicuspidata* – RL: LC
60Aa3	*Cladonietum caespiticiae* Paus 1997 – C: *Cladonia caespiticia, Micarea viridileprosa* – RL: LC
60Aa4	*Plagiothecietum nemoralis* (Scholz 1964) Von Hübschmann 1974 [*Plagiothecietum neglecti* Ricek 1968] – C: *Plagiothecium nemorale, Fissidens bryoides, Plagiothecium cavifolium*, D: *Kindbergia praelonga* – RL: LC
60Aa5	*Pleuridio acuminati-Ditrichetum pallidi* Gillet ex Marstaller 1990 – RL: NT
60Ab	*Pogonation urnigeri* Von Krusenstjerna 1945 – C: *Atrichum tenellum*
60Ab1	*Jungermannietum gracillimae* Neumayr 1971 nom. mut. propos. [*Solenostometum crenulati* Neumayr 1971] – C: *Jungermannia gracillima, Ditrichum pusillum, Pohlia lescuriana*, D: *Cephalozia bicuspidata, Pellia epiphylla* – RL: LC
60Ab2	*Pogonatetum aloidis* Von Krusenstjerna ex Philippi 1956 – C: *Pogonatum aloides* – RL: LC
60Ab3	*Pogonatetum urnigeri* Herzog 1943 [*Pogonato urnigeri-Atrichetum undulati* Von Krusenstjerna 1945] – C: *Pogonatum urnigerum, Pogonatum nanum*, D: *Polytrichum juniperinum* – RL: LC
61	***Psoretea decipientis* Mattick ex Follmann 1974** – C: *Barbula unguiculata, Bryum argenteum, Bryum barnesii, Bryum rubens* s.s., probably *Bryum microerythrocarpum, Bryum dichotomum, Marchantia polymorpha, Bryum caespiticium, Dicranella schreberiana*, D: *Ditrichum cylindricum*
61A	*Barbuletalia* Von Hübschmann 1960 [*Barbuletalia unguiculatae* Von Hübschmann 1960]
61Aa	*Phascion* Waldheim 1944 – C: *Phascum cuspidatum, Microbryum davallianum* s.l., D: *Blennothallia crispa, Pleuridium subulatum*
61Aa1	*Barbuletum convolutae* Hadač and Šmarda 1944 – C: *Barbula convoluta, Vezdaea leprosa, Sarcosagium campestre* – RL: LC
61Aa1a	*Barbuletum convolutae typicum* Hadač and Šmarda 1944 – D: *Lunularia cruciata, Cladonia humilis* – RL: LC
61Aa1b	*Barbuletum convolutae aloinetosum* Marstaller 1980 – D: *Aloina aloides* s.l., *Pseudocrossidium hornschuchianum, Brachythecium albicans* – RL: LC
61Aa2	*Dicranelletum variae* Giacomini 1939 nom. mut. propos. [*Dicranelletum rubrae* Giacomini 1939] – C: *Dicranella varia, Pohlia melanodon*, D: *Pellia endiviifolia, Didymodon fallax, Aneura pinguis, Didymodon tophaceus, Leiocolea badensis* – RL: LC
61Aa3	*Tortuletum truncatae* Von Krusenstjerna 1945 nom. mut. propos. [*Pottietum truncatae* Von Krusenstjerna 1945] – C: *Tortula truncata, Dicranella staphylina*, D: *Riccia glauca* – RL: LC
61Aa4	*Weissietum controversae* Marstaller 1988 – C: *Weissia controversa* s.l., *Weissia longifolia, Ephemerum serratum* var. *minutissimum, Microbryum curvicolle*, D: *Fissidens taxifolius* – RL: LC
61B	*Funarietalia hygrometricae* Von Hübschmann 1957
61Ba	*Funarion hygrometricae* Von Hübschmann 1957 – C: *Leptobryum pyriforme*
61Ba1	*Funarietum hygrometricae* Engel 1949 – C: *Funaria hygrometrica* – RL: LC
61Ba2	*Physcomitrietum pyriformis* Waldheim ex Von der Dunk 1972 – C: *Physcomitrium pyriforme*, D: *Pseudephemerum nitidum, Atrichum undulatum, Pleuridium palustre* – RL: LC
62	***Splachnetea* Von Hübschmann 1957** [*Funarietea hygrometricae* Von Hübschmann 1957]
62A	*Splachnetalia* Hadač and Klika ex Von Hübschmann 1957 [*Splachnetalia lutei* Hadač and Klika ex Von Hübschmann 1957]
62Aa	*Splachnion* Hadač and Klika ex Von Hübschmann 1957 [*Splachnion lutei* Hadač and Klika ex Von Hübschmann 1957]
62Aa1	*Splachnetum* Von Hübschmann 1957 [*Splachnetum ampullacei* Von Hübschmann 1957] – C: *Splachnum ampullaceum* – RL: NT
62Aa2	*Tetraplodontetum* Marstaller 2002 [*Tetraplodontetum angustati* Marstaller 2002] – C: *Tetraplodon mnioides* – RL: EX

always be necessary (Bout and Dirkx 2012, Schaminée et al. 2017, Haveman 2021, Haveman and De Ronde 2021).

Until recently, climatic conditions prevented the occurrence of xero-thermophilous species as *Fabronia pusilla* in the Netherlands (BLWG 2023a). The *Fabronion pusillae* Barkman 1958 is therefore not mentioned on the Dutch list (Table 1). Mucina et al. (2016) consider the *F. pusillae* synonymous with the *Syntrichion laevipilae*, widespread and common in the Netherlands – although *F. pusilla* is not indiginous (yet?) (BLWG 2023a). *Fabronia pusilla* may spread from populations on the stems of garden trees, imported from the Mediterranean countries, and become part of *Syntrichion* vegetations in the Netherlands in the near future.

Due to sulphur dioxide and ammonia emissions and depositions in the last century (Asman et al. 1988, Mylona 1996, De Ruiter et al. 2006, De Haan et al. 2008, Van der Swaluw et al. 2011, Van Zanten et al. 2017, Dammers et al. 2022, Wever et al. 2022), acidophilous cryptogams have decreased in distribution while epiphytes favoured by eutrophication have spread rapidly. Nitrophytes invaded vegetations to such an extend that formerly obvious floristical characteristics have been obscured. In particular vegetations representing *Hypogymnietea physodis* associations have impoverished and decreased in area (Van Herk and Spier 1994, Van Herk et al. 2000, Sparrius and Timmerman 2014). Within the *Hypogymnietea*, both alliances *Usneion barbatae* Ochsner 1928 and *Vulpicidion pinastri* Ochsner ex Kušan 1933 (synonym *Cetrarion pinastri*), two in many European boreal and mountain areas well represented alliances, are missing from the Dutch list with bryophyte-lichen syntaxa (Table 1). Some of the diagnostic species are known from lowland countries, but exist here on the edge of their natural distribution area due to climatic conditions. The epiphytic lichens *Bryoria fuscescens*, *Platismatia glauca*, *Tuckermanopsis*

chlorophylla, *Usnea filipendula*, *U. subfloridana* (all diagnostic for the *U. barbatae*), *Parmeliopsis ambigua* and *Vulpicida pinastri* (diagnostic for the *V. pinastri*) have declined tremendously in the last century, mainly due to the mentioned sulphur dioxide and ammonia emissions and depositions in the Netherlands (Aptroot et al. 2011, Van der Pluijm and Boesveld 2016, BLWG 2023b). All present vegetations in the Netherlands with one of these species are 'floristically blurred' and can hardly be distinguished syntaxonomically from the *Hypogymnion physodis*. We use a broad concept of the *H. physodis* and the impoverished *Usneetum filipendulae* and *Parmeliopsidetum ambiguae* vegetations are placed within the *H. physodis* (Table 1), while in our neighboring country Germany these associations still are included in the *U. barbatae* and *V. pinastri* (Drehwald 1993, Wirth 1995, Schubert and Stordeur 2011).

The forest species *Lobaria pulmonaria* and *Lobarina scrobiculata*, character species of the *L. pulmonariae* Ochsner 1928, disappeared long ago from the highly fragmented forests in the Netherlands (BLWG 2023c), and most European lowland forests. Therefore, the *Lobarion* appears under 'Disappeared climax vegetation' in the class *Neckeretea complanatae* in Van Dort et al. (2017). Another example of an epiphytic syntaxon absent in Table 1 is the *Nowellion curvifoliae* Philippi 1965 (*Cladonio digitatae-Lepidozietea reptantis*) (Barkman proposed the name *Blepharostomion trichophylli* for this alliance). Representatives of the *N. curvifoliae* are common in many conifer dominated forests in Europe. Due to adjusted forest management (Wijdeven 2005, Schelhaas et al. 2022), the diagnostic species *Nowellia curvifolia*, *Riccardia latifrons* and more recently also *R. palmata* are increasing in the Netherlands (BLWG 2023d), responding to an increased availability of large diameter logs at late decay stages (important for critical epiphytes; Ódor and Van Hees 2004, Ódor et al. 2006). Nevertheless, their current distribution does not yet justify the existence of an independent alliance in the Netherlands.

Epilithic bryophyte-lichen vegetation is widespread in the densely populated Netherlands. However, exposed acidic rock surface is nearly absent. Acidophytic epilitics are restricted to just a few imported graveyard stones, sea dikes constructed with granitic boulders from the 'hunebedden' (ancient tombs similar to dolmens; www.sketchfab.com/gia), few remaining hunebedden and some weathered walls from old churches and historical buildings. As a consequence, the number of syntaxa belonging to the *Racomitrio heterostichi-Rhizocarpetea geographici* is very small in the Netherlands (Table 1). Moreover, *Racomitrio-Rhizocarpetea* associations are poor in character species compared to corresponding associations in other European countries, especially in mountainous regions. Several reasons exist: the relatively small area available, the young age (no late succession stages present: graveyard stones, hunebedden and stone sea dikes were absent before 1700, or not exposed: hunnebedden were buried in the ground), eutrophication (particularly with nitrogen-containing compounds as mentioned earlier), and increasing shade and restauration measures of graveyard stones, hunebedden and granite sea dikes (Masselink and Van Zanten 1976, Boele and Van Zanten 1984, Siebel et al. 2000, Colpa and Van Zanten 2006, Bijlsma et al. 2009). On the other hand, epilithic vegetations with calcicolous species (*Verrucario nigrescentis–Schistidietea crassipili*, *N. complanatae*) are abundant in the Netherlands on anthropogenic substrate as buildings, extensively used roads and pavements. The species composition does not differ substantially from vegetation on natural calcareous and other base-rich siliceous rock surfaces. As species preferring chalk, limestone or other base-rich porouse rock surface are rare or absent in the Netherlands, so are the corresponding vegetations belonging to the *Verrucario nigrescentis–Schistidietea crassipili*, the *Ctenidietea mollusci* Von Hübschmann ex Grgić 1980 and the *Clauzadeetea immersae* Roux in Roux et al. 2009. The latter two classes are absent in Table 1, in spite of the fact that some impoverished communities or fragments do occur. For example, a characteristic *Ctenidietea* species like *Ctenidium molluscum* is rather widespread in the Netherlands (be it on antropogeneous substrata), and not rare in the southeastern part of the country (Mergelland) on nutrient-poor limestone substrates (BLWG 2023e).

In the Netherlands, both small and large freshwater bodies are common. Most of these are both mineral-rich and base-rich and therefore aquatic (amphibious and (semi-) permanently submerged) communities belonging to the *Hymenelio lacustris–Fontinalietea antipyreticae* are widespread. A rare cryptogam vegetation on pebbles and stones in clear, mineral-poor streams resembles the habitat of the montane association *Verrucarietum siliceae* Wirth and Ullrich in Wirth 1972 as described in Drehwald (1993). The species composition shows more affinities to the *Verrucarietum rheitrophilae* Coste 2011, belonging to the alliance *Verrucarion rheitrophilae* Coste 2011. We updated and modernized the syntaxon names to *Hydropunctarietum rheitrophilae* and *Hydropunctarion rheitrophilae*, respectively (Table 1). In the Netherlands, vegetations representing the alliances *H. rheitrophilae* and *Racomitrion acicularis* (common in montane and subalpine areas) have the Red List-status 'endangered' (Table 1). Our classification of these syntaxa is based on a limited number of relevés poor in diagnostic species and our description is probably incomplete. For example, only one character species (*Scapania undulata*) is distinguished in the *Chiloscypho rivularis-Scapanietum undulatae*, whereas in German literature *Dichodontium pellucidum* figures either as a second character species for this association (Marstaller 2006), or is present in the *Chiloscypho-Scapanietum* (Schubert 2008) or *R. acicularis* (Von Hübschmann 1986, Dierßen 2001). Interestingly, in a German province with relatively low elevation and bordering the Netherlands, *D. pellucidum* is characteristic for the *Brachythecietalia plumosi* (Drehwald and Preising 1991). Frey et al. (2006) describe *D. pellucidum* as a mountainous species, sparse in the lowlands. In the Netherlands, *D. pellucidum* is very rare and mainly growing in *Leptodictyo-Fissidentetum crassipedis* vegetation.

The bryophyte-lichen communities affected by saltwater (*Hydropunctarietea maurae*) are also common in the

Netherlands. Bryophytes are almost absent in these coastal communities. Noteworthy is that, unlike many other places in Europe, natural rock formations are lacking along the sandy North Sea coast line. Salt-tolerating lichens are almost exclusively restructed to dikes (often made of basalt, chalk stone or granite), and other antropogenic constructions as wooden poles. Sporadically, *H. maurae* communities are found on shells and other hard substrate from animals in the littoral zone (e.g. *Littorina* spp., *Ostrea* spp., *Sessilia* spp.) and on weathered bones or plant material (see the synoptic table of the *Lecanoretum zosterae* below).

Our interpretation of the *Psoretea decipientis*, pioneer epigaeic bryophyte-lichen vegetations on exposed, nutrient-rich, subneutral to calcareous soil differs from many other European classifications. The syntaxonomic interpretation of these vegetations is greatly influenced by the scale used (both temporal and sparial) and such vegetations are sometimes considered synusiae, microcoeni, microcommunities, or other dependent communities and not independent syntaxa. For a discussion about the classification of ephemeral small-scale bryophyte-lichen vegetations see Van Dort et al. (2017). Here we only mention some differences with other European classifications. Two orders are recognized in the *P. decipientis*: the *Barbuletalia* and *Funarietalia hygrometricae* (we don't distinguish a separate *Psoretalia decipientis* Mattick 1951; Table 1). In the *F. hygrometricae*, Von Hübschmann (1986), Drehwald and Preising (1991) and Marstaller (2006) distinguished a *Physcomitrellion patentis* Von Hübschmann 1957, whereas Bültmann placed this alliance in the *Dicranelletalia heteromallae* (Mucina et al. 2016). In the Netherlands, the *P. patentis* diagnostic species *Physcomitrium eurystomum*, *P. sphaericum* and *Physcomitrella patens* represent the *Eleocharito acicularis-Limoselletum* Wendelberger-Zelinka 1952 (*Bidentetea tripartitae* Tüxen et al. in Tüxen 1950) (Weeda et al. 1998, Nieuwkoop 2011, 2016), whereas *Physcomitrium pyriforme* is diagnostic of the *Funarion hygrometricae*. A peculiar feature of the Netherlands is the overall-presence of nutrient-enriched habitats (mainly resulting from a high ammonia deposition, see before). Therefore, the *P. patentis* elements are largely replaced by nitrophilous species diagnostic of the *F. hygrometricae* and consequently the *P. patentis* is absent in Table 1.

We do not accept many of the associations placed within the *P. decipientis*, particularly *Barbuletalia*, by other authors (Schlüsslmayr 2005, Marstaller 2006, Schubert 2009). Some character species of these associations occur or may be present occasionally in the Netherlands, but they appear periodically while forming a diffuse bryophyte layer in vegetation types dominated by vascular plants (e.g. the *Riccio-Anthocerotetum punctati* Koppe ex Neumayr 1971 vegetation in the Netherlands is appointed to the *Centunculo- Anthocerotetum punctati* Koch ex Libbert 1932 in the *N. flavescentis* Koch ex Libbert 1932 (*Isoeto-Nanojuncetea* Braun-Blanquet et Tüxen 1943) (Lemaire et al. 1998, Siebel and Van Dort 1999)). A second reason to ignore these *Psoretea*-syntaxa is that many of the vegetations, representing associations recognized in other countries, originate from pioneer habitats, e.g. river banks. In the Netherlands, fluviatile vegetation develops within an extremely short period. Bryophytes do sometimes build up quite large populations, always in combination with vascular plants. As both groups are fairly inseparable, both spatially and temporarily, they do not meet the definition of an independent bryophyte community (Siebel and Van Dort 1999). These vegetations therefore have to be considered as synusiae, or pioneer phases of the already mentioned *Eleocharito acicularis-Limoselletum*.

Two associations figure in the *Splachnetea* in Table 1. The coprophilous bryophytes in this class (all in the moss family *Splachnaceae*) occur widely on dung, carcasses, antlers and bird's pellets (Frey et al. 2006, Hallingbäck et al. 2008, Blockeel et al. 2014). In boreal, arctic and alpine habitat, these substrates decay slowly. In the Netherlands, the decomposition rate is generally too high to allow *Splachnaceae* to complete their life cycle (Cameron and Wyatt 1986, Bijlsma 2010). Suitable habitat, e.g. wet heathland, edges of fens and moorland and ombotrophic peat areas, have become extremely rare. Moreover, large herbivores which provide suitable dung are often absent. The two *Splachnetea* species known from the Netherlands most likely became extinct (*Splachnum ampullaceum*, last record in 2010; *Tetraplodon mnioides*, last record in 2002; BLWG 2023f). As *Splachnaceae* almost have disappeared from the surrounding countries, colonization from foreign populations is unlikely, but not impossible (Walsh 1951, Blockeel et al. 2014, Van Landuyt et al. 2020, BLWG 2023f, NBN 2023, PMD 2023).

New syntaxa

All 13 new syntaxa that are described in detail (with the addition 'nov. hoc loco') in Van Dort et al. (2017) are listed below, including a synoptic table (species cover according to an adjusted Braun-Blanquet cover-abundance scale; Van Dort et al. (2017)). Also the type relevé ('holotypus hoc loco' in Van Dort et al. (2017), Weber et al. (2000)) and a reference to the original publication are given.

Cinclidotetum fontinaloidis Von Hübschmann 1953 *cinclidotetosum danubici* Siebel 2017

Full name: *Cinclidotetum fontinaloidis* Gams 1927 ex Von Hübschmann 1953 *cinclidotetosum danubici* Siebel 2017 in Van Dort et al. 2017

First published on p. 43 in: Van Dort, K. W., Haveman, R., Schrijvers-Gonlag, M., Weeda, E. J. and Van Gennip, B. 2017. *Hymenelio lacustris-Fontinalietea antipyreticae*. Klasse van (spat)watergemeenschappen. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 23–50.

Type relevé subassociation: *Cinclidotetum fontinaloidis cinclidotetosum danubici* Siebel 2017, holotypus: relevé

nr 5 in the synoptic table below. Location: Winssen (the Netherlands), on a river groyne. Size: 1 m by 0.5 m (area 0.5 m^2). Recorded by H. N. Siebel on 5 August 1995.

Type relevé association: *Cinclidotetum fontinaloidis* Gams ex Von Hübschmann 1953, lectotypus: Von Hübschmann (1953), Table 4 (p. 22), relevé nr 6.

Synoptic table *Cinclidotetum fontinaloidis cinclidotetosum danubici* (Table 47-9 in Van Dort et al. 2017).

Relevé nr	1	2	3	4	5	6	7	8	9	10
Year	2012	1995	1995	1995	1995	1995	1995	1995	1995	1995
Cover bryophytes (%)	50	50	80	70	60	70	65	65	80	80
Recorder[1]	KvD	HS	HS	HS	HS	HS	HS	HS	HS	HS
Cinclidotetum fontinaloidis cinclidotetosum danubici										
Cinclidotus danubicus	2a	3	3	3	2b	2a	3	3	2b	2b
Cinclidotus riparius	2a	2a	2b	2a	2a	2b	+	2a	3	3
Cinclidotetum leskeetosum										
Cinclidotus fontinaloides							r	+	2a	
Hymenelio-Fontinalietea										
Leptodictyum riparium	+		3	3	3	3	3	2a	2a	2b
Fontinalis antipyretica var. *gracilis*					2a					

[1]HS = Henk Siebel, KvD = Klaas van Dort

Cinclidotetum fontinaloidis Von Hübschmann 1953 *leskeetosum polycarpae* Van Gennip 2017

Full name: *Cinclidotetum fontinaloidis* Gams 1927 ex Von Hübschmann 1953 *leskeetosum polycarpae* Van Gennip 2017 in Van Dort et al. 2017

First published on pp. 43–45 in: Van Dort, K. W., Haveman, R., Schrijvers-Gonlag, M., Weeda, E. J. and Van Gennip, B. 2017. *Hymenelio lacustris-Fontinalietea antipyreticae*. Klasse van (spat)watergemeenschappen. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 23–50.

Type relevé subassociation: *Cinclidotetum fontinaloidis leskeetosum polycarpae* Van Gennip 2017, holotypus: relevé nr 9 in the synoptic table below. Location: Havikerwaard, De Steeg (the Netherlands), on a river groyne. Size: 1 m by 3 m (area 3 m^2). Recorded by B. van Gennip on 28 February 2008.

Type relevé association: *Cinclidotetum fontinaloidis* Gams ex Von Hübschmann 1953, lectotypus: Von Hübschmann (1953), Table 4 (p. 22), relevé nr 6.

Synoptic table *Cinclidotetum fontinaloidis leskeetosum polycarpae* (Table 47-10 in Van Dort et al. 2017).

Relevé nr	1	2	3	4	5	6	7	8	9	10
Year	1996	1996	2004	2002	2014	2014	2006	2015	2008	2006
Cover bryophytes (%)	50	30	35	10	60	60	6	55	70	6
Cover lichens (%)						1		1		
Recorder[1]	KvD	KvD	KvD	KvD	K&B	KvD	BvG	KvD	BvG	BvG
Cinclidotetum fontinaloidis leskeetosum polycarpae										
Cinclidotus fontinaloides	1				2b	3		r		
Didymodon nicholsonii			1		+	+			2b	
Schistidium platyphyllum		1			+			r		
Cinclidotetum fontinaloidis										
Cinclidotus riparius		2b		1		+	2a	2b	4	2a
Cinclidotus danubicus	2a									
Cinclidotion fontinaloidis										
Fissidens crassipes								2a		
Rhynchostegion riparioidis										

Amblystegium tenax								2a		
Hymenelio-Fontinalietea										
Amblystegium fluviatile			+	+	1		+			+
Leptodictyum riparium	+		+				+	+		+
Fontinalis antipyretica							+			+
Verrucaria praetermissa						+				
Neckeretea complanatae										
Didymodon sinuosus			+			1		+	2a	
Leskea polycarpa	2b	2a	+	2a	3		+	2b	2a	+
Syntrichia latifolia			2a							
Bryophytes – other										
Amblystegium serpens			+							
Brachythecium rutabulum			1			2a		+	1	
Bryum barnesii			+							
Bryum capillare			2b			1				
Bryum gemmiferum									+	
Didymodon luridus			1							
Orthotrichum cupulatum			+		+					
Tortula muralis			+							
Lichens – other										
Blennothallia crispa								+		
Vascular plants										
Poa trivialis						+				

[1]BvG = Bas van Gennip, KvD = Klaas van Dort, K&B = Klaas van Dort and Bas van Gennip

Lecanoretum zosterae **Van Dort 2017**

Full name: *Lecanoretum zosterae* Van Dort 2017 in Van Dort et al. 2017

First published on pp. 64–66 in: Van Dort, K. W., Van Gennip, B. and Aptroot, A. 2017. *Hydropunctarietea maurae*. Zeestippelkorst-klasse. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 51–66.

Type relevé: *Lecanoretum zosterae* Van Dort 2017, holotypus: relevé nr 0 in the synoptic table below. Location: Wissenkerke (the Netherlands), on an old wooden sea barrier pole. Size: 1.5 m by 0.3 m (area 0.45 m^2). Recorded by K. W. van Dort on 13 August 2014.

Synoptic table *Lecanoretum zosterae* (Table 48-8 in Van Dort et al. 2017).

Relevé nr	0	1	2	3	4	5	6	7	8	9	10
Year	2014	2013	2013	2015	2013	2013	2000	2013	2013	2013	2013
Cover lichens (%)	45	60	55	25	45	50	5	15	10	5	10
Substrate[1]	W	W	W	W	W	W	B	B	B	B	S
Recorder[2]	K&A	K&A	K&A	K&A	K&A	K&A	K&A	K&A	K&A	K&A	K&A
Lecanoretum zosterae											
Lecanora zosterae	3	3	2b	2a	3	2a	1	2a	1	1	2a
Hydropunctarietea maurae											
Flavoplaca maritima	+	+	r						r		
Arthonia phaeobaea				r							
Lichens – other											
Amandinea punctata	2a			+	+						

Bacidina brandii							+				
Bacidina saxenii							1	+	1	1	
Candelariella vitellina				1							
Diplotomma alboatrum		+			1						
Diplotomma hedinii			+								
Flavoplaca citrina		+	2m						1		
Lecania rabenhorstii							+		+	+	
Lecanora albescens		+									
Lecanora carpinea			+		r						
Lecanora expallens	+										
Lecanora hagenii	1			2m		1	1		+		
Lecidella elaeochroma			+								
Phaeophyscia orbicularis			+			+					
Physcia tenella			+			r			r		
Polycauliona polycarpa		r									
Rinodina oleae		+	1	2m							
Verrucaria muralis									r		
Verrucaria nigrescens								+	1	1	
Xanthoria parietina		2a	3	2a	+	3		+	+	+	+

[1]B = bird bone, S = stem from *Artemisia maritima*, W = wooden pole
[2]K&A = Klaas van Dort and André Aptroot

Lecanorion pannonicae Van Gennip 2017

Full name: *Lecanorion pannonicae* Van Gennip 2017 in Van Dort et al. 2017

First published on p. 87 in: Van Dort, K. W., Aptroot, A. and Van Gennip, B. 2017. *Verrucario nigrescentis-Schistidietea crassipili*. Klasse van Stippelkorsten en Achterlichtmossen. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 67–92.

Type relevé: *Lecanoretum pannonicae* Van Gennip 2017, holotypus: relevé nr 0 in the synoptic table of the *L. pannonicae* further down. Location: Drempt (the Netherlands), on a tuff church wall. Size: 1 m by 1 m (area 1 m^2). Recorded by B. van Gennip on 1 February 2007.

Lecanoretum pannonicae Van Gennip 2017

Full name: *Lecanoretum pannonicae* Van Gennip 2017 in Van Dort et al. 2017

First published on pp. 87–90 in: Van Dort, K. W., Aptroot, A. and Van Gennip, B. 2017. *Verrucario nigrescentis-Schistidietea crassipili*. Klasse van Stippelkorsten en Achterlichtmossen. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 67–92.

Type relevé: *Lecanoretum pannonicae* Van Gennip 2017, holotypus: relevé nr 0 in the synoptic table below. Location: Drempt (the Netherlands), on a tuff church wall. Size: 1 m by 1 m (area 1 m^2). Recorded by B. van Gennip on 1 February 2007.

Synoptic table *Lecanoretum pannonicae* (Table 49-9 in Van Dort et al. 2017).

Relevé nr	0	1	2	3	4	5	6	7	8	9	10
Year	2007	2006	2006	2006	2007	2013	2017	2015	2006	2006	2015
Cover lichens (%)	45	40	25	50	30	85	55	35	70	40	50
Cover bryophytes (%)							2				
Cover vascular plants (%)							3				
Substrate[1]	T	T	T	B	T	M	B	B	C	B	B
Recorder[2]	BvG	BvG	BvG	BvG	BvG	KvD	KvD	AA	AA	AA	AA
Lecanoretum pannonicae											
Lecanora pannonica	3	2a	2b	3	2b	4	2b	+	+	2a	r
Flavoplaca ruderum	2a		2a	2a				r	+	+	

Lecanora antiqua	+	2m							3	2m	
Verrucario-Schistidietea											
Flavoplaca citrina	2b	+	+	+			1		3	+	
Calogaya pusilla		+				+		+		+	+
Lecanora albescens	+		r	+						+	
Rinodina oleae				+				2m			2a
Verrucaria nigrescens		+					2a			+	
Athallia holocarpa			r					+			1
Xanthoria calcicola			+				+				+
Lecanora dispersa								1			1
Lecania rabenhorstii				+					+		
Variospora flavescens			+		+						
Lecanora campestris							2a				
Flavoplaca dichroa		1									
Racomitrio-Rhizocarpetea											
Acarospora smaragdula											2a
Candelariella vitellina									2m		+
Lecanora sulphurea			+				2a	1		+	
Lecidella scabra	1			+	+						2a
Tephromela atra								2a			
Trapelia placodioides	+	+	+							+	2a
Chrysotrichetea chlorinae											
Bryostigma muscigena				r							
Dirina massiliensis		2b								+	
Gyrographa gyrocarpa		+								+	2m
Lepraria vouauxii			1								
Psilolechia lucida		1		+	2a					1	
Lichens – other											
Diploicia canescens		+	r		+		+			+	
Diploschistes muscorum							+				
Diplotomma alboatrum							2b	r			
Flavoplaca arcis							+				
Flavoplaca flavocitrina							+				
Haematomma ochroleucum										2b	
Hypocenomyce scalaris				1							
Lecanora hagenii							1				
Lecanora muralis				+							
Lepraria incana										+	
Phaeophyscia nigricans				+							
Phaeophyscia orbicularis											+
Physcia adscendens				r							+
Physcia caesia											+
Physcia tenella				r							+
Polysporina simplex				+							
Toninia aromatica							1	r			

Verrucaria muralis		+									
Bryophytes – other											
Tortula muralis							+				
Vascular plants											
Asplenium ruta-muraria							r				

[1]substrate (all stone): B = brick, C = chalk, M = marl, T = tuff
[2]BvG = Bas van Gennip, KvD = Klaas van Dort, AA = André Aptroot

***Porpidietum soredizodis* Van Gennip 2017**

Full name: *Porpidietum soredizodis* Van Gennip 2017 in Van Dort et al. 2017

First published on pp. 112–114 in: Van Dort, K. W., Aptroot, A. and Van Gennip, B. 2017. *Racomitrio heterostichi-Rhizocarpetea geographici*. Klasse van Bisschopsmutsen en Landkaartmossen. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 93–116.

Type relevé: *Porpidietum soredizodis* Van Gennip 2017, holotypus: relevé nr 0 in the synoptic table below. Location: Scheveningen (the Netherlands), on a brick wall. Size: 2 m by 0.35 m (area 0.7 m^2). Recorded by B. van Gennip on 8 July 2016.

Synoptic table *Porpidietum soredizodis* (Table 50-8 in Van Dort et al. 2017).

Relevé nr	0	1	2	3	4	5	6	7	8	9	10
Year	2016	2014	2013	2017	2013	2014	2015	2012	2012	2013	2015
Cover lichens (%)	50	95	60	60	55	45	65	40	75	55	90
Cover bryophytes (%)	2										
Substrate[1]	B	D	D	D	D	D	R	B	B	B	T
Recorder[2]	BvG	K&A	K&H	KvD	K&H	K&A	K&A	K&A	K&A	K&L	K&A
Porpidietum soredizodis											
Porpidia soredizodes	2b	4	2b	2a	1	1	2a	+	2a	+	3
Lecidella scabra	1	2m			1	+	+	+	3	2a	
Trapelia placodioides	+	1		+		2a		2b		2a	
Stereocaulon vesuvianum				3							
Xanthoparmelion conspersae											
Buellia aethalea		+	r		3						2a
Rhizocarpon reductum		+				2a	2a				r
Lecanora intricata		r	1		1						
Tephromela atra							2a				
Aspicilia cinerea						+					
Lecidea fuscoatra					r						
Racomitrio-Rhizocarpetea											
Candelariella vitellina	+	1	1	+	1	1	2a		2b		
Catillaria chalybeia	+						r	2m	+		2m
Scoliciosporum umbrinum	+	+							+		2m
Lecanora polytropa					+					1	+
Porpidia tuberculosa			3		1						
Buellia ocellata					+		+				
Acarospora fuscata											3
Catillaria lenticularis				1							
Melanelixia fuliginosa							+				
Myriospora smaragdula		+									

Porina chlorotica					+					
Verrucario-Schistidietea										
Flavoplaca flavocitrina								+		
Grimmia pulvinata				2a						
Lecania rabenhorstii								+		
Lecanora albescens	+									
Lecanora muralis	+									
Lecanora semipallida	1									
Lecidella stigmatea									+	
Tortula muralis	+									
Verrucaria nigrescens			1		2a		2a	+		2a
Verrucaria polysticta						+				
Lichens – other										
Bacidina caligans				+				+	+	
Physcia tenella							2a			
Rinodina oleae							+			
Xanthoria calcicola				+						
Xanthoria parietina							+			

[1]substrate: B = brick wall, D = dike stone, R = roof tile, T = tombstone
[2]BvG = Bas van Gennip, KvD = Klaas van Dort, K&A = Klaas van Dort and André Aptroot, K&H = Klaas van Dort and Hans Toetenel, K&L = Klaas van Dort and Leo Spier

Protoparmelietum oleaginae Van Dort and Van Herk 2017

Full name: *Protoparmelietum oleaginae* Van Dort and Van Herk 2017

First published on pp. 148–151 in: Van Dort, K. W. and Van Herk, C. M. 2017. *H. physodis*. Schorsmos-klasse. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 127–160.

Type relevé: *Protoparmelietum oleaginae* Van Dort and Van Herk 2017, holotypus: relevé nr 2 in the synoptic table below. Location: Wezup (the Netherlands), on a roadside *Quercus robur* trunk. Size: 1.5 m by 0.4 m (area 0.6 m^2). Recorded by K. W. van Dort and C. M. van Herk on 16 May 2013.

Synoptic table *Protoparmelietum oleaginae* (Table 52-7 in Van Dort et al. 2017).

Relevé nr	1	2	3	4	5	6	7	8	9	10
Year	2015	2013	2015	2015	2015	2016	2016	2015	2016	2016
Cover lichens (%)	75	50	50	40	55	40	45	40	70	80
Cover bryophytes (%)						1		1		
Substrate[1]	Qr	Qr	Qr	Qr	Qr	Qr	Qr	Qr	Qr	Ti
Recorder[2]	KKB	K&K	K&K	K&K	K&K	K&L	K&L	K&K	KvD	KvD
Protoparmelietum oleaginae										
Protoparmelia oleagina	4	3	2b	2a	2a					
Protoparmelia hypotremella						3	2b	3	3	2b
Sphinctrina anglica		2m		1	1					
Lecanora pulicaris	+	1		+						
Lecanora sinuosa			1	+						
Hypogymnion physodis										
Hypotrachyna revoluta	+						2b			
Melanohalea elegantula					2a	+				

Parmelia saxatilis	r	+								
Usnea hirta	r				r					
Pertusaria amara									2b	
Ochrolechia androgyna	1									
Pseudevernia furfuracea					+					
Hypogymnietea physodis										
Buellia griseovirens	1	2a	2a		1	1	+		2a	3
Evernia prunastri	1		+	2b	2a		1	+		
Hypogymnia physodes	r									
Melanelixia subaurifera	+		+				+			
Parmelia sulcata	+	1			2a					+
Arthonio-Lecidelletea										
Coenogonium pineti						+				
Lecanora chlarotera			+							2a
Lecanora compallens	+	1	+	+				+		+
Lecanora expallens		+	2a	2m			1	+		
Lecidella elaeochroma	r	r	+							+
Melanelixia glabratula										+
Phlyctis argena										+
Pseudoschismatomma rufescens										+
Cladonio-Lepidozietea										
Trapeliopsis granulosa	r									
Orthotricho-Physcietea										
Amandinea punctata	2a	1	1		1					
Candelaria concolor						r		+		+
Candelariella reflexa	+	+	+		+			1		+
Candelariella vitellina	+									
Haematomma ochroleucum		+								
Lecanora hagenii			+							
Melanohalea exasperatula	+		r		r					
Physcia tenella	1		+	1	1		+	+		+
Polycauliona candelaria	r				+					
Polycauliona polycarpa	+	+		r						
Punctelia jeckeri										r
Punctelia subrudecta	+									
Pyrrhospora quernea									2a	
Ramalina farinacea		r			2a				r	
Ramalina fastigiata					r					
Xanthoria parietina	+	r	+	+	1	r		+		
Lichens – other										
Lepraria incana			2m	2m		1	1	+		
Physcia caesia	r									
Bryophytes – other										
Hypnum cupressiforme						+		+		

[1]substrate (trunk of a tree): Qr = *Quercus robur*, Ti = *Tilia* sp.
[2]KKB = Kok van Herk, Klaas van Dort and Bas van Gennip, KvD = Klaas van Dort, K&K = Klaas van Dort and Kok van Herk, K&L = Klaas van Dort and Leo Spier

Ramalinion farinaceae Van Dort and Van Herk 2017

Full name: *Ramalinion farinaceae* Van Dort and Van Herk 2017 in Van Dort et al. 2017

First published on p. 181 in: Van Dort, K. W., Schrijvers-Gonlag, M. and Van Herk, C. M. 2017. *Orthotricho-Physcietea*. Klasse van Haarmutsen en Vingermossen. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 161–200.

Type relevé: *Ramalinetum fastigiatae* Duvigneaud 1942, holotypus: relevé nr 10 in the synoptic table below. Location: Gasteren (the Netherlands), on a roadside *Quercus robur* trunk. Size: 2 m by 0.5 m (area 1 m^2). Recorded by K. W. van Dort on 25 November 2016.

Synoptic table *Ramalinetum fastigiatae* (Table 53-7 in Van Dort et al. 2017).

Relevé nr	1	2	3	4	5	6	7	8	9	10
Year	2013	2015	2016	2006	2012	2012	2012	2012	2016	2016
Cover lichens (%)	25	15	40	50	15	40	50	55	25	55
Cover bryophytes (%)				22	4				3	
Substrate[1]	Qr	Qr	Ul	Sa	Qr	Qr	Qr	Qr	Sa	Qr
Recorder[2]	KvD	KvD	KvD	KvD	KvD	LS	LS	LS	NKA	KvD
Ramalinetum fastigiatae										
Ramalina fastigiata	+	+			+	2a		1		2a
Ramalina fraxinea		+								
Ramalinion farinaceae										
Ramalina farinacea	2a	1	3	3	2a	2b	3	3	2b	3
Diploicia canescens	1						+			
Pleurosticta acetabulum	r		+							
Polycauliona candelaria	+									
Xanthorion parietinae										
Punctelia jeckeri							2a			
Orthotricho-Physcietea										
Xanthoria parietina	+		r			r	+			+
Physcia tenella	2m					2a				1
Candelariella reflexa				1	+	1				
Amandinea punctata							+			
Lecanora hagenii	+									
Orthotrichum affine				+						
Polycauliona polycarpa	+									
Ulota bruchii				r						
Arthonio-Lecidelletea										
Candelariella xanthostigma	+									
Lecanora chlarotera		1				+				2a
Lecanora compallens		1				+	+			
Lecanora expallens			+	1	+					+
Lecidella elaeochroma		r			+					+
Melanelixia glabratula					1					+
Porina aenea					2m					
Hypogymnietea physodis										
Buellia griseovirens					+			2b		
Evernia prunastri										+
Melanelixia subaurifera								1	r	

Melanohalea elegantula										+
Parmelia sulcata	r			2a	+	r		+	+	
Bryophytes – other										
Hypnum cupressiforme				2b	1				+	
Lichens – other										
Cladonia fimbriata					+					
Dendrographa decolorans						+				
Lecanora dispersa	+									
Lepraria finkii				1					1	
Lepraria incana					+				1	+

[1]substrate (trunk of a tree): Qr = *Quercus robur*, Sa = *Salix* sp., Ul = *Ulmus* sp.
[2]KvD = Klaas van Dort, LS = Leo Spier, NKA = Nico de Bruin, Klaas van Dort and Arno van der Pluijm

Pertusarietum coccodis Van Dort and Van Herk 2017

Full name: *Pertusarietum coccodis* Van Dort and Van Herk 2017 in Van Dort et al. 2017

First published on pp. 181–184 in: Van Dort, K. W., Schrijvers-Gonlag, M. and Van Herk, C. M. 2017. *Orthotricho-Physcietea*. Klasse van Haarmutsen en Vingermossen. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 161–200.

Type relevé: *Pertusarietum coccodis* Van Dort and Van Herk 2017, holotypus: relevé nr 10 in the synoptic table below. Location: Havelte (the Netherlands), on a roadside *Quercus robur* trunk. Size: 1.5 m by 0.3 m (area 0.45 m^2). Recorded by C. M. van Herk, K. W. van Dort and B. van Gennip on 23 March 2015.

Synoptic table *Pertusarietum coccodis* (Table 53-5 in Van Dort et al. 2017).

Relevé nr	1	2	3	4	5	6	7	8	9	10
Year	2015	2015	2013	2013	2015	2015	2013	2013	2016	2015
Cover lichens (%)	50	85	85	55	35	70	55	25	20	65
Cover bryophytes (%)			1	1			30	10	1	
Substrate[1]	Qr	Qr	Qr	Qr	Qr	Qr	Qr	Qr	Qr	Qr
Recorder[2]	KBA	KBA	KvD	KvD	KvD	KvD	KvD	KvD	KvD	KKB
Pertusarietum coccodis										
Pertusaria coccodes	3	+	2b	1	2a	+	2a	2a	+	+
Pertusaria albescens										r
Ramalinion farinaceae										
Haematomma ochroleucum	r	5	2a	3	+	4	1	1		3
Ramalina fastigiata			+	r	r	r	+	+	r	1
Ramalina farinacea			2a	+	1	r			2a	2a
Polycauliona candelaria			3	1			2a	1		
Pleurosticta acetabulum			2a	2a			2a			+
Pyrrhospora quernea				+	+	2a				2a
Xanthorion parietinae										
Candelaria concolor			+						+	
Orthotricho-Physcietea										
Physcia tenella			+	1			2a	2m	+	
Xanthoria parietina	+	+						r	+	1
Polycauliona polycarpa			+	+			1		+	
Amandinea punctata			+						+	1

Orthotrichum affine			r	r							
Orthotrichum diaphanum										+	
Arthonio-Lecidelletea											
Arthonia atra							r				
Lecanora chlarotera	1	+	1	1	2b		+	1		+	r
Lecanora expallens		1			1					+	1
Lecidella elaeochroma	2a				+						+
Pseudoschismatomma rufescens											+
Hypogymnietea physodis											
Evernia prunastri										2a	
Lecanora sinuosa											r
Melanelixia subaurifera										+	
Melanohalea elegantula											r
Ochrolechia androgyna										2b	
Parmelia sulcata										+	
Pseudevernia furfuracea			+								
Bryophytes – other											
Hypnum cupressiforme							3	2a		+	
Lichens – other											
Dendrographa decolorans						+					
Lepraria incana		1					1				

[1]substrate (trunk of a tree): Qr = *Quercus robur*

[2]KBA = Klaas van Dort, Bas van Gennip and Ali Klinkhamer, KKB = Kok van Herk, Klaas van Dort and Bas van Gennip, KvD = Klaas van Dort

Fissidentetum gymnandri **Van Dort and Weeda 2017**

Full name: *Fissidentetum gymnandri* Van Dort and Weeda 2017

First published on pp. 262–263 in: Van Dort, K. W. and Weeda, E. J. 2017. *Neckeretea complanatae*. Kringmos-klasse. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 251–272.

Type relevé: *Fissidentetum gymnandri* Van Dort and Weeda 2017, holotypus: relevé nr 0 in the synoptic table below. Location: Sliedrechtse Biesbosch (the Netherlands), on a silted *Salix alba* trunk. Size: 1 m by 0.5 m (area 0. 5 m^2). Recorded by K. W. van Dort on 4 February 2004.

Synoptic table *Fissidentetum gymnandri* (Table 56-4 in Van Dort et al. 2017).

Relevé nr	0	1	2	3	4	5	6	7	8	9	10
Year	2004	2007	2007	2008	1995	1995	2000	1996	2005	2017	2008
Cover bryophytes (%)	15	50	70	60	85	50	60	90	30	75	45
Substrate[1]	Sa	ftb	dw	Sa	Sa	Sa	Sa	Sc	Sa	Sa	Sa
Recorder[2]	KvD	D&E	D&E	R&E	K&A	KvD	K&N	EW	KvD	KvD	KvD
Fissidentetum gymnandri											
Fissidens gymnandrus	2m	1	1	1	2a	2b	1	1	2m	2b	2m
Leskeion polycarpae											
Leskea polycarpa		+				+	1	3	1	3	+
Dialytrichia mucronata	1										
Didymodon sinuosus			+								
Neckerion complanatae											
Homalia trichomanoides							3	4			

Hymenelio-Fontinalietea											
Amblystegium tenax			2b								
Chiloscyphus polyanthos									1		
Leptodictyum riparium	+	1			2b					+	
Oxyrrhynchium speciosum					2b						
Bryophytes – other											
Amblystegium serpens	+		+	+		1	+		3		2b
Barbula unguiculata	1										
Brachythecium mildeanum	+										
Brachythecium rutabulum	+	3	+			1	+	+	1	1	2a
Bryum capillare s.l.	+			r	+	1					1
Cratoneuron filicinum		+									
Didymodon rigidulus		r									
Fissidens taxifolius	+		2a	3	2m		+				
Kindbergia praelonga	+					2a	+	+	+		
Lophocolea bidentata		+	3	r		2a	1				
Lunularia cruciata		2a		1							
Marchantia polymorpha				2a							
Oxyrrhynchium hians		+	2a	+		+			+		
Physcomitrium pyriforme					2m						
Rhizomnium punctatum						+			+		
Riccia fluitans			2b								

[1]substrate: dw = dead wood (*Salix alba*), ftb = floating timber beam, Sa = *Salix alba* trunk/branch, Sc = *Salix cinerea* trunk
[2]D&E = Dick Kerkhof and Eddy Weeda, EW = Eddy Weeda, KvD = Klaas van Dort, K&A = Klaas van Dort and Arno van der Pluijm, K&N = Klaas van Dort and Nico de Bruin, R&E = Rienk-Jan Bijlsma and Eddy Weeda

Sciurohypno populei-Anomodontetum viticulosi **Van Dort and Weeda 2017**

Full name: *Sciurohypno populei-Anomodontetum viticulosi* Van Dort and Weeda 2017

First published on pp. 266–270 in: Van Dort, K. W. and Weeda, E. J. 2017. *Neckeretea complanatae*. Kringmos-klasse. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 251–272.

Type relevé: *Sciurohypno populei-Anomodontetum viticulosi* Van Dort and Weeda 2017, holotypus: relevé nr 0 in the synoptic table below. Location: estate Hindersteyn (the Netherlands), on a coppiced *Fraxinus excelsior* stump (stool). Size: 2 m by 1 m (area 2 m^2). Recorded by K. W. van Dort on 15 November 2015.

Synoptic table *Sciurohypno populei-Anomodontetum viticulosi* (Table 56-6 in Van Dort et al. 2017).

Relevé nr	0	1	2	3	4	5	6	7	8	9	10
Year	2015	2015	2015	2017	2015	2009	2015	2010	2010	2017	2017
Cover bryophytes (%)	95	95	70	75	80	60	40	64	60	85	90
Cover lichens (%)	2	3	2		1		2	1	10	2	
Substrate[1]	Fe	Fe	Fe	Sa	Fe	Fe	Fe	Fe	Fe	Sa	Sa
Recorder[2]	KvD	KvD	KvD	KvD	KvD	KvD	HW	KvD	KvD	KvD	JN
Sciurohypno -Anomodontetum											
Anomodon viticulosus	2b	2b	2a	+	+	2b	2a	2a		2b	2a
Isothecium alopecuroides	2a	1	2a	+		1	1				
Thamnobryum alopecurum					2a	1	2b	2b	2a		+

Plagiothecium nemorale		+	+	+		r			+			
Brachythecium populeum	+	+					1	1				
Brachythecium salebrosum	2a		+					1	+			
Brachythecium reflexum	+							+				
Brachythecium velutinum		+		+								
Porella platyphylla	+				+							
Plagiomnium cuspidatum						r	+					
Anomodon attenuatus												2a
Peltigera praetextata									2a			
Neckerion complanatae												
Homalia trichomanoides	2b	2b	1	2a	2b	2b	2a	2a	2a			2b
Neckera complanata	+		+	2a	2a							
Leskeion polycarpae												
Leskea polycarpa										2b		2a
Fissidens gymnandrus												+
Syntrichia latifolia										+		
Neckeretea complanatae												
Homalothecium sericeum			2a				1	2a				
Arthonio-Lecidelletea												
Anisomeridium polypori								2m				
Orthotricho-Physcietea												
Candelaria concolor										1		
Metzgeria furcata				1	2a		2m					
Phaeophyscia orbicularis										+		
Physcia tenella										+		
Radula complanata			1							1		
Rhynchostegium confertum	+											
Xanthoria parietina										r		
Bryophytes – other												
Amblystegium serpens	+		+	+			2m	+		2a		
Brachythecium rutabulum	2b	2b	2a	3	+	1	2a	2b	2a	2a		
Bryum capillare s.l.		+				2m		+		+		
Dicranum scoparium		+										
Eurhynchium striatum						1						
Hypnum cupressiforme	2b	2a		3	2b		1	2b	2b			
Kindbergia praelonga	+	2b	+	+	+	1		1	2a			2b
Lophocolea bidentata									+			
Mnium hornum		+	+		2a	2m	1					
Polytrichum formosum			r									
Thuidium tamariscinum									+			
Lichens – other												
Lepraria finkii		2m	1		+		1	1				1
Lepraria incana								1				

[1]substrate: Fe = *Fraxinus excelsior* stool, Sa = *Salix alba* trunk

[2]HW = Hans Wondergem, JN = Jurgen Nieuwkoop, KvD = Klaas van Dort

Cladonietum digitatae Van Dort 2017

Full name: *Cladonietum digitatae* Van Dort 2017 in Van Dort et al. 2017

First published on pp. 296–298 in: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. 2017. *Cladonio digitatae-Lepidozietea reptantis*. Klasse van Vertakt bekermos en Neptunusmos. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 273–312.

Type relevé: *Cladonietum digitatae* Van Dort 2017, holotypus: relevé nr 4 in the synoptic table below. Location: Wolfheze-Laag (the Netherlands), on a collapsed very old *Quercus robur* trunk. Size: 2 m by 0.35 m (area 0.7 m^2). Recorded by K. W. van Dort on 2 January 2012.

Synoptic table *Cladonietum digitatae* (Table 57-6 in Van Dort et al. 2017).

Relevé nr	1	2	3	4	5	6	7	8	9	10
Year	2014	2005	2013	2012	2003	2013	2013	2007	2007	2013
Cover lichens (%)	45	35	30	55	30	45	45	45	45	50
Cover bryophytes (%)	25	15	10	5	5	50	45	4	20	35
Cover vascular plants (%)								4	4	3
Substrate[1]	Qp	Bp	Qrl	Qrl	Qrl	Qrs	Qrs	Ps	Ps	Qrt
Recorder[2]	KvD	KvD	KvD	KvD	KvD	KvD	KvD	KvD	KvD	KvD
Cladonietum digitatae										
Cladonia digitata	2a	2a	2b	2a	1		1		2b	3
Cladonia polydactyla	3			+	2b	1	3	2m		+
Cladonia incrassata								3	2b	1
Lichenomphalia umbellifera				+						1
Cladonia parasitica						3				
Lichenomphalia hudsoniana										1
Cladonion coniocraeae										
Trapeliopsis granulosa				2a						
Tetraphidion										
Lepidozia reptans	2m									1
Tetraphis pellucida	1		+							
Leucobryum glaucum										2b
Cephalozia connivens										2a
Cladonio-Lepidozietea										
Cladonia coniocraea	2m	2b		2a		+	2a		+	
Dicranum montanum	2b		1	+		2b	3			
Orthodontium lineare		2a			2m	1			2a	
Campylopus flexuosus				1	+			1		2m
Dicranum scoparium	2m			r					1	
Dicranoweisia cirrata		+	+				r			
Lophocolea heterophylla						+	r			
Cladonia chlorophaea			2a							
Hypogymnietea physodis										
Hypogymnia physodes		+								
Lichens – other										
Cladonia caespiticia							1			
Cladonia fimbriata									+	
Cladonia floerkeana				1						1
Cladonia macilenta				+						1

Cladonia ramulosa				2a						1
Lepraria finkii		2a								
Trapeliopsis pseudogranulosa					2m					1
Bryophytes – other										
Brachythecium rutabulum						r				
Campylopus introflexus		+								
Cephalozia bicuspidata										+
Cephaloziella divaricata									1	
Hypnum cupressiforme	1	+			r	3				
Hypnum jutlandicum			1							
Vascular plants										
Deschampsia flexuosa								+		
Dryopteris carthusiana									+	
Molinia caerulea										r
Vaccinium myrtillus								1		+

[1]substrate: Bp = base *Betula pendula*, Ps = lying dead *Pinus sylvestris*, Qrl = lying dead *Quercus robur*, Qrs = stump *Quercus robur*, Qrt = standing dead *Quercus robur*
[2]KvD = Klaas van Dort

***Trapeliopsidetum flexuosae* Van Dort 2017**

Full name: *Trapeliopsidetum flexuosae* Van Dort 2017 in Van Dort et al. 2017

First published on pp. 303–304 in: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. 2017. *Cladonio digitatae-Lepidozietea reptantis*. Klasse van Vertakt bekermos en Neptunusmos. – In: Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds), De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. KNNV Uitgeverij, pp. 273–312.

Type relevé: *Trapeliopsidetum flexuosae* Van Dort 2017, holotypus: relevé nr 5 in the synoptic table below. Location: Planken Wambuis, Ede (the Netherlands), on a collapsed *Pinus sylvestris* trunk (log). Size: 8 m by 0.3 m (area 2.4 m^2). Recorded by K. W. van Dort on 5 March 2013.

Synoptic table *Trapeliopsidetum flexuosae* (Table 57-9 in Van Dort et al. 2017).

Relevé nr	1	2	3	4	5	6	7	8	9	10
Year	2013	2013	2017	2008	2013	2005	2007	2016	2012	2008
Cover lichens (%)	85	70	50	70	70	55	55	65	40	10
Cover bryophytes (%)	5		2	4	2		25	4		10
Substrate[1]	Pss	wf	Psl	Pss	Psl	Pss	Pss	Pss	Psl	Pss
Recorder[2]	KvD	KvD	KvD	KvD	KvD	KvD	KvD	KvD	KvD	KvD
Trapeliopsidetum flexuosae										
Trapeliopsis flexuosa	5	3	3	+	2b	2m	+	2a	2a	2m
Cladonion coniocraeae										
Trapeliopsis granulosa				2a	+		2b	+	1	2m
Cladonia digitata										2a
Hypocenomyce scalaris							1			
Cladonio-Lepidozietea										
Cladonia coniocraea	+		1	+	2a					
Cladonia chlorophaea	+			1	2m					
Campylopus flexuosus							+			2a
Dicranoweisia cirrata								r		
Hypogymnietea physodis										
Evernia prunastri								+		

Hypogymnia physodes						+		+		
Hypogymnia tubulosa								r		
Melanelixia subaurifera									+	
Parmelia sulcata									+	
Parmotrema perlatum									r	
Ceratodonto-Polytrichetea										
Campylopus introflexus							2b	+		+
Campylopus pyriformis	1			1						
Cephaloziella rubella							2m			
Cladonia floerkeana					1			2b		
Cladonia glauca										1
Cladonia grayi						+	2m	1		
Cladonia macilenta			+		2a	2m		+		
Cladonia subulata					+					
Placynthiella icmalea	2a	3	2a	4	2b	3	2a	3	2b	
Placynthiella oligotropha						1				
Bryophytes – other										
Hypnum cupressiforme			+		+					
Hypnum jutlandicum	r									
Lichens – other										
Candelariella reflexa									+	
Cladonia fimbriata						+				
Micarea micrococca			+							
Micarea viridileprosa										+
Physcia tenella									+	

[1]substrate: Psl = lying dead *Pinus sylvestris*, Pss = stump *Pinus sylvestris*, wf = wooden fence
[2]KvD = Klaas van Dort

Table 2. Weighing of species to calculate mean habitat indicator values on association level. For each association, all species present in the association (and corresponding subassociations) in the synoptic table of the actual class (Van Dort et al. 2017) are considered. The weight per species is given, used to calculate, per association, a mean habitat indicator value (moisture, light availabilty, nutrient richness, acidity; Siebel 1993, 2005, Sparrius et al. 2015a, b). Species not identified on species level (e.g. *Collema* sp.) are excluded. If several subspecies or variants of one species are present, indicator values are averaged and used only once in the calculations. Additionally, character and differential species not present in the synoptic table, but present in the association table or mentioned as such in the accompanying text (in Van Dort et al. 2017), are also included with similar weights as in the table below. 'Species presence' under 'Note' is the species presence (%) in the actual association in the corresponding synoptic table. *Aptroot et al. (2011), Siebel et al. (2013).

Species	Syntaxon level	Weight (%)	Note
Character species	Association	100	
	Subassociation	100	If more subassociations are present, the weight is divided by the number of subassociations
	Alliance, order	25	Only if species presence is at least 40% (common and fairly rare species*) or at least 20% (rare and very rare species*)
	Class	25	Only if species presence is at least 80% (common and fairly rare species*) or at least 40% (rare and very rare species*)
Differential species	Association	25	
	Alliance, order	10	Only if species presence is at least 40% (common and fairly rare species*) or at least 20% (rare and very rare species*)
	Class	10	Only if species presence is at least 80% (common and fairly rare species*) or at least 40% (rare and very rare species*)
Other species	–	10	Only if species presence is at least 50% and species presence is less than 50% in at least one association in the actual class

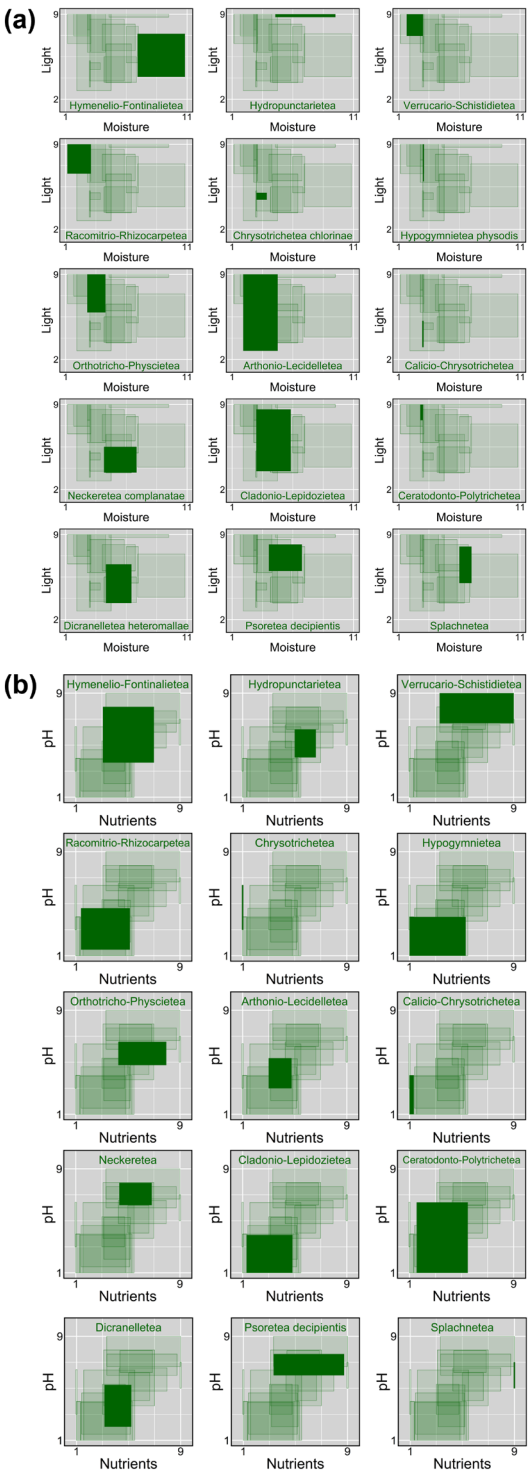

Figure 2. Relationships between classes for the habitat variables moisture, light availabilty, nutrient richness and acidity. For each class, the minimum and maximum ecological indicator values of their associations are indicated by a solid green box. Values for other classes are indicated by transparent green boxes. Moisture: 1 = very dry, 11 = in water; light availability ('Light'): 2 = shadow-deep shadow, 9 = very open; nutrient richness ('Nutrients'): 1 = very poor, 9 = excessively rich; acidity ('pH'): 1 = extremely acid, 9 = extremely basic. Class names truncated if necessary.

Ecological relationships between classes

In Van Dort et al. (2017) we analysed almost all associations on the abiotic habitat variables moisture, light availabilty, nutrient richness and acidity to compare habitat preferences of all associations within a class, using 'ecological indicator values' specifically designed for Dutch bryophyte and lichen species (Siebel 1993, 2005, Sparrius et al. 2015a, b). The class *Fellhaneretea bouteillei* with epiphyllic lichen species contains only three diagnostic species. One is a character species on class level *F. bouteillei* which also grows in completely different habitats than typical for this class. Also, its diagnostic value for one of the two associations is not fully clear (yet). Furthermore, this class contains two very rare character species on association level (*Fellhaneropsis vezdae* and *Fellhaneropsis rhododendri*; BLWG 2023g). Therefore we decided to exclude this class (two associations) from our analyses. For all other 80 associations in the remaining 15 classes, species indicator values were used to calculate an average value per association. In this calculation, species were weighted: character species were more important than differential species and diagnostic species on association level were more important than diagnostic species on other levels (Table 2). Here, we use this analysis to indicate, for these four habitat variables, the position of each class (except the *F. bouteillei*) relative to the other classes, using minimum and maximum values of all associations from each class (Fig. 2). Analyses performed in R ver. 4.2.2 (www.r-project.org). Figures in Fig. 2 made with R-package 'ggplot2' (www.r-project.org, Wickham 2016).

Acknowledgements – We thank Bas van Gennip, our co-editor and co-author (Van Dort et al. 2017), for his immense contribution to the classification. We thank Daniela Gigante for indispensable advice and Helga Bültmann and our co-authors (Van Dort et al. 2017) for invaluable discussions and contributions: André Aptroot, Rense Haveman, Kok (C. M.) van Herk, Iris de Ronde, Henk N. Siebel, Laurens B. Sparrius, Leo (J. L.) Spier, and particularly Eddy J. Weeda whose comments greatly improved the manuscript. We thank Heinjo During for some important final textual improvements. MSG thanks the Stack Exchange Q&A web communities Stack Overflow and Cross Validated for invaluable statistical and analytical insights, and Christina Skarpe, Harry P. Andreassen (deceased 21 May 2019) and especially Marieke Gonlag-Schrijvers for their patience and understanding.

Data availability statement

The dataset used in this study is stored in the DataverseNO database and available at https://doi.org/10.18710/L4IDNP (Schrijvers-Gonlag and Van Dort 2023).

References

Aptroot, A., Van Herk, C. M. and Sparrius, L. B. 2011. Basisrapport voor de Rode Lijst Korstmossen. – BLWG Rapport 12. Bryologische en Lichenologische Werkgroep, Oude-Tonge. – Buxbaumiella 92: 1–117.

Asman, W. A. H., Drukker, B. and Janssen, A. J. 1988. Modelled historical concentrations and depositions of ammonia and ammonium in Europe. – Atmos Environ. 22: 725–735.
Bardat, J. and Hauguel, J.-C. 2002. Synopsis bryosociologique pour la France. – Cryptogam Bryol. 23: 279–343.
Barkman, J. J. 1958. Phytosociology and ecology of cryptogamic epiphytes, including a taxonomic survey and description of their vegetation units in Europe. – Van Gorcum.
Barkman, J. J. 1969. De epifytenvegetatie van het Speulder en Sprielderbosch, de gezelschappen, hun milieu en successie. Vergelijking met andere bossen. – Med. Biol St. Wijster (Dr.) 146: 186–197.
Barkman, J. J. 1989. The *Dicranello cerviculatae-Campylopodetum pyriformis* in the Netherlands and NW Germany. – Lindbergia 15: 37–46.
Beijerinck, W. 1934. Sphagnum en Sphagnetum. – Meded. Ned. Biol. 6: 116.
Bijlsma, R. J. 2010. De vreugdevolle terugkeer van een strontmos. – De Levende Natuur 111: 222–223.
Bijlsma, R. J., Aptroot, A., Van Dort, K. W. et al. 2009. Preadvies mossen en korstmossen. – Directie Kennis, Ministerie LNV. Rapport DK nr. 2009/dk104-O.
Blockeel, T. L., Bosanquet, S. D. S., Hill, M. O. et al. 2014. Atlas of British & Irish bryophytes, vol. 2. – Br. Bryol. Soc. Pisces Publications.
BLWG 2017. Online bryophyte and lichen distribution data. – In: NDFF Verspreidingsatlas mossen en korstmossen. verspreidingsatlas.nl/mossen, verspreidingsatlas.nl/korstmossen.
BLWG 2023a. *Fabronia pusilla* distribution data. – In: NDFF Verspreidingsatlas mossen en korstmossen. verspreidingsatlas.nl/3734.
BLWG 2023b. *Bryoria fuscescens*, *Parmeliopsis ambigua*, *Platismatia glauca*, *Tuckermanopsis chlorophylla*, *Usnea filipendula*, *U. subfloridana, Vulpicida pinastri* distribution data. – In: NDFF Verspreidingsatlas mossen en korstmossen. verspreidingsatlas.nl/4075, verspreidingsatlas.nl/4450, verspreidingsatlas.nl/4507, verspreidingsatlas.nl/4132, verspreidingsatlas.nl/4626, verspreidingsatlas.nl/4632, verspreidingsatlas.nl/4135.
BLWG 2023c. *Lobaria pulmonaria*, *Lobarina scrobiculata* distribution data. – In: NDFF Verspreidingsatlas mossen en korstmossen. verspreidingsatlas.nl/4376, verspreidingsatlas.nl/4377.
BLWG 2023d. *Nowellia curvifolia*, *Riccardia latifrons*, *R. palmata* distribution data. – In: NDFF Verspreidingsatlas mossen en korstmossen. verspreidingsatlas.nl/3422, verspreidingsatlas.nl/3457, verspreidingsatlas.nl/3596.
BLWG 2023e. *Ctenidium molluscum* distribution data. – In: NDFF Verspreidingsatlas mossen en korstmossen. verspreidingsatlas.nl/2660.
BLWG 2023f. *Splachnum ampullaceum*, *Tetraplodon mnioides* distribution data. – In: NDFF Verspreidingsatlas mossen en korstmossen. verspreidingsatlas.nl/3031, verspreidingsatlas.nl/3037.
BLWG 2023g. *Fellhaneropsis vezdae*, *F. rhododendri* distribution data. – In: NDFF Verspreidingsatlas mossen en korstmossen. verspreidingsatlas.nl/4066, verspreidingsatlas.nl/7386.
Boele, C. and Van Zanten, B. O. 1984. De achteruitgang van de Nederlandse hunebeddenflora. – Lindbergia 10: 187–189.
Boerboom, J. H. A. 1960. De plantengemeenschappen van de Wassenaarse duinen. – Dissertatie. Meded. Landbouwhogeschool Wageningen 60: 1–135.
Bout, A. and Dirkx, G. H. P. 2012. Het gemaakte land. – In: Schaminée, J. H. J. and Janssen, J. A. M. (eds), Geboeid door het verleden. Beschouwingen over historische ecologie: . Vegetatiekundige Monografieën 4. KNNV Uitgeverij, pp. 117–137.
Bruin, C. J. W., Weeda, E. J. and Kruijsen, B. W. J. M. 1999. Twee door mossen gekenmerkte plantengemeenschappen van noordhellingen in de duinen. – Stratiotes 19: 83–102.
Cameron, R. G. and Wyatt, R. 1986. Substrate restriction in entomophilous *Splachnaceae*: role of spore dispersal. – Bryologist 89: 279–284.
Coesel, P. F. M. 1963. De associatie van *Didymodon recurvirostris* en *Tortella flavovirens*. Een nader onderzoek naar dit in 1960 door J. H. A. Boerboom als nieuwe associatie beschreven cryptogamengezelschap. – Rapport Hugo de Vries Lab. R.I.V.O.N. Bilthoven.
Colpa, J. G. and Van Zanten, B. O. 2006. Mossen op de Nederlandse hunebedden in 2004/2005. – Buxbaumiella 75: 34–50.
Dammers, E., Shephard, M., Griffin, D. et al. 2022. County-level ammonia emissions monitored worldwide. – ResearchSquare.
De Haan, B. J., Kros, J., Bobbink, R. et al. 2008. Ammoniak in Nederland. – PBL-publicatienummer 500125003. Planbureau voor de Leefomgeving.
De Ruiter, J. F., Van Pul, W. A. J., Van Jaarsveld, J. A. et al. 2006. Zuur- en stikstofdepositie in Nederland in de periode 1981–2002. MNP-rapport 500037005/2006. – Milieu- en Natuurplanbureau.
Delzenne-Van Haluwyn, C. 1976. Bibliographia phytosociologica syntaxonomica. Supplement I: Bibliographia societatum lichenorum. – Cramer.
Demaret, F. 1939. Quelques associations bryophytiques du Calcaire Belge. – C.R. Congrès Ass. Franç. Avanc. Sc., pp. 934–936.
Dierßen, K. 2001. Distribution, ecological amplitude and phytosociological characterization of European bryophytes. – Bryophytorum Bibliotheca Band 56.
Dirkse, G. M. and Martakis, G. F. P. 1998. Species density of phanerogams and bryophytes in Dutch forests. – Biodivers Conserv. 7: 147–57.
Drehwald, U. and Preising, E. 1991. Die Pflanzengesellschaften Niedersachsens; Moosgesellschaften. – Nat. Landsch. Niedersachsen 20: 204.
Drehwald, U. 1993. Die Pflanzengesellschaften Niedersachsens; Flechtengesellschaften. – Nat. Landsch. Niedersachsen 20: 124.
During, H. J. 1973. Het *Nanocyperion flavescentis* in de duinen, in atlantisch verband bezien. – Doctoraalscriptie Rijksuniversiteit.
Frey, W., Frahm, J. P., Fischer, E. et al. 2006. The liverworts, mosses and ferns of Europe, English edn. – Harley Books. Revised and edited by T. L. Blockeel. Original title: Kleine Kryptogamenflora, Bd. IV: Die Moos- und Farnpflanzen Europas. Gustav Fischer Verlag 1995.
Goffinet, B., Shaw, A. J., Cox, C. J. et al. 2004. Phylogenetic inferences in the Orthotrichoideae (Orthotrichaceae: Bryophyta) based on variation in four loci from all genomes. – Syst. Bot. Monogr. Miss. Bot. Gard. 98: 270–289.
Greven, H. C. 1990. De verspreiding van het *Grimmietum orbicularis* (Allorge 1922) Marstaller 1980 in Nederland. – Gorteria 16: 112–117.
Hallingbäck, T., Lönnell, N., Weibull, H. et al. 2008. Nationalnyckeln till Sveriges flora och fauna. Bladmosser: Kompaktmossor-kapmossor. Bryophyta: Anoectangium-Orthodontium. – ArtDatabanken, SLU.
Harmsen, G. 1999. Uit de geschiedenis van de bryosociologie en lichenosociologie. – Stratiotes 19: 6–27.
Hassel, K., Kyrkjeeide, M. O., Yousefi, N. et al. 2018. *Sphagnum divinum* (sp. nov.) and *S. medium* Limpr. and their relationship to *S. magellanicum* Brid. – J Bryol. 40: 197–222.

Haveman, R. 2016. Wat zegt een naam? Over naamgeving en identiteit. – In: Weeda, E. J., Schaminée, J. H. J. and Van Rooijen, N. M. (eds), Botanische meesterwerken. KNNV Uitgeverij, pp. 85–98.
Haveman, R. 2021. Op dat hele kleine stukje aarde. Een plantensociologische vakantievertelling. – Stratiotes 56: 13–28.
Haveman, R. and De Ronde, I. 2021. Eten is weten. Over plantensociologie, vegetatiekunde en kundig weten. – Stratiotes 57: 16–39.
Hovenkamp, P. 1975. Mosvegetaties in Callunaheide. – Doctoraalscriptie Universiteit Leiden, 35p.
James, P. W., Hawksworth, D. L. and Rose, F. 1977. Lichen communities in the British Isles; a preliminary conspectus. – In: Seaward, M. R. D. (ed.), Lichen ecology, vol. 10. Academic Press, pp. 295–413.
Klement, O. 1955. Prodromus der mitteleuropäischen Flechtengesellschaften. – Feddes Repertorium. Beiheft 135. Beiträge zur Vegetationskunde, Band 1. Akademie Verlag.
Kruijsen, B. W. J. M. 1982. Terrestrische en epilitische mosgezelschappen in grubben van het Savelsbos (Zuid-Limburg). – Doctoraalscriptie Rijksuniversiteit Utrecht, Instituut voor Systematische Plantkunde.
Lara, F., Garilleti, R., Goffinet, B. et al. 2016. *Lewinskya*, a new genus to accommodate the phaneroporous and monoicous taxa of *Orthotrichum* (Bryophyta, Orthotrichaceae). – Cryptogam Bryol. 37: 361–382.
Lecointe, A. 1978. Les associations bryologiques des éteules en Normandie (France). – Doc. Phytosociol. N.S. 2: 283–300.
Lemaire, A. J. J., Schaminée, J. H. J. and Weeda, E. J. 1998. *Isoeto-Nanojuncetea* (Dwergbiezen-klasse). – In: Schaminée, J. H. J., Weeda, E. J. and Westhoff, V. (eds), De vegetatie van Nederland. Deel 4. Plantengemeenschappen van de kust en van binnenlandse pioniermilieus. Opulus Press, pp.147–172.
Maas, F. M. 1959. Bronnen, bronbeken en bronbossen van Nederland, in het bijzonder die van de Veluwezoom. Een plantensociologische en oelogische studie. Dissertatie Landbouwhogeschool Wageningen. – Meded. Landbouwhogeschool Wageningen 59: 1–166.
Marstaller, R. 2006. Syntaxonomischer Konspekt der Moosgesellschaften Europas und angrenzender Gebiete. – Haussknechtia Beiheft 13.
Massé, L. 1964. Recherches phytosociologiques et écologiques sur les lichens des schistes rouges cambriens des environs de Rennes (i.-et-V.). – Vegetatio XII: 103–222.
Masselink, A. K. 1994. Pionier- en licheenrijke begroeiingen op stuifzanden benoorden de grote rivieren: typologie en syntaxonomie. – Stratiotes 8: 32–62.
Masselink, A. K. and Van Zanten, B. O. 1976. De bryofyten-flora van de Drentse hunebedden en zwerfkeien I: De hunebeddenflora. – Lindbergia 3: 323–31.
Messe, V. 1982. La végétation bryophytique des chemins empierrés au Plateau des Tailles (Haute Ardenne Belge). – Bull. Soc. R. Bot. Belgique/Bull. Koninklijke Belgische Bot. Vereniging 115: 161–176.
Mucina, L., Bültmann, H., Dierßen, K., et al. 2016. Vegetation of Europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. – Appl. Veg. Sci. 19: 3–264.
Mylona, S. 1996. Sulphur dioxide emissions in Europe 1880–1991 and their effect on sulphur concentrations and depositions. – Tellus B. Chem. Phys. Meteorol. 48: 662–89.
NBN 2023. *Aplodon wormskioldii*, *Splachnum* spp., *Tetraplodon* spp. distribution data. – National Biodiversity Network Atlas.
Nieuwkoop, J. A. W. 2011. *Physcomitrium eurystomum* – Vervolg. – Mosmail (BLWG) 13.
Nieuwkoop, J. A. W. 2016. Standplaatsen van *Physcomitrium eurystomum* (eirond knikkertjesmos) langs de Waal. – Buxbaumiella 105: 6–9.
Ódor, P. and Van Hees, A. F. M. 2004. Preferences of dead wood inhabiting bryophytes for decay stage, log size and habitat types in Hungarian beech forests. – J. Bryol. 26: 79–95.
Ódor, P., Heilmann-Clausen, J., Christensen, M. et al. 2006. Diversity of dead wood inhabiting fungi and bryophytes in seminatural beech forests in Europe. – Biol. Conserv. 131: 58–71.
Philippi, G. 1965. Moosgesellschaft en des morschen Holzes und des Rohhumus im Schwarzwald in der Rhön, im Weserberglandund im Harz. – Nova Hedwigia IX: 185–232.
PMD 2023. *Splachnum ampullaceum*, *Splachnum sphericum*, *Tetraplodon angustatus*, *Tetraplodon mnioides* distribution data. – Portal Moose Deutschlands.
Ringelberg-Giesen, W. 1958. De mosvegetatie van rieten en strooien daken in de omgeving van Wijster. – Doctoraalscriptie Landbouwhogeschool Wageningen.
Roux, C. 1981. Étude écologique et phytosociologique des peuplements lichéniques saxicoles-calcicoles du Sud-Est de la France. – Diss. Bot. Vaduz.
Sawicki, J., Plášek, V. and Szczecińska, M. 2010. Molecular studies resolve *Nyholmiella* (Orthotrichaceae) as a separate genus. – J. Syst. Evol. 48: 183–194.
Schaminée, J. H. J., Stortelder, A. F. H. and Westhoff, V. (eds). 1995a. De vegetatie van Nederland. Deel 1. Inleiding tot de plantensociologie: Grondslagen, methoden en toepassingen. – Opulus Press.
Schaminée, J. H. J., Weeda, E. J. and Westhoff, V. (eds). 1995b. De vegetatie van Nederland. Deel 2. Plantengemeenschappen van wateren, moerassen en natte heiden. – Opulus Press.
Schaminée, J. H. J., Stortelder, A. F. H. and Weeda, E. J. (eds). 1996. De vegetatie van Nederland. Deel 3. Plantengemeenschappen van graslanden, zomen en droge heiden. – Opulus Press.
Schaminée, J. H. J., Weeda, E. J. and Westhoff, V. (eds). 1998. De vegetatie van Nederland. Deel 4. Plantengemeenschappen van de kust en binnenlandse pioniermilieus. – Opulus Press.
Schaminée, J. H. J., Haveman, R., Hommel, P. W. F. M. et al. (eds). 2017. Revisie Vegetatie van Nederland. – Stratiotes 50/51: 1–232.
Schelhaas, M. J., Teeuwen, S., Oldenburger, J. et al. 2022. Zevende Nederlandse bosinventarisatie. Methoden en resultaten. – Wageningen University and Research. WOt-rapport 142.
Schlüsslmayr, G. 2005. Soziologische Moosflora des südostlichen Oberösterreich. – Stapfia 84. – Biology Centre of the Upper Austrian Museums.
Schrijvers-Gonlag, M. 2019. Mossen- en korstmossengemeenschappen in Nederland: what's in a name? Toepassing van de International Code of Phytosociological Nomenclature in de praktijk. – Stratiotes 53: 23–38.
Schrijvers-Gonlag, M. and Van Dort K. 2023. Data from: A synopsis of bryophyte-lichen syntaxa in the Netherlands. – DataverseNO, https://doi.org/10.18710/L4IDNP.
Schrijvers-Gonlag, M., Van Dort, K. W. and Van Gennip, B. 2018. Mossen- en korstmossengemeenschappen in Nederland: standaardlijst, verspreiding, zeldzaamheid, trend en Rode Lijststatus. – Stratiotes 53: 23–38.
Schubert, R. 2008. Die Moosgesellschaften des Nationalparks Harz. – Mitt florist Kart Sachsen-Anhalt. Sonderheft 5.

Schubert, R. 2009. Synopsis der Moosgesellschaften Sachsen-Anhalts. – Schlechtendalia 18: 1–158.
Schubert, R. and Stordeur, R. 2011. Synopsis der Flechtengesellschaften Sachsen-Anhalts. – Schlechtendalia 22: 1–88.
Shakespeare, W. 1597. An excellent conceited tragedie of Romeo and Iuliet. As it hath been often (with great applause) plaid publiquely, by the right Honourable the L. of *Hunsdon* his Seruants. – Iohn Danter.
Siebel, H. N. 1993. Indicatiegetallen van blad- en levermossen. – IBN-rapport 047. Wageningen.
Siebel, H. N. 2005. Ecologische indicatiewaarden van mossen. – BLWG.
Siebel, H. N. and Van Dort, K. W. 1999. Mossengemeenschappen in de plantensociologie. – Stratiotes 19: 37–49.
Siebel, H. N., Van Tooren, B. F., Van Melick, H. M. H. et al. 2000. Bedreigde en kwetsbare mossen in Nederland. Basisrapport met voorstel voor de Rode Lijst. – Buxbaumiella 54: 1–86.
Siebel, H. N., Bijlsma, R. J. and Sparrius, L. B. 2013. Basisrapport voor de Rode Lijst Mossen 2012. – BLWG Rapport 14. Bryologische en Lichenologische Werkgroep, Oude-Tonge. – Buxbaumiella 96: 1–75.
Sparrius, L. B. and Timmerman, H. J. 2014. Lichenologische excursies op herhaling: een vergelijking van de situatie op de Noord-Veluwe, 1960–2014. – Buxbaumiella 100: 4–7.
Sparrius, L. B., Aptroot, A. and Van Herk, C. M. 2015a. Ecological indicator values of lichens in the Netherlands. – BLWG.
Sparrius, L. B., Aptroot, A. and Van Herk, C. M. 2015b. Ecologische indicatiewaarden voor korstmossen en een vergelijking met mossen en vaatplanten. – Buxbaumiella 104: 18–24.
Spier, J. L. and Aptroot, A. 2000. *Fellhaneretum myrtillicolae* ass. nov., the lichen association on *Vaccinium myrtillus*. – Herzogia 14: 41–47.
Stortelder, A. H. F., Schaminée, J. H. J. and Hommel, P. W. F. M. (eds). 1999. De vegetatie van Nederland. Deel 5: plantengemeenschappen van ruigten, struwelen en bossen. – Opulus Press.
Sýkora, C. M. P. and Sýkora, K. V. 1987. Geschiedenis van de geobotanie. – De Levende Natuur 88: 7–11.
Touw, A. 1963. Enkele cryptogamenvegetaties in stuifzanden en heiden. – Rapport Biologisch Station Wijster.
Touw, A. 1969. On some liverwort communities in Dutch inland dunes and heaths. – Extrait de la Revue Bryologique et Lichénologique, T. XXXVI, Fasc. 34.
Van der Pluijm, A. and Boesveld, A. 2016. Baardmossen (*Usnea* spp.) in de Biesbosch, (vooral) vroeger en nu. – Buxbaumiella 107: 1–14.
Van der Swaluw, E., Asman, W. A. H., Van Jaarsveld, H. et al. 2011. Wet deposition of ammonium, nitrate and sulfate in the Netherlands over the period 1992–2008. – Atmos Environ. 45: 3819–3826.
Van Dort, K. W. and Siebel, H. N. 1995. Mossengemeenschappen van Nederland; een eerste aanzet. – Stratiotes 10: 28–32.
Van Dort, K. W., Van Gennip, B. and Schrijvers-Gonlag, M. (eds). 2017. De vegetatie van Nederland. Deel 6. Mossen- en korstmossengemeenschappen. – KNNV Uitgeverij, XVIII + 518p.
Van Herk, C. M. and Spier, J. L. 1994. Een lichenologisch onderzoek met de ladder. – Buxbaumiella 33: 21–25.
Van Herk, C. M., Spier, J. L., Aptroot, A. et al. 2000. De korstmossen van het Speulderbos, vroeger en nu. – Buxbaumiella 51: 33–44.
Van Landuyt, W., De Beer, D., Raeymaekers, G. et al. 2020. Voorlopige verspreidingsatlas van de Hauw-, Lever- en Bladmossen van Vlaanderen. – INB rapport 46. Instituut voor Natuur- en Bosonderzoek.
Van Zanten, M. C., Wichink Kruit, R. J., Hoogerbrugge, R. et al. 2017. Trends in ammonia measurements in the Netherlands over the period 1993–2014. – Atmos Environ. 148: 352–360.
Von Hübschmann, A. 1953. Einige hygro- und hydrophile Moosgesellschaften Norddeutschlands. – Mitteilungen der Floristisch-soziologischen Arbeitsgemeinschaft. N.F. Heft 4, pp. 15–25.
Von Hübschmann, A. 1986. Prodromus der Moosgesellschaften Zentraleuropas. – Bryophytorum Bibliotheca, Band 32.
Walsh, H. 1951. Spore dispersal in *Splachnum ovatum*. – Bryol. Notes Trans. Brit. Bryol. Soc. 1: 487.
Weber, H. E., Moravec, J. and Theurillat, J.-P. 2000. International Code of Phytosociological Nomenclature, 3rd edn. – J. Veg. Sci. 11: 739–768.
Weeda, E. J. 1994. Over Kegelmos (*Conocephalum conicum* (L.) Underw.) en het *Pellio-Conocephaletum*, in het bijzonder in Twente. – Stratiotes 8: 12–31.
Weeda, E. J., Van't Veer, R. and Schaminée, J. H. J. 1998. *Bidentetea tripartitae* (Tandzaad-klasse). – In: Schaminée, J. H. J., Weeda, E. J. and Westhoff, V. (eds), De vegetatie van Nederland. Deel 4. Plantengemeenschappen van de kust en van binnenlandse pioniermilieus. Opulus Press, pp. 173–198.
Westhoff, V., Van Dijk, J. W. and Passchier, H. 1942. Overzicht der plantengemeenschappen in Nederland. – Uitgaven der Ned. Natuurhist. Vereeniging, No. 7. Uitgaven van den Ned. Jeugdbond v. Natuurstudie, No. 7. G.W. Breugel, 's-Graveland.
Wever, D., Dröge, P. W. H. G., Geilenkirchen, G. P. et al. 2022. Informative Inventory Report 2022. Emissions of transboundary air pollutants in the Netherlands 1990–2020. – RIVM rapport 2022-0004. National Institute for Public Health and the Environment.
Wickham, H. 2016. ggplot2: elegant graphics for data analysis. – Springer.
Wijdeven, S. M. J. 2005. Dood hout in het Nederlandse bos. – In: Jagers op Akkerhuis, G. A. J. M., Wijdeven, S. M. J., Moraal, L. G. et al. Dood hout en biodiversiteit: Alterra-rapport 1320. Alterra, 21–44.
Wirth, V. 1980. Flechtenflora. Ökologische Kennzeichnung und Bestimmung der Flechten Südwestdeutschlands und angrenzender Gebiete. – Uni-Taschenbücher 1062. Verlag Eugen Ulmer.
Wirth, V. 1995. Die Flechten Baden-Württembergs. Teil 1 & 2. – Verlag Eugen Ulmer.