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ORIGINAL ARTICLE

Contribution to the knowledge of lichen flora of inland sand dunes in the western Po Plain (N Italy)

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Abstract
This paper describes the lichen flora surveyed in inland sand dunes, called dossi, in the western Po Plain (Lombardy region, Italy). Here, lichens were marginally known in comparison with the epigaeous component, but they were never studied before in relation to the epiphytic, epixylic and epilithic components. The floristic list includes 50 species; ecological and chorological analyses were carried out. Thirteen lichen species observed on various substrata were not reported in the lichen list of the Ticino Natural Park, which distances only few kilometres from our study area. Nine species are new for the Po phytoclimatic region and one species, *Cladonia portentosa*, is new for Lombardy. Particularly interesting are some species related to the *Corynephorus* grasslands, such as *Cladonia* sp. pl. and *Stereocaulon condensatum*, and three species usually absent, at our latitudes, beneath the montane belt: *Cladonia digitata*, *Hypocenomyce scalaris* and *Parmeliopsis ambigua*. These data confirm the importance of inland sand dunes for lichen diversity of the Po Plain. Some preliminary remarks concerning the management of the habitats hosting lichens are given, with particular emphasis to their conservation. Suggested actions include the possibility to keep woody coarse debris, to favour epixylic species, and mechanical disturbance, dispersal of lichen fragments and sheep grazing, to favour epigaeous species.

Keywords: Corynephorus *grasslands, Dossi di Cergnago, ecological indicator values, inland sand dunes, lichens, open woods*

Introduction

Inland sand dunes represent an important habitat for biodiversity (Riksen et al. 2006), both for invertebrate animals (Merkens 2002; Vogels et al. 2005) and, especially, for vascular plants (Jentsch & Beyschlag 2003; Assini et al. 2013) and cryptogams (Zielińska 1967; Ketner-Oostra 1994; Ketner-Oostra 2006). Lichens of these habitats were previously well studied in central Europe from different points of view: floristic (Ketner-Oostra 1994), vegetational (Zielińska 1967; Biermann & Daniëls 1997; Bültmann 2005; Hasse 2005; Daniëls et al. 2008; Ketner-Oostra & Sýkora 2009), ecological (Bültmann & Daniëls 2001; Bültmann 2006a,b; Jöhren & Bültmann 2006) and in relation to their management (Sparrius 2011; Ketner-Oostra et al. 2012).

In Italy, inland sand dunes are a very rare habitat occurring in few localities of the western Po Plain. They were studied only under floristic and vegetational aspects related to vascular plants (Bertossi 1950; Corbetta 1968; Assini 2007; Assini et al. 2013). Studies aimed only at the description of the lichen flora are not available.

Some floristic studies about lichens were carried out in other areas of the Po Plain (Roella 1999; Valcuvia-Passadore et al. 2002a,b; Valcuvia-Passadore & Truzzi 2008), but they are very scarce; this is probably due also to the low presence of natural and semi-natural habitats in the area. The study area represents one of the last relics of inland sand dunes called dossi of the western Po Plain, of which the vascular vegetation was previously detected by Corbetta (1968) and Assini (2007). These authors mentioned only few species of epigaeous lichens occurring in the *Corynephorus* grasslands of the sand dunes. Thus, due to the scarce knowledge of the lichen composition of these habitats, this paper aimed to describe the lichen flora of "Dossi di Cergnago" providing new data about epiphytic, epixylic and epilithic lichens and complementary data about epigaeous lichens.

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Study area

Geographic position and geology

This study was carried out in the locality known as "Dossi di Cergnago" which is sited in the countryside near Cergnago, but formally belongs to the municipality of San Giorgio Lomellina (Pavia Province, Lombardy, Northern Italy, N45° 11.611′ E8° 47.248′) (Figure 1). The area is included in a private hunting reserve and covers a surface of about 55 hectares.

The site is characterized by the presence of residual inland sand dunes formed during the period of the "Diluvium recente" through the deposition of acid siliceous sands subsequently remoulded by wind. Geomorphologically, these formations are not properly considered dunes, because of the impossibility to differentiate lee and upwind sides, but the absence of these features could be due to the erosion occurred between the end of the eolic remoulding in the Middle Ages and today (Boni 1947). For this reason, however, they are commonly called hillocks (dossi) instead of dunes.

These hillocks have irregular disposition and variable height (from 3 to 7 m), determining a slight variation of the altitude in the study area between 102 and 109 m above the sea level.

The fine-grained sands that constitute the hillocks are siliceous; the larger-grained sediments were buried under the finer materials during the eolic remoulding.

In the past, these hillocks were broadly widespread in Lomellina, characterizing its landscape in many places ("dossi della Lomellina"), but after centuries of levelling due to agriculture, some limited residual hillocks persist only in few localities: the best preserved hillocks are found at Cergnago and Remondò, while badly conserved traces of them still remain near Tromello, Ottobiano and Scaldasole. Particularly, at Scaldasole a Site of European Community Importance was established.

Climate

The climate of the study area is continental, with warm, muggy summers, often refreshed by rainstorms, and cold, foggy winters with little snow and rain. In recent years, an increase in the average temperature and a decrease in snowfall were observed. Intermediate seasons are brief and unstable, with many rainfalls (Scappatura 1995).

The average annual temperature is 11.8°C, while the average annual rainfall is 1037.2 mm (AA.VV. 2002).

Winds blow mainly from the south-western sector, but with considerable peaks from east and north-east; the average speed is about 0.9 m/s.

According to Rivas-Martínez et al. (2004), the bioclimate of the study area is temperate continental.

Vegetation

Two main plant communities are present in the study area.

An open oak wood, dominated by *Quercus robur* L., is very widespread. It hosts few species, due to the substrate nature. In the shrub layer, the main species are *Crataegus monogyna* Jacq., *Rhamnus frangula* L.,

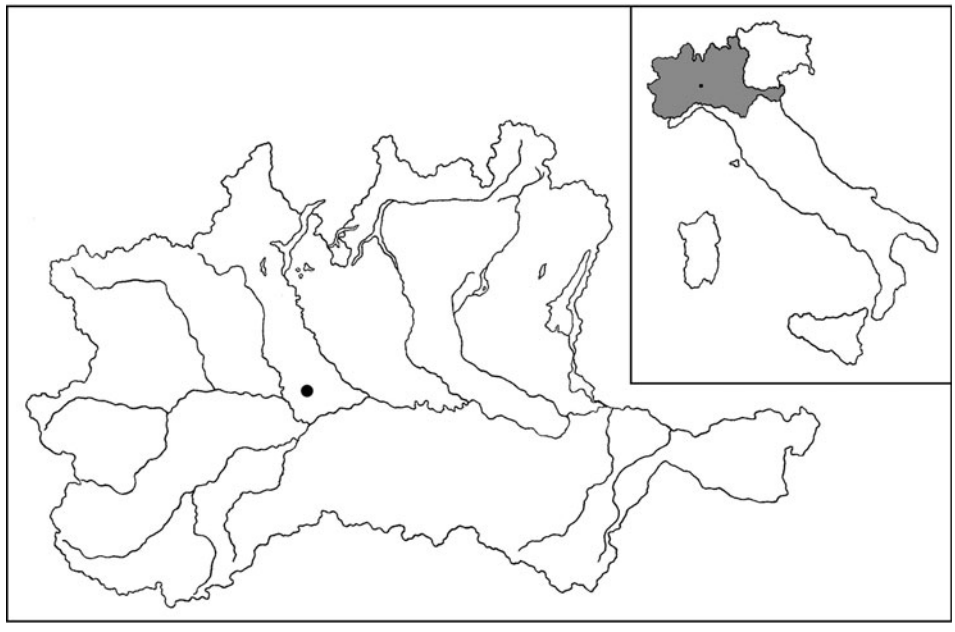

Figure 1. Location of the study area in the Italian part of the Po river basin.

Euonymus europaeus L. and *Ligustrum vulgare* L. The herb layer is characterized by the presence of *Rubus caesius* L., *Polygonatum multiflorum* L. and the invasive *Phytolacca americana* L. Other invasive species observed in the study area were *Robinia pseudacacia* L., already reported by Corbetta (1968), and *Prunus serotina* Ehrh. which is particularly abundant in areas affected by cutting. The open oak wood can be attributed to the 9190 Habitat Directive (Old acidophilus oak woods with *Quercus robur* on sandy plains – Directive 1992/43/CEE).

Very remarkable is the presence of acidophilus dry grasslands dominated by *Corynephorus canescens* (L.) P. Beauv. and characterized by the presence of *Teesdalia nudicaulis* (L.) R.Br., *Rumex acetosella* L., *Filago minima* (Sm.) Pers., *Veronica arvensis* L. and *Hypericum perforatum* L. (Assini 2007). These grasslands develop in large clearings of the previously described oak wood and have great importance for terricolous lichens. *Corynephorus* grasslands can be attributed to the 2330 Habitat Directive (Inland dunes with open *Corynephorus* and *Agrostis* grasslands; Biondi et al. 2012). This habitat is very rare in Italy and occurs only in the north-western part of the country: in Lomellina (Lombardy Region) and along the Ticino and Sesia rivers (Piedmont Region; Assini et al. 2013).

Nearby an artificial pond and along channels sited in the study area, hygrophilous communities dominated by *Alnus glutinosa* (L.) Gaertn. and *Salix cinerea* L. are also present.

Materials and methods

The fieldwork took place during spring and summer 2011.

Lichens were sampled from every suitable substrata in the study area: soil (both mineral sandy soil and humified soil), mosses, vegetal debris, stumps, dead trunks, bark of living trees, twigs and pieces of branches fallen to the ground from the canopies. Lithic substrata were also sampled, but only man-made lithic substrata were considered because rocky outcrops are not present in the study area.

The common and easily recognizable species were identified in the field, often with the help of a 4X magnifying glass, taking note of the data on a notebook; specimens not directly identified were collected and identified in the laboratory.

Epigaeous fruticose lichens were removed by hand and stored into rigid boxes during the transport, in order to not alter their shape; epiphytic and epixylic lichens were collected with the aid of a knife, together with a part of the bark or wood on which they were present, to avoid the spoiling of the specimens; epilithic lichens were sampled on brick and cement scraps detached from the top of the investigated artefacts; both epiphytic and epilithic lichens were transported into envelopes. Twigs and pieces of branches fallen to the ground from the canopies were also collected. Data concerning the sampling (date, locality, substratum and any other note) were reported for every specimen.

Specimens were identified in laboratory by means of the following keys and manuals: Britton (2008), Nimis (1986, 1992b), Nimis and Bolognini (1993), Nimis and Martellos (2004), Nimis et al. (1992), Ozenda and Clauzade (1970), Purvis et al. (1992) and Tretiach (2001). Nomenclature follows Nimis and Martellos (2008).

The following lichen features and attributes were analysed.

(1) Growth form (Nimis & Martellos 2008): leprose, crustose, squamulose, foliose and fruticose.
(2) Reproductive strategy (Nimis & Martellos 2008): mainly sexual, mainly asexual by isidia or isidia-like structures, mainly asexual by soredia or soredia-like structures.
(3) Substratum, or substrata, on which the lichen was found.
(4) Ecological indexes (Nimis & Martellos 2008), with values considered as follows. pH (pH of the substratum): 1, very acid substrata; 2, rather acid substrata; 3, subneutral substrata; 4, rather basic substrata; 5, basic substrata. L (degree of photophytism): 1, very skiophytic, in very shaded position; 2, moderately skiophytic, in shaded position; 3, moderately photophytic, in diffuse light but with scarce direct irradiation; 4, rather photophytic, in sun exposed positions but not under extreme solar irradiation; 5, photophytic, in strongly irradiated position. H (degree of hygrophytism): 1, hygrophytic; 2, rather hygrophytic; 3, mesophytic; 4, rather xerophytic; 5, xerophytic. N (degree of nitrophytism): 1, anitrophytic, in sites with no eutrophication; 2, moderately nitrophytic, in sites with very weak eutrophication; 3, rather nitrophytic, in sites with weak eutrophication; 4, very nitrophytic, in sites with rather high eutrophication; 5, extremely nitrophitic, in sites with very high eutrophication.
(5) Poleophoby index (Nimis & Martellos 2008): 1, species occurring in heavily disturbed habitats; 2, species occurring in moderately disturbed areas; 3, species occurring in natural or semi-natural habitats; 4, species occurring only on old trees in ancient, undisturbed forests (this last value is only for epiphytic species).
(6) Distribution in European latitudinal zones (Wirth 1980), with following abbreviations:

arkt, arctic zone; bor, boreal zone; s'bor, south boreal zone; mieur, middle European zone; s'mieur: south middle European zone; smed, sub-Mediterranean zone; med, Mediterranean zone; atl, atlantic zone; subatl, subatlantic zone.

(7) Distribution/presence in the Po phytoclimatic region (Nimis & Martellos 2008): absent, extremely rare, very rare, rare, rather rare, rather common, common, very common and extremely common.

Results

Lichen flora

Fifty lichen species were found in the study area (Appendix).

Epigaeous lichens include eight species of which one, *Cladonia coniocraea*, is typical of other substrata and only occasionally terricolous. A single species, *Stereocaulon condensatum*, was found only on mineral sandy soil, while all the other species preferred humified soil, mosses and vegetal debris; nevertheless, *Cladonia foliacea*, *Cladonia furcata* and, more rarely, *Cladonia portentosa* were also found on sandy soil.

Epiphytic and epixylic lichens comprise 36 species overall, sampled for most on *Quercus robur*, but also on *Salix cinerea* and *Robinia pseudacacia*. Two of these species were *Cladonia foliacea* and *Cladonia furcata*, exceptionally developed on the trunk of a living *Quercus robur* in the middle of an open clearing and not counted for the elaboration of the substrata spectrum; other 34 species, except *Cladonia pyxidata* and *Cladonia squamosa*, that can colonize a certain variety of different substrata, are epiphytic and epixylic sensu stricto (Nimis & Martellos 2008). *Scoliciosporum umbrinum* was found only on dead wood, while *Cladonia coniocraea*, *Cladonia digitata*, *Cladonia fimbriata*, *Cladonia squamosa* and *Hypocenomyce scalaris* were observed on both wood and bark.

Epilithic lichens include 11 species, of which 10 are rather common and only 1, *Porpidia cinereoatra*, is noteworthy.

Ecological and chorological analysis

The most represented growth form is the crustose growth form (40%, 20 species), followed by the foliose (34%, 17 spp.) and the fruticose (22%, 11 spp.) growth forms. Both leprose and squamulose lichens are less represented, with only 1 species (2%).

Twenty-four species (48%) reproduce through spores: 22 (44%) have apothecia and 2 (4%) have perithecia. Other species reproduce mainly by soredia (42%, 21 spp.) and isidia (10%, 5 spp.). It is interesting to point out that an alternative reproductive strategy achieved by epigaeous fruticose species in dry grasslands, observed in the study area, is the thallus fragmentation, which is facilitated by moderate trampling or other low-intensity disturbance (Bayfield et al. 1981; Christensen 1988; Heinken 1999; Bültmann 2005; Hasse 2005).

The substrata spectrum shows the predominance of epiphytic species (55%, 34 species), while epilithic (17.5%, 11 spp.), epigaeous (14.5%, 8 spp.) and epixylic (13%, 8 spp.) lichens are less represented. Note that species occurring on different kinds of substrata were considered in each substratum category in which they were observed.

Analysing the pH values, a distinction should be made depending on the substrata. Siliceous sand, bark and wood are mainly acid, while the materials used to build walls and other lithic manufacts are often basic. Epigaeous and epiphytic/epixylic lichens are mainly between acidophytic and subneutrophytic, with few rather basiphytic elements, while epilithic species are mainly between subneutrophytic and basiphytic, with only few rather acidophytic elements.

The surveyed species are mainly from moderately to very photophytic, mesophytic and from anitrophytic to rather and very nitrophytic.

Table I summarizes percentages and number of species for each class of the ecological indexes.

Poleophoby indexes show the prevalence of species that develop in natural habitats (value 3, 49 spp., 40%), followed by species able to endure rather disturbed habitats (value 2, 47 spp., 39%). Only 26 species (21%) can develop in very disturbed situations (value 1).

Table I. Percentages and number of species for the ecological indexes classes of pH (shown separately for epigaeous, epiphytic and epixylic and epilithic species), solar irradiation (L), humidity (H) and eutrophication (N).

Value	pH (epigaeic)	pH (epiphytic and epixylic)	pH (epilithic)	L	H	N
1	12% (2 spp.)	18% (14 spp.)	3% (1 sp.)	0 spp.	1% (1 sp.)	22% (27 spp.)
2	41% (7 spp.)	36% (28 spp.)	21% (6 spp.)	2% (2 spp.)	23% (21 spp.)	27% (33 spp.)
3	29% (5 spp.)	30% (23 spp.)	31% (9 spp.)	35% (39 spp.)	53% (49 spp.)	26% (32 spp.)
4	12% (2 spp.)	12% (9 spp.)	24% (7 spp.)	40% (45 spp.)	20% (18 spp.)	15% (17 spp.)
5	6% (1 sp.)	4% (3 spp.)	21% (6 spp.)	23% (26 spp.)	3% (3 spp.)	10% (12 spp.)

Notes: sp., species (singular); spp., species (plural).

Note that for both ecological and poleophoby indexes, the species having a range of values for considered index were included in each of the value classes in their range.

The chorological spectrum of the surveyed species is composed as follows: arkt, 8 species (2.9%); bor, 35 species (12.9%); s'bor, 40 species (14.8%); mieur, 49 species (18.2%); s'mieur, 48 species (17.8%); smed, 48 species (17.8%); med, 42 species (15.6%).

Note that species occurring in areas including a range of latitudinal zones were included in each zone of their range.

Frequency in the Po phytoclimatic region

Nine species (18%) have not been reported previously and were thus considered absent, 12 species (24%) are extremely rare, 8 species (16%) are very rare, 3 species (6%) are rare, 9 species (18%) are rather rare, 5 species (10%) are rather common, 3 species (6%) are common and 1 species (2%) is extremely common.

The research revealed the presence of nine species new for the Po phytoclimatic region: *Cladonia digitata, Cladonia foliacea, Cladonia portentosa, Hypocenomyce scalaris, Parmelia saxatilis, Parmeliopsis ambigua, Porpidia cinereoatra, Stereocaulon condensatum* and *Xanthoria fallax*. One of them, *Cladonia portentosa,* is new for Lombardy too.

Discussion

Results show that the lichen diversity is rather high, if we consider that the study area is included in a region heavily affected by pollution and agricultural activities and has a limited size. Anyway, this study contributed to increase the lichen knowledge of the Po Plain.

Particular attention was given to lichens in relation to the *Corynephorus* grasslands: *Stereocaulon condensatum*, according to Paus (1997), characterizes a microcommunity typically found inside the plant association *Spergula vernalis–Corynephoretum canescentis* (R. Tx.) Libbert, while *Cladonia foliacea*, *Cladonia furcata* and *Cladonia portentosa* are differential species of the subassociation *cladonietosum* (R. Tx.) Libbert, in which epigaeous lichens play an important ecological role.

Epigaeous lichen flora can be compared with lichen floras in other *Corynephorus* grasslands of central Europe: in Poland, Zielińska (1967) detected 32 species in the Kampinos Forest and Juskiewicz-Swaczyna (2009) detected 16 species in the Masurian Lake District, while in the Netherlands, Ketner-Oostra (1994) detected 28 species in Kootwijkerzand and Hasse (2007) detected 18 species in the Hoge Veluwe. Further authors and papers (Ketner-Oostra & Sýkora 2004; Bültmann 2005; Hasse 2005; Blunt 2006; Ketner-Oostra 2006; Daniëls et al. 2008) show that lichen species richness in *Corynephorus* grasslands of central Europe is always higher than in our study area, which is located in the southernmost part of the *Spergulo–Corynephoretum canescentis* areal (Assini et al. 2013). This is probably due to climate and latitude: many species observed in central European lowlands are present in Italy only in mountain regions. Furthermore, the grasslands of our study area are small and fragmented.

The epiphytic lichen flora of the study area can be compared with the epiphytic floras of two important natural areas of the Po Plain: "Bosco della Fontana" of Mantova, consisting of 54 species (Valcuvia-Passadore & Truzzi 2008), and Ticino Natural Park, consisting of 74 species (Valcuvia-Passadore et al. 2002b); even in these cases, study areas were larger than ours, and hosted a higher number of tree species suitable as substrata.

The ecological analysis of the flora shows the main discordance in the pH values: epigaeous and epiphytic lichens are mainly acidophytic, while epilithic species prefer rather basic substrates. For other ecological indexes, preferences are similar and oriented towards photophytism, mesophytism and low or mid eutrophication. Species of natural and semi-natural habitats prevail over species able to tolerate disturbed environments, as revealed by the analysis of the poleophoby indexes.

The chorological analysis of the flora shows the predominance of species which are typical of temperate zones in central and southern Europe, and this is coherent with the localization of the study area, which lies southern of the Alps.

It is interesting to note that 13 lichen species observed in the study area on various substrata (*Aspicilia caesiocinerea*, *Cladonia digitata*, *Cladonia portentosa*, *Lecania turicensis*, *Lepraria cf. lobificans*, *Parmeliopsis ambigua*, *Phlyctis argena*, *Porpidia cinereoatra*, *Rinodina pyrina*, *Scoliciosporum umbrinum*, *Stereocaulon condensatum*, *Trapelia coarctata* and *Verrucaria macrostoma*) were not reported in the lichen list of the Ticino Natural Park (Valcuvia-Passadore et al. 2002b), which distances only few kilometres from our study area.

Furthermore, the presence of nine species new for the Po phytoclimatic region and the presence of *Cladonia portentosa*, which is new for Lombardy, are noteworthy. Particularly interesting are some species related to the *Corynephorus* grasslands, such as *Cladonia* sp. pl. and *Stereocaulon condensatum*, and three species usually absent, at our latitudes, beneath the montane belt: *Cladonia digitata*, *Hypocenomyce scalaris* and *Parmeliopsis ambigua*.

These data confirm the importance of inland sand dunes for lichen diversity of the Po Plain.

Our floristic list does not include species of the proposed Red List for Lombardy in ITALIC (Nimis & Martellos 2008); however, *Cladonia portentosa* and *Phaeophyscia chloantha* were reported as "vulnerable" in the Italian Red List by Nimis (1992a).

Cladonia portentosa belongs to the taxon *Cladina* (Ahti 1962), which is reported in the annexe V of the Habitat Directive (animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures); thus, it is protected in Lombardy by the regional law (L.R. 10/2008) which aims to realize part of the instructions given by the Habitat Directive.

The *Corynephorus* grasslands have great importance for biodiversity in the Po Plain, and the same is for the inland sand dunes on which they are found. Epigaeous lichens depending on this habitat are likewise deserving attention and protection.

One of the management measures proposed in the study area for the *Corynephorus* grasslands (Assini et al. 2013) consists in the removal of the cryptogamic crust (lichens and mosses) to facilitate the resettlement of the annual vascular plants, hindered by a too dense presence of cryptogams; this could be in contrast to the conservation of the lichens inhabiting the cryptogamic crust settled on little humified soil, among which the rare and protected *Cladonia portentosa* is found. On the other hand, the artificial maintenance of open sand areas could probably benefit another rare epigaeous species, *Stereocaulon condensatum*, that cannot be restored after the disappearance of its suitable substrate and microhabitat conditions (Sparrius 2011), found exactly on the sand.

These and more other aspects must be deepened, in order to plan management operations aimed to conserve both the cryptogamic and vascular flora and vegetation.

About epiphytic and epixylic species, we assume that the wood management as realized till now is appropriate for their conservation. The tree management in the study area seems not compromising the lichen diversity, since both species associated and unassociated with aged coppiced woods *sensu* Giordani (2012) were found. The only suggestion regards the possibility to keep stumps and dead trunks on the ground, and maybe dead standing trees, in order to provide substrata to epixylic species.

Phytosociological studies are ongoing to better analyse relationships between epigaeous lichen vegetation and vascular vegetation in order to better point out clear conceptual and methodological separation between plant communities rich in cryptogams and cryptogam synusiae within plant communities (see Barkman 1968; Berg & Dengler 2005). These studies also aim to indicate management measures for the conservation of both lichens and vascular plants in these important *Corynephorus* grasslands. Possible management measures to restore and manage this particular habitat could include mechanical disturbance (Jentsch 2004; Ketner-Oostra et al. 2012), dispersal of lichen fragments (Heinken 1999; Jeschke 2012) and grazing by sheep (Schwabe et al. 2002). Grasslands are generally considered of high conservation concern because they are rich in species, and thus host a high proportion of Europe's biodiversity (Pärtel et al. 2007; Janišová et al. 2011; Blasi et al. 2012).

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Appendix: floristic list

For each species the substrata on which it occurred are reported in brackets, according to the following legend.

1, epigaeous on bare sand; 2, epigaeous on humified soil; 3, epixylic on dead wood (stumps and dead trunks); 4, epiphytic on living trees (trunks, branches and twigs); 5, epilithic on man-made lithic substrata.

Amandinea punctata (Hoffm.) Coppins & Scheid. (4), *Aspicilia caesiocinerea* (Malbr.) Arnold (5), *Caloplaca citrina* (Hoffm.) Th.Fr. (5), *Caloplaca teicholyta* (Ach.) J. Steiner (5), *Candelaria concolor* (Dicks.) Stein (4), *Candelariella vitellina* (Hoffm.) Müll.Arg. (5), *Candelariella xanthostigma* (Ach.) Lettau (4), *Cladonia coniocraea* (Flörke) Spreng. (2, 3, 4), *Cladonia digitata* Hoffm. (3, 4), *Cladonia fimbriata* (L.) Fr. (3, 4), *Cladonia foliacea* (Huds.) Willd. (1, 2, 4), *Cladonia furcata* (Huds.) Schrad. (1, 2, 4), *Cladonia portentosa* (Dufour) Coem. (1, 2), *Cladonia pyxidata* (L.) Hoffm. (2, 3), *Cladonia rangiformis* Hoffm. (2), *Cladonia squamosa* Hoffm. (2, 3, 4), *Evernia prunastri* (L.) Ach. (4), *Flavoparmelia caperata* (L.) Hale (4), *Hypocenomyce scalaris* (Ach.) M.Choisy (3, 4), *Hypogymnia physodes* (L.) Nyl. (3, 4), *Hypogymnia tubulosa* (Schaer.) Hav. (3, 4), *Lecania turicensis* (Hepp.) Müll.Arg. (5), *Lecanora campestris* (Schaer.) Hue (5), *Lecanora carpinea* (L.) Vain. (4), *Lecanora chlarotera* Nyl. (4), *Lecanora hagenii* (Ach.) Ach. (4), *Lecidella elaeochroma* (Ach.) M.Choisy (4), *Lepraria* cf. *lobificans* Nyl. (4), *Melanelixia subaurifera* (Nyl.) O.Blanco, A.Crespo, Divakar, Essl., D.Hawksw. & Lumbsch (4), *Melanohalea exasperatula* (Nyl.) O.Blanco, A.Crespo, Divakar, Essl., D.Hawksw. & Lumbsch (4), *Parmelia saxatilis* (L.) Ach. (4), *Parmelia sulcata* Taylor (4), *Parmelina tiliacea* (Hoffm.) Hale (4), *Parmeliopsis ambigua* (Wulfen) Nyl. (4), *Parmotrema perlatum* (Huds.) M.Choisy (4), *Phaeophyscia chloantha* (Ach.) Moberg (4), *Phlyctis argena* (Spreng.) Flot. (4), *Physcia adscendens* (Fr.) H.Olivier (4), *Porpidia cinereoatra* (Ach.) Hertel & Knoph (5), *Protoparmeliopsis muralis* (Schreb.) M.Choisy (5), *Pseudevernia furfuracea* Zopf (4), *Punctelia subrudecta* (Nyl.) Krog (4), *Rinodina pyrina* (Ach) Arnold (4), *Scoliciosporum umbrinum* (Ach.) Arnold (3), *Stereocaulon condensatum* Hoffm. (1), *Trapelia coarctata* (Sm.) M.Choisy (5), *Verrucaria macrostoma* DC. (5), *Verrucaria nigrescens* Pers. (5), *Xanthoria fallax* (Hepp) Arnold (4), *Xanthoria parietina* (L.) Th.Fr (4).