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The lichen biota of the beech forest of the Monte Lesima-Cima Colletta ridge (Northern Apennine, Italy)

Abstract

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In the last decades, lichenological studies started again in Lombardia (N Italy), where locally overlooked situations persist. One of such areas is the southernmost part of the Pavese Apennine, where the highest mountains of the Province of Pavia are located. We report the results of a thorough lichen survey carried out in the Natura 2000 Habitat 9130 "*Asperulo-Fagetum* beech forests" occurring along the Monte Lesima-Cima Colletta ridge, an area with an outstanding naturalistic relevance, part of which is included within the SCI IT2080025 "Le Torraie-Monte Lesima". Ninety-two taxa are recorded from four sites with different features, with the richest site hosting old beech trees and rock outcrops. *Circinaria coronata*, *Glaucomaria subcarpinea*, *Gyalolechia marmorata*, *Leproplaca chrysodeta*, *Pertusaria coronata*, *Physconia servitii*, *Variospora paulii* and *Wadeana dendrographa* are new to Lombardia.

Key words: Biodiversity, Conservation, Habitat 9130, Lichens, Natura 2000 Network, Oltrepò Pavese.

Introduction

Lombardia is one of the lichenologically best-known administrative regions of Italy, but most information dates back to works published in the 19th and the first half of the 20th century (Gheza et al. 2022a). Fortunately, in the last decades floristic research on lichens in Lombardia started again with renewed vigour, thanks to the work of lichenologists from the Universities of Pavia and Bologna (e.g. Valcuvia Passadore & Delucchi 2002; Valcuvia Passadore & al. 2003; Delucchi & Valcuvia Passadore 2004; De Vita & Valcuvia Passadore 2004; De Vita & al. 2004; Chiappetta & al. 2005; Nascimbene 2006; Chiappetta &

Valcuvia Passadore 2007; Gheza 2015, 2018, 2019a, 2019b, 2019c; Gheza & al. 2015, 2020, 2022a, 2020b; Nascimbene & al. 2021).

The Province of Pavia, reaching in its southern part (Oltrepò Pavese) the Apennine, was investigated with great discontinuity, despite the interesting records reported especially in the oldest literature sources. For example, the monograph by Nocca & Balbis (1823), which is the oldest source of lichenological information referring to the territory of Pavia, reported from the area of Monte Lesima and neighboring Monte Boglelio some remarkable species, including *Lobaria pulmonaria* and *Nephroma resupinatum*; the occurrence of the latter was confirmed recently (Ravera & al. 2021), whereas *L. pulmonaria* was never found again here. Epiphytic lichens were studied in selected areas of the Oltrepò Pavese more recently in the first decade of the current century (Valcuvia Passadore & al. 2003; Chiappetta & al. 2005; Chiappetta & Valcuvia Passadore 2007), but the southernmost part of the province – which hosts the wildest and vastest forests – was left largely neglected, being surveyed only in a few sites by Chiappetta & Valcuvia Passadore (2007).

Within this area, Monte Lesima was proposed (2017) and later appointed (2019) as a Site of Community Importance (SCI IT2080025 "Le Torraie – Monte Lesima"). The ridge between Monte Lesima and Cima Colletta, which is only partly included within the boundaries of the SCI, is in fact a naturalistically outstanding area within the Pavese Apennine (Gariboldi & Gatti 2019). The present paper reports a checklist of the lichens occurring in the wide beech forest that covers the montane belt of the ridge between Monte Lesima and Cima Colletta, within the SCI and in the surrounding area. This checklist could be compiled due to material collected during (1) the preliminary field excursions aimed at describing and mapping Natura 2000 Habitats prior to the establishment of the SCI, and (2) the field excursion of the 34th congress of the Italian Lichen Society, which took place in Pavia on 15th-17th September 2022.

This is also a first contribution to the knowledge of lichens of the Natura 2000 Habitat 9130 in the Northern Apennine, which can be a base and a stimulus for research on the relations between lichen biota and Natura 2000 Habitats both in the Region and at a national scale.

Material and methods

Study area

Monte Lesima (1724 m) and Cima Colletta (1493 m) are located at the southernmost edge of the Province of Pavia (Lombardia, N Italy), in the Northern Apennine (Fig. 1), forming part of the ridge that acts as watershed between Val Staffora and Val Trebbia. Both Monte Lesima, which is the highest mountain of the Pavese Apennine, and Cima Colletta belong to the group of Monte Antola, whose ridges represent administrative boundaries between the four regions of Lombardia, Piemonte, Liguria and Emilia Romagna. The other main mountains of the upper Val Staffora are Mount Chiappo (1699 m) and Mount Boglelio (1491 m), which are located on the opposite side of the Val Staffora.

Within this area, the Site of Community Importance IT2080025 "Le Torraie – Monte Lesima" covers an area of about 6 km^2 within the municipality of Brallo di Pregola (Province of Pavia), extending on the eastern slope of Mount Lesima, along the Torraie

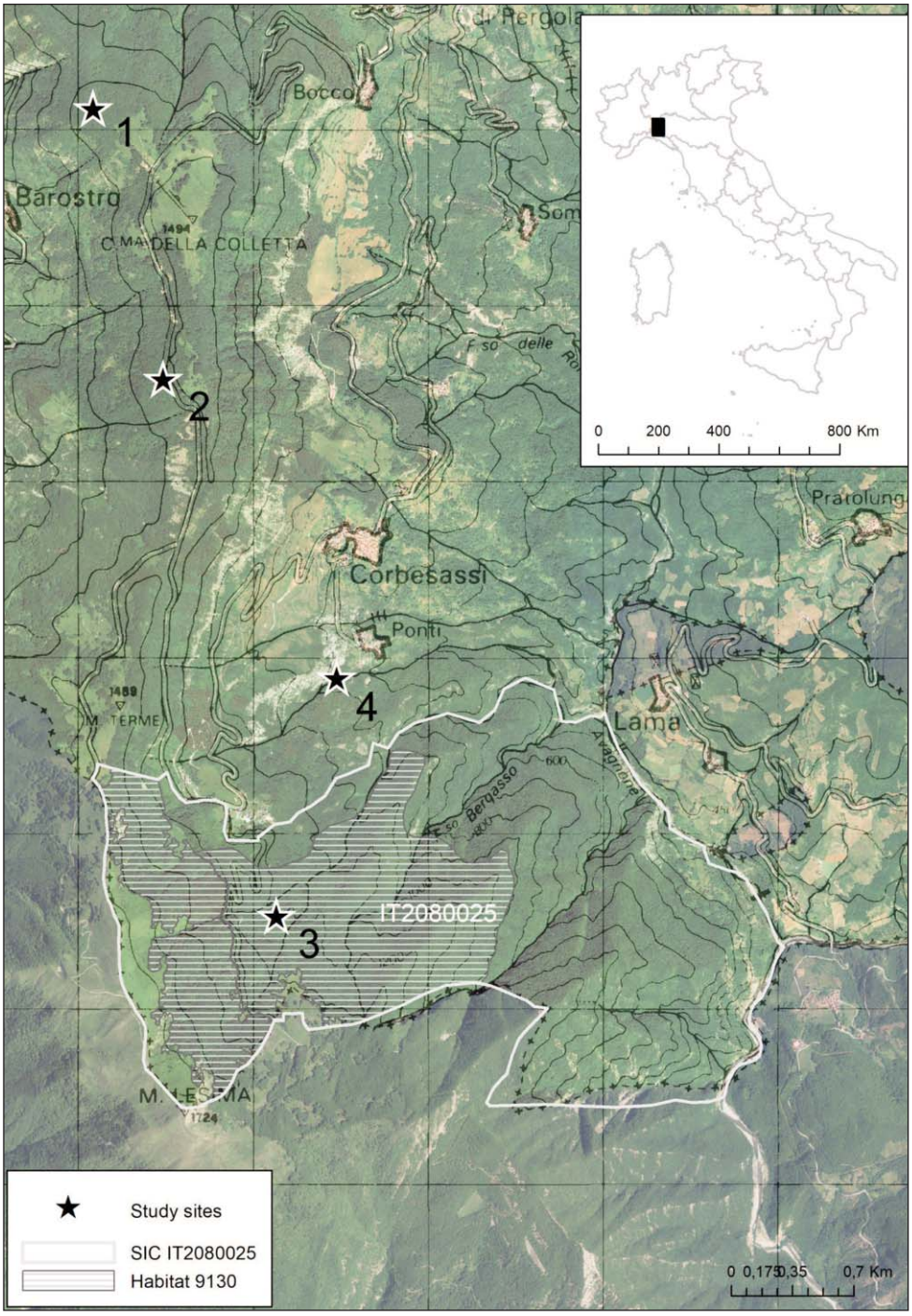

Fig. 1. Location and map of the study area and sampling sites.

valley, from the course of the Avagnone and Trebbia streams (at about 500 m) to the summit of Mount Lesima. On the steep slopes around the summit, orchid-rich mesophilous grasslands, which are currently managed through cattle grazing to prevent an invasion of shrubs and trees, are attributed to the Natura 2000 Habitat 6210* "Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchid sites)". Another relevant Habitat, which occurs scatteredly in a few sites where small travertine-forming waterfalls occur along creeks within the forest, is 7220* "Petrifying springs with tufa formation (*Cratoneurion*)". However, a wider part of the SCI surface, of about 2 km^2, is covered by a beech forest attributed to the Natura 2000 Habitat 9130 "*Asperulo-Fagetum* beech forests".

From a phytosociological point of view, this beech forest is attributed to the *Trochiscantho-Fagetum*, described from the adjacent Ligurian Apennine (Gentile 1974). The *Trochiscantho-Fagetum* has a high naturalistic value due to its rarity in Lombardia, where it occurs only in the Pavese Apennine. Furthermore, it hosts interesting floristic elements typical of the Apennines, e.g. *Trochiscanthes nodiflora*, *Anemonoides trifolia* subsp. *brevidentata*, *Acer opulifolium*, and several orchid species (Andreis & Sartori 2011). Particularly, the forest in the study area can be attributed to the subassociation *sorbetosum aucupariae*, which represents the most mesophilic aspect of the association and differs in the presence of *Cardamine heptaphylla*, *Galium odoratum*, *Stellaria nemorum*, *Sorbus aucuparia*, *Cardamine bulbifera*, and *Saxifraga rotundifolia*. Natural forests do not exist in this territory, which has been managed for hundreds of years; this beech forest is therefore in semi-natural conditions, being the result of the natural recovery of the forest from a last cut carried out more than twenty years ago. Some stands are still carefully managed to get timber in a sustainable way, or, more rarely and locally, are exploited with complete removal of trees. Old beeches with large trunks are extremely rare, but can be found in a few sites. The part of the beech forest located outside the SCI is not attributed to a Natura 2000 Habitat, but obviously belongs to the same forest type.

The bioclimate is classified as temperate oceanic submediterranean and as orotemperate termotype (Rivas-Martínez et al. 2004). According to the Köppen classification, climate is "cool temperate", with a mean annual temperature of 5°C and annual rainfall of about 1500 mm. The monthly pluviometric regime shows two maxima, in November and May, and two minima, in July and January (Maggi & Ottone 2003). Mineral substrates are built by the limestones of the "Calcare di Monte Antola" formation, consisting of alternating layers of limestones and calcareous turbidites with varying thickness, formed between 90 and 55 million years ago (Scholle 1971).

The sampling sites (Fig. 1), selected within different aspects of the beech forest, are listed and shortly described hereinafter.

1. Surroundings of Rifugio Nassano, 44°43'53"N 9°15'13"E, 1338–1365 m: coppiced beech forest including a small site with some old, large beeches; surveyed on 20.06.2022 and 15.09.2022 (field excursion of the Italian Lichen Society).

2. Between Rifugio Nassano and Monte Lesima, western slope, 44°43'02"N 9°15'30"E, 1387–1403 m: coppiced beech forest with several stumps and logs on a steep slope; surveyed on 04.10.2017 and 20.06.2022.

3. Between Piani di Lesima and Monte Lesima, eastern slope, 44°41’23”N 9°15’57”E, 1217–1253 m: coppiced beech forest with grey alder and goat willow along the creeks; surveyed on 12.04.2016 and 17.10.2022.

4. Ponti, 44°42’04”N 9°16’15”E, 892–926 m: broadleaved forest with beech, goat willow, grey alder and poplars along a creek; surveyed on 12.04.2016.

Sampling and analysis

Lichens were collected from all the available substrates in all the surveyed sites. Epiphytic species were collected mainly on bark of beech (*Fagus sylvatica*), but also the other tree species with scattered occurrences within the beech forest have been investigated, i.e. grey alder (*Alnus incana*) and goat willow (*Salix caprea*), especially along the creeks in sites 3 and 4. Epixylic species were collected from coarse woody debris, mainly stumps often covered with mosses. Epilithic species were collected in the few rock outcrops found in the understory, mainly in site 1. Epigaeic species were collected from organic soil, and epibryophytic species were found on mosses grown on both the two previous substrates.

Voucher specimens are stored in two public herbaria, i.e. GE (leg. et det. P. Giordani, G. Canali) and TO (leg. et det. E. Matteucci, S.E. Favero-Longo), and in four private herbaria, i.e. Gabriele Gheza (leg. et det. G. Gheza, F. Bottegoni, E. Cominato, J. Nascimbene, C. Pistocchi, F. Santi), Luca Di Nuzzo (leg. et det. L. Di Nuzzo), Luana Francesconi (leg. et det. L. Francesconi) and Luca Paoli (leg. et det. L. Paoli, Z. Fačkovcová, S. Munzi). Nomenclature follows ITALIC 7.0 (Nimis & Martellos 2023).

The lichen biota of the study area is characterised in terms of growth forms, photobionts, reproductive strategies, substrates and poleotolerance index, following ITALIC 7.0 (Nimis & Martellos 2023).

Results

Ninety-two taxa were recorded overall (Table 1). Out of them, eight are new to Lombardia, i.e. *Circinaria coronata*, *Glaucomaria subcarpinea*, *Gyalolechia marmorata*, *Leproplaca chrysodeta*, *Pertusaria coronata*, *Physconia servitii*, *Variospora paulii* and *Wadeana dendrographa*. Other 28 taxa, already known from the region Lombardia, were never reported before from the Oltrepò Pavese nor from the Province of Pavia (Tab. 1). Two species are listed in the Red List of the epiphytic lichens of Italy (Nascimbene et al. 2013), i.e. *Nephroma resupinatum* (“near threatened”) and *Wadeana dendrographa* (“critically endangered”).

One of the recorded species, i.e. *Kiliasia episema*, is a lichenicolous fungus. Of the lichenized taxa, most are crustose (52, 56.5%) or foliose (28, 30.4%), whereas fewer are fruticose (8, 8.7%), squamulose (2, 2.2%) or leprose (1, 1.1%). Most have a coccoid green alga as photobiont (80, 87.9%), whereas fewer have a cyanobacterium (7, 7.7%) or a trentepohlioid green alga (4, 4.4%). Most reproduce sexually (58, 63.0%), fewer by means of soredia (20, 21.7%) or isidia (13, 14.1%). The richest substrate is bark, which hosts 65 taxa (70.7%), followed by rock (16, 17.4%). Fewer species grow on dead wood (4, 4.4%), soil (3, 3.3%) and epilithic bryophytes (3, 3.3%).

Table 1. List of the lichen taxa recorded in the four sampling sites, numbered as in the materials and methods section. Taxa reported in bold are new to Lombardia, taxa marked with an asterisk are new to the Pavese Apennine and/or to the Province of Pavia. Substrates are abbreviated as follows: B: bark; W: dead wood; M: bryophytes; S: soil; R: rock, i.e. limestone of the "Calcare di Monte Antola" formation. Herbaria in which voucher specimens are deposited are abbreviated as follows: GE: University of Genova; TO: University of Torino; GG: private herbarium of Gabriele Gheza; LDN: private herbarium of Luca Di Nuzzo; LF: private herbarium of Luana Francesconi; LP: private herbarium of Luca Paoli.

	Taxon	**sampling sites**				**Voucher specimens**
		1	**2**	**3**	**4**	
01	*Amandinea punctata* (Hoffm.) Coppins & Scheid.	B				GE
02	*Anaptychia ciliaris* (L.) Flot.	B	B			GE, GG, LDN, LP
03	*Arthonia radiata* (Pers.) Ach.	B				GE, GG, LF, LP
04	*Aspicilia polychroma* Anzi *	R				TO
05	*Athallia pyracea* (Ach.) Arup, Frödén & Søchting	B			B	GG, LDN
06	*Bacidia rubella* (Hoffm.) A. Massal.				B	GG
07	*Bilimbia sabuletorum* (Schreb.) Arnold *	M				GE
08	*Blastenia ferruginea* (Huds.) A. Massal.	B	B			GG, LDN, LP
09	*Buellia disciformis* (Fr.) Mudd	B	B	B		GG
10	*Buellia griseovirens* (Sm.) Almb. *	B		B		GE
11	*Candelariella aurella* (Hoffm.) Zahlbr.	R				TO
12	*Candelariella efflorescens* R.C. Harris & W.R. Buck *	B				GE
13	*Candelariella reflexa* (Nyl.) Lettau	B	B			GE, GG, LP
14	*Candelariella xanthostigma* (Ach.) Lettau	B				LP
15	*Catillaria lenticularis* (Ach.) Th. Fr. *	R				TO
16	***Circinaria coronata* (A. Massal.)** *	R				TO
17	*Circinaria hoffmanniana* (S. Ekman & Fröberg ex R. Sant.) A. Nordin *	R				TO
18	*Cladonia coniocraea* (Flörke) Spreng.		W		W	GG
19	*Cladonia fimbriata* (L.) Fr.				W	GG
20	*Cladonia parasitica* (Hoffm.) Hoffm.				W	GG
21	*Cladonia pyxidata* (L.) Hoffm. f. *pyxidata*	S	W			LP
22	*Collema flaccidum* (Ach.) Ach.		M	B	B	GG
23	*Evernia prunastri* (L.) Ach.	B		B		GE, LDN, LP

Table 1. continued.

24	*Glaucomaria carpinea* (L.) S.Y. Kondr., Lőkös & Farkas	B	B			LP
25	*Glaucomaria leptyrodes* (G.B.F. Nilsson) S.Y. Kondr., Lőkös & Farkas *	B				GG
26	***Glaucomaria subcarpinea* (Szatala) S.Y. Kondr., Lőkös & Farkas** *			B		GG
27	*Graphis pulverulenta* (Pers.) Ach. *				B	GG
28	*Gyalolechia flavorubescens* (Huds.) Søchting, Frödén & Arup var. *flavorubescens*	B	B	B		GG
29	***Gyalolechia marmorata* (Bagl.) Nimis & Arup** *	R				TO
30	*Hypogymnia physodes* (L.) Nyl.	B				GG
31	*Hypogymnia tubulosa* (Schaer.) Hav.	B				GG
32	*Kiliasia episema* (Nyl.) Hafellner *	R				TO
33	*Lathagrium auriforme* (With.) Otálora, P.M. Jørg. & Wedin *	R	M-R	M-R		TO, GG
34	*Lecania cyrtellina* (Nyl.) Sandst. *	B				GG
35	*Lecanora argentata* (Ach.) Malme	B	B			GE, LDN, LF, LP
36	*Lecanora chlarotera* Nyl. subsp. *chlarotera*	B	B	B	B	GE, GG, LP
37	*Lecanora expallens* Ach. *	B				GE
38	*Lecanora glabrata* (Ach.) Nyl. *	B	B			GG
39	*Lecanora intumescens* (Rebent.) Rabenh.		B			GG, LP
40	*Lecidella elaeochroma* (Ach.) M. Choisy var. *elaeochroma* f. *elaeochroma*	B	B	B	B	GE, GG, LP
41	*Lepra albescens* (Huds.) Hafellner *	B	B		B	GE, GG
42	*Lepra amara* (Ach.) Hafellner	B	B		B	GE, LP
43	***Leproplaca chrysodeta* (Vain.) Ahti** *	R				LDN
44	*Lobothallia radiosa* (Hoffm.) Hafellner *	R				TO
45	*Melanelixia glabra* (Schaer.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch	B				GG, LP
46	*Melanelixia glabratula* (Lamy) Sandler & Arup *	B	B	B		GE, GG, LDN, LP
47	*Melanelixia subaurifera* (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch	B				GE
48	*Melanohalea elegantula* (Zahlbr.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch	B				GE
49	*Nephroma resupinatum* (L.) Ach.		W			GG

Table 1. continued.

50	*Ochrolechia pallescens* (L.) A. Massal.	B				GE, GG
51	*Parmelia saxatilis* (L.) Ach.	B	B	B		GE, GG
52	*Parmelia sulcata* Taylor	B	B	B		GE, GG, LF, LP
53	*Parmelina pastillifera* (Harm.) Hale	B	B			GE
54	*Parmelina tiliacea* (Hoffm.) Hale	B	B			LF
55	*Parmeliopsis ambigua* (Hoffm.) Nyl.	B				LF
56	*Peltigera horizontalis* (Huds.) Baumg. *	S	S			GG
57	*Peltigera praetextata* (Sommerf.) Zopf	S	S	S, R		GG
58	*Pertusaria coccodes* (Ach.) Nyl.	B				GG
59	***Pertusaria coronata* (Ach.) Th. Fr.** *	B				GG
60	*Pertusaria flavida* (DC.) J.R. Laundon *	B				GG, LDN, LP
61	*Pertusaria hymenea* (Ach.) Schaer. *	B				GE
62	*Pertusaria pertusa* (L.) Tuck.	B				GE, GG
63	*Phaeophyscia ciliata* (Hoffm.) Moberg				B	GG
64	*Phlyctis agelaea* (Ach.) Flot. *	B		B		GG, LDN
65	*Phlyctis argena* (Spreng.) Flot.	B	B	B	B	GG, LP
66	*Physcia adscendens* H. Olivier	B			B	GE, GG, LP
67	*Physcia aipolia* (Humb.) Fürnr.				B	GG
68	*Physcia leptalea* (Ach.) DC. *	B				GE
69	*Physcia stellaris* (L.) Nyl.				B	GG
70	*Physconia enteroxantha* (Nyl.) Poelt	B			B	GG
71	*Physconia grisea* (Lam.) Poelt subsp. *grisea*			B		GG
72	***Physconia servitii* (Nádv.) Poelt** *	B				LP
73	*Pleurosticta acetabulum* (Neck.) Elix & Lumbsch	B	B			GE, GG, LDN, LP
74	*Polyozosia hagenii* (Ach.) S.Y. Kondr., Lőkös & Farkas	R				TO
75	*Protoblastenia rupestris* (Scop.) J. Steiner subsp. *rupestris*	R				TO
76	*Pseudevernia furfuracea* (L.) Zopf var. *furfuracea*	B	B			GE, GG, LP
77	*Pseudevernia furfuracea* var. *ceratea* (Ach.) D. Hawksw. *	B				GE
78	*Pseudoschismatomma rufescens* (Pers.) Ertz & Tehler *				B	GG

Table 1. continued.

79	*Ramalina fastigiata* (Pers.) Ach.	B	B			GE, GG, LDN, LF
80	*Ramalina fraxinea* (L.) Ach.	B	B			LP
81	*Scoliciosporum umbrinum* (Ach.) Arnold	B				GE, LDN, LP
82	*Scytinium gelatinosum* (With.) Otálora, P.M. Jørg. & Wedin *	S				LF, LP
83	*Scytinium lichenoides* (L.) Otálora, P.M. Jørg. & Wedin *	S	M-R	M-R		GE, TO, GG, LF
84	*Tephromela atra* (Huds.) Hafellner var. *torulosa*	B	B			GE, GG, LDN, LP
85	*Tetramelas chloroleucus* (Körb.) A. Nordin *	B				GG
86	*Thelidium decipiens* (Nyl.) Kremp. *	R				TO
87	***Variospora paulii* (Poelt) Arup, Frödén & Søchting ***	R				TO
88	*Verrucaria dolomitica* (A. Massal.) Kremp. *	R				TO
89	*Verrucaria macrostoma* DC. f. *macrostoma*	R				TO
90	***Wadeana dendrographa* (Nyl.) Coppins & P. James ***	B				GE
91	*Xanthocarpia crenulatella* (Nyl.) Frödén, Arup & Søchting *	R				TO
92	*Xanthoria parietina* (L.) Th. Fr.	B			B	GE, LDN, LP
	Number of taxa per site	78	33	17	19	

The analysis of the poleotolerance index reveals that 2 species (2.2%), i.e. *Nephroma resupinatum* and *Wadeana dendrographa*, are typical of old trees in old-growth forests (index = 0), while 24 taxa (26.1%) occur mostly in natural or semi-natural habitats (index = 1); 40 (43.5%) can occur also in moderately disturbed areas (index between 1 and 2), and the other 26 (28.3%) are able to tolerate also heavily disturbed conditions (index between 1 and 3).

Discussion

The Oltrepò Pavese confirmed to be a promising area for lichenological research (Ravera & al. 2018, 2023). The number of species recorded in this study is high, suggesting a significant contribution given by this area and by the Apennine beech forest habitat to the regional lichen diversity. In fact, most of the beech forests of Lombardia are located in the Prealps, where both climate and plant species composition are different (Andreis & Sartori 2011) – they are even attributed to different Natura 2000 Habitats, i.e. 9110 "*Luzulo-Fagetum* beech forests" and 91K0 "Illyrian *Fagus sylvatica* forests (*Aremonio-*

Fagion)" – and preliminary data showed that lichen biota is generally poorer there (Gheza et al. 2020 and unpublished data).

Half of the newly recorded taxa are epilithic, highlighting the poor knowledge of this guild in the area. In the Oltrepò Pavese, extensive work was dedicated to epilithic lichens of ophiolite outcrops (Valcuvia Passadore & Delucchi 2002; Delucchi & Valcuvia Passadore 2004; De Vita & Valcuvia Passadore 2004; De Vita & al. 2004), but carbonatic sedimentary rocks, which are the most widespread in the area, have generally been neglected, except for a few scattered records published in recent years (Ravera & al. 2018). On the other hand, the occurrence of newly reported epiphytic species suggests that areas hosting suitable forest habitats need further studies.

Most of the newly recorded taxa are found mainly in the peninsular part of Italy, with a mainly Tyrrhenian (*Gyalolechia marmorata*, *Pertusaria coronata*, *Physconia servitii*, *Wadeana dendrographa*) or Adriatic (*Glaucomaria subcarpinea*) distribution (cf. Nimis & Martellos 2023). This highlights the suitability of the Pavese Apennine for species with a more Mediterranean distribution.

Among the species of conservation value, *Nephroma resupinatum* and *Wadeana dendrographa* are recognized as species of old-growth forests (Nimis & Martellos 2023) and are also included in the Red List of the epiphytic lichens of Italy (Nascimbene et al. 2013). Other species rarely recorded in the Region, and therefore considered of some conservation interest at least at the regional level, are *Aspicilia polychroma*, *Bacidia rubella*, *Buellia disciformis*, *Buellia griseovirens*, *Candelariella efflorescens*, *Lecanora glabrata*, *Lecanora intumescens*, *Ochrolechia pallescens*, *Pertusaria coccodes*, *Pertusaria flavida*, *Pertusaria hymenea*, *Tetramelas chloroleucus*, besides the newly reported taxa.

Site 1 was the richest in lichen species, probably due to two main reasons. Firstly, the joint effort of the lichenologists who attended the field excursion of the Italian Lichen Society congress took place there, while the other sites were explored by a single lichenologist. This aspect highlights the effectiveness of field surveys carried out involving many experts, recognized as the best way to detect the highest-possible lichen diversity of a territory (Vondrák et al. 2016). Furthermore, site 1 is the only investigated site that hosts old beech trees and large rock outcrops. Old trees are recognized as key components to foster epiphyte diversity in beech forests (Fritz 2008; Fritz & al. 2009; Hofmeister & al. 2016) and they can also act as microrefugia for rare and threatened species (Di Nuzzo & al. 2022). In addition, the occurrence of rock outcrops enhances species richness, offering the suitable substrate for the establishment of a further guild, i.e. epilithic lichens, which is not often represented in forests, where substrates for epiphytic and epixylic species prevail.

This extensive survey within the single Natura 2000 Habitat 9130 "*Asperulo-Fagetum* beech forests" is a first contribution to the knowledge of the lichen biota of this specific Habitat and of the Natura 2000 Network, where lichens are in general understudied (Rubio-Salcedo et al. 2013; Orlikowska et al. 2016). The knowledge of the relations between the lichen biota and Natura 2000 Habitats is partly developed only in very few European areas (e.g. Latvia: Moisejevs 2016), and practically not developed at all in Italy. These results suggest the importance of including lichen species in conservation policies and management practices (Rubio-Salcedo et al. 2013; Gheza et al. 2022c). An effort to frame red-listed epiphytic species within Natura 2000 Habitats was made by Nascimbene et al. (2013) based on an expert assessment, while a few recent papers reported epiphytic

lichens from forest habitats in areas of limited extent (Gheza & al. 2020, 2022b). Far better efforts are required to properly address this issue at a national scale, unavoidably including extensive fieldwork.

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