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## CONTRIBUTION TO THE KNOWLEDGE OF *MANNIA CALIFORNICA* (GOTTSCHÉ EX UNDERW.) L.C. WHEELER IN ITALY NEW REPORTS FROM NORTHERN ITALY (VENETO – VICENZA PROVINCE)

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**Abstract** - LUCIANO GIOVAGNOLI & CORRADO VIVIAN - Contribution to the knowledge of *Mannia californica* (Gottsché ex Underw.) L.C. Wheeler in Italy. New reports from northern Italy (Veneto - Vicenza Province).

*Mannia californica* (Gottsché ex Underw.) L.C. Wheeler was reported, in 2006, as new to Europe from Ardèche department, France. Afterwards, this rare hepatic was found also in Austria (2017) and in Italy (2019, 2020), in the Como and Lecco Province.

In this paper new findings of *Mannia californica* are reported to Veneto, in the Colline Subalpine between Bassano del Grappa and Thiene (Vicenza Province), an interesting sandstone/volcanic complex close to the southern slope of the Asiago Plateau.

The Veneto communities are briefly described from an ecological and phytosociological point of view. *Mannia californica* is compared with other European species of the genus *Mannia*, notably *Mannia androgyna* and *Mannia fragrans*.

**Keywords:** Colline Subalpine Venete, *Grimaldion fragrantis*, *Mannia androgyna*, *Mannia californica*, *Mannia fragrans*, *Mannion androgynae*, Oligocenic Sandstones.

**Riassunto** - LUCIANO GIOVAGNOLI & CORRADO VIVIAN - Contributo alla conoscenza di *Mannia californica* (Gottsché ex Underw.) L.C. Wheeler in Italia. Nuovi ritrovamenti nel nord Italia (Veneto - Provincia di Vicenza).

*Mannia californica* (Gottsché ex Underw.) L.C. Wheeler viene riportata, nel 2006, come specie nuova per l'Europa nel dipartimento di Ardèche, Francia. In seguito, questa rara epatica è stata trovata anche in Austria (2017) e Italia (2019, 2020), nelle province di Como e Lecco.

In questo lavoro vengono riportati nuovi ritrovamenti nel Veneto, nelle Colline Subalpine tra Bassano del Grappa e Thiene (Provincia di Vicenza), un interessante complesso di arenarie e rocce vulcaniche posto a ridosso della scarpata meridionale dell'Altopiano di Asiago.

I popolamenti veneti vengono descritti da un punto di vista ecologico e fitosociologico. *Mannia californica* è confrontata con altre specie del Genere *Mannia*, soprattutto *Mannia androgyna* e *Mannia fragrans*.

**Parole chiave:** Colline Subalpine Venete, *Grimaldion fragrantis*, *Mannia androgyna*, *Mannia californica*, *Mannia fragrans*, *Mannion androgynae*, Arenarie oligoceniche.



Fig. 1 - *Mannia californica* (Gottsche ex Underw.) L.C. Wheeler.

## INTRODUCTION

During some excursions (2019 - 2020) aimed at studying the flora and vegetation of the Colline Subalpine Venete (Veneto, Vicenza Province), close to the southern slope of the Asiago Plateau, between Bassano del Grappa and Thiene, we had the opportunity to observe discrete communities of liverworts belonging to the *Marchantiales* Limpr. (liverworts with “complex” thallose gametophyte). The study aimed at the rock outcrops of Oligocene sandstones, alternating with basaltic flows (pillow breccias), within the xerothermic mixed Oak wood, revealed the presence of *Mannia androgyna* (L.) A. Evans, *Mannia triandra* (Scop.) Grolle, *Mannia fragrans* (Balb.) Frye & Clark and, above all, *Mannia californica* (Gottsche ex Underw.) L.C. Wheeler<sup>1</sup> (Fig. 1).

This very rare liverwort is distributed from North America to Asia and Africa; initially considered endemic to California, but then found in several parts of North America with Mediterranean climate, it was subsequently found for the first time in Europe, i.e. in France (HUGONNOT & SCHILL, 2006), Austria (Köckinger, 2017), Italy (BRUSA & HUGONNOT, 2019) and also in the Asian continent, in China (SCHILL, 2006) and India (SCHILL, 2006). The findings in Veneto represent the third report from northern Italy, after the first report from Lenno (Como) (BRUSA, HUGONNOT in ELLIS *et al.*, 2019) and the second one from Galbiate, at the foot of Mt. Barro (Lecco) (BRUSA, 2020).

<sup>1</sup> In the neighbouring Pre-Alps area, *Mannia androgyna* is moreover present in the Canale di Brenta, along the cliffs of Cison del Grappa (western slope of the Grappa Massif) and just north of Valstagna (Montini, 1832) (eastern slope of the Asiago Plateau), *Mannia fragrans* along the path from Costa/Valstagna to Valgoda/Enego (eastern slope of the Asiago Plateau), *Mannia triandra*, species more widespread than the others, along the path from Costa/Valstagna to Valgoda/Enego (eastern slope of the Asiago Plateau), along the cliffs above Pove del Grappa (western slope of the Grappa Massif) and along the southern slope of the Grappa Massif, at the locality Napon.

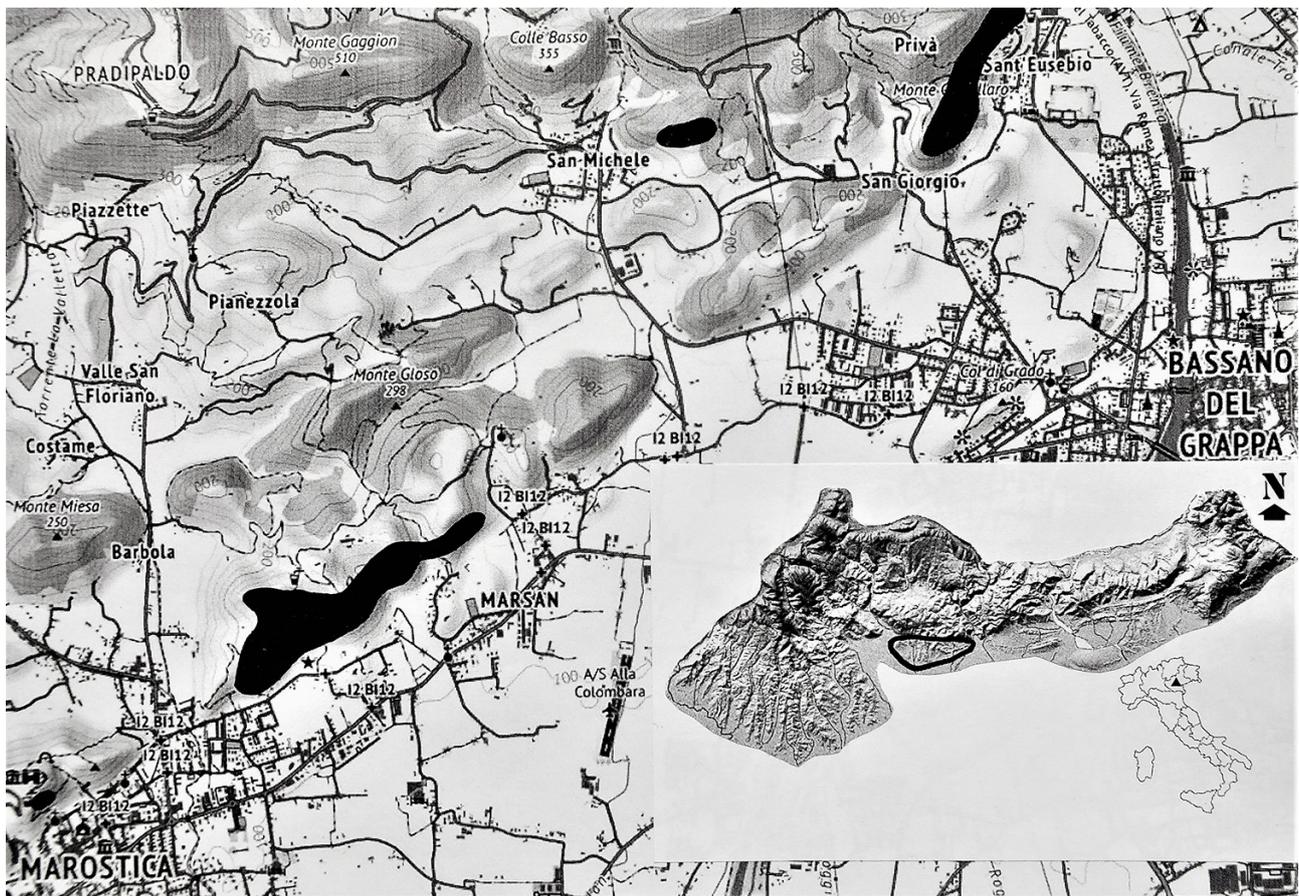


Fig. 2 - The Colline Subalpine Venete (the Venetian Prealps, Vicenza Province) and the *Mannia californica* bryo-community stands.

## STUDY AREA

The foothills between Thiene and Bassano del Grappa, known as Colline Subalpine Venete (the Venetian Prealps), extend between the Brenta river and the Astico stream, with a separate nucleus, to the west, between the Astico and Igna streams (Fig. 2).

It is a complex characterized by extensive outcrops of eruptive rocks, mainly basalts but also tuffs and fossiliferous breccias of prevalently Oligocene Age (Lower Oligocene) whose formation is to be linked to the Berico-Lessinian eruptive activity, in the western hilly part and along the southern foot, while, in the eastern part, there are mainly sandstones. The Lower Miocene outcrops, with a narrow band, in the south-eastern part, between S. Eusebio/S. Trinità of Bassano del Grappa and Marostica/Molvena. These are glauconous marls and calcareous sandstones. The Oligocene outcrops mainly in the eastern part of the hilly complex between S. Michele di Bassano del Grappa and Calvene. These are glauconous sandstones, nulliporic limestones and calcareous-marly strata interspersed with basaltic tuffs. The Upper Eocene is present along a narrow strip that

connects S. Bovo to Caltrano. These are blue-ashy marls with bryozoans and coarse limestones.

The Middle Eocene is represented, beyond the previous strip, between Valrovina and Mortisa. These are more or less marly and coarse limestones

The Lower Eocene is represented, beyond the previous strip, along the same extent. These are gray marls and marly limestones.

According to Pinna's climate classification (1970), inspired by Köppen's general scheme, the Veneto foothills are affected by a subcontinental temperate climate, up to 600 m altitude (average annual temperature between 10° and 13°C). The average annual rainfall (1992-2001) is 1300 mm in Marostica and 1259,7 mm in Bassano del Grappa. The average annual temperature (1992-2001) is 13° C for both localities. Winter is relatively harsh and is the driest season, the intermediate seasons are characterized by the prevalence of Atlantic and Mediterranean perturbations and summer records typical stormy phenomena (AA.VV., ARPAV, 2000; MENEGHIN, RECH, 2011).

## MATERIALS AND METHODS

The distribution of the *Mannia californica* bryo-communities was defined on the basis of the identification of microniches located along the sheltered cracks present in the rocky banks of Oligocene sandstones, in a warm and sunny environment, within the xerothermic mixed Oak woods. Eight relèves were carried out following the Zurich-Montpellier school (BRAUN-BLANQUET, 1964) with coverage values modified by PIGNATTI (1976).

The bryophyte nomenclature and systematic order follow SÖDERSTRÖM *et al.* (2016) for liverworts and ROS *et al.* (2013) for mosses. The vascular plant nomenclature follows BARTOLUCCI *et al.* (2018). The bryophyte syntaxonomic ordering and nomenclature follow PUGLISI & PRIVITERA (2012).

Bioindication values to define the ecology of the *Mannia californica* bryo-communities follow ELLENBERG *et al.* (1991). Chorotypes and life forms follow DIERSSEN (2001) and AUGIER (1966).

The pH values of the nike substratum were obtained with a Hanna Instruments pH meter (with pH 4.01 and 7.01 electrode calibration solutions) in aqueous solution with a weight/volume ratio of 1:2,5.

The spore structure images of *Mannia californica* and *Mannia androgyna*, for comparison, were obtained with SEM Zeiss at the MUSE-Science Museum of Trento by Dr. Paolo Ferretti. The *Mannia californica* and *Mannia androgyna* thallus section images were obtained with a Nikon Eclipse Ci microscope at the MUSE-Science Museum by Dr. Francesca Paoli.

## RESULTS AND DISCUSSION

*Mannia californica* occurs (Fig. 1) usually in 6 to 20 mm thalli, 1 to 4 mm wide and 10 to 20 mm long, often tinged with purple, forming dense carpets of interwoven segments. Thalli, when dried, curl up, exposing the underlying dark purple part, giving rise to a dried mass of small blackish “vermicelli”. The upper surface of the thallus has a dark green colour with a thin purplish stripe at the margin, minutely wavy-lobulated, while the lower one almost appears completely hidden by bright superimposed dark purple scales. Ventral scales are 0,3 - 0,5 mm wide and 0,8 - 1,2 mm long, lunate, dark purple, not forming a dense apical bundle but often protruding beyond the margin of the thallus, with 1 -2 filiform appendages, strictly triangular, purple, not

restricted at the base. Aeriferous pores are simple and elevated, surrounded by 2-3 concentric rings of cells in 6 to 8 rows. They become wider with age. Epidermal cells have distinct triangles. Thalli have latero-ventral and, apparently less frequently, dichotomous branches. Aerenchima very compact, almost occupied with chlorophyllous divided free filaments, with scattered oil cells. Ventral tissue occupying 0,5-0,7 of thallus height, with many scattered, obscure blackish to occasionally dark grey-brownish oil bodies. Autoicous, frequently fertile, but gynoecia vanishing after spore release. Androecia born over the main thallus, forming an irregular median group of antheridia. Female receptacle restricted to short latero-ventral cordiform branches, serially arranged along the main axis. Carpocephala with 2-5 campanulate lobes beneath. Sporophyte blackish, elaters purplish, spores dark violet-brown, 50-90 µm diameter, with dissimilar sculpturing on distal and proximal surface. Distal face deeply ornamented with irregular areolae, occasionally alveolate and ridged, minutely verruculose (Fig. 3); proximal face similarly sculptured but with an indistinct trilete scar (Fig. 4).

*Mannia californica* can be confused with other congeneric species, especially with the closely related *Mannia androgyna*.

They cannot be distinguished only on the basis of macroscopic vegetative characters. The essential characters distinguishing *Mannia californica* from *Mannia androgyna* are the structure of the spores with ridged and alveolate sculpture (Fig. 3 - 4) and the dark oil bodies in the transverse section of the thallus (Fig. 5), while *Mannia androgyna* shows spores with typically saccate sculpture (inflations) (Fig. 6) and distinctly pale oil bodies (Fig. 7). Another good character of *Mannia californica* is the position of the archegoniophores, mainly located on cordiform, reduced ventral lobes, serially arranged along the main axis (Fig. 8). In *Mannia androgyna*, gynoecia are usually located in apical notch of main branches. Schuster (1953, 1974, 1992 a-b) refers occasional gynoecia on shorter ventral branches also in *Mannia androgyna*.

*Mannia fragrans* is, instead, generally easy to distinguish from *Mannia californica* by the presence of apical, white, tufted ventral scales, conspicuously protruding and strongly odorous.

In sterile condition *Mannia californica* can be confused with *Reboulia hemisphaerica*. However, its thallus margins are not sinuose and the purplish thallus border and the scale appendages are wider.

The *Mannia californica* dominated bryo-communities, found in the Colline Subalpine Venete, between

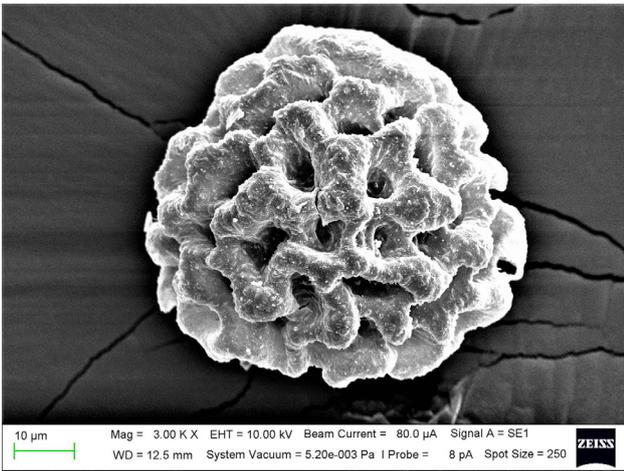


Fig. 3 - *Mannia californica* spores: sculpturing distal face with areolae and anastomosing ridges (SEM Zeiss, by Dr. Paolo Ferretti, MUSE-Science Museum, Trento).

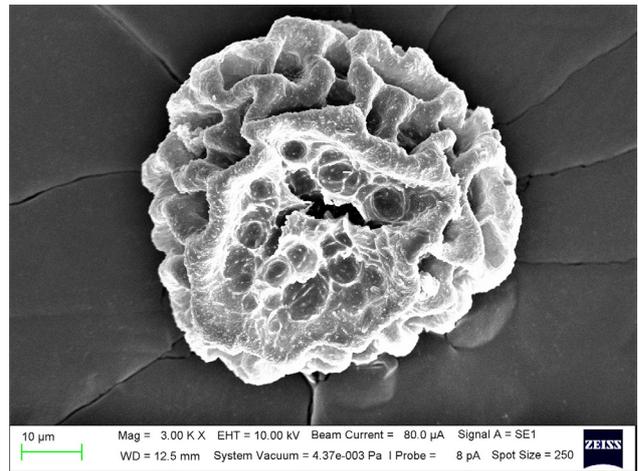


Fig. 4 - *Mannia californica* spores: proximal face, with sculpture similar to the distal one but with indistinct trilete scar (SEM Zeiss, by Dr. Paolo Ferretti, MUSE-Science Museum, Trento).

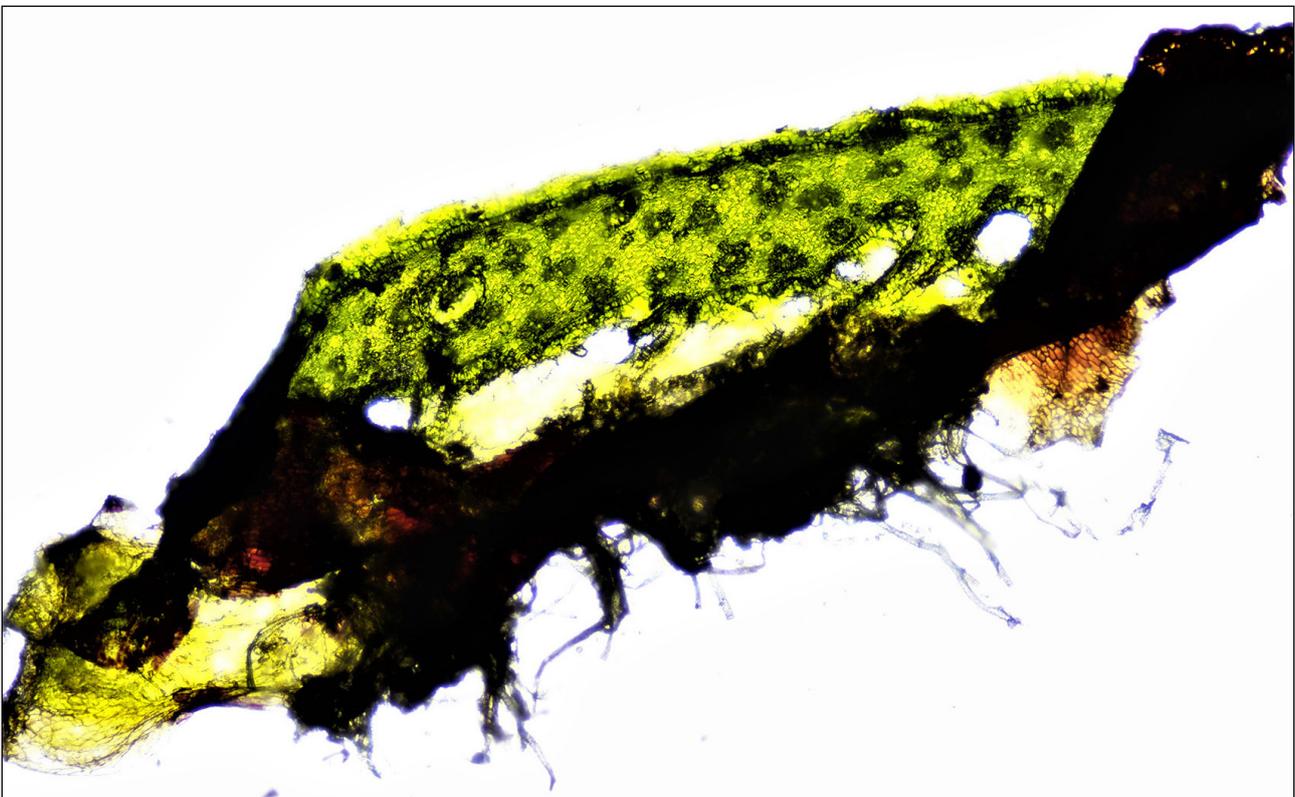


Fig. 5 - *Mannia californica*: thallus section with evident dark oil bodies immersed between the cells of the ventral tissue (Nikon Eclipse Ci microscope by Dr. Francesca Paoli MUSE-Science Museum, Trento).

Bassano del Grappa and Marostica, develop, with a linear structure, mainly along the earthy joints of the Oligocene sandstone layers, where thin clay material with slightly acidic to neutral pH accumulates. These niches (0,30 - 1sq m), sheltered from direct sunlight, benefit from temporary rivulets of rainwater gushing from the sandstone crevices, mitigating the extreme dry conditions (Fig. 9).

The coenosis, distributed from 130 to 270 m. a.s.l., with southern exposure, enjoys of medium aridity, thanks to the discontinuous “canopies” of ferns (*Ceterach officinarum*, *Asplenium trichomanes/quadrivalens*, *Asplenium ruta-muraria*) or coenoses of *Crassulaceae* (*Sedum album*, *Sedum acre*) and other xerophilous vascular species. These conditions occur mainly in open stands (arid/rupicolous clearings in the xerothermic mixed

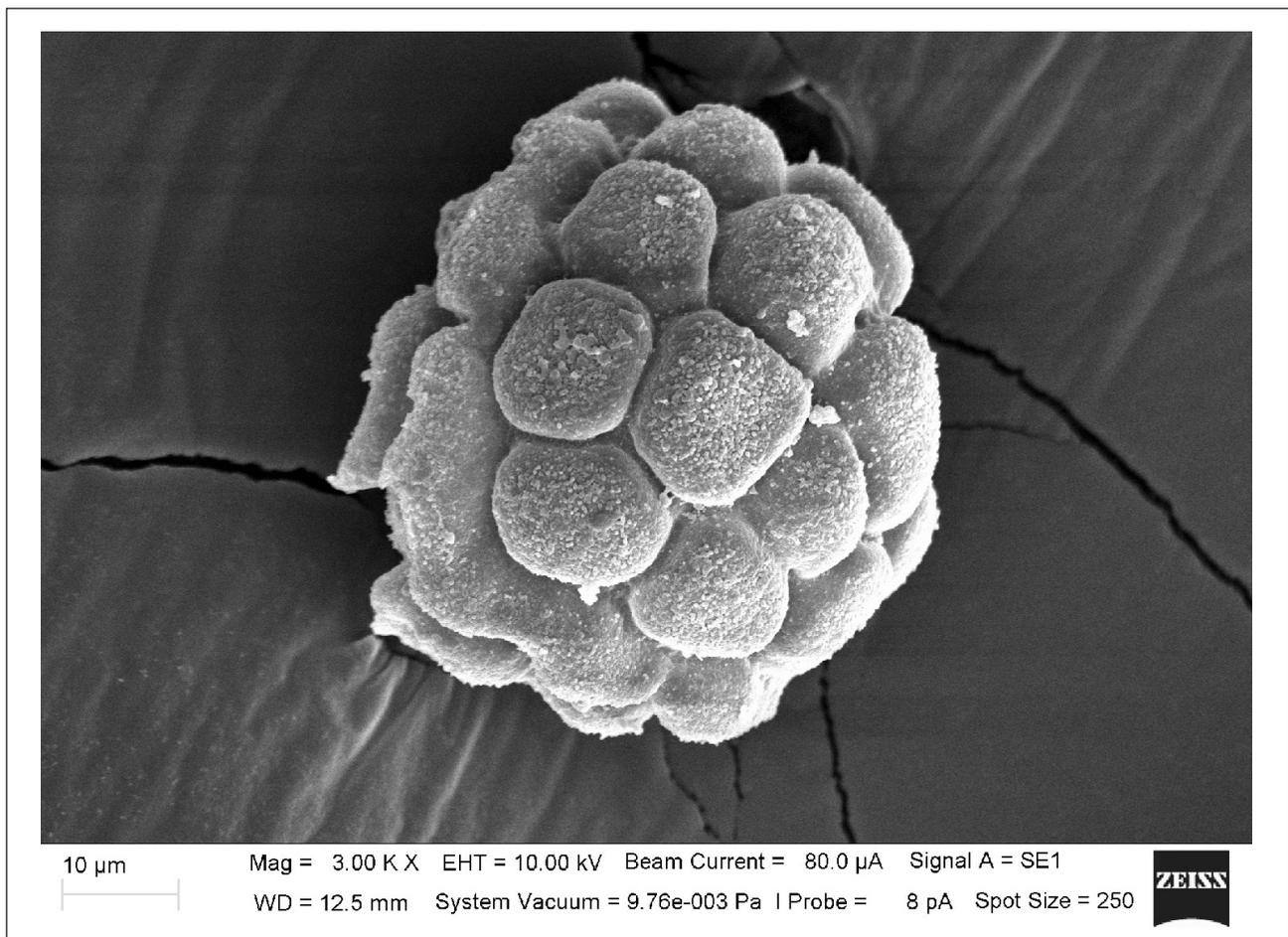


Fig. 6 - *Mannia androgyna* spores: proximal face with typically saccate sculpture (SEM Zeiss, by Dr. Paolo Ferretti, MUSE-Science Museum, Trento).

Oak wood, characterized by xeric meadow patches with *Bromus erectus*, *Crhysopogon grillus*, *Heteropogon contortus*). The *Mannia californica* cenosis occurs, more rarely, also in rock stands with wider clay loam pockets, rich in thin sandstone detritus, in a situation of more sensitive covering by xerothermic mixed Oak wood. In these cases, dense mats of *Mannia californica* thalli colonize larger surfaces than those insisting, with linear structure, along the thin sandstone joints, but, being less protected during their vegetative season and lodging on a very superficial and more exposed soil, they are subject to lose adherence, owing to the desiccation and detachment of soil in summer or the action of occasional frost, in winter.

The bryophytes of these niches on sandstones are more or less rich or poor depending on the microclimatic characteristics, such as insolation, microtopography and coverage of rupicolous plant communities or xeric meadows.

The vascular herbaceous cover that often protects the *Mannia californica* thalli mats, coming more or less in contact with this bryophytic coenosis, is discontinuous

and composed of *Asplenieta trichomanis* (Br.-Bl. in Meier et Br.-Bl. 1934) OBERD, 1977, *Sedo-Scleranthetea* Br.-Bl. 1955, *Koelerio-Corynephoretea* Klika in Klika et Novák 1941, *Festuco-Brometea* Br.-Bl. et Tx.ex Klika et Hadač 1944 species.

*Mannia californica*, sometimes, appears also as a border element of rupicolous coenoses present in the Oligocene sandstone crevices, especially those belonging to the class *Sedo-Scleranthetea* and *Asplenieta trichomanis*. *Mannia californica* is in active vegetation during winter. Wind and insolation, sometimes abruptly cause the thalli dehydration, so that they take on an involute shape with the edges covering the inner thallus surface, making the communities appear as dark spots not easily recognizable. Occasional summer rains favour the thalli rehydration, thus prolonging the active growth of the liverwort.

As regards the phenological reproductive phase of the species, we note that the carpocephala develop towards the end of winter (late February, March), releasing the spores in May. These are very abundant and easily

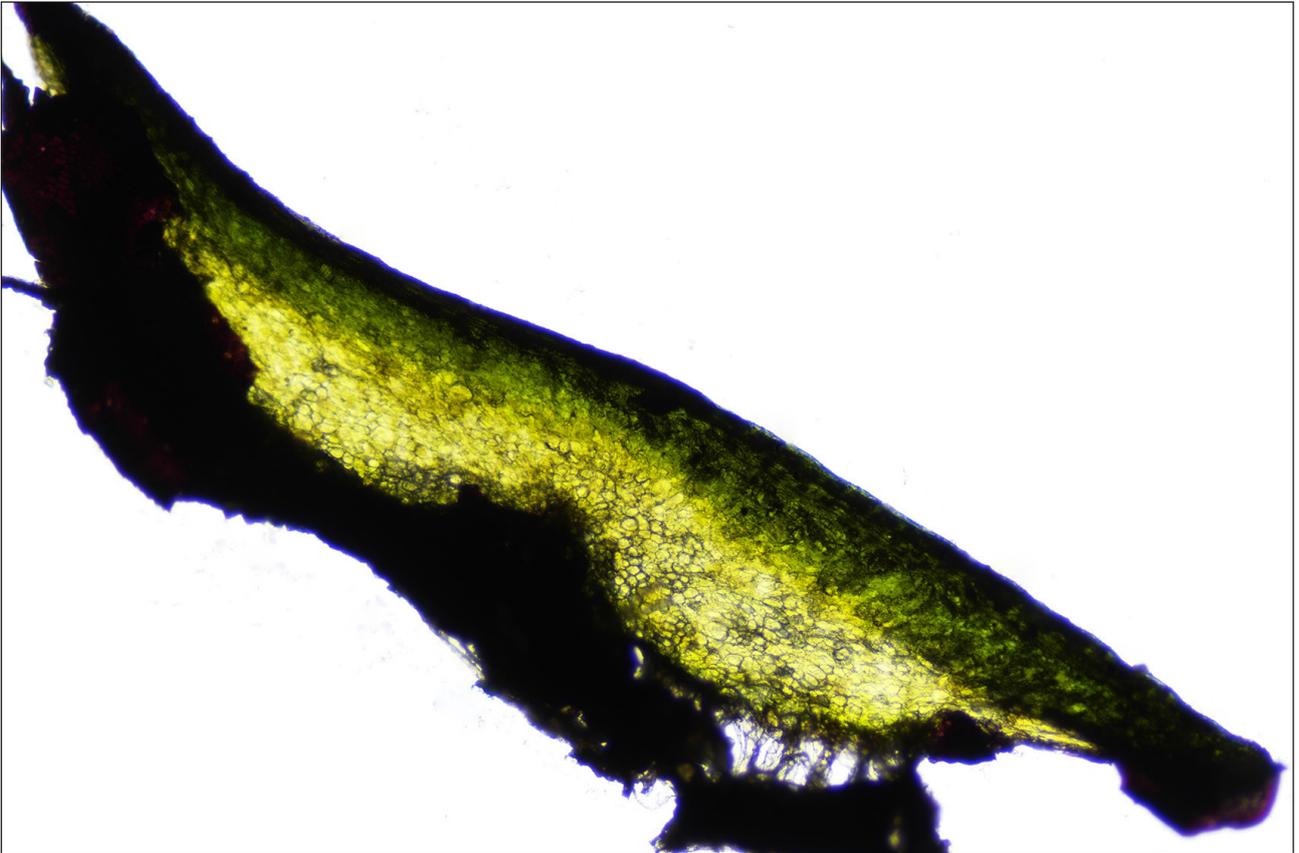


Fig. 7 - *Mannia androgyna*: thallus with evident pale oil bodies immersed between the cells of the ventral tissue (Nikon Eclipse Ci microscope by Dr. Francesca Paoli MUSE-Science Museum, Trento).



Fig. 8 - Archegoniophores of *Mannia californica* located on latero-ventral cordiform branches arranged in series along the main thallus with androecium over the centre of this one.

found among the thalli even after the disappearance of the sporophytes. The spores are spread by the action of gravity, wind and rain and have little chance of survival, since the narrow earthy joints between the layers of the sandstone banks are limited.

The *Mannia californica* stands of the Colline Subalpine Venete, are, without any doubt, natural, as they are located on unaltered rock slopes, inside or at edge of the xerothermic mixed Oak wood. Secondary micro-stands have also been rarely observed on dry stone walls with earthy pockets.

*Mannia californica* is considered endangered (EN - Endangered) in Europe (Hodgetts *et al.* 2019). The communities of the Colline Subalpine Venete enjoy a good degree of natural protection, as they are well preserved in stands not subject to human remodelling of slopes, nor to tourist stress or other forms of anthropogenic pressure. However, the rarity of this species in Italy, and the discontinuity of the communities, with strongly punctiform localization, must be pointed out. Molecular studies suggest that there may be several cryptic species in *Mannia californica* (Schill 2006; Borovichev *et al.* 2015). Plants found in Austria share the key morphological features (spores sculpture, dark oil bodies) of *Mannia californica*, but differ in having gynoeceum and androeceum on the main thallus and possess an isolated genetic position (Schill, 2006).

The stands are distributed inside a particularly sheltered and warm range of the hills between Marostica (Mt. Pausolino) and Bassano del Grappa (the S. Eusebio Hills). They include, from west to east, Mt. Pausolino, Mt. S. Benedetto, Mt. Cubalchi, Mt. Scmazzon, Mt. Costapelosa, Mt. Ronchetti, Mt. Sissiello (Fig. 1).

From a phytosociological point of view, the *Mannia californica* communities, found in the Colline Subalpine of Veneto belong to the alliance *Mannion androgynae* Ros & Guerra 1987, class *Barbuletea unguiculatae* Mohan 1978, order *Barbuletalia unguiculatae* Hubschm. 1960, alliance that includes terricolous basophyllous bryo-communities dominated by thallose liverworts (Table. 1). *Mannion androgynae* is a pioneer bryophyte vegetation on dry soils, in Mediterranean seals (Spring vegetation rich in thalloid liverworts, exochomophytic and casmocomophytic, subneutrophytic, Mediterranean) and is the southern vicar of the *Grimaldion fragrantis* Šmarda *et* Hadač 1944, Central European vegetation, oligotrophic and meso-xerophytic vegetation on basic soils. *Barbuletea unguiculatae* communities are established on soils or protosoils with a basic to neutral pH (pH found in the Colline Subalpine Venete 6,8) in

earthy joints. Acrocarpous mosses, with abundant, annual and biennial species (Musco-therophyta), prevail in these communities, but there are also liverworts with an annual cycle (Hepatico-therophyta). They are mostly found on open and dry soils and can also be found in conditions of less photophilia and xericity. Sometimes, in fact, they form the bryophytic basal layer of mesotrophytic phanaerogamic associations, behaving, in this case, as photo-sciaphilous and xero-mesophyllous. This class, very widespread at low altitude, is well represented in Central Europe, being widely found also in the Mediterranean area.

They can be interpreted as sub-Mediterranean micro-seals, discontinuously distributed in well sheltered areas, where the thin and dry soils and the strong insolation accentuate the already foothills mild climate, inside a hilly area characterized by sub-continental climate, underlined by the presence of bryophytes belonging to the alliance *Grimaldion fragrantis*. Our interpretation is supported by the presence, close to this area, of a further, significant, although sporadic, presence of stenomediterranean vascular species (xerothermic relicts), such as *Asparagus acutifolius*, *Rhamnus alaternus*, to which we can associate *Olea europea* (olive growing in Veneto has ancient origins, having been introduced in Roman times, although it has seen the maximum development in the Middle Ages by monastic institutions), that have their main nucleus between Pove del Grappa e Romano d'Ezzelino, with a small presence, beyond the Brenta river, close to the S. Eusebio hills, where the extreme southeastern Italian stands of *Mannia californica* are located. These typical oases of xerothermic species, probably penetrated during the Subboreal (3-4 thousand years ago), with a slightly warmer climate than today, are the rearguards of larger communities, eliminated almost everywhere by the climate deterioration of the last 2500 years, except in the small warmer oases where they have been able to keep up today. *Mannia californica* thus seems to develop in this limited area, west to the Brenta, between the S. Eusebio and the S. Benedetto/Pausolino hills, beyond which the conditions of (sub) mediterraneity disappear.

The coenosis we found seems to have its own autonomy, compared to *Reboulia hemisphaericae-Targionietum hypophyllae* Gil 1997 which grows in environments with more marked oceanic conditions and moderate acidity. The name we proposed for this bryophytic coenosis is *Mannietum californicae* ass. nova hoc loco (Table. 1).

Tab. 1 - Bryophyte communities dominated by *Mannia californica* (Gottsche ex Underw.) L.C. Wheeler (*Mannietum californicae* bryophytic ass. nova hoc loco, holotypus reléve n° 7).

Reléve n°	1	2	3	4	5	6	7	8	F
Location	Mt. Pausolino	S. Benedetto	Mt. Castellaro	Mt. Ronchetti	Cubalchi	Scomazzon	Mt. Sissello	Cubalchi	R
Relèves data	15.12.2019	20.12.2019	28.12.2019	15.03.2020	10.05.2020	10.05.2020	10.05.2020	20.05.2020	E
Altitude a.s.l.	150	130	260	270	225	175	200	150	Q
Exposure	S	S	S	S	S	S	SE	S	U
Inclination in °	45	45	50	30	45	45	45	45	E
Surface rel. Sqm.	1	1	0,50	1	0,50	0,50	0,30	0,50	N
Bryophyte cover %	60	60	40	50	60	60	40	40	C
N° species per reléve	7	7	5	7	9	8	5	6	Y
Char. <i>Mannion androgynae</i>									
<i>Mannia californica</i>	4	2	1	2	2	4	2	2	100
<i>Mannia androgyna</i>	+	•	•	•	•	•	•	+	25
Char. <i>Barbuletalia unguiculatae</i>									
<i>Bryum argenteum</i>	•	+	•	+	+	+	+	•	63
Char. <i>Grimaldion</i>									
<i>Pseudocrossidium revolutum</i>	+	1	1	1	2	2	1	1	100
<i>Weissia brachycarpa</i>	+	1	+	+	•	•	•	•	50
<i>Reboulia hemisphaerica</i>	+	2	•	•	•	•	•	+	38
<i>Mannia triandra</i>	•	•	•	•	+	•	+	•	25
<i>Barbula convoluta</i>	•	•	•	•	+	•	•	•	12
<i>Mannia fragrans</i>	•	•	•	•	•	•	•	+	12
Char. <i>Phascion cuspidati</i>									
<i>Phascum cuspidatum</i>	•	•	•	1	+	•	+	•	38
<i>Didymodon fallax</i>	•	•	•	•	+	•	•	•	12
<i>Riccia glauca</i>	•	•	•	•	•	•	•	1	12
Others									
<i>Nostocy sp.</i>	•	1	•	•	1	+	•	•	38
<i>Ambystegium serpens</i>	+	•	•	+	•	•	•	•	38
<i>Seligeria pusilla</i>	•	•	+	1	•	+	•	•	38
<i>Bryum capillare</i>	+	•	+	•	•	•	•	•	25
<i>Baeomyces rufus</i>	•	1	•	•	+	+	•	•	25
<i>Porella platyphylla</i>	•	•	•	•	•	+	•	•	12
<i>Bryum subelegans</i>	•		•	•	•	+	•	•	12

The biological spectrum of the *Mannia californica* cenosis shows a clear predominance of chamaephytes (58,30%), associated with a discrete group of hemicryptophytes (33,40%), with a modest participation of therophytes (8,30%) (Fig. 10).

The chorological spectrum shows a dominance of the Oceanic-Mediterranean chorotype (33,40%), followed by the Cosmopolitan (27%), Temperate (20,80%), Boreal (14,60%), Continental (4,20%) chorotypes (Fig. 11).

Hellenberg's bioindication values were applied to define the ecological parameters of the *Mannia californica* coenosis (Hellenberg *et al.* 1991) (Fig. 12).

The *Mannia californica* ecological behaviour seems to reflect the following parameters (with regard to the Veneto Hills communities): intermediate conditions between half light and light, moderately warm temperature, intermediate position between subcontinentality and suboceanicity, moderately dry niches, weak substratum acidity.



Fig. 9 - Typical *Mannia californica* stand with linear communities on earthy joints between the sandstone layers in the clearings of xerothermic mixed Oak wood in the Colline Subalpine Venete.

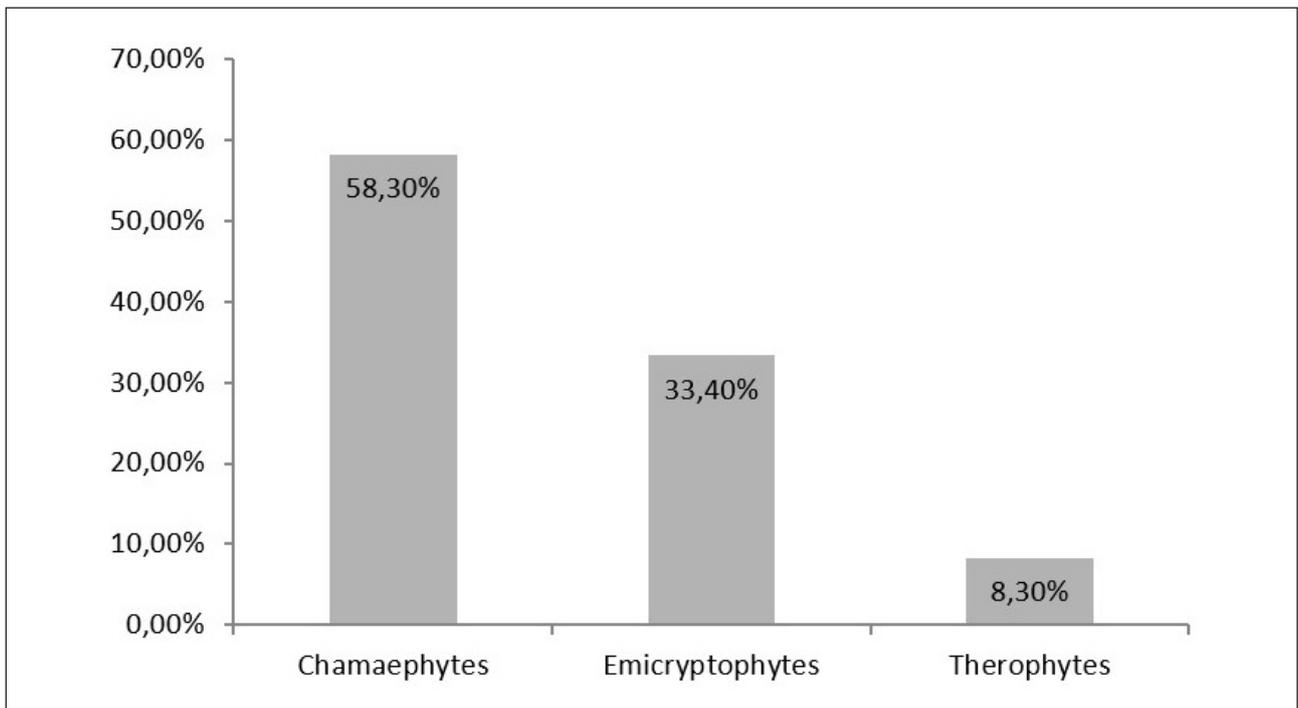


Fig. 10 - Biological Spectrum of the bryophyte coenosis with *Mannia californica*.

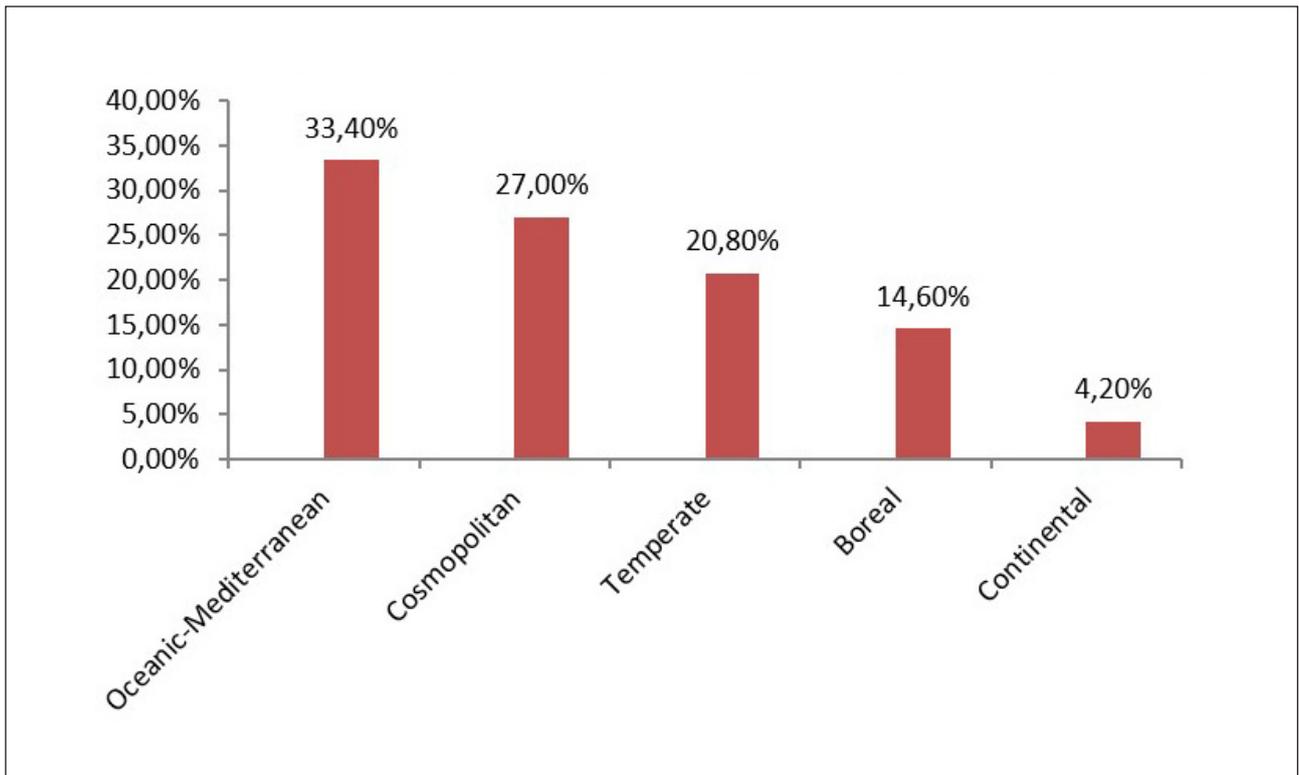


Fig. 11 - Chorological Spectrum of the bryophyte coenosis with *Mannia californica*.

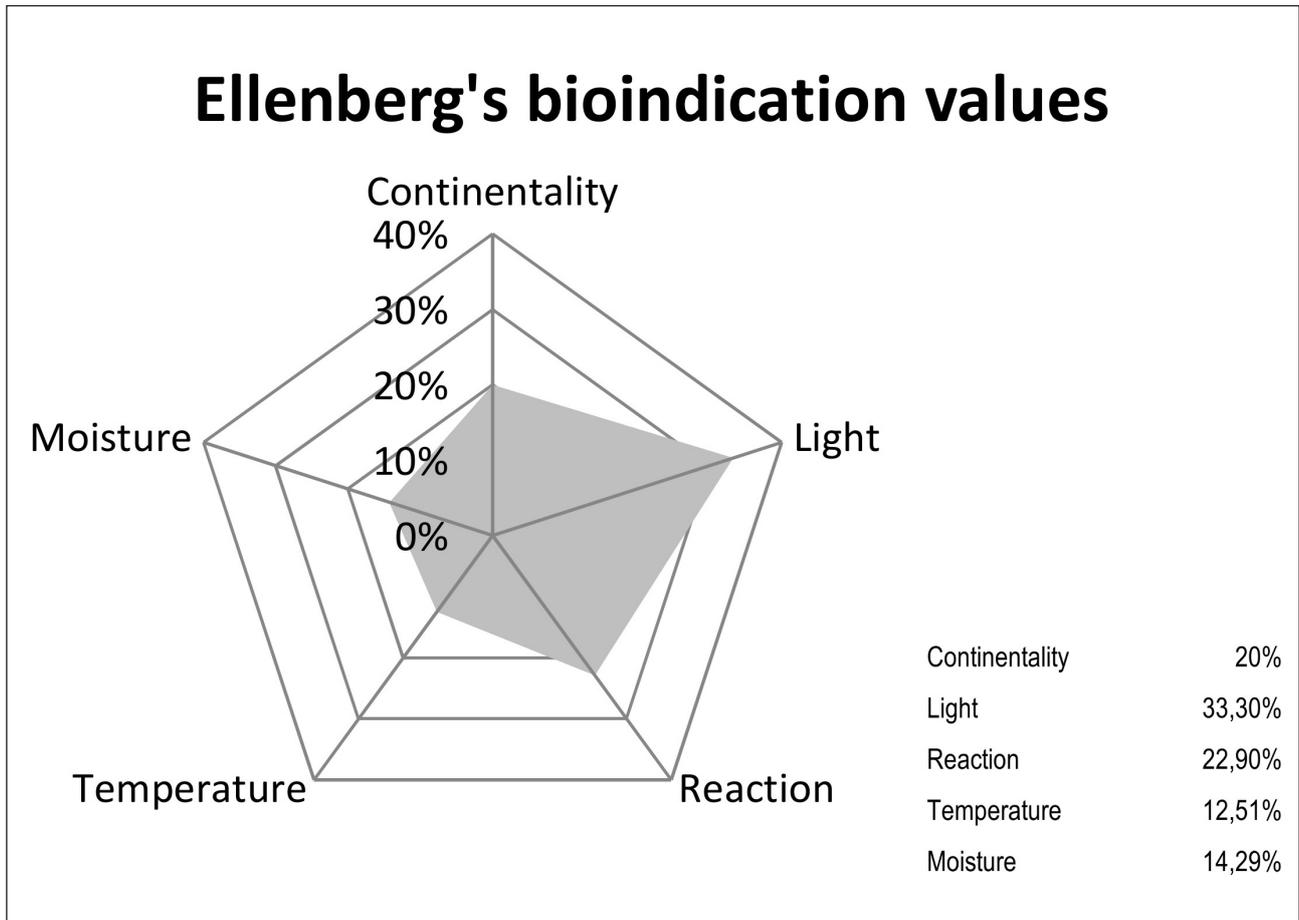


Fig. 12 - Ellenberg's bioindication values.

## CONCLUSION

The discovery of *Mannia californica* in a limited and particular area between Marostica and Bassano del Grappa, characterized by sub-continental temperate climate, with localized aspects of (sub)Mediterranean microtopography, is configured, in one way, as a point of continuity between the Larian stands (Lombardia) located west of Veneto, and Austria ones located north of the Veneto hilly complex.

The European range of this rare liverwort is not yet well defined. In northern Italy, further hypothetical stands could be present in areas characterized by similar conditions of (sub)Mediterranean climate around the Insubrian lakes, such as Lake Garda, where the secular olive growing is well established, or of (sub)Mediterranean infiltrated microtopography in the hilly area near more limited “xerothermic islands”.

The historical data on bryological research in the Veneto back mainly to the 19th century, but are unfortunately scarce and often limited to specific areas and, as regards the Genus *Mannia*, the only record present in historical data from the Venetian Pre-Alps is that of Giovanni Montini (1832), who, in some handwritten notes on an excursion in the Canale di Brenta, from the Frenzel Valley to the Gadena Valley, reports the presence of *Marchantia androgyna* (*Mannia androgyna*) just north of Valstagna.

## SYNTAXONOMIC SCHEME

*Barbuletea unguiculatae* Mohan 1978  
*Barbuletalia unguiculatae* Mohan 1978  
*Mannion androgynae* Ros & Guerra 1987  
*Mannietum californicae* ass. nova hoc loco

## OTHER SYNTAXA QUOTED IN THE TEXT

*Grimaldion fragrantis* Šmarda et Hadač 1944  
*Reboulia hemisphaericae-Targionietum hypophyllae* Gil 1997  
*Asplenietea trichomanis* (Br.-Bl. in Meier et Br.-Bl. 1934) Oberd. 1977  
*Koelerio-Coryneporetea* Klika in Klika et Novák 1941  
*Festuco-Brometea* Br.-Bl. et Tx. Ex Klika et Hadač 1944

## REFERENCES

- AA.VV., 2000 - La caratterizzazione climatica della Regione Veneto. *ARPAV*, Quaderni per l'Ambiente Veneto.
- AUGIER J., 1966 - Flore des bryotphytes. Paris.
- BARTOLUCCI F., PERUZZI L., GALASSO G., ALBANO A., ALESSANDRINI A., ARDENGHI N.M.G., ASTUTI G., BACCHETTA G., BALLELLI S., BANFI E., BARBERIS G., BERNARDO L., BOUVET D., BOVIO M., CECCHI L., DI PIETRO R., DOMINA G., FASCETTI S., FENU G., FESTI F., FOGGI B., GALLO L., GOTTSCHLICH G., GUBELLINI L., IAMONICO D., IBERITE M., JIMÉNEZ-MEJÍAS P., LATTANZI E., MARCHETTI D., MARTINETTO E., RIZZIERI MASIN R., MEDAGLI P., PASSALACQUA N. G., PECCENINI S., PENNESI R., PIERINI B., POLDINI L., PROSSER F., RAIMONDO F.M., ROMA-MARZIO F., ROSATI L., SANTANGELO A., SCOPPOLA A., SCORTEGAGNA S., SELVAGGI A., SELVI F., SOLDANO A., STINCA A., “WAGENSOMMER R.P. WILHALM T., & CONTI F., 2018 - An updated checklist of the vascular flora native to Italy. *Plant Biosystem*, 152 (2): 179-303.
- BOROVICHEV E.A., BAKALIN V.A. & VILNET A.A., 2015 - Revision of the Russian Marchantiales II. A review of the genus *Asterella* P. Beauv. (Aytoniaceae, Hepaticae). *Arctoa* 24 (2).
- BRAUN-BLANQUET J., 1964 - Pflanzensoziologie. 3rd edition. *Springer*, Wien.
- BRUSA G. & HUGONNOT V., 2019 - in ELLIS *et al.* New national and regional bryophyte records, 60. *J. of Bryol.*, 41 (3).
- BRUSA G., 2020 - Segnalazioni notevoli di epatiche dell'ordine *Marchantiales* per l'Italia Settentrionale. “*Natura Bresciana*” *Ann. Mus. Civ. Sc. Nat.*, 43.
- DIERSSEN K., 2001 - Distribution, ecological amplitude and phytosociological characterization of European bryophytes. *Bryophytorum Bibl.*, 56.
- HELLENBERG H., WEBER H.E., DÜLL R., WIRTH V., WERNER W., PAULISSEN D., 1991 - Zeigerwerte von Pflanzen in Mitteleuropa. *Scripta Geobotanica*, 18.
- HODGETTS N., CÁLIX M., ENGLEFIELD E. & ZARNOWIEC J., 2019 - A Miniature World in Decline: European Red List of Mosses, *Liverworts and Hornworts*. Brussels, Belgium: IUCN.
- HUGONNOT V. & SCHILL D.B., 2006 - *Mannia californica* (Gottsche ex Underw.) L.C. Wheeler (Aytoniaceae, Marchantiales) in Ardèche (France), new to Europe. *Cryptogam. Bryol.*, 27 (1).
- KÖCKINGER H., 2017 - Die Horn- und Lebermoose

- Österreichs (Anthocerophyta und Marchantiophyta). *Catalogus Florae Austriae*, II. Teil, Heft 2.
- MENEGHIN P., RECH F., 2011 - Le fonti dei dati pluviometrici. Servizio Meteorologico - Teolo (PD), *ARPAV*.
- MONTINI G., 1832 - Manoscritto appunti escursioni botaniche. *Museo Civico di Bassano del Grappa*.
- PINNA M., 1970 - Contributo alla classificazione del clima d'Italia. *Riv. Geogr. Ital.*, 77 (2).
- PIGNATTI S., 1976 - Geobotanica, in CAPPELLETTI C., Trattato di Botanica, vol 2, *UTET*, Torino.
- PUGLISI M., PRIVITERA M., 2012 - A synopsis of the Italian bryophyte vegetation. *Cryptogam. Bryol.*, 33 (4).
- ROS R.M., MAZIMPAKA V., ABOU-SOLAMA U., ALEFFI M., BLOCKEEL T.L., BRUGNÉS M., CROS R.M., DIA M.G., DIRKSE G.M., DRAPER I., EL-SAADAWI W., ERDAĞ A., GANEVA A., GABRIEL R., GONZÁLEZ-MANCEBO J.M., GRANGER C., HERRNSTADT I., HUOGONNOT V., KHALIL K., KÜRSCHNER H., LOSADA-LIMA A., LUÍS L., MIFSUD S., PRIVITERA M., PUGLISI M., SABOLJEVIĆ M., SÉRGIO C., SHABBARA H.M., SIM-SIM M., TACCHI R., VANDERPOORTEN A. & WERNER D., 2013 - Mosses of the Mediterranean, an annotated checklist. *Cryptogam. Bryol.*, 34 (2): 99-283.
- SCHILL D.B., 2006 - Taxonomy and phylogeny of the liverwort genus *Mannia* (Aytoniaceae, Marchantiiales). PhD thesis, University of Edinburgh and Royal Botanic Garden Edinburgh.
- SCHUSTER R.M., 1953 - Boreal Hepaticae. A manual of the Liverworts of Minnesota and adjacent regions. *Am. Nat.*, 49 (2).
- SCHUSTER R.M. & DAMSHOLT K., 1974 - The hepaticae of west Greenland from ca. 66° N to 72° N, *Medd. Grönl.*, 199 (1).
- SCHUSTER R.M., 1992a - Studies on Marchantiales, I-III. *J. Hattori Bot. Lab.*, 71.
- SCHUSTER R.M., 1992b - The hepaticae and anthocerotae of North America. Vol 6. Chicago, *Field Museum of Natural History*.
- SÖDERSTRÖM L., HAGBORG A., VON KONRAT M., BARTHOLOMEW-BEGAN S., BELL D., BRISCOE L., BROWN E., CARGILL D.C., COSTA D.P., CRANDALL-STOTLER B.J., COOPER E.D., DAUPHIN G., ENGEL J.J., FELDBERG K., GLENNY D., GRADSTEIN S.R., HE X., HEINRICHS J., HENTSCHEL J. ILKIN-BORGES A.L., KATAGIRI T., KONSTANTINOVA N.A., LARRAÍN J., LONG D.G., NEBEL M., PÓCS T., PUCHE F., REINER-DREHWALD E., RENNER M.A.M., SASS-GYARMATI A., SCHÄFER-VERWIMP A., MORAGUES J.G.S., STOTLER R.E., SUKKHARAK P., THIERS B.M., URIBE J. VÁŇA J., VILLAREAL J.C., WIGGINTON M., ZHANG L. & ZHU R.L. 2016 - World checklist of hornworts and liverworts. *Phytokeys*, 59: 1-828.

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