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The bryophyte flora of the Asinara Island (northwest Sardinia, Italy)

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Abstract – Seventy-four taxa (59 mosses, 13 hepatics, and 2 anthocerotes) are reported from the National Park of Asinara island, an islet situated at the north west of Sardinia. Besides general comments on phytogeographic and ecological aspects of this catalogue, some taxa, *Riccia sommieri, Tortula israelis, Scleropodium cespitans, Enthostodon muhlenbergii* are commented.

Bryophytes / Ecology / Asinara island / National Park / Sardinia / Italy / Mediterranean

INTRODUCTION

The present contribution is part of a quali-quantitative census project that also includes the determination of the biogeographic and ecological parameters of the bryophyte flora of the small islands surrounding Sardinia that form typical Mediterranean biotopes (Cogoni *et al.*, 2000, 2004, 2007). In 1997, Asinara island was declared a "zone of naturalistic importance" and converted into a National Park. Today the coasts are well conserved, although some areas in the interior have become degraded due to repeated brush fires, farming, and animal husbandry (Cossu *et al.*, 1994). Previously, the only reports on bryophytes from Asinara were made by Zodda (1914).

STUDY AREA

The island of Asinara (Fig. 1) is located just off the north western coast of Sardinia. It has an area of 51.9 km^2 and a coastline of 100 km in length. The island extends 17.6 km in the SW-NE direction, and its maximum width is 6.4 km.

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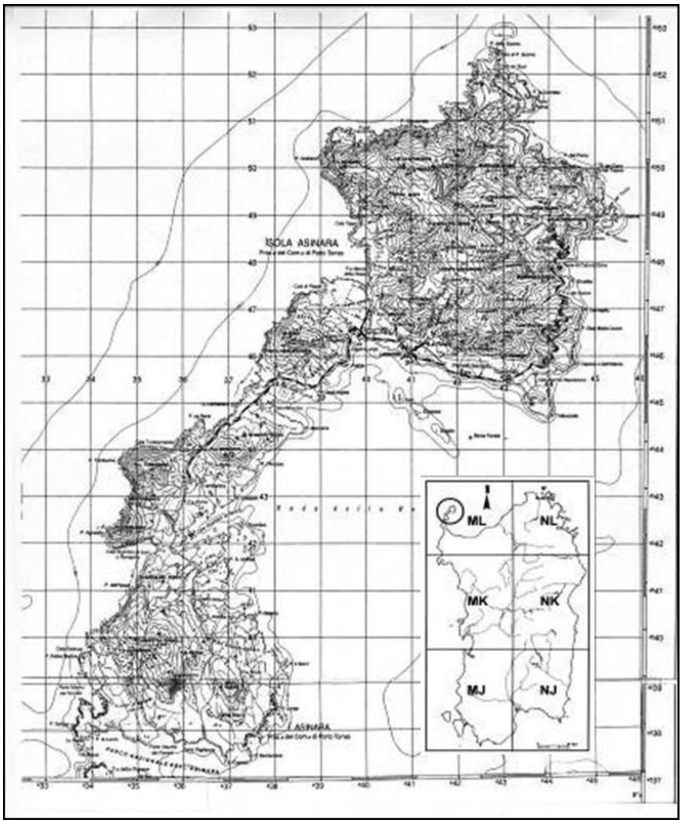

Fig. 1. Map of Asinara Island.

The maximum altitude is 408 m a.s.l., at Punta della Scomunica. Geographically, the island corresponds to the following coordinates: 40°59'6'' and 41°7'20'' latitude N and 8°21'8'' and 8°12'33'' longitude E from Greenwich [Sheet n° 425, Section II, Isola Asinara; Sheet n° 440, Section I, Stintino; I.G.M. (Istituto Geografico Militare)].

As regards the geology, the island is composed of rocks of sedimentary and volcanic origin attributed to the Palaeozoic era. The coasts are prevalently rocky and indented. There are cliffs mostly on the western and northern sides, while, to the east, the island slopes gradually down to the sea, where we find a series of sandy inlets alternating with rocky capes.

The climate is characterized by strong winds and rainfall concentrated mainly in the autumn and winter (500 mm per year). The temperature and precipitation regime is typical of a semiarid Mediterranean climate (Bocchieri, 1988).

The landscape is characterized by the different aspects of the Mediterranean shrub. The rocky environments exposed to marine areosol are characterized by halophilic species and in the less exposed areas prevail the elements of the coastal garigue. The nucleus of a forest formation that, in the past, extended further, includes *Quercus ilex* L. currently represented in the north of the island in the place known as Elighe Mannu (Bocchieri, 1988).

METHODS

The *exsiccata* were placed in the *Herbarium* CAG of the Department of Botanical Science of the University of Cagliari. For the nomenclature of liverworts and mosses, Ros *et al.* (2007) and Hill *et al.* (2006) were adopted, respectively. Phytogeographic elements (Düll, 1983, 1984, 1985, 1992) were assembled in main groups (Sérgio *et al.*, 2006a), and the relative percentages were then calculated. The ecological affinities of the species (humidity and human impact) were classified following Dierssen's indices (2001); life strategies were established according to During (1979), and life forms to Mägdefrau (1982) and Hill *et al.* (2007). These parameters are summarized in Table 2. The taxa are listed below in alphabetical order, beginning with the mosses, and then liverworts and hornworts. For each taxon, we report the abbreviation (in bold) derived from the first two letters of generic and specific name and the substrate and numbers corresponding to the location of sampling. The asterisk (*) indicates the species mentioned by Zodda (1914) but not found by the authors. Table 1 lists sampling locations marked with a number, the habitat, altitude, and coordinates UTM grid with approximate 1 km.

Table 1. Sampled localities.

N°	*Locality*	*Habitat*	*Altitude (m)*	*UTM*
1	Punta della Scomunica	on rock with *Cymbalaria aequitriloba*, *Bellium bellidioides*, *Arenaria balearica* and formations of garigue with *Genista corsica*	400	32T ML 40 50
2	Elighe Mannu	wood of *Quecus ilex*	287	32T ML 41 49
3	Cala Sabina	maquis with *Pistacia lentiscus* and *Artemisia arborescens*	14	32T ML 45 48
4	Guardiola Zonca	maquis with *Pistacia lentiscus*	20	32T ML 43 47
5	Punta Beccu	*idem*	108	32T ML 36 39
6	Colle Riparteddu	maquis with *Euphorbia dendroides* and *Pistacia lentiscus*	30	32T ML 44 48
7	Punta Figa Ranzica	maquis with *Cistus monspeliensis* and *Euphorbia dendroides*	231	32T ML 42 49
8	Cala d'Oliva	formation with *Euphorbia dendroides*	6	32T ML 43 48 32T ML 44 47
9	Piano gli Stretti	mica-schistic rocky ravines with halophilic vegetation	25	32T ML 37 45
10	Monte Marcutzeddu	*idem*	30	32T ML 37 44
11	Cala di Sgombro	garigue with *Centaurea horrida* and *Astragalus terraccianoi*	13	32T ML 35 41
12	Cala S. Andrea	maquis with *Helichrysum microphyllum* and *Euphorbia pithyusa*	20	32T ML 36 40
13	Cala del Turco	*idem*	5	32T ML 45 49
14	Cala S. Andrea to Cala Dorata	along the road	20	32T ML 36 41
15	Piano Schizziatogiu	rocky ravine in vegetable aspects with *Euphorbia dendroides*	163	32T ML 37 39
16	Castellaccio	meadows with *Bellium bellidioides* and rocks with "tafoni" with *Arenaria balearica*, *Umbilicus rupestris*	209	32T ML 35 39
17	Planu d'Auteri	garigue with *Helichrysum microphyllum, Genista corsica, Stachys glutinosa* and *Teucrium marum*	18	32T ML 34 38
18	Vallelunga			
19	Ligumanna to Vallelunga	(Zodda, 1914)		
20	Fonte ferruginosa			
21	Finocchio			

Table 2. Chorology and ecology of collected bryophytes.

Species	*Chorological elements*	*Humidity*	*Life strategies*	*Life forms*	*Human impact*
Amse	temp	hygro-xerophytic	perennial	mat rough	meso-euhemerobous
Aral	suboc	hygro-xerophytic	short-lived shuttle	short turf	meso-euhemerobous
Baun	temp	hygro-xerophytic	colonist	short turf	meso-polyhemerobous
Bast	suboc-med	xerophytic	long-lived shuttle	tuft	ahem-mesohemerobous
Bral	suboc-submed-mont	hygro-mesophytic	colonist	short turf	ahem-euhemerobous
Brce	temp	meso-xerophytic	colonist	short turf	meso-euhemerobous
Brca	temp	meso-xerophytic	colonist	short turf	oligo-euhemerobous
Brdi	submed	meso-xerophytic	competitive perennial	short turf	eu-polyhemerobous
Brdo	oc-med	xerophytic	colonist	short turf	ahem-euhemerobous
Brpa	temp	hygro-xerophytic	colonist	tuft	meso-euhemerobous
Brra	suboc-med	xerophytic	ephemeral colonist	cushion	meso-euhemerobous
Brto	submed-suboc	hygro-xerophytic	long-lived shuttle	short turf	oligo-euhemerobous
Chcl	oc-med	xerophytic	colonist	short turf	eu-polyhemerobous
Diho	suboc-med	xerophytic	colonist	short turf	meso-euhemerobous
Dilu	submed	xerophytic	colonist	short turf	meso-euhemerobous
Divi	submed	xerophytic	colonist	tuft	meso-euhemerobous
Epto	suboc-med	hygro-mesophytic	colonist	turf scattered	oligo-mesohemerobous
Ficr	oc-med	meso-xerophytic	competitive perennial	short turf	oligo-euhemerobous
Fivi	submed	hygro-mesophytic	ephemeral colonist	short turf	oligo-euhemerobous
Fivn	submed	xerophytic	colonist	short turf	meso-euhemerobous
Enco	med-mont	xerophytic	annual shuttle	short turf	ahem-euhemerobous
Fuhy	temp	hygro-mesophytic	fugitives	tuft	eu-polyhemerobous
Enmu	submed-suboc-mont	(seasonally)-hygro-xerophytic	annual shuttle	short turf	oligo-mesohemerobous
Grla	submed-suboc-mont	xerophytic	colonist	cushion	oligo-mesohemerobous
Grli	med-oc	hygro-mesophytic	ephemeral colonist	tall turf	ahem-oligohemerobous
Grpu	submed	xerophytic	colonist	cushion	meso-euhemerobous
Grtr	temp-mont	hygro-xerophytic	competitive perennial	cushion	oligo-mesohemerobous
Hoau	med-mont	xerophytic	perennial	tail	ahem-mesohemerobous
Hose	temp	xerophytic	perennial	mat rough	ahem-mesohemerobous
Hycu	temp	meso-xerophytic	stress tolerant perennial	mat smooth	oligo-euhemerobous
Hycr	oc	mesophytic	stress tolerant perennial	weft	n.d.
Kipr	temp	hygrophytic	perennial	mat rough	oligo-euhemerobous
Lesm	oc-med	meso-xerophytic	perennial	fan	ahem-euhemerobous
Oxhi	temp	hygro-mesophytic	competitive perennial	mat rough	ahem-euhemerobous
Oxte	suboc-mont	hygro-mesophytic	competitive perennial	mat	ahem-mesohemerobous
Plac	suboc	hygro-mesophytic	annual shuttle	short turf	meso-euhemerobous
Plsq	submed	xerophytic	competitive perennial	short turf	ahem-mesohemerobous
Psho	submed-suboc	meso-xerophytic	colonist	short turf	mesohemerobous

Table 2. Chorology and ecology of collected bryophytes.

Species	*Chorological elements*	*Humidity*	*Life strategies*	*Life forms*	*Human impact*
Ptgr	suboc-submed (-mont)	hygro-xerophytic	long-lived shuttle	tail	ahem-mesohemerobous
Rhcu	submed-suboc	hygro-xerophytic	stress tolerant perennial	mat, smooth	ahem-mesohemerobous
Rhco	submed-suboc	hygro-mesophytic	perennial	mat rough	ahem-euhemerobous
Rhme	submed	hygro-xerophytic	perennial	mat rough	mesohemerobous
Scce	oc-submed	mesophytic	perennial	mat smooth	meso-euhemerobous
Scto	oc-submed	xerophytic	perennial	mat rough	meso-euhemerobous
Scci	oc-med	xerophytic	perennial	mat rough	euhemerobous
Tofl	suboc-submed	xerophytic	colonist	short turf	oligo-mesohemerobous
Tohu	submed	xerophytic	colonist	short turf	ahem-mesohemerobous
Toin	suboc-submed	meso-xerophytic	colonist	short turf	ahem-mesohemerobous
Toni	oc-med	xerophytic	stress tolerant perennial	cushion	meso-euhemerobous
Tois	med(-oc)	xerophytic	colonist	short turf	ahem-oligohemerobous
Tomo	temp	meso-xerophytic	ephemeral colonist	short turf	euhemerobous
Tomu	temp	meso-xerophytic	colonist	short turf	meso-polyhemerobous
Trbr	submed-mont	meso-xerophytic	perennial	short turf	ahem-mesohemerobous
Trcr	temp-mont	meso-xerophytic	colonist	short turf	ahem-mesohemerobous
Webr	temp	xerophytic	short-lived shuttle	short turf	meso-euhemerobous
Wecn	submed-mont	xerophytic	colonist	short turf	meso-euhemerobous
Weco	temp	xerophytic	colonist	short turf	oligo-euhemerobous
Welo	s.temp	xerophytic	short-lived shuttle	short turf	meso-euhemerobous
Zyru	suboc-med	xerophytic	colonist	short turf	n.d.
Anpu	oc-submed	hygrophytic	annual shuttle	solitary thalloid	meso-euhemerobous
Phla	suboc-submed	hygro-mesophytic	annual shuttle	thalloid	meso-euhemerobous
Ceha	n.suboc	hygro-xerophytic	colonist	thread	ahem-mesohemerobous
Coco	suboc-med	xerophytic	short-lived shuttle	mat	oligo-mesohemerobous
Foan	oc-med	hygro-mesophytic	annual shuttle	mat	meso-euhemerobous
Frdi	temp	(aero)-hygro-xerphytic	colonist	mat smooth	ahem-mesohemerobous
Frta	w.temp-mont	meso-xerophytic	ephemeral colonist	mat	ahem-euhemerobous
Lucr	oc-med	meso-xerophytic	perennial	mat	meso-euhemerobous
Mefu	w.temp	meso-xerophytic	perennial	mat thalloid	ahem-mesohemerobous
Poob	w.med-mont	hygro-xerphytic	stress tolerant perennial	mat smooth	ahem-mesohemerobous
Raco	w.temp	hygro-xerphytic	long-lived shuttle	mat smooth	ahem-oligohemerobous
Rimi	med-suboc	meso-xerophytic	annual shuttle	solitary thalloid	mesohemerobous
Rini	oc-med	hygro-xerphytic	annual shuttle	solitary thalloid	ahem-mesohemerobous
Rism	med	meso-xerophytic	annual shuttle	solitary thalloid	oligo-mesohemerobous
Riso	temp	meso-xerophytic	annual shuttle	solitary thalloid	oligo-euhemerobous

RESULTS AND DISCUSSION

Seventy-four species were recorded on the island, of which 59 were mosses, 13 were liverworts and 2 were anthocerotes.. The most representative families were *Pottiaceae* (19 taxa) and *Brachytheciaceae* (10 taxa) among the mosses, while *Ricciaceae,* with 4 entities belonging to the genus *Riccia,* were the most numerous among the liverworts.

Mosses

Amblystegium serpens (Hedw.) Schimp. – **Amse** – damp soil – 2
Archidium alternifolium (Hedw.) Schimp. – **Aral** – soil – 7, 8, 12, 16
Barbula unguiculata Hedw. – **Baun** – soil, rock – 2, 8, 16, 17
Bartramia stricta Brid. – **Bast** – rock – 2
Bryum alpinum With. – **Bral** – soil, rock fissures – 12, 16
Bryum caespiticium Hedw. – **Brce** – soil, sand, wall – 2, 13, 16
Bryum capillare Hedw. – **Brca** – rock, soil – 1, 2, 3, 6, 7, 12, 14, 16
Bryum dichotomum Hedw. – **Brdi** – soil, rock – 6, 8, 12, 14, 16
Bryum donianum Grev. – **Brdo** – damp soil – 2
Bryum pallescens Sw. – **Brpa** – damp soil – 12
Bryum radiculosum Brid. – **Brra** – soil, rock – 2, 12, 16
Bryum torquescens Bruch *et* Schimp. – **Brto** – soil – 16
Cheilothela chloropus (Brid.) Limpr. – **Chcl** – soil – 16
Dicranella howei Renauld *et* Cardot – **Diho** – damp soil, rock – 2, 12
Didymodon luridus Hornsch. – **Dilu** – damp soil – 12
Didymodon vinealis (Brid.) R. H. Zander – **Divi** – rock fissures, soil – 2, 17
*****Entosthodon convexus*** (Spruce) Brugués – **Enco** – 18
Entosthodon muhlenbergii (Turner) Fife – **Enmu** – rock – 2
Epipterygium tozeri (Grev.) Lindb. – **Epto** – soil – 2
Fissidens crispus Mont. – **Ficr** – damp soil – 2, 15
Fissidens viridulus (Sw. *ex* anon.) Wahlenb. var. ***viridulus*** – **Fivi** – soil – 6
Fissidens viridulus var. ***incurvus*** (Starke *ex* Röhl.) Waldh. – **Fivn** – slopy soil in the wood of *Quercus ilex* – 2
Funaria hygrometrica Hedw. – **Fuhy** – soil – 4, 5, 8, 12, 16
Grimmia laevigata (Brid.) Brid. – **Grla** – rock, soil – 1, 14
Grimmia lisae De Not. – **Grli** – soil, rock – 1, 2, 4, 8, 15, 16
*****Grimmia pulvinata*** (Hedw.) Sm. – **Grpu** – 18
Grimmia trichophylla Grev. – **Grtr** – rock – 1, 2, 5, 12
*****Homalothecium aureum*** (Spruce) H. Rob. – **Hoau** – 18
Homalothecium sericeum (Hedw.) Schimp. – **Hose** – rock, soil, trunk of *Quercus ilex* – 1, 2, 4, 16
Hypnum cupressiforme Hedw. var ***cupressiforme*** – **Hycu** – rock, stone, soil – 1, 2, 4, 8, 12, 16
Hypnum cupressiforme var. ***resupinatum*** (Taylor) Schimp. – **Hycr** – trunk of *Quercus ilex* damp soil – 2
Kindbergia praelonga (Hedw.) Ochyra – **Kipr** – rock, dry stone wall – 1, 2, 16, 19
Leptodon smithii (Hedw.) Weber *et* D. Mohr – **Lesm** – soil, rock – 4, 16, 20
Oxyrrhynchium hians (Hedw.) Loescke – **Oxhi** – soil, rock – 2, 5, 16
Oxystegus tenuirostris (Hook. *et* Taylor) A.J.E. Sm. – **Oxte** – wall of water fountain – 2

Pleuridium acuminatum Lindb. – **Plac** – rock, soil – 7, 9
Pleurochaete squarrosa (Brid.) Lindb. – **Plsq** – rock, soil – 5, 12, 16
Pseudocrossidium hornschuchianum (Schultz) R. H. Zander – **Psho** – soil – 1, 8, 12, 16
Pterogonium gracile (Hedw.) Sm. – **Ptgr** – rock – 1, 2, 21
Rhynchostegiella curviseta (Brid.) Limpr. – **Rhcu** – rock fissures – 2
Rhynchostegium confertum (Dicks.) Schimp. – **Rhco** – soil, rock – 2, 4, 8
Rhynchostegium megapolitanum (Blandow *ex* F. Weber *et* D. Mohr) Schimp. – **Rhme** – soil – 12, 15, 15, 18
Scleropodium cespitans (Müll. Hal.) L.F. Koch – **Scce** – damp soil – 2
Scleropodium touretii (Brid.) L.F. Koch – **Scto** – rock, soil – 2, 3, 5, 7, 17
Scorpiurium circinatum (Bruch.) M. Fleisch. – **Scci** – stone – 2, 4
Tortella flavovirens (Bruch) Broth. – **Tofl** – soil, rock – 5, 9, 10, 16, 17
Tortella humilis (Hedw.) Jenn. – **Tohu** – rock – 17
Tortella inflexa (Bruch) Broth. – **Toin** – soil – 5
Tortella nitida (Lindb.) Broth. – **Toni** – soil, rock – 4, 8, 18
Tortula israelis Bizot *et* F. Bilewsky – **Tois** – soil – 8
Tortula modica R.H. Zander – **Tomo** – soil – 7
Tortula muralis Hedw. – **Tomu** – soil, rock – 1, 2, 4, 5, 16
Trichostomum brachydontium Bruch – **Trbr** – damp soil, rock – 2, 3, 4, 5, 8, 17
Trichostomum crispulum Bruch – **Trcr** – soil, rock – 2, 3, 5, 6, 8, 12, 16, 17
Weissia brachycarpa (Nees *et* Hornsch.) Jur. – **Webr** – soil – 10
Weissia condensa (Voit) Lindb. – **Wecn** – rock – 2, 11, 12, 18
Weissia controversa Hedw. – **Weco** – rock – 6, 9
Weissia longifolia Mitt. – **Welo** – soil – 6
Zygodon rupestris Schimp. *ex* Lorentz – **Zyru** – trunk of *Quercus ilex* – 2

Liverworts

Cephaloziella hampeana (Nees) Schiffn. – **Ceha** – rock fissures – 2
Corsinia coriandrina (Spreng.) Lindb. – **Coco** – soil – 6, 15
Fossombronia angulosa (Dicks.) Raddi – **Foan** – soil – 2
Frullania dilatata (L.) Dumort. – **Frdi** – rock, soil – 2, 4, 16
Frullania tamarisci (L.) Dumort. – **Frta** – rock, trunk of *Quercus ilex* – 2, 4, 20
Lunularia cruciata (L.) Lindb. – **Lucr** – damp soil – 2, 19, 21
Metzgeria furcata (L.) Dumort. – **Mefu** – damp soil – 1, 2
Porella obtusata (Taylor) Trevis. – **Poob** – damp soil – 2
Radula complanata (L.) Dumort. – **Raco** – damp soil, trunk of *Quercus ilex* – 2, 20
Riccia michelii Raddi – **Rimi** – soil – 15
Riccia nigrella DC. – **Rini** – rock. 12
Riccia sommieri Levier – **Rism** – damp soil – 2
Riccia sorocarpa Bisch. – **Riso** – soil – 12

Anthocerotes

Anthoceros punctatus L. – **Anpu** – soil – 2
Phaeoceros laevis (L.) Prosk. – **Phla** – damp soil – 2

Most of the species listed are very common and widely distributed throughout the Mediterranean region (Cortini Pedrotti, 1980; Carratello & Raimondo, 1997; Privitera & Puglisi, 1989, 1999; Ros *et al.*, 1999, 2000; Cano *et al.*, 2001; Carratello, 2001, 2004; Sáez *et al.*, 2002, 2006; Sotiaux *et al.*, 2007; Cros *et al.*, 2008; Frahm & Lüth, 2008).

Among the liverworts, *Riccia sommieri*, whose range is limited to the Mediterranean basin (Crete, Greece, Italy, Sardinia and Spain), Portugal and North Africa (Algeria and Morocco) (Bischler, 2004), is of a special phytogeographic interest. In Sardinia, it had been previously reported by Bischler et Jovet-Ast (1971-1972) and, in the rest of Italy, it was only found in Tuscany (Aleffi *et al.,* 2008). Schumacker & Váňa (2005) attribute it the *status* of rare species.

Among the mosses, *Tortula israelis*, which is a controversial species (Aiello & Dia, 2000), has been found in different parts of the Mediterranean (Italy, Israel, Cyprus, Turkey, Spain). In Italy, it has been recorded in Sardinia (Cogoni *et al.,* 2006, 2007) and in urban areas of Lazio and Sicily (Aleffi *et al.,* 2008). However, the geographic distribution is at the present confined to a few areas and could be wider. In fact, some specimens named *Tortula muralis* are *Tortula israelis* (Gueli *et al.*, 2001) likely correspond to this species.

Scleropodium cespitans has been found infrequently in the Mediterranean. In the Iberian Peninsula Sérgio *et al.* (1994) attribute it the *status* of rare species and in the most recent Red List, it is listed as having "inadequate information about distribution (DD)" (Sérgio *et al.,* 2006b). In Italy, it can be found from the sea level up to the hill top in a few places from the Friuli Venezia Giulia, Tuscany, Marche, Sardinia, and Sicily (Aleffi *et al.,* 2008).

Entosthodon muhlenbergii is distributed in the submediterranea-suboceanica-mountain. In the Iberian Peninsula, *E. muhlenbergii* is found only in the Andorra. It is included in the Red List in the category of vulnerable taxa (D2), which identifies taxa collected in less than 5 locations (Sérgio *et al.*, 2006b). In Italy, it is rather widespread in the plains up to the mountain (Cortini Pedrotti, 2001; Lo Giudice *et al.*, 1997). In the Mediterranean islands, in addition to Sardinia and Sicily, it is reported in Corsica (Sotiaux *et al.*, 2007), Pantelleria (Privitera & Puglisi, 1989), and the Maltese archipelago (Frahm & Lüth, 2008). Its presence in the Balearic Islands archipelago was challenged by Cros *et al.* (2008) in connection with the previously reported by Casas *et al.* (1996).

Biogeographic data (Fig. 2) show the dominance of species belonging to the Mediterranean-oceanic and oceanic-mediterranean groups (43%), followed by that of temperate (30%) in the presence of a high atmospheric humidity, which clearly compensates for the scarcity of rainfall. Well represented are also the species of submediterranean and Mediterranean groups (20%), much less than oceanic and suboceanic (7%). These data well correlate with the bioclimatic characteristics of the Asinara, as well as reports for other Mediterranean islands, such as Malta, Montecristo, Pantelleria, Marettimo, Stagnone, Serpentara, Cavoli, and Molara (Frahm & Lüth, 2008; Cortini Pedrotti, 1980; Privitera & Puglisi, 1989; Caratello, 2001, 2004, Cogoni *et al.,* 2000, 2004, 2007).

In Table 2, we summarize the main ecological aspects related to the species collected in the Park dell'Asinara. The low rainfall and high wind on the island explain not only the high percentage of xerophytic (34%) and meso-xerophytic (24%) species, but also the well represented hygro-xerophytic and hygro-mesophytic (respectively 21% and 15%). A few hygrophytic *s. str.* species (3%) are found mainly on the wet slopes of holm oak woods at Elighe Mannu and in the rocks of Punta della Scomunica in the communities of *Cymbalaria aequitriloba* (Viv.) Cheval., *Bellium bellidioides* L. and *Arenaria balearica* L.

In terms of life strategies, most of the species are colonist (42%) and live mainly in dry areas, especially in the glades of scrub and rocks exposed to winds

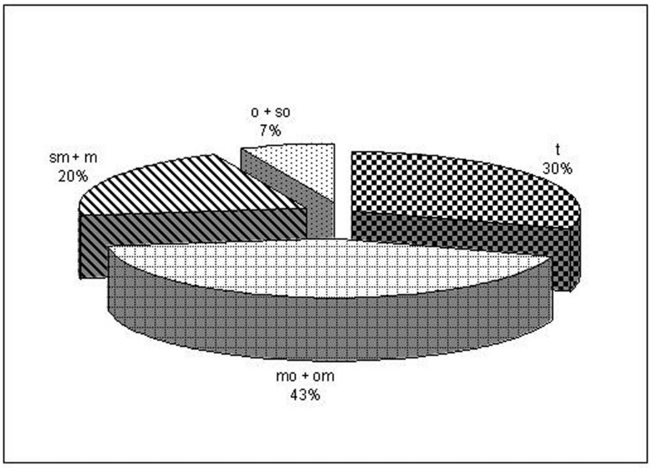

Fig. 2. Chorological spectrum (t = temperate; o + so = oceanic and suboceanic; mo + om = Mediterranean-oceanic and oceanic-mediterranean; sm + m = submediterranean and Mediterranean).

and to the marine aerosol. The taxa that are predominantly perennial (32%) are found especially in cooler habitats along the valley, away from rocks and behind the trunks of trees. Species with an annual shuttle strategy (14%) are represented especially by liverworts and hornworts (9%) that do not tolerate water stress during the driest season.

As for the life forms the short turf (43%) and, among the liverworts the talloid (11%) represent the predominant types. Their values suggest a high capacity of resistance to the aridity and the low human activity, as it has been found in the urban environment and in some small islands of Sicily (Privitera & Puglisi, 1999; Pokorny *et al.*, 2006; Campisi *et al.*, 2008). In not or slightly disturbed areas, the mat (26%) and cushion (7%) types, which areless tolerant to anthropic impact (Gilbert, 1970), are highly represented.

Human pressure is not particularly critical, given. The high percentage of species that can tolerate a wide spectrum of anthropic impact, from absent up to moderate (ahem-mesohemerobous 22%, ahem-oligohemerobous 4%, oligo-mesohemerobous 9% and 4% mesohemerobous) and moderate to strong (meso-euhemerobous 28%). The species that tolerate anthropic impact from strong (euhemerobous 3%) to very strong (eu-polyhemerobous 4%, oligo-euhemerobous 11%) are located mainly in the urbanized areas, while settlements in burnt areas are probably linked to agro-pastoral. In general, it can be assumed that the low anthropic impact doesn't put at risk to the bryophyte biodiversity in the Asinara island.

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