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The bryophytic flora of the Molara Island (Northeastern Sardinia)

Abstract

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The results of the exploration of Molara Island (in Northeastern Sardinia) recorded in the framework of a bryophytic research programme are given. 80 taxa have been registered, 69 of which belong to the *Bryophyta*, 10 belong to the *Marchantiophyta* and 1 to the *Anthocerotophyta*. *Scorpiurium sendtneri* (Schimp.). M. Fleisch is new to the Sardinia bryoflora. Moreover, the analysis of phytogeographic elements and the elaboration with the multivaried analysis of the ecological data are reported.

Key words: Bryophytes, Phytogeography, Ecology.

Introduction

This contribution is part of a project oriented both to the quali-quantitative census and to the survey of the biogeographical and ecological parameters of the bryological flora of the small islands around Sardinia that represent biotopes of remarkable naturalistic interest. These results have to be added to those produced for the isle of Serpentara (Cogoni & al. 2000) and the isle of Cavoli (Cogoni & al. 2004), in the Marine Protected Area of Capo Carbonara (southeastern Sardinia). Moreover through the detrended correspondence analysis (DCA) we wanted to establish a connection between the brioflora and the different vegetational types of the island and the use of the territory in time.

Molara Island is situated on the north-east coast of Sardinia and it is located, together with the nearby Tavolara Island, in the Tavolara – Capo Coda Cavallo Marine Park . This island was used for cultivation and sheep grazing from the end of the nineteenth century until 50 years ago. Since then cultivation has stopped and there are few cows and goats left.

Scientific research dedicated to phanerogamic flora in this island started with Moris (1837-59) and continued with Béguinot (1929), Picci (1972), Lorenzoni (1970), Lorenzoni & Chiesura Lorenzoni (1973), Bocchieri (1995) and Bocchieri & Iiriti (2005). In literature there are not sources of information regarding bryophytic flora.

The study area

Molara Island has a surface area of 3.5 square kilometers, its geographical coordinates are: 40°51'38'' and 40°52'41'' latitude N and 9°42'40'' and 9°44'35'' longitude E of Greenwich (sheet n°445, Sez. III, Molara Island , I.G.M.) (Fig. 1).

The geology of the island consists of rocky formations which belong to Gallura's granitic plutonic rock, which emerged in the Paleozoic era during the Ercinic orogeny (Bocchieri & Iiriti 2005). In this area there are many grey-pink biotitic granites, which partly turn into granodiorites, with heterogeneous grain and with medium-sized/large components, which sometimes contain traces of biotite and various other materials (AA. VV. 1974). The north-eastern and southern part of the island is characterized by high and rocky coasts (Punta di Levante, Punta di Arresto, Punta di Scirocco and Costa dell'Aia) whereas the north-western side is characterized by small coves (Cala Spagnola and Cala di Chiesa). The highest altitude is "Punta La Guardia" 155 m high which dominates a landscape full of granites with *tafoni* and one of two perennial springs found on the island. La Vallata and L'Orto are the most important valleys present in the northern area and in the past were used for cultivation, whereas in the eastern area there is a valley known as Fosso dei Morti (Bocchieri & Iiriti 2005).

According to the results of the thermo-pluvial-metrical data processing in the stations of Olbia and Suaredda-Monte Pedrosu between 1982 and 2001, following the typology of Rivas-Martinez & al. (1999), the territory is part of the mesomediterranean thermotype with an ombrotype included between a dry superior and a subhumid inferior. The yearly average temperature is 16.4°C and annual precipitation is 600 mm, mainly concentrated in autumn and winter.

The vegetation of Molara is characterized by the presence of wide *Olea europaea* L.var *sylvestris* Brot. woods, especially in the area between La Vedetta and Costa dell'Aia. In the coastal areas, olive trees, *Phillyrea angustifolia* L., *Juniperus turbinata* Guss., *Pistacia lentiscus* L., *Rhamnus alaternus* L. occur. In the northern area, which is cooler and wetter, there are groups or isolated samples of *Quercus ilex* L., *Quercus suber* L. and *Acer monspessulanum* L. The area used for agriculture is characterized by herbaceous growth in evolution with the exception of the areas used for sheep grazing.

Materials and Methods

The collection of bryophytes was carried out between June 2002 and the first few months of 2004, in different periods of the year. 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 Schumacker & Váňa (2005) and Hill & al. (2006) were adopted respectively. Phytogeographyc elements (Düll 1983, 1984, 1985, 1992) were assembled in main groups (Sérgio & al. 2006), and then the relative percentages were calculated. The ecological features of the species (pH, humidity and human impac) were classified following Dierssen's indices (2001); the life strategies were classified following During (1979) and growth forms following Mägdefrau (1982).

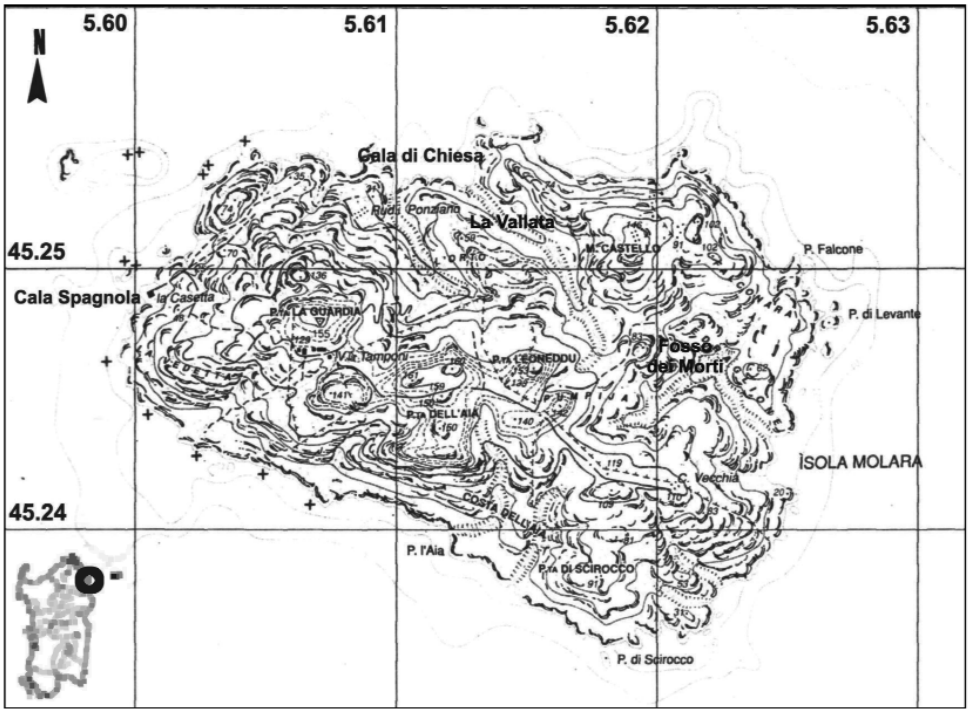

Fig. 1. Map of the Molara Island.

The multivaried analyses of DCA were realised using the CANOCO programme (ter Braak & Šmilauer 2002) according to the matrix of presence/absence/frequency of species in different typologies of environment. The detected entities are listed later in alphabetic order, and for each one, the identification code used for making tables and graphs, the habitat in the study area and the UTM coordinates are indicated.

Floristic list

Bryophyta

***Aloina rigida* (Hedw.) Limpr.** (Alri): on soil, Casa Vecchia (32T NL 62083 24156).

***Archidium alternifolium* (Hedw.) Mitt.** (Aral): on soil in therophytic meadows in front of the sea (32T NL 60229 24337); on soil nearby L'Orto (32T NL 61886 25029); on soil nearby Fosso dei Morti (32T NL 62278 24539).

***Barbula convoluta* Hedw.** (Baco): on rock (32T NL 61065 24821); on rock in the L'Orto valley nearby the spring in the nearness of the only specimen of *Castanea sativa* Miller (32T NL 61226 24935).

***Barbula unguiculata* Hedw.** (Baun): on soil in a rock crevice nearby Punta La Guardia (32T NL 60440 24858); on soil in vegetation with *Juniperus turbinata*, *Pistacia lentis-*

cus and *Cistus salvifolius* L. (32T NL 60531 24931); on soil in therophytic meadows in front of the sea (32T NL 60736 24125); on rock (32T NL 60952 24858); on soil nearby Punta dell'Aia (32T NL 61658 24553); among granitic pebbles along the pathway in vegetation with *Cistus monspeliensis* L, *Pistacia lentiscus*, *Genista corsica* (Loisel.) DC. and *Lavandula stoechas* L., nearby Casa Vecchia (32T NL 61761 24246); on soil nearby Casa Vecchia (32T NL 62083 24156); on soil in vegetation with *Cistus monspeliensis* and *Pistacia lentiscus* (32T NL 62123 24138).

***Bartramia stricta* Brid.** (Bast): on rock in therophytic meadows in the nearness of the sea (32T NL 60390 25722); on soil nearby Villa Tamponi (32T NL 60784 24803); on soil in the clearings of the vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris* (32T NL 60933 24806); on soil nearby Punta dell'Aia (32T NL 61723 24621); on rock along the gully to Fosso dei Morti (32T NL 62115 24558).

***Brachythecium rutabulum* (Hedw.) Schimp..** (Brun): on rock in therophytic meadows in the nearness of the sea (32T NL 60390 25722); on soil in the L'Orto valley nearby the second spring in the nearness of a tree of *Castanea sativa* (32T NL 61226 24935).

***Bryum alpinum* With.** (Bral): on rock (32T NL 61886 25029); on soil (32T NL 61886 25029) ; on soil nearby Fosso dei Morti (32T NL 62278 24539).

***Bryum caespiticium* Hedw.** (Brce): on the bark of *Olea europaea* var. *sylvestris* (32T NL 60739 24725).

***Bryum capillare* Hedw.** (Brca): on rock in front of the sea in the nearness of Fosso dei Morti (32T NL 62386 24396); on soil in a therophytic meadow with *Cistus monspeliensis* and *Pistacia lentiscus*, at the entrance of the valley Fosso dei Morti, (32T NL 62214 24623); on rock along the gully Fosso dei Morti (32T NL 62115 24558); on rock and on soil in vegetation with *Juniperus turbinata*, *Pistacia lentiscus* and *Cistus salvifolius* (32T NL 60531 24931); on soil in the wood with *Phillyrea angustifolia* L. nearby La Casetta (32T NL 60608 24969); on soil nearby some trees of *Quercus suber* (32T NL 60535 25003); on bark of *Olea europaea* var. *sylvestris* (32T NL 60739 24725); on soil in the meadows with *Asphodelus aestivus* Brot., *Avena barbata* Potter, *Plantago* sp., *Trifolium* sp. (32T NL 60799 24766); on rock (32T NL 61065 24821); on soil rich in litter, in vegetation with *Cistus monspeliensis*, (32T NL 61107 24491); on soil, in the second spring in the nearness of a tree of *Castanea sativa* (32T NL 61226 24935); on soil, in vegetation with *Pistacia lentiscus*, *Phillyrea* sp. and *Olea europaea* var. *sylvestris* (32T NL 61854 24492); on rock (32T NL 61886 25029); on soil (32T NL 61886 25029); on soil, in a clearing with big emergent boulders and in vegetation with *Pistacia lentiscus* and *Olea europaea* var. *sylvestris* (32T NL 61943 25095); on soil (32T NL 61994 25058); on soil, therophytic meadow with *Carlina corymbosa* L. (32T NL 62343 23993); on soil in therophytic meadows in front of the sea, nearby Punta dell'Aia (32T NL 60736 24125); on rock, Punta dell'Aia (32T NL 61744 24640); on soil, between Punta dell'Aia and La Vedetta (32T NL 60667 24590); on soil in a rocky ridge with *Cistus salvifolius* and *Pistacia lentiscus* under Monte Castello (32T NL 61777 24570); on soil nearby some trees of *Quercus suber* (32T NL 60535 25003); on rock in vegetation with *Cistus monspeliensis, C. salvifolius*, *Pistacia lentiscus* and *Erica arborea* L. to Monte Castello (32T NL 61872 24772).

***Bryum dichotomum* Hedw.** (Brdi): on soil nearby some trees of *Quercus suber* L. (32T NL 60535 25003); on soil (32T NL 60764 24225), (32T NL 61584 25108), (32T NL

62153 25053); on rock nearby Punta dell'Aia (32T NL 61744 24640); among granitic pebbles along the pathway in vegetation with *Cistus monspeliensis*, *Pistacia lentiscus*, *Genista corsica* and *Lavandula stoechas*, nearby Casa Vecchia (32T NL 61761 24246); on soil, along the gully, Fosso dei Morti (32T NL 61983 24506); on soil in vegetation with *Cistus monspeliensis* and *Pistacia lentiscus* (32T NL 62123 24138).

***Bryum pseudotriquetrum* (Hedw.) P. Gaertn. & al.** (Brps): on soil (32T NL 61712 24866).

***Bryum radiculosum* Brid.** (Brra): on rock in the gully to Cala Spagnola (32T NL 60240 24932); on soil in the nearness of Punta La Guardia (32T NL 60551 24975); on rock, about 6 m from the sea, Cala di Chiesa (32T NL 61050 25310); on soil (32T NL 61712 24866); on soil, Punta dell'Aia (32T NL 61723 24621); on soil in a clearing with big emergent boulders and in vegetation with *Pistacia lentiscus* and *Olea europaea var. sylvestris* (32T NL 61943 25095).

***Bryum torquescens* Bruch & Schimp.** (Brto): on soil nearby some trees of *Quercus ilex* after the second spring (32T NL 61066 24994); on soil rich in litter in vegetation with *Cistus salvifolius* (32T NL 61107 24491).

***Cheilothela chloropus* (Brid.) Broth.** (Chcl): on soil and on rock in meadows with *Asphodelus aestivus* Brot., *Avena barbata* Potter, *Plantago* sp., *Trifolium* sp. (32T NL 60784 24803); on soil in vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris*, entrance of the L'Orto valley (32T NL 60883 24843); on rock (32T NL 61065 24821).

***Cirriphyllum crassinervium* (Taylor) Loeske & M. Fleisch.** (Cicr): on soil in the nearness of Monte Castello (32T NL 61806 24725).

***Didymodon luridus* Hornsch.** (Dilu): on soil in the nearness of Villa Tamponi (32T NL 60696 24634).

***Eurhynchiastrum pulchellum* (Hedw.) Ignatov. & Huttunen** (Eupu): on rock in the gully to Cala Spagnola (32T NL 60240 24932); on rock in therophytic meadows in the nearness of the sea (32T NL 60390 25722); on rock, about 6 m from the sea, Cala di Chiesa (32T NL 61050 25310); on soil in a rocky ridge with *Cistus monspeliensis, C. salvifolius* and *Pistacia lentiscus* under Monte Castello (32T NL 61777 24570); on soil in a therophtic meadow with *Cistus monspeliensis* and *Pistacia lentiscus*, entrance of the Fosso dei Morti valley (32T NL 62214 24623).

***Fissidens bryoides* Hedw.** (Fibr): on soil, meadows with *Asphodelus aestivus*, *Avena barbata*, *Plantago* sp., *Trifolium* sp. (32T NL 60799 24766).

***Fissidens crispus* Mont.** (Ficr): on soil, between Punta dell'Aia and La Vedetta (32T NL 60575 24508); on soil in vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris*, La Vedetta (32T NL 60575 24508); on soil in vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris*, entrance of the L'Orto valley (32T NL 60883 24843); on soil, in the second spring in the nearness of a tree of *Castanea sativa* (32T NL 61226 24935); on the cement edge of the triangular basin, vegetation with *Pistacia lentiscus*, *Phillyrea* sp. and *Olea europaea* var. *sylvestris* (32T NL 61854 24492).

***Fissidens taxifolius* Hedw.** (Fita): on soil, Punta dell'Aia (32T NL 61769 24668).

***Fissidens viridulus* (Sw.) Wahlenb.** (Fivi): on soil in a rock crevice, Punta La Guardia (32T NL 60440 24858); at the base of the trunk of *Olea europaea* var. *sylvestris* in the gully to Punta dell'Aia (32T NL 60922 24375).

***Fontinalis hypnoides* C. Hartm. *var. duriaei* (Schimp.) Kindb.** (Fohd): on soil, Fosso dei Morti (32T NL 62278 24539).

***Grimmia laevigata* (Brid.) Brid.** (Grla): on rock, along the gully to the sea (32T NL 60321 25148); on rock, in front of the sea (32T NL 60795 24142); on rock (32T NL 61069 24405), (32T NL 61886 25029), (32T NL 61902 24204), (32T NL 61994 25058); on rock in vegetation with *Pistacia lentiscus*, *Phillyrea* sp. and *Olea europaea* var. *sylvestris* (32T NL 61854 24492); on rock in vegetation with *Cistus monspeliensis, C. salvifolius*, *Pistacia lentiscus* and *Erica arborea*, nearby Monte Castello (32T NL 61872 24772).

***Grimmia lisae* De Not.** (Grli): on rock in vegetation with *Juniperus turbinata*, *Pistacia lentiscus* and *Cistus salvifolius* (32T NL 60531 24931); on rock and on ruins behind the houses (32T NL 60696 24634); on rock (32T NL 60952 24858), (32T NL 61020 24806); on soil in the nearness of some trees of *Quercus suber* (32T NL 61041 24571); on rock, Punta dell'Aia (32T NL 61184 24524), on rock, L'Orto (32T NL 61226 24935); on rock in vegetation with *Cistus monspeliensis*, *Pistacia lentiscus* and *Erica arborea*, nearby Monte Castello (32T NL 61872 24772).

***Grimmia pulvinata* (Hedw.) Sm.** (Grpu): on rock in the nearness of some trees of *Quercus suber* (32T NL 61041 24571); on soil, second spring in the nearness of a tree of *Castanea sativa* (32T NL 61226 24935); on soil in a therophytic meadow with *Carlina corymbosa* (32T NL 61514 24459).

***Grimmia trichophylla* Grev.** (Grtr): on rock in therophytic meadows in the nearness of the sea (32T NL 60390 25722); on rock, between Punta dell'Aia and La Vedetta (32T NL 60575 24508); on rock in the wood with *Phillyrea angustifolia* (32T NL 60608 24969); on a low wall (32T NL 60933 24806); on rock in the nearness of water dripping (32T NL 61034 24809); on rock in vegetation with *Cistus monspeliensis* (32T NL 61107 24491); on rock (32T NL 61020 24806), (32T NL 61069 24405), (32T NL 61994 25058); on rock, Punta dell'Aia (32T NL 61184 24524), (32T NL 61723 24621), (32T NL 61744 24640), (32T NL 61769 24668); on rock in vegetation with *Pistacia lentiscus, Phillyrea* sp. and *Olea europaea* var. *sylvestris* (32T NL 61854 24492); on rock in a clearing with big emergent boulders and in vegetation with *Pistacia lentiscus* and *Olea europaea* var. *sylvestris* (32T NL 61943 25095); on rock along the gully, Fosso dei Morti (32T NL 62115 24558).

***Gymnostomum aeruginosum* Sm.** (Gyae): on soil (32T NL 62153 25053).

***Homalothecium philippeanum* (Spruce) Schimp..** (Hoph): on soil in meadows with *Asphodelus aestivus, Avena barbata*, *Plantago* sp., *Trifolium* sp. (32T NL 60799 24766).

***Homalothecium sericeum* (Hedw.) Schimp.** (Hose): on rock in the gully to Cala Spagnola (32T NL 60240 24932); on bark of *Olea europaea* var. *sylvestris*, in the gully to Cala Spagnola (32T NL 60297 24913); on rock in therophytic meadows in the nearness of the sea (32T NL 60390 25722); on soil (32T NL 60436 25101); on soil in a rock crevice, Punta La Gurdia (32T NL 60440 24858); on soil between Punta dell'Aia and La Vedetta (32T NL 60575 24508), (32T NL 60667 24590); at the base of the trunk of *Olea europaea* var. *sylvestris*, entrance of the L'Orto valley (32T NL 60883 24843); at the base of the trunk of *Olea europaea* var. *sylvestris* in the clearings of the vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris* (32T NL 60933 24806); on rock

(32T NL 61020 24806), (32T NL 61069 24405), (32T NL 61184 24524); on rock, Punta dell'Aia (32T NL 61723 24621); on bark of *Salix atrocinerea* Brot., in the nearness of the triangular basin (32T NL 61034 24809).

***Hygroamblystegium tenax* (Hedw.) Jenn.** (Hyte): on soil nearby La Casetta (32T NL 60486 24961).

***Hypnum cupressiforme* Hedw.** (Hycu): on rock along the gully to the sea (32T NL 60321 25148); at the base of the trunk of *Olea europaea* var. *sylvestris* (32T NL 60739 24725); on rock (32T NL 60952 24858), (32T NL 61020 24806), (32T NL 61069 24405); on soil (32T NL 61069 24405); on the bark of *Cistus monspeliensis* (32T NL 61107 24491); on rock, along the gully, Fosso dei Morti (32T NL 62115 24558).

***Hypnum lacunosum* (Brid.) Hoffm. ex Brid.** (Hyla): on rock, Punta dell'Aia (32T NL 61723 24621).

***Hypnum resupinatum* Taylor** (Hyre): on soil in the wood with *Phillyrea angustifolia* (32T NL 60178 24997); on soil in a therophytic meadow in the nearness of the sea (32T NL 60436 25101); on the bark of *Juniperus turbinata*, on rock and on soil, in vegetation with *Juniperus turbinata*, *Pistacia lentiscus* and *Cistus salvifolius* (32T NL 60531 24931); at the base of the trunk of *Quercus suber* (32T NL 60535 25003); on the bark of *Salix atrocinerea*, in the nearness of the first triangular basin (32T NL 61034 24809); on rock in the nearness of water dripping (32T NL 61034 24809); on rock, in the nearness of some trees of *Quercus suber* (32T NL 61041 24571); on rock nearby the second spring in the nearness of a tree of *Castanea sativa* (32T NL 61226 24935); on rock (32T NL 61065 24821), (32T NL 61184 24524); on rock, Punta dell'Aia (32T NL 61744 24640), (32T NL 61769 24668); on rock in front of the sea, Fosso dei Morti (32T NL 62386 24396).

***Kindbergia praelonga* (Hedw.) Ochyra** (Kipr): on soil in meadows with *Asphodelus aestivus*, *Avena barbata*, *Plantago* sp., *Trifolium* sp. (32T NL 60799 24766); on soil in vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris*, entrance of the L'Orto valley (32T NL 60883 24843); on rock in the nearness of water dripping (32T NL 61034 24809); on soil (32T NL 61854 24492).

***Leptodon smithii* (Hedw.) F. Weber & D. Mohr** (Lesm): at the base of the trunk of *Olea europaea* var. *sylvestris*, in the gully to Punta dell'Aia (32T NL 60922 24375); on rock, La Vedetta (32T NL 60575 24508); at the base of the trunk of *Olea europaea* var. *sylvestris* (32T NL 61069 24405).

***Orthotrichum diaphanum* Brid.** (Ordi): on the bark of *Olea europaea* var. *sylvestris*, at a height of about 2 m (32T NL 60518 25023); at the base of the bark of *Olea europaea* var. *sylvestris,* nearby Villa Tamponi (32T NL 60739 24725), (32T NL 61069 24405); on the bark of *Olea europaea* var. *sylvestris,* in the clearings of the vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris* (32T NL 60933 24806); on the bark of *Cistus monspeliensis* (32T NL 61107 24491).

***Oxyrrhynchium hians* (Hedw.) Loeske** (Oxhi): on soil in vegetation with *Juniperus turbinata*, *Pistacia lentiscus* and *Cistus salvifolius* (32T NL 60531 24931); on soil in vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris*, entrance of the L'Orto valley (32T NL 60883 24843); on soil (32T NL 60987 25237); on soil nearby a group of *Quercus ilex* after the second spring (32T NL 61066 24994); on soil in a therophytic meadow with *Carlina corymbosa,* (32T NL 61514 24459).

***Oxyrrhynchium pumilum* (Wilson) Loeske** (Oxpu): on soil in a spring nearby some trees of *Quercus ilex* (32T NL 61066 24994).

***Oxyrrhynchium schleicheri* (R. Hedw.) Röll** (Oxsc): on soil in the wood with *Phillyrea angustifolia* (32T NL 60178 24997); on rock in the gully to Cala Spagnola (32T NL 60240 24932); on rock, in therophytic meadows in the nearness of the sea (32T NL 60390 25722); on soil, Punta dell'Aia (32T NL 61723 24621).

***Oxyrrhynchium speciosum* (Brid.) Warnst.** (Oxsp): on soil, La Casetta (32T NL 60486 24961).

***Oxystegus tenuirostris* (Hook. & Taylor) A.J.E. Sm.** (Oxte): on rock, in the nearness of water dripping (32T NL 61034 24809); on a low wall (32T NL 60933 24806).

Phascum cuspidatum* Hedw. *var. cuspidatum (Phcu): on soil in meadows (32T NL 60682 24667); at the base of the trunk of *Olea europaea* var. *sylvestris* (32T NL 60682 24667).

***Phascum cuspidatum var. piliferum* (Hedw.) Hook & Taylor** (Phcp): on the bark of *Olea europaea* var. *sylvestris* nearby Villa Tamponi (32T NL 60739 24725).

***Pleuridium acuminatum* Lindb.** (Plac): on the bark of *Olea europaea* var. *sylvestris* nearby Villa Tamponi (32T NL 60739 24725).

***Pleurochaete squarrosa* (Brid.) Lindb.** (Plsq): on soil, in the wood with *Phillyrea angustifolia* (32T NL 60178 24997); on rock in the gully to Cala Spagnola (32T NL 60240 24932); on soil in therophytic meadows in the nearness of the sea (32T NL 60390 25722), (32T NL 60613 25921); on soil in meadows with *Asphodelus aestivus*, *Avena barbata*, *Plantago* sp., *Trifolium* sp. (32T NL 60784 24803), (32T NL 60799 24766); on soil in vegetation with *Cistus monspeliensis, C. salvifolius* and *Olea europaea* var. *sylvestris*, entrance of the L'Orto valley (32T NL 60883 24843); on soil in the nearness of some trees of *Quercus suber* (32T NL 61041 24571); on soil in a rocky ridge with *Cistus monspeliensis, C. salvifolius* and *Pistacia lentiscus*, under Monte Castello (32T NL 61777 24570); on soil in a therophytic meadow with *Carlina corymbosa* (32T NL 62343 23993); on soil, Punta Leoneddu (32T NL 61806 24725); on soil (32T NL 61854 24492), (32T NL 61886 25029); on soil, vegetation with *Pistacia lentiscus*, *Phillyrea* sp. and *Olea europaea* var. *sylvestris* (32T NL 61854 24492); on rock in vegetation with *Cistus monspeliensis, C. salvifolius*, *Pistacia lentiscus* and *Erica arborea* nearby Monte Castello (32T NL 61872 24772); on soil in a clearing with big emergent boulders and in vegetation with *Pistacia lentiscus* and *Olea europaea* var. *sylvestris* (32T NL 61943 25095).

***Pseudocrossidium hornschuchianum* (Schultz) R. H. Zander** (Psho): on soil in the nearness of Villa Tamponi (32T NL 60933 24806); on soil in a therophytic meadow with *Carlina corymbosa* (32T NL 61514 24459).

***Pterogonium gracile* (Hedw.) Sm.** (Ptgr): at the base of the trunk of *Olea europaea* var. *sylvestris*, along the gully to Punta dell'Aia (32T NL 60922 24375); on rock (32T NL 61020 24806); on rock in the nearness of some trees of *Quercus suber* (32T NL 61041 24571); on rock along the gully, Fosso dei Morti (32T NL 62115 24558).

***Rhynchostegiella litorea* (De Not.) Limpr.** (Rhli): on the cement edge of the triangular basin in vegetation with *Pistacia lentiscus*, *Phillyrea* sp. and *Olea europaea* var. *sylvestris* (32T NL 61854 24492).

***Rhynchostegiella tenella* (Dicks.) Limpr.** (Rhte): on rock in the nearness of water dripping (32T NL 61034 24809); on soil, Punta dell'Aia (32T NL 61723 24621); on rock, Punta dell'Aia (32T NL 61744 24640).

***Rhynchostegium confertum* (Dicks.) Schimp..** (Rhco): on rock, between Punta dell'Aia and La Vedetta (32T NL 60575 24508); on soil (32T NL 61065 24821); on rock, L'Orto (32T NL 61226 24935).

***Rhynchostegium megapolitanum* (F. Weber & D. Mohr) Schimp.** (Rhme): on soil in vegetation with *Juniperus turbinata*, *Pistacia lentiscus* and *Cistus salvifolius* (32T NL 60531 24931); on soil in therophytic meadows in front of the sea, Punta dell'Aia (32T NL 60736 24125); on soil in meadows with *Asphodelus aestivus*, *Avena barbata*, *Plantago* sp., *Trifolium* sp. (32T NL 60799 24766); on soil and at the base of the trunk of *Olea europaea* var. *sylvestris*, along the gully to Punta dell'Aia (32T NL 60922 24375); on soil in vegetation with *Olea europaea* var. *sylvestris* (32T NL 61107 24491); on soil, in vegetation with *Pistacia lentiscus*, *Phillyrea* sp. and *Olea europaea* var. *sylvestris* (32T NL 61854 24492); on rock in front of the sea, Fosso dei Morti (32T NL 62386 24396); on rock (32T NL 61184 24524); on soil, Punta Leoneddu (32T NL 61806 24725), (32T NL 61854 24492).

***Scleropodium cespitans* (Müll. Hal.) L. F. Koch** (Scce): on soil in the clearings of the vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris* (32T NL 60933 24806); on soil in the nearness of some trees of *Quercus suber* (32T NL 61041 24571).

***Scleropodium touretii* (Brid.) L. F. Koch** (Scto): on soil in the wood of *Phillyrea angustifolia* (32T NL 60178 24997); on soil in therophytic meadows in the nearness of the sea (32T NL 60613 25921); on soil (32T NL 61584 25108); on soil, Punta dell'Aia (32T NL 61658 24553).

***Scorpiurium circinatum* (Bruch) M. Fleisch. & Loeske** (Scci): on soil, grazing (32T NL 61034 24803); at the base of the trunk of *Olea europaea* var. *sylvestris* (32T NL 61069 24405); on soil (32T NL 61069 24405), (32T NL 61854 24492); on rock in front of the sea, Fosso dei Morti (32T NL 62386 24396).

***Scorpiurium sendtneri* (Schimp.) M. Fleisch.** (Scse): on bark in the wood of *Phillyrea angustifolia* nearby La Casetta (32T NL 60486 24961); on rock in the nearness of water dripping (32T NL 61034 24809).

***Syntrichia laevipila* Brid.** (Syla): at the base of the trunk of *Olea europaea* var. *sylvestris,* along the gully to Punta dell'Aia (32T NL 60922 24375); at the base of the trunk of *Olea europaea* var. *sylvestris* (32T NL 61069 24405).

***Timmiella barbuloides* (Brid.) Mönk.** (Tiba): on soil in the clearings of the vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris* (32T NL 60933 24806).

***Tortella flavovirens* (Bruch) Broth.** (Tofl): on soil, Cala Spagnola (32T NL 60064 24881); on soil in the wood of *Phillyrea angustifolia* (32T NL 60178 24997); on the trunk of *Olea europaea var. sylvestris*, along the gully to Cala Spagnola (32T NL 60297 24913); on rock in therophytic meadows in the nearness of the sea (32T NL 60390 25722); on soil in vegetation with *Juniperus turbinata*, *Pistacia lentiscus* and *Cistus salvifolius* (32T NL 60531 24931); on soil, meadows (32T NL 60682 24667); on soil in therophytic meadows in front of the sea, Punta dell'Aia (32T NL 60736 24125); on rock (32T NL 60764 24225); on soil (32T NL 60987 25237), (32T NL 61034 24809), (32T NL 61652 24997), (32T NL 61854 24492); on soil in the nearness of some trees of *Quercus suber* (32T NL 61041 24571); on ruins, Monte Castello (32T NL 61928 25118); on rock, about 6 m from the sea, Cala di Chiesa (32T NL 61050 25310); on soil, nearby L'Orto (32T NL 61296 25300); on soil along the pathway to the sea, nearby L'Orto (32T NL

61365 25549); on soil, Punta dell'Aia (32T NL 61723 24621); on rock along the gully, to Fosso dei Morti (32T NL 62115 24558); on soil in a therophytic meadow with *Cistus monspeliensis* and *Pistacia lentiscus*, entrance of the Fosso dei Morti valley (32T NL 62214 24623); on rock in front of the sea, Fosso dei Morti (32T NL 62386 24396); on soil in front of the sea, Cala di Chiesa (32T NL 61050 25310).

***Tortella inflexa* (Bruch) Broth.** (Toin): on soil under a rock crevice (32T NL 60687 24706); on rock and on ruins behind the houses (32T NL 60696 24634); at the base of the trunk of *Olea europaea* var. *sylvestris* (32T NL 60739 24725); on soil in vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris*, entrance of the L'Orto valley (32T NL 60883 24843); on soil, second spring in the nearness of a tree of *Castanea sativa* (32T NL 61226 24935).

***Tortella nitida* (Lindb.) Broth.** (Toni): on rock in vegetation with *P. lentiscus*, *Phillyrea* sp. and *Olea europaea* var. *sylvestris* (32T NL 61854 24492).

***Tortula canescens* Mont.** (Toca): at the base of the trunk of *Olea europaea* var. *sylvestris* (32T NL 60739 24725).

***Tortula cuneifolia* (Dicks.) Turner** (Tocu): on a low wall (32T NL 60933 24806).

***Tortula israelis* Bizot & F. Bilewsky** (Tois): on rock and on the ruins behind the houses (32T NL 60696 24634).

***Tortula muralis* Hedw.** (Tomu): on soil in the nearness of Villa Tamponi (32T NL 60696 24634), (32T NL 60682 24667).

***Tortula wilsonii* (Hook.) R. H. Zander** (Towi): on soil (32T NL 61994 25058).

***Trichostomum brachydontium* Bruch** (Trbr): on soil, between Punta dell'Aia and La Vedetta (32T NL 60575 24508); on soil in therophytic meadows in the nearness of the sea (32T NL 60613 25921); on soil along the gully to Punta dell'Aia (32T NL 60922 24375); on rock (32T NL 61065 24821); on soil, second spring in the nearness of a tree of *Castanea sativa* (32T NL 61226 24935); on soil, Punta dell'Aia, (32T NL 61658 24553); on rock, Punta dell'Aia, (32T NL 61744 4524640); on soil along the gully, to Fosso dei Morti (32T NL 61983 21506); on soil in vegetation with *Cistus monspeliensis, C. salvifolius* and *Pistacia lentiscus*; on rock (32T NL 61065 24821); on soil in a therophytic meadow with *Cistus monspeliensis* and *Pistacia lentiscus,* entrance of the Fosso dei Morti valley (32T NL 62214 24623); on soil (32T NL 61065 24821), (32T NL 61069 24405), (32T NL 61584 25108); on soil, Fosso dei Morti (32T NL 62278 24539).

***Trichostomum crispulum* Bruch** (Trcr): on rock, Cala Spagnola (32T NL 60015 24834); on the roots of *Pistacia lentiscus*, in the gully to Cala Spagnola (32T NL 60240 24932); on rock in therophytic meadows in the nearness of the sea (32T NL 60390 25722); on soil in the nearness of big oaks (32T NL 60535 25003); on rock and on soil between Punta dell'Aia and La Vedetta (32T NL 60575 24508); on soil in meadows with *Asphodelus aestivus*, *Avena barbata*, *Plantago* sp. and *Trifolium* sp. pl. (32T NL 60784 24803); on rock in the nearness of some trees of *Quercus suber* (32T NL 61041 24571); on rock in vegetation with *Cistus monspeliensis* (32T NL 61107 24491); on rock in vegetation with *Cistus salvifolius*; on soil, second spring in the nearness of a tree of *Castanea sativa* (32T NL 61226 24935); on soil and on rock, Punta dell'Aia (32T NL 61723 24621), (32T NL 61769 24668); on soil in the rocky ridge with *Cistus monspeliensis, C. salvifolius* and *Pistacia lentiscus* under Monte Castello (32T NL 61777 24570); on soil, Punta Leoneddu (32T NL 61806 24725); on rock in vegetation with

Cistus monspeliensis, C. salvifolius, *Pistacia lentiscus* and *Erica arborea*, nearby Punta Castello (32T NL 61872 24772); on ruins, Monte Castello (32T NL 61928 25118); on rock in a clearing with big emergent boulders and in vegetation with *Pistacia lentiscus* and *Olea europaea* var. *sylvestris* (32T NL 61943 25095); on soil (32T NL 61994 25058); on soil in the clearings of the vegetation with *Cistus salvifolius* and *Olea europaea* var. *sylvestris* (32T NL 60933 24806).

***Weissia controversa* Hedw.** (Weco): on soil in therophytic meadows (32T NL 60535 25503); at the base of the trunk of *Olea europaea* var. *sylvestris*, along the gully to Punta dell'Aia (32T NL 60922 24375); on soil in vegetation with *Cistus monspeliensis, C. salvifolius*, *Pistacia lentiscus* and *Erica arborea*, nearby Monte Castello (32T NL 61872 24772); on soil (32T NL 61886 25029); on soil in a clearing with big emergent boulders and in vegetation with *Pistacia lentiscus* and *Olea europaea* var. *sylvestris* (32T NL 61943 25095); on soil, along the gully, Fosso dei Morti (32T NL 61983 21506).

***Zygodon rupestris* Schimp. ex Lorentz** (Zyru): on bark of *Olea europaea* var. *sylvestris*, at about 2 m of height (32T NL 60518 2502); at the base of the trunk of *Olea europaea* var. *sylvestris*, entrance of the L'Orto valley (32T NL 60883 24843); at the base of the trunk of *Olea europaea* var. *sylvestris*, along the gully to Punta dell'Aia (32T NL 60922 24375); on the dung of a cow, Punta dell'Aia (32T NL 61041 24571).

Marchantiophyta

***Chiloscyphus coadunatus* (Sw.) J.J. Engel *et* R.M. Schust var. *rivularis* (Raddi) Schumacker *et* Váňa** (Chcr): on soil in a rock crevice, Punta La Guardia (32T NL 60440 24858).

***Corsinia coriandrina* (Spreng.) Lindb.** (Coco): on soil (32T NL 60064 24881), (32T NL 60390 25122), (32T NL 61622 24997); on soil, along the gully with *Olea europaea* var. *sylvestris* and *Pistacia lentiscus* in the nearness of a spring (32T NL 60591 24975).

***Fossombronia angulosa* (Dicks.) Raddi** (Foan): on soil (32T NL 60400 24858).

***Frullania dilatata* (L.) Dumort.** (Frdi): on rock in front of the sea, Fosso dei Morti (32T NL 62386 24396); at the base of the trunk of *Olea europaea* var. *sylvestris*, entrance of the L'Orto valley (32T NL 60883 24843); on the bark of *Olea europaea* var. *sylvestris*, at about 2 m of height (32T NL 60518 25023); on the bark of *Quercus suber* (32T NL 60562 25018); at the base of the trunk of *Olea europaea* var. *sylvestris* (32T NL 60933 24806); on rock, in the nearness of water dripping (32T NL 61034 24809); on rock (32T NL 61065 24821), (32T NL 61069 24405); at the base of the trunk of *Olea europaea* var. *sylvestris*, (32T NL 61069 24405); on rock in vegetation with *Cistus monspeliensis* (32T NL 61107 24491); on the trunk of *Olea europaea* var. *sylvestris*, Monte Castello (32T NL 61928 25118); on soil and on rock, Punta dell'Aia (32T NL 61723 24621), (32T NL 61744 24640); at the base of the trunk of *Olea europaea* var. *sylvestris*, along the gully to Punta dell'Aia (32T NL 60922 24375); on rock, between Punta dell'Aia and La Vedetta (32T NL 60575 24508); at the base of the trunk of *Quercus suber* (32T NL 60535 25003).

***Frullania tamarisci* (L.) Dumort.** (Frta): on the trunk of *Olea europaea* var. *sylvestris*, in the gully to Cala Spagnola (32T NL 60297 24913); on the bark of *Salix atrocinerea*, before the triangular basin (32T NL 61034 24809); on soil in a rock crevice, Punta La Guardia (32T NL 60440 24858); on rock in vegetation with *Juniperus turbinata*, *Pistacia lentiscus* and *Cistus salvifolius* (32T NL 60531 24931); on rock in the nearness of some trees of *Quercus suber* (32T NL 61041 24571); on rock, along the gully, Fosso dei Morti (32T NL 62115 24558); on rock, between Punta dell'Aia and La Vedetta (32T NL 60575 24508); on rock, La Vedetta (32T NL 60575 24508); on rock, Punta dell'Aia (32T NL 61744 24640), (32T NL 61769 24668); on a low wall (32T NL 60933 24806); on rock (32T NL 61020 24806), (32T NL 61069 24405).

***Radula complanata* (L.) Dumort.** (Raco): on soil in a rock crevice nearby Punta La Guardia (32T NL 60440 24858).

***Reboulia hemisphaerica* (L.) Raddi** (Rehe): on soil, nearby some trees of *Quercus ilex* after the second spring (32T NL 61066 24994).

***Riccia crosalzii* Levier** (Ricr): on soil in a gully with *Olea europaea* var. *sylvestris* and *Pistacia lentiscus* in the nearness of a spring (32T NL 60591 24975).

***Riccia nigrella* DC.** (Rini): on soil in a gully with *Olea europaea* var. *sylvestris* and *Pistacia lentiscus* in the nearness of a spring (32T NL 60591 24975).

***Riccia sorocarpa* Bisch.** (Riso): on soil in a gully with *Olea europaea* var. *sylvestris* and *Pistacia lentiscus* in the nearness of a spring (32T NL 60591 24975).

Anthocerotophyta

***Phaeoceros bulbiculosus* (Brot.) Prosk.** (Phbu): on soil near the triangular basin in vegetation with *Pistacia lentiscus*, *Phillyrea angustifolia* ad *Olea europaea* var. *sylvestris* (32T NL 61854 24492).

Results

The total number of bryophytes which were found during the research is of 80 taxa, 69 of which belong to the *Bryophyta,* 10 to the *Marchantiophyta* and 1 to the *Anthocerotophyta.* The presence and the quantity of the species depends mainly on the zones and on the sites and the conditions of the habitats in question; however, mosses are the predominant elements in the bryoflora of the area. *Pottiaceae* and *Brachytheciaceae* are the most represented families (respectively 23 and 18 taxa) among the mosses, whereas *Ricciaceae* (with 3 taxa) are the most present among the hepatics. The acrocarpic mosses (44 taxa), half of which consist of entities with a colonist life strategy (24 taxa), are predominant and settles mainly in the most xeric areas, especially in the numerous therophytic grasses. Because of the xeric nature of the island, pleurocarpic mosses (25 taxa), mainly with a perennial life strategy, grow mainly on the rocks and on the land, in the clearings in the shade of the scrubs and at the base of the trunks of the trees which are found in the south-eastern area. A discovery of great interest is the finding of *Scorpiurium sendtneri* , a new species for Sardinia which settles on barks of *Phillyrea angustifolia* and on rocks near

dripping water. It is a submediterranean-(suboceanic) subneutrophile entity, which is moderately xerophile and has a perennial life strategy. In Italy it can be found in northern and central areas and in Sicily (Cortini Perdrotti 2001); the area it occupies extends across the eastern Mediterranean (Yugoslavia, Crete, Israel, Cyprus, Greece) as far as the Iberian Peninsula (Casas & al. 1985). The elaboration of chorologic data (Fig. 2) features the predominance of the species belonging to the Mediterranean-Oceanic group and to the Oceanic-Mediterranean group (34 species, 42 %) and the temperate group (27 species, 34%), whereas the number of species belonging to the Submediterranean and Mediterranean group (11 taxa, 14%) is modest. On the whole, data are well related to the Mediterranean bioclimatic characteristics of the examined territory.

As regards ecological factors (Table 1), xerophytic entities (27 species) and acid-subneutrophytic entities (28 species) prevail. They are widespread throughout the island and grow mainly in therophytic grasses, on rocks and on land, with a predominant short–turf form of growth. Hygrophytic *s.str* species, especially among the mosses, are common (8 species). The numerous subneutrophytic entities (21 species) grow mainly on the barks of wild olive trees. As regards the anthropic impact, on the whole, those species which can tolerate from a low to high anthropic impact (meso-euhemerophile 14; oligo-euhemerophile and ahem-mesoemerophile 13 e 12, respectively) are present mainly in the area of L'Orto, which in the past was used for cultivation and where animals currently graze.

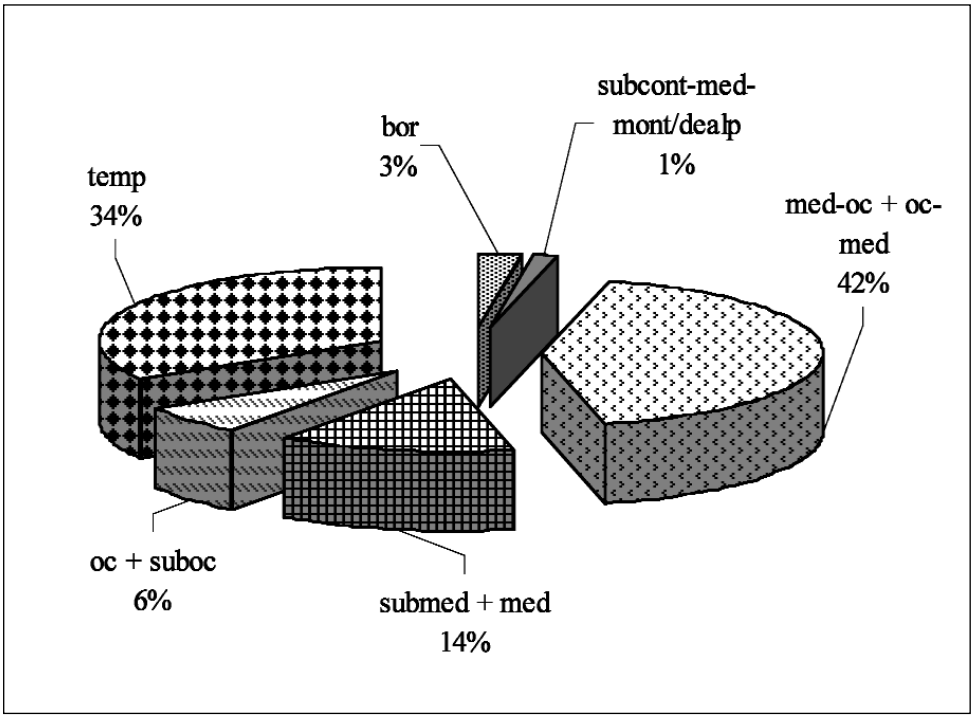

Fig. 2. Chorological spectrum.

Table 1. Chorology and ecology of collected species.

Species	Chorological elements	pH	Humidity	Human impact	Life strategiess	Growth forms
Alri	temp	subneutro-basiphytic	xerophytic	meso-euhemerobous	colonist	short turf
Aral	suboc	acido-subneutrophytic	hygro-xerophytic	oligo-euhemerobous	short-lived shuttle	short turf
Baco	temp	subneutro-basiphytic	meso-xerophytic	eu-polyhemerobous	colonist	short turf
Baun	temp	acido-subneutrophytic	hygro-xerophytic	meso-polyhemerobous	colonist	short turf
Bast	suboc-med	acido-subneutrophytic	xerophytic	ahem-mesohemerobous	long-lived shuttle	short turf
Brru	temp	acido-subneutrophytic	hygro-mesophytic	meso-euhemerobous	competitive perennial	weft
Bral	suboc-submed-mont	acido-subneutrophytic	hygro-mesophytic	ahem-euhemerobous	colonist	short turf
Brce	temp	subneutro-basiphytic	meso-xerophytic	ahem-oligohemerobous	colonist	short turf
Brca	temp	subneutro-basiphytic	meso-xerophytic	oligo-euhemerobous	colonist	short turf
Brdi	submed	subneutro-basiphytic	meso-xerophytic	eu-polyhemerobous	competitive perennial	short turf
Brps	temp	subneutrophytic	hygrophytic	ahem-mesohemerobous	competitive perennial	short turf
Brra	suboc-med	basiphytic	xerophytic	meso-euhemerobous	ephemeral colonist	short turf
Brto	submed-suboc	basiphytic	hygro-xerophytic	meso-euhemerobous	long-lived shuttle	short turf
Chcl	oc-med	subneutrophytic	xerophytic	n.d.	colonist	short turf
Cicr	suboc(-mont)	subneutrophytic	hygro-mesophytic	ahem-oligohemerobous	perennial	weft
Dilu	submed	basiphytic	xerophytic	meso-euhemerobous	colonist	short turf
Eupu	subbor-mont	acido-subneutrophytic	meso-xerophytic	oligo-mesohemerobous	stress tolerant perennial	weft
Fibr	submed	acido- subneutrophytic	hygro-xerophytic	oligo-euhemerobous	colonist	short turf
Ficr	oc-med	subneutrophytic	meso-xerophytic	oligo-euhemerobous	competitive perennial	short turf
Fita	temp	acido-subneutrophytic	mesophytic	meso-euhemerobous	colonist	short turf
Fivi	submed	subneutrophytic	hygro-mesophytic	oligo-euhemerobous	ephemeral colonist	short turf
Fohd	submed	subneutrophytic	hygrophytic	ahem-mesohemerobous	perennial	tail
Grla	submed-suboc-mont	acido-subneutrophytic	xerophytic	oligo-mesohemerobous	colonist	short turf
Grli	med-oc	acido-subneutrophytic	hygro-mesophytic	ahem-oligohemerobous	ephemeral colonist	tall turf
Grpu	temp	acido-basiphytic	xerophytic	n.d.	annual shuttle	short turf
Grtr	temp (-mont)	acido-subneutrophytic	hygro-xerophytic	oligo-mesohemerobous	competitive perennial	short turf
Gyae	bor-mont	subneutrophytic	hygrophytic	ahem-mesohem	competitive perennial	tail
Hoph	subcont-med-mont/dealp	basiphytic	xerophytic	n.d.	perennial	mat
Hose	temp	basiphytic	xerophytic	ahem-mesohemerobous	perennial	mat
Hyte	temp	subneutrophytic	hygrophytic	oligohemerobous	perennial	weft
Hycu	temp	acido-subneutrophytic	meso-xerophytic	oligo-euhemerobous	stress tolerant perennial	weft
Hyla	temp	acido-basiphytic	xerophytic	n.d.	stress tolerant perennial	weft
Hyre	oc	acidophytic	mesophytic	n.d.	stress tolerant perennial	weft
Kipr	temp	acido- subneutrophytic	hygrophytic	oligo-euhemerobous	perennial	weft
Lesm	oc-med	subneutrophytic	meso-xerophytic	ahem-euhemerobous	perennial	weft
Ordi	temp	subneutro-basiphytic	xerophytic	mesoeuhemerobous	colonist	mat
Oxhi	temp	acido-basiphytic	hygro-mesophytic	ahem-euhemerobous	competitive perennial	weft
Oxpu	suboc-submed	subneutrophytic	xerophytic	oligo-euhemerobous	perennial	weft
Oxsc	submed-suboc	acido-subneutrophytic	hygro-xerophytic	oligo-mesohemerobous	perennial	weft
Oxsp	temp	acido-subneutrophytic	hygro-mesophytic	oligo-mesohemerobous	perennial	weft
Oxte	suboc-mont	acido-(subneutrophytic)	hygro-mesophytic	ahem-mesohemerobous	competitive perennial	mat

Table 1. (continued.)

Phcu	temp	acido-subneutrophytic	mesophytic	eu-polyhemerobous	annual shuttle	mat
Phcp	submed	acido-subneutrophytic	mesophytic	eu-polyhemerobous	annual shuttle	cushion
Plac	suboc	acido-subneutrophytic	hygro-mesophytic	meso-euhemerobous	annual shuttle	cushion
Plsq	submed	basiphytic	xerophytic	ahem-mesohemerobous	competitive perennial	cushion
Psho	submed-suboc	subneutrophytic	meso-xerophytic	mesohemerobous	colonist	short turf
Ptgr	suboc-submed-mont	subneutrofytic	hygro-xerophytic	ahem-mesohemerobous	long-lived shuttle	tail
Rhli	oc-med	basiphytic	hygrophytic	ahem-oligohemerobous	stress tolerant perennial	mat
Rhte	submed-suboc	subneutro-basiphytic	hygro-mesophytic	ahem-oligohemerobous	stress tolerant perennial	mat
Rhco	submed-oc	subneutrophytic	hygro-mesophytic	ahem-euhemerobous	perennial	tail
Rhme	submed	subneutrophytic	hygro-xerophytic	mesohemerobous	perennial	short turf
Scce	oc-submed	subneutrophytic	mesophytic	meso-euhemerobous	perennial	weft
Scto	oc-submed	acido-subneutrophytic	xerophytic	meso-euhemerobous	perennial	weft
Scci	oc-med	basiphytic	xerophytic	euhemerobous	perennial	weft
Scse	submed(-suboc)	subneutrophytic	xerophytic	n.d.	perennial	weft
Syla	oc-submed	subneutrophytic	xerophytic	ahem-euhemerobous	colonist	short turf
Tiba	med	basiphytic	xerophytic	ahem-euhemerobous	short-lived shuttle	short turf
Tofl	suboc-submed	subneutrophytic	xerophytic	oligo-mesohemerobous	colonist	short turf
Toin	oc-med	basiphytic	meso-xerophytic	oligo-mesohem	colonist	short turf
Toni	oc-med	subneutro- basiphytic	xerophytic	meso-euhemerobous	stress tolerant perennial	short turf
Toca	suboc-med	subneutrophytic	xerophytic	oligo-euhemerobous	colonist	short turf
Tocu	suboc-submed	subneutrophytic	xerophytic	meso-euhemerobous	colonist	short turf
Tois	med(-oc)	subneutrophytic	xerophytic	ahem-oligohemerobous	colonist	short turf
Tomu	temp	subneutro-basiphytic	meso-xerophytic	meso-polyhemerobous	colonist	short turf
Towi	oc-med	acido-basiphytic	xerophytic	meso-polyhemerobous	annual shuttle	cushion
Trbr	submed-mont	acido-basiphytic	meso-xerophytic	ahem-mesohemerobous	perennial	short turf
Trcr	temp-mont	basiphytic	meso-xerophytic	ahem-mesohemerobous	colonist	short turf
Weco	temp	acido-subneutrophytic	xerophytic	oligo-euhemerobous	colonist	short turf
Zyru	suboc-med	basiphytic	xerophytic	n.d.	colonist	cushion
Chcr	w.temp	acido-subneutrophytic	hygrophytic	oligo-euhemerobous	competitive perennial	mat
Coco	suboc-med	acido-subneutrophytic	xerophytic	oligo-mesohemerobous	short-lived shuttle	mat
Foan	oc-med	acido-subneutrophytic	hygro-mesophytic	meso-euhemerobous	annual shuttle	mat
Frdi	temp	acido-subneutrophytic	hygro-mesophytic	ahem-mesohemerobous	colonist	short turf
Frta	w.temp-mont	acidophytic	meso-xerophytic	ahem-euhemerobous	ephemeral colonist	short turf
Raco	w.temp	acido-subneutrophytic	hygro-xerophytic	ahem-oligohemerobous	long-lived shuttle	tail
Rehe	submed-suboc-mont	(acido)-basiphytic	hygro-xerophytic	ahem-oligohemerobous	long-lived shuttle	mat
Ricr	s.oc-med-mont	acido-subneutrophytic	hygro-xerophytic	oligo-euhemerobous	annual shuttle	short turf
Rini	oc-med	acido-basiphytic	hygro-xerophytic	ahem-mesohemerobous	annual shuttle	mat
Riso	temp	acido-basiphytic	meso-xerophytic	oligo-euhemerobous	annual shuttle	mat
Phbu	med	acido-subneutrophytic	hygrophytic	meso-euhemerobous	annual shuttle	mat

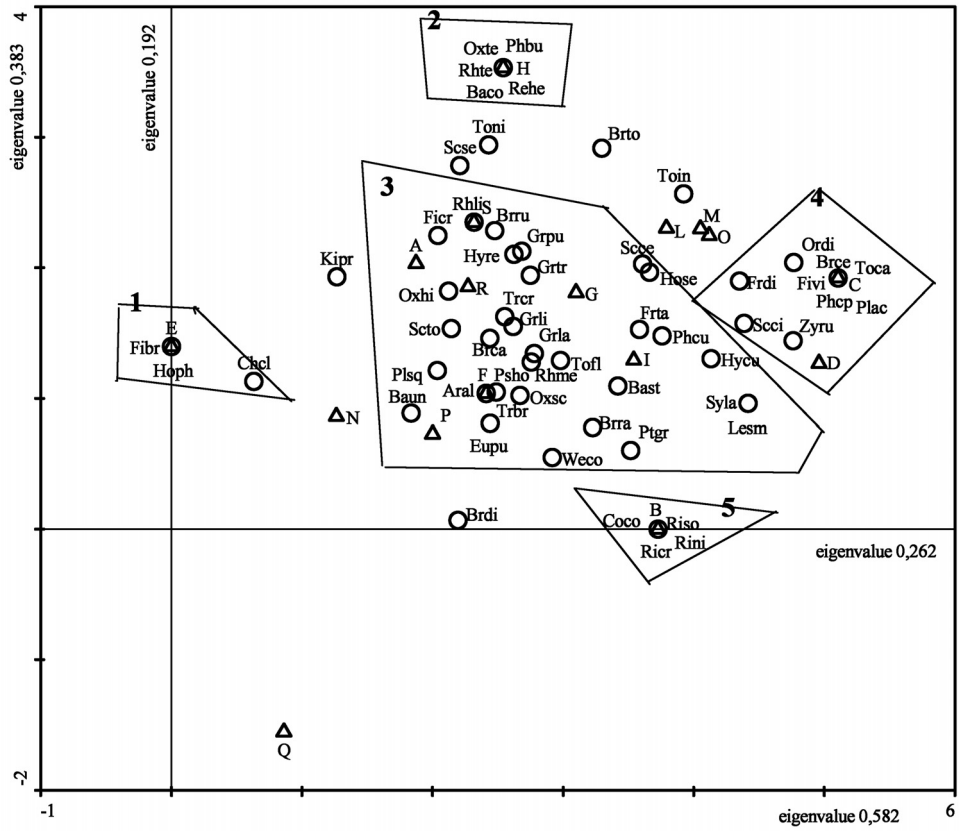

Fig. 3. Graphic of DCA analysis (○ species; Δ vegetation type).

In the analysis of the DCA (Fig. 3, Table 2) the principal axis (axis 1) shows a correlation between found taxa and the different vegetational types in which they have been picked up while the secondary axis (axis 2) seems to show a gradual transition from areas with a natural vegetation to areas interested by a previous agricultural activity and, at the present, from grazing. In the graph of the DCA it has been possible to identify five different groups.

G**roup 1,** with low values along axis 1 and medium values along axis 2, characterised by *Fissidens bryoides* and *Homalothecium philippeanum*, is represented by species which are common in the grasses in *Asphodelus aestivus*, *Avena barbata*, *Plantago* sp. and *Trifolium* sp. pl., as well as *Cheilothela chloropus* which is present in the *Cistus* sp. pl. and *Pistacia lentiscus* vegetation in contact with the former.

Group 2, with high values along axis 2 and medium values along axis 1, is characterised by higro-mesophytic and higro-xerophytic species (*Reboulia hemisphaerica, Phaeoceros bulbiculosus, Rhynchostegiella tenella, Rhynchostegiella pumila, Oxystegus*

Table 2. Presence-absence and frequency matrix for the DCA (A=wood of *Phillyrea angustifolia*; B=gullies to the sea; C= on the trunk of *Olea europaea* var. *sylvestris*; D=grazing; E=meadows with *Asphodelus aestivus, Avena barbata, Plantago* sp. pl., *Trifolium* sp. pl.; F=therophitic meadows; G=in the nearness of a group of *Quercus suber*; H=in the nearness of water dripping or springs; I=in the nearness of the sea; L= on the trunk of *Salix atrocinerea*; M=vegetation with *Cistus* sp. pl.; N=vegetation with *Cistus* sp. pl. and *Pistacia lentiscus*; O=vegetation with *Cistus* sp. pl. and *Olea europaea* var. *sylvestris*; P= vegetation with *Cistus* sp. pl., *Pistacia lentiscus* and *Erica arborea*; Q= vegetation with *Cistus* sp. pl., *Pistacia lentiscus, Genista corsica* and *Lavandula stoechas*; R= vegetation with *Juniperus turbinata, Pistacia lentiscus* and *Cistus salvifolius*; S= vegetation with *Pistacia lentiscus, Phillyrea* sp. pl. and *Olea europaea* var. *sylvestris*.
Classes of frequence of occerrences in samples made in the vegetation considered: 1 = 1-20%; 2 = 21-40%; 3 = 41-60%; 4 = 61-80%; 5 = 81-100%).

species code	A	B	C	D	E	F	G	H	I	L	M	N	O	P	Q	R	S
Aral						1											
Baco								1									
Baun						1						1			1	1	
Bast		1				1							1				
Brru						1		1									
Brce			1														
Bral																	
Brca	1	1	1		1	3		1	1		1	2		2		2	1
Brdi		1										1			1		
Brra		1				1			1								
Brto								1			1						
Chcl					1							1					
Eupu		1				1			1			2					
Fibr					1												
Ficr								1				1					1
Fivi			1														
Grla		1							1					1			2
Grli							2							1		1	
Grpu						1	1	1									
Grtr	1	1				1		1			1						2
Gyae																	
Hoph					1												
Hose		1	2			1	1	1		1	2		1				1
Hycu		2	1								2						
Hyre	1					1	1	2	1	1						3	
Kipr					1			1				1					
Lesm		1	1														
Ordi			4								1		1				
Oxhi						1		1				1				1	
Oxsc	1	1				1											
Oxte								1									
Phcu			1			1											
Phcp			1														
Plac			1														
Plsq	1	1			2	4	1					3	1	2			1

Table 2. (continued.)

Psho						1										
Ptgr		2					1									
Rhco																
Rhli																1
Rhte								1								
Rhme		2			1	1			1		1				1	1
Scce							1						1				
Scto	1					1										
Scci			1	1					1							
Scse	1							1								
Syla		1	1													
Tiba													1			
Tofl	1	1	1			3	1		4			1			1	
Toin			1					1					1			
Toni								1								1
Toca			1													
Trbr		2				1		1				2				
Trcr		1			1	1	1	1			1	1	1	1		1
Weco		3				3								1		
Zyru		1	3													
Coco		1														
Frdi		1	5					1	1		1		1			
Frta		1	1				1			1					1	
Phbu								1								
Rehe								1								
Ricr		1														
Rini		1														
Riso		1														

tenuirostris, Barbula convoluta), which have been detected in the particularly wet environments of valleys and near dripping water that also provide water during the summer.

Group 3, with medium and high values along axis 1 and medium values along axis 2, includes the most common species of the island which can be found both in several kinds of grasses and in scrublands which characterise the vegetation in Molara. They are mainly acid-subneutrophytic, higro- and meso-xerophytic species and are highly adaptable. Among them, the most frequent in the different vegetational types that characterize this group, are *Pleurochaete squarrosa*, *Bryum capillare* and *Weissia controversa,* especially in the clearings of scrublands and *Tortella flavovirens* that, thanks to its well known alotolerance, is frequent especially where the exposure to the sea aerosol is greater.

Group 4, with high values along axis 1 and medium values along axis 2, is represented by species growing in *Olea europaea* var. *sylvestris* woodland both on barks, in which corticolous species appear (*Orthotrichum diaphanum* and *Zygodon rupestris*) and on the ground (*Tortula canescens, Pleuridium acuminatum, Fissidens viridulus, Bryum caespiticium, Phascum cuspidatum* var. *piliferum, Scorpiurium circinatum*). *Frullania dilatata* is the most frequent species in this vegetational type and it has been found both on barks and

on rocks. In particular, the species which were found on olive tree barks are mainly subneutrophile.

Group 5, with high values along axis 1 and low values along axis 2, is characterised by thallous hepatics (*Riccia crosalzii, Riccia nigrella, Riccia sorocarpa, Corsinia coriandrina*), which are found on the ground along the wet gullies which lead to the several *Cale* of the island.

In the graph also some letters and some taxa that have not been included in any group appear. With the letter Q is identified the vegetation with *Cistus* sp. pl., *Pistacia lentiscus*, *Genista corsica* and *Lavandula stoechas* in which two only species have been found (*Barbula unguiculata* and *Bryum dichotomum*), with low frequency and present also in other vegetational types. The letter N identifies a vegetation with *Cistus* sp. pl. and *Pistacia lentiscus* very similar to the vegetation types of the group 3 and with which it shares the most frequent species and from which differs for the presence of *Cheilothela chloropus*. The letters M and O point out a vegetational type in which *Cistus* sp. pl. (M) and/or *Olea europaea* var. *sylvestris* (O) are present and in which a set of species among those belonging to the group 3 has been found. The letter L identifies *Salix atrocinerea* present in the L'Orto valley, on which three species have been found (*Frullania tamarisci*, *Homalothecium sericeum* and *Hypnum resupinatum*) although it grows in the cooler sector of the island.

The species out of groups are *Bryum dichotomum*, *Kindbergia praelonga*, *Scorpiurium sendtneri*, *Tortella inflexa*, *T. nitida* and *Bryum torquescens*. They have a low frequency and appear not particularly linked to a specific vegetational type.

The central and western part of the island is the richest in terms of species (32T NL 60 24 and 61 24 respectively 55 and 54 examples) and is characterised by scrubland with *Cistus* sp.pl., *Pistacia lentiscus* and *Olea europaea* var. *sylvestris*. In the past, the area could be used for cultivation thanks to the presence of one of the two perennial springs. The mountainous areas (32T NL 61 25) and the coast between Punta dell'Aia and La Vedetta (32T NL 60 24) have a low biodiversity, which is characterised by the presence of *Euphorbia dendroides* L. and where the soil is particularly covered and stirred by an abundant forest floor.

On the whole, the island shows a high level of naturalisation. This is certainly due to the fact that the territory has been owned privately for seven generations and therefore the preservation of the bryological component has been possible. The recent introduction of the island to the Tavolara-Capo Coda Cavallo Maritime Park guarantees a sustainable fruition, favouring the preservation of biodiversity.

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