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Bryoflora of the Monte Conero Regional Park (Marche, C-Italy)

Abstract

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The bryophyte flora of Monte Conero Regional Park (Marche, C-Italy) has been studied for the first time and includes 104 *taxa* (9 hepatics and 95 mosses). Four hepatics and 13 mosses are newly recorded for the Marche region (C-Italy). Among these *Didymodon sicculus* is new for Italy and *Trichostomopsis aaronis* is a second report for Italy and the first for the Italian peninsula. An analysis of chorological elements is also given.

Introduction

In recent years numerous bryological studies conducted in the Marche have significantly increased the number of species known for this region (Aleffi & Cortini Pedrotti 2002). According to the check-list of mosses (Cortini Pedrotti 2001) and of hepatics (Aleffi & Schumacker 1995) of Italy, the Marche hosts to date 373 *taxa*, 60 of which are hepatics and 313 mosses. Our chorological data for this region reveal the prevalence of temperate (35.91%) and boreal elements (20.95%) (Aleffi & Cortini Pedrotti 2002).

In the context of a program to conduct a series of studies along the coastal areas of the Italian peninsula, the authors performed a detailed investigation in the spring of 2002 into the bryological flora of Monte Conero Regional Park, an area that has never been the subject of bryological research.

Study area and methods

Monte Conero, or "Monte di Ancona", is one of the most interesting localities of the whole Italian Adriatic coast from an environmental point of view. The promontory, located about 10 km southeast of the city of Ancona, is a huge ellipsoid that rises 572 m directly from the coast. Monte Conero (Fig. 1) is one of the few calcareous mountains on the western Adriatic coast: in fact, the only other ones are on the coast of Trieste in the north and the Gargano promontory in the south. This lithological characteristic, together with the central position of Monte Conero in the Adriatic basin and its climatic and microclimatic

conditions, enable this promontory to host a remarkably rich flora for its size (Biondi 1986).

The nucleus of Monte Conero is composed of carbonate formations from the Cretaceous, Eocene and Oligocene. Next are marly-calcareous formations from the Miocene and more recent lithologies of the Lower and Middle Pliocene and of the Pleistocene with marly-arenaceous and argillaceous types (Cello & Coppola 1983).

The ridge of Monte Conero has an asymmetrical structure: seaward the slopes are steeply inclined or even vertical, while on the western side they are rounded and only moderately inclined, and furrowed by a superficial system of streams.

From the climatic point of view this area is submediterranean with limited summer aridity, reduced or absent in the higher sectors of Monte Conero. Biondi (1986) places the Conero Promontory at the limit of the temperate mediterranean belt towards the humid mediterranean. The winds have here a notable effect on vegetation development.

The varied microclimatic characteristics together with different lithologies promote the presence of a phanerogamic flora that is particularly rich, especially given the limited dimensions of the territory (over 1000 *taxa* in 10 km^2) (Biondi 1986). This aspect is related to the presence of a wide variety of plant communities, which can be grouped according to environmental context as coastal vegetation, rupicolous vegetation, vegetation of brackish lakes, vegetation of fresh water courses, vegetation of xeric grazing lands, vegetation of evergreen schlerophyllous woods, vegetation of deciduous woods and finally, field vegetation.

Assessment of the bryological flora was conducted in the spring of 2002, over a 10 km^2 study area. All the localities are included in the UTM 33TUJ82 quadrant. Samples were collected along a series of transects identified on the basis of the various habitats in the area. For each species the collection location and ecological characteristics were identified.

The samples are deposited in the herbarium of the University of Camerino Botany and Ecology Department (CAME).

Bryoflora

In all, 104 bryophyte *taxa* (9 hepatics and 95 mosses) were gathered. The following floristic list is arranged in alphabetical sequence and those species considered new for the Marches are marked with an asterisk. The nomenclature follows that of Aleffi & Schumacker (1995) for hepatics and Cortini Pedrotti (2001) for mosses. The chorological elements are taken from Düll (1983, 1984, 1985, 1992).

List of localities (Fig. 1):

1. Belvedere – ex Convento
2. Due Sorelle – versante
3. Ex Convento dei Camaldolesi
4. Lago Grande
5. Lago Profondo
6. Le Casermette
7. Passo del Lupo
8. Portonovo
9. Sentiero dei Gigli
10. Sirolo

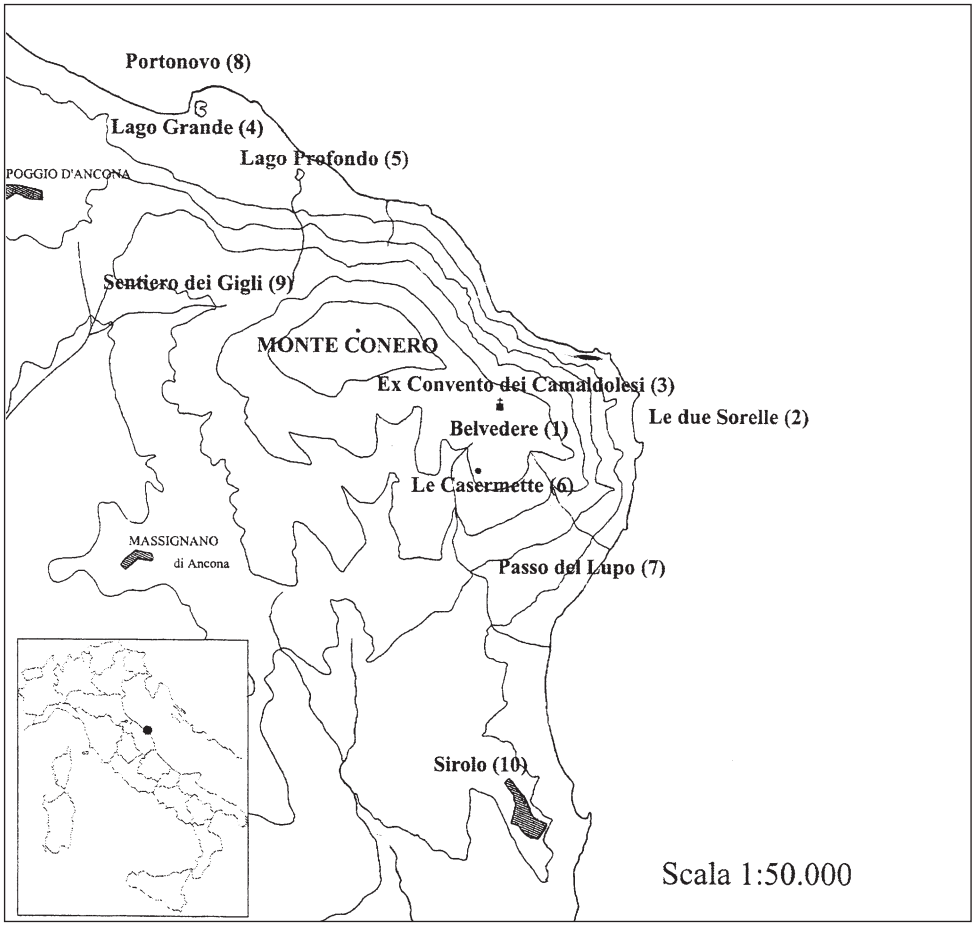

Fig. 1. Geographic position of the study area (Monte Conero) and research localities.

Floristic list

Hepatics

* *Cephaloziella baumgartneri* Schiffn. - 2, 8 – on rocks; on clayey, damp slopes.
* *Fossombronia caespitiformis* De Not. ex Rabenh. - 8 – on clayey soil, in shaded sites.
Frullania dilatata (L.) Dumort. - 1, 3, 6, 7, 9 – on bark.
* *Gongylanthus ericetorum* (Raddi) Nees - 8 – on wet, schistose rocks.
Metzgeria furcata (L.) Dumort. - 1, 3, 6, 7, 9 – on bark.
Pellia endiviifolia (Dicks.) Dumort. - 8 – on clayey soil, in shaded sites.
Radula complanata (L.) Dumort. - 1, 3, 6, 7, 9 – on bark.
* *Radula lindenbergiana* Gottsche ex C. Hartm. - 1, 3, 6 – on bark.
Southbya tophacea (Spruce) Spruce - 8 – on clayey soil, in shaded sites.

Mosses

Aloina aloides (Schultz.) Kindb. - 8 – on clayey soil.
Aloina ambigua (Bruch. & Schimp.) Limpr. - 8 – on clayey soil, in shaded sites.
Amblystegium serpens (Hedw.) Bruch & al. - 1, 3, 6 – on bark
Barbula convoluta Hedw. - 1, 2, 4, 5, 7, 8, 10 – on soil and slopes along the path.
Barbula unguiculata Hedw. - 1, 2, 3, 5, 6, 7, 8, 10 – on stony soil and slopes, along the path.
Brachythecium rutabulum (Hedw.) Bruch & al. - 3, 6, 9 – on soil in shaded sites.
Brachythecium salebrosum (Weber & D. Mohr.) Bruch & al. – 1, 3, 6, 9 – on soil and slopes in the woodland.
Bryum algovicum Sendtn. - 2 – on soil.
Bryum argenteum Hedw. - 2, 8, 10 – on cement.
Bryum bicolor Dicks. - 1, 2, 7, 8, 10 – on soil and rock cleft.
Bryum caespiticium Hedw. - 1, 2, 3, 4, 5, 7, 8, 10 – slopes along the path.
* *Bryum canariense* Brid. - 1 – on soil in the woodland.
Bryum capillare Hedw. - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 – on stony soil along the path.
* *Bryum dunense* A.J.E. Sm. & Whitehouse - 8 – on stony soil.
Bryum radiculosum Brid. - 2, 8 – on slopes.
Bryum ruderale Crundw. & Nyholm - 2, 8 – on slopes.
Bryum torquescens Bruch & Schimp. - 2, 8 – on slopes.
Bryum versicolor A. Braun. - 5, 8 – on soil along the path.
Calliergonella cuspidata (Hedw.) Loeske - 4 – on marshy soil along the lake.
Campyliadelphus chrysophyllus (Brid.) Kanda - 6 – on stony soil.
* *Cirriphyllum tommasinii* (Sendtn. ex Boulay) Grout - 4 – on soil along the path.
Ctenidium molluscum (Hedw.) Mitt. - 1, 9 – on calcareous rocks in shaded sites.
Dicranella howei Renauld & Cardot - 2, 7, 8, 10 – on slopes.
Dicranella varia (Hedw.) Schimp. - 1, 9 – on soil.
Didymodon acutus (Brid.) K. Saito - 2, 7, 8, 9, 10 – on stony soil.
Didymodon fallax (Hedw.) R.H. Zander - 2, 8, 10 – on soil along the path
Didymodon insulanus (De Not.) M.O. Hill - 8, 10 – on soil along the path
Didymodon luridus Hornsch. - 1, 2, 5, 6, 7, 8, 9, 10 – on sunny soil along the path.
Didymodon rigidulus Hedw. - 8, 10 – on stony soil and slopes along the path.
* *Didymodon sicculus* Cano, Ros, Garcia-Zamora & Guerra - 2, 8, 10 – on clayey soil.
Didymodon vinealis (Brid.) R.H. Zander - 1, 2, 4, 5, 7, 8, 10 – on stony soil along the path.
Eucladium verticillatum (Brid.) Bruch & al. - 8 – calcareous rocks and damp, clayey slopes.
Eurhynchium hians (Hedw.) Sande Lac. - 6 – on soil along the path
Eurhynchium meridionale (Bruch & al.) De Not. - 1, 2, 8, 9 – on soil and slopes.
Eurhynchium praelongum (Hedw.) Bruch & al. - 1, 6, 9 – on soil.
Eurhynchium pulchellum (Hedw.) Jenn. - 5, 7, 8, 9, 10 – on soil.
Eurhynchium schleicheri (R. Hedw.) Jur. - 3, 4, 5, 6, 9 – on soil along the path, in shaded sites.
Eurhynchium speciosum (Brid.) Jur. - 5, 6, 9 – on soil along the path.

* *Fissidens bryoides* Hedw. - 9 – on soil in the woodland.
Fissidens exiguus Sull. - 1 – on soil in the Mediterranean scrub.
Fissidens exilis Hedw. - 1, 3, 6, 9 – on soil in the Mediterranean scrub, on shaded slopes.
Fissidens incurvus Starke ex Röhl. - 1, 10 – on soil in the Mediterranean scrub.
Fissidens serrulatus Brid. - 1, 3, 6, 7, 9, 10 – on soil in the Mediterranean scrub.
Fissidens taxifolius Hedw. - 9, 10 – on slopes.
Funaria hygrometrica Hedw. - 2, 5, 9 – on soil.
Grimmia pulvinata (Hedw.) Sm. - 3 – on stone wall.
Gymnostomum calcareum Nees & Hornsch. - 10 – on shaded, clayey soil.
Gyroweisia tenuis (Hedw.) Schimp. - 10 – on soil along the path.
Habrodon perpusillus (De Not.) Lindb. - 3 – on bark.
Homalothecium lutescens (Hedw.) H. Rob. - 8 – on sunny, stony soil.
Homalothecium sericeum (Hedw.) Bruch et al. - 1, 2, 3, 4, 6, 7, 9, 10 – on rocks, bark, slopes and soil along the path.
Hypnum cupressiforme Hedw. - 1, 2, 3, 4, 5, 6, 7, 9, 10 – on soil along the path, on slopes, on the base of a tree, on rocks.
Hypnum cupressiforme Hedw. var. *filiforme* Brid. - 1, 3 , 6 – on bark.
Hypnum lacunosum (Brid.) Hoffm. ex Brid. - 1, 3, 4, 6, 7 – on soil.
Hypnum resupinatum Taylor - 3 – stony soil.
Leptodon smithii (Hedw.) Weber & D. Mohr - 1, 3, 6 – on bark.
Orthotrichum anomalum Hedw. - 2, 7, 9 – on rocks.
Orthotrichum diaphanum Brid. - 1, 3, 6, 9, 10 – on *Olea europea* and *Quercus ilex*.
Orthotrichum striatum Hedw. - 1, 3, 6, 9, 10 – on *Quercus ilex.*
Phascum cuspidatum Hedw. - 6, 7 – on exposed soil.
* *Platydictya confervoides* (Brid.) H.A.Crum - 8 – on rocks in the Mediterranean scrub.
Pleurochaete squarrosa (Brid.) Lindb. - 1, 2, 4, 5, 7, 8, 9, 10 – on sunny, stony soil.
Pohlia melanodon (Brid.) A.J. Shaw - 8 – on clayey, damp slopes.
Pseudocrossidium hornschuchianum (Schultz) R.H. Zander - 2, 7, 8, 10 – on stony soil.
Pseudoleskeella nervosa (Brid.) Nyholm - 9 – on the base of a tree.
Rhynchostegiella tenella (Dicks.) Limpr. - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 – on the base of a tree, on shaded rocks, on slopes.
Rhynchostegium confertum (Dicks.) Bruch & al. - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 – on the base of a tree, on shaded rocks and soil, on slopes.
Rhynchostegium megapolitanum (Weber & D. Mohr) Bruch & *al.* - 1, 3, 6, 7 – on soil.
Schistidium crassipilum Blom - 7 – on calcareous rocks.
Scleropodium purum (Hedw.) Limpr. - 1, 3, 6, 7, 9 – on soil along the path in the woodland.
Scorpiurium circinatum (Brid.) M. Fleisch. & Loeske - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 – on soil.
* *Sematophyllum substrumulosum* (Hampe) E. Britton - 7 – on decaying wood.
* *Syntrichia calcicolens* Amann - 2, 8 – on stony soil.
Syntrichia intermedia Brid. - 2, 7, 10 – on calcareous rocks.
Syntrichia laevipila Brid. - 1, 3 – on *Quercus ilex.*
Syntrichia pagorum (Milde) Amann - 8 – on *Quercus ilex.*
Syntrichia papillosa (Wilson) Jur. - 1 – on *Quercus ilex.*

* *Syntrichia princeps* (De Not.) Mitt. - 8 – on stony soil.
Syntrichia ruralis (Hedw.) Weber & D. Mohr - 9, 10 – on stony soil.
Tortella flavovirens (Bruch) Broth. - 2, 8, 10 – on clayey soil.
Tortella humilis (Hedw.) Jenn. - 1, 3 – on soil.
* *Tortella inclinata* (R. Hedw.) Limpr. - 7, 9 – on soil.
Tortella inflexa (Bruch.) Broth. - 7, 10 – on stony soil.
Tortella nitida (Lindb.) Broth. - 2, 7, 8, 10 – on calcareous soil.
Tortula muralis Hedw. - 1, 2, 4, 7, 8, 10 – on rocks, on stony soil.
Tortula muralis Hedw. var. *obcordata* (Schimp.) Limpr. - 2, 3, 5, 8, 10 – on rocks.
* *Trichostomopsis aaronis* (Lor.) Agnew & Towsend - 2 – on clayey soil.
Trichostomum brachydontium Bruch - 1, 2, 3, 4, 5, 7, 8, 10 – on slopes along the path.
Trichostomum crispulum Bruch - 1, 2, 4, 7, 8, 9, 10 – on slopes.
Weissia brachycarpa (Nees & Hornsch.) Jur. - 2, 7, 10 – on slopes.
Weissia condensa (Voit) Lindb. - 2, 7, 8 – on rocks.
Weissia controversa Hedw. - 2, 3, 7, 8, 9, 10 – on stony soil and rocks along the path.
* *Weissia longifolia* Mitt.- 10 – on soil.
* *Weissia triumphans* (De Not.) M.O. Hill - 2, 8 – on stony, clayey slopes.
Zygodon rupestris Schimp. ex Lorentz - 1, 3, 6, 9 – on *Quercus ilex.*

Floristic and phytogeographical considerations

The study yielded important qualitative and quantitative data not only for the area under examination but also for the entire region.

This examination of the bryological flora of Monte Conero revealed 104 bryophyte *taxa*, of which 9 are hepatics and 95 are mosses. Among these, 4 hepatics and 13 mosses are new for the Marche Region; *Didymodon sicculus* is new for Italy and *Trichostomopsis aaronis* is new for the Italian peninsula.

Among the species that are new to the Marche, those of special floristic and phytogeographical interest are reported below.

Gongylanthus ericetorum is an oceanic-mediterranean species gathered on humid schistose rocks near the sea. In Italy it is reported for Trentino-Alto Adige, Liguria, Tuscany, Umbria, Lazio, Sardinia and Sicily. This species is not only new for the Marches Region but relatively rare for the rest of Italy as well.

Didymodon sicculus was gathered on loamy soils at the edge of the slopes of Monte Conero and recently along the coastal area of National Park of Gargano (Puglia, S-Italy). The specimens were growing in partial shade on saline and/or loamy soil quite close to the sea line (ca 10 m), or on dry and sunny or partially shaded loam slopes. *Didymodon sicculus* is new for Italy (Aleffi & al. 2003).

Trichostomopsis aaronis is a mediterranean species that grows in the dryer zones of Monte Conero, on argillaceous substratum near the Adriatic coast. It was first found in Sicily (Dia & Raimondo 1994) and was previously unknown for the Italian peninsula.

Bryum dunense is an oceanic-mediterranean species reported to date for Campania, Basilicata, Sardinia and Sicily. Thus the report for Monte Conero, in addition to being the first for the Marches, represents one of the northernmost sites of its Italian distribution area

as well. This species was found in various localities along the sandy coastal zone of Monte Conero.

Platydictya confervoides is a small boreal-montane species, where most recent records correspond to the Piemonte, Veneto and Abruzzo (Fig. 2A). It was found in a humid, cool and shady deep valley near Portonovo where the microclimatic conditions promoted its development. This highlights how interesting is Monte Conero from the phytogeographical point of view: it penetrates deeply into the Adriatic Gulf while the Apenninic-Alpine-Dinaric mountain chains isolate it and shelter it from the mediterranean influx, making it a promontory with characteristics not typically mediterranean.

Another interesting find is *Sematophyllum substrumulosum*, a species with a southern-oceanic-mediterranean distribution, seen on a decaying *Pinus halepensis* trunk. In Europe it is a rare species and in Italy it is known only from Sicily, Lazio and Tuscany. It is interesting to observe that the old records are located along the Tyrrhenian coast of the peninsula and that, therefore, the locality of the Monte Conero represents the first record for the Adriatic side (Fig. 2B).

The histogram (Fig. 3) compares the chorological elements of the bryological flora of the Marche region and that of Monte Conero. One can observe how in both cases the temperate element predominates (Marches: 35.91%; Conero: 43.27%). Another evident datum is the predominance of the boreal element in the Marches region (20.95%) compared to Monte Conero (4.81%), an understandable difference since the region has numerous mountain peaks over 2000 m, while Monte Conero is located near the sea. The percentage of the oceanic-mediterranean element is significant both on Monte Conero (21.15%) and

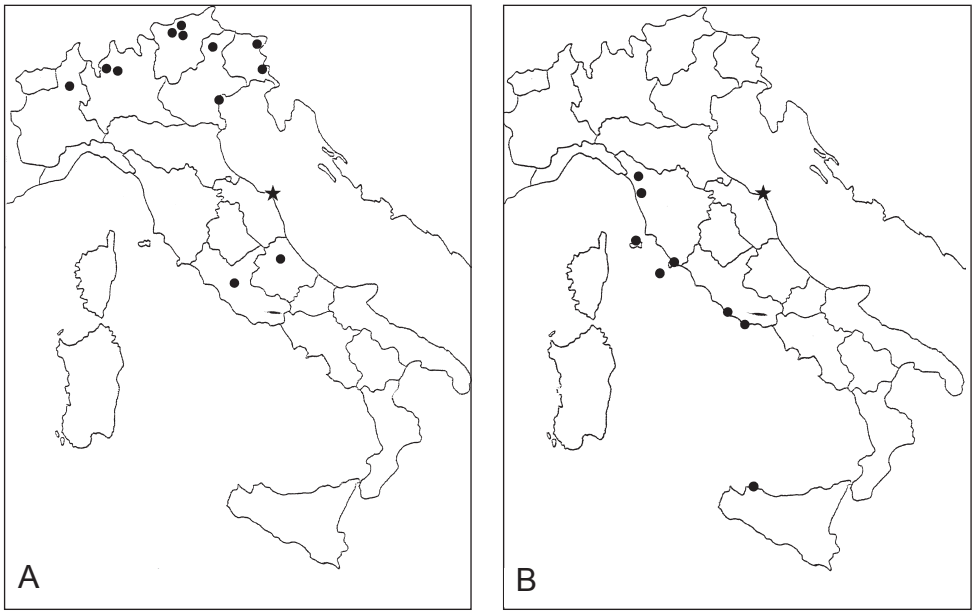

Fig. 2. Italian distribution of: A) *Platydictya confervoides* (Brid.) H.A.Crum; B) *Sematophyllum substrumulosum* (Hampe) E. Britton. The star indicates the new localities from Monte Conero.

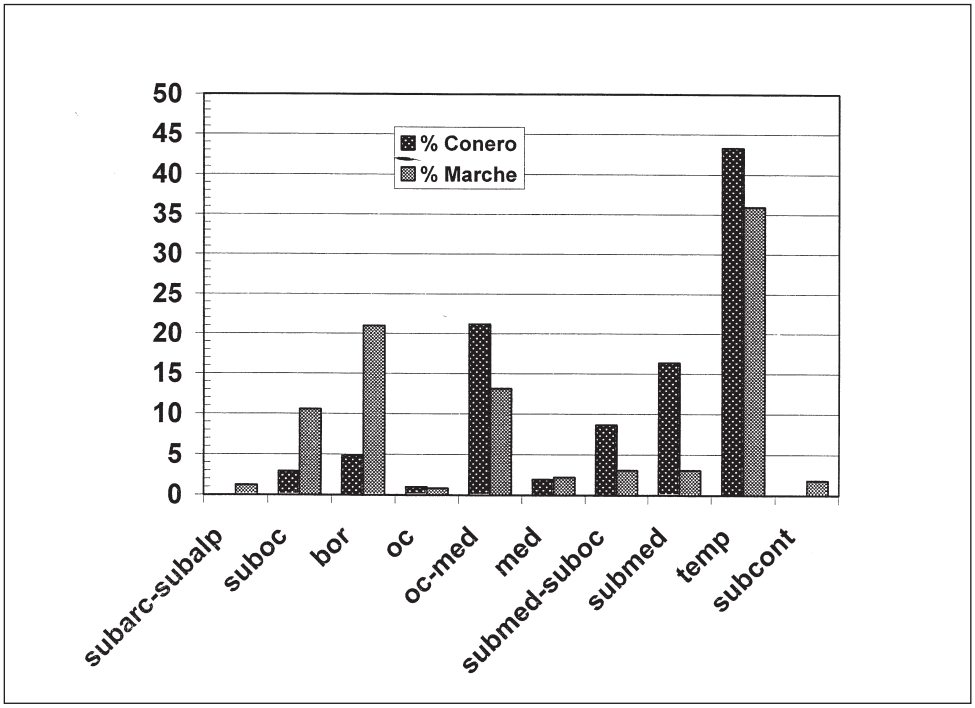

Fig. 3. Histogram of chorological elements.

in the entire region (13.15%), as is that of the (submed)-suboceanic element, though to a lesser degree (respectively 11.54% and 18.62%), characterized, as mentioned above, by a group of species of particular floristic and chorological interest.

Finally, another important element is Monte Conero's considerable percentage of sub-mediterranean species (16.34%), in accordance with the climatic conditions of the area.

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