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The flora of Monte Perda ‘e Liana (CE-Sardinia)

Abstract

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This contribution presents the results of the floristic research carried out on Monte Perda ‘e Liana, one of the most characteristic Mesozoic calcareous formations of centre-eastern Sardinia. The found floristic component numbers 247 taxa that can be ascribed to 57 families and 176 genera. The endemic quota is made up of 44 species or 17.81% of the local flora mostly ascribed to the Sardinian sector. The analysis of the biological forms has pointed out a high percentage of hemicryptophytes and therophytes; while the chorological spectrum has shown the dominance of steno and euri Mediterranean elements.

Introduction

Among the many geological forms that manifest themselves on the Sardinian territory, there is a vast group of mountains that characterises the centre-eastern area of the island and is ascribable chronologically to the Mesozoic Era. These reliefs are almost exclusively represented by calcareous-dolomitic rocks at whose base are levels, a few metres deep, made up of granites or Palaeozoic schists.

Though these outrcrops are separated today and as in the case of Perda ‘e Liana they occupy a limited territory, they testify to the existence in the past of a vast Mesozoic sea on this part of the island. An erosive process that lasted millions of years led to the formation of the typical isolated towers, named “Tacchi” o “Tonneri”. This erosion is still ongoing and often uncovers the underlying basement while modelling and further marking this landscape typology. The harsh morphology on the surface of the “Tacchi” shows that the limestones of which it is made have undergone deep changes due to karst phenomena, which manifest themselves with jagged edges and overhanging walls up to a few hundreds of metres tall.

For a long time, these calcareous mountains were poorly known from a botanical point of view. The difficulty accessing the place as well as its insecurity have been the main obstacles to exploring its flora in a sufficiently analytical manner. It is only in the past century that the area has been visited by researchers (Morris 1858; Barbey 1884; Martelli 1896; Herzog 1909), who still did not draw up any large, detailed systematic lists. Thanks

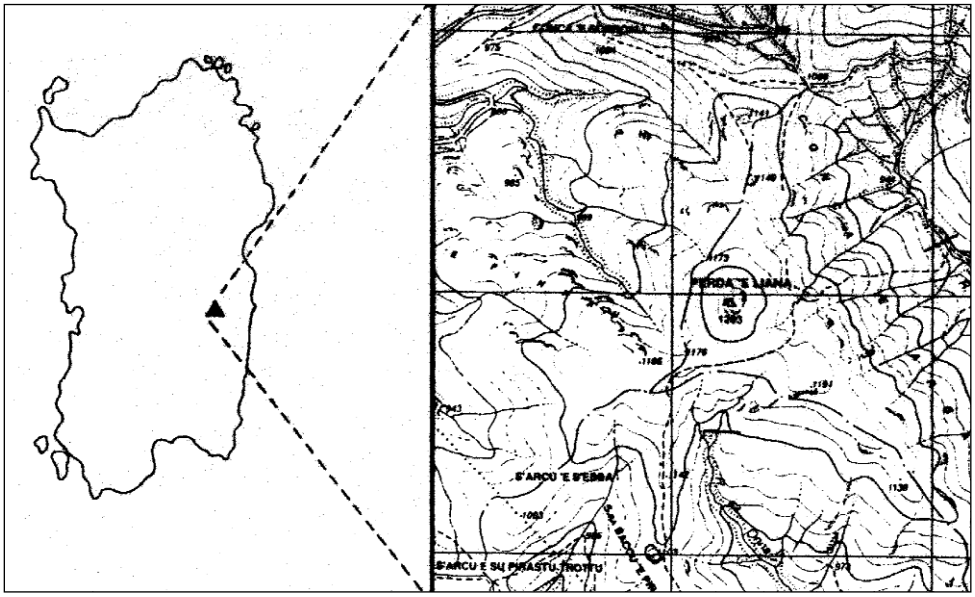

Fig. 1. Geographical location of M.te Perda 'e Liana.

to other more recent contributions, it has been possible to investigate the floristic and vegetational knowledge of this territory in greater depth (Arrigoni & Di Tommaso 1991; Ballero & al. 1993; Loi & Lai 2001), showing the high naturalistic value of the area. Moreover, the data sheets on the endemic plants of Sardinia (Arrigoni & al. 1976-1991) contain detailed floristic and taxonomical information, which still do not lead to specific indications on Perda ‘e Liana.

This work is meant to contribute towards providing a more explanatory and detailed picture of the flora of Perda ‘e Liana (1293 m above sea level), a mountain in Ogliastra in the centre-eastern part of Sardinia (Fig. 1), and assess the possible floristic differences and affinities with other calcareous areas of Sardinia.

The territory

Ogliastra has been inhabited since the III millennium B.C., as is testified by the archaeological remains that are still present today, and by the *Ilienses,* who according to tradition descend from Trojan exiles fleeing with Aeneas from their homeland in flames. According to tradition, the chiefs of the different villages used to meet around a characteristic tall towering rock to make important decisions. This rock which they revered as a divinity came to be known by the name *Perda ‘e Liana* or *Pietra Iliana*, that is the Rock of the Ilienses.

Monte Perda ‘e Liana, which was declared a natural monument by decree of the Sardinian Autonomous Region (D.A.D.A. n° 705 del 29/4/1993) following Act no. 31/89 in protection of areas of naturalistic and environmental interest, is in Section IGM n° 531

IV "Villanova Strisaili" and is adminstratively part of the Commune of Gairo in the Province of Nuoro.

The flora was collected on the *Tacco* proper and on a surrounding area for about 22 ha starting from an altitude of 1,200 m above sea level up to the top at 1,293 m above sea level. The calcareous tower, 25 metres tall, rises on a cone-shaped hill made up of a metamorphosed Palaeozoic succession and an arenaceous conglomeratic complex with layers of Trassic dolomites (Cocozza 1974). The Lithic and Typic Xerorthents soils occupy an area with a sparse maquis intercalated with scanty therophytic grassland, while the areas affected by Lithic and Typic Rhodoxeralls with a clayey horizon host a vegetable cover represented by degradation forms of the maquis and garrigue; finally Lithic and Typic Xerochrepts soils are present in the few edges covered by an evolved maquis (Aru & al. 1991).

In the *Tacco* area watercourses are totally absent and the collection of water in springs and sources is very scanty and at the cone base. Only sporadic pools or transient trickles along the faces of the tower, can be found for a limited period of time after abundant rainfall.

The climate

In order to analyse the climate, the data supplied by the Hydrographic Service of the Councillorship for Public Works of the Sardinian Autonomous Region were used. These data refer to the Seui surveying station, at 812 m above sea level, not far from the collection area as the crow flies. The analysed periods refer to the years from 1961 to 2001 as regards rainfall and to the years from 1986 to 2001 as regards temperature (Table 1).

Rainfall occurs between October and April with maximum values in November and December, with an annual mean rainfall of 853 mm for a total average of 84 rainy days. Though modest and scarce in our observation, snow precipitation is present and appears to be concentrated in January and February.

An analysis of the thermometric data shows that the hottest months are July and August with average temperatures of 24 °C, while the coldest month is February with 6,63 °C.

The Bagnouls and Gaussen diagram (1953) reported in Figure 2 shows a period of summer drought from mid June to early September lasting about 85 days. Following Emberger's bioclimatic classification (Daget 1977), the climate of the studied territory can be framed as Mediterranean climate, humid bioclimatic stage, cool winter variant.

Table 1. Thermometric and pluviometric data relating to the Seui station.

	J	F	M	A	M	J	J	A	S	O	N
Max T	11,75	12,05	15,20	16,59	24,07	28,18	32,31	32,31	26,78	22,43	16,41
Min T	1,77	1,21	2,83	4,34	9,04	12,42	15,53	16,07	12,99	9,60	4,42
Mean T	6,76	6,63	9,01	10,47	16,56	20,30	23,92	24,19	19,89	16,01	10,42
mm	84,38	78,93	70,64	74,785	58,34	41,12	23,13	32,55	54,95	66,91	126,18
days	8,7	7,85	8,05	9,75	6,7	3,66	2,1	2,6	5,15	7,6	11

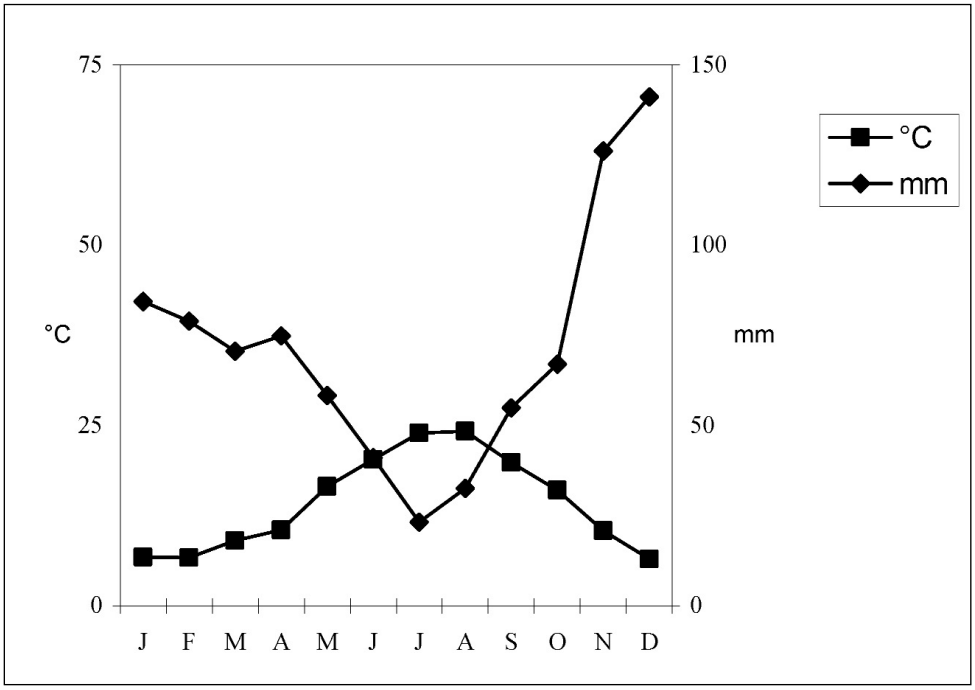

Fig. 2. Bagnouls and Gaussen diagram of the Seui station.

The vegetation

In its general physiognomic aspect the vegetation appears homogeneous and xerophilous though very fragmented and degraded not only on account of the rough territory and hard edaphic onditions but especially because of sequential anthropic pressure in time with fires and disforesting. The outcropping lithosoil area is so extended that the different geological typologies are not easily identified. The grassy area is poor in trees and few orophilous plants cling to the cooler and more sheltered winding ravines of the Tacco, where one can find isolated specimens of *Quercus ilex* and *Acer monspessulanum*.

The greatest expression of the vegetation is in the more sheltered areas and is represented by a high maquis of *Quercus ilex, Erica* sp. pl., and *Arbutus unedo*. This suggests that the entire area must have been covered with dense oak wood in the past. On the slope exposed to the Mistral, which rages violently on the area, the vegetation is more sparse and structured in garigues of modest extension, pointing out the special adaptation of a few species to this extreme environment. In the topmost area dense populations of *Juniperus nana* and *Daphne oleoides* can be identified.

The flora

The flora was gathered in the three-year period between 2000 and 2002, with periodic excursions that were more frequent in the period of maximum anthesis.

For the systematic and taxonomical arrangement and for the nomenclature, reference was made mainly to Pignatti (1982), for the *Pteridophyta* to Ferrarini & al. (1986), for the *Orchidaceae* to Scrugli (1990), and for the endemic species to the suggestions by Arrigoni & al. (1976-1991).

Next to each entity in the systematic list, we report the biological form indicated by Pignatti (according to Raunkiaer 1934) as well as the chorological element.

Floristic list

Aspleniaceae

Asplenium trichomanes L. – H ros – Cosmopolitan – rocks
Ceterach officinarum Willd. – H ros – Eurasiatic – rupestral ravines

Aspidiaceae

Dryopteris thyrrhena Fras.-Jenk. et Reichst – G rhiz – Mediterranean – cool spots

Polypodiaceae

Polypodium cambricum L. subsp. *serrulatum* (Sch. ex Arcang.) Pic. Ser.– H ros – Euri-Mediterranean – cool spots

Cupressaceae

Juniperus nana Willd. – NP – Boreal – garrigue exposed to the winds
Juniperus oxycedrus L. subsp. *oxycedrus* L. – P caesp – Euri-Mediterranean – maquis

Salicaceae

Salix alba L. subsp. *coerulea* (Sm.) Rech. fil. – P scap – Paleotemperata – humid ravines

Fagaceae

Quercus ilex L. – P caesp – Steno-Mediterranean – maquis

Urticaceae

Urtica atrovirens Requien. ex Loisel. – H scap – Endemic – soils rich in nitrates
Parietaria judaica L. – H scap – Euri-Mediterranean – Macaronesic – sunny cliffs

Santalaceae

Osyris alba L. – NP – Mediterranean – Macaronesic – maquis

Rafflesiaceae

Cytinus hypocistis (L.) L. – G rad – Euri-Mediterranean – on *Cistus monspeliensis*

Polygonaceae

Rumex acetosella L. – H scap – Cosmopolitan – grassland
Rumex acetosa L. – H scap – Circumboreal – grassland
Rumex thyrsoides Desf. – H scap – Steno-Mediterranean – garrigue
Rumex conglomeratus Murray – H scap – Eurasiatic – garrigue
Rumex suffocatus Moris ex Bertol. – H scap – Endemic – garrigue

Amaranthaceae

Amaranthus deflexus L. – T scap – Cosmopolitan – grassland

Caryophyllaceae

Arenaria bertolonii Fiori – Ch suffr – Orophilous – Tyrrhenian– screes
Arenaria balearica L. – Ch suffr – Endemic – humid ravines
Moehringia pentandra Gay – T scap – Euri-Mediterranean – maquis
Minuartia verna (L.) Hiern subsp. *grandiflora* (C. Presl) Hayek – H caesp – Endemic – cliffs
Cerastium glomeratum Thuill. – H scap – Cosmopolitan – garrigue
Cerastium supramontanum Arrigoni – H scap – Endemic – garrigue, grassland
Silene nodulosa Viv. – H ros – Endemic – cliffs
Silene vulgaris (Moench) Garcke subsp. *prostrata* (Gaudin) Sch. et Th. – H scap – Subcosmopolitan – garrigue, gravels
Silene alba (Miller) Krause – H bienn – Eurasiatic – garrigue
Silene gallica L. – T scap – Cosmopolitan – grassland
Petrorhagia prolifera (L.) P. W. Ball et Heywood – T scap – Euri-Mediterranean – grassland
Dianthus siculus C. Presl. – Ch suffr – Eurasiatic – cliffs
This species has been described by Camarda and Corrias (1987) for Sardinia

Ranunculaceae

Anemone hortensis L. – G bulb – N Mediterranean – dry meadows
Ranunculus macrophyllus Desf. – H scap – Steno-Mediterranean- humid meadows
Ranunculus gramineus L. – H scap – Orophilous – SW European – meadows
Thalictrum minus L. – H scap – Eurasiatic – low shrubs

Paeoniaceae

Paeonia corsica Tausch – G rhiz – SW Mediterranean – maquis

Guttiferae

Hypericum hircinum L. – Ch suffr – Endemic – cool, shady areas
Hypericum perfoliatum L. – H scap – Steno-Mediterranean – low maquis

Papaveraceae

Papaver pinnatifidum Moris – T scap – Steno-Mediterranean – grassland
Fumaria capreolata L. – T scap – Euri-Mediterranean – grassland

Cruciferae

Arabis hirsuta (L.) Scop. – H bienn – European – garrigue
Arabis collina Ten. – H scap – Orophilous – Mediterranean – garigue
Arabis auriculata Lam. – T scap – Orophilous Mediterranean – meadows
Arabis verna (L.) R. Br. – T scap – Steno-Mediterranean – grassland
Alyssum minus (L.) Rothm. – T scap – Mediterranean – Turanian – garrigue
Clypeola jonthlaspi L. – T scap – Steno-Mediterranean – garrigue
Erophila verna (L.) Chevall. – T scap – Circumboreal – garrigue
Hornungia petraea (L.) Rchb. – T scap – Euri-Mediterranean – meadows
Thlaspi brevistylum (DC.) Jordan – H scap – Endemic – grassland
Biscutella morisiana Raffaelli – T scap – Endemic – grassland. Species described for Sardinia by Raffaelli (1991).
Eruca sativa Miller – T scap – Mediterranean -Turanian – grassland
Morisia monantha (Viv.) Ascherson ex Barbey – H ros – Endemic – humid grassland

Crassulaceae

Umbilicus rupestris (Salisb.) Dandy – G bulb – Mediterranean-Atlantic – shady and humid cliffs
Sedum alpestre Vill. – Ch succ – Orophilous – S European – cool areas
Sedum dasyphyllum L. – Ch succ – SW Mediterranean – cliffs, gravels
Sedum caeruleum L. – T scap – Euri-Mediterranean – cliffs, gravels

Saxifragaceae

Saxifraga tridactylites L. – T scap – Euri-Mediterranean – cliffs
Saxifraga corsica (Ser. ex Duby) Gren. & Godr. – H scap – Endemic – shady cliffs, ravines

Rosaceae

Rubus ulmifolius Schott – NP – Euri-Mediterranean – garrigue
Rosa serafini Viv. – NP – Orophilous – Steno-Mediterranean – low shrubs
Sanguisorba minor Scop. – H scap – Cosmopolitan – garrigue
Potentilla reptans L. – H scap – Circumboreal – grassland and cliffs
Potentilla caulescens L. subsp *nebrodensis* (Strobl. ex Zimm.) Arrigoni – Ch frut – Endemic – cliffs
Amelanchier ovalis Medicus – P caesp – Mediterranean – Mont. – rupestral steppe
Crataegus monogyna Jacq. – P caesp – Paleotemperate – low shrubs
Prunus spinosa L. – P caesp – Orophilous – European-Caucasian – low shrubs
Prunus prostrata Labill. – NP – Orophilous – Paleosubtropical – cliffs, garrigue

Leguminosae

Genista salzmannii DC. – NP – Mediterranean – garrigue
Genista corsica (Loisel.) DC. in Lam. & DC. – NP – Endemic – maquis
Vicia tetrasperma (L.) Schreber – T scap – Cosmopolitan – grassland
Lathyrus cicera L. – T scap – Euri-Mediterranean – grassy glades, maquis
Lathyrus hirsutus L. – T scap – Euri-Mediterranean – garrigue
Pisum sativum L. subsp. *elatius* (Bieb.) Asch. et Gr. – T scap – Mediterranean-Turanian – garrigue.
Medicago orbicularis (L.) Bartal. – T scap – Euri-Mediterranean - garrigue
Medicago arabica (L.) Hudson – T scap – Euri-Mediterranean – grassland
Medicago hispida Gaertner – T scap – Cosmopolitan – meadows
Trifolium campestre Schreber – T scap – Paleotemperate – meadows
Trifolium arvense L. – T scap – Paleotemperate – grassland
Trifolium stellatum L. – T scap – Euri-Mediterranean – grassland
Trifolium subterraneum L. – T rept – Euri-Mediterranean – grassland
Dorycnium hirsutum (L.) Ser. – Ch suffr – Euri-Mediterranean – maquis
Anthillis vulneraria L. subsp. *praepropera* (Kern.) Bornm. – H scap – Steno-Mediterranean – dry meadows
Coronilla valentina L. subsp. *glauca* (L.) Batt. – NP – Steno-Mediterranean – cliffs, garrigue

Geraniaceae

Geranium rotundifolium L. – T scap – Paleotemperate – meadows
Geranium molle L. – T scap – Cosmopolitan – meadows
Erodium chium (L.) Willd. – T scap – Euri-Mediterranean – garrigue
Erodium ciconium (L.) L’ Hèr. – T scap – Euri-Mediterranean – garrigue

Linaceae

Linum bienne Miller – H bienn – Euri-Mediterranean – dry meadows
Linum strictum L. – T scap - Steno-Mediterranean – maquis, garrigue

Euphorbiaceae

Euphorbia spinosa L. – Ch suffr – N Mediterranean – cliffs, gravels, slopes exposed to the North
Euphorbia helioscopia L. – T scap – Cosmopolitan – garrigue

Polygalaceae

Polygala sardoa Chodat – H scap – Endemic – dry meadows

Aceraceae

Acer monspessulanum L. – P caesp – Euri-Mediterranean – cool shady areas

Rhamnaceae

Rhamnus alpinus L. – P caesp – Mediterranean montane – cliffs

Malvaceae

Malva alcea L. – H scap – Centre – European – meadows

Thymelaeaceae

Daphne oleoides Schreber – Ch frut – Orophilous – Mediterranean – cliffs

Violaceae

Viola alba Besser subsp. *dehnhardtii* (Ten.) W. Becken – H ros – Euri-Mediterranean – glades, shady spots

Cistaceae

Cistus incanus L. – NP – Steno-Mediterranean – maquis and garrigue
Cistus monspeliensis L. – NP – Steno-Mediterranean – Macaronesic – garrigue and degraded maquis
Cistus salvifolius L. – NP – Steno-Mediterranean – maquis garrigue
Tuberaria guttata (L.) Fourr. – T scap – Euri-Mediterranean – grassland
Helianthemum morisianum Bertol. – Ch suffr. – Endemic – garrigue
Helianthemum aegyptiacum (L.) Miller – T scap – Mediterranean-Turanian – grassland

Araliaceae

Hedera helix L. subsp. *helix* L. – P lian – Sub-Atlantic – maquis, shady cliffs

Umbelliferae

Eryngium campestre L. – H scap – Euri-Mediterranean – dry meadows
Bunium corydalinum DC. – G bulb – Orophilous – W Mediterranean – scree, cliffs
Oenanthe lisae Moris – H scap – Endemic – pools
Ptychotis sardoa Pign. et Metlesics – H scap – Endemic – cliffs
Ferula communis L. – H scap – Euri-Mediterranean – garrigue
Laserpitium gallicum L. – H scap – Orophilous – NW Mediterranean – cliffs
Torilis nodosa (L.) Gaertner – T scap – Euri – Mediterranean-Turanian – grassland

Ericaceae

Erica terminalis Salisb. – P caesp – Steno-Mediterranean – shady, humid cliffs
Erica arborea L. – P caesp – Steno-Mediterranean – maquis
Erica scoparia L. – P caesp – Steno-Mediterranean – maquis and garrigue
Arbutus unedo L. – P caesp – Steno-Mediterranean – maquis

Primulaceae

Cyclamen repandum S. et S. – G bulb – N Mediterranean – maquis

Plumbaginaceae

Limonium morisianum Arrigoni – Ch frut – Endemic – cool and shady cliffs

Asclepiadaceae

Vincetoxicum hirundinaria Medicus – H scap – Eurasiatic – sunny shrubby rocky crags

Rubiaceae

Sherardia arvensis L. – T scap – Cosmopolitan – garrigue
Crucianella angustifolia L. – T scap – Euri-Mediterranean – garrigue
Asperula pumila Moris – Ch suffr – Endemic – very dry cliffs
Galium corsicum Sprengel – H scap – Endemic – dry and stony slopes
Galium parisiense L. – T scap – Euri-Mediterranean – maquis, garrigue
Valantia muralis L. – T scap – Steno-Mediterranean – calcareous cliffs
Rubia peregrina L. – P lian – Steno – Mediterranean – Macaronesic – maquis

Convolvulaceae

Convolvulus cantabrica L. – H scap – Euri-Mediterranean – dry meadows, garrigue

Boraginaceae

Myosotis pusilla Loisel. – T scap – European – W Asiatic – humid grassland
Myosotis ramosissima Rochel in Schultes – T scap – Steno-Mediterranean – grassland

Verbenaceae

Verbena officinalis L. – H scap – Cosmopolitan – grassland

Labiatae

Teucrium chamaedrys L. – Ch suffr – Euri – Mediterranean – dry meadows
Teucrium marum L. – Ch frut – Steno-Mediterranean – cliffs
Lamium bifidum Cyr. – T scap – Steno – Mediterranean – meadows
Marrubium vulgare L. – H scap – Cosmopolitan – dry meadows (nitrophilous)
Stachys glutinosa L. – Ch frut – Endemic – dry slopes, windy ridges
Stachys corsica Pers. – H rept – Endemic – humid and shady ravines
Prunella laciniata (L.) L. – H scap – Euri-Mediterranean – dry and sunny meadows
Micromeria graeca (L.) Bentham – Ch suffr – Steno – Mediterranean – cliffs, stony ground
Micromeria cordata (Moris ex Bertol.) Moris – Ch suffr – Endemic – cliffs
Calamintha nepeta L. – H scap – Mediterranean – Montane – dry meadows
Acinos sardous (Asch. et Levier) Arrigoni – Ch suffr – Endemic – grassy grassland
Clinopodium vulgare L. subsp. *orientale* Bothmer – H scap – Boreal – maquis
Thymus catharine Camarda. – Ch rept – Endemic – dry and windy slopes. This species has been recently described by Camarda (2003) for Sardinia.
Lavandula stoechas L. – NP – Steno-Mediterranean – low maquis and garrigue
Salvia verbenaca L. – H scap – Mediterranean-Atlantic – dry meadows

Scrophulariaceae

Scrophularia trifoliata L. – H scap – Endemic – humid and shady cliffs
Misopates orontium (L.) Rafin. – T scap – Eurasiatic – dry meadows
Linaria pelisseriana (L.) Miller – T scap – Mediterranean – Atlantic – dry meadows
Linaria vulgaris Miller – H scap – Euroasiatic – meadows
Cymbalaria muelleri (Moris) Cheval. – Ch rept – Endemic – shady cliffs
Digitalis purpurea L. – H scap – Euri-Mediterranean – glades
Erinus alpinus L. – H scap – W Mediterranean – Montane – cliffs, consolidated stony ground
Veronica hederifolia L. – T scap – Euroasiatic – meadows
Veronica cymbalaria Bodard – T scap – Euri-Mediterranean – rocks
Euphrasia genargentea (Feoli) Diana Corrias – T scap – Endemic – grassy glades

Orobanchaceae

Orobanche minor Sm. – T par – Cosmopolitan – parasite on *Trifolium* and many *Leguminosae*
Orobanche rigens Loisel. – G par – Endemic – parasite on *Genista corsica*

Plantaginaceae

Plantago subulata L. subsp. *insularis* (Gren. & Godr.) Nyman – Ch pulv – Endemic – at windy stations
Plantago lanceolata All. – H ros – Cosmopolitan – meadows
Plantago bellardi All. – T scap – S Mediterranean – dry meadows

Valerianaceae

Valerianella eriocarpa Desv. - T scap – Steno – Mediterranean – garrigue
Valerianella dentata (L.) Pollich – T scap – Atlantic – meadows

Dipsacaceae

Scabiosa maritima L. – H bienn – Steno-Mediterranean – dry meadows

Campanulaceae

Legousia hybrida (L.) Delarbre – T scap – Mediterranean – Atlantic – grassy grassland
Jasione montana L. – H bienn – European-Caucasian – cliffs
Jasione echinata Boiss. et Renter – H scap – Mediterranean montane – dry and windy grassland

Compositae

Bellis sylvestris Cyr. – H ros – Steno-Mediterranean – grassland
Bellium bellidioides L. – H ros – Endemic – rocks and cliffs, cool spots
Filago germanica (L.) Hudson – T scap – Paleotemperate – grassland
Phagnalon rupestre (L.) DC. – Ch suffr – SW Mediterranean – cliffs

Helichrysum italicum (Roth) Don subsp. *microphyllum* (Willd.) Nyman – Ch suffr – Steno-Mediterranean – maquis, garrigue
Inula viscosa (L.) Aiton – H scap – Euri-Mediterranean – meadows
Pulicaria odora (L.) Rchb. – H scap – Euri-Mediterranean – maquis
Santolina insularis (Genn. ex Fiori) Arrigoni – NP – Endemic – windy moorland
Anthemis arvensis L. – T scap – Cosmopolitan – grassland
Achilllea millefolium L. – H scap – Euro-Siberian – dry meadows
Senecio vulgaris L. – T scap – Cosmopolitan – meadows
Carduus pycnocephalus L. – H bienn – Mediterranean-Turanian – meadows
Ptilostemon casabonae (L.) Greuter – Ch scap – Endemic – meadows
Onopordum illyricum L. – H bienn – Steno-Mediterranean – meadows
Centaurea cyanus L. – T scap – Subcosmopolitan – meadows
Carlina lanata L. – T scap – Steno-Mediterranean – dry meadows
Carlina macrocephala Moris – H scap – Endemic – dry and windy glades
Hyoseris radiata L. - H ros – Steno-Mediterranean – grassland
Scorzonera callosa Moris – H scap – Endemic – dry meadows
Hypochoeris cretensis (L.) Chaub. et Bory – H scap – Orophilous – NE Mediterranean – dry and stony slopes
Hypochoeris achyrophorus L. – T scap – Steno-Mediterranean – grassland
Urospermum dalechampi (L.) Schmidt – H scap – Euri-Mediterranean – grassland
Hieracium zizianum Tausch subsp. *sardonium* Zahn – H ros – Endemic – grassland
Hieracium pallidum Bivona – H ros – Atlantic – W European – cliffs, stony slopes

Liliaceae

Asphodelus microcarpus Salzm. et Viv. – G rhiz – Steno-Mediterranean – garrigue
Gagea granatellii Parl. – G bulb – Steno-Mediterranean – glades
Gagea soleirolii Schultz - G bulb – Orophilous – W Mediterranean – cliffs, garrigue
Scilla autumnalis L. – G bulb – Euri – Mediterranean – garrigue.
Ornithogalum corsicum Jord. et Fourr. – G bulb – Steno-Mediterranean – dry meadows
Allium sphaerocephalon L. – G bulb – Paleotemperate – dry environments
Allium vineale L. – G bulb – Euri – Mediterranean – dry meadows
Allium parciflorum Viv. – G bulb – Endemic – dry environments
Allium roseum L. – G bulb – Steno-Mediterranean – garrigue, dry meadows
Allium subhirsutum L. – G bulb – Steno-Mediterranean – garrigue, dry meadows

Amaryllidaceae

Pancratium illyricum L. – G bulb – Endemic – rocks and humid small valleys

Iridaceae

Crocus minimus DC. – G bulb – Endemic – dry, stony slopes
Romulea ligustica Parl. – G bulb – Steno-Mediterranean – meadows
Romulea requienii Parl. – G bulb – Endemic – meadows
Romulea columnae Seb. et Mauri – G bulb – Steno-Mediterranean – grassland – low shrubs and glades

Gladiolus italicus Miller – G bulb – Euri-Mediterranean – grassland

Juncaceae

Juncus subulatus Forsskål – G rhiz – Steno-Mediterranean – humid areas

Gramineae

Cynosurus echinatus L. – T scap – Euri-Mediterranean – grassland
Cynosurus elegans Desf. – T scap – Steno-Mediterranean – glades, maquis
Briza media L. – H caesp – Eurosiberian – meadows
Dactylis glomerata L. – T scap – Paleotemperate – grassland
Poa bulbosa L. – H caesp – Paleotemperate – dry meadows
Vulpia ciliata (Danth.) Link – T caesp – Euri-Mediterranean – garrigue
Sesleria insularis Sommier subsp. *barbaricina* Arrigoni – H caesp – Endemic – cliffs, exposed slopes
Melica minuta L. – H caesp – Steno-Mediterranean – cliffs, stony slopes
Lolium rigidum Gaudin – T scap – Paleotropical – glades
Lolium multiflorum Lam. – T scap – Euri-Mediterranean – grassland
Bromus rubens L. – T scap – S Mediterranean – edge of footpaths
Bromus rigidus Roth – T scap – Sub-tropical – grassland
Bromus hordeaceus L. – T scap – Cosmopolitan – meadows
Brachypodium retusum (Pers.) Beauv. – H caesp – Steno-Mediterranean – garrigue, degraded maquis
Brachypodium distachyum (L.) Beauv. – Tscap – Steno-Mediterranean – grassland
Hordeum leporinum Link – T scap – Steno-Mediterranean – grassland
Agropyron repens (L.) Beauv. – G rhiz – Boreal – dry meadows
Avena barbata Potter – T scap – Euri-Mediterranean -Turanian – meadows
Lophochloa pubescens (Lam.) Scholz – T scap – Steno-Mediterranean – grassland
Lagurus ovatus L. – T scap – Euri-Mediterranean – grassland
Aira caryophyllea L. – T scap – W Mediterranean – grassland
Phalaris canariensis L. – T scap – Macaronesic – grassland
Phleum pratense L. – T scap – Centre European – grassland
Stipa bromoides (L.) Dorfl. – Tscap – Steno-Mediterranean – grassland
Stipa capensis Thumb. – T scap – Steno-Mediterranean – grassland

Araceae

Arum italicum Miller – G rhiz – Steno-Mediterranean – maquis
Arum pictum L. fil. – G rhiz – Endemic – maquis, low shrubs
Arisarum vulgare Targ-Tozz. – G rhiz – Steno-Mediterranean – at the maquis edges

Cyperaceae

Carex microcarpa Bertol. ex Moris – H rhiz – Endemic – humid grassland
Carex flacca Schreber – G rhiz – European – grassland
Schoenus nigricans L. – H caesp – Cosmopolitan – humid grassland

Orchidaceae

Ophris morisii (Martelli) Soò in Keller et al. – G bulb – Endemic – maquis, garrigue
Ophris tenthredinifera Willd. – G bulb – Steno-Mediterranean – maquis
Ophris lutea Cav. subsp. *minor* (Tod.) O. et E. Danesch – G bulb – Steno-Mediterranean – maquis, garrigue
Ophris fusca Link subsp. *iricolor* (Desf.) K. Ricther – G bulb – Steno-Mediterranean – maquis, garrigue
Aceras anthropophorum (L.) R. Br. – G bulb – Mediterranean-Atlantic – maquis, dry meadows
Anacamptis pyramidalis (L.) L. C. Rich. – G bulb – Euri-Mediterranean – humid meadows
Orchis papilionacea L. subsp. *papilionacea* – G bulb – Euri-Mediterranean – grassland
Orchis mascula (L.) L. subsp. *ichnusae* Corrias – G bulb – Endemic – low shrubs
Orchis provincialis Balbis ex Lam. et DC. – G bulb – Steno-Mediterranean – low shrubs
Dactylorhiza insularis (Sommier) Landw – G bulb – Steno-Mediterranean – glades
Cephalanthera longifolia (L.) Fritsch – G rhiz – Eurasiatic – low shrubs

Discussion

From the list of flora it is possible to quantify the flora of the Tacco Monte Perda ‘e Liana in 247 species ascribable to 57 families and 176 genera with a collected species/investigated area ratio of 11.3 taxa per hectare. The most represented families are the *Gramineae* (25), the *Compositae* (24), the *Leguminose* (16) and the *Labiatae* (15); *Rumex* and *Allium* are the most numerous genera with 5 species each.

The endemic taxa are 44, that is 17,8 % of the local flora, and 22,3 % of the endemics present in Sardinia. This very high quota is mainly made up of species of a rather varied ecology, and on account of this they can be found in different and heterogeneous places on the island, while the distribution of some others is limited to a few stations. Among these *Thalapsi brevistylum* is indicated by Arrigoni (1983) for the Gennargentu on a siliceous substrate and dubiously for Oliena on a calcareous substrate. Its finding at Perda ‘e Liana significantly extends its distribution area and ecology. Only on the siliceous substrate of the Gennargentu, *Euphrasia genargentea* (Diana Corrias 1983) and *Carlina macrocephala* (Diana Corrias 1979) are reported, and only on the limestones of the Tonneri, *Minuartia verna* (Arrigoni 1984); our reports extend the discontinuous distribution area of *Rumex suffocatus*, which has so far been indicated for few stations in Sardinia (Camarda 1985). Its finding at Perda ‘e Liana of *Euphrasia genargentea* significantly extends its distribution area and ecology; this is justified, probably because dolomitic rocks place on clay and quartzose pebbly sandstone with variable thickness.

Comparing the endemic quota of Perda ‘e Liana with that of the Tonneri specifically (Loi & Lai 2001), the great analogy between these two areas can be seen. Areas that separated edges today of the same original calcareous massif of the Mesozoic era. Unlike indications for the Tacco ‘e Ticci (Ballero & al. op.cit.), these two reliefs significantly include a few floristic elements typical of the Subsector of the siliceous Mountains, District of Gennargentu (Arrigoni 1983), such as *Carlina macrocephala, Plantago insularis,* and

Table 2. Typology of the endemic entities of the Flora of M.te Perda 'e Liana (SA, Sardinia; CO, Corsica; SI, Sicily; AT, Tuscan Arcipelago; BL, Balearis Island; GA, Hyeres Islands).

Species	**Distr. Area**	**Type of endemic**
Urtica atrovirens	SA CO AT BL	Paleoendmic
Rumex suffocatus	SA	Schizocndcmic
Arenaria balearica	SA CO AT BL	Paleoendemic
Minuartia grandiflora	SA SI	Endemo vicariant
Cerastium supramontanum	SA	Schizocndcmic
Silene nodulosa	SA CO	Schizoendemic
Hypericum hircinum	SA AT	Endemo vicariant
Thlaspi brevistylum	SA CO	Endcmo vicariant
Biscutella morisiana	SA	Schizoendemic
Morisia monantha	SA CO	Paleoendemic
Saxifraga corsica	SA CO	Schizocndcmic
Genista corsica	SA CO	Paleoendemic
Polygala sardoa	SA	Endemo vicariant
Helianthemum morisianum	SA	Schizocndcmic
Oenanthe lisae	SA	Mesogenic endemic
Ptychotis sardoa	SA	Paleoendemic
Limonium morisianum	SA	Palcocndcmic
Asperula pumila	SA	Schizoendemic
Galium corsicum	SA CO	Paleoendemic
Stachys glutinosa	SA CO AT	Palcocndcmic
Stachys corsica	SA CO	Paleoendemic
Micromeria cordata	SA	Schizoendemic
Acinos sardous	SA	Endcmo vicariant
Thymus catharinae	SA	Endemo vicariant
Scrophularia trifoliata	SA CO AT	Schizoendemic
Cymbalaria muelleri	SA	Palcocndcmic
Euphrasia genargentea	SA	Endemo vicariant
Orobanche rigens	SA CO	Neoendemic
Plantago insularis	SA CO	Apocndcmic
Bellium bellidioides	SA BL	Schizoendemic
Santolina insularis	SA	Endemo vicariant
Ptilostemon casabonae	SA CO AT GA	Palcocndcmic

Table 2. Continued.

Carlina macrocephala	SA	Schizoendemic
Scorzonera callosa	SA	Progressive neoendemic
Hieracium sardonium	SA CO	Neoendemic
Allium parciflorum	SA CO	Paleoendemic
Pancratium illyricum	SA CO AT	Paleoendemic
Crocus minimus	SA CO	Neoendemic
Romulea requienii	SA CO AT	Schizoendemic
Sesleria barbaricina	SA	Neoendemic
Arum pictum	SA CO AT BL	Paleoendemic
Carex microcarpa	SA CO AT	Paleoendemic
Ophris morisii	SA	Schizoendemic
Orchis ichnusae	SA	Schizoendemic

Thymus catharinae. This immigration of silicicolous species is made possible both by the fact that the two separated floristic territories are only a few kilometres away, and by the presence of siliceous substrates appropriate for these specific entities at the base of the calcareous outcroppings.

Table 2 points out the large number of exclusively Sardinian (*Rumex suffocatus, Cerastium supramontanum, Polygala sardoa, Helianthemum morisianum, Oenanthe lisae, Ptychotis sardoa, Limonium morisianum, Asperula pumila, Micromeria cordata, Acinos sardous, Thymus catharinae, Cymbalaria muelleri, Euphrasia genargentea, Santolina insularis, Carlina macrocephala, Scorzonera callosa, Sesleria barbaricina, Ophris morisii, Orchis ichnusae*) and Sardo-Corsican (*Allium parciflorum, Hieracium sardonium, Plantago insularis, Orobanche rigens, Stachys corsica, Galium corsicum, Genista corsica, Saxifraga corsica, Morisia monantha, Thalapsi brevistylum, Silene nodulosa, Crocus minimus*) endemics, showing the high community coefficient and the same biogeographic past (Contandriopoulos 1981) shared by the two Mediterranean islands.

The ancestral isolation of these two territories on the island is confirmed by the large number of paleoendemics (*Urtica atrovirens, Arenaria balearica, Morisia monantha, Genista corsica, Ptychotis sardoa, Limonium morisianum, Galium corsicum, Stachys glutinosa, Stachys corsica, Cymbalaria muelleri, Ptilostemon casabonae, Allium parciflorum, Pancratium illyricum, Arum pictum, Carex microcarpa*) and schizoendemics (*Rumex suffucatus, Cerastium supramontanum, Silene nodulosa, Biscutella morisiana, Saxifraga corsica, Helianthemum morisianum, Asperula pumila, Micromeria cordata, Scrophularia trifoliata, Bellium bellidioides, Carlina macrocephala, Romulea requienii, Ophris morisii, Orchis ichnusae*) or ancient origin in the case of the paleoendemics, and of a new origin in the case of the schizoendemics testifying to the scanty contacts with more extended populations on mainland territories. This shows that from the Oligocene onwards, isolation in

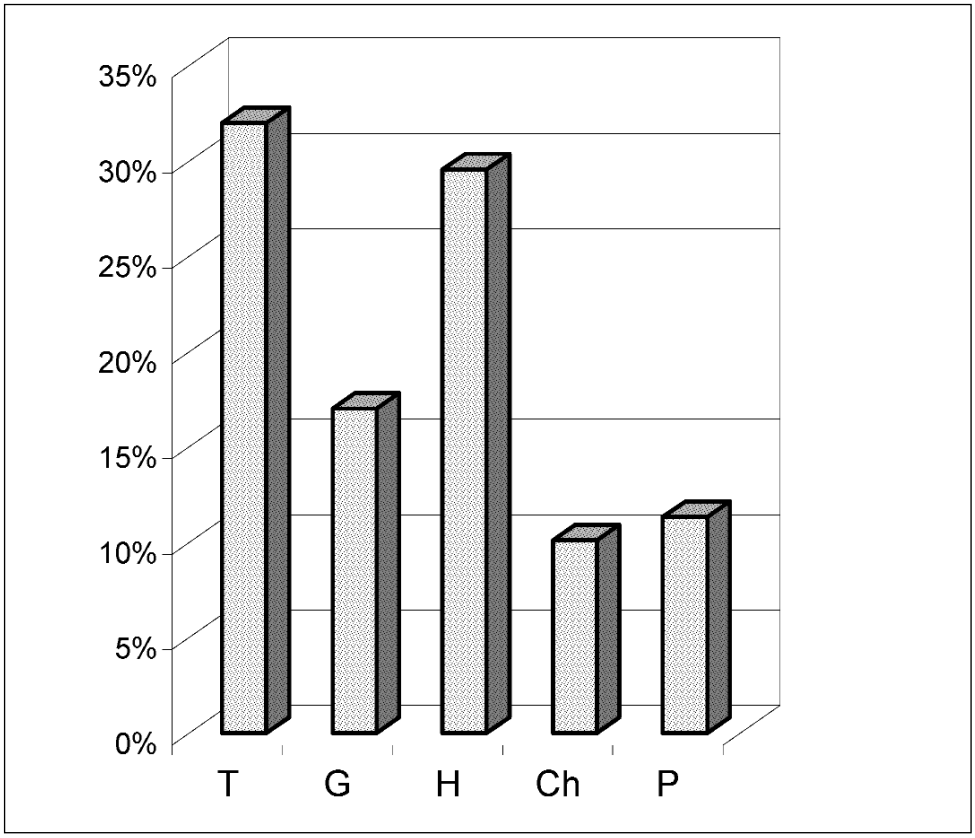

Fig. 3. Biological spectrum of the flora of M.te Perda 'e Liana.

Sardinia has exerted a protective action on the vegetation that evolved locally before the Neogene, so much so that it appears to be a relict compared to the flora of other areas of the Mediterranean.

Considering the ecological element of the endemic taxa, it should be pointed out that some species of a cool and/or humid environment (*Mentha requienii, Mentha insularis, Solerolia solerolii, Helleborus argutifolius, Aquilegia sp. pl., Borago pygmaea, Dephinium pictum, Polygonum scoparium*) are absent due to the lack of streams, springs, or stable water reservoirs, while they are easily found in less extended neighbouring calcareous localities. Other endemics typical of ruderal environments such as *Psoralea morisiana, Mercurialis corsica, Euphorbia cupanii, Verbascum conocarpum, Bryonia marmorata*, which are present in neighbouring areas, are significanty absent here.

From the biological spectrum summed up in Figure 3, it is clearly visible that in spite of the scanty meadows, the therophytes are more numerous among the Perda ‘e Liana flora, followed by the hemicryptophytes. Though on the one hand these values show a clear Mediterranean imprint, on the other they indicate a difficult edaphic situation on

Table 3. Comparison among the biological spectra of the floras of a few areas of calcareous substrate.

Locality	Altitude	n° species	T	G	H	Ch	P	Varia
Perda 'e Liana	1293	247	31,99	17,01	29,55	10,12	11,34	0
M.te Albo	1050	659	43,00	12,30	26,50	7,60	9,80	0,80
M.te Tuttavista	805	224	54,00	9,40	17,40	7,60	11,20	0,40
Tacco 'e Ticci	800	442	37,00	11,00	33,00	7,00	12,00	0
Marganai	906	597	38,00	14,00	29,00	6,00	12,00	1,00
M.te Tonneri and M.te Arquerì	1200	508	34,84	11,02	32,68	7,28	11,03	3,15
Sardinia	----	2013	38,90	10,80	28,90	9,70	8,80	2,80

account of the stressful climatic conditions (strong winds, large temperature differences) which often occur during the year and prevent the re-establishment of the tree cover, while they clearly favour soil erosion. This is also confirmed by the high percentage of geophytes, clearly above the regional average and similar floristic conditions (Table 3). The large number of camephytes, compared to the regional average, is due to the

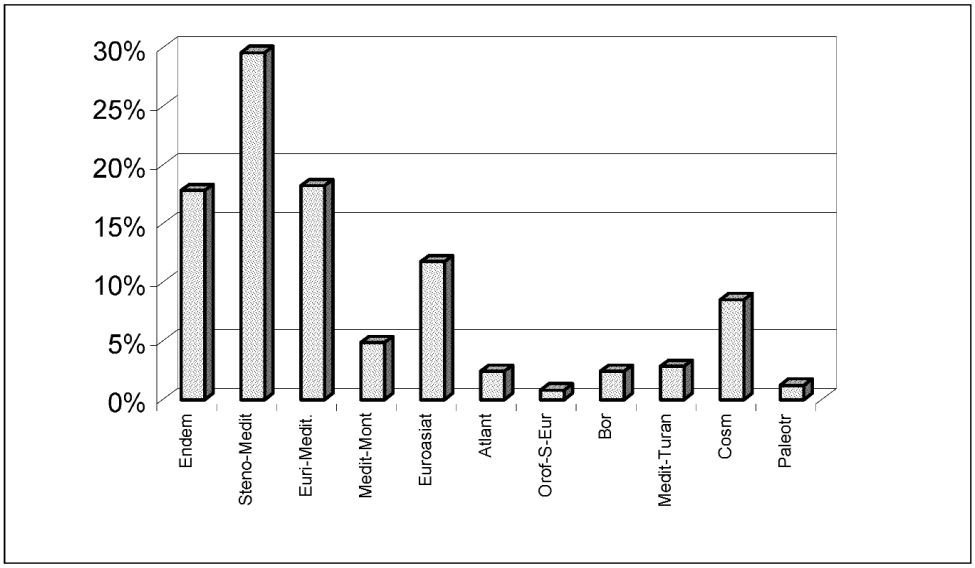

Fig. 4. Chorological spectrum of the flora of the M.te Perda 'e Liana.

local edaphic situation, which is comparable to the topmost areas of the island's reliefs where the cold north winds significantly interfere with the development of the larger plants. This can be seen in the behaviour of the phanerophytes, which are almost entirely represented by nanophanerophytes, at times considerably old - real natural bonsai plants.

The chorological spectrum (Fig. 4) clearly indicates the prevalence of Mediterranean forms, since 29,5% are steno-Mediterranean, 18,3% euri-Mediterranean, and 4,9% Mediterranean montane. The latter group are ascribable to the mesophilic horizon of the *Quercus ilex* forest with a few elements of the Q.T.A. girdle and of the forests of *Quercus pubescens*. Though limited, the presence of this quota, tough limited, suggests a more compact and numerically significant past component, which became rarefied in time and space by the fires and deforestation that affected the entire Ogliastra region, and by the extreme environmental conditions of Perda 'e Liana. A minor role is played by orientally gravitating species, such as the boreal and Atlantic species. The remaining chorotypes are represented by entities that are more widely distributed in Europe and by the cosmopolitan entities. We did not find naturalised species on the Perda 'e Liana Tacco in confirmation of the scanty human impact in the area through agricultural activity as mentioned when dealing with the endemics.

It seems interesting also to confirm the finding of *Linaria vulgaris,* a species not indicated by Pignatti (1982) for the regional flora, and the presence of *Amelanchier ovalis*, *Daphne oleoides,* and *Laserpitium gallicum¸* which represent an important phytogeographic finding.

In conclusion it may be stated that, though limited in its extension and in the number of its flora, the Perda 'e Liana Tacco is a site of great naturalistic and environmental value on account of the particular structure characterising it and its protective ability towards the flora. The high endemic quota of species undoubtedly represents the most significant witness of an original flora that mostly became extinct on account of the geological vicissitudes that led to the separation of the vast calcareous Mesozoic bank but also to that of the vegetable formations gravitating on it. This is strengthened by the homogeneity and analogies among the floras of the Tacchi of this floristic district studied so far, which should be analysed in greater detail from a vegetational point of view.

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