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Phytogeographic studies in the Sinis peninsula (C. W. Sardinia): Capo S. Marco

Abstract

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Results of floristic studies at Capo S. Marco, the southern extremity of the wide Sinis peninsula, are presented. The flora is composed of 400 spontaneous taxa belonging to 63 families and 242 genera and includes species of notable phytogeographic significance which have the *locus classicus* here. The floristic list of Capo S. Marco has been analysed in order to elaborate the life forms, to check the different growth forms of the plants in response to environmental factors, to record the phytogeographic elements of all species so as to show the various geographic components. Ecologic elements for about 50% of the flora characterizing the landscape of Capo S. Marco are considered.

This work is part of a phytogeographic study of the Sinis peninsula. The previous works have examined the flora of the areas of Capo Mannu (Bocchieri & al. 1988), Torre del Sevo (Mulas 1993) and Mari Ermi (Mulas 1986). They have enable us to report on the threats to the vegetation resulting from mans activities (Bocchieri & Mulas 1994).

The territory

The area of this study is the southern most part of the Sinis peninsula and belongs administratively to the borough of Cabras, included on Map 216 (I S.E. Capo San Marco) of the Military Geographic Institute. It is 2.5 km long and 100-700 m in width and its maximum height, occuring between N.ghe Baboe Cabitza and Torre Vecchia, is 57 m. In accordance with the subdivisions of the floristic territories proposed by Arrigoni (1983), Capo San Marco is in the Campidano district of the coastal and hilly subsector of Sardinia.

The geological section of the Cape shows a base characterized by organogenic sea-limestones and laminated limestones, which are both attributed to the Messinian. This sedimentary formation is covered with basalts of various thickness of Plio-Pleistocene age. Of particular importance are the sandy deposits represented by aeolic gritstones of the Würmian and by conglomerates, especially rich in fossils. To the south of the tower of S. Giovanni there are expanses of aeolic sands which rest on the Tyrrhenian bank in the southern-eastern part (Cherchi & al. 1978).

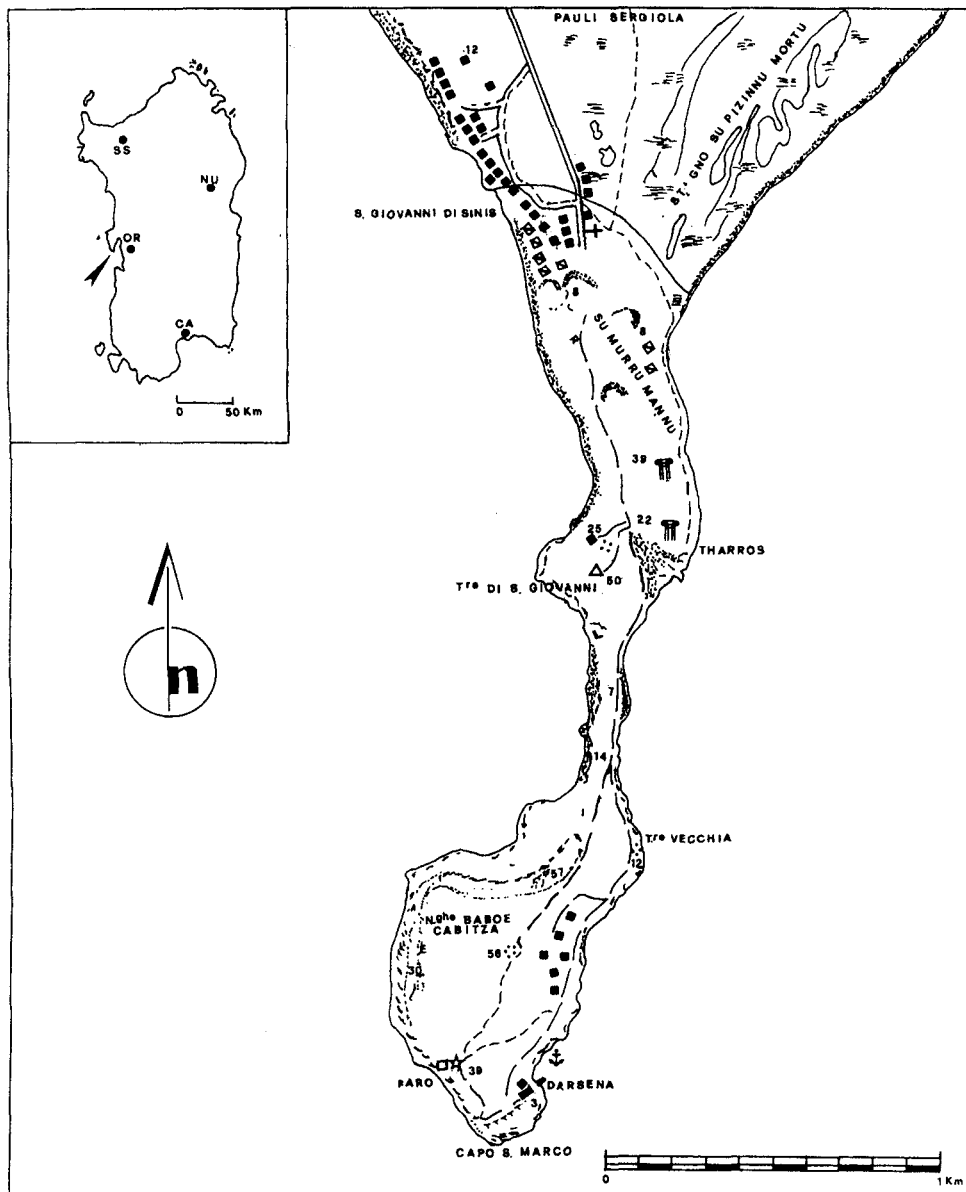


Fig. 1. Capo S. Marco.

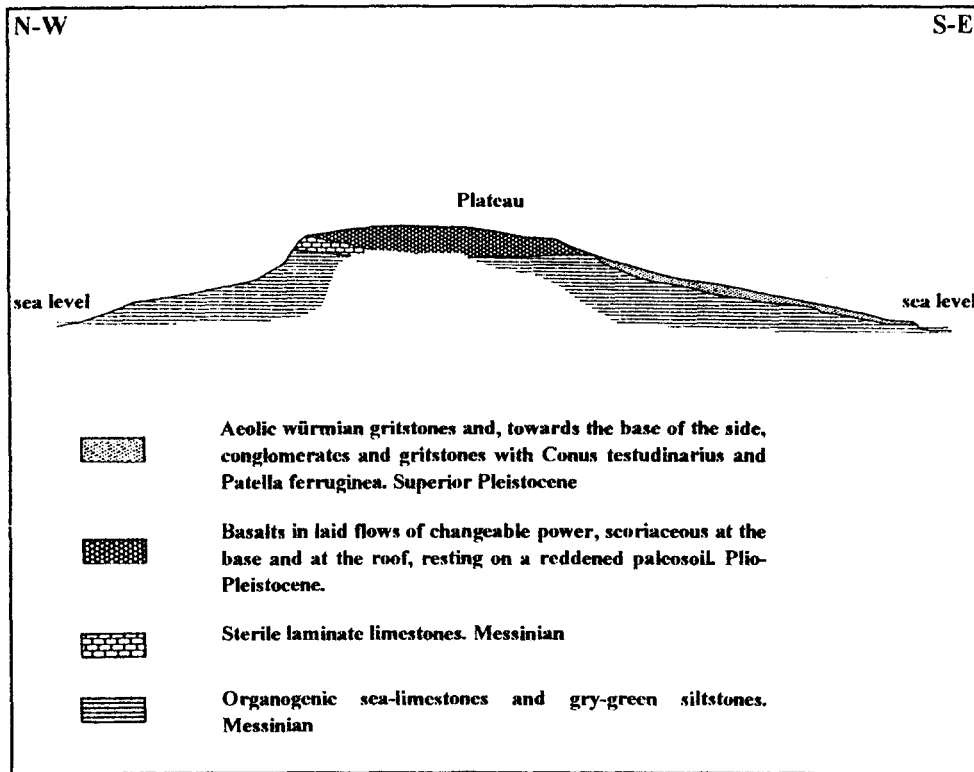


Fig. 2. Schematic geological section of Capo S. Marco.

According to Pinna (1950), during a sea-ingression of the Pleistocene, Capo S. Marco was disconnected by the basaltic flow and was subsequently rejoined by sandy deposits.

Sandy and rocky coasts alternate along the Cape. In some points, they degrade gradually towards the sea and in others, like in the neighbourhood of the lighthouse, they make cliffs 40 m high.

For climatic details, see the previously mentioned works (Bocchieri & al. 1988, Mulas 1986, 1993) and those of the nearby Capo Frasca (Bocchieri & Mulas 1992) which closes the wide Gulf of Oristano to the south.

The flora

Capo S. Marco has never before been subjected to a detailed study. In addition to some records reported by Barbey (1884) concerning seaweed and fungi and Nimis & Poelt (1987) for lichens, this territory is quoted in the work on the distribution and sociology of *Chamaerops humilis* L. (Chiesura Lorenzoni & Lorenzoni 1977), the psammophilous coastal vegetation of southern Sardinia (Bartolo & al. 1989, Brambilla & al. 1982, De Marco & Mossa 1980), the distribution of *Ephedra distachya* L. (Desole 1949, 1965) and

the description and recording of some endemics (Arrigoni & al. 1977-1993, Bocchieri 1988, Dolcher & Pignatti 1971). Dolcher (1970) includes Capo San Marco among the significant biotopes.

Our collections began at the end of 1990 and continued monthly until the end of 1993. The specimens, kept in the Herbarium CAG, have been determined using *Flora Europaea* (Tutin & al. 1964-1993), *Flora d'Italia* (Pignatti 1982) and, as regards the endemic plants, the contributions of Arrigoni & al. (1977-1993).

The systematic order presented below is that of *Flora Europaea*. For nomenclature, we have followed *Flora Europaea*, *Atlas Florae Europaeae* (Jalas & Suominen 1977-1991) and *Med-Checklist* (Greuter & al. 1984-1989).

For each taxon, the biological life form was checked in field and quoted in accordance with Raunkier's

terminology (Raunkier 1934). The growth forms are given according to Arrigoni & Di Tommaso (1991), the phytogeographical units account to Arrigoni (1983). One or more localities, habitat and abundance are given for each taxon.

Floristic list

Isoetaceae

Isoetes histrix Bory - G bulb, PT, M-At

Temporary pools of the plateau situated between the lighthouse and N. ghe Baboe Cabitza; rare.

Aspleniaceae

Asplenium onopteris L. - H ros, PT, O-Pt

Wet rocks to the west of S. Giovanni's tower; very rare.

Cupressaceae

Juniperus phoenicea L. - P caesp/P scap, WA, M

Scrub; sporadic.

Ephedraceae

Ephedra distachya L. - NP, WS, T-Es

Sands of the isthmus; frequent.

Moraceae

Ficus carica L. - P caesp, WA, T

Between S. Giovanni's tower and the ruins of Tharros; rare.

Urticaceae

Urtica urens L. - T scap, Hi Aes, SCo

Near the harbour; common.

Urtica membranacea Poir. - T scap, Hi Others, T

Clearings near the lighthouse and the harbour; common.

Parietaria judaica L. - H scap, Hi Others, T-Eu

In the crevices of S. Giovanni's tower; frequent.

Parietaria lusitanica L. - T rept, Hi Ave, T-Eu

Near the houses of Torre Vecchia; rare.

Santalaceae

Osyris alba L. - NP, WS, Eu-M

Among the scrub; frequent.

Rafflesiaceae

Cytinus hypocistis (L.) L. - T par, Others, M-At

Among the expanses of *Cistus*; sporadic.

Balanophoraceae

Cynomorium coccineum L. - G par, Hri, T

Among the expanses of *Atriplex*; frequent.

Polygonaceae

Polygonum maritimum L. - H rept, Hps, SCo

Sands of S. Giovanni di Sinis and of Murru Mannu; rare.

Rumex pulcher L. - H scap, Hi Pve, SCo

Temporary damp meadows near the lighthouse; sporadic.

Rumex obtusifolius L. - H scap, Hi Pve, Co

Depressions near the lighthouse and between Torre Vecchia and N. ghe Baboe

Cabitzza; sporadic.

Rumex bucephalophorus L. - T scap, Hi Ave, M

Sands, clearings of the scrub, rocky fissures; frequent.

Emex spinosa (L.) Campd. - T scap, Hi Aes, M-Ma

Sands and fallow lands near the harbour; rare.

Chenopodiaceae

Beta maritima L. - H scap, Hi Pve, T-Eu

Near the harbour and among the fissures of the cliffs; frequent.

Chenopodium murale L. - T scap, Hi Others, SCo

Among the ruins of Tharros; sporadic.

Chenopodium album L. - T scap, Hi Others, Co

Near the harbour and the houses of Torre Vecchia; sporadic.

Atriplex halimus L. - P caesp, WB, Pt-T

Along the path which leads from the lighthouse to the harbour; frequent.

Atriplex portulacoides L. - Ch frut, WS, Eu-M (coastal)

Near the harbour and along the coasts in the south of the lighthouse and Torre Vecchia; frequent.

- Camphorosma monspeliaca* L. - Ch frut, WF, M-Po
Common everywhere.
- Sarcocornia fruticosa* (L.) A. Y. Scott - Ch succ, WS, M-At
Rocky coasts west of S. Giovanni's tower; sporadic.
- Arthrocnemum macrostachyum* (Moric.) C. Koch - Ch succ, WS, M-Ma
Rocky coasts west of S. Giovanni's tower; rare.
- Suaeda vera* J. F. Gmelin - NP, WF, Co
Near the harbour and along the southern coasts; sporadic.
- Salsola soda* L. - T scap, Hi Ave, T-Es
Near the harbour and among the ruins of Tharros; rare.
- Salsola kali* L. - T scap, Hi Ave, SCo
Sands of the isthmus and of the harbour; rare.

Aizoaceae

- Carpobrotus edulis* (L.) N. E. Br. - Ch suffr, WS, Naturalized
Sands near the huts of S. Giovanni di Sinis; frequent.
- Mesembryanthemum nodiflorum* L. - T scap, Hcr, T
Coastal meadows near Torre Vecchia; frequent.

Caryophyllaceae

- Arenaria serpillifolia* L. - T scap, Hi Ave, SCo
Among the ruins of Tharros; rare.
- Stellaria media* (L.) Vill - T rept, Hde, SCo
Among the scrub of the plateau and in the coolest zones; frequent.
- Stellaria pallida* (Dumort.) Piré - T scap, Hi Ave, T-Eu
Under the bushes near Torre Vecchia; rare.
- Cerastium glomeratum* Thuill. - T scap, Hi Others, Co
Among the ruins; sporadic.
- Cerastium pumilum* Curtis - T scap, Hce, Eu-M
Meadows of Torre Vecchia and near the Tophet of Tharros; rare.
- Sagina apetala* Ard. - T scap, Hce, T-Eu
Interruptions of the scrub and meadows; frequent.
- Sagina maritima* G. Don - T scap, Hce, T-Eu (coastal)
Southern sector of the cape; rare.
- Paronychia echinulata* Chater - T scap, Hce, M-Ma
Clearings, meadows and rocky fissures; frequent.
- Paronychia argentea* Lam. - H caesp, Hps, M-Ma
Sands of Murru Mannu; sporadic.
- Polycarpon tetraphyllum* (L.) L. subsp. *tetraphyllum* - T scap, Hce, SCo
Interruptions of the scrub; frequent.
- Polycarpon tetraphyllum* (L.) L. subsp. *alsinifolium* (Biv.) Ball - T scap, Hce, M-At
Sands of the isthmus; rare.
- Spergularia rubra* (L.) J. & C. Presl. - Ch suffr, Hce, SCo
Inland clearings of the scrub; sporadic.
- Silene vulgaris* (Moench) Garch - H scap, Hi Pve, SCo
Central-western sector of the cape; rare.

- Silene corsica* DC. - H scap, Hrg, Esc
Sandy zones; frequent.
- Silene latifolia* Poir. - H bienn, Hi Pve, M-Po
Rocky fissures and meadows in the west of N.ghe Baboe Cabitza; sporadic.
- Silene coeli-rosa* (L.) Godron - T scap, Hi Ave, M-Ma
Sands of the isthmus and near the huts; rare.
- Silene nocturna* L. - T scap, Hi Ave, M-Ma
Near S. Giovanni's tower and among the ruins of Tharros; rare.
- Silene gallica* L. - T scap, Hi Ave, Co
Frequent almost everywhere.
- Silene canescens* Ten. - T scap, Hi Ave, M-Ma
Sandy zones; frequent.
- Silene nummica* Valsecchi - T scap, Hi Ave, Mco
Beach of S. Giovanni di Sinis; sporadic. This species was described by Valsecchi (1995) and it is part of the group "*Silene colorata* Poir. - *Silene sericea* All. - *Silene canescens* Ten."
- Petrorhagia prolifera* (L.) P. W. Ball & Heywood - T scap, Hi Ave, T-Eu
Dry meadows and cleared scrub near Torre Vecchia; frequent.

Ranunculaceae

- Nigella damascena* L. - T scap, Hi Ave, T-Eu
Clearings of the scrub of the plateau; rare.
- Delphinium longipes* Moris - T scap, Hi Acs, M-Ma
Near S. Giovanni's tower and in the gorge south of N.ghe Baboe Cabitza; frequent but localized.
- Clematis cirrhosa* L. - P lian, WL, Mco
Tall scrub between the harbour and the lighthouse; rare.
- Ranunculus trilobus* Desf. - T scap, Hi Ave, M-Ma
Damp meadows and temporary pools; rare.
- Ranunculus muricatus* L. - T scap, Hi Ave, T-Es
Meadows and pools; rare.
- Ranunculus bullatus* L. - H ros, Hy, M
Damp meadows and clearings; frequent but localized.

Papaveraceae

- Papaver rhoeas* L. - T scap, Hi Ave, T-Eu
Near the lighthouse; sporadic.
- Papaver hybridum* L. - T scap, Hi Ave, T-Eu
Among the ruins of Tharros; sporadic.
- Glaucium flavum* Crantz - H scap, Hi Pve, T-Eu (coastal)
Sands of the isthmus; frequent.
- Fumaria capreolata* L. - T scap, Hde, T-Eu
Among the low scrub; frequent.
- Fumaria bicolor* Sommier - T scap, Hdc, Mco
Among the scrub; rare.
- Fumaria bastardii* Boreau - T scap, Hde, T-Eu

Among the scrub; frequent.

Fumaria parviflora Lam. - T scap, Hde, T-Eu

Among the scrub; rare.

Cruciferae

Matthiola sinuata (L.) R. Br. - H scap, Hi Pve, M-At

Sands of the isthmus and in some rocky fissures; sporadic.

Matthiola tricuspidata (L.) R. Br. - T scap, Hi Ave, M

Sands; frequent.

Cardamine hirsuta L. - T scap, Hce, Co

On the plateau; rare.

Lobularia maritima (L.) Desv. - Ch suffr, WS, M-Ma

Rocky and sandy coasts; frequent.

Lepidium graminifolium L. subsp. *suffruticosum* (L.) P. Monts. - H scap, WS, Mo

Near the harbour; rare.

Diplotaxis viminea (L.) DC. - T scap, Hi Ave, Eu-M

Among the scrub near N.ghe Baboe Cabitza; rare.

Hirschfeldia incana (L.) Lagrèze-Fossat - T scap, Hi Ave, M-Ma

Among the ruins of Tharros; rare.

Cakile maritima Scop. subsp. *aegyptiaca* (Willd.) Nyman - T scap, Hcr, M

Sands of the isthmus and among the paths of the ruins of Tharros; frequent.

Rapistrum rugosum (L.) All. subsp. *linnaeanum* Rouy & Fouc. - T scap, Hi Ave, M

Along the paths; rare.

Crassulaceae

Crassula tillaea Lester-Garland - T scap, Hps, T-Eu

Meadows and clearings of the scrub; frequent.

Crassula vaillantii (Willd.) Roth - T scap, Hce, Eu-M

Temporary pools of the plateau; rare.

Umbilicus rupestris (Salisb.) Dandy - G bulb, Hcr, T-Eu

Rocky fissures of the western cliff; sporadic.

Umbilicus horizontalis (Guss.) DC. - G bulb, Hcr, M-Ma

Fissures near the ruins; very rare.

Sedum sediforme (Jacq.) Pau - Ch succ, WS, Eu-M

Ruins and fissures near Torre Vecchia; frequent.

Sedum rubens L. - T scap, Hcr, T-Eu

Plateau near the lighthouse; rare.

Sedum caeruleum L. - T scap, Hcr, Mco

Meadows and fissures; sporadic.

Rosaceae

Rubus ulmifolius Schott - NP, WS, T-Eu

Eastern sector of the ruins of Tharros; rare.

Sanguisorba minor Scop. subsp. *rupicola* (Boiss. & Reuter) Nordborg - H scap, Hri, Eu-M

Among the scrub of the plateau toward the slope; sporadic.

Leguminosae

- Anagyris foetida* L. - P caesp, WB, M
Along the path which leads from the plateau to the harbour; common.
- Calicotome villosa* (Poiret) Link - P caesp, WB, M
On the plateau near the lighthouse and in the harbour; common.
- Lupinus micranthus* Guss. - T scap, Hi Ave, M
Interruptions of the scrub near the isthmus and among the ruins of Tharros; rare.
- Astragalus boeoticus* L. - T scap, Hi Ave, T
Coastal sands near the huts of S. Giovanni di Sinis and among the ruins of Tharros; frequent.
- Vicia sativa* L. subsp. *nigra* (L.) Ehrh. - T scap, Hde, T-Es
Meadows and clearings of the scrub; rare.
- Vicia lutea* L. - T scap, Hi Ave, T-Eu
Among the scrub; very rare.
- Lathyrus articulatus* L. - T scap, Hde, M-Ma
Among the scrub and along the paths; sporadic.
- Lathyrus ochrus* (L.) DC. - T scap, Hde, Eu-M
Clearings near Torre Vecchia; sporadic.
- Lathyrus aphaca* L. - T scap, Hde, T-Eu
Among the scrub; rare.
- Pisum sativum* L. subsp. *elatius* (Bieb.) Ascherson & Graebner - T scap, Hde, Eu-M
Among the scrub of the plateau; rare.
- Ononis reclinata* L. - T scap, Hi Ave, T-At
Under the scrub and at the edges of the clearings and of the paths; sporadic.
- Ononis viscosa* L. subsp. *breviflora* (DC.) Nyman - T scap, Hi Ave, M
Clearings of the plateau; frequent but localized.
- Ononis variegata* L. - T scap, Hps, M-Ma
Sands of the isthmus and of S. Giovanni di Sinis; frequent.
- Melilotus sulcata* Desf. - T scap, Hi Ave, M-Ma
Near S. Giovanni's tower; rare.
- Medicago orbicularis* (L.) Bartal. - T scap, Hps, T-Eu
Among the ruins of Tharros; rare.
- Medicago marina* L. - Ch rept, WS, Eu-M
Sandy of the isthmus and near the huts of S. Giovanni di Sinis; frequent.
- Medicago littoralis* Rohde - T scap, Hps, M-At
Rocky and sandy coasts, inland clearings; frequent.
- Medicago turbinata* (L.) All. - T scap, Hps, M
Along the path which leads from the lighthouse to the harbour; rare.
- Medicago polymorpha* L. - T scap, Hps, T-Eu
Present almost everywhere.
- Medicago minima* (L.) Bartal. - T scap, Hps, T-Es
Coastal and scrub zones; frequent.
- Trifolium nigrescens* Viv. - T scap, Hps, T-Eu
Damp meadows near the lighthouse and the Tophet of Tharros; frequent.
- Trifolium glomeratum* L. - T scap, Hi Ave, T-Eu
Clearings of the scrub in the plateau; sporadic.
- Trifolium spumosum* L. - T scap, Hce, T

- Meadows near Torre Vecchia; rare.
- Trifolium resupinatum* L. - T rept, Hi Ave, T-Es
Among the scrub; frequent.
- Trifolium tomentosum* L. - T rept, Hps, T
Sandy meadows; sporadic.
- Trifolium campestre* Schreber - T scap, Hi Ave, T-Eu
Clearings and interruptions of the scrub; rare.
- Trifolium arvense* L. - T scap, Hi Ave, T-Es
Pebbly soils between Torre Vecchia and the harbour; sporadic.
- Trifolium scabrum* L. - T rept, Hce, T-Eu
Meadows near the lighthouse and among the scrub; frequent.
- Trifolium stellatum* L. - T scap, Hi Ave, M-Ma
Along the paths and the lanes; rare.
- Trifolium incarnatum* L. subsp. *molinerii* (Balbis ex Hornem.) Syme - T scap, Hi Ave, Eu-M
Clearings among the scrub and near the lighthouse; frequent.
- Trifolium cherleri* L. - T scap, Hce, T-Eu
Inland and coastal meadows; frequent.
- Trifolium angustifolium* L. - T scap, Hi Ave, T-Eu
Edges of the paths; sporadic.
- Trifolium squamosum* L. - T scap, Hi Ave, M-At
Meadows near the coast; rare.
- Trifolium subterraneum* L. - T rept, Hps, T-Eu
Near the lighthouse and the harbour; frequent.
- Dorycnium hirsutum* (L.) Ser. - Ch suffr, WS, Eu-M
Among the rocky fissures and along the path which leads from the lighthouse to the harbour; rare.
- Lotus parviflorus* Desf. - T scap, Hps, T-Eu
Lithosoils of the plateau; very rare.
- Lotus angustissimus* L. - T scap, Hps, T-Eu
S. Giovanni's tower; rare.
- Lotus edulis* L. - T scap, Hps, M
Among the scrub and near the Tophet of Tharros; frequent.
- Lotus conimbricensis* Brot. - T scap, Hps, M
Meadows between Torre Vecchia and the houses; very rare.
- Lotus cytisoides* L. - Ch suffr, WS, M
Sands and rocks; frequent.
- Lotus ornithopodioides* L. - T scap, Hi Ave, M-Po
Among the scrub; sporadic.
- Ornithopus compressus* L. - T scap, Hce, T-Eu
Among the scrub and in the clearings; frequent.
- Hippocrepis unisiliquosa* L. - T scap, Hce, M-Po
Clearings and meadows near Torre Vecchia; sporadic.
- Scorpiurus muricatus* L. - T scap, Hps, T-Po
Meadows near Torre Vecchia; rare.
- Hedysarum spinosissimum* L. - T scap, Hps, Eu-M
Present almost everywhere.

Oxalidaceae

Oxalis pes-caprae L. - G bulb, Hbu, Naturalized
Near the harbour and Torre Vecchia; frequent.

Geraniaceae

Geranium molle L. - T scap, Hi Ave, T-Es
Edges of paths and meadows; frequent.
Geranium purpureum Vill. - T scap, Hi Ave, T-Eu
Among the scrub of the plateau; rare.
Erodium cicutarium (L.) L'Hér. - T scap, Hce, SCo
Meadows and clearings; frequent.
Erodium moschatum (L.) L'Hér. - T scap, Hi Ave, T-Eu
Meadows near the lighthouse; sporadic.

Linaceae

Linum bienne Miller - T scap, Hi Ave, T-Eu
Clearings and meadows; frequent.
Linum trigynum L. - T scap, Hi Ave, O
Particularly pebbly soils near the lighthouse; sporadic.
Linum strictum L. - T scap, Hi Ave, T-Eu
Dry meadows near Torre Vecchia; frequent.

Euphorbiaceae

Mercurialis annua L. - T scap, Hi Others, T-Es
Among the paths of the ruins of Tharros, rubble and near the harbour; rare.
Euphorbia peplis L. - T scap, Hps, T-Eu
Sands of the isthmus and in the north of S. Giovanni's tower; rare.
Euphorbia dendroides L. - NP, WB, M
South-western side of the cape; frequent but localized.
Euphorbia pterococca Brot. - T scap, Hi Ave, M-Ma
Among the low scrub of the plateau; rare.
Euphorbia helioscopia L. - T scap, Hi Ave, Co
Clearings near the lighthouse; frequent but localized.
Euphorbia exigua L. - T scap, Hi Ave, T-Eu
Meadows and clearings of the scrub near the lighthouse; frequent.
Euphorbia peplus L. - T scap, Hi Others, Co
Scrub and clearings; frequent.
Euphorbia peploides Gouan - T scap, Hi Others, M
Scrub and clearings; frequent.
Euphorbia cupanii Guss. - G rhiz, Hri, Eti
Paths of the scrub, rubble and clearings; rare.
Euphorbia paralias L. - Ch frut, Hi Pve, M-At
Sands of the isthmus and of the harbour; frequent.
Euphorbia terracina L. - H scap, Hi Pve, M-Ma

Sandy and inland zones; rare.

Euphorbia characias L. - NP, WS, Mco

Among the scrub of the western sector; rare.

Rutaceae

Ruta chalepensis L. - Ch suffr, WS, M-Ma

Among the scrub of the plateau; frequent.

Anacardiaceae

Pistacia lentiscus L. - P caesp, WB, M-Ma

Common among the scrub.

Rhamnaceae

Rhamnus alaternus L. - P caesp, WB, M

Along the path which leads to the harbour; very rare.

Malvaceae

Malva sylvestris L. - H scap, Hde, SCo

Rocky lands in the isthmus near the ruins of Torre Vecchia; rare.

Malva nicaeensis All. - T scap, Hi Ave, T

Clearings and paths among the scrub of the plateau; rare.

Malva parviflora L. - T scap, Hde, T-Eu

Ruins of Tharros, edges of the paths and near S. Giovanni's tower; very rare.

Lavatera cretica L. - T scap, Hi Ave, M-At

Among the scrub; not frequent.

Althaea hirsuta L. - T scap, Hi Ave, T-Eu

Dry and coastal meadows; rare.

Thymelaeaceae

Thymelaea hirsuta (L.) Endl. - NP, WS, M

Present almost everywhere.

Guttiferae

Hypericum perforatum L. - H scap, Hi Pvc, SCo

Clearings and temporary damp meadows near N.ghe Baboe Cabitza; rare.

Cistaceae

Cistus incanus L. [= *C. creticus* L. subsp. *eriocephalus* (Viv.) Greuter & Burdet] - NP, WB, M

Among the scrub; frequent but localized.

Cistus monspeliensis L. - NP, WB, M-Ma

Present almost everywhere.

Cistus salviifolius L. - NP, WB, M-Po

Low scrub near the lighthouse; not frequent.

Tuberaria guttata (L.) Fourr. - T scap, Hi Ave, T-Eu

Clavey meadows and edges of the paths; common

Fumana thymifolia (L.) Webb - Ch suffr, WS, M

Eastern and western side of the cape; sporadic.

Tamaricaceae

Tamarix canariensis Willd. - P scap, WA, M-Ma

In the ruins of Tharros near the Tophet; very rare.

Frankeniaceae

Frankenia hirsuta L. - Ch suffr, WS, M-Po

Sands of the harbour and coastal salt meadows; frequent.

Cactaceae

Opuntia maxima Miller - P succ, WF, Naturalized

Near the harbour; localized.

Lythraceae

Lythrum hyssopifolia L. - T scap, Hi Ave, SCo

Edges of the pools situated among the scrub of the plateau; rare.

Lythrum borysthenticum (Schrank) Litv. - T scap, Hps, Eu-M

Among the pools and the meadows of the plateau; rare.

Theligonaceae

Theligonum cynocrambe L. - T scap, Hdc, M-Po

Walls and rocky fissures; very rare.

Umbelliferae

Eryngium barrelieri Boiss. - T scap, Hce, Mco

Damp and muddy meadows of the plateau; rare and localized.

Eryngium maritimum L. - G rhiz, Hri, Eu-M (coastal)

Sands of the harbour, of the isthmus and of S. Giovanni di Sinis; frequent.

Eryngium tricuspdatum L. - H scap, Hi Pve, Mco

Among the low scrub of the plateau; rare.

Eryngium campestre L. - H scap, Hi Pve, Eu-M

Among the paths of the scrub; sporadic.

Scandix pecten-veneris L. - T scap, Hi Ave, SCo

Clearings and meadows near the lighthouse; rare.

Smyrniolus olusatrum L. - H bienn, Hi Pve, T-Eu

Along the path which leads to the harbour; rare.

- Crithmum maritimum* L. - Ch suffr, WS, M-At
Rocky and sandy coasts; common.
- Foeniculum vulgare* Miller subsp. *piperitum* (Ucria) Coutinho - H scap, Hi Pve, M-Ma
Near in the lighthouse and in the harbour; rare.
- Bupleurum semicompositum* L. - T scap, Hi Ave, T
Dry clearings of the plateau; sporadic.
- Ammoides pusilla* (Brot.) Breistr. - T scap, Hi Ave, M
Among the low scrub near N.ghe Baboe Cabitza; rare.
- Ferula arrigonii* Bocchieri - H scap, Hi Pve, Esc
In the south of the sandy isthmus; frequent.
- Thapsia garganica* L. - H scap, Hi Pve, M
Near Torre Vecchia; sporadic.
- Torilis nodosa* (L.) Gaertner - T scap, Hi Ave, T-Eu
Clearings near S. Giovanni's tower; very rare.
- Daucus carota* L. subsp. *carota* - T scap, Hi Others, SCo
Among the scrub; sporadic.
- Daucus carota* L. subsp. *maximus* (Desf.) Ball - H bienn, Hi Pve, M
Paths among the scrub; rare.
- Daucus gingidium* L. subsp. *polygamus* (Gouan) Onno - H bienn, Hi Pve, M
Among the coastal scrub; frequent.

Primulaceae

- Asterolinon linum-stellatum* (L.) Duby - T scap, Hi Ave, T-Eu
Under the scrub and in some clearings; frequent.
- Anagallis arvensis* L. - T rept, Hps, SCo
Clearings, meadows; common.

Plumbaginaceae

- Plumbago europaea* L. - Ch frut, WS, T-Eu
Near S. Giovanni's tower; localized.
- Limonium capit-marci* Arrigoni et Diana - Ch suffr, WS, Esa
Capo S. Marco, among the seaside rocks and under S. Giovanni's tower; frequent.
- Limonium glomeratum* (Tausch) Erben - Ch suffr, WS, Esc
Tyrrhenian bank near the ruins of Tharros; frequent.
- Limonium lausianum* Pignatti - Ch suffr, WS, Esa
Coastal and rocky zones; frequent.
- Limonium oristanense* Meyer - Ch suffr, WS, Esa
Southern extremity of the cape; rare (Meyer 1995).
- Limonium tharosianum* Arrigoni et Diana - Ch suffr, WS, Esa
Coastal zones; frequent.
- Limonium virgatum* (Willd.) Fourr. - Ch suffr, WS, M
Coastal, rocky and rarely sandy zones; sporadic.

Oleaceae

- Olea europaea* L. subsp. *oleaster* (Hoffmanns. & Link) Negodi - P caesp, WB, M-Ma

Common among the scrub.

Phillyrea angustifolia L. - P caesp, WB, M-At

Frequent among the scrub.

Phillyrea latifolia L. - P caesp, WB, M-PO

Along the path which leads from the lighthouse to the harbour; rare.

Gentianaceae

Blackstonia perfoliata (L.) Hudson - T scap, Hi Ave, T-Eu

Clearings and edges of paths; rare.

Centaureum erythraea Rafn subsp. *rhodense* (Boiss. & Reuter) Melderis - H bienn, Hi Ave, M

Along the paths and among the scrub; sporadic.

Centaureum tenuiflorum (Hoffmanns. & Link) Fritsch subsp. *acutiflorum* (Schott) Zeltner - T scap, Hi Ave, M

Clearings and meadows; sporadic.

Centaureum maritimum (L.) Fritsch - T scap, Hi Ave, T-Eu

Meadows of the northern-western sector of the cape; rare.

Rubiaceae

Sherardia arvensis L. - T scap, Hi Ave, SCo

Among the scrub; common.

Crucianella maritima L. - Ch suffr, WF, M

Sandy coasts of the cape; frequent.

Galium aparine L. - T scap, Hde, Co

Near the Tophet of Tharros; sporadic.

Galium murale (L.) All. - T scap, Hde, M-Ma

Among the scrub and in the ruins; frequent.

Valantia muralis L. - T scap, Hce, M

Dry meadows of the western sector; frequent.

Rubia peregrina L. - P lian, WL, T-Eu

Among the scrub; common. There are some examples with oval leaf.

Convolvulaceae

Calystegia soldanella (L.) Roemer & Schultes - G rhiz, Hri, SCo (sandy coastal)

Sandy of the isthmus, of the harbour and of S. Giovanni di Sinis; frequent.

Convolvulus arvensis L. - G rhiz, Hri, SCo

Paths among the scrub; sporadic.

Convolvulus althaeoides L. - H scand, Hde, M-Ma

Among the bushes and at the edges of the paths; common.

Boraginaceae

Heliotropium europaeum L. - T scap, Hi Ave, T-Eu

Rocky fissures, rubble; sporadic.

- Cerintho major* L. - T scap, Hi Aes, M
Between the ruins of Tharros and S. Giovanni's tower; common.
- Echium plantagineum* L. - H bienn, Hde, T-Eu
Damp meadows, edges of paths; common.
- Echium sabulicola* Pomel - H scap, Hps, Mco
Sands of the isthmus; frequent.
- Echium creticum* L. - H bienn, Hi Ave, Mo
Among the coastal scrub; rare.
- Cynoglossum creticum* L. - H bienn, Hi Ave, T-Eu
Meadows of the degraded scrub near Torre Vecchia; rare.

Labiatae

- Ajuga iva* (L.) Schreber subsp. *iva* - Ch suffr, Hce, M-Ma
Dry meadows among the scrub; sporadic.
- Ajuga iva* (L.) Schreber subsp. *pseudoiva* (Rob. et Cast.) Albert et Jah. - Ch suffr, Hce, M-Ma
Among the ruins of Tharros; rare: This subspecies has been identified utilising the analytical key proposed by Valsecchi (1976).
- Teucrium marum* L. - Ch frut, WF, Mco
Coastal rocky zones and among the scrub; frequent.
- Teucrium subspinosum* Pourret - Ch frut, WF, Emo
Southern part of the cape; very rare.
- Teucrium capitatum* L. - Ch suffr, WF, T-Eu
On the plateau near the lighthouse; sporadic.
- Prasium majus* L. - Ch frut, WL/WS, M-Ma
Among the scrub and in the rocky fissures; frequent.
- Sideritis romana* L. - T scap, Hi Ave, T
Eastern dry meadows near Torre Vecchia; sporadic.
- Lamium amplexicaule* L. - T scap, Hi Ave, T-Es
Clearings near the lighthouse and along the paths; sporadic.
- Mentha pulegium* L. - H scap, Hi Pve, SCo
Temporary damp meadows; frequent.
- Rosmarinus officinalis* L. - NP, WB, M-Ma
Plateau in the north of the lighthouse; rare.
- Salvia verbenaca* L. - H scap, Hi Others, T-Eu
Edges of paths; frequent.

Solanaceae

- Hyoscyamus albus* L. - Ch frut, Hi Pve, T-Eu
At the foot of S. Giovanni's tower; frequent.
- Solanum nigrum* L. - T scap, Hi Others, Co
Rubble, ruins; sporadic.

Scrophulariaceae

- Verbascum sinuatum* L. - H bienn, Hi Pve, T-Eu

Clearings and ruins; sporadic.

Linaria pelisseriana (L.) Miller - T scap, Hi Ave, M-At
Among the scrub; rare.

Parentucellia viscosa (L.) Caruel - T scap, Hi Ave, T-Eu
Temporary damp meadows among the scrub; frequent.

Bellardia trixago (L.) All. - T scap, Hi Ave, T-Eu
Clearings and edges of paths; frequent.

Orobanchaceae

Orobanche minor Sm. - T par Hi, Others, SCo
Parasite on *Helichrysum italicum* subsp. *microphyllum*; common.

Orobanche sanguinea C. Presl - T par, Hi Others, M
Parasite on *Eryngium maritimum*; rare.

Plantaginaceae

Plantago coronopus L. subsp. *coronopus* - H ros, Hy, T-Eu
Meadows and paths; common.

Plantago coronopus L. subsp. *commutata* (Guss.) Pilger - T scap, Hy, M
Dry coastal subsalt meadows; frequent.

Plantago macrorhiza Poirlet - H ros, Hy, Mco
Sands of the harbour and western cliffs; frequent.

Plantago lanceolata L. - H ros, Hy, SCo
Meadows and clearings of the scrub; frequent.

Plantago lagopus L. - T scap, Hy, T
Meadows near N.ghe Baboe Cabitza; sporadic.

Plantago bellardii All. - T scap, Hy, T-Eu
Meadows and clearings of the scrub; sporadic.

Caprifoliaceae

Lonicera implexa Aiton - P lian, WL, M-Ma
Among the scrub; sporadic.

Dipsacaceae

Dipsacus ferox Loisel. - H bienn, Hi Ave, Mco
Near S. Giovanni's tower; rare.

Sixalix atropurpurea (L.) Greuter & Burdet subsp. *maritima* (L.) Greuter & Burdet - H
bienn, Hi Pve, M-Ma
Inland and coastal zones; sporadic.

Pycnocomon rutifolium (Vahl) Hoffmanns. & Link - H scap, Hi Pve, Mco
Sands of S. Giovanni di Sinis and of Murru Mannu; frequent.

Campanulaceae

Campanula erinus L. - T scap, Hi Ave, T-Eu

Dry meadows of the eastern sector; sporadic.

Compositae

Bellis annua L. - T scap, Hy, M-Ma

Meadows and temporary damp zones; common.

Bellis perennis L. - H ros, Hy, B-T

Among the scrub near the lighthouse; sporadic.

Aster squamatus (Sprengel) Hieron. - H scap, Hi Pes, Naturalized

In the damp depressions near the lighthouse; rare.

Filago vulgaris Lam. - T scap, Hi Ave, T-Eu

Meadows and dry clearings; rare.

Logfia gallica (L.) Cosson & Germ. - T scap, Hi Ave, T-Eu

Edges of the paths and of the meadows near the lighthouse; common.

Evax pygmaea (L.) Brot. - T rept, Hce, M-Ma

Meadows; common.

Evax asterisciflora (Lam.) Pers. - T rept, Hce, M

Along the path which leads to the western cliffs; rare.

Helichrysum italicum (Roth) G. Don subsp. *microphyllum* (Willd.) Nyman - Ch suffr,

WS, Mo

Coastal garigues; frequent.

Inula crithmoides L. - Ch suffr, WS, M-At

Depressions and sandy and salt soils of the coasts; frequent.

Dittrichia viscosa (L.) W. Greuter - H scap, WS, M-Ma

In the harbour and among the rubble of the lighthouse; frequent.

Dittrichia graveolens (L.) W. Greuter - T scap, Hi Aes, T-Eu

Clearings near the lighthouse; rare.

Pulicaria odora (L.) Reichenb. - H scap, Hi Pve, M

Among the scrub; common.

Pulicaria sicula (L.) Moris - T scap, Hi Ave, M

Temporary damp meadows among the scrub; sporadic.

Asteriscus spinosus (L.) Schultz Bip. - H bienn, Hi Pve, T-Eu

Near the isthmus and near S. Giovanni's tower; common.

Bubonium aquaticum (L.) Hill - T scap, Hi Ave, M-Ma

Coastal zones; sporadic.

Anthemis maritima L. - H scap, WS, Mco

Sandy zones; common. Some examples make suffruticous hemispheric, low and almost crawling pulvins.

Anthemis arvensis L. - T scap, Hi Ave, SCo

Meadows and clearings; frequent.

Anthemis secundiramea Biv. - T scap, Hce, Mco

Sands of the isthmus; frequent.

Otanthus maritimus (L.) Hoffmanns. & Link - Ch suffr, WS, M-At

Sands of the harbour and of the isthmus; frequent.

Chrysanthemum coronarium L. - T scap, Hi Ave, M-Ma

Rubble and ruins of Tharros; common.

Coleostephus myconis (L.) Reichenb. - T scap, Hi Ave, M-Ma

Meadows near the lighthouse; sporadic.

- Artemisia arborescens* L. - NP, WB, M
Abundant in the low scrub of the plateau between the lighthouse and N.ghe Baboe Cabitza.
- Senecio leucanthemifolius* Poirlet - T scap, Hce, M
Sandy and rocky coastal zones; common.
- Senecio vulgaris* L. - T scap, Hi Others, Co
Clearings and rocky meadows; sporadic.
- Calendula arvensis* L. - T scap, Hce, T-Eu
Clearings and edges of the paths; sporadic.
- Carlina corymbosa* L. - H scap, Hi Pve, Eu-M
Meadows and clearings; common.
- Carlina lanata* L. - T scap, Hi Ave, M
Under S. Giovanni's tower; rare and localized.
- Carlina racemosa* L. - T scap, Hi Aes, Mo
Among the scrub of the plateau; sporadic.
- Atractylis gummifera* L. - H ros, Hce, M
Edges of paths and slopes; sporadic.
- Carduus pycnocephalus* L. - T scap, Hi Ave, T-Eu
Among the ruins; sporadic.
- Notobasis syriaca* (L.) Cass. - T scap, Hi Ave, M-Ma
Among the *Dasyphyrum* gatherings situated between S. Giovanni's tower and the ruins of Tharros; rare.
- Galactites tomentosa* Moench - H bienn, Hi Ave, T-Eu
Dry meadows, edges of the paths; common.
- Onopordum illyricum* L. - H scap, Hi Pve, Mco
Between the ruins of Tharros and S. Giovanni's tower; frequent.
- Cynara cardunculus* L. - H scap, Hi Pve, M-Ma
Clearings near S. Giovanni's tower; rare.
- Silybum marianum* (L.) Gaertner - H bienn, Hi Ave, T-Eu
Rubble near the lighthouse; rare.
- Centaurea calcitrapa* L. - H bienn, Hce, SCo
Paths and clearings; frequent.
- Carthamus lanatus* L. - T scap, Hi Ave, T-Eu
To the east of S. Giovanni's tower; rare.
- Carduncellus caeruleus* (L.) C. Presl - H scap, Hi Pve, M-Ma
Along the path in the north-west of the lighthouse; very rare.
- Cichorium intybus* L. - H scap, Hi Pes, Co
Along the path which leads from the lighthouse to the harbour; rare.
- Tolpis barbata* (L.) Gaertner - T scap, Hi Ave, M-Ma
Paths among the scrub; rare.
- Tolpis virgata* Bertol. - H scap, Hi Pve, M
Sands localized in the north of the Tophet of Tharros; frequent.
- Hedypnois cretica* (L.) Dum.-Courset - T scap, Hce, T-Eu
Among the scrub; common.
- Urospermum dalechampii* (L.) Scop. - H scap, Hi Pve, Eu-M
Meadows and clearings near the lighthouse; rare.
- Urospermum picroides* (L.) Scop. - T scap, Hi Ave, T-Eu
Damp meadows among the scrub; rare.

- Hypochoeris achyrophorus* L. - T scap, Hi Ave, M-Ma
Among the low scrub; common.
- Leontodon tuberosus* L. - H ros, Hy, M
Among the scrub and at the edges of the paths; frequent.
- Picris echioides* L. - T scap, Hi Ave, T-Eu
Clearings and meadows near the lighthouse; rare.
- Reichardia picroides* (L.) Roth - H scap, Hi Others, M
Rocky fissures of the cliffs; common.
- Aetheorhiza bulbosa* (L.) Cass. - G bulb, Htu, M-At
Clearings among the scrub and sandy zones; common.
- Sonchus tenerrimus* L. - T scap, Hi Others, SCo
Damp meadows among the scrub of the plateau; rare.
- Sonchus oleraceus* L. - T scap, Hi Ave, SCo
Among the walls of the lighthouse; sporadic.
- Crepis vesicaria* L. subsp. *hyemalis* (Biv.) Babcock - H ros, Hi Pve, Mco
Clearings in the south of the lighthouse; rare.
- Crepis bellidifolia* Loisel. - T scap, Hce, Mco
Dry meadows and clearings of the scrub; sporadic.
- Andryala integrifolia* L. - T scap, Hi Ave, M-At
Rocky fissures and clearings of the scrub; rare.

Juncaginaceae

- Triglochin laxiflorum* Guss. - G bulb, Hbu, M-At
Damp meadows among the scrub and near the lighthouse; frequent.

Posidoniaceae

- Posidonia oceanica* (L.) Delile - I rad, Hri, M
Rather wide sea-beds on the eastern side of the cape; common.

Liliaceae

- Asphodelus microcarpus* Viv. - G rhiz, Hrg, M
Among the scrub and near Torre Vecchia; frequent.
- Ornithogalum corsicum* Jord. et Fourr. - G bulb, Hbu, Esc
Among the graves situated in the west of Torre Vecchia; very rare (Garbari 1990).
- Urginea undulata* (Desf.) Steinh. - G bulb, Hbu, Mo
Numerous gatherings but localized in the clearings of the plateau.
- Urginea fugax* (Moris) Steinh. - G bulb, Hbu, M
Clearings near the lighthouse; very rare.
- Urginea maritima* (L.) Baker - G bulb, Hbu, M-Ma
Present almost everywhere but not abundant.
- Scilla autumnalis* L. - G bulb, Hbu, Eu-M
Among the scrub; frequent.
- Muscari comosum* (L.) Miller - G bulb, Hbu, T-Eu
Clayey, sandy meadows near Torre Vecchia; very rare.
- Allium roseum* L. - G bulb, Hbu, T-Eu

Among the western scrub; sporadic. Some examples lack bulbils, while others with numerous bulbils can be attributed to var. *bulbiferum* DC.

Allium subhirsutum L. - G bulb, Hbu, M

Among the scrub; frequent.

Allium triquetrum L. - G bulb, Hbu, M-Ma

Low walls, edges of paths, hedges; frequent.

Allium ampeloprasum L. - G bulb, Hbu, T-Eu

Near the huts at S. Giovanni di Sinis; sporadic.

Allium commutatum Guss. - G bulb, Hbu, M

Coastal rocky zones; frequent.

Asparagus albus L. - Ch frut, WF, Mco

Abundant among the scrub and along the path which leads to the harbour.

Asparagus acutifolius L. - G rhiz, WS, Eu-M

Among the scrub; frequent.

Asparagus aphyllus L. - Ch frut, WS, M

Western side of the cape and among the scrub; sporadic.

Asparagus stipularis Forskål - NP, WS, M-Ma

Near the Tophet of Tharros; rare.

Ruscus aculeatus L. - G rhiz, WS, T-Eu

Among the scrub; sporadic.

Smilax aspera L. - NP, WL, T-Eu

Among the scrub; common.

Amaryllidaceae

Narcissus tazetta L. - G bulb, Hbu, M

Along the coasts among the scrub; rare. The colour of the corolla is extremely variable.

Pancratium maritimum L. - G bulb, Hbu, M-At

Sands of the isthmus and of S. Giovanni; common.

Iridaceae

Gynandris sisyrrinchium (L.) Parl. - G bulb, Hbu, M

Coastal meadows, paths, clearings of the scrub; frequent.

Romulea ligustica Parl. - G bulb, Hbu, Mco

Meadows of the plateau; common.

Romulea requienii Parl. - G bulb, Hbu, Esc

Meadows near the lighthouse; frequent.

Romulea rollii Parl. - G bulb, Hbu, M

Somewhat damp meadows among the scrub; sporadic.

Juncaceae

Juncus maritimus Lam. - G rhiz, Hri, SCo

Along the coast; rare.

Juncus acutus L. - H caesp, Hcc, SCo

In the north of the Tophet of Tharros; frequent.

- Juncus subulatus* Forskål - G rhiz, Hri, T
Damp depressions; rare.
- Juncus bufonius* L. - T caesp, Hce, Co
Damp meadows; frequent.
- Juncus hybridus* Brot. - T caesp, Hce, M-At
Sandy sometimes coastal meadows; sporadic.

Gramineae

- Festuca arundinacea* Schreber subsp. *fenas* (Lag.) Arcangeli - H caesp, Hg Pve, Eu-M
Along a path near the lighthouse; extremely rare.
- Lolium perenne* L. - H caesp, Hg Pve, SCo
Eastern sector of the cape; sporadic.
- Lolium rigidum* Gaudin - T scap, Hg Ave, T-Eu
Edges of the paths among the scrub; sporadic.
- Vulpia geniculata* (L.) Link - T caesp, Hg Ave, M-Ma
Inland meadows among the scrub; frequent.
- Vulpia fasciculata* (Forskål) Samp. - T caesp, Hg Ave, M-At
Sands of the isthmus, of S. Giovanni di Sinis and of Murru Mannu; frequent.
- Vulpia myuros* (L.) C.C. Gmelin - T caesp, Hg Ave, SCo
Dry meadows among the low scrub; frequent.
- Vulpia ciliata* Dumort - T caesp, Hg Ave, T-Eu
Among the scrub; rare.
- Desmazeria sicula* (Jacq.) Dumort. - T scap, Hg Ave, Mco
Coastal, sandy, clayey meadows; frequent.
- Desmazeria marina* (L.) Druce - T scap, Hg Ave, M-At
Meadows and rocky coastal fissures; common.
- Desmazeria rigida* (L.) Tutin - T scap, Hg Ave, T-Eu
Dry meadows, paths, clearings of the scrub; common.
- Cutandia maritima* (L.) W. Barbey - T scap, Hg Ave, M-Ma
Sands of the isthmus; frequent.
- Cutandia divaricata* (Desf.) Ascherson - T scap, Hg Ave, Mco
Sands of the isthmus and of Murru Mannu; sporadic.
- Poa annua* L. - T scap, Hg Others, Co
Inland meadows among the scrub; frequent.
- Poa infirma* Kunth - T caesp, Hg Ave, M-At (coastal)
Coastal, clayey and somewhat salty meadows; frequent.
- Poa bulbosa* L. - H caesp, Hg Pve, T-Es
Central plateau of the cape; sporadic.
- Dactylis glomerata* L. subsp. *hispanica* (Roth) Nyman - H caesp, Hg Pve, Eu-M
Coastal zones, inland meadows, scrub; common.
- Cynosurus echinatus* L. - T scap, Hg Ave, T-Eu
Meadows and clearings; common.
- Cynosurus effusus* Link - T scap, Hg Ave, T
Meadows near the harbour; sporadic.
- Briza maxima* L. - T scap, Hg Ave, O
Edges of the paths, meadows; frequent.
- Melica minuta* L. (incl. *M. arrecta* G. Kuntze) - H caesp, Hg Pve, Mco

Rocky fissures, scrub; sporadic.

Melica ciliata L. subsp. *magnolii* (Gren. & Godron) Husnot - H caesp, Hg Pve, M

Among the low scrub; frequent.

Bromus rigidus Roth - T scap, Hg Ave, T-Eu

Among the scrub of the plateau; rare.

Bromus tectorum L. - T scap, Hg Ave, O

Near the lighthouse; rare.

Bromus madritensis L. - T scap, Hg Ave, T-Eu

Meadows of the harbour; frequent.

Bromus hordeaceus L. subsp. *molliformis* (Lloyd) Maire & Weiller - T scap, Hg Ave, Eu-M

Scrub and clearings; sporadic.

Brachypodium plukenetii Beauv. - H caesp, Hg Pve, M

Among the scrub; common.

Brachypodium distachyon (L.) Beauv. - T scap, Hg Ave, T

Clearings and meadows; sporadic.

Elymus farctus (Viv.) Runemark - G rhiz, Hg Pve, M

Sands of the isthmus, of S. Giovanni di Sinis and of Murru Mannu; frequent.

Aegilops ventricosa Tausch - T scap, Hg Ave, Mco

Among the scrub; rare.

Aegilops geniculata Roth - T scap, Hg Ave, T

Meadows and clearings; sporadic.

Dasypyrum villosum (L.) P. Candargy - T scap, Hg Ave, T-Eu

Between S. Giovanni tower and the ruins of Tharros; frequent.

Hordeum murinum L. subsp. *leporinum* (Link) Arcangeli - T scap, Hg Ave, T-Eu

Meadows and edges of paths; common.

Hordeum marinum Hudson - T scap, Hg Ave, T-Eu

Coastal, somewhat salty meadows; sporadic.

Avena barbata Pott - T scap, Hg Ave, T-Eu

Meadows, edges of paths, clearings of scrub, common.

Avena sterilis L. - T scap, Hg Ave, T-Eu

Clearings of the scrub and rocky fissures; sporadic.

Gaudinia fragilis (L.) Beauv. - T scap, Hg Ave, Eu-M

Temporary damp meadows of the plateau; rare.

Lophochloa cristata (L.) Hyll. - T caesp, Hg Ave, SCo

Clearings and edges of paths; common.

Lophochloa hispida (Savi) Jonsell - T scap, Hg Ave, M

Damp and muddy meadows among the scrub; rare.

Lophochloa pubescens (Lam.) H. Scholz - T scap, Hg Ave, M

Sands of the isthmus and of Murru Mannu; common.

Lagurus ovatus L. - T scap, Hg Ave, M-At

Frequent almost everywhere.

Aira caryophyllea L. - T scap, Hg Ave, O-Pt

Meadows and clearings; frequent.

Aira cupaniana Guss. - T scap, Hg Ave, M

Meadows near Torre Vecchia; common.

Corynephorus divaricatus (Pourret) Breistr. - T scap, Hg Ave, M

Among the sands of the isthmus and at the foot of S. Giovanni's tower; frequent.

- Gastridium ventricosum* (Gouan) Schinz & Thell. - T scap, Hg Ave, T-Eu
Among the scrub and at the edges of the temporary damp meadows; sporadic.
- Polypogon maritimus* Willd. - T scap, Hg Ave, T-At
Meadows and coastal fissures; sporadic.
- Ammophila arenaria* (L.) Link subsp. *arundinacea* H. Lindb. *fil.* - G rhiz, Hg Pve, M
Sands of the isthmus and of S. Giovanni di Sinis; sporadic.
- Parapholis incurva* (L.) C.E. Hubbard - T scap, Hg Ave, T-At
Sandy coastal meadows; common.
- Hainardia cylindrica* (Willd.) W. Greuter - T scap, Hg Ave, T-Eu
Edges of the paths and trampled zones; sporadic.
- Phalaris aquatica* L. - H caesp, Hg Pve, T-Eu
Temporary damp meadows of the scrub; rare.
- Phalaris paradoxa* L. - T scap, Hg Ave, M-Ma
Edges of paths and of clearings; sporadic.
- Piptatherum miliaceum* (L.) Cosson - H caesp, Hg Pve, T
Among the scrub of the eastern side of the cape; sporadic.
- Piptatherum coerulescens* (Desf.) Beauv. - H caesp, Hg Pve, M-Ma
Among the scrub of the eastern side; very rare.
- Stipa capensis* Thunb. - T scap, Hg Ave, T
Dry and rocky meadows; sporadic.
- Phragmites australis* (Cav.) Trin. - G rhiz, Hg Pes, SCo
In a marsh at the west of the Tophet of Tharros; localized.
- Sporobolus pungens* (Schreber) Kunth - G rhiz, Hg Pes, M-Ma
Sands of the isthmus and of S. Giovanni di Sinis; frequent.
- Cynodon dactylon* (L.) Pers. - G rhiz, Hg Pes, Co
Meadows, edges of paths; common.

Palmae

- Chamaerops humilis* L. - NP, WB, Mco
Among the scrub of the plateau and along the cliffs of the western side; frequent.

Araceae

- Arum pictum* L. *fil.* - G rhiz, Htu, Emo
Among the ruins of Tharros, rubble, under *Pistacia lentiscus* bushes and near S. Giovanni's tower; common.
- Arisarum vulgare* Targ.-Tozz. - G rhiz, Htu, M-Ma
Common everywhere.

Cyperaceae

- Scirpus holoschoenus* L. - G rhiz, Hri, SCo
Little impluvium and temporary damp pools; sporadic.
- Cyperus capitatus* Vandelli - G rhiz, Hri, T-At
Sands of the isthmus; frequent.
- Schoenus nigricans* L. - H caesp, Hce, SCo
Damp meadows of the plateau; sporadic.

- Carex flacca* Schreber subsp. *serrulata* (Biv.) W. Greuter - G rhiz, Hce, T-Eu
 Dry meadows, edges of paths and slopes; frequent.
- Carex extensa* Good. - H caesp, Hce, T-Eu (coastal)
 Among the coastal scrub; sporadic.
- Carex hallerana* Asso - H caesp, Hce, O
 Dry clearings and meadows; sporadic

Orchidaceae

- Orchis coriophora* L. subsp. *fragrans* (Pollini) Sudre - G bulb, Htu, T-Eu
 Among the low scrub of the plateau; rare.
- Serapias parviflora* Parl. - G bulb, Htu, M-Ma
 Among the scrub near the lighthouse; sporadic.
- Ophrys vernixia* Brot. (= *O. speculum* Link) - G bulb, Htu, M
 Among the scrub; rare.
- Ophrys lutea* (Gouan) Cav. - G bulb, Htu, T
 Among the scrub of the plateau; rare.

Conclusions

During researches at Capo S. Marco 400 spontaneous taxa were found, belonging to 64 families and 242 genera. This is a considerable number for an area of about 1 square km, where there are archaeological ruins, settlements and some military operations. The systematic detail subdivision of the 400 entities is shown in Table 1.

Table 1. Systematic subdivision of the flora of Capo S. Marco.

	Families	Genera	Species	Subspecies	Varieties
<i>Pteridophyta</i>	2	2	2	-	-
<i>Gymnospermae</i>	2	2	2	-	-
<i>Dicotyledones</i>	48	179	275	19	1
<i>Monocotyledones</i>	11	59	90	11	-

Table 2. Number of genera, species and subspecies of the most numerous families of the flora of Capo S. Marco.

	Genera	Species	Subspecies	Total
<i>Gramineae</i>	33	50	7	57
<i>Compositae</i>	41	52	2	54
<i>Leguminosae</i>	17	41	4	45
<i>Umbelliferae</i>	11	13	3	16
<i>Caryophyllaceae</i>	9	19	1	20
<i>Liliaceae</i>	9	18	-	18

The floristic list also shows the families with the largest number of taxa (Table 2). Only a small number of endemics were found, as also observed at Capo Frasca, Capo Mannu

and Torre del Sevo. Amongst the 12 endemics six are restricted to Sardinia, four are Sardinian-Corsican and the others have a distribution which includes also the Balearic Islands, the Tuscan Archipelago and Sicily. *Limonium capitis-marci* Arrigoni & Diana, *Limonium lausianum* Pignatti and *Limonium tharrosianum* Arrigoni & Diana have their *locus classicus* at Capo S. Marco. Other species are remarkable phytogeographic significance, and are threatened with extinction by the fragility of the ecosystem where they occur: *Cynomorium coccineum* L., *Ephedra distachya* L., *Silene corsica* DC. and *Silene nummica* Valsecchi.

The analysis of the biological spectrum (Table 3), compared also with that one of other Sardinian capes, shows the high percentage of annual species, due to the remarkable annual dry period of about four months. We see a certain analogy in the response of the plants to the same environmental factors with the near Capo Mannu and Capo Frasca and, for some values, also with Capo Bellavista, situated on the same latitude in central-eastern Sardinia.

Table 3. Biological spectrum of Capo S. Marco compared with the general one of Sardinia and with other capes of the island.

	No. taxa	T%	H%	G%	Ch%	P%	I%
Capo S. Marco	400	52.6	19.1	11.5	9.1	7.5	0.2
Capo Frasca (Bocchieri & Mulas 1992)	517	51.7	18.8	13.6	4.7	7.9	3.3
Capo Bellavista (Bocchieri 1990)	318	53.8	19.5	9.4	5.9	12.3	-
Capo Teulada (Ballero & Bocchieri 1987)	466	43.5	21.6	16.9	7.3	9.4	1.3
Capo Carbonara (Camarda & Ballero 1981)	321	49.5	24.6	12.8	5.6	7.5	-
Capo S. Elia (Martinoli 1950)	547	43.0	30.0	13.0	8.0	6.0	-
Capo Caccia (Valsecchi 1966)	231	43.0	23.9	10.4	5.2	10.4	-
Capo Mannu (Bocchieri & al. 1988)	446	50.9	17.0	13.4	9.6	7.2	1.6
Sardegna (Bocchieri 1994)	2054	39.9	28.1	12.1	8.1	8.8	3.0

In order to make a better analysis of the response of the plants to the environmental factors, we have taken into consideration the different growth forms proposed by Arrigoni & Di Tommaso (1991) and quoted in Table 4. Their percentage of the flora shows the great number of herbaceous taxa (332), containing 220 species, which have an annual cycle (66.3%) and 112 (33.7%), which have a biennial or perennial cycle. Amongst the annual species, those which have a winter growth cycle are dominant and, as already reported by Arrigoni & Di Tommaso (1991), the open and low vegetative formations are the most frequent at Capo S. Marco. Also, among the herbaceous perennial grasses and scapose species, the winter species predominate over the summer species. On the whole, one can observe that the different growth forms which have been found generally reflect the biological forms reported in Table 3.

Table 4. Distribution spectrum of the growth forms in the flora of Capo S. Marco.

PT	LIGNEOUS						HERBACEOUS																		
	WA	WB	WF	WS	WL		Hi Ave	Hi Aes	Hi Pve	Hi Pes	Hi Others	Hg Ave	Hg Pve	Hg Pes	Hg Others	Hbu	Htu	Hri	Hps	Hde	Hoe	Hcr	Hy	Hrg	Others
N°	2	3	15	8	36	4	89	6	33	2	16	41	11	3	1	18	7	11	22	17	35	6	10	2	2
%	0.50	0.75	3.75	2.00	9.00	1.00	22.25	1.05	8.25	0.50	4.00	10.25	2.75	0.75	0.25	4.50	1.75	2.75	5.05	4.25	8.75	1.50	2.50	0.50	0.50

A further analysis of the flora of Capo S. Marco has been carried out applying Takhtajan's phytogeographical units (Takhtajan 1986) and, as regards the European Mediterranean area, the subdivisions proposed by Arrigoni (1983). Therefore, it has been necessary to know, for each entity, the areal of distribution which has been extrapolated using the works of Meusel & Weinert (1965), Meusel & Jager (1992), Meusel & al. (1978), Jalas & Suominen (1972-1991) and the principal floras, which report chorological data. In this way, it has been possible to attribute to each entity to its own geographical element, indispensable condition to construct the scheme of Fig. 3, which graphically shows the different geographical components of the flora of Capo S. Marco.

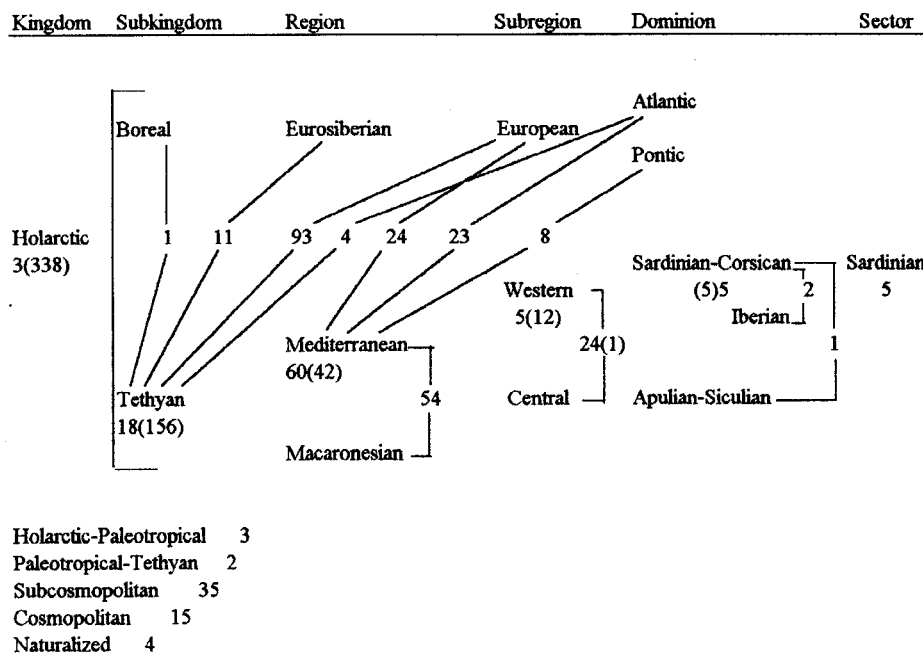


Fig. 3. Geographical components of the flora of Capo S. Marco.

This figure shows the limited presence of polycore species (cosmopolitan and subcosmopolitan) and the high percentage of typically Mediterranean species (25%) which, in addition to those connected to other regions, exceed the 60% of the whole floristic component. For the geographical position of Sardinia, the connecting species between the Tethyan subkingdom and the European region are particularly numerous.

Therefore, the scheme of Fig. 3 permits the attribution of the flora of Capo S. Marco to the Mediterranean region with a prevalence of central-western elements. One also observes that within the Tethyan subkingdom the Macaronesic region is the one which shows more phytogeographical affinity with.

As regards the floristic sector (Sardinian sector), this territory has a remarkable number of endemic species which, according to Arrigoni (1983), contribute to characterize the coastal and hilly subsector of Sardinia. Besides the endemic species with a wider

distribution area are many of the western subregion and in particular of the Sardinian-Corsican axis.

Within the area of Capo S. Marco, there are many plants which are restricted to one habitat and which could be included among the different ecological elements proposed by Arrigoni (1983) for the Sardinian flora.

The psammophilous, rupicolous and thermo xerophilous elements of the scrubs and coastal garigues characterize the vegetation of Capo S. Marco and represent about 50% of the flora.

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