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Contribution to the vascular flora of the archaeological park of Selinunte and Cave of Cusa (South-Western Sicily, Italy): preliminary results*

Abstract

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This study aims to present a complete inventory of the vascular flora of the Archaeological Park of Selinunte. A total of 443 specific and infraspecific taxa are here reported. *Fabaceae* was the most collected family with 47 species. *Asteraceae* and *Poaceae* were the next largest families with 45 and 35 species, respectively. *Euphorbia* was the largest genus, represented by 9 species. The analysis of the biological spectrum of the vascular flora indicate the predominance of therophytes (42%) and hemicryptophytes (22%) while, from a chorological point of view, most of the species show a Mediterranean distribution. The presence of *Cynara cardunculus* subsp. *zingaroensis* (taxon endemic to W-Sicily) is reported for the first time for the investigated area.

Key words: archaeological areas, vascular flora, endemics, alien species, Sicily, Italy.

Introduction

Archaeological sites in the Mediterranean Basin are often of great artistic and historical value and play an important role in the tourist industry (Celesti-Grapow & Blasi 2004).

Among these, the Archaeological Park of Selinunte and Cave of Cusa (Trapani Province) is, certainly, one of the largest and most extraordinary archaeological sites in the Western Mediterranean.

This contribution is limited only to the part of the park around the ancient city of Selinunte. This area and its temples represented the western part of the Greek advance in Sicily. It was founded in 651-650 B.C. and built with calcarenites extracted from the quarries of the near locality Cusa, in Campobello di Mazzara territory (Trapani Province) (Brai & al. 2004).

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The toponym “Selinunte” probably, is due to savage parsley, ‘selinon’ in ancient Greek, which in turn refers to *Apium* spp. growing wild in such moist habitats (Guarino & Pasta 2017) and was also present on the local coins (Fabbrocino & al. 2001).

The Archaeological Park, with almost 270 hectares of extension, houses also elements of flora and vegetation of great natural value.

The site is also characterized by the presence of wide sandy dunes included in “The Natural Reserve Foce of Belice and Dune Limitrofe” and in the SIC (Sites of Community Interest) ITA010011 named “Dunal system of Capo Granitola, Porto Palo and Foce of Belice”.

Nevertheless, very poor are studies carried out on the flora and vegetation on this area (Frei 1937; Brullo & al. 1974; Speranza & al. 1993; Troia & Spallino 2009).

Furthermore, in the past, plant cover and Mediterranean maquis of the Selinunte archaeological site have been attentioned by various landscape ecologists, mainly with regard to its restoration (Raimondo & al. 1991; Raimondo & al. 2018), however at today, a floristic inventory of the whole area is still missing.

In 2018, the project “Census of the vascular plants of the Archaeological Park of Selinunte and Cave of Cusa” started, with the aim of improving the botanical knowledge of this area and to produce a complete check-list of this flora.

The studied area

The Archaeological area of Selinunte is located on the southwest coast of Sicily in the central part of the coastline, between Capo Granitola and Capo San Marco (south-western Sicily).

It is stretched over three hills that from east to west are: Marinella or Eastern Hill, Manuzza and Gaggera Hills (Piro & Vesinon 1995), and it is part of a territory that is represented by Modione basin and partially by the Belice basin (Fig. 1). The area is characterized by clay or clayey-marl with sand breakthroughs covered by calcarenites (Liguori & Porcaro 2010) it falls in the floristic subunit “2.3.1 Southern and Western coast” (Domina & al. 2018a). Phytogeographically, the site falls in the Drepano-Panormitano district. (Brullo & al. 1995).

According to Bazan & al. (2015), the bioclimate of the area can be defined lower thermomediterranean and lower dry, with annual average temperature around 18 °C and upper dry ombrotpe (average annual rainfall of 500 mm) (La Rosa & al. 2012).

Material and Methods

Inventory of the flora was carried in the year 2018, from February to August, several samplings were performed in order to cover the whole area investigated.

Herbarium specimens have been collected and stored in the Herbarium Mediterraneum Panormitanum (PAL-Gr), acronym according to Thiers (2018).

For the taxa identification, we mainly referred mainly to the Italian floras (Fiori 1923-29; Pignatti 1982) and systematic revisions and monographs (Delforge 2005; Giardina & al. 2007; Venturella & al. 2007; Domina & al. 2011).

In the floristic list, the systematic order and taxonomic circumscription of the families



Fig. 1. Study area: the Archaeological Park of Selinunte (Sicily, Italy).

follow Bartolucci & al. (2018) and Galasso & al. (2018). Taxa are ordered alphabetically within each family. Life forms and chorological types of natural and alien taxa are according respectively to Raimondo & al. (2010) and Raimondo & al. (2005), while cultivated plant follow Bazan & al. (2005).

Results and Discussion

A total of 443 specific and infraspecific taxa currently occur on the Archaeological Park of Selinunte, belonging to 302 genera and 85 families. *Fabaceae* was the largest family with 47 species. *Asteraceae* and *Poaceae* were the next largest families with 45 and 35 species. *Euphorbia* was the largest genus, represented by 9 species.

The life form spectrum (Fig. 2A) shows a dominance of Therophytes (42%), followed by Hemicryptophytes (22%), Phanerophytes (15%) and Geophytes (11%). From a chorological viewpoint, most species show a Mediterranean distribution (Stenomedit. and Eurimedit.) (Fig. 2B).

Italian endemics are seven (Raimondo & al. 2010; Bartolucci & al. 2018) which amounted to 2% of the taxa observed. In particular, only two taxa are endemic to Sicily:

- *Cynara cardunculus* subsp. *zingaroensis* (Raimondo & Domina) Raimondo & Domina (Fig. 3A), is endemic to W-Sicily (Raimondo & al. 2004). The population founded in the Eastern Hill has never been reported at today and therefore it is the first record for this area.

- *Limonium selinuntinum* Brullo (Fig. 3B), is a narrow endemic that occur only on the sea cliffs in in the Archaeological Park of Selinunte. (Brullo 1980). At today, the total pop-

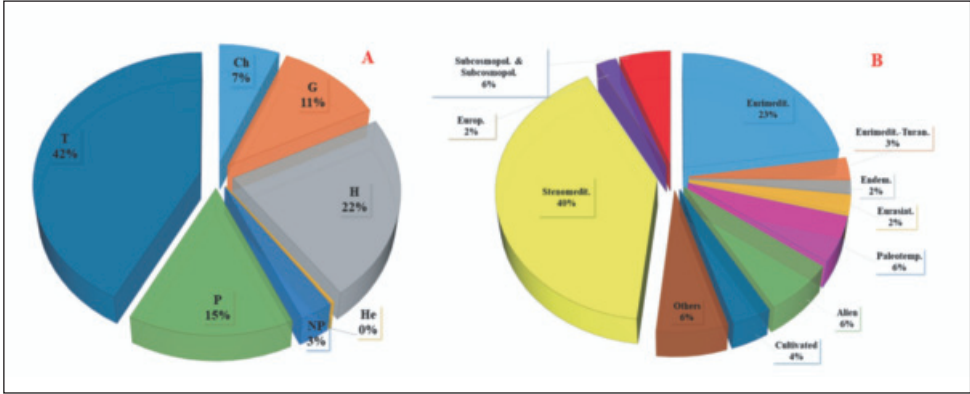


Fig. 2. A) Biological spectrum of the vascular flora of Archaeological Park of Selinunte. Ch - chamaephytes; G - geophytes; H - hemicryptophytes; He - helophytes; NP - nanophanerophytes; P - phanerophytes; T - therophytes; and B) The Chorological spectrum.

ulation is estimated to be fewer than 200 individuals. Its range is seriously threatened due to strong anthropogenic pressure present in the investigated area.

Antirrhinum siculum Mill. shows wide Italian distribution, three taxa are endemic to Southern Italy (*Euphorbia ceratocarpa* Ten; *Gypsophila arrostii* Guss. subsp. *arrostii*; *Retama raetam* (Forssk.) Webb & Berthel. subsp. *gussonei* (Webb) Greuter), and *Seseli tortuosum* subsp. *maritimum* (Guss.) C.Brullo, Brullo, Giusso & Sciandr. is endemic to Southern Italy and Sardinia.

Others taxa with particular phytogeographical interest are: *Ajuga iva* subsp. *pseudoiva* (DC.) Briq., *Crucianella marittima* L. *Echium sabulicola* Pomel subsp. *sabulicola*, *Launaea fragilis* (Asso) Pau, *Lomelosia rutifolia* (Vahl) Avino & P. Caputo, and *Pancreatium maritimum* L.

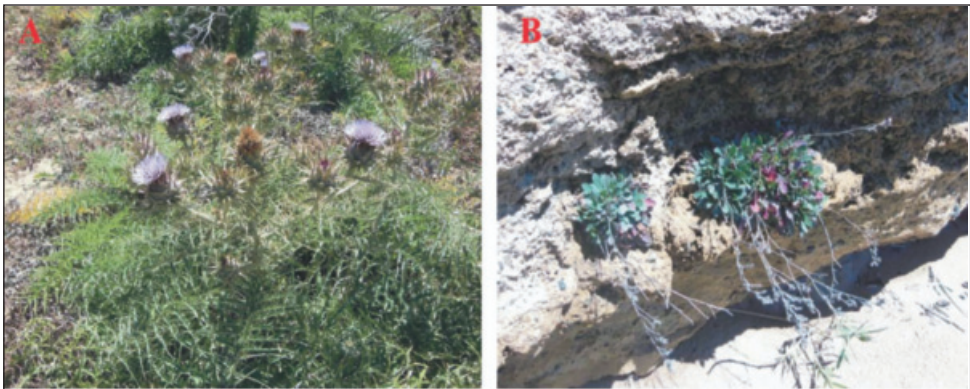


Fig. 3. A) *C. cardunculus* L. subsp. *zingaroensis* (Raimondo & Domina) Raimondo & Domina; B) *L. selinuntinum* Brullo.



Fig. 4. Some alien taxa in the Archaeological Park of Selinunte: A) *Ailanthus altissima*; B) *Agave americana* subsp. *americana*; C) *Carpobrotus edulis*.

Our results confirm that this area is among the richest in biodiversity of the southern coast of Sicily as reported in Domina & al. (2018b). The present contribution has also highlighted the presence of the high number of alien species (29 taxa), mostly naturalized and sometimes more or less invasive (Fig. 4) such as: *Ailanthus altissima* (Mill.) Swingle, *Carpobrotus edulis* (L.) N. E. Br., *Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*, *Phoenix canariensis* H. Wildpret. and *Vachellia karroo* (Hayne) Banfi & Galasso. Other alien species (13 taxa) are cultivated in the Archaeological Park for ornamental purposes.

Moreover, on the basis of our observations in the field the exclusion of *Scrophularia frutescens* L., is confirmed. In the past, its presence in the dune system was reported by Brullo & al. (1974) and misidentified with *S. canina* L.

At the end, due to its specific climatological position and habitat diversity, we can expect that the investigated area hosts more species than currently recorded.

Floristic list

PTERIDOPHYTA

EQUISETACEAE

Equisetum ramosissimum Desf. – G rhiz – Circumbor.

Equisetum telmateia Ehrh. – G rhiz – Circumbor.

SELAGINELLACEAE

Selaginella denticulata (L.) Spring – Ch rept – Stenomedit.

GYMNOSPERMAE

ARAUCARIACEAE

Araucaria heterophylla (Salisb.) Franco – P scap – Australia – Cultivated as ornamental.

CUPRESSACEAE

Cupressus sempervirens L. – P scap – Eurimedit. Orient.

PINACEAE

Pinus halepensis Mill. subsp. *halepensis* – P scap – Stenomedit.

Pinus pinea L. – P scap – Eurimedit. – Naturalized alien.

ACANTHACEAE

Acanthus mollis L. – H scap – Stenomedit.

AIZOACEAE

Carpobrotus edulis (L.) N.E.Br. – Ch suffr – South Africa – Naturalized alien.

AMARANTHACEAE

Amaranthus albus L. – T scap – America – Naturalized alien.

Amaranthus deflexus L. – T scap – S-Amer. – Naturalized alien.

Amaranthus hybridus subsp. *cruentus* (L.) Thell – T scap – America Trop. e Subtrop. – Naturalized alien

ANACARDIACEAE

Pistacia lentiscus L. – P caesp – Stenomedit.

Pistacia terebinthus L. subsp. *terebinthus* – P caesp – Eurimedit. – Cultivated as ornamental.

Rhus coriaria L. – P caesp – S-Stenomedit.

Schinus molle L. – P scap – America – Cultivated as ornamental. *Schinus terebinthifolia* Raddi – P scap – S-Amer. – Cultivated as ornamental.

APIACEAE

Crithmum maritimum L. – Ch suffr – Eurimedit.

Daucus aureus Desf. – T scap – S-Stenomedit.

Daucus carota L. subsp. *carota* – H bienn – Paleotemp.

Daucus pumilus (L.) Hoffmanns. & Link – T scap – Stenomedit.

Echinophora spinosa L. – H scap – Eurimedit.

Eryngium maritimum L. – G rhiz – Stenomedit.

Eryngium triquetrum Vahl – H scap – SW-Stenomedit.

Ferula communis L. – H scap – S-Eurimedit.

Foeniculum vulgare Mill. subsp. *vulgare* – H scap – S-Eurimedit.

Helosciadium nodiflorum (L.) W.D.J.Koch subsp. *nodiflorum* – H scap – Eurimedit.

Kundmannia sicula L. – H scap – Stenomedit.

Magydaris pastinacea (Lam.) Paol. – H scap – W-Stenomedit.

Oenanthe pimpinelloides L. – H scap – Eurimedit.-Subatl.

Opopanax chironium (L.) W.D.J.Koch – H scap – Stenomedit.

Seseli tortuosum L. subsp. *maritimum* (Guss.) C.Brullo, Brullo, Giusso & Sciandr. – H bienn – Endem. *Smyrniolus olusatrum* L. – H bienn – Eurimedit.-Subatl.

Thapsia garganica L. – H scap – S-Stenomedit.

Tordylium apulum L. – T scap – Stenomedit.

APOCYNACEAE

Nerium oleander L. subsp. *oleander* – P caesp – S-Stenomedit.

Vinca major L. subsp. *major* – Ch rept – Eurimedit.

ARALIACEAE

Hedera helix L. – P lian – Eurimedit.

ASTERACEAE

Achillea maritima (L.) Ehrend. & Y.P.Guo subsp. *maritima* – Ch suffr – Stenomedit.-Atl.

Achillea integrifolia L. – T scap – W-Eurimedit.

- Anthemis arvensis* L. subsp. *arvensis* – T scap – Stenomedit.
Artemisia arborescens L. – NP – S-Stenomedit.
Bellis annua L. – T scap – Stenomedit.
Bellis sylvestris Cyr. – H ros – Stenomedit.
Calendula arvensis (Vaill.) L. – T scap – SW-Stenomedit.
Carduus pycnocephalus L. subsp. *pycnocephalus* – H bienn – Eurimedit.-Turan.
Centaurea aspera L. subsp. *aspera* – H scap – Stenomedit.
Centaurea napifolia L. – T scap – SW-Stenomedit.
Centaurea sphaerocephala L. subsp. *sphaerocephala* – H scap – W-Stenomedit.
Chamaemelum fuscatum (Brot.) Vasc. – T scap – W Medit.-Mont.
Cichorium intybus L. – H scap – Paleotemp.
Crepis vesicaria L. subsp. *vesicaria* – T scap – Eurimedit.-Subatl.
Cynara cardunculus subsp. *zingaroensis* (Raimondo & Domina) Raimondo & Domina – H scap – Endem.
Dittrichia viscosa (L.) Greuter subsp. *viscosa* – H scap – Eurimedit.
Eclipta prostrata (L.) L. – T scap – Neotropic. – Naturalized alien.
Erigeron bonariensis L. – T scap – America Trop. – Naturalized alien.
Filago germanica (L.) Huds. – T scap – Paleotemp.
Filago pygmaea L. – T rept – Stenomedit. *Filago pyramidata* L. – T scap – Stenomedit.
Galactites tomentosus Moench – H bienn – Stenomedit.
Glebionis coronaria (L.) Spach – T scap – Stenomedit.
Hedypnois rhagadioloides (L.) F.W.Schmidt – T scap – Stenomedit.
Helminthotheca aculeata (Vahl) Lack subsp. *aculeata* – H scap – SW-Stenomedit.
Hyoseris radiata L. – H ros – Stenomedit.
Hypochaeris achyrophorus L. – T scap – Stenomedit.
Xanthium italicum Moretti – T scap – Eurimedit.
Lactuca sativa subsp. *serriola* (L.) Galasso, Banfi, Bartolucci & Ardenghi – H bienn – S-Europ.-Sudsib.
Launaea fragilis (Asso) Pau – Ch frut – SaharoSind.
Logfia gallica (L.) Cosson & Germ. – T scap – Eurimedit.
Pallenis spinosa (L.) Cass. subsp. *spinosa* – T scap – Eurimedit.
Phagnalon rupestre subsp. *illyricum* (H.Lindb.) Ginzb. – Ch suffr – W-Stenomedit.
Pulicaria dysenterica (L.) Bernh. – H scap – Eurimedit.
Reichardia picroides (L.) Roth – H scap – Stenomedit.
Scolymus grandiflorus Desf. – H scap – SW-Stenomedit.
Scolymus hispanicus L. subsp. *hispanicus* – H bienn – Eurimedit.
Senecio leucanthemifolius Poir. subsp. *leucanthemifolius* H scap – Stenomedit.
Senecio vulgaris L. subsp. *vulgaris* – T scap – Eurimedit.
Sonchus bulbosus (L.) N.Kilian & Greuter subsp. *bulbosus* – H ros – Stenomedit.
Sonchus oleraceus L. – T scap – Eurasiat.
Sonchus tenerrimus L. – T scap – Stenomedit.
Silybum marianum (L.) Gaertn. – H bienn – Eurimedit.-Turan.
Symphyotrichum squamatum (Spreng.) G.L.Nesom – T scap – S-Amer. – Naturalized alien.
Tragopogon porrifolius L. – H bienn – Eurimedit.
Tolpis virgata (Desf.) Bertol. subsp. *virgata* – T scap – Stenomedit.
Urospermum dalechampii (L.) F.W.Schmidt – H scap – Eurimedit.

BORAGINACEAE

- Alkanna tinctoria* Tausch subsp. *tinctoria* – H scap – Stenomedit.

Borago officinalis L. – T scap – Eurimedit.
Cerintho major L. subsp. *major* – T scap – Stenomedit.
Cynoglossum cheirifolium L. – H bienn – Stenomedit.
Cynoglossum creticum Mill. – H bienn – Eurimedit.
Echium italicum subsp. *siculum* (Lacaita) Greuter & Burdet – H bienn – Eurimedit.
Echium plantagineum L. – T scap – Eurimedit.
Echium sabulicola Pomel subsp. *sabulicola* – H scap – W-Stenomedit.
Heliotropium europaeum L. – T scap – Eurimedit.

BRASSICACEAE

Brassica tournefortii Gouan – T scap – SaharoSind.
Biscutella maritima Ten. – T scap – SW-Medit.
Capsella bursa-pastoris (L.) Medik. subsp. *bursa-pastoris* – H bienn – Eurimedit.
Cakile maritima Scop. subsp. *maritima* – T scap – Eurosib.
Cardamine graeca L. – T scap – Cosmopol.
Diplotaxis erucooides (L.) DC. subsp. *erucooides* – T scap – W-Stenomedit.
Hirschfeldia incana (L.) Lagr.-Foss. subsp. *incana* – H scap – Eurimedit.
Lobularia maritima (L.) Desv. – H scap – Stenomedit.
Matthiola tricuspidata (L.) R.Br. – T scap – Stenomedit.
Nasturtium officinale R.Br. – H scap – Cosmopol.
Raphanus raphanistrum subsp. *landra* (DC.) Bonnier & Layens – T scap – Eurimedit.
Sinapis alba subsp. *dissecta* (Lag.) Bonnier – T scap – E-Medit.-Mont.
Sinapis arvensis L. subsp. *arvensis* – T scap – Stenomedit.
Sisymbrium irio L. – T scap – Paleotemp.

CACTACEAE

Opuntia ficus-indica (L.) Mill. – P succ – America Trop. – Naturalized alien.

CAMPANULACEAE

Campanula dichotoma L. – T scap – Stenomedit.
Campanula erinus L. – T scap – Stenomedit.

CAPPARACEAE

Capparis spinosa L. – NP – Medit.-Turan.

CAPRIFOLIACEAE

Lonicera etrusca Santi – P lian – Eurimedit.
Lonicera implexa Aiton subsp. *implexa* – P lian – Stenomedit.

CARYOPHYLLACEAE

Arenaria leptoclados (Rchb.) Guss. subsp. *leptoclados* – T scap – Paleotemp.
Arenaria serpyllifolia L. subsp. *serpyllifolia* – T scap – Subcosmop.
Cerastium glomeratum Thuill. – T scap – Eurimedit.
Gypsophila arrostii Guss. subsp. *arrostii* – Ch suffr – Endem.
Paronychia argentea Lam. – H caesp – Stenomedit.
Polycarpon tetraphyllum (L.) L. subsp. *tetraphyllum* – T scap – Eurimedit.
Rhodalsine geniculata (Poir.) F.N.Williams – Ch suffr – Stenomedit.
Sagina apetala Ard. subsp. *apetala* – T scap – Eurimedit.
Sagina procumbens L. – H caesp – Subcosmop.

- Silene colorata* Poir. – T scap – Stenomedit.
Silene gallica L. – T scap – Eurimedit.
Silene latifolia Poir. – H bienn – Stenomedit.
Silene niceensis All. – T scap – Stenomedit.
Spergularia rubra (L.) J.Presl & C.Presl – Ch suffr – Subcosmop.
Stellaria media (L.) Vill. subsp. *media* – T rept – Cosmopol.

CHENOPODIACEAE

- Beta vulgaris* subsp. *maritima* (L.) Arcang. – H scap – Eurimedit.
Atriplex halimus L. – P caesp – Stenomedit.-Atl.
Chenopodium murale (L.) S.Fuentes, Uotila & Borsch – T scap – Subcosmop.
Chenopodium album L. subsp. *album* – T scap E Europ-Asia.
Salsola kali L. – T scap – Paleotemp.

CISTACEAE

- Tuberaria guttata* (L.) Fourr. – T scap – Eurimedit.
Fumana laevis (Cav.) Pau – Ch suffr – Stenomedit.

CONVOLVULACEAE

- Cressa cretica* L. – Ch suffr – Cosmopol.
Convolvulus althaeoides L. – H scap – Stenomedit.
Convolvulus arvensis L. – G rhiz – Paleotemp.
Convolvulus cantabrica L. – H scand – Eurimedit.
Convolvulus lineatus L. - Ch suffr – Stenomedit.
Convolvulus silvaticus Kit. – H scand – Eurimedit.–Turan.
Convolvulus soldanella L. – G rhiz – SE-Europ.
Convolvulus tricolor subsp. *cupanianus* (Tod.) Cavara & Grande – T scap – Stenomedit.
Cuscuta epithimum (L.) L. subsp. *epithimum* – T par – Eurasiat.
Ipomoea purpurea (L.) Roth – G rhiz – America Trop. – Naturalized alien.

CRASSULACEAE

- Crassula tillaea* Lest.–Garl. – T scap – Subatlant.
Phedimus stellatus (L.) Raf. – T scap – Stenomedit.
Petrosedum sediforme (Jacq.) Grulich – Ch succ – Stenomedit.
Sedum album L. subsp. *album* – Ch succ – Eurimedit.
Sedum caeruleum L. – T scap – SW-Medit.
Sedum dasyphyllum L. subsp. *dasyphyllum* – Ch succ – Eurimedit.
Sedum rubens L. – T scap – Eurimedit.-Subatl.
Umbilicus horizontalis (Guss.) DC. – G bulb – Stenomedit.

CUCURBITACEAE

- Ecballium elaterium* (L.) A.Rich. – G bulb – Eurimedit.

DIPSACACEAE

- Dipsacus fullonum* L. subsp. *fullonum* – H bienn – Eurimedit.
Lomelosia rutifolia (Vahl) Avino & P.Caputo – T scap – Stenomedit.
Sixalix atropurpurea (L.) Greuter & Burdet – H bienn – Stenomedit.

EUPHORBIACEAE

- Chrozophora tinctoria* (L.) A.Juss. – T scap – Eurimedit.-Turan.

- Euphorbia ceratocarpa* Ten. – Ch suffr – Endem.
Euphorbia exigua L. subsp. *exigua* – T scap – Eurimedit.
Euphorbia helioscopia L. subsp. *helioscopia* – T scap – Cosmopol.
Euphorbia maculata L. – T scap – N-America – Naturalized alien.
Euphorbia paralias L. – Ch frut – Eurimedit.
Euphorbia peplis L. – T rept – Eurimedit.
Euphorbia peplus L. – T scap – Eurosib.
Euphorbia prostrata Aiton – T rept – N-America – Naturalized alien.
Euphorbia terracina L. – T scap – Stenomedit.
Mercurialis annua L. – T scap – Paleotemp.
Ricinus communis L. – P scap – Paleotrop. – Naturalized alien.

FABACEAE

- Acacia saligna* (Labill.) H.L.Wendl. – P scap – Australia – Naturalized alien.
Anagyris foetida L. – P caesp – S-Stenomedit.
Astragalus boeticus L. – T scap – S-Stenomedit.
Bituminaria bituminosa (L.) Stirton – H scap – Eurimedit.
Ceratonia siliqua L. – P caesp – S-Stenomedit.
Cercis siliquastrum L. subsp. *siliquastrum* – P scap – S-Europe.
Cytisus villosus Pourr – P caesp – W-Stenomedit.
Erythrina humeana Spreng. – P scap – South Africa – Cultivated as ornamental.
Ervum pubescens DC. – T scap – Eurimedit.
Hippocrepis multisiliquosa L. – T scap – Stenomedit.
Lathyrus clymenum L. – T scap – Stenomedit.
Lathyrus grandiflorus Sm. – G rhiz – NE-Stenomedit.
Lotus creticus L. – H scap – Stenomedit.
Lotus biflorus Desr. – T scap – SW-Stenomedit.
Lotus cytisoides L. – Ch suffr – Stenomedit.
Lotus parviflorus Desf. – T scap – Stenomedit.
Lotus tetragonolobus L. – T scap – Stenomedit.
Lupinus angustifolius L. – T scap – Stenomedit.
Medicago littoralis Loisel. – T scap – Eurimedit.
Medicago lupulina L. – T scap – Stenomedit.
Medicago marina L. – Ch rept – Eurimedit.
Medicago minima (L.) L. – T scap – Eurimedit.
Medicago monspeliaca (L.) Trautv. – T scap – Eurimedit.
Medicago polymorpha L. – T scap – Eurimedit.
Medicago rigidula (L.) All. – T scap – Eurimedit.
Medicago truncatula Gaertner – T scap – Eurimedit.
Ononis natrix subsp. *ramosissima* (Desf.) Batt. – T scap – S-Stenomedit.
Ononis variegata L. – T scap – Stenomedit.
Parkinsonia aculeata L. – P scap – America Trop. – Invasive alien.
Retama raetam subsp. *gussonei* (Webb) Greuter – P caesp – Endem.
Scorpiurus muricatus L. – T scap – Eurimedit.
Sulla coronaria (L.) Medik. – T scap – Stenomedit.
Trifolium bocconeii Savi – T scap – Stenomedit.
Trifolium campestre Schreber – T scap – Paleotemp.
Trifolium cherleri L. – T scap – Eurimedit.
Trifolium nigrescens Viv. subsp. *nigrescens* – T scap – Eurimedit.

- Trifolium resupinatum* L. – T rept – Paleotemp.
Trifolium scabrum L. – T rept – Eurimedit.
Trifolium stellatum L. – T scap – Eurimedit.
Trigonella sulcata (Desf.) Coulot & Rabaute – T scap – S-Stenomedit.
Tripodion tetraphyllum (L.) Fourr. – T scap – Stenomedit.
Vachellia karroo (Hayne) Banfi & Galasso – P scap – Australia – Naturalized alien.
Vicia ervoides (Brign.) Hampe – T scap – Stenomedit.
Vicia hybrida L. – T scap – Eurimedit.
Vicia leucantha Biv. – T scap – SW-Stenomedit.
Vicia sativa L. subsp. *sativa* – T scap – Eurimedit.-Turan.
Vicia villosa subsp. *varia* (Host) Corb. – T scap – Eurimedit.-Turan.

FAGACEAE

- Quercus ilex* L. – P scap – Stenomedit.
Quercus suber L. – P scap – W-Stenomedit.

FRANKENIACEAE

- Frankenia hirsuta* L. – Ch suffr – Stenomedit.

GENTIANACEAE

- Blackstonia perfoliata* (L.) Huds. subsp. *perfoliata* – T scap – Eurimedit.
Centaurium erythraea Rafn subsp. *erythraea* – H bienn – Paleotemp.

GERANIACEAE

- Erodium acaule* (L.) Bech. & Thell. – H ros – Medit.-Mont.
Erodium cicutarium (L.) L'Hér. – T scap – Subcosmop.
Erodium malacoides (L.) L'Hér. subsp. *malacoides* – T scap – Stenomedit.
Geranium dissectum L. – T scap – Eurasiat.
Geranium robertianum L. – T scap – Subcosmop.
Geranium rotundifolium L. – T scap – Paleotemp.
Geranium sanguineum L. – H scap – Europ.-Caucas
Pelargonium zonale (L.) Aiton. – Ch suffr – Africa – Cultivated as ornamental.

HYPERICACEAE

- Hypericum perfoliatum* L. – H scap – Stenomedit.

LAMIACEAE

- Ajuga iva* subsp. *pseudoiva* (DC.) Briq. – Ch suffr – Stenomedit.
Ballota nigra subsp. *uncinata* (Fiori & Bég.) Patzak – H scap – Eurimedit.
Clinopodium nepeta (L.) Kuntze subsp. *nepeta* – H scap – Orof. S-Europ.
Lamium amplexicaule L. – T scap – Paleotemp.
Micromeria graeca (L.) Rchb. subsp. *graeca* – Ch suffr – Stenomedit.
Micromeria nervosa (Desf.) Benth. – Ch suffr – Stenomedit.
Mentha pulegium L. subsp. *pulegium* – H scap – Eurimedit.
Salvia clandestina L. – H scap – SE-Europ.
Salvia rosmarinus Schleid. – NP – Europ.
Salvia verbenaca L. – H scap – Stenomedit.-Atl.
Stachys major (L.) Bartolucci & Peruzzi – Ch suffr – Stenomedit.
Stachys ocymastrum (L.) Briq. – T scap – W-Stenomedit.

Stachys romana (L.) E.H.L.Krause – T scap – Stenomedit.
Teucrium capitatum L. subsp. *capitatum* – Ch suffr – Stenomedit.
Teucrium flavum L. subsp. *flavum* – Ch suffr – Stenomedit.
Teucrium fruticans L. subsp. *fruticans* – NP – W-Stenomedit.
Thymbra capitata (L.) Cav. – Ch suffr – Stenomedit.
Vitex agnus-castus L. – P caesp – Eurimedit.-Turan.

LAURACEAE

Laurus nobilis L. – P caesp – Stenomedit.

LINACEAE

Linum bienne Mill. – H bienn – Eurimedit.
Linum decumbens Desf. – T scap – W-Stenomedit.

LYTHRACEAE

Lythrum hyssopifolia L. – T scap – Subcosmop.
Lythrum junceum Banks & Sol – H scap – Stenomedit.
Punica granatum L. – P scap – Asia – Cultivated as ornamental.

MALVACEAE

Hibiscus rosa-sinensis L. – T scap – China – Cultivated as ornamental.
Malva arborea (L.) Webb & Berthel. – H bienn – Stenomedit.
Malva cretica Cav. subsp. *cretica* – T scap – Stenomedit.
Malva nicaeensis All. – T scap – Stenomedit.
Malva olbia (L.) Alef. – P caesp – Stenomedit.
Malva parviflora L. – T scap – Stenomedit.
Malva trimestris (L.) Salisb. – T scap – Stenomedit.

MELIACEAE

Melia azedarach L. – P scap – Asia – Cultivated as ornamental.

MYRTACEAE

Eucalyptus camaldulensis Dehnh. subsp. *camaldulensis* – P scap – Australia – Naturalized alien
Myrtus communis L. – P caesp – Stenomedit.

MORACEAE

Broussonetia papyrifera (L.) Vent. – P caesp – Asia – Naturalized alien.
Ficus carica L. – P scap – Eurimedit.-Turan.
Ficus microcarpa L.f. – P scap – Australia – Cultivated as ornamental.

NYCTAGINACEAE

Bougainvillea spectabilis Willd. – P lian – S-Amer. – Cultivated as ornamental.
Mirabilis jalapa L. – G bulb – America Trop. – Naturalized alien.

OLEACEAE

Olea europaea L. – P caesp – Stenomedit.
Phillyrea latifolia L. – P caesp – Stenomedit.

ONAGRACEAE

Epilobium hirsutum L. – H scap – Paleotemp.

OROBANCHACEAE

- Bellardia trixago* (L.) All. – T scap – Eurimedit.
Orobanche crenata Forssk. – T par – Eurimedit.-Turan.
Orobanche hederæ Duby – T par – Eurimedit.
Orobanche minor Sm. – T par – Paleotemp.
Orobanche sanguinea C.Presl – T par – Stenomedit.
Parentucellia latifolia (L.) Caruel – T scap – Eurimedit.
Phelipanche lavandulacea (Rchb.) Pomel subsp. *lavandulacea* – T par – W-Stenomedit.
Phelipanche nana (Reut.) Soják – T par – Paleotemp.
Phelipanche ramosa (L.) Pomel – T par – Paleotemp.
Phelipanche schultzei (Mutel) Pomel – T par – Paleotemp.

OXALIDACEAE

- Oxalis corniculata* L. – H rept – Eurimedit.
Oxalis pes-caprae L. – G bulb – S-Africa – Invasive alien

PAPAVERACEAE

- Fumaria capreolata* L. subsp. *capreolata* – T scap – Eurimedit.
Glaucium flavum Crantz – H scap – Eurimedit.
Papaver rhoeas L. subsp. *rhoeas* – T scap – E-Medit.-Mont.

PHYTOLACCACEAE

- Phytolacca americana* L. – P scap – N-Americ. – Naturalized alien

PITTOSPORACEAE

- Pittosporum tobira* (Thunb.) W.T.Aiton – P caesp – China – Cultivated as ornamental.

PLANTAGINACEAE

- Kickxia spuria* (L.) Dumort. subsp. *spuria* – T scap – Eurasiat.
Plantago afra L. subsp. *afra* – T scap – Stenomedit.
Plantago bellardii All. subsp. *bellardii* – T scap – S-Stenomedit.
Plantago coronopus L. – T scap – Eurimedit.
Plantago lagopus L. – T scap – Stenomedit.
Plantago lanceolata L. – H ros – Eurasiat.
Plantago serraria L. – H ros – Stenomedit.
Veronica arvensis L. – T scap – Paleotemp.
Veronica cymbalaria Bodard subsp. *cymbalaria* – T scap – Eurimedit.
Veronica polita Fr. – T scap – Paleotemp.

PLUMBAGINACEAE

- Limonium selinuntinum* Brullo – H ros – Endem.
Limonium narbonense Mill. – H ros – Eurimedit.

POLYGONACEAE

- Polygonum aviculare* L. subsp. *aviculare* – T rept – Cosmopol.
Polygonum maritimum L. – H rept – Subcosmop.
Rumex bucephalophorus L. subsp. *bucephalophorus* – T scap – Eurimedit.-Macaron.
Rumex crispus L. – H scap – Subcosmop.
Rumex thyrsoides Desf. – H scap – W-Stenomedit.

PORTULACACEAE

Portulaca oleracea L.aggr. – T scap – Subcosmop.

PRIMULACEAE

Lysimachia arvensis (L.) U.Manns & Anderb. subsp. *arvensis* – T rept – Eurimedit.

Lysimachia foemina (Mill.) U.Manns & Anderb. – T rept – Subcosmop.

Samolus valerandi L. – H caesp – Cosmopol.

RANUNCULACEAE

Adonis annua L. – T scap – Eurimedit.-Subatl.

Anemone hortensis L. subsp. *hortensis* – G bulb – N-Eurimedit.

Clematis cirrhosa L. – P lian – Stenomedit.

Clematis vitalba L. – P lian – Europ.-Caucas.

Nigella damascena L. – T scap – Eurimedit.

Ranunculus bulbosus L. – H scap – Eurasiat.

Ranunculus bullatus L. – H ros – Stenomedit.

Ranunculus lanuginosus L. – H scap – Europ.

Ranunculus millefoliatus Vahl – H scap – Medit.-Mont.

Ranunculus muricatus L. – T scap – Eurimedit.

RESEDACEAE

Reseda alba L. – T scap – Stenomedit.

RHAMNACEAE

Rhamnus alaternus L. – P caesp – Eurimedit.

ROSACEAE

Crataegus monogyna Jacq. – P scap – Paleotemp.

Pyrus communis L. subsp. *communis* – P scap – Medit.

Pyrus spinosa Forssk. – P caesp – Stenomedit.

Rosa sempervirens L. – NP – W-Medit.-Mont.

Rubus ulmifolius Schott – NP – Eurimedit.

Sanguisorba minor Scop. – H scap – Paleotemp.

RUBIACEAE

Asperula aristata subsp. *scabra* Nyman – H scap – Eurimedit.

Crucianella maritima L. – Ch suffr – Stenomedit.

Galium aparine L. – T scap – Eurasiat.

Galium lucidum All. subsp. *lucidum* – H scap – Eurimedit.

Galium murale (L.) All. – T scap – Stenomedit.

Galium verrucosum Huds. subsp. *verrucosum* – T scap – Stenomedit.

Rubia peregrina L. – T scap – Stenomedit.

Sherardia arvensis L. – T scap – Eurimedit.

Theligonum cynocrambe L. – T scap – Stenomedit.

Valantia muralis L. – T scap – Stenomedit.

RUTACEAE

Citrus × aurantium L. – P scap – Asia – Cultivated as oramental.

Citrus × limon (L.) Osbeck – P scap – Uncertain origin – Cultivated as oramental.

SALICACEAE

Populus alba L. – P scap – Paleotemp.

Salix pedicellata Desf – P caesp – Stenomedit.

SANTALACEAE

Osyris alba L. – NP – Eurimedit.

SCROPHULARIACEAE

Antirrhinum siculum Mill. – Ch suffr – Endem.

Myoporum insulare R.Br. – P caesp – Australia – Cultivated as ornamental.

Scrophularia canina L. – H scap – Eurimedit.

Scrophularia peregrina L. – T scap – Stenomedit.

Verbascum creticum (L.) Kuntze – H bienn – SW-Stenomedit.

Verbascum sinuatum L. – H bienn – Eurimedit.

SIMAROUBACEAE

Ailanthus altissima (Miller) Swingle – P scap – E-Asia – Invasive alien.

SOLANACEAE

Hyoscyamus albus L – T scap – Stenomedit.

Lycium europaeum L. – H sca – Paleotemp.

Mandragora autumnalis Bertol. – H ros – Stenomedit.

Nicotiana glauca Graham – NP – S-Amer. – Naturalized alien.

Solanum linnaeanum Hepper & P.-M.L.Jaeger – NP – S-Africa – Naturalized alien.

Solanum nigrum L. – T scap – Cosmopol.

ULMACEAE

Ulmus canescens Mill. subsp. *canescens* (Melville) Browicz & Ziel.– P caesp – E-Eurimedit.

TAMARICACEAE

Tamarix africana Poir. – P caesp – W-Stenomedit.

Tamarix gallica L. – P caesp – W-Stenomedit.

THYMELAEACEA

Daphne gnidium L. – P caesp – Stenomedit.

Thymelaea hirsuta (L.) Endl. – NP – S-Stenomedit.

URTICACEAE

Parietaria judaica L. – H scap – Eurimedit.-Macaron.

Parietaria lusitanica L. subsp. *lusitanica* – T rept – Stenomedit.

Urtica membranacea Poir. – T scap – S-Stenomedit.

Urtica urens L. – T scap – Subcosmop.

VALERIANACEAE

Centranthus calcitrapae (L.) Dufur. subsp. *calcitrapae* – T scap – Stenomedit.

Centranthus ruber (L.) DC. subsp. *ruber* – Ch suffr – Stenomedit.

Fedia graciliflora Fisch. & C.A.Mey. – T scap – Stenomedit.

Valerianella eriocarpa Desv. – T scap – Stenomedit.

VERBENACEAE

Lantana camara subsp. *aculeata* (L.) R.W.Sanders – P caesp – Neotropic. – Naturalized alien.
Verbena officinalis L. – H scap – Paleotemp.

ZYGOPHYLLACEAE

Tribulus terrestris L. – T rept – Cosmopol.

VITACEAE

Vitis vinifera L. – P lian – Medit.

LILIOPSIDA

AMARYLLIDACEAE

Allium chamaemoly L. subsp. *chamaemoly* – G bulb – Stenomedit.
Allium pendulinum Ten. – G bulb – W-Stenomedit.
Allium neapolitanum Cirillo – G bulb – Stenomedit.
Allium roseum L. – G bulb – Stenomedit.
Allium subhirsutum L. subsp. *subhirsutum* – G bulb – Stenomedit.
Allium triquetrum L. – G bulb – W-Stenomedit.
Narcissus serotinus L. – G bulb – Stenomedit.

ARACEAE

Arisarum vulgare O.Targ.Tozz. subsp. *vulgare* – G rhiz – Stenomedit.
Arum italicum Mill. – G rhiz – Stenomedit.

ARECACEAE

Chamaerops humilis L. – P scap – W-Stenomedit.
Phoenix canariensis H.Wildpret – P scap – Canarie – Naturalized alien.
Phoenix dactylifera L. – P scap – Paleosubtrop. – Casual alien.

ASPARAGACEAE

Agave americana L. subsp. *americana* – P caesp – Mexico – Naturalized alien.
Asparagus acutifolius L. – NP – Stenomedit.
Asparagus pastorianus Webb & Berth. - NP - SW Stenomedit.
Prospero autumnale (L.) Speta – G bulb – Eurimedit.
Muscari commutatum Guss. – G bulb – E-Stenomedit.

ASPHODELACEAE

Aloë arborescens Mill. – P succ – South Africa – Cultivated as ornamental.
Asphodelus ramosus L. – G rhiz – Stenomedit.

CYPERACEAE

Carex riparia Curtis – G rhiz – Eurasiat.
Cyperus badius Desf. – He – Paleotemp.
Cyperus capitatus Vand. – G rhiz – Stenomedit.
Cyperus rotundus L. – G rhiz – Subcosmop.
Scirpoides holoschoenus (L.) Soják – G rhiz – Eurimedit.-Subatl.

IRIDACEAE

Chasmanthe aethiopica (L.) N.E.Br. – G rhiz – South Africa – Naturalized alien.

Gladiolus italicus Mill. – G bulb – Eurimedit.
Moraea sisyrinchium (L.) Ker Gawl. – G bulb – Stenomedit.
Juno planifolia (Mill.) Asch. – G bulb – S-Stenomedit.
Romulea bulbocodium (L.) Sebast. & Mauri – G bulb – Stenomedit.
Romulea rollii Parl. – G bulb – W-Stenomedit.

JUNCACEAE

Juncus articulatus L. subsp. *articulatus* – G rhiz – Circumbor.
Juncus acutus L. subsp. *acutus* – H caesp – Eurimedit.
Juncus littoralis C. A. Mey. – H caesp – Eurimedit.-Turan.
Juncus maritimus Lam. – G rhiz – Subcosmop.

ORCHIDACEAE

Anacamptis collina (Russell) R.M.Bateman, Pridgeon & M.W.Chase – G bulb – Stenomedit.
Anacamptis pyramidalis (L.) Rich. – G bulb – Eurimedit.
Barlia robertiana (Loisel.) Greuter – G bulb – Stenomedit.
Ophrys lutea Cav. – G bulb – Stenomedit.
Ophrys speculum Link – G bulb – Stenomedit.
Orchis italica Poir. – G bulb – Stenomedit.
Serapias vomeracea (Burm.f.) Briq. – G bulb – Eurimedit.

POACEAE

Agrostis stolonifera subsp. *maritima* (Lam.) Vasc. – H rept – Circumbor.
Ampelodesmos mauritanicus (Poir.) T.Durand & Schinz – H caesp – SW-Stenomedit.
Andropogon distachyos L. – H caesp – Paleotemp.
Anisantha madritensis (L.) Nevski subsp. *madritensis* – T scap – Eurimedit.
Anisantha sterilis (L.) Nevski – T scap – Eurimedit.
Anthoxanthum gracile Biv. – T scap – E-Stenomedit.
Anthoxanthum odoratum L. – H caesp – Eurasiat.
Arundo donax L. – G rhiz – Subcosmop.
Avena barbata Link – T scap – Eurimedit.
Brachypodium retusum (Pers.) P.Beauv. – H caesp – Eurasiat.
Briza maxima L. – T scap – Subtrop.
Bromus hordeaceus L. subsp. *hordeaceus* – T scap – Subcosmop.
Calamagrostis epigejos (L.) Roth subsp. *epigejos* – H caesp – Medit.
Calamagrostis arenaria subsp. *arundinacea* (Husn.) Banfi, Galasso & Bartolucci – G rhiz – Eurimedit.
Cynodon dactylon (L.) Pers. – G rhiz – Cosmopol.
Corynephorus divaricatus (Pourr.) Breistr. – T scap – Stenomedit.
Dactylis glomerata subsp. *hispanica* (Roth) Nyman – H caesp – Stenomedit.
Dasyphyrum villosum (L.) P.Candargy – T scap – Eurimedit.-Turan.
Digitaria sanguinalis (L.) Scop. – T scap – Cosmopol.
Elymus farctus (Viv.) Melderis – G rhiz – Eurimedit.
Festuca maritima L. – T scap – Stenomedit.
Hyparrhenia hirta (L.) Stapf subsp. *hirta* – H caesp – Paleotrop.
Hordeum marinum Huds. – T scap – W-Stenomedit.
Hordeum murinum L. subsp. *murinum* – T scap – Circumbor.
Lagurus ovatus L. subsp. *ovatus* – T scap – Eurimedit.
Lolium perenne L. – H caesp – Circumbor.

Melica minuta L. subsp. *minuta* – H caesp – Stenomedit.
Oloptum miliaceum (L.) Röser & H.R.Hamasha – H caesp – Stenomedit.
Panicum repens L. – G rhiz – Paleosubtrop.
Parapholis incurva (L.) C.E.Hubb. subsp. *incurva* – T scap – Stenomedit
Phalaris coerulescens Desf. – H caesp – Stenomedit.
Phragmites australis (Cav.) Steud. subsp. *australis* – G rhiz – Subcosmop.
Poa annua L. – T caesp – Cosmopol.
Rostraria cristata (L.) Tzvelev – NP – Stenomedit.
Sorghum halepense (L.) Pers. – G rhiz – Termocosmop.
Stipellula capensis (Thunb.) Röser & H.R.Hamasha – T scap – Stenomedit.
Sporobolus virginicus (L.) Kunth – T caesp – N. Amer.

SMILACACEAE

Smilax aspera L. – NP – Subtrop.

TYPHACEAE

Typha angustifolia L. – G rhiz – Circumbor.

Conclusion

This study not only highlighted the great naturalistic value of the studied area, but also allowed to verify some critical issues such as the presence and sometimes large spread of some invasive alien species which threaten not only local biodiversity but also the monuments themselves. In fact, the damage inflicted by alien plants on the country's historical heritage is a particularly relevant issue in Italy (Celesti-Grapow & al. 2009).

It would be desirable in the future, that alien species present in this archaeological site to be constantly monitored and to prevent their diffusion through a landscape management plan that involving regular containment and eradication interventions.

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