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Analysis of the vascular flora of four satellite islets of the Egadi Archipelago (W Sicily), with some notes on their vegetation and fauna

Salvatore Pasta[1*], Arnold Sciberras[2], Jeffrey Sciberras[3] & Leonardo Scuderi[4]

[1]National Research Council (CNR), Istitute of Biosciences and Bioresources (IBBR), Corso Calatafimi, 414 - 90129, Palermo, Italy; e-mail: salvatore.pasta@ibbr.cnr.it
[2]133, Arnest, Arcade Str., Paola, Malta; e-mail: bioislets@gmail.com
[3]24 Camilleri crt Flt 5,Triq il-Marlozz, Ghadira, Mellieha, Malta; e-mail: wildalienplanet@gmail.com
[4]via Andromaca, 60 - 91100 Trapani, Italy; e-mail: scuderileo@yahoo.it
[*]Corresponding author

ABSTRACT This paper represents the first contribution on the vascular flora of the stack named Faraglione di Levanzo and of three satellite islets of Favignana, i.e. Prèveto, Galeotta and a stack located at Cala Rotonda. A sketch of their vegetation pattern is also provided, as well as a list of all the terrestrial fauna, with some more detailed information on the vertebrates. The finding of some bones of *Mustela nivalis* Linnaeus, 1758 is the first record for the whole archipelago and deserves further investigations. The floristic data have been used in order to analyze life-form and chorological spectra and to assess species-area relationship, the peculiarity of local plant assemblages, the occurrence of islet specialists, the risk of alien plants invasion and the refugium role played by the islets. The significant differences among the check-lists compiled by the two different couples of authors during their own visits to Prèveto and Galeotta underline the need of planning regular and standardized field investigations in order to avoid an overestimation of local species turnover rates.

KEY WORDS Ellenberg bioindicator values; Life-form spectra; Mediterranean Sea; Unbalanced biota.

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INTRODUCTION

The aims of the paper

Egadi Islands are located in the province of Trapani and form the westernmost archipelago of Sicily. The whole archipelago includes three main islands, i.e. Favignana, Marettimo and Levanzo, and almost ten islets and stacks, mostly dispersed in the sea near the coast of Trapani or between Trapani and Levanzo. In this paper we present the results of a five-years-long investigation carried out by two different teams, mainly focused on the vascular flora of four of these tiny islets, i.e. the "Faraglione" (= stack) of Levanzo (hereinafter named "FLE") and 3 satellite islets of Favignana, i.e. Prèveto ("PRE"), Galeotta ("GAL"), and a little islet without any official name situated within Cala Rotonda and therefore indicated as "ROT" (Figs. 1-5).

The present study enters the strand of recent investigations on the botanical features of circum-Sicilian satellite islets (Siracusa, 1996; Pasta, 1997a, 2001, 2002; Scuderi et al., 2007; Pasta & Scuderi, 2008; Lo Cascio & Pasta, 2008b, 2012; Sciberras & Sciberras, 2012) and updates the available information on the vascular flora of Egadi Archipelago (Di

Martino & Trapani, 1967; Gianguzzi et al., 2006; Romano et al., 2006). Some rough information on the vegetation and the fauna of the islets is given, too.

Basic information on the study area

All the studied islets are characterized by Jurassic or Cretaceous calcareous rocks, although some spots of outcropping marls and radiolarites have been recorded on PRE (Abate et al., 1997). The available information on the rainfall and temperature regimes of the nearest climate recording station, i.e. Trapani (Zampino et al., 1997) suggests that the islets are all subject to the same bioclimatic type, which is upper thermo-mediterranean dry according to Rivas-Martínez (2008) classification.

During Last Glacial Maximum (i.e. c. 18-12 Kyrs BP), the sea level was some 80-120 m lower than today (Lambeck et al., 2010), so that all the considered islets were part of the main islands, and they must have been connected with them at least till 8 Kyrs BP (Agnesi et al., 1993; Antonioli et al., 2002).

Malatesta (1957) noticed plenty of lithic artifacts on PRE. No other information seems to be available on the past land use and human presence on the islets. Besides, a lot of potsherds have been observed on the flat inland of PRE, which also hosts a little and rough cubic structure, probably built up some decades ago by shepherds, who used to transfer on PRE their animals during summer, in order to have a shady and fresh place where to eat and rest. Moreover, along the eastern border of FLE a sort of path was noticed, perhaps produced by intense trampling due to the presence of herbivores left on the islet during summer season. The main geographical characteristics of the islets are summarized in Table 1.

MATERIAL AND METHODS

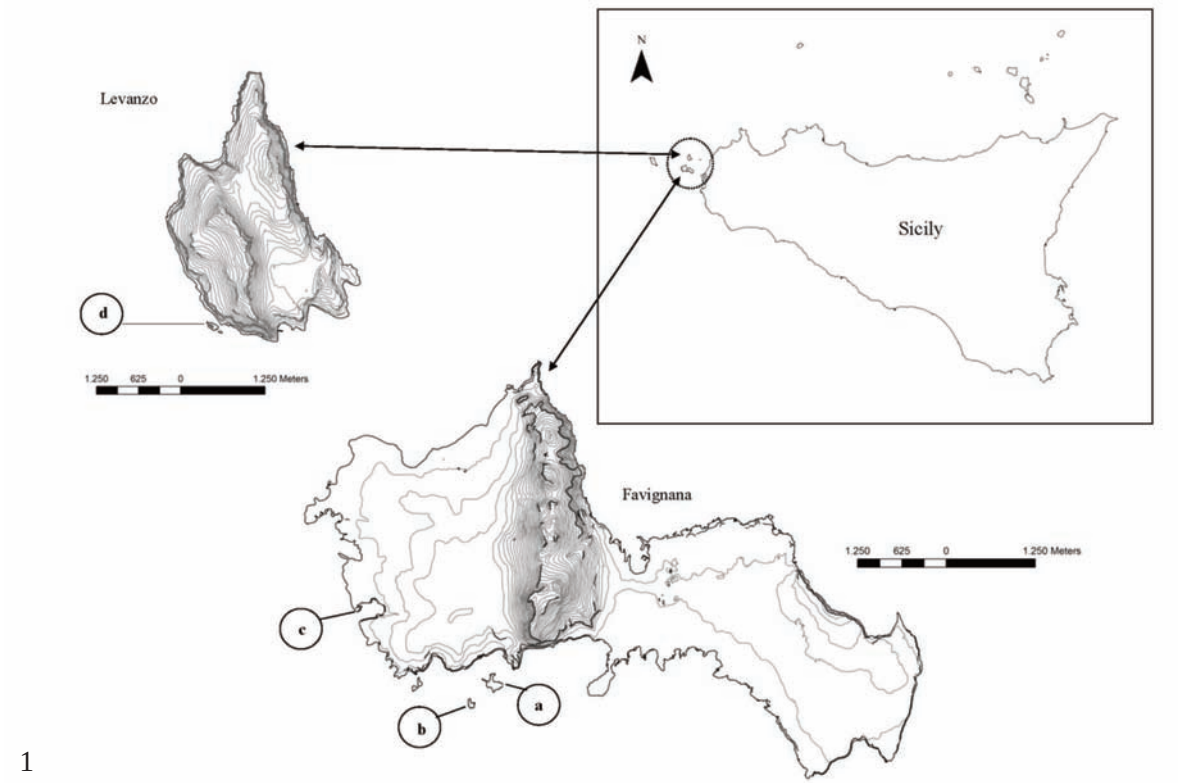
A specimen of *Parapholis pycnantha* (Hack.) C.E. Hubb. (Poaceae), quoted by Cuccuini (2002), testifies that Giovanni Gussone, the indefatigable botanist who explored every hidden spot of Sicily and wrote down the most detailed checklist of Sicilian vascular flora ever published, visited FLE during his botanical expedition to Egadi islands during May 1829 (Pasquale, 1876; Trotter, 1948). The only recent data on FLE flora and vegetation were collected by S. Pasta during a short visit some twenty years ago (April 1995; hereinafter indicated as SP0). More recently the investigation on the vascular flora of the four islets was carried out through five visits between 2004 and 2010. More in detail, three of them were carried out by S. Pasta and L. Scuderi (PRE: SP-LS1, 21/09/2004; PRE and GAL: SP-LS2, 14/08/2005; FLE: SP-LS3, 27/09/2005), while A. and J. Sciberras first visited PRE and GAL (A-JS1, 10/10/2010) and then ROT (A-JS2, 17/10/2010).

The classification of the observed plants was carried out mainly using Pignatti (1982) and Tutin et al. (1964-1980, 1993), while their nomenclature is mainly based on Euro+Med (2006). Moreover, the families are circumscribed according to the most recent proposals of Angiosperm Phylogeny Group (APG, 2009; Reveal & Chase, 2011), while families, genera and infrageneric taxa are listed in alphabetical order.

The check-list also provides basic information on life forms (Raunkiær, 1934) and chorotypes (according to Pasta, 1997b) or xenophyte status (Richardson et al., 2000). In order to perform a better interpretation of the floristic similarity among the islets, the niche width of each taxon was taken

Code	Per (m)	Surface (ha)	Dist (m)	ME (m)	UTM coordinates
PREV	1,240	4.319	224	8	E 262835.73 - N 4199765.67
GAL	453	0.706	420	2	E 262512.94 - N 4199493.17
ROT	305	0.423	1	4	E 260929.07 - N 4200840.57
FLE	489	0.959	46	20	E 265383.93 - N 4207687.67

Table 1. Main geographic features of the investigates islets. Per: perimeter; Dist: minimum distance from the main island; ME: maximum elevation above sea level.



1

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5

Figure 1. Location of the investigated islets. a: Prèveto (PRE); b: Galeotta (GAL); c: islet of Cala Rotonda (ROT); d: Faraglione di Levanzo (FLE). Figure 2. Prèveto and Galeotta from the southern coast of Favignana (photo L. Scuderi). Figure 3. The Islet of Galeotta from Prèveto (photo A. Sciberras). Figure 4. Cala Rotonda islet from the coast of Favignana (photo A. Sciberras). Figure 5. Faraglione di Levanzo from the south-eastern coast of Levanzo (photo L. Scuderi).

into account through Ellenberger's bioindication values (data from Pignatti, 2005, modified), i.e. L (light, whose range of variation is from 1 to 9), T (temperature, 1-9), C (continentality, 1-9), U (moisture, 1-12), R (soil pH, 1-9), N (soil fertility, 1-9) and S (soil salinity, 1-3). Basic information used for data elaboration is contained in Table 2. In this Table 2 the Column "LF" contains information on Raunkiaer's life forms. Columns 2-8 refer to Ellenberger's bioindication values as follows: L (light), T (temperature,), C (continentality), U (moisture), R (soil pH), N (soil fertility) and S (soil salinity). For further information on the range of these values see the text in "Material and Methods" paragraph. Column "Choro" illustrates the chorotype of each plant. In the last four columns the presence ("1") or absence ("0") of each detected vascular plant is reported.

Moreover, the main literature concerning coastal Sicilian vegetation (Bartolo et al., 1982; Brullo et al., 2001; Minissale et al., 2010) has been consulted in order to facilitate the interpretation of local plant communities.

Data on fauna were collected as a broad brush baseline survey of all the specimens (including remains, traces and faecal pellets) encountered. Identifications of most invertebrate species were carried out according to Fontana et al. (2002).

RESULTS

The vascular flora

AIZOACEAE

Malephora crocea (Jacq.) Schwantes - Ch succ - Naturalized: FLE (LS-SP3)

Mesembryanthemum crystallinum L. - T rept - Subcosmopolitan: PRE (LS-SP2; A-JS1)

Mesembryanthemum nodiflorum L. - T rept - Tethyan-Capensis: PRE (LS-SP2; A-JS1); FLE (SP0; LS-SP3)

AMARANTHACEAE

Arthrocnemum macrostachyum (Moric.) K. Koch - NP succ - Mediterranean-Irano-Turanian: PRE (LS-SP1, LS-SP2; A-JS1); GAL (LS-SP2; A-JS1); ROT (A-JS2); FLE (SP0; LS-SP3)

Beta maritima L - H scap - Mediterranean-Atlantic: PRE (LS-SP2; A-JS1)

Chenopodium murale L. - T scap - Subcosmopolitan: PRE (LS-SP2; A-JS1)

Chenopodium opulifolium Schrad. - T scap - Subcosmopolitan: GAL (A-JS1)

†*Halimione portulacoides* (L.) Aellen - NP - Tethyan-European: GAL (LS-SP2)

Suaeda vera J.F. Gmelin - Ch frut - Tethyan-Atlantic: PRE (LS-SP1, LS-SP2; A-JS1); GAL (LS-SP2; A-JS1)

AMARYLLIDACEAE

Allium commutatum Guss. - G bulb - Mediterranean: PRE (LS-SP2; A-JS1); GAL (LS-SP2; A-JS); FLE (SP0; LS-SP3)

ANACARDIACEAE

Pistacia lentiscus L. - P caesp - Mediterranean: FLE (SP0; LS-SP3)

APIACEAE

Crithmum maritimum L. - Ch suffr - Mediterranean-Atlantic: GAL (LS-SP2; AJ&JS1); ROT (AJ&JS2); FLE (SP0; LS-SP3)

Daucus bocconei Guss. - H bienn - CW Mediterranean: FLE (SP0; LS-SP3)

Ferula communis L. - H scap - Mediterranean-Macaronesian: PRE (LS-SP2)

Thapsia garganica L. subsp. *garganica* - H scap - CW Mediterranean: PRE (LS-SP2; A-JS1)

ARACEAE

Arisarum vulgare Targ.-Tozz. - G rhiz - Mediterranean: PRE (LS-SP2; A-JS1); FLE (LS-SP3)

ARECACEAE

Chamaerops humilis L. - NP - CW Mediterranean: FLE (SP0; LS-SP3)

ASPARAGACEAE

Asparagus acutifolius L. - G rhiz - Mediterranean: PRE (LS-SP2); FLE (LS-SP3)

Asparagus aphyllus L. - Ch frut - S Mediterranean: ROT (A-JS2)

Prospero autumnale (L.) Speta (= *Scilla autumnalis* L.) - G bulb - Tethyan-European: ROT (A-JS2)

ASTERACEAE

Anthemis secundiramea Biv. - T scap - CW Mediterranean: FLE (SP0; LS-SP3)

Bellis annua L. - T scap - Tethyan: PRE (A-JS1)

Calendula arvensis L. - T scap - Tethyan-European: PRE (A-JS1)

Carduus pycnocephalus L. - H bienn - Tethyan-European: PRE (LS-SP2; A-JS1)

Galactites tomentosa Moench - H bienn - Mediterranean: PRE (LS-SP2; A-JS1)

Helichrysum panormitanum Tineo [= *H. rupestre* (Raf.) DC.] - Ch frut - NW Sicilian endemic: FLE (LS-SP3)

Jacobaea maritima (L.) Pelser et Meijden subsp. *bicolor* (Willd.) B. Nord. et Greuter [= *Senecio bicolor* (Willd.) Tod.] - Ch frut - CW Medit: FLE (LS-SP3)

Limbarda crithmoides (L.) Dumort. (= *Inula crithmoides* L.) - Ch suffr - CS - Mediterranean-Atlantic: ROT (A-JS2); FLE (SP0; LS-SP3)

Senecio leucanthemifolius Poir. s.l. - T scap - CW Mediterranean: PRE (LS-SP2; A-JS1); GAL (LS-SP2; A-JS1); ROT (A-JS2)

Sonchus oleraceus L. - T scap - Boreal-Tethyan: PRE (LS-SP2; A-JS1); GAL (A-JS1); FLE (LS-SP3)

Sonchus tenerrimus L. - T scap - Tethyan-Paleotropical: PRE (A-JS1)

Xanthium strumarium L. subsp. *italicum* (Moretti) D. Löve - T scap - Subcosmopolitan: ROT (A-JS2)

BORAGINACEAE

Echium plantagineum L. - H bienn - Tethyan-European: PRE (LS-SP2; A-JS1); FLE (LS-SP3)

Heliotropium europaeum L. - T scap - Tethyan-European: PRE (LS-SP1, LS-SP2; A-JS1)

BRASSICACEAE

Diplotaxis erucoides (L.) DC. - T scap - Mediterranean: PRE (A-JS1)

Iberis semperflorens L. - Ch suffr - Central Mediterranean: FLE (LS-SP3)

Lobularia maritima (L.) Desv. - H scap - Medit: FLE (SP0; LS-SP3)

CAPPARACEAE

Capparis spinosa L. subsp. *rupestris* (Sibth. et Sm.) Nyman - NP - Mediterranean - PRE (LS-SP1, LS-SP2, A-JS1); GAL (LS-SP2; A-JS1); ROT (A-JS2); FLE (SP0; LS-SP3)

CARYOPHYLLACEAE

Dianthus rupicola Biv. subsp. *rupicola* - Ch frut - Apulian-Sicilian endemic: FLE (LS-SP3)

Polycarpon alsinifolium (Biv.) DC. - T scap - S Mediterranean-Atlantic: PRE (LS-SP2)

Silene sedoides Poir. subsp. *sedoides* - T scap - Mediterranean: PRE (LS-SP2); GAL (LS-SP2); FLE (LS-SP3)

CRASSULACEAE

Sedum litoreum Guss. - T succ - Mediterranean: PRE (LS-SP2)

CUCURBITACEAE

Ecballium elaterium (L.) A. Rich. - H scand - Tethyan-Pontic: PRE (LS-SP1, LS-SP2; A-JS1)

EUPHORBIACEAE

Euphorbia segetalis L. (incl. *E. pinea* L.) - Ch suffr - CW Mediterranean: PRE (A-JS2); ROT (A-JS2)

Mercurialis annua L. - T scap - R - Tethyan-European: PRE (LS-SP1, LS-SP2; A-JS1)

FABACEAE

Lotus cytisoides L. - Ch suffr - Mediterranean: ROT (A-JS2)

FRANKENIACEAE

Frankenia hirsuta L. - Ch suffr - Mediterranean-Pontic: FLE (LS-SP3)

Frankenia pulverulenta L. - T scap - Tethyan-Pontic: PRE (LS-SP2)

GENTIANACEAE

Centaurium tenuiflorum (Hoffmgg. et Link) Fritsch - T scap - Mediterranean: PRE (LS-SP2)

GERANIACEAE

Erodium malacoides (L.) L'Hérit. - T scap - Tethyan: PRE (A-JS1)

Erodium moschatum (L.) L'Hérit. - T scap - Mediterranean-European: PRE (A-JS1)

LAMIACEAE

Sideritis romana L. - T scap - Mediterranean: PRE (LS-SP2); FLE (LS-SP3)

MALVACEAE

Malva arborea (L.) Webb. et Berthel. [= *Lavatera arborea* L.) - H bienn - Mediterranean-Atlantic: PRE (LS-SP1, LS-SP2; A-JS1)

Malva multiflora (Cav.) Soldano, Banfi et Galasso [= *Lavatera cretica* L.] - T scap - Mediterranean: PRE (A-JS1)

PLUMBAGINACEAE

Limonium aegusae Brullo - Ch suffr - endemic of Favignana: ROT (A-JS2)

Limonium bocconei (Lojac.) Litard. - Ch suffr - NW Sicilian endemic: PRE (LS-SP2)

Limonium lojaconoi Brullo - Ch suffr - NW Sicilian endemic: FLE (LS-SP3)

Limonium ponzoi (Fiori et Bég.) Brullo - Ch suffr - W Sicilian endemic: FLE (LS-SP3)

POACEAE

Avena cfr. *barbata* Link - T scap - Tethyan-Pontic: PRE (A-JS1)

Brachypodium retusum (Pers.) P. Beauv. - H caesp - Mediterranean: FLE (LS-SP3)

Catapodium pauciflorum (Merino) Brullo, Giusso, Minissale et Spampinato - T scap - CW Mediterranean: FLE (LS-SP3)

Catapodium rigidum C.E. Hubb. subsp. *rigidum* - T scap - Tethyan-European: FLE (LS-SP3)

Dactylis glomerata Roth. L. subsp. *hispanica* (Roth) Nyman - H caesp - Mediterranean: FLE (SP0; LS-SP3)

Hordeum leporinum Link - T scap - Mediterranean-European: PRE (LS-SP2)

Lagurus ovatus L. s.l. - T scap - Mediterranean-Atlantic: PRE (AS & JS 1)

Parapholis incurva (L.) C.E. Hubb. - T scap - Tethyan-Eurosibirian: PRE (LS-SP2); GAL (LS-SP2); FLE (SP0; LS-SP3)

Parapholis pycnantha (Hack.) C.E. Hubb. - T scap - CW Mediterranean: FLE (LS-SP3)

†*Sporobolus pungens* (Schreb.) Kunth - G rhiz - Holarctic-Paleotropical: GAL (LS-SP2)

RANUNCULACEAE

Ranunculus bullatus L. - G bulb - R - Mediterranean: PRE (LS-SP2)

RUBIACEAE

Valantia muralis L. - T scap - R - Mediterranean: PRE (LS-SP2); FLE (LS-SP3)

SOLANACEAE

Hyoscyamus albus L. - T scap - Mediterranean-Macaronesian: GAL (LS-SP2; A-JS1)

Mandragora autumnalis Bertol. - H ros - Mediterranean: PRE (LS-SP1, LS-SP2; A & ES1)

Solanum lycopersicum L. (= *Lycopersicon esculentum* Mill.) - T scap - Casual alien: PRE (A & ES1)

URTICACEAE

Parietaria lusitanica L. - H scap - Tethyan-European: PRE (LS-SP2)

Urtica membranacea Poir. - T scap - Mediterranean-Macaronesian: PRE (A-JS1)

Two sea-grasses, *Cymodocea nodosa* (Ucria) Asch. and *Posidonia oceanica* (L.) Delile, quite common along the coasts of Egadi islands (Giaccone et al., 1985) and present near all the considered islets, do not figure within the list. The symbol † underlines that *Halimione portulacoides* and *Sporobolus pungens*, were no more observed in GAL. Considering their perennial life-cycle, the very little size of both their local population and the islet, they must be considered as locally extinct and therefore excluded from further data elaboration.

Main structural and floristic patterns of local plant communities

The distribution and the floristic assemblage of the observed plant communities firstly depends on the size and the topography (e.g. flat areas, rocky cliffs, even or steep shores, etc.) of the islets.

The natural landscape of PRE is also shaped by the disturbance induced by a huge breeding colony of yellow-legged seagulls (at least 60 pairs), which causes important changes on both the structure and chemistry of the soil due to trampling and to organic matter input, respectively (see Caldarella et al., 2010, and references therein). In fact, the northern half of its inland area (Fig. 6), where most part of the nesting sites are concentrated, holds a ruderal community referred to *Stellarietea mediae* R. Tx. Lohmeyer et Preising ex von Rochow 1951, rather rich in annual pioneer plants which are quite common in disturbed places, arable lands and in fallow communities; among them, *Malva arborea* and *Carduus pycnocephalus* are the most common and dominant species.

LF	L	T	C	U	R	N	S	Choro	Scientific name
G	7	7	5	3	6	5	2	Med	*Allium commutatum* Guss.
T	11	11	5	1	3	1	3	CW Med	*Anthemis secundiramea* Biv.
G	6	8	4	4	4	4	0	Med	*Arisarum vulgare* Targ.-Tozz.
NP	11	9	5	8	9	7	3	Med-Ir-Tur	*Arthrocnemum macrostachyum* (Moric.) K. Koch
G	6	9	4	2	5	5	0	Med	*Asparagus acutifolius* L.
Ch	8	8	5	3	7	2	0	S Med	*Asparagus aphyllus* L.
T	8	8	5	3	7	2	0	Tet-Pont	*Avena* cfr. *barbata* Link
T	6	9	4	7	2	2	0	Tet	*Bellis annua* L.
H	11	7	4	6	6	5	2	Med-Atl	*Beta maritima* L.
H	11	10	3	2	5	2	0	Med	*Brachypodium retusum* (Pers.) P. Beauv.
T	7	8	5	3	8	5	0	Tet-Eur	*Calendula arvensis* L.
NP	9	10	5	2	5	1	1	Med	*Capparis spinosa* L. subsp. *rupestris* (Sibth. & Sm.) Nyman
H	7	8	4	3	X	3	0	Tet-Eur	*Carduus pycnocephalus* L.
T	11	10	3	1	X	1	2	CW Medit	*Catapodium pauciflorum* (Merino) Brullo, Giusso, Minissale et Spampinato
T	8	8	5	2	5	4	0	Tet-Eur	*Catapodium rigidum* C.E. Hubb. subsp. *rigidum*
T	9	8	5	7	7	2	0	Med	*Centaurium tenuiflorum* (Hoffmgg. et Link) Fritsch
NP	11	10	3	1	4	1	0	CW Med	*Chamaerops humilis* L.
T	8	7	5	4	X	9	0	Subcosmop	*Chenopodium murale* L.
T	8	7	5	3	X	6	0	Subcosmop	*Chenopodium opulifolium* Schrad.
Ch	11	8	2	1	X	1	3	Med-Atl	*Crithmum maritimum* L.
H	11	8	4	2	5	2	0	Med	*Dactylis glomerata* L. subsp. *hispanica* (Roth) Nyman
H	8	6	5	4	5	4	3	CW Med	*Daucus bocconei* Guss.
Ch	11	10	3	2	7	1	1	End Apul-Sic	*Dianthus rupicola* Biv. subsp. *rupicola*
T	8	8	4	3	5	5	0	Med	*Diplotaxis erucoides* (L.) DC.
H	7	8	5	3	5	3	1	Tet-Pont	*Ecballium elaterium* (L.) A. Rich.

Table 2. Basic information used for data elaboration. LF = life forms according to Raunkiær (1934); for the meaning of the abbreviations of the following 7 columns, please see Ellenberger bioindicator values in "Material and Methods" paragraph; Choro = chorotype (continued).

LF	L	T	C	U	R	N	S	Choro	Scientific name
H	11	8	5	3	5	5	0	Tet-Eur	*Echium plantagineum* L.
T	11	9	4	2	5	2	0	Tet	*Erodium malacoides* (L.) L'Hérit.
T	11	9	5	2	5	2	0	Med-Eur	*Erodium moschatum* (L.) L'Hérit.
Ch	11	10	4	2	0	2	0	CW Med	*Euphorbia segetalis* L.
H	9	8	5	3	5	2	0	Med-Mac	*Ferula communis* L.
Ch	11	10	4	1	7	1	3	Med-Pont	*Frankenia hirsuta* L.
T	11	9	4	1	7	1	3	Tet-Pont	*Frankenia pulverulenta* L.
H	8	8	4	3	X	7	0	Med	*Galactites tomentosa* Moench
Ch	11	9	3	2	7	1	0	End NW Sic	*Helichrysum panormitanum* Tineo
T	11	8	5	3	7	2	1	Tet-Eur	*Heliotropium europaeum* L.
T	9	9	5	3	5	3	0	Med-Eur	*Hordeum leporinum* Link
T	8	8	5	2	X	9	1	Med-Mac	*Hyoscyamus albus* L.
Ch	6	8	3	3	6	2	0	C Med	*Iberis semperflorens* L.
Ch	11	10	3	1	X	1	3	CW Med	*Jacobaea maritima* (L.) Pelser et Meijden subsp. *bicolor* (Willd.) B. Nord. et Greuter
T	8	9	5	3	X	2	1	Med-Atl	*Lagurus ovatus* L. *s.l.*
Ch	11	8	4	7	9	5	3	Med-Atl	*Limbarda crithmoides* (L.) Dumort.
Ch	11	10	3	1	9	1	3	End Favign	*Limonium aegusae* Brullo
Ch	11	10	3	1	9	1	3	End NW Sic	*Limonium bocconei* (Lojac.) Litard.
Ch	11	10	3	1	9	2	3	End NW Sic	*Limonium lojaconoi* Brullo
Ch	11	10	3	1	9	1	3	End NW Sic	*Limonium ponzoi* (Fiori et Bég.) Brullo
H	8	9	4	2	X	1	0	Med	*Lobularia maritima* (L.) Desv.
Ch	11	10	3	1	X	1	2	Med	*Lotus cytisoides* L.
Ch	11	12	5	1	X	1	2	Naturalized	*Malephora crocea* (Jacq.) Schwantes
H	8	9	4	2	5	4	3	Med-Atl	*Malva arborea* (L.) Webb. & Berthel.

Table 2 (continued). Basic information used for data elaboration. LF = life forms according to Raunkiær (1934); for the meaning of the abbreviations of the following 7 columns, please see Ellenberger bioindicator values in "Material and Methods" paragraph; Choro = chorotype (continued).

LF	L	T	C	U	R	N	S	Choro	Scientific name
T	8	9	4	2	5	4	3	Med	*Malva multiflora* (Cav.) Soldano, Banfi et Galasso
H	7	9	4	2	7	3	0	Med	*Mandragora autumnalis* Bertol.
T	7	7	5	4	7	8	1	Tet-Eur	*Mercurialis annua* L.
T	11	11	5	1	X	1	2	Subcosmop	*Mesembryanthemum crystallinum* L.
T	11	12	5	1	X	1	3	Tet-Cap	*Mesembryanthemum nodiflorum* L.
T	11	7	4	5	7	2	3	Tet-Eurosib	*Parapholis incurva* (L.) C.E. Hubb.
T	11	7	4	5	7	2	3	CW Medit	*Parapholis pycnantha* (Hack.) C.E. Hubb.
H	7	10	4	3	4	6	0	Tet-Eur	*Parietaria lusitanica* L.
P	11	10	5	2	X	2	0	Med	*Pistacia lentiscus* L.
T	11	11	5	2	7	3	0	S Medit-Atl	*Polycarpon alsinifolium* (Biv.) DC.
G	8	8	4	2	6	3	0	Tet-Eur	*Prospero autumnale* (L.) Speta
G	7	8	4	2	7	2	0	Med	*Ranunculus bullatus* L.
T	11	10	5	2	3	1	2	Med	*Sedum litoreum* Guss.
T	11	9	4	2	9	3	2	CW Med	*Senecio leucanthemifolius* Poir. *s.l.*
T	11	9	4	2	6	1	0	Med	*Sideritis romana* L.
T	11	10	3	2	2	1	2	Med	*Silene sedoides* Poir. subsp. *sedoides*
T	7	7	X	5	5	7	1	Casual	*Solanum lycopersicum* L.
T	7	5	X	4	8	8	0	Bor-Tet	*Sonchus oleraceus* L.
T	7	8	4	2	5	4	1	Tet-Paleotrop	*Sonchus tenerrimus* L.
Ch	11	10	5	8	9	7	3	Tet-Atl	*Suaeda vera* J.F. Gmelin
H	11	8	5	3	5	3	0	CW Med	*Thapsia garganica* L. subsp. *garganica*
T	7	8	5	3	6	3	0	Med-Mac	*Urtica membranacea* Poir.
T	11	9	4	2	3	1	0	Med	*Valantia muralis* L.
T	8	8	5	5	X	1	0	Subcosmop	*Xanthium strumarium* L. subsp. *italicum* (Moretti) D. Löve

Table 2 (continued). Basic information used for data elaboration. LF = life forms according to Raunkiær (1934); for the meaning of the abbreviations of the following 7 columns, please see Ellenberger bioindicator values in "Material and Methods" paragraph; Choro = chorotype.

The second half of PRE, more exposed to southern winds and, thus, to salt-spray, is less disturbed by seagulls and it is covered by a species-poor chenopod halo-xero-nitrophilous scrubland dominated by *Suaeda vera* (SE) or by *Arthrocnemum macrostachyum* (SW and S) and referred to the class *Sarcocornietea fruticosae* Br.-Bl. et R. Tx. ex A. et O. de Bolòs 1950 em. O. de Bolòs 1967.

ROT is characterized by a low halophilous shrubland ascribed to *Crithmo-Limonietea* Br.-Bl. in Br.-Bl., Roussine et Nègre 1952 and dominated by *Limbarda crithmoides* and *Limonium aegusae* (Fig. 7).

Due to its extremely low elevation and its even topography, no plant communities could be detected on GAL, except from a little *Arthrocnemum macrostachyum* halophilous scrub. It worths to be emphasized the local frequency of *Hyoscyamus albus*, a plant which is normally associated with sheltered/shaded nutrient-rich ruderal communities, a pattern also observed at Maraone (S. Pasta pers. obs.).

Probably due to its shape and elevation FLE shows the highest richness in terms of number of plant communities. In fact, its bare and rocky coasts host a mosaic-like vegetation dominated by halophilous species-poor chenopod scrubland referred to *Sarcocornietea fruticosae* intermingled with little spots of therophytic vegetation ascribed to *Saginetea maritimae* Westhoff, Van Leeuwen et Adriani 1962, the base of the rocky and steep inland is colonized by several species of the class *Crithmo-Limonietea*, and the cliffs host some perennial grassland species, truly rupicolous species such as *Dianthus rupicola* subsp. *rupicola* and even a little nucleus of low, scattered and extremely simplified maquis with *Chamaerops humilis*, *Pistacia lentiscus* and *Asparagus acutifolius*.

Notes on the invertebrate fauna

As concerns PRE, a remarkable number of animals was collected and/or recorded during A & JS 1 visit on the islet. Except from *Cantareus apertus* (Born, 1778), all the other (8 species) collected species of terrestrial Mollusca still await identification. So goes for three species of *Lepisma* Linnaeus, 1758 and for four species of Hymenoptera. Two specimens of one species of Formicidae were also collected. Moreover, several individuals of Orthoptera, like *Calliptamus barbarus* (Costa, 1836), *Aiolopus strepens* (Latreille, 1804), *Anacridium aegyptium* (Linnaeus, 1758), *Eyprepocnemis plorans* (Charpentier, 1825) and *Acrida* sp. (Acrididae) were observed. Among the few collected Coleoptera it has been possible to identify the narrow endemic *Otiorhynchus* (*Arammichnus*) *aegatensis* (Solari et Solari, 1913). More detailed information on the animals observed/collected at PRE is provided in Table 3.

Phylum	Order	Family	Species	Nr ind.	Status
Mollusca	Gastropoda	Helicidae	*Cantareus apertus*	53	A
Arthropoda	Orthoptera	Acrididae	*Calliptamus barbarus*	c. 15	A
Arthropoda	Orthoptera	Acrididae	*Aiolopus strepens*	3	A
Arthropoda	Orthoptera	Acrididae	*Anacridum aegyptium*	7	B
Arthropoda	Orthoptera	Acrididae	*Eyprepocnemis plorans*	73	A
Arthropoda	Coleoptera	Curculionidae	*Otiorhynchus* (*Arammichnus*) *aegatensis*	11	A

Table 3. Prospect, number of individuals and status of the identified terrestrial invertebrates observed and/or collected by A&JS during their visit to PRE. Abbreviations concerning the "status" column: A = living and B = living and/or migratory.

Notes on the vertebrate fauna

As concerns reptiles, *Tarentola mauritanica* (Linnaeus, 1758) was observed close to the abandoned building. Interestingly, *Podarcis siculus* (Rafinesque, 1810) was the only lizard found at PRE (Fig. 8), while at Favignana it co-occurs with *Podarcis waglerianus* (Gistel, 1868) (Corti et al., 1998, 2006). It was also observed on ROT (Fig. 9). On both islets it performs very high densities like elsewhere in Mediterranean microinsular biota (Lo Cascio & Pasta, 2006, 2008a; Sciberras, 2007; Sciberras & Sciberras, 2014).

Oryctolagus cuniculus (Linnaeus, 1758) and *Rattus norvegicus* (Berkenhout, 1769) were collected at PRE and both were observed on the islet. Local rabbit population appears to be very massive. Some vertebrae (8) and a lower jaw bone of *Mustela nivalis* (Linnaeus, 1766) were collected from site but no living individuals were encountered. Among the observed bird species (data not shown), only the permanent presence of *Larus michahellis* (Naumann, 1840) is very much evident.

No terrestrial fauna was encountered on GAL. Several *Larus michahellis* were observed on ROT and GAL. Due to the total lack of traces of nesting material, both islets probably are only perching/resting sites. As concerns FLE, it represents the nesting site of few pairs of yellow-legged seagulls and hosts a population of *Podarcis siculus*. The presence of numerous mounds of olive seeds suggests the occasional visit of Turdidae; most of these seeds are bitten by a rodent, probably *Rattus rattus* (Linnaeus, 1758).

Figure 6. The flat top of Prèveto (photo A. Sciberras). Figure 7. The natural landscape of Cala Rotonda islet (photo A. Sciberras). Figure 8. *Podarcis siculus* at Prèveto islet (photo A. Sciberras). Figure 9. *Podarcis siculus* at Cala Rotonda islet (photo A. Sciberras).

DISCUSSION

Phytogeographical insight on the local vascular flora

The 73 terrestrial vascular plants recorded on the four considered islets belong to 28 different families (the most represented being Asteraceae, Poaceae and Amaranthaceae with 12, 11 and 6 infrageneric taxa, respectively) and 62 genera. If we consider absolute values, the richest islet is PRE with 46 taxa, followed by FLE (32), while both GAL and ROT host only 11 species. A simplified analysis of species/area relationship seems to separate the most isolated islets from those that are near to the main islands. In fact, the value of the rate nr taxa/m^2 is 0.011 and 0.015 for PRE and GAL, respectively, while it is 0.026 for ROT and 0.033 for FLE.

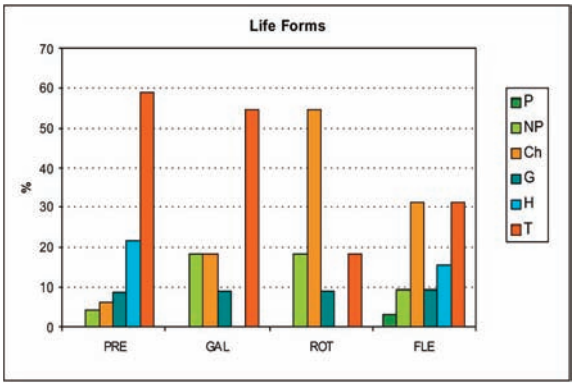
Although the striking differences concerning both the life-form spectrum (e.g. stark prevalence of therophytes only on PRE and GAL, high variability of the percentage of chamaephytes, total absence of hemicryptophytes in GAL and ROT: Fig. 10) and the chorological spectrum (e.g. absolute dominance of Mediterranean taxa only on FLE: Fig. 11) are still unexplained, this is not such a rare pattern on the very little islets, which often represent 'unbalanced biota'.

As for Ellenberg bioindicators values (Fig. 12), only R show some significant - and yet unexplained - variation between PRE e GAL (very high) and FLE (very low).

Although no real islet specialists have been detected, it should be underlined that the only two taxa whose presence has been recorded on all the four considered islets, i.e. *Arthrocnemum macrostachyum* and *Capparis spinosa* subsp. *rupestris*, are very common in all the circum-Sicilian islets and stacks (Pasta, 1997a).

Faunistic notes

The detected remains of *Mustela nivalis* on PRE represent the first record of the species for the whole Egadi Archipelago (Sarà, 1998; Siracusa & Lo Duca, 2008). Its regular presence on the islet seems quite improbable, while it might have reached PRE as a carcass picked up by a seagull or as a prey of the barn-owl, *Tyto alba* (Scopoli, 1769), or the buzzard, *Buteo buteo* (Linnaeus, 1758), two birds which occasionally feed on it according to Sarà & Zanca (1988) and Siracusa & Lo Duca (2008), respectively. As the western coast of Sicily seems to be too far away from PRE, future investigations on its occurrence should start from Favignana.



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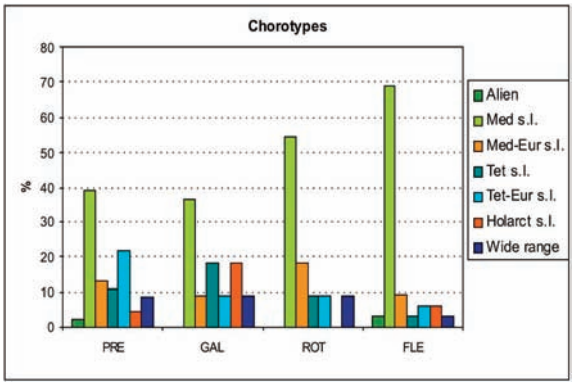

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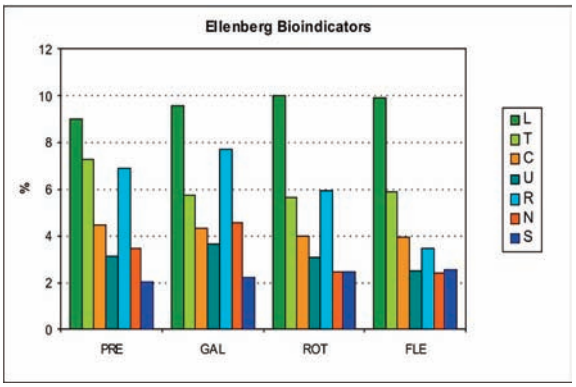

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Figure 10. Life-form spectrum of the vascular flora of each islet. Figure 11. Chorological spectrum of the vascular flora of each islet. Figure 12. average values of Ellenberg indicators concern-ing the vascular flora of each islet.

Considering that *Podarcis siculus* shows a high morphological plasticity and that all the micro-insular races described in the past are now treated as mere synonyms of the species, an accurate field data collection focused on many different meristic and morphological parameters should be carried out in order to assess the pattern and the range of variability of PRE and ROT lizard populations.

CONCLUSIONS

Small areas, few or no available niches: effects on microinsular assemblages

If compared with other islets with a similar size, like Strombolicchio on Aeolian Islands (Lo Cascio & Pasta, 2008a) or Lampione on Pelagian Archipelago (Lo Cascio & Pasta, 2012), the studied islets do not show a remarkable botanical value. Nonetheless, they give hospitality to nine species of biogeographic and/or conservation interest, i.e. *Dianthus rupicola* subsp. *rupicola*, *Iberis semperflorens*, *Limonium aegusae*, *Limonium bocconei*, *Limonium lojaconoi* (Fig. 13), *Limonium ponzoi*, *Helichrysum panormitanum*, *Polycarpon alsinifolium* and *Silene sedoides* subsp. *sedoides*, and to several plants which became extinct or are extremely rare on Egadi islands: for example, at FLE thrive 4 out of less than 10 plants of *Chamaerops humilis* present in the whole Egadian archipelago, while PRE hosts perhaps the last individual of *Ranunculus bullatus*, apparently extinct at Favignana (S. Pasta, pers. obs.). The same "refugium" role is played by Strombolicchio, which hosts the only known Aeolian (and Sicilian) populations of *Ephedra podostylax* Boiss. and *Eokochia saxicola* (Guss.) Freitag et G. Kadereit (Lo Cascio & Pasta, 2008b).

On the other hand, only two aliens, probably recently introduced by seagulls, i.e. *Solanum lycopersicum* (PRE) and *Malephora crocea* (FLE), were noticed. The first one behaves as a casual on many little islets (Lo Cascio & Pasta, 2008b; Caldarella et al., 2010), while the second is becoming a more and more frequent invasive within the halo-lithophilous communities of circum-Sicilian islands (Romano et al., 2006).

Figure 13. *Limonium lojaconoi*: Prèveto (photo L. Scuderi)

Goodbye or see you soon?

Although they have visited PRE and GAL nearly in the same period, the check-lists written down by the two different couples of co-authors show rather striking differences, perhaps because of the different intensity and duration of summer drought period. For example, this could be the case of all the 11 species (*Avena* cfr. *barbata*, *Bellis annua*, *Calendula arvensis*, *Chenopodium opulifolium*, *Diplotaxis erucoides*, *Erodium malacoides* and *E. moschatum*, *Lagurus ovatus*, *Solanum lycopersicum*, *Sonchus tenerrimus* and *Urtica membranacea*) which have been observed at PRE only by A & JS. The presence and commonness of these annual pioneer therophytes linked to disturbed habitat is probably subject to annual fluctuations due to local climatic regime and species patterns (e.g. low numbered and/or extremely localized populations).

The same goes also for 13 of the 15 taxa which have been seen only by LS & SP, i.e. two hemicryptophytes (*Ferula communis* and *Parietaria lusi-*

tanica) and 11 therophytes (*Centaurium tenuiflorum*, *Frankenia pulverulenta*, *Hordeum leporinum*, *Parapholis incurva*, *Polycarpon alsinifolium*, *Ranunculus bullatus*, *Sedum litoreum*, *Sideritis romana*, *Silene sedoides* subsp. *sedoides* and *Valantia muralis* which may have been totally undetectable after summer period, while *Limonium bocconei* was probably neglected by A and JS). As concerns *Halimione portulacoides* and *Sporobolus pungens* once recorded at GAL, considering their perennial life-cycle as well as the very little size of the islet, they must be considered as locally extinct.

Rather dramatic changes recently affected many different micro-insular systems of W Mediterranean area (e.g. Bocchieri, 1998; Lo Cascio & Pasta, 2010, 2012; Caldarella et al., 2010). In order to avoid a misinterpretation of Species/Area relationships, an overestimation of species turnover processes and to allow a better understanding of the rate and the driving-forces of such mechanisms, standard, regular and long-lasting data collections are needed (Walter, 2004).

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