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Geobotanical aspects of *Cytisus oromediterraneus* and *Genista cinerascens* in Serra da Estrela (Portugal)

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Abstract
In this paper we present the results of a geobotanical study carried out on the communities of *Cytisus oromediterraneus* and *Genista cinerascens* in Serra da Estrela, two species that in the Central Iberian Peninsula lead the associations *Cytiso oromediterranei-Genistetum cinerascentis* and *Pteridio aquilini-Cytisetum oromediterranei*. The prime objective was to describe their geographical and main ecological features, floristic structure and composition, as well as local dynamics. The sampling analyses were carried out using Braun–Blanquet's methodology, and respective outcomes were studied using the phytosociological methodology, combined with a statistic analysis performed through the Vegana package. The results indicate that the Portuguese community of *Cytisus oromediterraneus* and *Genista cinerascens* represents a new association, that we called *Teucrio salviastri-Cytisetum oromediterranei*. This is an association endemic from the Estrelensean territories, siliceous, hyperhumid to ultrahyperhumid, present in supra-orotemperate territories with evident Mediterranean influence.

Key words: *Cytisus oromediterraneus*; *Genista cinerascens*; Estrelensean sector; phytosociology; climate change.

Introduction

The five Mediterranean-climate regions of the world occupy around 5% of the land surface but shelter nearly 20% of known vascular plant species (Cowling *et al*. 1996 in Thompson, 2005). Within them, the Mediterranean basin (including Portugal) is a hot spot of plant diversity with about 24000 species (10% of known plant species) present in a small part of the world (Greuter, 1991). One of its most particular territories is the Iberian Peninsula whose geographical position, geological history, climate, relief and ancient human presence, had played a fundamental role in shaping plant diversity. The known botanical richness of Portugal and Spain mainland, comprises around 7000 plant species and subspecies, more than 1400 of them endemic from this region (Rivas-Martínez, 1999) and about 500 Iberian endemics whose distribution also extends into the Rif in northern Morocco (Thomson, 2005). One of the essential factors that determines the Iberian biodiversity is the multiplicity of climate conditions. Here converge two major climate types: the Mediterranean that dominates most of the Peninsula, and the Eurosiberian, present in the north-west and along a narrow band parallel to the north coast (Peinado & Rivas-Martínez, 1987; Rívas-Martínez *et al*. 1999). In addition the Iberian Peninsula is also marked by important reliefs, particularly several mountain systems characterized by high diversity and, often, high levels of endemicity.

The major objective of the present work was to investigate the main geobotanical aspects, in Serra da Estrela, of two endemic species from the western Mediterranean montains: 1. *Cytisus oromediterraneus* Rivas-Mart., T. E. Díaz, Fern. Prieto, Loidi et Penas, an exclusive plant from the center and south of France, as well as from the center and north of the Iberian Peninsula; 2. *Genista cinerascens* Lange, an endemism from the center and center-west of the Iberian Peninsula. In more detail, the aims of this study were: a) recognize the geographical and ecological features of the two species in Serra da Estrela; b) describe the respective community(s); c) understand the local vegetation dynamics.

Species and Study area

Cytisus oromediterraneus is a shrub with about a meter high, natural from several mountain of the center and south of France and the center and north of the

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Iberian Peninsula. The name *Cytisus purgans* auct. non L. was incorrectly applied to this taxon in the past. However, in the last decades, several taxonomic studies have reviewed the *C. purgans* s. l. (López et Jarvis, 1984; Rivas-Martínez *et al*., 1984; Talavera & Gibbs, 1997; Cantó & Riva-Martínez, 2002). Lopez & Jarvis (1984) reject the use of the name *Cytisus purgans* (L.) Boiss. for the European specimens because they found that was based on a spiny type specimen belonging to *Genista scorpius* (L.) DC. (*Spartium scorpius* L., Sp. Pl. 708. 1753). They also proposed the use of the name *C. balansae* (Boiss.) Ball, as substitute and recognized two different varieties: var. *balansae*, from North Africa and var. *europaeus* G. López and Jarvis from south Europe. Currently, after several reviews from different authors, Flora Iberica considers the existence of two different species in Europe, both derived from the *C. balansae* var. *europaeus* group: *C. oromediterraneus* present in France and in the centre and north of the Iberian Península; and *C. galianoi* Talavera et P.E. Gibbs, endemic from Sierra Nevada and Sierra de los Filabres (South of Spain).

In Portugal, both *Cytisus oromediterraneus* and *Genista cinerascens* have a restrict distribution, almost confined to Serra da Estrela, reason why it is the main study area of the present work. *Cytisus oromediterraneus* seems to be exclusive from this territory. We found no evidences of its presence in surrounding mountain territories (Silveira, 2000; Almeida, 2009). The same does not happen with *Genista cinerascens*, a phanerophyte species that can be found occasionally in some locations in the north of Serra da Estrela (Almeida, 2009). Both are mountain species present in transition zones between Mediterranean-Eurosiberian macrobioclimate and, therefore, they can play an important role as bioindicators of local and regional climate changes.

Serra da Estrela, with 1993 m, is the highest mountain in Portuguese mainland and integrates a biogeographic unit known as Estrelensean sector (Carpetan-Leonese Subprovince). Part of the Central Iberian System, on its most oceanic segment, Serra da Estrela is dominated by siliceous substrates, mostly granite and schist, and a landscape with clear evidences of the last major glaciation (Ferreira 1993; Ferreira & Vieira, 1999; Vieira & Ferreira, 1998; Vieira, 2005; Vieira, 2004). The geographical particularities of this territory, sited in transition areas between Mediterranean and Temperate macrobioclimates, together with the territory orography, allows the existence of several bioclimatical stages: mesomediterranean, mesotemperate, supramediterranean, supratemperate, and orotemperate (with all the temperate stages having a submediterranean character). The local vegetation *is* highly diverse (Henriques, 1883; Braun-Blanquet *et al*. 1952; Malato-Beliz, 1955; Duvigneaud 1962; Rivas-Martínez, 1974, 1981; Rivas-Martinez *et al*., 2000; Pinto da Silva & Teles, 1986; Jansen, 1994, 1997, 1998, 2002; Jansen & Sequeira, 1999; Jansen & Paiva, 2000; Meireles *et al*., 2006; Meireles *et al*., 2008; Meireles *et al*., 2009; Meireles, 2010; Meireles & Pinto Gomes, 2012; Meireles *et al*., 2012) with the presence of several climatophilous series: 1. *Lycopodio clavati-Junipero nani* $\sum$.; 2. *Saxifrago spathularis-Betulo celtibericae* $\sum$.; 3. *Holco mollis-Querco pyrenaicae* $\sum$.; 4. *Arbuto-Querco pyrenaicae cytisetoso grandiflori* $\sum$.; and 5. *Viburno tini-Querco roboris* $\sum$. (Meireles *et al*., 2012).

Materials and Methods

Sampling

For the vegetation analysis we used a phytosociological approach, according with the proposal of Zurich-Montpellier school (according to Braun-Blanquet, 1979; Géhu & Rivas-Martínez, 1981 and modernized by Rivas-Martínez, 2005; Géhu, 2006; Biondi, 2011; and Pott, 2011). Data sampling was carried out in spring and summer of 2006-2009 during the fieldwork of a PhD. developed in Serra da Estrela. Nomenclatural references used on flora followed the overall work of Flora Ibérica (Castroviejo *et al*., 1986-2010), Nova Flora de Portugal (Franco, 1971 & 1984; Franco & Rocha Afonso, 1994-2003) and the main list of Rivas-Martínez *et al*. (2002). The adopted sintaxonomical nomenclature was the one present in the works of Rivas-Martínez *et al*. (2001, 2002) and Costa *et al*. (2012). Biogeographical information followed the proposals of Costa *et al*. (1998) and Rivas-Martinez (2007).

Statistical analysis

In order to support the observations made in the fieldwork and the overall analysis of the authors we performed a numerical analysis using the *Vegana* package, specifically the programs "Quercus" and "Ginko" (Cáceres *et al*. 2003; Font, 2005). An agglomerative analysis was performed through the algorithm UPGMA (Unweighted Pair-Group Arithmetic Mean Method) and a Bray-Curtis dissimilarity matrix. In this numerical analysis we contrast the relevés obtained in our fieldwork with those from the original tables of similar communities referred for the same Subprovince: 26 relevés from *Cytiso oromediterranei-Genistetum cinerascentis* Rivas-Martínez 1970 corr. Rivas-Martínez et Cantó 1987 (Rivas-Matínez *et al*., 1970); and 11 from relevés *Pteridio aquilini-Cytisetum oromediterranei* Gavilán, Cantó, Fernández-González, Rivas-Martínez et Sánchez-Mata (Rivas-Martínez *et al*., 2002). In all cases, taxonomic references were homogenized and Braun-Blanquet's abundance indexes were converted to the scale of 0-9 proposed by Van Der Maarel (1979).

Tab. 1 - Synthetic table with floristic comparison between: estrelensean communities (Ts-Co; 13 relevés); *Cytiso oromediterranei-Genistetum cinerascentis* (Co-Gc; 26 relevés) and *Pteridio aquilini-Cytisetum oromediterranei* (Pa-Co; 11 relevés).

Characteristics species	Co-Gc	Pa-Co	Ts-Co
Cytisus oromediterraneus Rivas Mart., Díaz, Prieto, Loidi & Penas	V	V	V
Genista cinerascens Lange	V	V	III
Pteridium aquilinum (L.) Kuhn	III	V	.
Cytisus scoparius (L.) Link	IV	II	.
Orobanche rapum-genistae Thuill.	.	I	II
Adenocarpus argyrophyllus (Rivas Goday) Caball.	I	.	.
Echinospartum barnadesii (Graells) Rothm.	I	.	.
Genista florida L. subsp. florida	I	.	.
Cytisus multiflorus (L'Hér.) Sweet	I	.	.
Adenocarpus hispanicus subsp. gredensis Rivas Mart. & Belmonte	.	.	II
Teucrium salviastrum Shreb.	.	.	IV
Companion species			
Corynephorus canescens (L.) Beauv.	IV	I	III
Festuca elegans Boiss.	IV	.	I
Festuca ovina subsp. laevis Hack.	IV	.	.
Jasione sessiliflora Boiss. & Reut.	III	.	III
Agrostis truncatula Parl.	II	III	.
Celtica gigantea (Link) F. M. Vazquez & Barkworth	II	III	.
Thymus zygis L.	II	II	.
Quercus pyrenaica Willd.	II	I	I
Festuca gredensis Fuente & Ortúñez	II	.	.
Santolina rosmarinifolia L.	II	.	.
Arrhenatherum carpetanum ined.	I	III	IV
Luzula lactea Link ex E.H.F. Mey.	I	III	I
Pinus sylvestris var. iberica Svob.	I	III	.
Agrostis castellana X tenuis	I	II	.
Juniperus communis subsp. hemisphaerica (C. Presl) Nyman	I	II	.
Lavandula pedunculata (Mill.) Cav.	I	II	.
Hieracium castellanum Boiss. et Reut.	I	I	II
Plantago radicata Hoffmanns. & Link	I	I	I
Spergula morisonii Boreau	I	I	I
Linaria spartea (L.) Chaz.	I	I	.
Rosa canina L.	I	I	.
Rosa corymbifera Borkh.	I	I	.
Sorbus aucuparia L.	I	I	.
Thymus mastichina (L.) L.	I	I	.
Arenaria intricata (Ser.) Rivas Mart. & J.M. Costa	I	.	.
Asperula cynanchica L.	I	.	.
Aster aragonensis Asso	I	.	.
Carduus gayanus Durieu ex Willk.	I	.	.
Carex muricata L.	I	.	.
Centaurea alba L.	I	.	.
Cerastium ramosissimum Boiss.	I	.	.
Conopodium majus auct.	I	.	.
Deschampsia flexuosa (L.) Trin.	I	.	.
Digitalis thapsi L.	I	.	.
Echium fontanesii DC.	I	.	.
Taeniatherum caput-medusae (L.) Nevski	I	.	.
Euphorbia oxyphylla Boiss. in DC.	I	.	.
Festuca durandoi Clauson	I	.	.
Logfia minima (Sm.) Dumort.	I	.	.
Helichrysum stoechas (L.) Moench	I	.	.
Hieracium pilosella L.	I	.	.
Holcus gayanus Boiss.	I	.	.
Jurinea humilis (Desf.) DC.	I	.	.
Lactuca chondrilliflora Boreau	I	.	.
Linaria elegans Pourr. ex Cav.	I	.	.
Lotus corniculatus subsp. carpetanus	I	.	.
Nardus stricta L.	I	.	.
Molineriella laevis (Brot.) Rouy	I	.	.
Phleum pratense L.	I	.	.
Polytrichum juniperinum Hedw.	I	.	.
Rosa villosa L.	I	.	.
Santolina oblongifolia Boiss.	I	.	.
Leucanthemopsis pallida (Mill.) Heywood	I	.	.
Teesdalia nudicaulis (L.) R. Br.	I	.	.
Thapsia villosa L.	I	.	.
Thymus pulegioides L.	I	.	.
Trisetum ovatum (Cav.) Pers.	I	.	.
Festuca rubra L.	I	.	.
Avenella flexuosa subsp. iberica (Rivas Mart.) García-Suárez, Fern.-Carv. & Fern. Prieto	.	IV	.
Avenula sulcata (Gay ex Boiss.) Dumort.	.	III	II
Lactuca viminea (L.) J. et C. Presl	.	III	I
Koeleria caudata subsp. crassipes (Lange) Rivas Mart.	.	III	.
Linaria nivea Boiss. & Reut.	.	III	.
Festuca indigesta subsp. curvifolia (Lag. ex Lange) Rivas Mart., Fuente & Ortúñez	.	II	.
Thymus bracteatus subsp. borgiae (Rivas Mart., A. Molina & G. Navarro) Rivas Mart.	.	II	.
Arenaria montana L.	.	I	II
Arenaria querioides Pourr. ex Willk.	.	I	II
Digitalis purpurea subsp. carpetana (Rivas Mateos) Rivas Mart., Fern. Gonz. & Sánchez Mata	.	I	I
Armeria lacaitae (Villar) Rivas Mart.	.	I	.
Carduus carpetanus Boiss. & Reut.	.	I	.
Jasione montana L.	.	I	.
Leucanthemopsis alpina (L.) Heywood	.	I	.
Lotus carpetanus Lacaita	.	I	.
Ononis spinosa L.	.	I	.
Crataegus monogyna Jacq.	.	I	.
Erica arborea L.	.	.	IV
Festuca summilusitana Franco & Rocha Afonso	.	.	IV
Agrostis truncatula subsp. commista Castrov. & Charpin	.	.	III
Dianthus lusitanus Brot.	.	.	III
Phalacrocarpon oppositifolium (Brot.) Willk.	.	.	III
Rumex acetosella subsp. angiocarpus (Murb.) Murb.	.	.	III
Agrostis x fouilladae Fouill. ex P.Fourn	.	.	II
Erica australis subsp. aragonensis (Wk.) P.	.	.	II
Halimium alyssoides (Lam.) C. Koch	.	.	II
Hypochoeris radicata L.	.	.	II
Juniperus communis subsp. alpina (Neilr.) Celak	.	.	II
Sedum brevifolium DC.	.	.	II
Silene acutifolia Link ex Rohrb.	.	.	II
Viola langeana Valentine	.	.	II
Allium sphaerocephalon L.	.	.	I
Calluna vulgaris (L.) Hull	.	.	I
Coincya monensis subsp. orophila (Franco) Aedo, Leadlay et Muñoz Garm.	.	.	I
Cytisus striatus (Hill) Rothm.	.	.	I
Dianthus laricifolius Boiss. & Reuter	.	.	I
Echinospartum ibericum subsp. pulviniformis (Rivas Mart.) Rivas Mart.	.	.	I
Erica umbellata L.	.	.	I
Genista florida subsp. polygaliphylla (Brot.) Cout.	.	.	I
Murbeckiella boryi (Boiss.) Rothm.	.	.	I
Narcissus asturiensis (Jordan) Pugsley	.	.	I
Ranunculus nigrescens Freyn in Willk. & Lange	.	.	I

Results

The fieldwork showed the presence of both target species in the higher territories of Serra da Estrela. Usually *Cytisus oromediterraneus* occurs between the 1400 m and the top of the mountain. However, *Genista cinerascens* can occasionally descend to lower altitudes (aprox. 900-950 m), and only in rare cases reaches heights greater than 1750 m. Differing from our initial conception, based on the scarce information available, *Genista cinerascens* is a relatively common

species in the upper southeastern territories of Serra da Estrela, probably almost unnoticed by its apparent similarity with *Genista florida* subsp. *poligaliphylla* Brot. In addition to the taxonomical differences, we noticed that the particular ecology of each species is quite distinct. *Genista cinerascens* lives in more xerophytic locations than *Genista florida* subsp. *poligaliphylla*, with less water available during summer and high insolation levels, features that occasionally create a topographic supramediterranean in the predominant supratemperate territory.

Both *Cytisus oromediterraneus* and *Genista cinerascens* are present in soils originated by granitic rocks, sometimes in soils with some depth, but also in rugged environments composed by large stone blocks, in stations with great insolation and high water stress during the summer. The results illustrate that in lower territories, especially in topographic supramediterranean, both species have identical ecology, integrating the same dense scrubland community, where they are dominant species. However, at higher altitudes, in orotemperate territories, with a patent submediterranean character, these formations come to be largely dominated by *Cytisus oromediterraneus*. In these territories *Genista cinerascens* disappears and only survives very occasionally in rare deep sheltered situations. The fieldwork crossed with other local vegetation works (Meireles, 2010; Meireles & Pinto-Gomes, 2012; Meireles *et al*., 2012) also revealed that these taxa are present in territories marked by two Climatophilous series: *Lycopodio clavati-Junipero nanae sigmetum* and *Holco mollis-Querco pyrenaicae sigmetum*.

The output relevés (Table 1) reveal a community very rich in flora species, with several Iberian endemisms: [e.g. *Festuca summilusitana* Franco et Rocha Afonso, *Adenocarpus hispanicus* subsp. *gredensis* Rivas Mart. et Belmonte, *Jasione sessiliflora* Boiss. et Reut., *Arenaria querioides* Pourr. ex Willk., *Viola langeana* Valentine, *Silene acutifolia* Link ex Rohrb., *Narcissus asturiensis* (Jord.) Pugsley], among others from which we highlight *Teucrium salviastrum* Schreb. subsp. *salviastrum*, a Portuguese endemism.

In contrast with the association previously referred for this territory (*Cytiso oromediterranei-Genistetum cinerascentis*), as well as with *Pteridio aquilini-Cytisetum oromediterranei*, we observed the entrance of

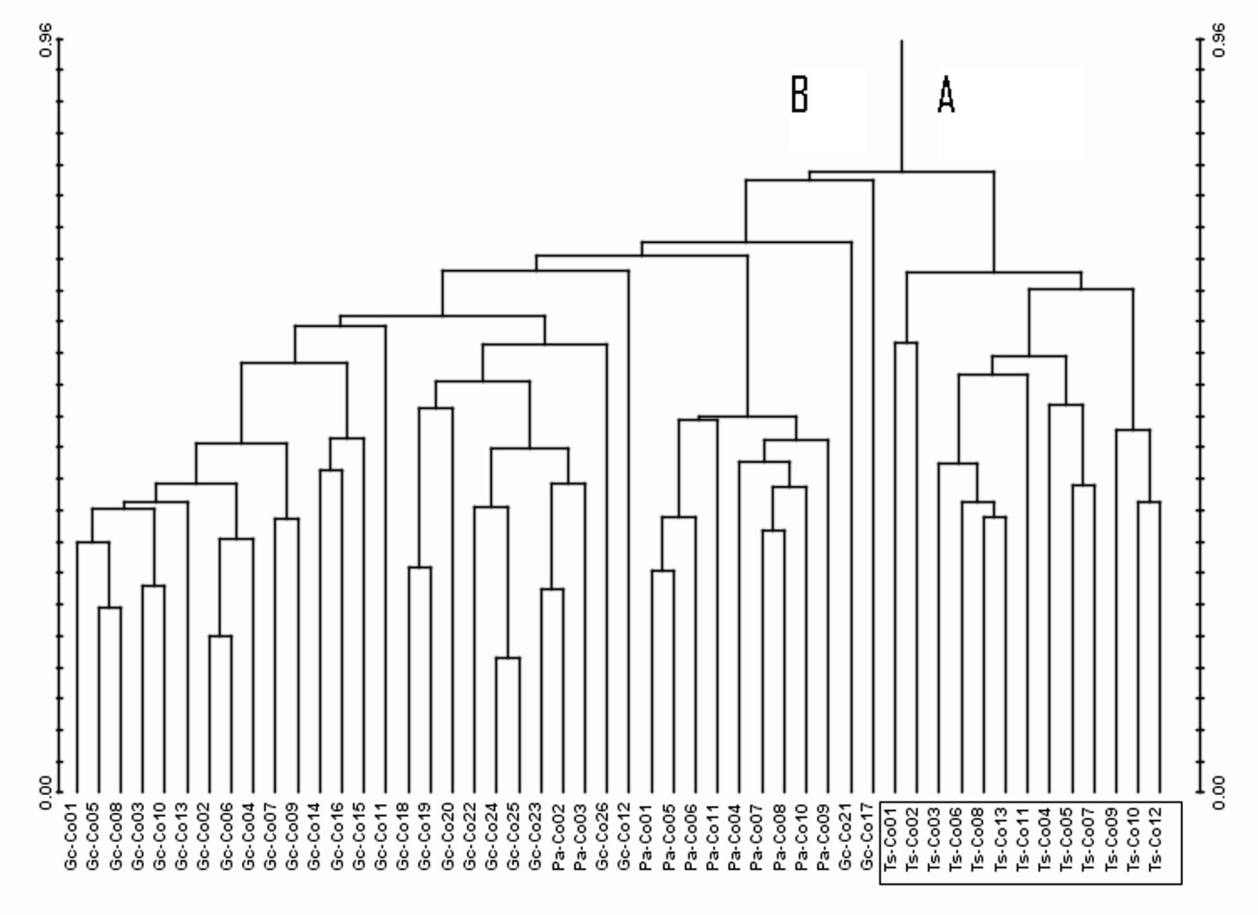

Fig. 1 - Dendrogram obtained by contrast the relevés from Serra da Estrela *Teucrio salviastri-Cytisetum oromediterranei* (group Ts-Co:01-13) with the original relevés from *Cytiso oromediterranei-Genistetum cinerascentis* (group Gc-Co:01-26) and *Pteridio aquilini-Cytisetum oromediterranei* (group Pa-Co: 01-11).

Tab. 2 - Table of *Teucrio salviastri-Cytisetum oromediterranei* ass. nova.

Ordinal number	1	2	3	4	5	6	7	8	9	10	11	12	13	
Exposure	O	NO	S	NO	S	E	S	SE	E	S	S	O	S	
Slope (º)	10	20	25	10	10	15	20	80	5	8	35	2	45	
Altitude (x 10m)	155	162	178	155	157	163	160	168	169	190	176	170	185	
Cover (%)	90	98	100	95	100	90	80	85	90	90	95	100	95	
Area (m^2)	16	100	200	100	100	200	200	200	100	9	200	100	100	
Species richness	12	14	17	21	19	17	20	20	6	10	10	10	11	
Charact. and diff. Sp. of Ass.														
Cytisus oromediterraneus	4	4	1	4	5	3	2	2	5	5	4	5	4	V
Teucrium salviastrum	.	1	1	.	2	1	2	2	.	1	2	.	1	IV
Cytisus striatus	.	.	.	.	+	.	1	.	.	.	.	.	.	II
Orobanche rapum-genistae	.	.	.	.	.	1	.	.	.	.	2	.	1	I
Adenocarpus hispanicus subsp. gredensis	.	.	.	.	.	.	.	1	.	.	.	.	1	I
Diff of subass. *genistetosum cinerascentis*								.						
Genista cinerascens	1	2	4	1	.	3	4	4	.	.	.	.	.	III
Erica australis subsp. aragonensis	2	3	1	1	.	.	.	.	.	.	.	.	.	II
Luzula lactea	.	1	.	.	+	.	.		.	.	.	.	.	I
Arenaria montana	.	.	2	+	+	.	.	.	.	.	.	.	.	I
Other species														
Arrhenatherum carpetanum	1	.	2	2	3	2	2	2	.	2	.	+	3	IV
Festuca summilusitana	.	1	2	.	.	3	.	2	1	1	3	+	2	IV
Erica arborea	.	.	2	2	2	2	1	2	.	.	2	2	2	IV
Jasione sessiliflora	2	.	2	1	2	.	1	1	.	.	+	.	+	III
Corynephorus canescens var. montana	2	.	.	+	1	+	1	.	.	.	+	+	.	III
Agrostis truncatula subsp. commista	1	1	.	.	.	2	2	1	.	1	.	1	.	III
Deschampsia flexuosa subsp. iberica	.	+	3	.	1	+	1	2	.	.	.	.	2	III
Rumex acetosella subsp. angiocarpus	.	.	1	+	+	.	2	.	+	1	.	.	.	III
Phalacrocarpum oppositifolium	.	.	+	1	.	1	1	2	.	3	.	.	1	III
Dianthus lusitanicus	.	.	+	.	+	2	.	2	.	+	.	+	1	III
Hieracium castellanum	2	.	.	+	1	.	1	+	.	.	.	1	.	II
Arenaria querioides	2	1	.	1	.	.	.	.	+	.	+	.	.	II
Sedum brevifolium	.	1	1	+	.	+	.	+	.	+	.	1	.	II
Hypochoeris radicata	.	1	+	.	+	.	1	.	.	.	+	.	.	II
Avenula sulcata	.	.	1	1	2	.	3	.	.	.	2	.	.	II
Halimium alyssoides	.	1	.	1	3	.	.	.	.	.	.	.	.	II
Viola langeana	.	.	.	+	.	+	+	.	.	.	.	.	.	II
Agrostis x fouilladae	.	.	.	.	2	+	2	+	.	.	.	.	.	II
Juniperus communis subsp. alpina	.	.	.	.	.	2	.	.	1	2	.	2	.	II
Silene acutifolia	.	.	+	.	.	+	.	2	.	.	.	.	.	II
Genista florida subsp. polygaliphylla	+	.	.	.	.	.	.	1	.	.	.	.	.	I
Lactuca viminea	.	.	.	+	.	.	+	.	.	.	.	.	.	I
Sporadic species	2	2	0	4	2	0	2	2	1	0	0	1	0	

presences

several taxa typical from territories with more atlantic influence, such as *Teucrium salviastrum*, *Festuca summilusitana*, *Phalacrocarpum oppositifolium* (Brot.) Willk., Halimium alyssoides (Lam.) K. Koch, *Viola langeana* Valentine, *Narcissus asturiensis* (Jord.) Pugsley, among others (Table 1). We also notice the absence of species that are exclusive or more frequent in the interior of the Iberian Peninsula. For example, *Genista florida* subsp. *florida*, *Thymus zygis* Loefl. ex L., *Festuca gredensis* Fuente et Ortúñez, *Santolina rosmarinifolia* L. (present in *Cytiso oromediterranei-Genistetum cinerascentis*) or *Pinus sylvestris* var. *iberica* Svob, *Linaria nivea* Boiss. et Reut., *Thymus bracteatus* Lange ex Cutanda, *Festuca curvifolia* Lag. ex Lange, among others (present in *Pteridio aquilini-Cytisetum oromediterranei*). Another very particular feature of Serra da Estrela communities is the high frequency of *Erica arborea* L., species that only appears occasionally in relevés from the typical *Cytiso oromediterranei-Genistetum cinerascentis*. These characteristic approaches the Estrelensean community to the *Cytiso oromediterranei-Genistetum cinerascentis* subass. *ericetosum arboreae* proposed by Rivas-Martínez et Canto (1987) for Serra de Guadarrama (Spain) and also later referred by other authors (Fernández-González, 1991; Sardinero, 2004).

Discussion

The syntaxonomical checklist of vascular plant communities of Spain and Portugal, and respective addenda (Rivas-Martínez *et al*., 2001, 2002) refers the existence of two associations dominated by *Cytisus oromediterraneus* and/or *Genista cinerascens* in the Carpetan-Leonese Subprovince, the biogeographical entity in which the study territory is included. *Cytiso oromediterranei-Genistetum cinerascentis* was first described by Rivas-Martínez for the Iberian Central Range and later documented in several territories of the carpetan-Leonese Subprovince (Costa, 1974; Ri-

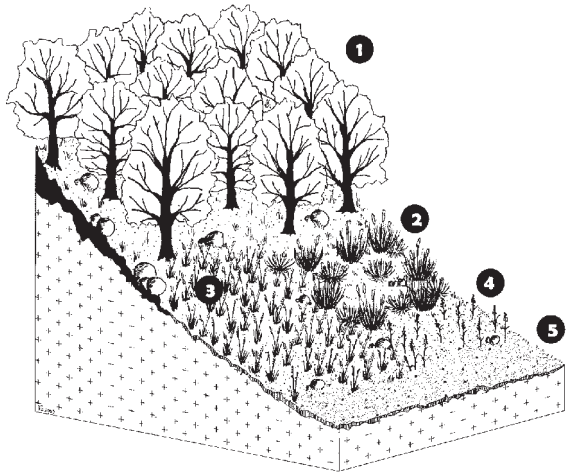

Fig. 2 - Simplified scheme of the Pyrenean oak series (*Holco mollis-Querco pyrenaicae sigmetum*) in Serra da Estrela, in its variant present on granite upper-supramediterranean territories (*in* Meireles, 2010). 1. *Holco mollis-Quercetum pyrenaicae*; 2. *Teucrio salviastri-Cytisetum oromediterranei genistetosum cinerascentis*; 3. *Minuartia juresii-Festucetum summilusitanae*; 4. Community of *Arrhenatherum carpetanum*; 5. *Arenario-Cerastietum ramosissimi*.

vas-Martinez & Cantó, 1987; Navarro *et al*., 1987; Sánchez-Mata, 1989; Amor, 1991; Fernández González, 1991; Sardinero, 2004). More recently, Gavilán *et al*. in Rivas-Martínez *et al*. (2002) described another association from the Guadarramean Sector (*Pteridio aquilini-Cytisetum oromediterranei*), present in supramediterranean and supratemperate submediterranean belts, in sub-humid and humid ombroclimates, and which represent the first substitution stage of the *Pteridio-Pinetum ibericae* woods and the Pyrenean oak forests of the *Luzulo-Quercetum pyrenaicae galietosum rotundifolii* (Rivas-Martínez *et al*., 2002).

The particular floristic composition of the communities of *Cytisus oromediterraneus* and *Genista cinerascens* present in Serra da Estrela, together with the fact that we are in a specific biogeographic territory (Estrelensean Sector), strongly suggest that this is a new association, different from those described for the same subprovince. We called this new syntaxa *Teucrio salviastri-Cytisetum oromediterranei* ass. nov. hoc loco (*Genistion floridae, Cytisetalia scopario-striati, Cytisetea scopario-striati*) (Holotypus: inv. 8, Tab.2). This is a siliceous association formed by *Cytisus oromediterraneus* and/or *Genista cinerascens*, biogeographically distributed in the Estrelensean Sector of the Carpetan-Leonese Subprovince, in supratemperate and orotemperate territories, both submediterranean (also in topographic supramediterranean), in hyperhumid to ultrahyperhumid ombroclimates. We also recognise two different subasociations: 1. the typical, present in submediterranean orotemperate territories, market especially by the absence of *Genista cinerascens* (subass. *cytisetosum oromediterranei*), being present in the dynamics of the *Lycopodio clavati-Junipero nanae sigmetum*; 2. and a supratemperate subassociation, (*genistetosum cinerascentis* subass. nov. hoc loco, typus: inv 3, table 2), marked by the presence of several species that do not reach the submediterranean orotemperate belt (*Genista cinerascens, Erica australis* subsp. *aragonensis* (Willk.) Cout. or *Luzula lactea* Link ex E.H.F. Mey.) and present in the dynamics of the local Pyrenean Oak (*Quercus pyrenaica* Willd.) forests of *Holco mollis-Querco pyrenaicae sigmetum*, (Figure 2) in a variant described for the granitic upper supramediterranean territories (Meireles *et al*., 2012; Meireles & Pinto-Gomes, 2012).

In conclusion, this work contributes to the characterization of the geobotanical issues of *Cytisus oromediterraneus* and *Genista cinerascens* in Portugal. From the results we can see that this is a unique community, very rich in endemic flora and, therefore, very important in terms of conservation value. Its ecological position is also very particular taking refuge in the high territories with marked Mediterranean influence, especially on slopes facing south and southeast. This specificity makes this community (and also both dominant species) particularly interesting as a possible indicator for local climate change, monitoring both temperature change and displacements in Mediterranean/Temperate influences.

Currently, this community is not at risk in Serra da Estrela, since it is well represented and, mainly because of the after fire behavior of *Cytisus oromediterraneus* (Fernández-Santos, 2004) is not especially affected by local human activities. Also because it is included in a Protected Area/Nature 2000 and is classified under the Habitats Directive (Habitat 5120).

Syntaxonomical scheme

TUBERARIETEA GUTTATAE Br.-Bl. in Br.-Bl.
Tuberarietalia guttatae Br.-Bl. in Br.-Bl., Molinier & Wagner 1940
Molinerion laevis Br.-Bl., P. Silva, Rozeira & Fontes 1952
Arenario-Cerastietum ramosissimi Br.-Bl., P. Silva, Rozeira & Fontes 1952
FESTUCETEA INDIGESTAE Rivas Goday & Rivas-Martínez 1971
Jasiono sessiliflorae-Koelerietalia crassipedis Rivas-Martínez & Cantó 1987
Hieracio castellani-Plantaginion radicatae Rivas-Martínez & Cantó 1987
Minuartio juresii-Festucetum summilusitanae Meireles, Pinto-Gomes & Costa in Costa, Neto, Aguiar, Capelo,

Espirito-Santo, Honrado, Pinto-Gomes, Monteiro-Henriques, Sequeira & Lousã, 2012
CYTISETEASCOPARIO-STRIATIRivas-Martínez 1975
Cytisetalia scopario-striati Rivas-Martínez 1975
*Genistion floridae*Rivas-Martínez 1974
Cytiso oromediterranei-Genistetum cinerascentis Rivas-Martínez 1970 corr. Rivas-Martínez&Cantó 1987
Pteridio aquilini-Cytisetum oromediterranei Gavilán, Cantó, Fernández-González, Rivas-Martínez & Sán chez-Mata in Rivas-Martínez, Fernández-González & Sánchez-Mata 1986 corr. Rivas-Martínez& Sán chez-Mata 2002
Teucrio salviastri-Cytisetum oromediterranei ass. nova *hoc loco*
QUERCO-FAGETEA Br.-Bl. & Vlieger in Vlieger 1937
Quercetalia roboris Tüxen 1931
Quercion pyrenaicae Rivas Goday ex Rivas-Martínez 1965
Quercenion pyrenaicae
Holco mollis-Quercetum pyrenaicae Br.-Bl., P. Silva & Rozeira 1956

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Appendix 1: Sporadic species

Table 2: *Dianthus laricifolius* 1(+); *Murbeckiella boryi* 1(r); *Calluna vulgaris* 2(2); *Erica umbellata* 2(2); *Coincya monensis* subsp. *orophila* 4(+); *Narcissus asturiensis* 4(+); *Ranunculus nigrescens* 4(1); *Spergula morisonii* 4(1); *Allium sphaerocephalon* 5(+); *Festuca elegans* subsp. *merinoi* 5(+); *Digitalis purpurea* subsp. *carpetana* 7(+); *Pteridium aquilinum* 7(1); *Echinospartum ibericum* subsp. *pulviniformis* 8(2); *Quercus pyrenaica* 8(2); *Plantago radicata* 9(+); *Hieracium castellanum* 12(1).

Appendix 2: Localities of relevé

Table 2: 1. Covilhã: Unhais da Serra, próx. Nave de Santo António, 09-Ago-2007, 29TPE2063; 2. Covilhã, Cortes do Meio, Cascalvo, 21-Jul-2007, 29TPE2063; 3. Manteigas: Manteigas (S. Pedro), Cântaro Gordo, 09-Jun-2009, 29TPE1780; 4. Covilhã: Unhais da Serra, Nave de Santo António, 02-Jul-2007, 29TPE2063; 5. Covilhã: Unhais da Serra, cruzamento Nave de Santo António e Unhais, 07-Jul-2009, 29TPE2063; 6. Covilhã: Unhais da Serra, Alto da Nave de Santo António, 07-Jul-2009, 29TPE2063; 7. Covilhã: Unhais da Serra, Covão do Ferro, 09-Jul-2009, 29TPE1963; 8. Manteigas: S. Pedro (Manteigas), Cântaro Magro, 07-Jul-2009, 29TPE1964; 9. Manteigas: S. Pedro (Manteigas), próx. de Azimbres, 11-Jul-2006, 29TPE1968; 10. Covilhã: Unhais da Serra, Cântaro Raso, 26-Ago-2008, 29TPE1964; 11. Covilhã: Unhais da Serra, Espinhaço de Cão, 01-Jul-2008, 29TPE1964; 12. Covilhã: Unhais da Serra, Cântaro Raso, 01-Jul-2008, 29TPE1864; 13. Covilhã: Unhais da Serra, alto de Espinhaço de Cão, 31-Jul-2009, 29TPE1964.