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Syntaxonomical review of *Cytisetea scopario-striati* communities in central Spain

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Abstract: Gavilán, R.G., Vilches de la Serna, B. & Fernández-González, F. *Syntaxonomical review of Cytisetea scopario-striati communities in central Spain. Lazaroa 32: 29-72 (2011).*

A syntaxonomical study was carried out using techniques of multivariate analysis on the nanophanerophytic vegetation of Genistées included in the class *Cytisetea scopario-striati*, in the central Iberian Peninsula. 700 relevés -both published and unpublished- have been analysed using various types of classifications and ordinations in different stages. For this vast territory a total of 15 associations have been recognised, distributed into the four alliances traditionally recognised for the area: *Retamion sphaerocarpae, Genistion floridae, Genistion polygaliiphyllae* and *Ulici europaei-Genistion polygaliiphyllae*. The concepts of subassociation and variant recently developed have been applied in the syntaxonomical nomenclature. Of these three subassociations are proposed as new.

Keywords: *Cytisetea scopario-striati*, Genistées, mantle communities, Iberian Peninsula, multivariate analyses, relevés.

Resumen: Gavilán, R.G., Vilches de la Serna, B. & Fernández-González, F. *Revisión sintaxonómica de las comunidades de Cytisetea scopario-striati communities en el centro de España. Lazaroa 32: 29-72 (2011).*

Se presentan los resultados de una revisión sintaxonómica de las comunidades de Genisteas del centro de España incluidas en *Cytisetea scopario-striati*. 700 inventarios, publicados e inéditos han sido analizados por medio de técnicas exploratorias multivariables en distintos niveles de complejidad. Para este vasto territorio 15 asociaciones han sido reconocidas, distribuidas en las cuatro alianzas que, tradicionalmente, se han reconocido para esta área: *Retamion sphaerocarpae, Genistion floridae, Genistion polygaliiphyllae* y *Ulici europaei-Genistion polygaliiphyllae*. Los conceptos de subasociación y variantes desarrollados en años pasados han sido aplicados a la nomenclatura sintaxonómica y, así, se han reconocido tres nuevas subasociaciones.

Palabras clave: *Cytisetea scopario-striati*, Genisteas, orlas, Peninsula Ibérica, análisis multivariables, inventarios.

INTRODUCTION

The phytosociological study of the shrubby communities of Genistées included in the *Cytisetea scopario-striati* RIVAS-MARTÍNEZ 1975 in the central Iberian Peninsula has been extremely profuse. Numerous authors have carried out phytosociological studies in these mountains ranges, as well as in the areas around it. The first works to appear in the bibliography are those of BRAUN-BLANQUET and colleagues in Portugal (1952, 1964), and contained the earliest descriptions of this shrubby community comprising leguminous plants: *Lavandulo-Cytisetum multiflori*. Rivas Goday, in his works on the vegetation of Extremadura (1964), also studied this type of communities, and described the broom community of *Cytiso-Sarothamnetum eriocarpi*. Subsequently, RIVAS-MARTÍNEZ (1963, 1970, 1974, 1975) established the basis for the phytosociological study of these species and gave the name to the primary units: class, order and alliance. He also grouped the associations described until then into two alliances: *Retamion sphaerocarpae* and *Genistion*

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floridae, encompassing them within the order *Cytisetalia scopario-striati*. The same author studied *Cytisetea* in greater detail and published new associations (RIVAS-MARTÍNEZ, 1981), differentiating new alliances for the westernmost areas of the Sistema Central mountain range and for the north-western Iberian Peninsula: *Genistion polygaliiphyllae* (RIVAS-MARTÍNEZ & *al*., 1984) and *Ulici europaei-Genistion polygaliiphyllae* (RIVAS-MARTÍNEZ & *al*., 1991).

Since the early 1980s, the contributions to the knowledge of this type of vegetation have come primarily from territorial monographs, frequently derived from doctoral theses. Some of these works describe new associations (RIVAS-MARTÍNEZ & CANTÓ, 1987), others confirm communities which had been described illegitimately, as is the case of the broom communities included in the alliance *Retamion sphaerocarpae* (FUENTE, 1986; F. NAVARRO & *al*., 1987), while others provide detailed descriptions of certain associations and their variability in specific territories (F. NAVARRO & C. J. VALLE, 1983; VALDÉS, 1984; BELMONTE, 1986; RUIZ TÉLLEZ, 1988; SÁNCHEZ-MATA, 1989; FERNÁNDEZ-GONZÁLEZ, 1991; COSTA TENORIO & *al*., 1993; GAVILÁN, 1994; SARDINERO, 1994; CANTÓ, 2004). In total, the number of publications containing relevant information for the systematics of this type of vegetation in the Sistema Central range can be calculated at over 30, and the number of relevés published at around 650. Although approximately 15 associations and 45 subassociations have been described, no study has been made of the whole, although this procedure is necessary in order to establish the systematics and to extract the phytogeographical and floristic information contained in these communities (FOUCAULT, 1982). Moreover, the shrubby leguminous plants in the genera *Cytisus, Adenocarpus, Genista, Echinospartum*, etc., have an important centre of evolutionary diversification in the western part of the Iberian Peninsula, where they form communities which are significant on the scale of the landscape, and thus play a key role in the dynamic and functioning of the ecosystems. In view of all these considerations, the present work is designed to revise in its totality the maximum amount of information published up to the present. Due to the high number of relevés, the syntaxonomical study has been based on techniques of multivariate analysis in order to synthesise the whole of the multidimensional floristic variability to be found in this group.

MATERIALS AND METHODS

VEGETATION DATA

As part of a wider project which studied the relationships existing between vegetation and climate (GAVILÁN, 1994, GAVILÁN & FERNÁNDEZ, 1997, GAVILÁN & *al*., 1998, Gavilán, 2005), phytosociological relevés were taken of different types of plant communities in the areas around the weather stations located in the central area of Spain, which included the Sistema Central mountain range, as well as part of the two sub-plateaus, north and south, between the Duero and Tagus river basins. The plant communities involved in this study were the forests (*Quercetea ilicis* and *Querco-Fagetea*) and their closest successional communities: nanophanerophytic genistea communities (*Cytisetea scopario-striati*) and other chamaephytic communities included in the classes *Calluno-Ulicetea* and *Cisto-Lavanduletea*. It was necessary to analyse other serial communities in order to interpret forest types in deforested areas, with data collected by us but also from bibliographic resources. This work thus presents the results of these analyses of the shrubby communities of *Cytisetea scopario-striati*. The new concepts of subassociation and variant have been applied in the syntaxonomical nomenclature (RIVAS-MARTÍNEZ, 2005).

CLASSIFICATIONS

A range of agglomerative hierarchical classification methods have been used to analyse the vegetation data matrices. These techniques have a dual function; on the one hand they were applied to large matrices of relevés in order to extrapolate other smaller matrices which were easier to handle. These were then submitted to the same type of analysis in order to observe the relationships between some relevés with others

within the groups obtained and among the groups themselves. In most cases minimum variance clustering was used (BURR, 1970), -a technique designated by PODANI (1994) as h-SAHN- as it optimises the homogeneity within the groups, and is considered among all the agglomerative methods to be the one which establishes the clearest dichotomies and best classifies variables which are continuously varying, forming compact clusters (FEOLI-CHIAPELLA & FEOLI, 1977; WILDI, 1989; LAPOINTE & LEGENDRE, 1994). To measure similarity in the data from the vegetation analyses, we used Van Der Maarel's similarity ratio (1979) and a quantitative coefficient which excludes double zeros, a very common phenomenon in floristic matrices (ESCUDERO & *al*., 1994).

The vegetation data have been transformed and standardized by means of widely used methods, applying the square root and the standardization by totals method. The divisive classification method known as minimum spanning tree (MST) has also been applied to the synthetic matrices of relevés, whose overprinting on the ordination diagram proved to be extremely useful as a complement to the diagram, as it highlighted various relationships between the groups which were not clearly shown in the ordination, mainly due to the reduction in their dimensions which occurred in the ordination (PIELOU, 1984). The statistical packages used were MULVA-5 (WILDI & ORLOCI, 1996) and SYNTAX 2000 (PODANI, 2000).

ORDINATIONS

These techniques have been used on both simple and synthetic relevé matrices. They were applied in simple relevé matrices in order to corroborate the results of the agglomerative classifications carried out in the earlier phase. The comparison of both methods gave groups of homogeneous relevés which were subsequently synthesised. The set of these synthesised groups gave rise to other matrices whose final ordination and divisive classification (MST) was extremely useful for the study of the relationships existing between the different syntaxa and communities recognised, and in some cases contributed original perspectives on particular syntaxonomical issues. The techniques used were correspondence analysis (CA) and principal components analysis (PCA). The first was applied on vegetation relevé matrices due to the fact that this technique is very sensitive to the floristic variations found within them, an important factor in extracting groups of homogeneous relevés for synthetic purposes. The second was used with the data matrices in cases where the gradients involved showed a better fit with a linear model than with a unimodal model (TER BRAAK, 1987; ESCUDERO & *al*., 1994).

Finally, given the high number of relevés and the limitations of the programs, it was necessary to adapt the numerical methodology to each particular case. For this reason the relevé matrices were adapted mainly following the criterion of alliance, although the contacts between the alliances were taken into account, and were analysed in each case. Thus throughout the text below, an introduction is given to the numerical analysis of the data included in each alliance.

RESULTS AND DISCUSSION

CYTISETEA SCOPARIO-STRIATI RIVAS-MARTÍNEZ 1975

Woody shrub-like or nanophanerophytic vegetation, with a predominance of different Leguminosae species of *Genista, Cytisus, Adenocarpus*, etc., occasionally accompanied by tree heath (*Erica arborea*) and bracken ferns (*Pteridium aquilinum*). They grow on deep siliceous meso-oligotrophic soils with humus mull and without temporal hydromorphy. They generally represent the shrubby mantle or first serial stage of different types of deciduous or sclerophyllous forests of the western Mediterranean Subregion.

Cytisetalia scopario-striati Rivas-Martínez 1974

Silicicolous Western Mediterranean broom communities, with irradiations in western Eurosiberian areas (Orocantabric subprovince and Galician-Asturian sector).

Retamion sphaerocarpae Rivas-Martínez 1981

Open nanophanerophytic communities presided by *Retama sphaerocarpa*, or in some cases by *Adenocarpus aureus*, accompanied or not by other brooms (*Cytisus scoparius, C. multiflorus* or *C. eriocarpus* mainly, in the case of this territory). Due to its open physiognomy usually they aree communities which are floristically poor, with few characteristic and/or differential plants, in comparison with other syntaxa of the same class. They represent serial shrubby stages of various types of holm oak forests.

Floristic characterisation. *Retama sphaerocarpa* is the only species which can be considered territorially characteristic in the alliance, apart from its indifferent soil behaviour. The following can also be considered differential compared to the broom communities of *Genistion floridae* (*Cytisetum multifloro eriocarpi*): *Asparagus acutifolius, Cistus albidus, Genista hirsuta, Juniperus oxycedrus* and *Rhamnus fontqueri*, although their constancy and abundance are never very high. *Adenocarpus aureus* is considered characteristic of an association included in this alliance, although it also appears as a differential of a variant in *Genistion floridae*.

Numerical data analysis. In the first stage the associations included in this alliance were studied together to other meso-Mediterranean associations of *Genistion floridae* with which they make contact, in order to define accurately their reciprocal delimitation. Given the total number of relevés (260) a first classification was made following the methodology described above. In this classification (Figure 1) a preliminary separation was observed at a very high level, which leaves the *Retama communities* on one side and on the other the meso-Mediterranean broom relevés of *Genistion floridae* (Figure 1, CS1 and CS2) and *Adenocarpus* communities (*Adenocarpetum argyrophylli*, AA and *Adenocarpetum aurei*, AU). However, certain transfers of relevés were found between the groups of *Retamion s. str.* and *Genistion floridae*, making it necessary to conduct a further analysis in a second step, while

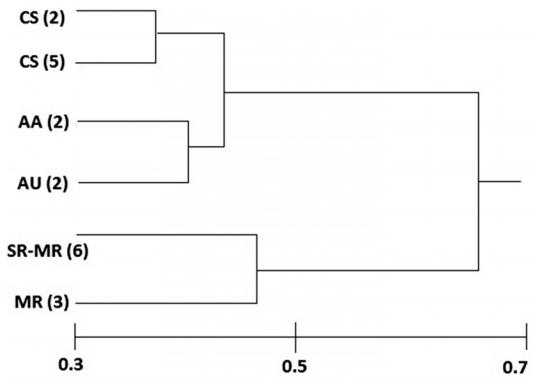

Figure 1. – Classification of plant communities of *Retamion sphaerocarpae* and *Genistion floridae* from the mesomediterranean belt. The abbreviation are: *Cytisetum multifloro-eriocarpi* (CS), *Adenocarpetum argyrophylli* (AA), *Adenocarpetum aurei* (AU), *Cytiso scoparii-Retametum sphaerocarpae* (SR), *Cytiso multiflori-Retametum sphaerocarpae* (MR). Between brackets the groups included in every branch of the dendrogram.

in the groups of *Adenocarpus s.l.* these transfers were not detected and were not included in subsequent stages.

The second stage consisted of applying classification methods to the relevés with *Retama* and to transitional groups. The results were satisfactory; the separation between the two associations with *Retama sphaerocarpa* which are described below occurs at the first cutting level. The two transitional groups described above are separated from *Cytiso multiflori-Retametum* at the third cutting level, simultaneously with separation from the typical core of these *Retama* communities, with the subassociations or their subordinate variants. The final stage, as in the rest of the alliances, consisted of the ordination (PCA) and divisive classification (MST) of 23 synthetic groups which include all the variability existing in the territory of these communities (Figure 2, groups 1-12), plus those of the meso-Mediterranean *Genistion floridae*: *Cytisetum multifloro-eriocarpi* (13-21) and *Adenocarpetum argyrophylli* (groups 22, 23). The numbering of the synthetic groups indicated in Figure 2 corresponds to the numbering assigned to the synthetic relevés in Table 3, in the case of *Retamion*, or in Table 7 in the case of *Genistion floridae*.

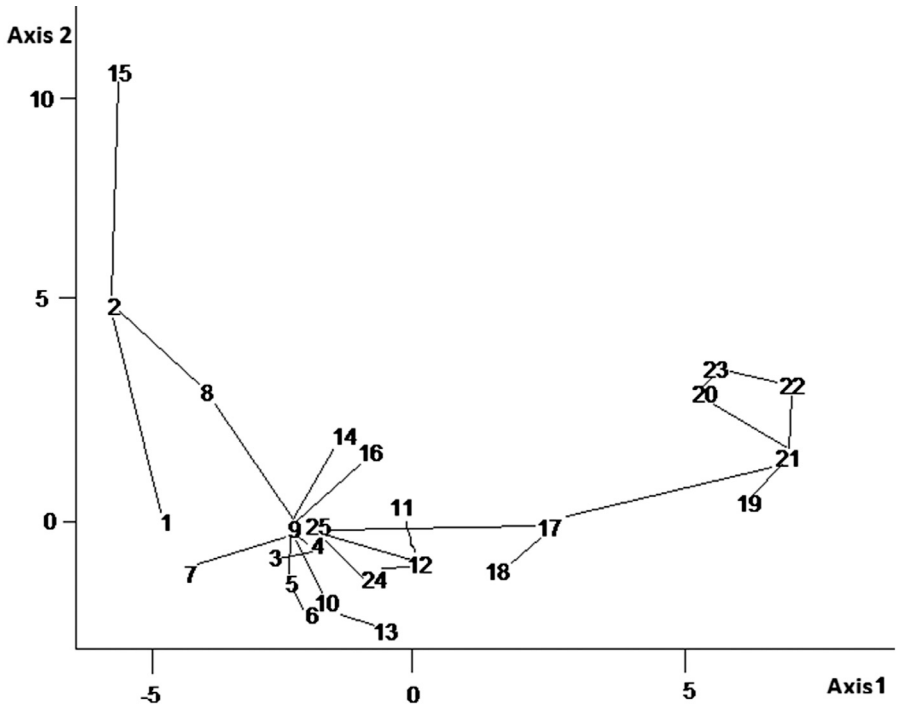

Figure 2. – Final ordination (PCA) and divisive classification (MST) of communities of *Retamion sphaerocarpae* and mesomediterranean *Genistion floridae*. Numbers correspond to those in the text and tables 3 and 7: *Cytiso scoparii-Retametum* (1-4); *Cytiso multiflori-Retametum* (5-10); *Lavandulo-Adenocarpetum aurei* (11, 12); *Cytisetum multifloro-eriocarpi* (13-21) and *Adenocarpetum argyrophylli* (22, 23).

1. *Cytiso scoparii-Retametum sphaerocarpae* Rivas-Martínez ex V. Fuente 1986 (Tables 1 and 3)

Retama community with Scotch brooms (*Cytisus scoparius*). Dynamically these constitute the first substitution stage of the silicicolous Guadarraman holm oaks (*Junipero oxycedri-Quercetum rotundifoliae*). They are distributed in the Guadarramean sector (Carpetan-Leonese subprovince) at an altitudinal level ranging from 500 to 1000 m, and appear throughout their extension in great abundance on southern slopes, whereas on northern slopes they are restricted to altitudes between 900 and 1000 m.

Floristically they are differentiated from the western Retama community by the absence of *Cytisus multiflorus* and the presence of essentially Guadarraman plants such as *Centaurea macrocephala, Centaurea ornata* and *Juniperus oxycedrus*. With regard to *Lavandula pedunculata*, it can be considered to be almost differential although in the easternmost Salmantino zones, as well as in the Sierra de San Vicente mountain range, it is found accompanied by *L. sampaioana* or its hybrids.

subas. **typical**

In addition to the typical groups of the northern and southern slopes of the Sistema Central mountain range -which do not show any significant differences in the analysis-, we have differentiated a variant of *Pistacia terebinthus*, originally described as a subassociation in the Sierra de Ayllón Mountains (*pistacietosum terebinthi*, FUENTE 1986: 179). The scarcity of relevés published on the Sistema Central Mountains -only the two original relevés- as well as the presence of *P. terebinthus* in other relevés of the southern Guadarramean slopes, meant that they were not independent in the numerical analysis.

Table 1

Cytiso scoparii-Retametum sphaerocarpae (1-18) *Lavandulo pedunculatae-Adenocarpetum aurei* (19-28)
(*Retamion sphaerocarpae, Cytisetalia scopario-striati, Cytisetea scopario-striatae*)

Altitude (1=10 m)	50	60	69	67	92	95	89	94	57	89	58	89	87	82	57	67	103	75	82	82	80	81	83	91	94	87	92	85
Number of species	6	7	6	9	9	9	15	6	10	7	7	10	10	9	9	8	9	9	13	15	13	13	8	14	12	8	13	10
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Characteristics:																												
Retama sphaerocarpa	3	5	4	4	5	3	4	4	3	3	3	3	+	2	1	4	4	4	.	2	2	1	.	.	.	.	2	.
Cytisus scoparius	.	+	.	.	.	2	+	+	3	1	2	2	4	4	3	.	2	+	.	1	3	+	.	1	.	.	.	.
Adenocarpus aureus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	+	2	4	3	4	4	5	4	5
Genista hirsuta	+	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Pteridium aquilinum	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Genista cinerascens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Shrubby and *forest companions*:																												
Quercus rotundifolia	.	1	+	1	.	.	1	.	+	+	.	+	.	.	+	.	+	+	.	.	.	.	.	+	+	.	+	.
Pinus pinaster	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	+	+	+	+	1	+	1	+	+	1
Crataegus monogyna	.	.	+	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Cistus laurifolius	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	+	.
Daphne gnidium	.	.	.	.	.	.	.	.	+	.	.	.	.	1	.	+	+	.	.	.	.	.	.	.	.	.	.	.
Cistus ladanifer	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	1	+	.	.	.	.	.	.	.	.	.	.
Asparagus acutifolius	.	+	.	1	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Dorycnium pentaphyllum	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1
Others:																												
Lavandula pedunculata	+	.	.	.	+	+	2	+	+	.	1	1	3	2	+	.	.	.	1	1	+	+	2	.	+	.	+	.
Thymus mastichina	+	.	.	+	+	+	1	.	.	.	.	.	1	.	.	.	.	+	1	3	1	1	1	1	.	1	1	+
Jasione montana s.l.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	+	.	.	1	+	+	+	.	+	+	+	+	+
Thapsia villosa	.	1	1	+	+	.	+	.	.	+	.	+	.	.	.	1	.	+	.	.	.	+	.	.	+	.	.	.
Silene portensis	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	+	.	+
Carlina hispanica	1	1	1	.	+	+	.	.	+	.	.	.	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.
Andryala integrifolia	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	+	+	+	+	+
Stipa lagascae	.	.	.	.	1	1	+	.	.	.	+	1	.	.	.	+	.	1	.	+	.	1	.	.	.	.	.	.
Helichrysum serotinum	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	2	1	1	.	.	1	2	+	1	+
Dactylis hispanica	1	1	2	.	.	.	.	.	+	+	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Chondrilla juncea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	+	+	1	+	.	.	.	.	.
Malcolmia patula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	+	.	.	+
Thymus zygis	.	.	.	.	1	1	1	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea castellana	.	.	.	.	.	.	+	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.
Centaurea alba	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Santolina rosmarinifolia	.	.	.	.	.	.	1	.	.	+	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Juniperus oxycedrus	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	+	+	.	.	.	.	.	.	.	.	.	.
Andryala ragusina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.
Corynephorus canescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	+	.	.	.
Armeria lacaitae	.	.	.	.	.	.	+	1	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asperula aristata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.
Ruta montana	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Agrostis castellana	.	.	.	1	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea macrocephala	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lavandula sampaioana	.	.	.	.	.	.	.	.	+	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helichrysum stoechas	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Artemisia glutinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.

Shrubby and forest companions: *Pistacia terebinthus* 1 in 11; *Osyris alba* + in 14; *Rosmarinus officinalis* 1 in 17. Others: *Digitalis thapsi* + in 5; *Halimium viscosum* 2 in 24; *Calluna vulgaris* 2 in 27.

Localities: 1: Toledo, Nombela; 2: Madrid, Brunete; 3: Madrid, Majadahonda; 4: Madrid, Fuente El Saz; 5: Segovia, Ortigosa del Pestaño; 6: Segovia, Jemenuño; 7: Segovia, Juarros de Riomoros; 8: Segovia, Lastras del Pozo; 9: Toledo, Sotillo de las Palomas; 10: Madrid, Galapagar; 11: Ávila, El Tiemblo 'Central Puente'; 12: Madrid, Robledo de Chavela; 13: Madrid, Presa del Vellón; 14: Toledo, El Real de San Vicente; 15: Madrid, Navalcarnero; 16: Madrid, San Martín de Valdeiglesias; 17: Madrid, Valdemaqueda; 18: Ávila, Presa del Burguillo; 19: Segovia, Cuéllar; 20: Segovia, Navas de Oro; 21: Segovia, Coca; 22: Segovia, Nava de la Asunción; 23: Segovia, Sanchonuño; 24 and 25: Segovia, Veganzones; 26 and 27: Segovia, Lastras de Cuéllar; 28: Segovia, Santa María la Real de Nieva.

Table 2
Cytiso multiflori-Retametum sphaerocarpae
(*Retamion sphaerocarpae, Cytisetalia scopario-striatae, Cytisetea scopario-striatae*)

Altitude (1=10 m)	40	35	70	65	57	67	67	62	58	21	40	76	78	84	83	81	52	50	26	43	24	35	15	43	30	54	25
Number of species	8	6	8	9	7	10	10	8	8	9	6	10	9	10	14	8	14	9	8	6	6	7	9	8	10	8	7
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Characteristics:																											
Retama sphaerocarpa	4	4	1	+	4	+	3	3	4	4	4	4	2	5	4	4	2	3	3	2	4	5	4	4	3	3	3
Cytisus multiflorus	2	3	4	5	1	4	4	3	2	3	.	.	.	.	.	.	5	4	4	4	1	2	.	.	.	.	+
Cytisus scoparius	.	.	.	.	.	.	.	.	.	.	.	.	1	+	2	1	1	1	+	3	2	2	.	.	.	2	+
Genista hirsuta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	+	.	.
Shrubby and forest companions:																											
Quercus rotundifolia	1	.	+	+	1	+	.	+	+	.	1	1	+	1	1	.	1	.	+	1	.	1	.	+	+	+	.
Daphne gnidium	.	1	+	.	.	.	.	.	1	.	.	.	.	.	1	.	1	1	1	1	+	.	.	1	+	.	.
Asparagus acutifolius	.	.	.	.	.	.	.	.	+	.	.	.	.	1	.	.	.	.	.	.	.	.	+	.	.	+	.
Crataegus monogyna	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	+	.	.	.
Cistus ladanifer	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Osyris alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	2	+
Cistus albidus	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Juniperus oxycedrus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	+	.	.	.	.
Others:																											
Lavandula sampaioana	2	1	1	3	2	2	2	2	2	2	2	.	.	.	+	1	2	2	.	2	.	1	+	2	3	3	1
Dactylis hispanica	.	.	.	1	.	.	+	+	1	1	1	+	1	.	1	+	1	+	.	.	+	1	.	.	.	.	.
Carlina hispanica	+	1	.	+	+	+	+	+	1	+	1	.	.	.	1	.	+	+	.	.	.	.	+	.	.	.	.
Thymus mastichina	.	.	.	1	1	.	1	1	.	.	.	1	1	+	1	.	1	1	1	.	.	.	.	+	.	.	.
Agrostis castellana	.	.	.	.	.	.	.	.	.	.	.	+	2	1	1	2	1	+	.	.	.	.	.	.	.	.	.
Andryala integrifolia	.	.	+	+	.	+	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Thapsia villosa	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.	.	.	.	.	.	1	+	.	+	.	.
Urginea maritima	.	+	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.
Ruta montana	.	.	.	.	+	+	1	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Jasione montana s.l.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	+	.	+	.	+
Stipa lagascae	.	.	.	.	.	+	+	.	.	.	.	.	.	2	+	.	.	.	.	.	.	.	.	.	.	.	.
Helichrysum stoechas	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	.	.	.	.	.	.	.	+	.	.	.
Halimium viscosum	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.
Thymus zygis	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	+	.	.	.	.	.	.	.	.	.	.	.
Centaurea castellana	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia oxyphylla	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Digitalis thapsi	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stipa gigantea	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.

Characteristics: *Genista hystrix* 1 in 8; *Adenocarpus complicatus* 1 in 12. Shrubby and forest companions: *Dorycnium pentaphyllum* 2 in 17; *Rubus ulmifolius* 1 in 19; *Olea europaea* + in 25; *Rhamnus alaternus* + in 27. Others: *Lavandula pedunculata* and *Centaurea alba* + in 15; *Cistus salvifolius* + in 17.

Localities: 1: Cáceres, Torrejoncillo; 2: Cáceres, Portaje; 3: Salamanca, Saelices el Chico; 4: Salamanca, Gallegos de Argañán; 5: Salamanca, Ciudad Rodrigo; 6 and 7: Salamanca, Pantano de Agueda; 8 and 9: Salamanca, Hinojosa de Duero; 10: Salamanca, Salto de Saucelle; 11: Cáceres, Serradilla; 12 and 13: Salamanca, Valverdón; 14: Salamanca, Alba de Tormes; 15: Salamanca, Sieteiglesias de Tormes; 16: Salamanca; 17 and 18: Salamanca, Fregeneda de Duero; 19: Cáceres, Navalmoral de la Mata; 20: Cáceres, Malpartida de Plasencia; 21: Cáceres, Coria; 22: Toledo, Valverdeja; 23: Salamanca, Salto de Saucelle; 24: Toledo, La Puebla Nueva; 25: Cáceres, Galisteo; 26: Toledo, Velada; 27: Cáceres, Casas de Don Gómez.

In the final ordination diagram (Figure 2, Groups 1, 2 and 3, respectively) the two first groups were clearly independent from the total of the groups in the association *Cytiso multiflori-Retametum*. In contrast, Group 2 is more separated from the others and very near Group 4 (subas. *cytisetosum eriocarpi*) and the typical groups of western *Retama* formation. This fact can be attributed to the geographic proximity of these two groups (both Ayllonense) and to the floristic composition of the relevés which form Group 4, enriched with *Cytisus eriocarpus*, which tend to relate with those of the variant of *C. eriocarpus* of the western *Retama* community (Groups 11 and 12).

Table 3
Synthetic table of *Retamion sphaerocarpae* plant communities
Cytiso scoparii-Retametum sphaerocarpae subas. típica (1-3), subas. *cytisetosum eriocarpi* (4)
Cytiso multiflori-Retametum sphaerocarpae (5-10)
Lavandulo pedunculatae-Adenocarpetum aurei (11-12)
subas. *adenocarpetosum aurei* (11), subas. *lavanduletosum sampaioanae* (12)
(*Cytisetalia scopario-striatae, Cytisetea scopario-striatae*)

N. of relevés	4	14	10	4	9	17	16	9	15	10	13	3
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12
Characteristics:												
Retama sphaerocarpa	5	5	5	4	5	5	5	5	5	5	2	.
Cytisus scoparius	2	5	5	5	.	.	.	5	5	3	2	5
Cytisus multiflorus	.	.	.	.	5	5	5	.	5	3	.	4
Adenocarpus complicatus	.	.	.	2	.	.	.	1	.	.	.	.
Cytisus eriocarpus	.	.	.	5	.	.	.	.	.	.	.	4
Genista cinerascens	.	.	.	.	.	.	.	.	.	.	2	5
Adenocarpus aureus	.	.	.	.	.	.	.	.	.	.	5	5
Shrubby and forest companions:												
Quercus rotundifolia	4	2	1	4	4	2	3	5	3	3	2	.
Crataegus monogyna	3	1	1	3	.	1	.	1	1	1	1	.
Daphne gnidium	.	1	2	5	1	3	1	3	4	3	.	.
Cistus ladanifer	.	1	3	5	2	1	.	.	1	2	.	2
Asparagus acutifolius	3	1	2	.	.	1	1	1	.	1	.	.
Genista hirsuta	2	1	.	.	.	1	.	.	1	3	.	.
Juniperus oxycedrus	.	1	3	.	.	1	.	.	1	1	.	.
Pistacia terebinthus	.	1	1	.	1	1	.	.	.	.	.	.
Rosmarinus officinalis	.	.	1	5	.	.	.	.	.	1	.	.
Cistus albidus	.	.	.	.	.	.	1	.	1	1	.	.
Dorycnium pentaphyllum	.	1	.	.	.	.	.	2	.	.	1	.
Pinus pinaster	.	1	1	.	.	.	.	.	.	.	5	.
Phillyrea angustifolia	.	.	.	.	1	.	.	.	.	1	.	2
Rubus ulmifolius	.	.	.	.	.	1	.	.	1	.	.	.
Osyris alba	.	1	.	.	.	.	.	.	.	2	.	.
Cistus laurifolius	.	1	.	.	.	.	.	.	.	.	1	.
Quercus suber	.	.	.	.	.	.	.	.	1	.	.	4
Others:												
Thymus mastichina	2	2	.	3	.	2	3	4	2	1	5	5
Thapsia villosa	3	2	1	.	.	1	2	2	1	1	1	.
Dactylis hispanica	4	1	4	2	2	.	3	3	2	.	.	2
Lavandula sampaioana	.	2	.	.	2	5	4	2	3	5	.	5
Carlina hispanica	4	3	1	.	.	1	5	1	2	1	.	.
Ruta montana	2	2	1	.	1	.	2	1	1	.	.	.
Eryngium campestre	3	2	.	.	1	.	2	3	1	.	1	.
Halimium viscosum	.	.	.	.	2	2	.	3	1	.	1	2
Centaurea castellana	.	2	.	.	1	.	1	.	1	.	1	.
Stipa lagascae	.	2	1	.	.	.	1	2	.	.	2	.
Cistus salvifolius	.	.	.	.	1	1	.	1	1	.	.	2
Helichrysum stoechas	.	2	.	.	.	.	.	2	1	1	.	4
Digitalis thapsi	.	1	.	.	1	2	2	.	.	.	.	.
Agrostis castellana	2	2	.	.	.	.	.	3	1	.	.	.
Thymus zygis	.	2	.	.	.	.	1	3	1	.	.	.
Stipa gigantea	.	.	.	.	1	1	.	2	.	1	.	.
Urginea maritima	.	.	.	.	.	3	1	.	1	3	.	.
Lavandula pedunculata	2	5	.	.	.	.	.	2	.	.	4	.
Sanguisorba spachiana	2	1	.	.	.	1	.	.	.	.	.	.
Arrhenatherum album	.	1	.	.	.	1	1	.	.	.	.	.
Asphodelus aestivus	.	.	.	.	1	2	1	.	.	.	.	.
Jasione montana s.l.	.	.	.	.	.	.	.	2	.	.	4	5
Euphorbia oxyphylla	.	1	.	.	.	.	1	.	.	.	.	.

Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12
Centaurea alba	.	.	.	.	.	.	.	1	.	.	1	.
Helichrysum serotinum	.	1	.	.	.	.	.	.	.	.	4	.
Silene portensis	.	1	.	.	.	.	.	.	.	.	4	.
Chondrilla juncea	.	1	.	.	.	.	.	.	.	.	2	.

Characteristics: *Pteridium aquilinum* 1 in 3; *Genista hystrix* 1 in 7; *Orobanche rapum-genistae* 1 in 10. Shrubby and forest companions: *Quercus faginea* and *Tamus communis* 1 in 3; *Rhamnus fontqueri* 1 in 7; *Quercus pyrenaica* 1 in 9; *Fraxinus angustifolia* 4 in 16. Others: *Centaurea macrocephala* 2 in 2; *Arrhenatherum bulbosum* 3 in 3; *Cistus crispus* 1 in 5; *Ornithogalum concinnum* 1 in 6; *Halimium ocymoides* and *Lavandula luisieri* 1 in 10; *Calluna vulgaris* 1, *Asperula aristata* 2, *Malcolmia patula* and *Corynephorus canescens* 3 in 11; *Cistus psilosepalus* 2 in 12.
Procedence of relevés: 1: Table 1, invs. 1-3; 2: Table 1, invs. 5-15; Cantó 1979, tab. pg. 85, invs. 1-3; 3: Table 1, invs. 16-18; Fuente 1986, tab. 38, invs. 1-4, 9, 10; 4: Fuente 1986, tab. 38, invs. 5-8; 5: Table 2, inv. 1; Belmonte 1986, tab. 96, inv. 5; Rivas-Martínez & Belmonte inéd., tab. 17, invs. 5, 7, 9; Laorga 1986, tab 96, inv. 3; Navarro & al. 1987, tab. 2, inv. 1; Ruiz Téllez 1988, tab 2, invs. 3, 4; 6: Table 2, invs. 2,3; Valdés 1984, tab. 13, invs. 5, 6, 8; Belmonte 1986, tab. 96, invs. 4, 5; Laorga 1986, tab. 96, invs. 4 y 5; Navarro & al. 1987, tab. 2, invs. 2-6; Ruiz Téllez 1988, tab. 1, inv. 1; Santos Bobillo 1989, tab. 30, inv. 5; 7: Table 2, invs.4-11; Valdés 1984, tab. 13, inv. 4; Laorga 1986, tab. 96, invs. 1, 2, 6; Belmonte 1986, tab. 96, inv. 3; Rivas-Martínez & Belmonte inéd., tab. 17, invs. 1-3. 8: Table 2, invs. 12-16; Navarro & al., tab. 1, invs. 1-4; 9: Table 2, invs. 17-22; Belmonte 1986, tab. 96, inv. 1; Ruiz Téllez 1988, tab. 2, inv. 1; Santos Bobillo 1989, tab. 30, invs. 6, 7; Amor 1991, tab. 102, invs. 1, 4; 10: Tabla 2, invs. 23-27; Ruiz Téllez 1988, tab. 2, invs. 8, 9; Santos Bobillo 1989, tab. 30, inv. 4; Amor 1991, tab. 102, invs. 2, 3; 11: Table 1, invs. 19-28; Rivas-Martínez 1968, tab. 4, invs. 1, 2, 4; 12: Rivas-Martínez & Belmonte inéd., tab. 16, invs. 1-3.

subas. ***cytisetosum eriocarpi*** Rivas-Martínez ex V. Fuente 1986

The only relevés located were the four original relevés from the Ayllonense subsector and the upper altitudinal limits of the association in this area, growing on soils rich on clays formed from slate (FUENTE, *loc. cit.*). In the previous classifications, these relevés appear linked in the same group to those of some of the variants of *Cytiso multiflori-Retametum*; however for reasons of biogeographical consistency we maintain their syntaxonomical subordination to the Guadarraman *Retama* formations. Thus in the final ordination and MST (Figure 2, Group 4) the influence of *Cytisus eriocarpus* is sufficiently strong so as to place the group, and linked through the MST, in the core formed by the groups of Luso-Extremaduran Retama formations.

2. *Cytiso multiflori-Retametum sphaerocarpae* F. Navarro & *al*. 1987 (Tables 2 and 3)
(Incl.: *Cytiso scoparii-Retametum sphaerocarpae cytisetosum multiflori* Ruiz Téllez 1988).

Retama community with white Spanish brooms (*Cytisus multiflorus*) representing the first substitution stage of the silicicolous Luso-Extremadurean (*Pyro bourgaeanae-Quercetum rotundifoliae*) and Salmantino meso-Mediterranean holm oak forests (*Genisto hystricis-Quercetum rotundifoliae)*. Their biogeographical distribution covers the sectors Toledano-Tagano (Luso-Extremadurean subprovince), Salmanticensean and Lusitano-Duriense (Carpetan-Leonese subprovince). They grow at altitudes of between 200 and 900 m on northern slopes and 250-550 m on southern slopes, where they are found in greater abundance.

Floristically they are distinguished from the previous by the presence of plants with an eastern distribution such as *Cytisus multiflorus* (absent however from part of the relevés of the northern slopes), *Genista hirsuta, Lavandula sampaioana* (these two are present in some of the relevés of the previous association, as has been indicated), *Pyrus bourgaeana, Quercus suber, Urginea maritima, Ornithogalum concinum* and *Galactites tomentosa*.

The three groups extracted from a prior classification and whose results are not shown in the present work have been differentiated in the typical central group of the association, and were synthesised as such. In the final ordination and MST (Figure 2, Groups 5-7) the two first are shown linked together with the rest of the groups which form the association, whereas Group 7 tends to be detached from them, although it is linked to them through the MST.

On the northern slope, based on the results of the numerical analysis, we have differentiated a group of relevés impoverished in *Cytisus multiflorus* in the easternmost areas of the Salmanticensean sector (Table 2, invs. 12-16). The table of relevés of F. NAVARRO & *al*. (1987: 339, table 1) subordinated to *Cytiso scoparii-Retametum* also belongs to this small group. In the final ordination and MST (Figure 2, Group 8) it appears near the typical groups of *Cytiso scoparii-Retametum*, and is the linking group (MST) between the two types of *Retama* formations which appear in the Sistema Central. However, considering the biogeographical limits between these associations and the location of these relevés in the Salmantincensean sector, we consider it more appropriate to include them, for reasons of biogeographical consistency, within the variability of the present association, in spite of the absence of this taxon and the presence of *Lavandula pedunculata s.l.* in this table.

We have distinguished a variant of *Cytisus scoparius* in the Oretano, Talaverano-Placentino and Ribaduriense territories between 250 and 300 m. In the final ordination (Figure 2, Groups 9 and 10) they are located at one of the extremes of variability in the present association, but near the typical groups of Guadarraman Retama formations (Figure 2, Groups 1 and 2). In the MST it is linked to the Salmantino Group 8, and together they form a nexus of union with these Retama communities. For this reason we do not consider their initial syntaxonomical inclusion in *Cytiso scoparii-Retametum* (subordinated as subas. *cytisetosum multiflori*) to be correct, given how restricted the distribution of this association is in the Guadarramean sector, a fact which is reinforced by the presence of *Cytisus multiflorus*, a taxon with a western character. Nor does it represent the contact between these two *Retama* formations, due to its extensive geographic distribution and its distance from the first *Retama* association.

3. *Lavandulo pedunculatae-Adenocarpetum aurei* Rivas-Martínez 1968 (Tables 1 and 3)

Open phanerophytic communities presided by *Adenocarpus aureus* accompanied by other brooms of the class such as *Genista cinerascens* and *Retama sphaerocarpa* and by *Cisto-Lavanduletea* such as *Lavandula pedunculata, L. sampaioana* and *Cistus laurifolius*. They grow on extremely sandy soils on the northernmost and southernmost sedimentary glacis in the Sistema Central (Guadarramean and Talaverano-Placentino sectors) reforested with resin pines (*Pinus pinaster*). Bioclimatically they appear preferably in the meso- or supra-Mediterranean belts in dry or subhumid ombroclimates. The altitudinal limits of the two associations recognised are very different: 650-900 m for the first and 200-300 m for the second.

Although it was originally described in the class *Cisto-Lavanduletea* (*Cistion laurifolii*) (RIVAS-MARTÍNEZ, 1968), the same author subsequently opted to transfer it to *Cytisetea scopario-striatae*, within the present alliance. The numerical study of the associations included in the alliance together with the broom community of *Cytisetum multifloro-eriocarpi* (Figure 1) showed a clear link with the latter. However the ordination and particularly the MST carried out on the synthesis of the groups (Figure 2, Groups 11 and 12), revealed the relationships of these communities with the *Retama* community, and we have therefore preferred to maintain them within the alliance *Retamion sphaerocarpae*.

subas. **typical**

Its biogeographical distribution is circumscribed by the Guadarramean sector, to the Arevaliense district. The final ordination (Figure 2, Group 11) separates it on the negative section of axis 1 together with the groups of *Cytiso scoparii-Retametum* (1 and 2), linking with this last (2) through MST.

subas. ***lavanduletosum sampaioanae*** Rivas-Martínez & Belmonte 1987 nova

(*Holotypus:* Rivas-Martínez & Belmonte 1987, table 16, inv. 3: Altitude 250 m, area 30 m^2. Characteristics: *Adenocarpus aureus, Cytisus scoparius* and *Genista cinerascens* 2; *Cytisus multiflorus* +. Shrub and forest companions: *Fraxinus angustifolia* +. Other companions: *Cistus psilosepalus* 2; *Lavandula sampaioana, Cistus ladanifer, C. salvifolius* and *Centaurea alba* 1¸ *Jasione echinata, Halimium viscosum* and *Dactylis hispanica* +. Locality: Cáceres: Toril, Vega del Chisquero).

Both in the initial classification and in the final ordination (Figure 2, Group 12) it is clearly independent from the previous group. Moreover in the MST it is linked to the association *Cytiso multiflori-Retametum*, through Group 9, which indicates its relationships with these *Retama* communities with which it comes into contact in less sandy soils. This fact, together with its biogeographical distribution (Toledan-Taganean sector) supports its possible separation as an independent association. However due to the scarcity of available data (only the three relevés by the authors of the subassociation, RIVAS-MARTÍNEZ & BELMONTE, 1987), we have preferred to maintain the subordination, and to await further data on its distribution and variability throughout the southernmost face of the Sistema Central.

Genistion floridae Rivas-Martínez 1974

Phanerophytic retamoid communities, generally dense, mainly composed of broom species of genus *Cytisus* and *Genista*, growing on soils similar to those of forest. The communities included in this alliance are usually dominated by at least two species. Within our study territory they are distributed in the Carpetan-Leonese (Guadarramean and Bejaran-Gredensean sectors) and Lusitan-Extremadurean subprovinces (Toledan-Taganean sector). They represent serial stages of different types of deciduous and sclerophyllous forests.

Floristic characterisation. In addition to the presence of the *Genisteae* of the class, the following taxa can also be considered: *Genista florida, Adenocarpus argyrophyllus, A. hispanicus, A. gredensis,* etc.

Numerical data analysis. The seven associations recognized were analyzed in three steps. The first included those Luso-Extremadurean plant associations traditionally included in this alliance, which grow in a lower altitudinal belt (*Cytisetum multifloro-eriocarpi* and *Adenocarpetum argyrophylli*). Their differentiation from the rest of *Genistion floridae* communities-except with *Thymo-Cytisetum multiflori*- was clearly evident, and for this reason they were also compared with those of *Retamion* with which they contact (see section above), and were subsequently analysed separately. They were not compared with *Thymo-Cytisetum multiflori* due to the problems of internal variability arising in both, and they will be analysed in their corresponding sections.

The second stage includes the study of the communities distributed in a higher altitudinal belt and those already mentioned in the above paragraph: *Cytiso oromediterranei-Genistetum cinerascentis s.l., Genisto floridae-Adenocarpetum hispanici* and *Genisto floridae-Cytisetum scoparii*. This part included a set of 308 relevés, which were first studied jointly by means of the classification (Figure 4) which separated 20 groups, from which were extracted the three groups which were separated at the first cutting levels, basically corresponding to the three associations considered, which were then analysed individually in view of the large number of relevés involved (over 100 in *Cytiso-Genistetum cinerascentis* and *Genisto-Cytisetum scopariae*). Some transfers of relevés were detected, generally from contact areas, which are discussed in the corresponding sections. The independent study of these three associations (discussed in more detail in the corresponding sections) led to the synthesis of 36 groups.

The association *Thymo mastichinae-Cytisetum multiflori* -altitudinally typical of the same vegetation belt as those mentioned above- were also contrasted in a third stage together with the plant communities of *Genistion polygaliiphyllae*, due to the presence of *Cytisus multiflorus* in most of the associations which form this suballiance, in order to establish the relationships and limits between them.

Finally the relationships between *Genisto floridae-Cytisetum scoparii* (7 groups), *Genisto floridae-Adenocarpetum hispanici* (6 groups), *Cytiso oromediterranei-Genistetum cinerascentis s.l.* (23 groups) and *Thymo-Cytisetum multiflori* (11 groups) were studied. The ordination of the set of these groups was done by means of correspondence analysis (CA) and non-divisive classification (MST), the results of which are shown in Figure 10. The numbering of the synthetic groups shown in Figure 10 corresponds to the numbering

assigned to the synthetic relevés (groups) in Tables 8-10.

4. *Cytisetum multiflori-eriocarpi* Rivas Goday 1964 nom. mut. (Tables 4 and 7)

(Syn.: *Cytiso multiflori-Sarothamnetum eriocarpi* Rivas Goday 1964, *Cytisetum scopario-striati* Belmonte 1986 inéd., *Cytisetum grandifloro-striati* ['*Cytiso grandiflori-Cytisetum striati*'] Valdés 1984, *Lavandulo-Cytisetum multiflori* sensu Valdés 1984 non Br.-Bl. & *al*. 1964. incl. *Thymo mastichinae-Cytisetum multiflori* Rivas-Martínez 1968 *lavanduletosum sampaioanae* Rivas-Martínez & Sánchez-Mata in Sánchez-Mata 1989).

Luso-Extremadurean broom communities growing on deep soils. These are physiognomically more or less dense and high-growing communities dominated indistinctly by various combinations of *Cytisus multiflorus, C. eriocarpus* or *C. scoparius*, accompanied by other genistées such as *Genista florida* or *Cytisus grandiflorus* and other non-papilionaceous shrubs (*Erica arborea, E. australis*...). Dynamically they constitute the first substitution stage of meso-Mediterranean Pyrenean oak (*Arbuto unedonis-Quercetum pyrenaicae*) and cork oak forests (*Sanguisorbo agrimonioidis-Quercetum suberis*).

Biogeographically they are distributed in the Talaverano-Placentino and Oretano subsectors (Toledan-Taganean sector), where they occupy an altitudinal space immediately above the *Retama* community of white Spanish broom (*Cytiso multiflori-Retametum*), with which they contact. From the bioclimatic point of view they grow in the meso-Mediterranean belt in a humid, subhumid ombroclimate. Their altitudinal interval (350-1000 m) largely depends on the orientation, with more frequent exposure to shade at lower altitudes, whereas the higher altitudes are in sunny orientations in the westernmost zones of the territory (Sierra de Gata).

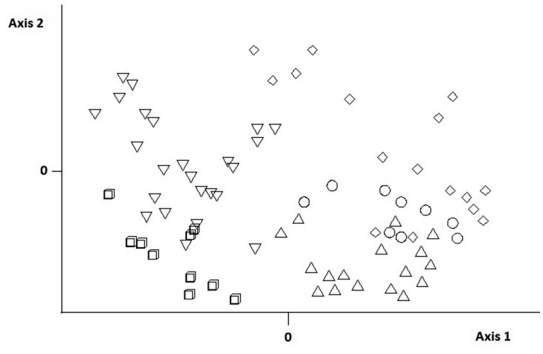

Figure 3. – Ordination (PCA) of *Cytisetum multifloro-eriocarpi* relevés: Up-triangles and circles represent combinations of *Cytisus multiflorus* and C. eriocarpus; diamonds are combinations of *C. multiflorus* y *C. scoparius*; down-triangles are combinations of *C. scoparius* and *C. eriocarpus*; squares are combinations of *Erica arborea*.

The floristic composition of this association is very varied with regard to the brooms which comprise it, which exist in all their possible combinations. This variability has caused certain syntaxonomical problems as can be seen from the abundance of synonyms to be found in the literature. They are also very rich from a floristic point of view, both in taxa belonging to the class and in taxa from the forests whose potential territory they occupy (*Erica arborea, Arbutus unedo, Castanea sativa, Viburnum tinus, Quercus pyrenaica, Quercus suber*, etc.), or from other more degraded serial stages (*Ericion umbellatae: Erica australis, Cistus populifolius, Cistus psilosepalus,* etc.).

Numerical data analysis. As mentioned in the section on the alliance *Retamion sphaerocarpae*, the relevés of this association, as well as those of *Adenocarpetum argyrophylli*, were analysed together with those of the *Retama* community with which they establish contacts. Moreover, a study of the communities in the westernmost zones of the Sistema Central (Sierra de Gata) showed that a table of relevés subordinated to *Lavandulo sampaioanae-Cytisetum multiflori* (VALDÉS, 1984, table 10), as well as some relevés belonging to the same geographic provenance, were floristically very different to the rest of the tables studied from this association, and that their analysis could be better fitted to *Cytisetum multifloro eriocarpi*. A new classification was therefore carried out with the set of the 92 relevés which could be attributed to the present association, and an ordination was done in order to establish more synthetic groups which summarised its floristic variability.

Both the classification and the ordination (PCA, Figure 3) applied to the set of relevés revealed the

Table 4
Cytisetum multifloro-eriocarpi
(*Genistion floridae*, *Cytisetalia scopario-striatae*, *Cytisetea scopario-striatae*)

Altitude (1=10 m)	69	63	32	33	30	42	57	50	57	45	85	77	63	89	76	66	48	70	45	30	30	35	34	35
Number of species	6	7	3	6	6	5	13	5	5	10	7	7	10	7	12	9	13	16	9	8	10	10	7	6
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Characteristics:																								
Cytisus scoparius	.	3	+	+	+	1	3	2	5	3	1	4	1	.	+	.	2	.	+	.	.	+	2	1
Cytisus multiflorus	4	3	5	5	4	5	4	5	+	4	.	.	1	.	.	.	.	.	.	3	+	5	.	.
Cytisus eriocarpus	1	.	.	.	.	.	.	.	.	.	5	2	4	1	.	.	.	1	.	+	+	1	1	3
Pteridium aquilinum	1	1	.	+	.	.	+	.	.	.	2	1	.	.	.	1	1	.	.	.	.	.	.	.
Erica arborea	.	.	.	.	.	.	+	.	.	.	.	.	1	4	4	4	3	4	4	.	.	.	.	.
Genista falcata	.	+	.	.	.	.	.	.	.	.	.	.	1	.	3	1	.	+	1	.	.	.	.	.
Adenocarpus complicatus	.	+	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	+	.	.	.	1	.	.
Retama sphaerocarpa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	4	+	4	3
Genista florida	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Orobanche rapum-genistae	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Shrubby and forest companions:																								
Quercus pyrenaica	+	.	.	+	.	.	+	1	.	+	+	+	.	.	.	+	+	+	.	.	.	.	.	.
Daphne gnidium	.	.	+	.	.	1	+	.	.	1	.	+	.	.	+	.	.	+	.	+	1	+	.	.
Erica australis	.	.	.	.	.	.	+	.	.	.	.	.	1	2	.	1	2	.	2	.	.	.	.	.
Cistus ladanifer	.	.	.	.	1	.	.	.	.	1	.	.	.	.	2	.	.	.	1	.	+	.	.	.
Quercus rotundifolia	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	1	.	.
Arbutus unedo	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	+	.	.	.	.	.
Erica scoparia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	2	.	.	.	.	.
Phillyrea angustifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	+	.	.	.
Asparagus acutifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	.	.
Osyris alba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	+	.
Crataegus monogyna	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.
Rubus ulmifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.
Pinus pinaster	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.
Others:																								
Lavandula sampaioana	+	.	1	1	2	3	1	.	+	2	1	.	.	+	+	.	.	+	.	+	+	.	.	+
Cistus psilosepalus	.	1	.	.	.	.	+	2	.	.	.	.	+	.	+	.	.	1	.	.	.	.	.	.
Cistus salvifolius	.	.	.	.	2	.	.	3	3	1	.	.	.	+	+	.	.	.	.	.	.	.	.	.
Calluna vulgaris	.	.	.	.	.	.	1	.	.	.	.	.	+	2	.	3	.	2	.	.	.	.	.	.
Thymus mastichina	+	.	+	.	.	.	.	.	.	.	1	.	.	.	+	.	.	.	.	.	.	.	.	.
Urginea maritima	.	.	.	.	.	1	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	1
Halimium ocymoides	.	.	.	.	.	.	1	.	.	2	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Stipa gigantea	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Erica umbellata	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.
Lithodora prostrata	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Lavandula luisieri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.
Dactylis hispanica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.

Shrubby and forest companions: *Quercus broteri* + in 17; *Castanea sativa* + in 18; *Pistacia terebinthus* + in 24. Others: *Thapsia villosa* + in 7; *Pterospartum tridentatum* 1 in 15; *Lotus glareosus* + in 18; *Halimium viscosum* + in 20; *Andryala integrifolia* + in 21; *Thapsia villosa* + and *Digitalis thapsi* 1 in 22.

Localities: 1: Cáceres, Hervás; 2: Cáceres, Hoyos; 3: Toledo, La Calzada de Oropesa; 4: Cáceres, Pueblo Nuevo de Miramontes; 5: Cáceres, Talayuela ; 6: Cáceres, Robledillo de la Vera; 7: Cáceres, Jaraíz de la Vera; 8: Cáceres, Torremenga; 9: Cáceres, Arroyomolinos de la Vera; 10: Cáceres, Tejeda de Tiétar; 11: Cristóbal; 12: Cáceres, El Torno; 13: Salamanca, Las Casas del Conde; 14: Salamanca, Mogarraz; 15: Salamanca, Villanueva del Conde; 16: Salamanca, Miranda del Castañar; 17: Salamanca, Sotoserrano; 18: Salamanca, Valdelageve; 19: Cáceres, Pinofranqueado; 20: Cáceres, Acehuche; 21: Cáceres, Moraleja; 22: Cáceres, Montehermoso; 23: Cáceres, Guijo de Granadilla; 24: Cáceres, Presa de Valdeobispo.

absence of clearly independent groups from the floristic point of view, and showed a continuous gradient between the relevés, which reflects the great internal variability mentioned. We will also refer to Figures 1 and 2 in the section on *Retamion*, as it includes part of the synthetic groups in this association.

Given the floristic complexity of the relevés -already discussed in the above paragraphs- it was not possible to establish syntaxonomical conclusions below the rank of association due to their heterogeneity. Instead, groups with a more or less homogeneous variability are proposed according to the predominance of different brooms (*Cytisus spp*.), although the differences between some of these are not completely clear, and they therefore do not represent synthetic groups.

Combinations of *Cytisus multiflorus* and *Cytisus eriocarpus*

This combination is found abundantly in the whole of the territory of distribution of the association except in the region of La Vera and schistic zones to the north of the Oretano subsector (Sierra de las Corchuelas), as shown in the tables of BELMONTE (1986, table 97 sub. *Cytisetum scopario-striati*) and AMOR (1991, table 98, 1993, table 13 sub. *Cytisetum scopario-striati*; 1991, table 101 sub. *Thymo-Cytisetum lavanduletosum)* with different floristic combinations.

The relevés included in this group can be considered the typical relevés of the association, as their floristic composition corresponds to the original name. However in the classification they were distributed around the whole of the dendrogram. In the ordination (Figure 3) they are located in the lower right part in contact with a species-poor relevés group.

The original table (RIVAS GODAY, 1964, table pg. 466) presented numerous problems as its relevés are very rich in the number of species and their cover, and are distributed in the ordination into groups, one of which would be included in this combination and the other enriched with *Erica arborea* (Figure 3).

Also included here are the relevés which VALDÉS (1984, table 10) subordinated to *Lavandulo sampaioanae-Cytisetum multiflori*, a table with greater floristic impoverishment. These relevés are distributed into groups, one of which is somewhat richer in *C. eriocarpus*, and integrated into the most typical group formed by this combination, whereas the rest of the relevés in this table are located above them, indicating this impoverishment.

Moreover the table composed by three relevés enriched with *Cytisus grandiflorus* from the Sierra de La Malvana mountains (Sierra de Gata) subordinated by VALDÉS (1984, table 9) under a new syntaxon (*Cytisetum grandifloro-striati*) could also be included as a variant. These were not differentiated as an independent group either in the ordination or in the classification, and we have thus preferred to include them in this group.

The relevés with a Gredense provenance subordinated to *Thymo mastichinae-Cytisetum multiflori lavanduletosum sampaioanae* (SÁNCHEZ-MATA, 1989, table 107) also integrated into the ordination together with the rest of the relevés ascribed to this combination.

In the final ordination and MST (Figure 2) the relevés included under this heading (Group 13) can be seen to be clearly separated from the groups of Retamion s. str. and related with the rest of the combinations studied here.

Combinations of *Cytisus multiflorus and Cytisus scoparius*

Widely distributed throughout the Toledan-Taganean sector, it is particularly worth noting here the absence of *C. eriocarpus* -which could reflect a certain dryness of the soil -in comparison to the rest of the relevés in this association. In the ordination diagram (Figure 3) they are located in the upper right quadrant, connecting with the previous group and very poor from a floristic point of view. We already mentioned previously in the section dedicated to the *Retamion* alliance the intermediate position of these relevés -which are collected into two groups (15 and 16)- between the Luso-Extremadurean *Retama* community (*Cytiso multiflori-Retametum*) and the others that can be attributed to this association, as can be seen in Figure 3. For this reason this section includes some relevés of RUIZ TÉLLEZ (1988, table 1, inv. 1; table 2, inv. 2) and BELMONTE (1986, table 96, invs. 8-10) subordinated to these *Retama* communities.

In the final ordination and MST (Figure 2) the relevés included under this heading (Groups 14 and 17) can be seen to be clearly separated from the groups of *Retamion s. str.* and related with the rest of the combinations studied here.

Combinations of *Cytisus scoparius* and *Cytisus eriocarpus*

The geographic distribution in the region of La Vera and the Sierra de las Corchuelas (Oretano and Talaverano-Placentino subsectors) of the relevés included here, acts as a complement to the distribution of the relevés in the first section. In the ordination diagram (Figure 3) they are located in the negative part of the first axis in contrast to the two previous ones, rich in *Cytisus multiflorus*. Along the second axis it is related with the group 2 (see Figure 3), appearing on the positive part of the axis due to the presence of *C. scoparius*. Some relevés include some *C. multiflorus* in their composition, albeit sparsely. In the classification this is fairly well-distributed in the groups in the first part of the dendrogram, where there is a clear absence of white Spanish broom.

Included here are two tables by AMOR (1991, table 98; 1993, table 13), the second of which is composed of relevés enriched with *Genista florida*, the reason it was described as an independent subassociation (AMOR, *loc. cit.*), although the presence of this taxon in other relevés with floristic compositions which are in general different, does not appear with enough importance in the numeric analysis to justify its independence, and it should therefore perhaps be defined as a variant. The third table included in this group is that of Belmonte (*op. cit.*, table 97).

In the final ordination and MST (Figure 2) the relevés included here (Group 15) are clearly separated from the groups of *Retamion s. str.* and related to the rest of the combinations studied.

Combinations of *Erica arborea*

Complex group from the Sierra de Gata (Hurdano-Zezerense subsector), composed of unpublished relevés which are very rich in *E. arborea*, -with rates of cover of 4 and 5- and pre-forest plants such as *Arbutus unedo, Phillyrea angustifolia* and other plants from the heath communities of *Ericion umbellatae* (*Calluna vulgaris, Erica australis, E. umbellata, E. scoparia, Cistus populifolius*, etc.). Its inclusion in this association derives from the very generalised presence of tree heath in the rest of the groups, particularly in the original relevés to which it is linked in the classification, as well as to the sporadic presence of *C. scoparius, C. multiflorus* and *C. eriocarpus*. In the ordination (Figure 3) it is located on the negative part of the two axes due to the presence of tree heath in the relevés. Its floristic composition indicates that these are predominantly degraded stages of *Phillyreo angustifoliae-Arbutetum unedonis*, with whom we consider they are actually related.

In the final ordination and MST (Figure 2) the relevés included in this combination (Group 16) are clearly separated from the groups of *Retamion s. str.* and related to the rest of the combinations studied here, although in a somewhat outlying position, which reinforces their relationship with the arbutus community, as indicated.

Combinations with *Retama sphaerocarpa*

We have differentiated what could be considered as a variant of *Retama sphaerocarpa* widely distributed throughout the whole of the southern slopes of the Sistema Central. This area includes a group of relevés enriched with *C. scoparius* in the Hurdano-Zezerense areas located between the reservoirs of Gabriel and Galán and Borbollón (VALDÉS, 1984, table 12, sub. Cytis*o scopari-Retametum cytisetosum scopariae* sensu Valdés *non* Fuente 1986). In the final ordination and MST (Figure 2, Groups 18-20) they are located at one end of the variability of the association, highlighting their relationships with the *Retama* community of *Cytiso multiflori-Retametum*.

We include in this section a group of relevés enriched with *Genista florida* (=*Cytiso multiflori-Retametum genistetosum floridae* Sánchez-Mata 1989) of the Gredense territories in the valley of Cinco Villas, (SÁNCHEZ-MATA, *op. cit.*). The presence of this genistea, occasionally accompanied by *G. cinerascens*, was sufficient for its separation by numerical methods, although in the first multivariate analysis it was linked to these broom communities, for which reason we have included them here. However in the final ordination and MST (Figure 2, Group 21) this group was linked to the *Retama* community of *Cytisus multiflorus*, although in a somewhat outlying position with regard to them.

5. *Adenocarpetum argyrophylli* Rivas-Martínez, Cantó, Sánchez-Mata & Belmonte 2002 (Table 7)

Communities dominated by *Adenocarpus argyrophyllus*, a characteristic species of the association in contrast to the rest of the species included in the alliance *Genistion floridae*, with a marked permanent character. They are located on culminal ridges of Oretano Silurian mountains. In addition to the *A. argyrophyllus*, its floristic composition also includes particularly elements from the alliance *Rumici-Dianthion lusitanici* such as *Arrhenatherum montanum, Dianthus lusitanus* and *Digitalis thapsi*, whose communities grow in a mosaic pattern with the *Adenocarpus* community of this association (BELMONTE, 1986: 191; CANTÓ, 2004). They are located at an altitude of between 500 and 1400 m. The typical subassociation appears in a lower altitudinal belt (500-800 m) than the *franguletosum* (1000-1400 m).

Its numerical study has been described and discussed in the section relating to the alliance *Retamion*.

subas. **typical**

The presence of *Cytisus eriocarpus* and *C. multiflorus* is more frequent in less sloping areas (BELMONTE, *loc. cit.*). The ordination on axes 1 and 2, as well as the MST shown in Figure 2 (Group 22) highlights the relationships of this group with the Luso-Extremadurean *Retama* community (*Cytiso multiflori-Retametum* var. *C. eriocarpus*). In contrast, axis 4 separates them clearly from all the cores of variability. The dendrogram in Figure 1 locates it together with the broom communities of the previous association, and for this reason we have preferred to maintain it in its original position within this suballiance.

subas. ***franguletosum alni*** Ladero 1970 nova

(= *Frangulo-Adenocarpetum argyrophyllae* Ladero 1970. *Holotypus* table As. *Frangulo-Adenocarpetum argyrophylli*, inv. 1: Altitude 1056 m, area 100 m^2, slope 98%, exposure NE, nº inv. L/383. Characteristics: *Adenocarpus argyrophyllus* 1; *Erica arborea* +. Shrubby and forest companions: *Frangula alnus* 2, *Quercus rotundifolia, Q. pyrenaica* and *Juniperus oxycedrus* +. Other companions: *Digitalis purpurea, Jasione crispa* subsp. *tomentosa, Asplenium billotii, Conopodium pyrenaeum* and *Umbilicus rupestris* 1; *Arrhenatherum album, Sedum hirsutum, Sedum brevifolium, Dianthus lusitanicus, Rumex angiocarpus* and *Gladiolus illyricus* +. Localidad: Cáceres: Carrascalejo, Sierra de Altamira, Risco del Prado).

Developing at higher altitudes than the typical association in the Villuercas massif. It is particularly worth noting the absence of the two brooms and the presence of *Frangula alnus*, a taxon with greater hygrophilic demands. In Figure 2 (Group 23) it is clearly linked to the typical subassociation, which supports its subordination to this association.

6. *Genisto floridae-Cytisetum scoparii* Rivas-Martínez & Cantó 1987 (Tables 5 and 8)

Broom communities including Scotch broom (*Cytisus scoparius*), *Genista florida* or *G. cinerascens* and *Adenocarpus complicatus*. Dynamically they represent the first substitution stage of holm oak forest (*Junipero-Quercetum rotundifoliae*) or Pyrenean oak forests, in their most xerophilic facies (*Luzulo-Quercetum pyrenaicae* subas. *paeonietosum* and *quercetosum pyrenaicae* Fernández-González 1991).

They are biogeographically distributed throughout the Guadarramean sector, penetrating into the Bejaran-Gredensean sector through the subas. *genistetosum falcatae* (CANTÓ, 2004), in the supra-Mediterranean belt, in a subhumid, humid ombroclimate, in an altitudinal space between 850 and 1450 m.

Numerical data analysis. In the first classification it separated at the second cutting level (Figure 4, Groups 14-20) from *Genisto floridae-Adenocarpetum hispanici* (Groups 9-13), which highlights its relationships and differences with this association. Under this denomination in the bibliography consulted we find Bejaran-Gredense relevés rich in western taxa such as *Cytisus eriocarpus, C. multiflorus, Festuca elegans*, etc., forming a very heterogeneous group which we have studied within *Thymo-Cytisetum multiflori*. The classification done on the 60 relevés revealed the independence of relevés with *G. cinerascens* and *Adenocarpus gredensis*. This fact is also shown in the ordination done by means of correspondence analysis (CA),

Table 5
Genisto floridae-Cytisetum scoparii var. típica (1-17), var. *Erica arborea* (18)
Genisto floridae-Adenocarpetum hispanicae var. *Erica arborea* (19)
Pteridio aquilini-Cytisetum oromediterranei (20)
(*Genistion floridae, Cytisetalia scopario-striatae, Cytisetea scopario-striatae*)

Altitude (1=10 m)	117	120	134	100	133	110	116	117	109	120	116	118	124	129	139	122	117	132	129	129
Number of species	9	7	7	7	7	8	10	5	10	10	11	6	7	10	8	8	12	8	7	7
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Characteristics:																				
Cytisus scoparius	.	2	4	3	3	2	3	5	2	1	+	3	+	1	1	1	2	2	.	3
Genista florida	4	4	4	2	4	4	.	.	+	.	.	.	1	1	.	.	4	4	4	.
Genista cinerascens	+	.	.	.	.	.	5	1	4	5	5	3	4	4	5	5	.	.	.	3
Pteridium aquilinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	3	.	.
Cytisus oromediterraneus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Erica arborea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.
Adenocarpus hispanicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Adenocarpus complicatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Shrubby and forest companions:																				
Quercus rotundifolia	.	+	.	1	.	.	1	.	+	1	+	+	.	+	.	.	.	.	.	.
Rosa corymbifera	.	.	+	.	+	.	.	.	.	.	.	+	.	.	.	.	1	1	+	.
Cistus laurifolius	.	.	.	1	.	.	.	.	.	.	.	+	+	+	.	1	.	.	.	.
Juniperus hemisphaerica	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.
Quercus pyrenaica	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	.	.	.
Crataegus monogyna	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Pinus sylvestris	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	.	.	.	.	.
Pinus pinaster	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Rubus ulmifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.
Others:																				
Lavandula pedunculata	1	.	1	.	+	1	+	.	1	+	2	1	+	1	.	.	1	.	.	1
Thymus mastichina	+	1	.	.	.	.	1	+	1	1	+	.	.	+	.	.	+	.	.	.
Santolina rosmarinifolia	+	1	1	.	1	+	+	.	.	.	+	.	.	.	.	.	1	.	.	.
Centaurea macrocephala	.	1	.	+	+	.	.	.	.	+	1	.	.	.	+	.	.	.	.	+
Thymus zygis	.	.	+	.	.	+	.	.	1	+	+	.	.	.	.	+	.	.	.	+
Stipa gigantea	.	.	.	.	.	.	1	1	+	2	.	.	.	.	1	+	.	.	.	.
Agrostis castellana	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Dactylis hispanica	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	+	1	.	.	.
Thapsia villosa	.	.	.	.	.	.	+	.	.	.	1	.	.	.	.	.	+	.	.	.
Stipa lagascae	.	.	.	.	.	.	+	.	1	1	.	.	.	.	.	.	.	.	.	.
Halimium viscosum	.	.	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Helianthemum masguindalii	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.

Shrubby and forest companions: *Juniperus oxycedrus* + in 14; *Erica aragonensis* 2 in 18; *Holcus mollis* and *Poa nemoralis* 1 in 19; *Teucrium scorodonia* 1, *Castanea sativa* + in 20. Others: *Arrhenatherum carpetanum* and *Avenula sulcata* 1 in 1; *Andryala integrifolia* + in 6; *Carduus carpetanus* + in 8; *Luzula lactea* + in 13; *Leucanthemopsis pallida* + in 14; *Calluna vulgaris* + in 19; *Arenaria querioides* + in 20.

Localities: 1: Segovia, Revenga; 2: Ávila, Cillán; 3: Ávila, Narrillos del Rebollar; 4: Madrid, Embalse de La Jarosa; 5 and 6: Madrid, San Lorenzo de El Escorial; 7: Ávila, Gallegos de Sobrinos; 8: Ávila, Urraca-Miguel; 9: Segovia, Villacastín; 10: Segovia, Navas de San Antonio; 11: Segovia, Revenga; 12: Ávila, Aldea del Rey Niño; 13: Madrid, Becerril de la Sierra; 14: Madrid, Cercedilla; 15: Ávila, Peguerinos; 16: Ávila, Las Navas del Marqués; 17: Madrid, Miraflores de la Sierra; 18: Madrid, Cercedilla; 19: Guadalajara, Valverde de los Arroyos; 20: Ávila, Las Navas del Marqués.

in which the relevés of the subassociation *adenocarpetosum gredensis* are independent from the rest. Once this group was extracted, the ordination was performed again with the 54 remaining relevés (Figure 5). The final synthesis gave rise to seven groups.

subas. **typical**

Within the typical relevés we have differentiated a gradation around the abundance/dominance of *Genista cinerascens* related with the most degraded and stony soils. In the lower left quadrant

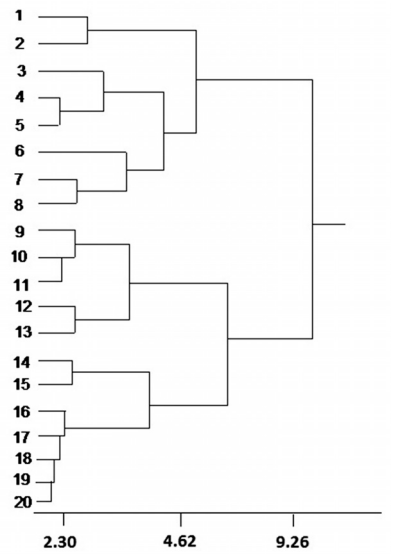

Figure 4. – Classification of *Cytiso oromediterranei-Genistetum cinerascentis* and *Pteridio aquilini-Cytisetum oromediterranei* relevés (groups 1-8), *Genisto floridae-Adenocarpetum hispanicae* relevés (groups 9-13) and *Genisto floridae-Cytisetum scoparii* relevés (groups 14-20).

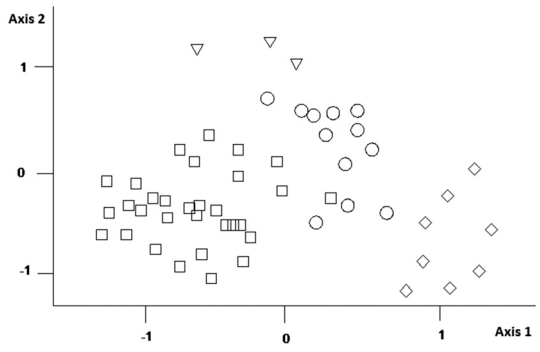

Figure 5. – Ordination (CA) of *Genisto floridae-Cytisetum scopariae* relevés: squares, var. typical; circles, var. typical enriched in *Adenocarpus complicatus*; diamonds, var. of *Erica arborea*; down-triangles var. of *Adenocarpus argyrophyllus*.

of the ordination diagram in Figure 5 we can see this gradation, from the most impoverished in *G. cinerascens* (group of relevés located at the upper part of this group) -which also have some relevés of *G. florida*-, until the furthest away, which are richest in this broom, that we consider the most typical. There is also a group (Figure 5), closely related to that typical one, enriched with *Adenocarpus complicatus*. Its ecological significance - based on the floristic composition featuring an abundance of plants such as *Santolina rosmarinifolia, Thymus zygis* and *Lavandula pedunculata*-, appears to be the first stages of broom communities growing on farmlands or abandoned grazing lands, rather than of preferably edaphohygrophilic facies (FERNÁNDEZ-GONZÁLEZ, 1991: 235). We think these last to be nearer the variant of *Erica arborea* in which we include relevé 3 of the table by the author mentioned. The final ordination and MST (Figure 8, Group 3) highlights its relationships with those more typical (Groups 1 and 2).

We recognise a variant of *Erica arborea* in Aillonense and Guadarraman territories rich in *Erica arborea* and others without tree heath, but with taxa from more hygrophilous communities such as *Frangula alnus, Rubus ulmifolius, Rosa corymbifera* and *Crataegus monogyna*. These relevés represent a contact with the spiny shrubby mantle of hygrophilous Pyrenean oak and willow forests (FERNÁNDEZ-GONZÁLEZ, 1991: 235; sub. *Genisto-Cytisetum scoparii ericetosum arboreae* V. FUENTE 1986 *ex* FERNÁNDEZ-GONZÁLEZ 1991). Figure 5 shows the independence of this group from the rest, except for two relevés which are located near the group rich in *Adenocarpus complicatus*. In the final ordination (Figure 8, Group 4) it is related with other groups which present *E. arborea* in their composition (*Genisto-Adenocarpetum hispanici* var. de *E. arborea* (Group 11), or else with the group denominated 'communities of *Erica arborea*' (FERNÁNDEZ-GONZÁLEZ, 1991: 246; Group 12), linking to the latter in the MST.

The variant of *Adenocarpus argyrophyllus* (=*Cytiso-Genistetum cinerascentis adenocarpetosum* Cantó 1979) with a Cadalsian distribution (Guadarramean sector) highlights the influence exerted by the taxa with a western distribution on the mountains surrounding it, as is the case of the Sierra de San Vicente. The presence of *A. argyrophyllus* marks sufficient independence from the typical subassociation. The relevés analysed (Cantó, *op. cit.*, table pg. 70) were synthesised in two groups depending on the presence of *Adenocarpus argyrophyllus*. In the final ordination these two groups (Figure 8, Groups 5 and 6, respectively) are located together with the typical groups of the association *Cytiso-Genistetum*, linking in the MST to Group 16 with Paramero-Serrotense

distribution and included in the same association, thus establishing possible floristic relationships between these two mountain ranges surrounding the Gredos massif.

subas. ***genistetosum falcatae*** Sánchez-Mata 1989

This is the only subassociation with a Bejaran-Gredense distribution, located on the limit between the eastern Gredense and the Guadarramean (Cadalsian district CANTÓ, 2004). It was independent in the first numerical analysis carried out on the 308 relevés comprising this association and the two following ones. In the final ordination and MST (Figure 8, Group 7) it is located near, although sufficiently isolated, to the core of this association, linking through the MST to the group of *Thymo-Cytisetum multiflori* var. *Genista falcata* (Group 46), which displaces it to altitudes of 1000-1100 m (SÁNCHEZ-MATA, 1989: 289).

7. *Genisto floridae-Adenocarpetum hispanicae* Rivas-Martínez 1974 (Tables 5 and 8)

Communities of *Adenocarpus hispanicus* and "flowering brooms" (*Genista florida*) developing on deep cool siliceous soils with humus mull. They represent the first substitution stage of Pyrenean oak (*Luzulo forsteri-Quercetum pyrenaicae*) and birch forests (*Melico uniflorae-Betuletum celtibericae*).

Their biogeographical distribution is restricted to the sub-Guadarramean sector. They appear at altitudes of between 1250 m and 1550 m, although the dominant species (*A. hispanicus*) can be found at much higher altitudes.

Numerical data analysis. After the first classification (Figure 4), some relevés originally subordinated to *Cytiso-Genistetum cinerascentis* were transferred here mainly due to the absence of *Genista cinerascens* and also to the presence of *Cytisus scoparius*. However a subsequent ordination (CA) performed on the 59 relevés which can be attributed to this association, and separated from the rest (*Genisto-Cytisetum scoparii* and *Cytiso-Genistetum cinerascentis*) in this classification, separated them into two independent groups (Figure 8, Group 2: FERNÁNDEZ-GONZÁLEZ, 1991, table 14B, invs. 28-32; Group 3: FERNÁNDEZ-GONZÁLEZ, *op. cit*., table 15). The 49 remaining relevés were once again submitted to an ordination by means of correspondence analysis (CA) and the results are discussed below. This analysis summarised the variability of this association into six groups.

The most typical relevés in this association were synthesised into groups based on the results of the ordination which separated the three impoverished relevés, particularly in *Cytisus scoparius* and *Genista florida*, with scarce or no presence of transgressive plants of *Prunetalia* such as *Rosa canina* or *Rubus ulmifolius*. For all these reasons they were synthesised independently. In the final ordination and MST (Figure 8, Groups 8 and 9) they appear linked within the core of groups which comprise this association.

We differentiated a variant of *Genista cinerascens* (= *Genisto-Adenocarpetum genistetosum cinerascentis* Rivas-Martínez 1974) integrated by relevés which were separated in the analysis carried out. Although in the ordination two tendencies were differentiated according to the cover of broom, the relevés were synthesised in a single group. In the final ordination (Figure 8, Group 10) it is located in a position very near the two typical groups, linking to one of them (Group 8) in the MST, as well as to Group 13 of *Adenocarpus complicatus* and to 16 of *Cytiso-Genistetum cinerascentis*.

The variant of *Erica arborea* (=*Genisto-Adenocarpetum ericetosum arboreae* FERNÁNDEZ-GONZÁLEZ 1991) is clearly differentiated on the three first axes of the ordination carried out on the set of the relevés. This is a group which is rich in nemoral plants such as *Arenaria montana, Holcus mollis* and *Galium rotundifolium*, as well as other herbaceous plants such as *Avenella iberica* or *Luzula lactea*, although none of them is exclusive to the group. In the final ordination and MST (Figure 8, Group 11) it links to the groups enriched with *Erica arborea* of *Cytiso-Genistetum cinerascentis*, as well as to the typical group (Figure 8, Group 14 and 8, respectively).

We include in this variant the relevés of FERNÁNDEZ-GONZÁLEZ (1991) subordinated to "communities of *Erica arborea*". The study of these

relevés revealed a degree of independence, and for this reason they were synthesised separately. The resulting synthetic relevé is composed by three original author relevés (FERNÁNDEZ-GONZÁLEZ, *op. cit.*) and one by us. The final ordination and MST (Figure 8, Group 12) show their relationship with the rest of the groups which form this association.

The relevés included in the variant of *Adenocarpus complicatus* (= *Genisto-Adenocarpetum adenocarpetosum complicati* Rivas-Martínez 1974) are located in the ordination very close to the typical relevés, and are better differentiated along the third axis. It is very poor in brooms, and is only sparsely represented, as well as *Adenocarpus hispanicus* and *A. complicatus, Cytisus scoparius* and *Genista florida*; moreover, the cover of *A. hispanicus* is the highest in the whole table (5 in 90% of the invs.). Their impoverishment makes it difficult, from the numerical point of view, to relate them with the other groups, although in the final ordination diagram it is located in the distribution area of this association (Figure 8, Group 13), linking with the group of the variant of *G. cinerascens* (Group 10).

8. *Cytiso oromediterranei-Genistetum cinerascentis* Rivas-Martínez 1970 corr. Rivas-Martínez & Cantó 1987 (Tables 6 and 9)

Nanophanerophytic communities constituted by *Cytisus oromediterraneus* and *Genista cinerascens* in addition to other genistées. Dynamically they represent the first substitution stage of the Pyrenean oak forests of *Festuco elegantis-Quercetum pyrenaicae*. They are distributed biogeographically in the Bejaran-Gredensean sector on both slopes of the Sistema Central. They appear at altitudes of between (1250) 1400 and 1700 (1800) m.

Numerical data analysis. An independent study was done on 142 relevés. The first classification carried out on the set of the relevés (Figure 6) separated, at the first level of cutting, the Guadarraman from the Bejarano-Gredense relevés, with the exception of a set of Guadarraman relevés rich in *Cytisus scoparius* which were mixed with the western (Bejarano-Tormantino) relevés. Therefore the Guadarraman and Bejarano-Gredense relevés were studied separately by means of classifications and ordinations. The classification of the 85 Bejarano-Gredense relevés separated at the first cutting level the more typical relevés in general, as well as others rich in *Euphorbia oxyphylla* and *Cytisus x praecox*. The other arm of the dendrogram concentrated the relevés rich in western taxa such as *Echinospartum barnadesii* and *Cytisus eriocarpus*, in addition to *Erica arborea*. The ordination was carried out separately on the two parts by means of correspondence analysis (CA). Finally the total relevés were synthesised into 14 groups.

subas. **typical**

In addition to the Bejarano-Gredense relevés traditionally subordinated to this subassociation, this also includes the Paramero-Serrotense relevés which were originally subordinated within the subas. *stipetosum giganteae* by their author (SÁNCHEZ-MATA 1989, table 101). However, in spite of the absence of *Festuca elegans* in these relevés, which would distance them from the clearly typical (RIVAS-MARTÍNEZ & CANTÓ, 1987), the almost constant presence of western taxa such as *F. summilusitana, Ornithogalum concinnum* and *Centaurea alba* relates them more to this subassociation than to the typical Guadarraman subassociation (*Pteridio aquilini-Cytisetum oromediterranei*). In the final ordination (Figure 8, Group 16) it is located near the other two typical Gredense groups (14 and 15). The MST shows the relationships with them through Group 18 (var. de *Cytisus x praecox*).

In addition, a group of Bejarano-Tormantino relevés (upper Tormes) with *Euphorbia oxyphylla* at altitudes below 1500 m. is clearly independent from the most typical. In the final ordination this group (Figure 8, Group 17), while still close to the most typical (14 and 15) and even linked to them through the MST, is located at a somewhat outlying position establishing relationships with groups in the association *Thymo-Cytisetum multiflori*. From the syntaxonomical point of view we consider that the best treatment we can give it is that of variant.

Table 6
Cytiso oromediterranei-Genistetum cinerascentis var. típica (1-6), var. *Genista florida* (7)
Thymo mastichinae-Cytisetum multiflori var. típica (8-11), var. *Genista cinerascens* (12-20)
(*Geniston floridae*, *Cytisetalia scopario-striatae*, *Cytisetea scopario-striatae*)

Altitud (1=10 m)	157	147	156	147	147	120	134	123	97	92	117	100	115	118	145	116	96	98	125	108
Number of species	9	6	5	13	14	13	10	12	12	7	10	7	14	9	6	13	6	9	11	9
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Characteristics:																				
Cytisus scoparius	.	1	.	1	3	3	3	.	2	.	1	1	2	4	5	2	2	2	5	4
Cytisus oromediterraneus	5	3	4	5	3	1	4	.	.	.	.	.	.	.	.	1	4	4	+	1
Genista cinerascens	2	4	2	2	3	4	.	2	.	.	.	5	4	.	.	.	.	.	.	.
Genista florida	.	.	.	.	.	2	+	+	+	2	4	.	.	.	.	2	.	.	.	+
Pteridium aquilinum	.	.	.	1	+	.	.	+	3	3	+	.	.	.	.	.	.	.	.	.
Adenocarpus complicatus	.	.	.	+	+	+	.	.	+	.	+	.	.	.	.	1	.	.	.	.
Cytisus multiflorus	.	.	1	.	.	.	.	4	4	4	1	.	1	.	.	.	.	.	.	.
Erica arborea	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	5	.	.	.	+
Cytisus eriocarpus	.	.	.	.	.	.	.	3	1	+	+	.	.	.	.	.	.	.	.	.
Orobanche rapum-genistae	+	.	.	1	1	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Genista tournefortii	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	+	.
Adenocarpus gredensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Shrubby and forest companions:																				
Quercus pyrenaica	.	.	.	1	+	+	.	+	.	.	.	+	1	.	+	1	.	.	.	.
Quercus rotundifolia	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	1	+	.
Arenaria montana	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Rosa corymbifera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.
Daphne gnidium	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.
Others:																				
Centaurea alba	+	.	+	1	+	.	.	+	.	.	.	+	.	.	.	.	+	1	1	+
Lavandula sampaioana	.	.	.	.	.	.	2	.	.	1	.	1	.	2	.	1	+	+	+	.
Thymus mastichina	+	.	.	.	.	.	1	.	.	.	.	.	+	1	.	1	.	1	1	.
Lavandula pedunculata	.	.	.	.	.	.	.	2	+	1	.	.	+	.	.	.	1	+	2	.
Euphorbia oxyphylla	.	.	.	+	+	+	.	.	.	.	.	.	+	.	.	+	1	1	.	+
Festuca elegans	1	.	.	2	2	2	.	1	1	.	.	.	.	.	.	2	.	.	.	+
Agrostis truncatula	1	+	+	+	+	+	.	.	.	.	.	.	.	.	.	+	.	1	.	.
Carduus carpetanus	+	+	.	.	.	+	1	.	.	.	.	+	.	.	.	.	.	.	+	+
Agrostis castellana	.	1	.	.	.	.	1	.	.	.	.	.	1	1	.	.	.	.	.	.
Halimium viscosum	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	1	.	.	.	.
Dactylis hispanica	.	.	.	.	.	.	.	.	.	.	.	.	1	+	1	.	.	.	.	.
Thymus zygis	.	.	.	.	.	+	1	.	.	.	.	.	.	+	.	.	.	.	.	.
Helianthemum masguindalii	.	.	.	.	.	.	.	1	.	1	.	.	+	.	.	.	.	.	.	.
Festuca summilusitana	2	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thapsia villosa	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1
Santolina rosmarinifolia	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.

Shrubby and forest companions: *Erica aragonensis* and *Rubus ulmifolius* + in 11; Others: *Stipa gigantea* + in 5; *Centaurea macrocephala* and *Biscutella scaposa* + in 6; *Arrhenatherum carpetanum* 1 in 7; *Cistus psilosepalus* 1, *Digitalis thapsi* and *Helichrysum serotinum* + in 9; *Calluna vulgaris* 1 and *Corynephorus canescens* + in 15.
Localities: 1: Ávila, Villanueva del Campillo; 2: Ávila, La Herguijuela; 3: Ávila, San Martín de la Vega del Alberche; 4 and 5: Ávila, Tremedal; 6: Ávila, Gil García; 7: Ávila, Riofrío; 8: Ávila, Serranillos; 9: Ávila, Navaluenga; 10: Ávila, El Arenal; 11: Cáceres, Piornal; 12: Ávila, El Losar del Barco; 13: Ávila, El Barco de Avila; 14: Ávila, Collado del Mirón; 15: Ávila, La Lastra del Cano; 16: Ávila, Nava del Barco; 17: Ávila, Malpartida de Corneja; 18: Ávila, La Horcajada; 19: Ávila, Casas del Puerto de Villatoro; 20: Ávila, Navamojada.

We have differentiated a variant of *Genista florida* (=*Cytiso-Genistetum genistetosum floridae* Rivas-Martínez 1970) as an impoverished aspect of this typical subassociation. In successive ordinations they were separated into two groups, the first of them from the areas in the Sierra de Gredos mountains near the Tormes (Rivas-Martínez, 1970, table 1, invs. 14-16) and including in their composition *Cytisus scoparius* and some *Festuca elegans*. The second group comes from the Sierra de Béjar

(F. NAVARRO & *al*., 1987, table 4, invs. 3 and 4) and is somewhat richer in brooms such as *Cytisus eriocarpus* and was separated in previous ordinations. In the final ordination (Figure 8, Groups 18 and 19, respectively) both were close to the western core. The MST, however, relates Group 19 to the Guadarraman groups of *Pteridio-Cytisetum*, due to the floristic impoverishment described above.

The variant of *Cytisus x praecox* (=*Cytiso-Genistetum cytisetosum praecocis* Rivas-Martínez & Sánchez-Mata in Sánchez-Mata 1989) represents the transit towards the broom communities of *Cytisus multiflorus* (*Thymo-Cytisetum multiflori*). The lower cover of *Cytisus x praecox*, the presence of Cytisus multiflorus in other relevés, in addition to their scarcity, hinder their separation in the first analyses; subsequently, however, they became independent relatively well. In the final ordination (Figure 8, Group 20) it is located in the typical core of this association, linked to them in the MST.

The group of relevés described as the dynamic transit towards the heath communities of *Erica aragonensis* (*Cytiso-Genistetum ericetosum aragonensis*, F. NAVARRO & *al*., 1987: 344) behaved as deviants, as in the first ordinations carried out they were ultimately synthesised as an independent group. In the final ordination (Figure 8, Group 21) they maintain a tendency to remain distant from the rest of the groups, although linking in the MST to Group 25 (subas. *adenocarpetosum gredensis*); we therefore maintain it as a variant, although it appears more likely to be a facies of *Junipero-Ericetum aragonensis*.

subas. ***echinospartetosum barnadesii*** Rivas-Martínez 1970

This subassociation was described as belonging to unfavourable biotopes, shallow soils and windy sites, and also to have a transitional significance towards the Gredense oro-Mediterranean broom community of *Cytiso oromediterranei-Echinospartetum barnadesii* (SÁNCHEZ-MATA, 1989).

In addition to the typical variant, three more have been described (SÁNCHEZ-MATA, *op. cit*): 1) with *Adenocarpus gredensis*, 2) with *Cytisus multiflorus* and *C. x praecox* and 3) with *Erica arborea*. The ordination performed on the relevés does not allow differentiation on its first two axes of more than the variant with *A. gredensis* which, although comprising two relevés, has a high cover of this plant in these relevés. However the three groups of variants were synthesised separately from the typical. In the final ordination and MST (Figure 8) the typical group (20) acts as a central core in the lower left section of the diagram surrounded by the three variants (groups 21, 22 and 23), which are linked to it in the MST.

Finally the lack of separation of the relevés subordinated to the subassociation *cytisetosum eriocarpi* (SÁNCHEZ-MATA, 1989) was not completely clear due to the presence of *Echinospartum barnadesii* in their composition (approximately 80%), which has led us to formulate it as a variant of it. In addition, the presence of *Erica arborea* (SÁNCHEZ-MATA, 1989) in the relevés is not sufficient to maintain it as a subassociation, as it also appears in the other two variants, as well as in the subassociation *adenocarpetosum gredensis*. The final ordination and MST (Figure 8, Group 26) show the relationship with these communities, linking to the group which represents the typical variant of this subassociation (Group 22), which reinforces its inclusion in the subassociation.

subas. ***adenocarpetosum gredensis*** Rivas-Martínez 1970 corr.

As with the previous subassociation, it grows on more or less rocky sites. In the ordinations carried out, the three relevés in this subassociation are well separated from the rest of the relevés, as well as from the relevés subordinated to the variant with *Adenocarpus gredensis* of the subas. *echinospartetosum barnadesii*. In the final ordination (Figure 8, Group 24) and it is more or less near the group of variants of the subas. *echinospartetosum*, linking to their typical variants (Group 22) in the MST.

9. *Pteridio aquilini-Cytisetum oromediterranei* Gavilán, Cantó, Fernández-González, Rivas-Martínez & Sánchez-Mata 2002 (Tables 5 and 9)

(Incl.: *Cytiso oromediterranei-Genistetum cinerascentis stipetosum giganteae* (Rivas-Martínez 1970) Rivas-Martínez & Cantó 1987, *Cytiso oromediterranei-Genistetum cinerascentis genistetosum floridae*

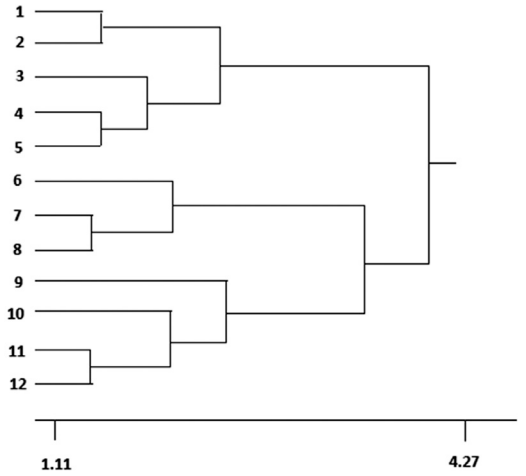

Figure 6. – Classification of *Pteridio aquilini-Cytisetum oromediterranei* relevés (groups 1-6) y *Cytiso oromediterranei-Genistetum cinerascentis* relevés (groups 6-12).

Rivas-Martínez 1970 p.p., *Cytiso oromediterranei-Genistetum cinerascentis lavandulo-thymetosum zygidis* Rivas-Martínez 1970 nom. illeg.)

Nanophanerophytic communities of *Cytisus oromediterraneus*, occasionally accompanied by *Genista cinerascens*, in addition to other *Genisteae species*. Dynamically they represent the first substitution stage of the pine forests of *Pteridio aquilini-Pinetum ibericae* (Rivas-Martínez & Molina, 1998) and the Pyrenean oak forests of *Luzulo-Quercetum pyrenaicae galietosum rotundifolii*. They are biogeographically distributed in the Guadarramean sector of the Carpetan-Leonese subprovince. They appear at an altitude of between (1250) 1400 and 1700 (1800) m.

Numerical data analysis. As mentioned in the previous association, the relevés included here were analysed in conjunction with those of *Cytiso-Genistetum cinerascentis*, and separated from these in the first classification; the study of both groups of relevés was therefore done independently. The results of the classification of the Guadarraman relevés coincided with the ordination (CA, Figure 7) separating the groups richest in *Cytisus scoparius*, or *Erica arborea* and/or *Genista florida* from the rest. In general, as indicated in the previous association, and as will be seen in the description of the subassociations, there is considerable biogeographic polarity in these two associations, as can also be seen in the final ordination of the synthetic relevés (Figure 8).

This association is the habitual Guadarraman community of *Cytisus oromediterraneus* (Rivas-Martínez & Cantó, 1987; Cantó & Rivas-Martínez, 2005). In comparison with the previous association it is worth noting, in addition to the absence of western taxa such as *Festuca elegans, F. summilusitana*, etc., the almost constant presence in almost all the relevés of *Avenella iberica*, typically very scarce in *Cytiso-Genistetum cinerascentis*.

We have included in this subassociation the relevés subordinated by Fernández-González (1991) to *Cytiso-Genistetum cinerascentis genistetosum floridae* and which have considerable heterogeneity as a group, and these form two groups, one of which (Fernández-González, *op. cit.*, table 14b, invs. 19 and 20) was classified in the first stages of analysis within *Genisto floridae-Cytisetum scopariae* (Figure 4, Group 20 p.p.) due to the absence (or scarce presence) of *Genista cinerascens* in these groups. In the ordination of the group of relevés in this association they separated from the rest along both axis 1 and axis 2, together with another relevé without prior adscription (Figure 5), and they were thus synthesised as an independent group. With regard to the other three, they are richer in *Genista cinerascens* than in *G. florida*. The final ordination (Figure 8, Groups 28 and 29) shows their relationships with the rest of the Guadarraman groups.

A variant of *Cytisus scoparius* has also been distinguished. In the partial ordination of the relevés (Figures 7a,b) it is clearly separated from the typical variant (Figs. 7a,b). The difference is established by the presence of *C. scoparius* and by characteristic taxa of serial communities such as *Lavandula pedunculata, Thymus zygis, Santolina rosmarinifolia* and *Corynephorus canescens*. This confirms the plasticity of Scotch broom (*C. scoparius*) in adapting to more degraded biotopes. In this variant it is also worth noting the absence of *Pinus sylvestris* var. *iberica*, a species which is relatively frequent in the typical variant. These relevés correspond to the subassociation denominated *lavandulo-thymetosum zygidis* (Rivas-Martínez

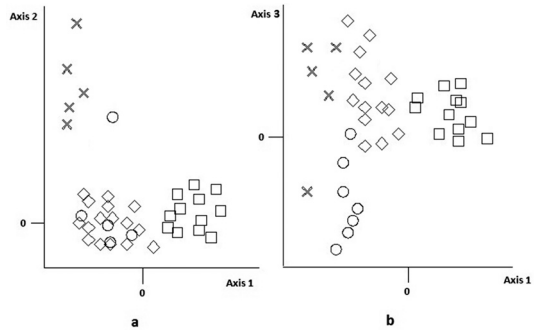

Figure 7. – Ordination (CA) of *Pteridio aquilini-Cytisetum oromediterranei* releves: diamonds, var. typical; squares, var. of *Cytisus scoparius*; crosses, var. of *Erica arborea*; stars, var. of *Genista florida*. Diagram a represents axis 1 and 2; b, axis 1 and 3.

1970: 161, table 2), a name which was subsequently officially recognised as the subassociation *stipetosum giganteae* (RIVAS-MARTÍNEZ & CANTÓ, *loc. cit.*). In the final ordination and MST (Figure 8, Groups 30 and 31), these variants are linked together and to groups of other variants also included in this association. The irregularity presence of *Stipa gigantean* has already been discussed by other authors (FERNÁNDEZ-GONZÁLEZ, 1991).

With regard to the variant of *Erica arborea* (sub. *Cytiso-Genistetum ericetosum arboreae* Rivas-Martínez & Cantó 1987), we have distinguished two synthetic groups; the first, in addition to *Erica arborea*, also has *Genista florida* and is separated in the ordination (Figs. 7a and 7b, Group 5) along axes 1-3. The second group is formed by five relevés of FERNÁNDEZ-GONZÁLEZ (1991, table 14B, invs. 28-32), in which it is particularly worth noting the absence of *G. cinerascens* and the presence of plants typical of cool soils such as *Galium rotundifolium, Rosa canina, Teucrium scorodonia* and *Rubus idaeus*. Finally, the relationships of these two groups with the rest of the groups in the final ordination and the MST were studied, as seen in Figure 8 (Groups 32 and 33). They are located near the Guadarraman groups in this same association, connecting in the MST to the *Genisto-Adenocarpetum* var. of *Erica arborea* (Group 11).

The variant of *Adenocarpus hispanicus* (=*Cytiso-Genistetum cinerascentis adenocarpetosum hispanici* Costa 1974) represents the transit towards the broom community of *Genisto-Adenocarpetum hispanici*. This transit was evidenced with two subassociations. However, as has been indicated (FERNÁNDEZ-GONZÁLEZ, 1991: 240), it appears more correct to link them under the same heading -older in the original description- and for this reason, following this author, we maintain them in this association although under a lower rank. Three synthetic groups, fairly conflictive with each other, are included under this heading. The difference between the first, which corresponds to the relevés of the original description of the subassociation, and the two second groups, with a similar floristic composition, appears to be the proportion of the cover of *Adenocarpus hispanicus* and *Cytisus oromediterraneus*, which is inverted in both. In the final ordination (Figure 8, 34-36) the location of these three groups is very different, although they remain in the area of the groups in this association. The MST, on the other hand, evidences the lack of relationship discussed earlier, and thus the first is linked to the group of the var. of *Cytisus scoparius* of this association (30) and the other two to the groups of *Genisto-Adenocarpetum* (Groups 8 and 10).

10. *Thymo mastichinae-Cytisetum multiflori* Rivas-Martínez 1968 (Tables 6 and 10)

Broom communities characterised by the presence of "white Spanish broom" (*Cytisus multiflorus*), although other genistées are also frequent such as *Cytisus eriocarpus, C. scoparius* and *Genista florida*. They represent the first substitution stage of the Pyrenean oak forests of *Festuco elegantis-Quercetum pyrenaicae*. They are distributed biogeographically in the sectors Bejaran-Gredensean, Salmanticensean and Toledano-Tagano. They grow at an altitude between 900 and 1350 m.

Numerical data analysis. They were analysed previously together with the westernmost brooms communities of the Sistema Central mountains, although due to their floristic composition, they were studied independently. A first classification was done which clearly separated the subassociations *adenocarpetosum aurei, adenocarpetosum gredensis* and *genistetosum falcatae*. A corres-

pondence analysis (CA) was done on the rest of the relevés, with somewhat unclear results and which distinguished a group of Bejarano-Tormantino relevés with *Euphorbia oxyphylla* and/or *Genista tournefortii*, which in turn included a small group of relevés rich in *Cytisus oromediterraneus*, although at altitudes under 1000 m. Once these had been excluded, a further CA was carried out, whose results are discussed in the text below.

The most typical relevés of this association, in addition to *Cytisus multiflorus* and *Festuca elegans*, have *Cytisus eriocarpus* and *Genista florida* in their composition, while *C. scoparius* is somewhat scarce. We have distinguished a Bejarano-Tormantino and Verense variant rich in *C. scoparius* and *Genista cinerascens* but poor in *Cytisus multiflorus*, which is slightly separated from the typical group. In the final ordination and MST the two groups described (Figure 8, Groups 37 and 38) appear linked, although the latter (Bejarano-Tormantino and Verense variant) is located beside those of *Cytiso-Genistetum cinerascentis*, linking to the typical group of this association (Group 15), thus showing its transitional character between the two associations.

The variant of *Genista cinerascens* (=*Thymo-Cytisetum genistetosum cinerascentis* Rivas-Martínez 1968) shows a scarcity in plants of the class such as *Cytisus eriocarpus, Genista florida* and *Pteridium aquilinum*, although on the other hand there is an abundance of *Genista cinerascens*. There is also a greater presence of *Lavandula pedunculata* and *Santolina rosmarinifolia*, which gives an idea of its somewhat more degraded character with regard to usual, probably due to its development in rockier biotopes, ridges etc. (SÁNCHEZ-MATA, 1989). It is relatively well-differentiated in the second ordination, and relationships have been observed with the typical variant in the final ordination (Figure 8, Group 39), where they are linked to the same group (Group 37) in the MST.

In addition to the typical group -discussed in the paragraph above- we have also included here two groups of relevés from the Bejaran-Tormantino subsector which separated in the first of the ordinations. Both are differentiated from the typi-

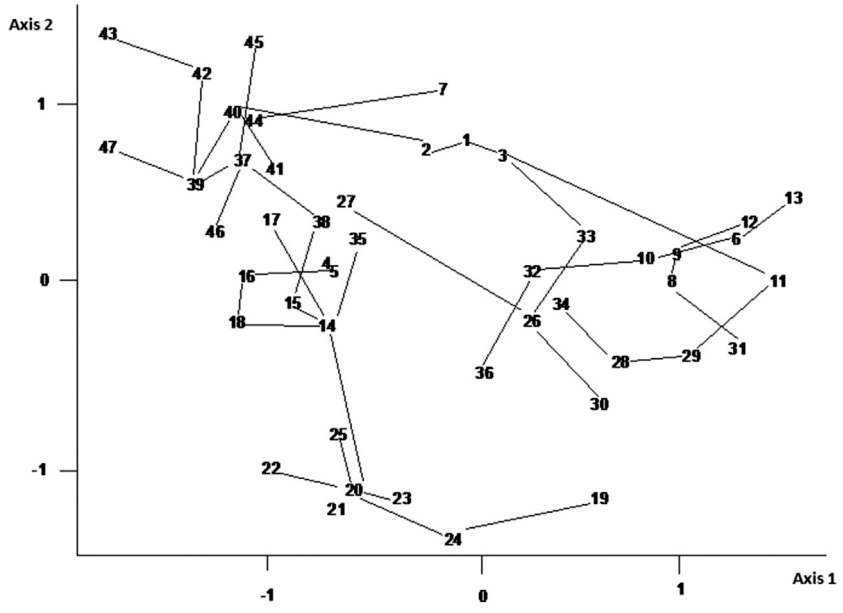

Figure 8. – Final ordination (CA) and divisive classification (MST) of supramediterranean *Genistion floridae* communities. Numbers are the same as in the text and tables 8-10: *Genisto floridae-Cytisetum scoparii* (1-7); *Genisto floridae-Adenocarpetum hispanici* (8-13); *Cytiso oromediterranei-Genistetum cinerascentis* (14-27); *Pteridio aquilini-Cytisetum oromediterranei* (28-36); *Thymo-Cytisetum multiflori* (37-47).

Table 7
Synthetic table of *Genistion floridae* plant communities
Cytisetum multifloro-eriocarpi (13-21)
Adenocarpetum argyrophylli subas. típica (22), subas. *franguletosum alni* (23)
(*Cytisetalia scopario-striatae*, *Cytisetea scopario-striatae*)

N. of relevés	29	17	24	10	12	6	13	7	5	9	4
Relevé N.	1	2	3	4	5	6	7	8	9	10	11
Characteristics:											
Cytisus multiflorus	5	5	2	1	5	1	5	.	5	3	.
Cytisus eriocarpus	5	.	5	3	.	5	5	5	2	3	.
Adenocarpus complicatus	1	1	2	2	1	1	1	.	.	.	.
Cytisus scoparius	1	5	5	3	.	.	1	5	.	.	.
Orobanche rapum-genistae	1	1	1	1	1	.	.	1	.	.	.
Pteridium aquilinum	3	2	3	2	2	.	.	.	5	.	.
Genista florida	2	1	2	.	.	.	.	.	5	.	.
Retama sphaerocarpa	.	.	.	.	.	5	5	5	5	.	.
Genista falcata	.	1	.	3	.	.	.	.	.	.	.
Adenocarpus anisochilus	.	.	2	.	.	.	.	.	2	.	.
Adenocarpus argyrophyllus	.	.	.	.	.	.	.	.	.	5	5
Cytisus grandiflorus	1	.	.	.	.	.	.	.	.	.	.
Genista cinerascens	.	.	.	.	.					.	3
Shrubby and forest companions:											
Cistus ladanifer	3	2	3	2	.	1	3	3	2	3	.
Daphne gnidium	2	2	3	1	2	.	3	2	3	.	.
Quercus rotundifolia	.	2	.	1	1	.	2	1	2	3	4
Quercus pyrenaica	2	2	3	2	2	.	2	.	3	.	.
Rubus ulmifolius	2	.	1	1	.	3	1	.	3	.	.
Crataegus monogyna	.	.	1	1	1	4	1	.	3	.	.
Erica australis	3	1	1	3	1	.	.	.	.	.	.
Quercus suber	1	1	2	1	1	.	.	.	.	.	.
Erica arborea	3	1	2	5	.	.	.	.	.	.	2
Phillyrea angustifolia	1	.	2	2	.	.	1	.	.	.	.
Osyris alba	.	.	1	1	.	.	.	1	1	.	.
Arbutus unedo	1	.	2	4	.	.	.	.	.	.	.
Cistus populifolius	2	.	2	1	.	.	.	.	.	.	.
Juniperus oxycedrus	.	.	.	.	.	.	.	.	1	3	2
Viburnum tinus	1	.	1	.	.	.	.	.	.	.	.
Quercus broteroi	.	.	1	1	.	.	.	.	.	.	.
Castanea sativa	.	.	1	1	.	.	.	.	.	.	.
Genista hirsuta	.	.	.	.	.	.	1	2	.	.	.
Pyrus bourgaeana	.	.	.	.	.	.	1	3	.	.	.
Pinus pinaster	.	.	.	1	.	.	.	.	2	.	.
Frangula alnus var. *retusa*	.	.	.	.	.	.	.	.	.	.	5
Others:											
Lavandula sampaioana	5	4	3	2	5	5	4	3	4	3	.
Cistus salvifolius	3	3	2	2	3	1	1	.	.	.	.
Urginea maritima	2	1	1	.	1	.	2	3	.	.	.
Thymus mastichina	3	1	1	1	1	.	.	.	5	.	.
Cistus psilosepalus	3	2	2	2	2	.	.	.	.	.	.
Halimium ocymoides	2	2	2	1	1		.	.	.	.	.
Lavandula luisieri	1	1	2	2	.	.	.	1	.	.	.
Thapsia villosa	1	2	2	.	.	.	1	1	.	.	.
Calluna vulgaris	1	1	1	3	.	.	.	.	.	.	.
Digitalis thapsi	2	1	.	.	3		.	.	.	2	.
Origanum virens	1	1	3	.	.	.	.	1	.	.	.
Lithodora prostrata	1	1	.	1	.	.	.	.	.	.	.
Helichrysum serotinum	1	.	2	.	.	.	.	.	2	.	.
Stipa gigantea	.	1	1	.	.	.	.	.	1	.	.
Dianthus lusitanicus	.	.	.	.	.	.	.	.	1	4	4

Relevé N.	1	2	3	4	5	6	7	8	9	10	11
Tuberaria vulgaris	1	1	.	.	.	.	.	.	.	.	.
Erica scoparia	1	.	.	2	.	.	.	.	.	.	.
Pterospartum tridentatum	1	.	.	1	.	.	.	.	.	.	.
Lotus glareosus	1	.	.	1	.	.	.	.	.	.	.
Leucanthemopsis flaveola	1	.	.	.	3	.	.	.	.	.	.
Erica umbellata	.	.	.	1	1	.	.	.	.	.	.
Asphodelus aestivus	.	.	.	.	.	.	1	1	.	.	.
Centaurea castellana	.	.	.	.	.	.	1	.	1	.	.

Shrubby and forest companions: *Tamus communis* 1 in 19; *Cistus albidus* and *Asparagus acutifolius* 1 in 20; *Dorycnium pentaphyllum* 1 in 21. Others: *Halimium alyssoides* and *Ulex europaeus* 1 in 13; *Genista triacanthos* 1 in 16; *Arrhenatherum bulbosum* and *Astragalus lusitanicus* 1 in 19; *Sanguisorba spachiana* and *Helichrysum stoechas* 1 in 20; *Agrostis castellana* 2 and *Jasione montana s.l.* 1 in 21; *Arrhenatherum album* 1 in 22.

Procedence of relevés: 1: Table 4, inv. 1; Rivas Goday 1955, tab. pag. 466, invs. 1, 2; Valdés 1984, tab. 9, invs. 1, 3 & tab. 10, invs 1, 5, 13-18; Sánchez-Mata 1989, tab. 107, invs. 1-15; 2: Table 4, invs. 2-10; Valdés 1984, Tab. 10, inv. 11; Belmonte 1986, tab. 96, invs. 8-10; Ruiz Téllez 1988, tab. 1, inv. 3 & tab. 2, inv. 2; Amor 1991, tab. 101, invs. 2, 3; 3: Table 4, invs. 11,12; Rivas-Martínez & Belmonte inéd., tab. 5, inv. 6; Belmonte 1986, tab. 97, invs. 1-5, 7-9; Amor 1991, tab. 98, invs. 1-7 & tab. 99, invs. 1-6. 4: Table 4, invs. 13-19; Rivas Goday 1964, tab. pag. 466, inv. 3; Belmonte 1986, tab. 97, invs. 6, 10. 5: Valdés 1984, tab. 10, invs. 2-4, 6-10, 12; Ruiz Téllez 1988, tab. 1, inv. 4 & tab. 2, inv. 7; Amor 1991, tab. 101, inv. 1; 6: Rivas-Martínez & Belmonte inéd. tab. 17, invs. 15, 18-21; 7: Table 4, invs. 20-22; Valdés 1984, tab. 12, inv. 4 & tab. 13, invs. 1-3, 7, 9-11; Rivas-Martínez & Belmonte inéd., tab. 17, invs. 22-24; 8: Table 2, invs. 23, 24; Valdés 1984, tab. 12, invs. 1-3; Santos Bobillo 1989, tab. 30, invs. 1, 3; 9: Sánchez-Mata 1989, tab. 108, invs. 1-5; 10: Belmonte 1986, tab. 98, 1-9; 11: Ladero 1970, tab. pag. 107, 1, 3, 6, 7.

cal variant by the presence of typically Salmantino species such as *Euphorbia oxyphylla* and *Genista tournefortii*, taxa which do not occur simultaneously in all the relevés, and whose cover is also very low. There is also a fairly regular occurrence of *Cytisus scoparius* in their composition, with a scarce or irregular presence of other brooms such as *C. multiflorus, C. eriocarpus, Genista florida, G. cinerascens, Erica arborea, Lavandula sampaioana* and *Festuca elegans*. Additionally, the second differentiated group is composed of five relevés enriched with *Cytisus oromediterraneus* at altitudes which are unusual (960-1250 m) for the development of communities with a predominance of this taxon (*Cytiso oromediterranei-Genistetum cinerascentis*). All this gave rise to a situation in which the ordination of the relevés showed a considerable lack of internal cohesion, hindering the definition of synthetic groups and therefore making the synthesis laborious, with relevés rich in *C. oromediterraneus* on the one side, and the rest on the other.

The final ordination (Figure 8, Groups 40 and 41) includes them in the group of this association, although Group 41 is located in a position somewhat nearer the groups of *Cytiso-Genistetum cinerascentis*, but without any relation with them in the MST and appearing in this analysis as an extreme of the variability of the present association, as it only maintains connecting links with Group 40 -also Bejaran-Tormantino- which in turn is linked to the typical group of this variant (39), which is the reason we preferred to include them here more or less provisionally, in order to await new data which clarify their syntaxonomical position.

The variant of *Cistus laurifolius* (*Thymo-Cytisetum cistetosum laurifolii* Rivas-Martínez 1968) typical of the northern slope of the Sierra de Gredos, is found on disturbed soils. In addition to *Cistus laurifolius* its composition includes other taxa from serial stages of degradation: *Cistus x cyprius, Lavandula pedunculata, Santolina rosmarinifolia, Helichrysum serotinum, Thymus mastichina* and *Thymus zygis*. In the ordinations, the relevés subordinated to this variant are well separated from the rest. Within it we have distinguished a group of relevés enriched with *Cistus ladanifer* and with a scarce presence of *C. laurifolius*, which are typical of disturbed biotopes on the southern slope of Gredos. In the final ordination and MST these two variants (Figure 8, Groups 42 and 43) are located in a somewhat outlying part of the association, and are linked to each other and also to the

Table 8
Synthetic table of *Genistion floridae* plant communities (cont.)
Genisto floridae-Cytisetum scoparii subas. típica (1-3), var. *Erica arborea* (4),
var. *Adenocarpus argyrophyllus* (5 and 6), subas. *genistetosum falcatae* (7)
Genisto floridae-Adenocarpetum hispanici var. típica (8 and 9), var. *Genista cinerascens* (10),
var. *Erica arborea* (11 and 12), var. *Adenocarpus complicatus* (13)
(*Cytisetalia scopario-striati, Cytisetea scopario-striatae*)

N of relevés	10	23	9	6	3	4	9	3	17	11	6	5	5
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13
Characteristics:													
Pteridium aquilinum	1	2	4	4	4	3	5	5	5	3	5	4	2
Cytisus scoparius	5	5	5	5	4	.	5	.	5	5	5	.	2
Genista florida	5	3	5	4	.	.	5	.	5	5	5	3	1
Genista cinerascens	1	5	1	1	5	5	1	.	.	5	.	.	.
Adenocarpus complicatus	1	1	5	3	.	.	.	.	1	.	.	.	5
Adenocarpus hispanicus	.	.	.	.	.	.	.	5	5	5	5	.	5
Erica arborea	.	.	.	3	.	.	1	.	.	.	5	5	.
Cytisus oromediterraneus	.	.	.	.	.	.	.	.	1	1	.	.	1
Orobanche rapum-genistae	.	.	1	.	.	.	.	.	1	.	.	.	.
Retama sphaerocarpa	.	.	1	.	.	.	.	.	.	.	.	.	.
Adenocarpus gredensis	.	.	.	.	5	.	.	.	.	.	.	.	.
Genista falcata	.	.	.	.	.	.	5	.	.	.	.	.	.
Shrubby and forest companions:													
Rubus ulmifolius	1	1	2	4	.	.	5	.	3	3	.	3	3
Quercus pyrenaica	1	2	4	3	.	.	3	4	3	.	5	.	.
Rosa canina	.	.	2	1	.	.	.	2	3	3	4	2	4
Poa nemoralis	1	.	.	3	.	.	1	.	1	3	1	2	4
Juniperus hemisphaerica	1	1	1	2	.	.	.	2	1	.	5	.	.
Rosa corymbifera	1	1	1	3	.	.	.	2	2	.	.	4	.
Arenaria montana	.	.	2	.	.	.	2	2	3	3	5	2	.
Pinus sylvestris	.	1	1	1	.	.	.	.	3	1	5	.	.
Holcus mollis	.	1	.	1	.	.	.	2	2	.	4	.	.
Quercus rotundifolia	2	3	2	.	2	.	.	.	.	.	.	.	.
Cistus laurifolius	1	2	.	1	.	.	2	.	.	.	.	.	.
Pinus pinaster	2	1	.	.	.	.	2	.	.	.	.	.	.
Rosa micrantha	.	.	1	.	.	.	.	.	1	.	2	.	.
Lonicera hispanica	.	.	.	3	.	.	.	.	.	.	2	4	.
Juniperus oxycedrus	.	1	.	.	4	.	.	.	.	.	.	.	.
Castanea sativa	.	.	.	.	.	.	3	.	.	.	.	2	.
Galium rotundifolium	.	.	.	.	.	.	.	.	.	.	3	3	.
Others:													
Agrostis castellana	3	2	3	.	.	3	1	5	1	1	3	.	.
Luzula lactea	.	1	.	.	5	3	.	2	1	1	3	.	.
Lavandula pedunculata	2	3	4	.	.	2	2	.	1	.	.	.	.
Andryala integrifolia	1	1	1	1	.	.	.	2	2	.	.	.	.
Avenula sulcata	1	.	1	1	.	.	1	2	3	.	.	.	.
Dactylis hispanica	3	2	4	1	.	.	.	2	1	.	.	.	.
Santolina rosmarinifolia	4	3	4	1	.	.	2	.	.	1	.	.	.
Thymus mastichina	2	2	2	1	.	.	2	.	.	.	.	.	.
Crataegus monogyna	2	1	1	3	.	.	.	.	1	.	.	.	.
Thapsia villosa	.	1	2	.	.	.	1	.	.	1	.	.	2
Halimium viscosum	1	1	2	.	5	.	.	.	.	.	.	.	.
Thymus zygis	1	2	.	.	4	.	2	.	.	.	.	.	.
Helichrysum serotinum	1	1	1	.	.	.	1	.	.	.	.	.	.
Koeleria crassipes	1	.	1	.	5	.	.	2	.	.	.	.	.
Stipa gigantea	1	3	.	.	.	5	.	.	1	.	.	.	.
Arenaria querioides	.	.	.	.	2	3	1	.	.	.	.	.	.
Teucrium scorodonia	.	.	.	1	.	.	2	.	.	.	2	4	.
Carduus carpetanus	.	1	.	.	.	2	.	4	.	.	.	.	.

Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13
Frangula alnus	.	.	.	2	.	.	.	.	.	.	2	3	.
Avenella iberica	.	.	.	.	.	.	.	.	1	.	4	.	1
Linaria nivea	.	.	.	.	.	.	.	4	.	.	4	.	3
Centaurea macrocephala	2	2	.	.	.	.	.	.	.	.	.	.	.
Agrostis truncatula	.	.	.	.	4	5	.	.	.	.	.	.	.
Biscutella scaposa	1	.	.	.	.	.	4	.	.	.	.	.	.
Helianthemum masguindalii	.	1	.	.	.	.	.	.	1	.	.	.	.
Leucanthemopsis pulverulenta	.	.	.	.	.	.	.	.	1	1	.	.	.
Arrhenatherum carpetanum	1	.	.	.	.	.	.	.	.	.	2	.	.
Vaccinium myrtillus	.	.	.	.	.	.	.	.	.	.	1	2	.

Shrubby and forest companions: *Erica aragonensis* 2 and *Pterospartum tridentatum* 1 in 4; *Rubus idaeus* 1 in 9. Others: *Centaurea alba, Stipa lagascae* and *Leucanthemopsis pallida* 1 in 2; *Daphne gnidium* + in 3; *Ornithogalum concinnum* 2, *Origanum virens* 4 in 7; *Calluna vulgaris* 2 in 12.

Procedence of relevés: 1: Table 5, invs. 1-6; Rivas-Martínez & Cantó 1987, tab. 3, invs. 3, 9; Fernández-González 1991, tab. 12, invs. 4, 9; 2: Table 5, invs. 7-16; Cantó 1979, tab. pag. 70, inv. 8; Rivas-Martínez & Cantó 1987, tab. 3, invs. 1, 2, 4-8, 11, 12; Fernández-González 1991, tab. 12, invs. 10-12; 3: Table 5, inv. 17; Rivas-Martínez & Cantó 1987, tab. 3, inv. 10; Fernández-González 1991, tab. 12, invs. 1, 2, 5-8, 14; 4: Table 5, invs. 18; Fuente 1986, tab. 40, invs. 1-4; Fernández-González 1991, tab. 12, inv. 13; 5: Cantó 1979, tab. pag. 70, invs. 1-3; 6: Cantó 1979, tab. pag. 70, invs. 4-7; 7: Sánchez-Mata 1989, tab. 97, invs 5-13; 8: Fernández-González 1991, tab. 13, invs. 3, 7, 8; 9: Rivas-Martínez 1974, tab. 1, invs. 1-9; Rivas-Martínez & Cantó 1987, tab. 1, invs. 1, 2; Fernández-González 1991, tab. 13, invs. 1, 2, 4-6, 9; 10: Rivas-Martínez 1974, tab. 1, invs. 10-19; Rivas-Martínez & Cantó 1987, tab. 1, inv. 3; 11: Fernández-González 1991, tab. 13, invs. 10-15; 12: Table 5, inv. 19; Fernández-González 1991, tab. 15; 13: Rivas-Martínez 1974, tab. 1, invs. 20-24.

typical groups through the var. of *G. cinerascens* (Group 39), also commonly found on somewhat disturbed biotopes.

The variant of *Genista falcata* (=*Thymo-Cytisetum genistetosum falcatae* Sánchez-Mata 1989) appears on the southern slope of the Sierra de Gredos mountains, in the upper basin of the Tiétar river and represents the contact with the broom community of *Genisto-Cytisetum scoparii genistetosum falcatae* (SÁNCHEZ-MATA, 1989), also typical of that territory, although in a slightly lower altitudinal belt. The presence of *Genista falcata* in the relevés caused it to separate in previous analyses. The final ordination and MST (Figure 8, Group 44) brings them closer to the most typical variant group.

The variant of *Cistus psilosepalus* (=*Thymo-Cytisetum cistetosum psilosepali* Sánchez-Mata 1989) is distributed in the upper basin of the Tiétar river, and is the transit towards the shrubby communities of *Ericion umbellatae* (SÁNCHEZ-MATA, 1989). In the final ordination (Figure 8, Group 45) it is separated at one end of the diagram together with Group 43 (variant of *Cistus ladanifer*), both from the southern slope and with a similar ecological significance, linking in the MST to the typical group (37).

The variant of *Adenocarpus gredensis* (=*Thymo-Cytisetum adenocarpetosum gredensis* Sánchez-Mata 1989) is typical of rocky biotopes with a degree of soil humidity on the southern slopes of the Sistema Central mountains at altitudes of around 1300 m. As in the previous variant, it was differentiated in the first analyses. In the final ordination (Figure 8, Group 46) the presence of *Adenocarpus gredensis* causes this group to move nearer the western groups of *Cytiso-Genistetum cinerascentis*, without any clear evidence of its possible transitional character to these broom communities. In the MST, on the other hand, it remains linked to the typical group.

The variant of *Adenocarpus aureus* (=*Thymo-Cytisetum adenocarpetosum aurei* Sánchez-Mata 1989) is relatively abundant in the upper basin of the Alberche river, appearing on substrates of detritic origin and with a sandy or gravel texture in the upper horizons due to the intense degradation of the mother rock. As in the previous subassociation, it was clearly differentiated in previous analyses. In the final ordination diagram (Figure 8, Group 47) it is located in the same area as the rest of the groups which comprise this association. In the MST it is linked to the var. of *Genista cinerascens*, probably due to the presence of

Table 9
Synthetic table of *Genistion floridae* plant communities (cont.)
Cytiso oromediterranei-Genistetum cinerascentis subas. típica (14-17), var. *Genista florida* (18, 19)
var. *Cytisus praecox* (20), var. *Erica aragonensis* (21),
subas. *echinospartetosum barnadesii* (22-26), subas. *adenocarpetosum gredensis* (27),
Pteridio aquilini-Cytisetum oromediterranei var. típica (28-31),
var. *Erica arborea* (32, 33), var. *Adenocarpus hispanicus* (34-36)
(*Cytisetalia scopario-striatae, Cytisetea scopario striatae*)

N. of relevés	17	9	7	6	3	2	3	2	14	2	2	6	9	3	3	2	30	13	5	5	8	2	3
Relevé N.	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Characteristics:																							
Cytisus oromediterraneus	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Genista cinerascens	5	5	5	5	4	5	5	5	5	5	5	5	5	5	2	5	5	5	5	.	5	.	5
Pteridium aquilinum	3	3	1	4	.	3	5	.	3	.	3	5	4	.	3	.	3	2	1	4	4	3	5
Genista florida	1	3	4	1	5	5	5	.	2	3	3	.	3	.	5	5	.	.	4	2	1	.	5
Cytisus scoparius	3	2	.	5	5	3	2	.	.	.	.	1	1	2	4	.	1	5	.	.	.	.	5
Erica arborea	1	3	.	.	.	5	.	3	1	.	.	5	5	4	.	.	.	.	5	5	.	.	.
Orobanche rapum-genistae	1	.	.	2	.	.	.	.	2	5	3	.	2	.	.	.	2	.	.	1	.	.	.
Cytisus eriocarpus	.	1	.	.	.	3	.	.	1	.	3	.	5	.	.	.	.	.	.	.	.	.	.
Echinospartum barnadesii	.	.	.	.	.	.	.	.	5	5	5	5	4	.	.	.	.	.	.	.	.	.	.
Cytisus multiflorus	.	2	.	.	.	.	5	.	.	.	5	.	2	.	.	.	.	.	.	.	.	.	.
Adenocarpus complicatus	.	.	.	3	.	3	.	.	.	.	.	.	1	.	3	.	.	.	.	.	.	.	.
Cytisus x praecox	.	.	.	.	.	.	5	.	.	.	5	.	2	.	.	.	.	.	.	.	.	.	.
Adenocarpus gredensis	.	.	.	.	.	.	.	.	1	5	.	.	.	5	.	.	.	.	.	.	.	.	.
Adenocarpus hispanicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	5	5
Shrubby and forest companions:																							
Arenaria montana	.	.	.	2	.	.	.	.	1	3	.	2	2	.	4	.	2	.	2	1	2	.	.
Pinus sylvestris	1	.	.	.	.	.	.	.	.	.	.	.	.	.	3	3	3	1	1	3	4	5	.
Quercus pyrenaica	1	.	.	3	2	.	.	.	.	.	.	.	.	.	3	3	3	1	4	4	.	.	.
Juniperus hemisphaerica	.	.	.	.	4	.	.	.	.	.	3	.	.	.	2	5	3	3	2	5	2	.	.
Juniperus alpina	.	.	.	.	.	.	.	.	2	.	3	5	1	.	.	.	.	.	1	.	1	.	.
Sorbus aucuparia	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	1	.	1	1	.	.	.
Galium rotundifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.	1	3	.	.	.
Rosa corymbifera	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Rosa canina	1	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.	.	2	.	.	.
Holcus mollis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	5	.
Rubus ulmifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.	.	.	.	.	.
Rosa micrantha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	1	.	.	.	.
Rubus idaeus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	5	.	.	.
Cistus laurifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	2
Others:																							
Arrhenatherum carpetanum	2	2	5	.	1	.	4	.	2	3	.	2	4	.	3	.	3	1	1	5	.	.	.
Avenella iberica	1	2	.	.	.	.	.	5	3	5	.	5	2	4	2	5	5	1	4	3	5	.	.
Luzula lactea	1	2	.	.	.	.	.	5	4	5	3	5	.	2	2	3	3	.	3	3	.	5	.
Arenaria querioides	2	1	4	.	2	.	4	.	4	5	5	5	2	.	.	.	.	2	.	.	.	.	.
Jasione sessiliflora	4	.	4	2	2	.	5	.	3	3	5	5	3	.	.	.	2	2	.	.	.	.	.
Carduus carpetanus	2	3	5	2	.	.	5	.	2	3	5	.	2	.	3	.	1	1	.	.	.	.	.
Festuca summilusitana	4	1	4	2	.	.	4	.	4	5	3	5	3	2	.	.	.	.	.	.	.	.	.
Festuca elegans	5	4	.	5	2	.	5	.	5	5	5	5	5	2	.	.	.	.	.	.	.	.	.
Lavandula pedunculata	1	.	5	.	.	.	.	.	1	3	3	1	5	.	2	.	2	4	.	.	.	.	.
Agrostis castellana	.	1	4	1	.	.	.	.	.	.	.	.	.	.	5	5	2	1	3	2	.	5	.
Santolina rosmarinifolia	2	1	3	.	5	.	5	.	.	.	.	.	.	.	3	3	1	3	.	.	.	.	2
Thymus mastichina	1	2	.	2	.	.	.	.	1	3	.	.	3	.	2	.	1	1	.	.	.	.	.
Agrostis truncatula	2	2	1	5	.	.	.	.	1	.	.	.	.	.	.	.	3	1	.	.	3	.	.
Avenula sulcata	.	.	.	.	.	.	.	.	1	5	.	.	2	.	.	.	4	2	2	.	4	5	.
Corynephorus canescens	2	1	.	3	4	.	.	.	1	.	.	.	.	.	.	.	1	4	.	.	.	.	.
Linaria nivea	1	.	.	.	.	.	2	3	.	.	.	.	.	.	2	.	3	.	.	4	.	5	.
Stipa gigantea	1	.	3	3	.	.	.	.	.	.	.	.	.	.	.	3	2	3	.	.	.	.	2
Thymus zygis	.	.	3	4	.	.	2	.	.	.	.	.	.	.	2	.	1	5	.	.	.	.	.

Relevé N.	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Leucanthemopsis alpina	1	.	.	.	.	.	.	.	1	.	.	.	1	2	.	.	1	.	.	.	2	.	.
Centaurea alba	1	2	4	2	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ornithogalum concinnum	1	1	5	.	.	.	5	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
Koeleria crassipes	.	.	5	.	.	.	.	.	.	.	.	.	.	.	2	3	3	.	1	.	.	.	.
Conopodium ramosum	.	1	.	.	.	.	.	.	2	.	.	1	2	.	.	.	.	.	.	.	.	.	.
Thymus xbractichina	.	.	.	.	.	.	.	.	2	3	.	2	4	.	.	.	.	.	.	.	.	.	.
Santolina oblongifolia	.	.	.	.	.	.	.	.	3	5	.	.	2	4	.	.	.	.	.	.	.	.	.
Halimium viscosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	1	2	.	.	.	.
Dactylis hispanica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	1	.	2	2	.	.	.
Erysimum linifolium	.	.	.	.	.	.	.	.	1	3	3	.	.	.	.	.	.	.	.	.	.	.	.
Calluna vulgaris	.	.	.	.	.	.	.	.	1	.	.	3	2	.	.	.	.	.	.	.	.	.	.
Jurinea humilis	1	.	.	.	.	5	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
Leucanthemopsis pallida	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Thymus bracteatus	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	2	1	.	.	.	.	.
Leucanthemopsis pulverulenta	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	2	.	.	.	.	.
Crataegus monogyna	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	1	.	2	.	.	.	.
Thapsia villosa	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Centaurea macrocephala	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	2	.	.	.	.	.
Helichrysum serotinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.	.	.	.
Festuca curvifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.

Shrubby and forest companions: *Erica aragonensis* and *Pterospartum tridentatum* 5 in 21; *Quercus rotundifolia, Poa nemoralis* and *Juniperus oxycedrus* 1 in 26. Others: *Euphorbia oxyphylla* 5 in 17; *Teucrium scorodonia* 2 in 31; *Helianthemum masguindalii* 1 in 32; *Biscutella scaposa* 2 in 35.

Procedence of relevés: 14: Table 6, inv. 1; Rivas-Martínez 1970, tab. 2, invs. 1-9, 13; F. Navarro & al. 1987, tab. 4, inv. 2; Sánchez-Mata 1989, tab. 98, invs. 1, 2, 4 & tab. 101, inv. 3; Amor 1991, tab. 100, inv. 6; 15: Table 6, invs. 2, 3; F. Navarro & al. 1987, tab. 4, inv. 1; Sánchez-Mata 1989, tab. 98, inv. 5; Amor 1991, tab. 100, invs. 1-5; 16: Sánchez-Mata 1989, tab. 101, invs. 1, 2, 4-8; 17: Table 6, invs. 4-6; Rivas-Martínez 1970, tab. 2, invs. 18-20; 18: Table 6, inv. 7; Rivas-Martínez 1970, tab. 2, invs. 14-16; 19: F. Navarro & al. 1987, tab. 4, invs. 3, 4; 20: Sánchez-Mata 1989, tab. 98, invs. 6-8; 21: Navarro & al. 1987, tab. 4, invs. 8, 9; 22: Rivas-Martínez 1970, tab. 2, invs. 10-12; Sánchez-Mata 1989, tab. 100, invs. 1-9, 11, 25; 23: Sánchez-Mata 1989, tab. 100, invs. 23, 24; 24: Sánchez-Mata 1989, tab. 100, invs. 21, 22; 25: Sánchez-Mata 1989, tab. 100, invs. 10, 12-16; 26: F. Navarro & al. 1987, tab. 4, inv. 5; Sánchez-Mata 1989, tab. 99, invs. 1-4 & tab. 100 invs. 17-20; 27: F. Navarro & al. 1987, tab. 4, invs. 6, 7; Rivas-Martínez 1970, tab. 2, inv. 17; 28: Fernández-González 1991, tab. 14B, invs. 19, 20, 23; 29: Fernández-González 1991, tab. 14B, invs. 21, 22; 30: Costa 1974, tab. 13, invs. 1-7, 13; Rivas-Martínez & Cantó 1987, tab. 2, invs. 1-4; Fernández-González 1991, tab. 14A, invs. 1-18 (incl. holotypus, inv. 16); 31: Table 5, inv. 22; Costa 1974, tab. 13, invs. 6, 8, 10-12; Rivas-Martínez 1970, tab. 2, invs. 21-26; Rivas-Martínez & Cantó 1987, tab. 2, inv. 5; 32: Rivas-Martínez & Cantó 1987, tab. 2, inv. 10; Fernández-González 1991, tab. 14B, invs. 24-27; 33: Fernández-González 1991, tab. 14B, invs. 28-32; 34: Costa 1974, tab. 13, invs. 14-20; Rivas-Martínez & Cantó 1987, tab. 2, inv. 9; 35: Fernández-González, tab. 14B, invs. 33, 34; 36: Rivas-Martínez & Cantó 1987, tab. 2, invs. 6-8.

thymes and genistas (*Santolina rosmarinifolia*) in these groups.

Genistion polygaliiphyllae Rivas-Martínez, T.E. Díaz, F. Prieto, Loidi & Penas 1984 and ***Ulici europaei-Genistion polygaliiphyllae*** Rivas-Martínez, Báscones, T.E. Díaz, Fernández-González & Loidi 1991

Phanerophytic communities dominated by brooms (*Cytisus spp.*) and genistas (*Genista spp.*) growing generally on forest soils. Their biogeographic distribution in the territory is primarily Salmantino and Estrellense (subprovince Carpetan-Leonese). They represent shrubby serial stages of different types of both holm oak and pedunculate oak forests on the supramediterranean belt (*Genistion polygaliiphyllae*) and mesomediterranean belts (*Ulici-Cytision*).

Floristic composition. *Genista polygaliiphylla, Echinospartum ibericum* and *Genista hystrix* can be considered the characteristic territorial plants in this alliance. In addition to these, *Halimium alyssoides* can also be considered as a differential from the communities of *Genistion floridae*.

Numerical data analysis. A total of 137 relevés were analysed from the Salmanticensean and Es-

Table 10
Synthetic table of *Genistion floridae* plant communities (cont.)
Thymo mastichinae-Cytisetum multiflori var. típica (37 y 38), var. *Genista cinerascens* (39-41), var. *Cistus laurifolius* (42), var. *Cistus ladanifer* (43), var. *Genista falcata* (44), var. *Cistus psilosepalus* (45), var. *Adenocarpus gredensis* (46) ,var. *Adenocarpus aureus* (47)
(*Cytisetalia scopariae-striatae, Cytisetea scopario-striatae*)

N. of relevés	10	7	9	7	9	8	3	6	4	4	8
Relevé N.	37	38	39	40	41	42	43	44	45	46	47
Characteristics:											
Cytisus multiflorus	5	1	5	3	.	5	5	5	5	5	5
Pteridium aquilinum	5	5	4	1	.	4	4	5	5	5	3
Cytisus scoparius	2	5	3	5	5	4	2	4	2	.	3
Genista florida	5	5	3	.	2	1	.	5	3	4	4
Cytisus eriocarpus	3	3	2	1	.	.	.	2	1	5	1
Genista cinerascens	1	5	5	2	.	2	.	.	.	.	.
Orobanche rapum-genistae	1	2	1	.	.	.	.	.	.	.	.
Adenocarpus complicatus	1	.	.	.	1	.	.	.	2	.	.
Cytisus oromediterraneus	1	.	.	.	5	.	.	.	.	.	.
Adenocarpus gredensis	.	.	.	.	1	.	.	.	.	5	.
Genista falcata	.	.	.	.	.	.	.	5	.	.	.
Adenocarpus aureus	.	.	.	.	.	.	.	.	.	.	5
Shrubby and forest companions:											
Quercus pyrenaica	1	2	2	4	1	4	.	3	1	.	.
Pinus pinaster	2	.	2	.	.	1	.	4	3	.	.
Juniperus hemisphaerica	1	.	1	.	.	2	2	.	.	2	.
Erica arborea	2	3	.	1	2	.	.	.	.	.	.
Rubus ulmifolius	3	.	.	.	.	2	.	1	3	.	.
Cistus laurifolius	.	.	.	1	.	5	2	.	.	.	.
Daphne gnidium	.	.	.	2	.	.	4	.	2	.	.
Origanum virens	2	.	.	.	.	.	.	3	5	.	.
Arenaria montana	1	.	.	.	.	.	.	2	1	.	.
Juniperus oxycedrus	.	1	.	2	.	.	.	.	.	.	.
Rosa corymbifera	.	.	.	1	1	.	.	.	.	.	.
Quercus rotundifolia	.	.	.	3	2	.	.	.	.	.	.
Cistus x cyprius		.	.	.	.	.	1	5	.	.	.
Cistus ladanifer	.	.	.	.	.	.	5	.	4	.	.
Others:											
Thymus mastichina	4	3	4	4	3	5	5	5	5	5	5
Lavandula pedunculata	4	2	4	3	3	4	5	5	5	4	4
Festuca elegans	5	4	4	1	2	5	2	4	5	5	5
Centaurea alba	2	.	3	1	4	2	2	3	2	.	3
Santolina rosmarinifolia	2	.	4	2	1	5	4	2	1	.	5
Carduus carpetanus	3	2	1	1	2	.	2	3	1	3	2
Jasione sessiliflora	2	.	3	2	.	2	2	3	.	2	3
Corynephorus canescens	1	1	2	3	1	2	.	.	.	.	2
Agrostis castellana	2	.	2	3	.	2	2	.	1	.	1
Thymus zygis	1	.	2	3	.	2	5	.	.	.	3
Arrhenatherum baeticum	1	.	1	.	.	1	2	.	.	4	2
Arenaria querioides	1	1	2	1	.	2	.	.	.	.	.
Helianthemum apenninum	1	1	1	1	.	.	2	.	.	.	.
Thapsia villosa	1	1	.	1	1	.	4	.	.	.	.
Halimium viscosum	1	1	.	1	1	.	.	2	.	.	.
Lavandula sampaioana	1	3	.	2	4	.	.	.	.	.	.
Leucanthemopsis pallida	1	2	.	.	.	.	.	.	.	3	2
Helichrysum serotinum	1	.	.	.	.	4	4	.	.	.	.
Helichrysum stoechas	1	.	.	.	.	2	2	.	.	.	.
Stipa gigantea	.	.	.	1	.	3	2	.	.	.	.
Stipa lagascae	.	.	.	1	.	3	5	.	.	.	.
Luzula lactea	1	1	.	.	.	.	.	4	.	.	.

Relevé N.	37	38	39	40	41	42	43	44	45	46	47
Avenula sulcata	.	1	.	.	.	.	.	1	1	.	.
Leucanthemopsis pulverulenta	.	.	2	1	.	.	.	.	.	.	.
Sesamoides suffruticosa	.	.	1	1	.	.	.	.	.	.	.
Calluna vulgaris	1	.	.	.	1	.	.	.	.	.	.
Agrostis truncatula	.	.	2	.	2	.	.	.	.	.	.
Euphorbia oxyphylla	.	.	.	3	4	.	.	.	.	.	.
Genista tournefortii	.	.	.	2	1	.	.	.	.	.	.
Dactylis hispanica	.	.	.	3	.	.	2	.	.	.	.
Cistus psilosepalus	1	.	.	.	.	.	.	.	5	.	.
Armeria lacaitae	1	.	.	.	.	.	.	.	.	.	5

Shrubby and forest companions: *Juniperus alpina* and *Erica aragonensis* 1 in 37; *Frangula alnus* 1 in 38. Others: *Arrhenatherum carpetanum* 2 in 37; *Festuca curvifolia* and *Koeleria crassipes* 1 in 38; *Astragalus lusitanicus, Tuberaria vulgaris* and *Teucrium scorodonia* 2 in 45; *Linaria nivea* and *Santolina oblongifolia* 4 and 2 in 46.
Procedence of relevés: 37: Table 6, invs. 8-11; Rivas-Martínez 1968, tab. 6, invs. 1, 2; Sánchez-Mata 1989, tab. 102 & tab. 103, invs. 1, 2; 38: F. Navarro & al. 1987, tab. 5, invs. 1-3; Amor 1991, tab. 97, invs. 2-6; 39: Rivas-Martínez 1968, tab. 6, invs. 9-14; Sánchez-Mata 1989, tab. 104, invs. 9-11; 40: Table 6, invs. 12-15; Rivas-Martínez 1968, tab. 6, invs. 3, 8, 15; 41: Table 6, invs. 16-20; 42: Rivas-Martínez 1968, tab. 3, invs. 4, 5, 7, 8; Sánchez-Mata 1989, tab. 97, invs. 3, 4 & tab. 105, invs 3, 4; 43: Rivas-Martínez 1968, tab. 3, inv. 6; Sánchez-Mata 1989, tab. 105, invs. 4, 5; 44: Sánchez-Mata 1989, tab. 106, invs. 1-6; 45: Sánchez-Mata 1989, tab. 106, invs. 7-11; 46: Sánchez-Mata 1989, tab. 103, invs. 3-6; 47: Sánchez-Mata 1989, tab. 104, invs. 1-8.

trellense sectors. In some cases, as will be explained below, the study was extended with relevés from territories within the Orensano-Sanabriense sector. The relevés were divided into geographically homogeneous zones: 1) Sierras de Gata and Peña de Francia; 2) the Salmantino plain and adjacent areas in the Orensano-Sanabriense sector; and 3) Sierra de Estrela mountains.

The relevés of each one of the zones were analysed by means of prior classification, followed by an ordination, although only the results of these last are discussed. The ordination of the relevés of the Sierras de Gata and Peña de Francia mountains showed a group which was very compacted on the negative part of the first axis; this was separated and studied together with the relevés of *Cytisetum multifloro-eriocarpi* (*Genistion floridae*). Finally, the relevés were synthesised in homogeneous groups which were analysed by means of ordination (CA) and divisive classification (MST) (Figure 10), whose objective was to observe the relationships between them, and in some cases to clarify the syntaxonomy of the present alliance.

11. *Cytiso scoparii-Genistetum polygaliiphyllae* Rivas-Martínez, T.E. Díaz, J.A.F. Prieto, Loidi & Penas 1984 (Tables 11 and 12).

(= *Genisto polygaliiphyllae-Cytisetum scoparii* F. Navarro & C.J. Valle 1984 p.p.)

High-growing broom communities presided by *Genista polygaliiphylla* and *Cytisus scoparius*, accompanied by other phanerophytes such as *Erica arborea* or *Adenocarpus complicatus*. Dynamically they represent the first substitution stage on well conserved silicious soils of certain types of beech (*Luzulo henriquesii-Fagetum*) or Pyrenean oak forests, both euro-Siberian and Mediterranean (*Linario triornithophorae-Quercetum pyrenaicae, Holco mollis-Quercetum pyrenaicae*; Rivas-Martínez & *al*. 1984). It is distributed in the Salmanticensean and Orensano-Sanabriense sectors (Carpetan-Leonese subprovince). It grows at an altitude of between 650 m and 1300 m.

We follow the criterion of RIVAS-MARTÍNEZ & *al*. (1984: 115) with regard to the synonomy of the name proposed by F. NAVARRO & C. J. VALLE (1984: 94) for a part of the relevés subordinated to *Genisto polygaliiphyllae-Cytisetum scoparii* (F. NAVARRO & C. J. VALLE , 1984, table 7). The combined analysis of the Salmantino data showed two groups within this table (Figure 9), one of them subordinable to this association (*loc. cit.*, invs. 1, 2, 4, 6, 8, 9) and clearly independent from the rest, while we consider the other, which includes *Genista hystrix* in its composition, to be more closely related to *Genisto hystricis-Cytisetum multiflori* (*loc. cit.*, invs. 3, 5, 7, 10).

Table 11

Cytiso scoparii-Genistetum polygaliiphyllae (1-3) *Genisto hystricis-Cytisetum multiflori* subas. *lavanduletosum sampaioanae* (4-39) *Echinospartetum iberici* (40) (*Genistion polygaliiphyllae*, *Cytisetalia scopario-striatae*, *Cytisetea scopario-striatae*)

Altitude (1=10 m)	103	94	115	71	72	68	75	68	72	73	76	72	58	79	77	77	77	77	77	80	70	71	71	97	87	69	76	87	71	88	70	66	70	66	66	65	75	65	66	78
Number of species	6	5	10	9	7	8	4	10	11	10	12	10	11	7	6	11	8	10	6	4	8	9	8	10	7	8	7	9	6	7	10	5	9	6	6	6	7	6	7	9
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Characteristics:																																								
Cytisus multiflorus	.	.	.	4	3	4	4	4	3	4	3	3	4	4	4	3	3	3	4	4	4	5	3	2	3	4	4	4	4	4	3	5	4	4	4	4	4	4	4	4
Cytisus scoparius	2	4	4	.	.	+	.	1	+	.	+	+	+	2	.	+	1	+	2	3	3	2	3	4	2	.	.	+	.	+	1	.	.	.	.	.	.	.	.	+
Genista hystrix	.	.	.	+	4	3	3	3	4	3	4	4	2	2	3	4	4	4	.	.	.	.	+	+	+	.	.	.	.	.	.	+	1	.	.	.	.	.	.	+
Cytisus eriocarpus	3	.	1	.	.	.	.	.	2	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	3	2	3	4	+	2	.	.	.	.	.	.	.
Adenocarpus complicatus	1	.	.	.	.	.	.	.	.	1	1	+	.	.	.	1	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Genista falcata	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Genista polygalaephylla	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pteridium aquilinum	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Adenocarpus anisochilus	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erica arborea	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Genista cinerascens	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Echinospartum ibericum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Shrubby and forest companions:																																								
Quercus rotundifolia	.	.	.	1	1	1	.	.	.	+	+	+	1	.	+	+	+	+	.	.	+	.	+	.	.	1	+	+	1	.	+	.	.	+	+	+	+	.	+	+
Quercus pyrenaica	.	1	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	+	.	.	1	1	1	1	.	.	1	.	.	1	.	+	.	.	.	.	.	.	1
Daphne gnidium	.	.	.	1	.	1	.	+	1	.	.	+	1	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	.	1	+	.	1	+	.
Others:																																							
Lavandula sampaioana	.	.	.	2	1	2	+	2	.	1	1	1	2	1	1	1	1	1	2	+	1	+	2	2	1	3	2	1	2	3	+	.	.	1	2	3	3	2	3	1
Thymus mastichina	.	.	.	+	+	1	1	+	+	+	+	.	1	.	.	.	.	.	+	+	1	.	1	+	.	1	.	.	+	+	1	.	+	.	.	1	1	1	2	.
Digitalis thapsi	.	.	.	+	+	+	.	1	1	1	+	1	.	.	.	+	.	+	.	.	.	.	.	.	.	.	+	+	.	1	+	1	+	.	.	.	.	.	.	+
Stipa gigantea	.	.	.	.	.	.	.	.	+	.	.	.	.	1	1	1	.	1	.	.	1	.	.	.	+	.	.	1	.	2	+	.	.	.	.	.	.	.	.	1
Agrostis castellana	.	1	.	1	1	.	.	.	+	.	1	+	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	3	.	1	.	.	.	.	.	1	.
Thapsia villosa	.	.	+	.	.	.	.	.	.	1	1	.	.	.	.	+	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	.
Jasione montana s.l.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	+	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	+	+	+	.	.	.	.	+	.
Halimium viscosum	.	.	+	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	+	1	+	1	+	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.
Thymus zygis	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.
Stipa lagascae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia oxyphylla	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Arrhenatherum album	.	.	.	.	.	.	.	+	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Avenula sulcata	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Cistus salvifolius	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.

The relevés of Sierra de Gata with *Genista polygaliiphylla* are separated from the rest along the third axis in one of the ordinations carried out. Two of these are fairly distant from the group due to the absence of *Genista polygaliiphylla* in these relevés, and can be considered a degraded version of this association, which is relatively normal in these mountain ranges where forest fires are frequent; for this reason they were synthesised independently. The presence of *Cytisus multiflorus* in three of the relevés of VALDÉS (1984, table 8, invs. 3, 4, 8) and the original subordination of this table to *Cytiso striati-Genistetum polygaliiphyllae* led us to consider the possible subordination of these relevés to the variant of *Cytisus multiflorus* of this association, and they were therefore synthesised independently. In the partial ordination of the relevés in the Sierra de Gata no type of separation was observed, and in the final ordination and MST (Figure 10, Group 4) it did not even appear related to the relevés subordinated to *Cytiso striati-Genistetum polygaliiphyllae*.

The table of F. NAVARRO & C. J. VALLE describes how *Adenocarpo complicati-Cytisetum multiflori* (1984, table 9) remains in an intermediate position in the ordination diagram (Figure 9) between the most typical group of *Genista polygaliiphylla* (Figure 9) and the broom community of *Genista hystrix* (*Genisto hystricis-Cytisetum multiflori*, Figure 9). Despite its close relationships to the typical group of communities of *Genista hystrix*, we preferred to synthesise it separately from the rest of the groups, due to the absence of this taxon from these relevés.

In the final ordination (Figure 10, Groups 1-5, respectively) they are located forming part of the core of groups with *Genista polygaliiphylla* in their composition, and have therefore been subordinated to this association. The MST links them together, except for Group 2 which is linked through Group 6 subordinated to the typical subassociation of *Genisto hystricis-Cytisetum multiflori*. Group 3, comprising two relevés from the Sierra de Gata, is shown as being deviant from the rest; in addition, its floristic impoverishment links it to a group subordinated to *Genisto hystricis-Cytisetum multiflori* (Group 8).

12. *Genisto hystricis-Cytisetum multiflori* Rivas-Martínez in Rivas-Martínez, T.E. Díaz, J.A.F. Prieto, Loidi & Penas 1984 (Tables 11 and 12)

Nanophanerophytic communities comprising *Cytisus multiflorus* and *Genista hystrix* either accompanied or not by other genistées such as *Genista polygaliiphylla, Adenocarpus complicatus* or *Cytisus scoparius*. Dynamically they are the first substitution stage of Pyrenean oak (*Genisto falcatae-Quercetum pyrenaicae*) and holm oak forests (*Genisto hystricis-Quercetum rotundifoliae*). They are distributed in the Salmanticensean and Orensano-Sanabriense sectors (*Carpetan-Leonese subprovince*). They grow at altitudes of between 500 m and 1000 m.

subas. **typical**

As has been shown (RIVAS-MARTÍNEZ & *al.*, 1984, table 13), the typical floristic composition of this association corresponds to a substitution broom community of Salmantino Pyrenean oak forests (*Genisto falcatae-Quercetum pyrenaicae*) which, in addition to the two taxa which give the association its name, have in their composition *Genista polygaliiphylla* - a typical plant of cooler,

Table 11 (cont.)

Shrubby and forest companions: *Castanea sativa* 1 in 3; *Osyris alba* and *Pistacia terebinthus* 1 in 13; *Cistus ladanifer* + in 26. Others: *Calluna vulgaris* 2 in 1; *Genista tournefortii* 1 in 24; *Helichrysum stoechas* + in 26.

Localities: Todas se encuentran en la provincia de Salamanca. 1: La Alberca; 2 y 3: Valdelacasa; 4: Ahigal de los Aceiteros; 5: Lumbrales; 6: Bermellar; 7: Bañobárez; 8: Barruecopardo; 9: Villasbuenas; 10: Bogajo; 11: Villavieja de Yeltes; 12: Yecla de Yeltes, holotypus subass. ; 13: Vilviestre; 14: Iruelos; 15: Villarmuerto; 16: Villaseco de los Reyes; 17: Ledesma; 18: Villaseco de los Reyes; 19: Robleda; 20: Fuenteguinaldo; 21: Villavieja de Yeltes; 22: Salto de Villarino; 23: Almendra; 24: Casafranca; 25: Monleón; 26: Villar de Argañán; 27: Fuentes de Oñoro; 28: Casillas de Flores; 29: Martiago; 30: Fuenteguinaldo; 31: Lumbrales; 32: Mieza; 33: El Milano; 34: Villar de Ciervo; 35: Villar de la Yegua; 36: Ituero de Azaba; 37: La Alamedilla; 38: Pastores; 39: Bermellar; 40: El Manzano.

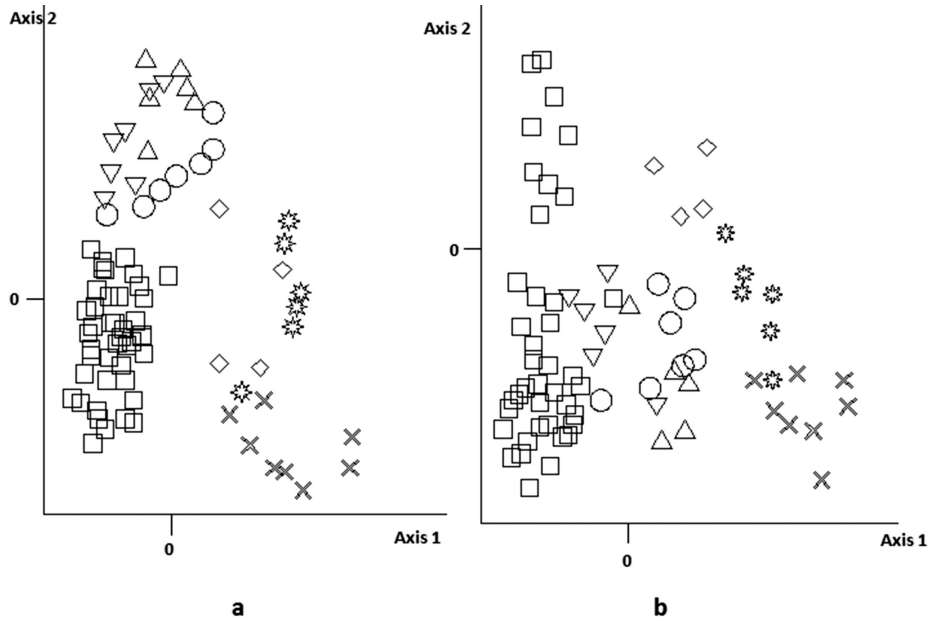

Figure 9. – Ordination (CA) of Salmantino *Genistion polygaliiphyllae* relevés: up and down triangles, *Cytiso scoparii-Genistetum polygaliiphyllae*; circles, *Genisto hystricis-Cytisetum multiflori* típica; squares, *Genisto hystricis-Cytisetum multiflori lavanduletosum sampaioanae*; diamonds, *Echinospartetum iberici*.

better structured soils-, and other chamaephytes such as *Pterospartum tridentatum* or *Lavandula pedunculata*. The ordination (CA, Figure 9) showed the closeness of these relevés (Figure 9) to those of *Cytiso scoparii-Genistetum polygaliiphyllae* (Figure 9) and their independence with regard to the rest of the relevés included in the following subassociation (*lavanduletosum sampaioanae*, Figure 9), which are poorer from a floristic point of view. This subassociation includes part of the relevés subordinated by F. NAVARRO & C. J. VALLE to *Cytiso striati-Genistetum polygaliiphyllae* (1984; table 6, invs. 2, 4 and 5) and *Genisto polygaliiphyllae-Cytisetum scoparii* (*op. cit.*; table 7, invs. 3, 5, 7 and 10), as well as the type relevé of the association (RIVAS-MARTINEZ & *al.* 1984). Given the absence of *Cytisus multiflorus* in a large part of the relevés, the presence of *Genista hystrix* is what characterises them -the reason for the nomen inversum proposed by Rivas-Martínez & *al.* (*op. cit.*: 68)-, and what produces in the ordination the distancing of the relevés with *Genista polygaliiphylla* (Figure 9).

The final ordination (Figure 10, Group 6) shows its close relationships with the groups of *Cytiso scoparii-Genistetum polygaliiphyllae* and its place in the big aggrupation formed by these groups (1, 2, 4, 5). The MST connects it on the one hand to these groups and on the other to the subassociation *lavanduletosum sampaioanae* (7-10).

subas. ***lavanduletosum sampaioanae*** nova
(*Holotypus*: Table 11, inv. 12)

Dynamically these represent the serial stage of the supra-Mediterranean Salmantino holm oak forests (*Genisto hystricis-Quercetum rotundifoliae*). These are poorer than the typical subassociation, with regard to the number of species, and particularly of the class. Generally only *Genista hystrix* and *Cytisus multiflorus* form part of this community, and some of these, such as *Genista hystrix* (see Table 11, invs. 4-39) may even be absent. Compared to the typical subassociation, it is also worth noting the absence of the brooms which grow on more fertile soils (*G. polygaliiphylla*), the presence of *Lavandula sampaioana*, which gives its name to this subassociation and which has scarce or no presence in the typical subassociation, surrendering its place to *Lavandula pedunculata*.

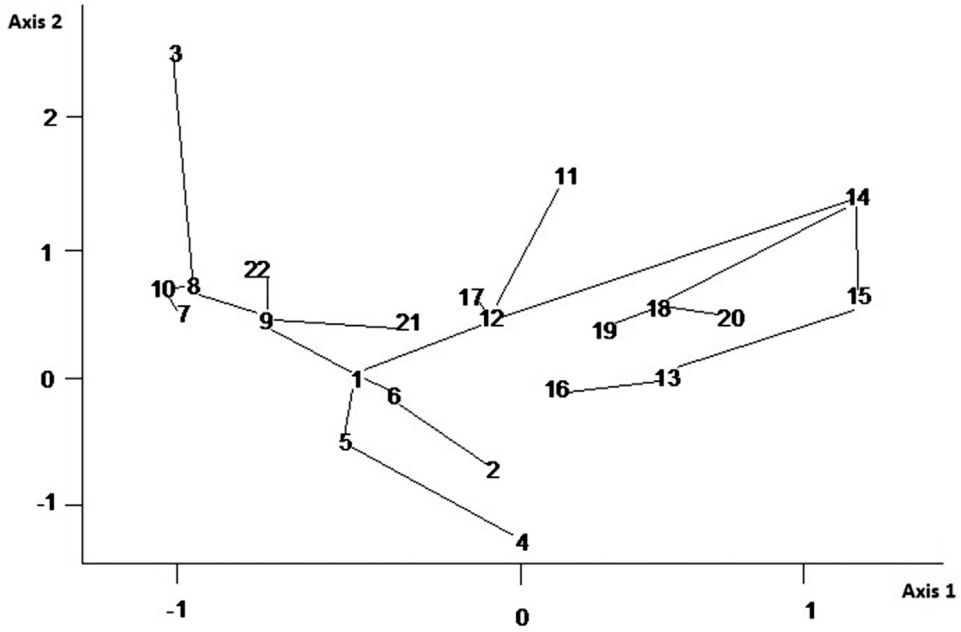

Figure 10. – Final ordination (PCA) and divisive classification (MST) of *Genistion polygaliiphyllae* and *Ulici-Cytision striatae* communities: *Cytiso scoparii-Genistetum polygaliiphyllae* (1-5); *Genisto hystricis-Cytisetum multiflori* (6); *Genisto hystricis-Cytisetum multiflori lavanduletosum sampaioanae* (7-10); *Echinospartetum iberici* (11-17); *Cytiso striati-Genistetum polygaliiphyllae* (18-20); *Lavandulo-Cytisetum multiflori* (21, 22).

In the ordination (Figure 9) it is well separated compared to the typical. The number of relevés we have which are subordinable to this subassociation (39), their compactness and independence and their separation in the first classification of the Salmantino relevés, led us to order it separately in order to obtain homogeneous groups for synthetic purposes.

The ordination showed only major trends due to the general impoverishment of the relevés, and caesuras could be observed due to the presence of *Cytisus scoparius* and *Genista hystrix*, as well as in those relevés which contain *Cytisus multiflorus* or *Cytisus eriocarpus*. In the final ordination (Figure 10, Groups 7-10) they form a small group, of which only Group 9 is detached, probably due to its richness in *Cytisus eriocarpus* and to the scarcity of *C. scoparius* and *Genista hystrix*. In the MST they are linked together, with Group 9 forming the nexus of union with Group 1 of the typical subassociation.

13. *Echinospartetum iberici* Rivas-Martínez 1974 corr. Rivas-Martínez, Lousa, T.E. Díaz, Fernández-González & J.C. Costa 1990 (Tables 11 and 12)

(=*Cytiso multiflori-Echinospartetum lusitanici* Rivas-Martínez 1981)

Communities of *Echinospartum ibericum* with a generally open structure which additionally include *Cytisus multiflorus, Genista hystrix, G. tridentata, G. polygaliiphylla* or *Cytisus eriocarpus* with a greater or lesser degree of frequency. They are distributed biogeographically in the Salmanticensean and Estrellense sectors (Carpetan-Leonese subprovince), at altitudes of between 700 and 1500 m.

The most typical relevés of this association are distinguished from the rest of the variants by the presence of *Cytisus multiflorus* in them, which causes them to be clearly independent from the rest of the communities in the corresponding ordinations performed on the relevés (Figure 9). The final ordination and MST (Figure 10, Groups 11-13) highlights the relationships between Groups 11 and 12 (Estrellense and Salmanticensean), whereas Group 13 is detached from them in both analyses, possibly due to the greater altitude at which the relevés were taken (1000-1200 m), which brings them somewhat closer to the re-

Table 12

Synthetic table of *Genistion polygaliiphyllae* and *Ulici europaei-Genistion polygaliiphyllae* plant communities *Cytiso scoparii-Genistetum polygaliiphyllae* (1-5) *Genisto hystricis-Cytisetum multiflori* subas. típica (6), subas. *lavanduletosum sampaioanae* (7-10) *Echinospartetum iberici* var. típica (11-13), var. *Erica arborea* (14), var. *Cytisus oromediterraneus* (15), var. *Genista hystrix* (16 y 17) *Cytiso striati-Genistetum polygaliiphyllae* (18-20) *Lavandulo-Cytisetum multiflori* (21 y 22) (*Cytisetalia scopario-striatae, Cytisetea scopario-striatae*)

N. of relevés	7	4	2	3	5	7	15	7	10	7	8	4	7	4	7	7	6	5	3	3	6	9
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Characteristics:																						
Pteridium aquilinum	1	2	1	4	2	2	.	1	1	1	.	.	2	.	.	.	.	2	4	.	4	4
Erica arborea	1	3	1	.	.	1	.	.	1	1	.	1	.	5	2	.	.	5	5	2	.	1
Cytisus multiflorus	.	.	.	5	5	1	5	5	5	5	5	4	5	.	.	.	.	.	5	.	4	5
Genista polygalaephylla	5	5	.	5	5	5	.	.	.	.	.	2	.	4	.	.	3	5	5	2	.	.
Cytisus scoparius	5	2	2	2	.	4	4	5	2	.	.	1	.	.	.	1	3	.	.	.	.	.
Cytisus eriocarpus	.	5	1	5	5	2	1	.	5	.	.	4	.	.	.	.	.	.	.	.	.	5
Adenocarpus complicatus	.	2	.	.	5	2	2	1	1	1	.	.	.	.	.	.	.	.	.	.	.	5
Genista hystrix	.	.	.	.	.	5	5	3	1	.	.	1	.	.	.	5	5	.	.	.	.	.
Echinospartum ibericum	.	.	.	.	.	.	.	.	.	.	5	5	5	5	5	5	5	.	.	.	.	.
Cytisus striatus	.	.	.	.	.	.	.	.	.	.	2	.	.	3	.	.	.	5	5	2	3	.
Genista falcata	.	2	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Orobanche rapum-genistae	2	.	.	.	.	2	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Cytisus oromediterraneus	.	.	.	.	.	.	.	.	.	.	.	.	.	2	5	.	.	.	.	2	.	.
Cytisus grandiflorus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	1	.	.
Genista cinerascens	.	.	1	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.
Adenocarpus gredensis	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	2	.	.	.
Shrubby and forest companions:																						
Quercus pyrenaica	1	2	1	.	2	1	1	4	2	.	2	1	.	.	.	.	.	1	5	.	1	3
Quercus rotundifolia	.	.	.	.	.	1	4	2	3	3	.	1	.	.	.	1	.	.	.	.	.	.
Pterospartum tridentatum	.	2	.	.	.	2	.	.	.	.	.	2	4	.	.	4	.	.	2	1	.	.
Daphne gnidium	.	.	.	.	.	1	3	.	1	3	.	.	.	.	.	.	.	.	.	.	.	2
Erica aragonensis	.	2	.	.	.	1	.	.	.	.	.	1	.	.	4	.	.	.	.	.	.	.
Crataegus monogyna	1	2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cistus ladanifer	1	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Conopodium pyrenaeum	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Erica australis	.	2	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.
Ulex europaeus	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	2
Others:																						
Halimium alyssoides	.	2	.	4	.	1	.	.	.	.	.	2	5	2	2	.	1	1	4	1	2	1
Agrostis truncatula	.	.	.	.	.	1	.	.	1	.	4	4	1	5	4	1	3	2	.	1	3	.
Lavandula sampaioana	2	2	.	.	.	2	5	5	4	5	.	2	.	.	.	1	.	.	.	.	5	5
Digitalis thapsi	1	.	.	.	.	1	4	.	4	1	5	2	1	.	.	.	2	.	.	.	1	2
Stipa gigantea	.	1	.	.	.	2	2	2	2	.	2	2	.	.	.	.	3	.	2	.	1	.
Agrostis castellana	.	.	1	.	1	.	2	2	1	1	.	.	3	.	3	1	.	.	.	.	4	.
Halimium viscosum	4	.	1	.	3	3	1	4	.	1	.	.	.	.	.	3	2	.	.	.	.	.
Avenula sulcata	.	.	.	.	.	.	1	.	1	.	1	.	5	.	1	5	.	5	5	2	.	.
Thymus mastichina	2	.	.	.	.	.	3	4	3	4	.	.	.	.	.	1	.	.	.	.	.	2
Jasione montana s.l.	.	.	.	4	3	.	2	.	2	2	.	.	.	.	.	.	.	.	.	.	2	.
Arrhenatherum bulbosum	1	.	.	4	1	2	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Festuca elegans	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	4	2	.	.	.
Lavandula pedunculata	5	1	.	.	4	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thapsia villosa	.	.	1	.	.	.	2	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.
Calluna vulgaris	.	2	.	.	1	.	.	.	.	.	.	.	1	.	.	3	.	.	.	.	.	.
Corynephorus canescens	.	.	.	.	.	.	1	.	.	.	.	.	1	.	1	1	.	.	.	.	.	.
Santolina rosmarinifolia	2	.	.	.	2	.	.	.	1	.	.	.	.	.	.	.	2	.	.	.	.	.
Festuca summilusitana	.	.	.	.	.	.	.	.	.	.	.	.	2	3	5	.	.	1	.	.	.	.
Cistus salvifolius	.	2	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	2	.
Thymus zygis	1	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia oxyphylla	.	.	2	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.

Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Hypericum linarifolium	.	.	.	5	.	.	.	.	.	.	2	.	2	.	.	.	.	.	.	.	.	.
Luzula lactea	.	2	.	4	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Sedum brevifolium	.	.	.	.	.	.	.	.	.	.	.	.	1	2	3	.	.	.	.	.	.	.
Leucanthemopsis pulverulenta	.	.	.	.	.	2	.	.	.	.	.	1	.	.	.	.	4	.	.	.	.	.
Linaria saxatilis	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	1	2	.	.	.	.	.
Lotus glareosus	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	1	.
Erica umbellata	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	2	.	.	.	.	1	.
Leucanthemopsis flaveola	.	2	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arrhenatherum album	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Arenaria querioides	.	.	.	.	.	.	.	.	.	.	.	.	5	.	2	.	.	.	.	.	.	.
Avenella iberica	1	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
Koeleria crassipes	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Carduus carpetanus	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	1	.	.	.	.	.
Sesamoides suffruticosa	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2	.
Rumex angiocarpus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	.
Dactylis hispanica	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Cistus psilosepalus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	1

Characteristics: *Adenocarpus anisochilus* + in 3. Shrubby and forest companions: *Rubus ulmifolius* 2 in 2; *Castanea sativa* and *Teucrium scorodonia* 1 in 3; *Pistacia terebinthus* and *Osyris alba* 1 in 7; *Genista tournefortii* + in 8; *Polygala microphylla* 2 and *Erica cinerea* 3 in 17; *Pinus pinaster* 1 in 21. Others: *Centaurea alba* 1 in 3; *Stipa lagascae* and *Origanum virens* 1 in 7; *Helichrysum stoechas* 1 in 9; *Jasione sessiliflora* 2 in 17; *Lithodora prostrata* 1, *Halimium ocymoides* 2 and *Sanguisorba spachiana* 3 in 21.
Procedence of relevés: 1: Table 11, inv. 1; F. Navarro & C. J. Valle 1984, tab. 7, invs. 1, 2, 4, 6, 8, 9; 2: Valdés 1984, tab. 8, invs. 1, 5, 9; Navarro & Valle 1984, tab. 6, inv. 3; 3: Table 11, invs. 2, 3; 4: Valdés 1984, tab. 8, invs. 3, 4, 8; 5: F. Navarro & C.J. Valle 1984, tab. 9, invs. 1-5; 6: F. Navarro & C. J. Valle 1984, tab. 6, invs. 2, 4, 5 & tab. 7, invs. 3, 5, 7, 10. Rivas-Martínez & al. 1984, tab. 13; 7: Table 11, invs. 4-18; 8: Table 11, invs. 19-25; 9: Table 11, invs. 26-33; F. Navarro & C.J. Valle 1984, tab. 8, invs. 1, 2; 10: Table 11, invs. 34-39; F. Navarro & C.J. Valle 1984, tab. 8, inv. 3; 11: Tabla 11, inv. 40; Rivas-Martínez 1984, tab. 16, invs. 1-7; 12: F. Navarro & C.J. Valle 1984, tab. 6, inv. 1 & tab. 10, invs. 1-3; 13: Valdés 1984, tab. 11, invs. 1-7; 14: Rivas-Martínez 1984, tab. 16, invs. 8-11; 15: Valdés 1984, tab. 11, invs. 8-14; 16: Díaz & Penas, 1985, tab. 3, invs. 2-8; 17: F. Navarro & C. J. Valle 1984, tab. 11, invs. 1-6; 18: Rivas-Martínez 1984, tab. 14, invs. 1-5; 19: Rivas-Martínez 1984, tab. 14, invs. 6-8; 20: Rivas-Martínez 1984, tab. 14, invs. 8-10; 21: Braun-Blanquet & al. 1964, tab. 15; 22: Rivas-Martínez 1984, tab. 15, invs. 2-10.

presentative variants of the contacts with the upper vegetation belt (var. of *Erica arborea* and *Cytisus oromediterraneus*). It is also worth noting that all the variants subordinated to this association are linked among each other (MST) forming a semicircle around the Estrellense groups in *Cytiso striati-Genistetum polygaliiphyllae* (Groups 18-20).

The variant of *Erica arborea* (=*Echinospartetum iberici ericetosum arboreae* Rivas-Martínez 1984) is only represented by the original relevés from the Sierra de Estrela (Rivas-Martínez, *op. cit.*, table 16, invs. 8-11) at altitudes above 1320 m. It is well separated from the typical group in previous ordinations. In the final ordination (Figure 10, Group 14) it is at the right end of axis 1 together with other groups of relevés taken at altitudes above 1300 m (Groups 15 and 20), linking to them and to the typical (Group 12), through the MST.

The variant of *Cytisus oromediterraneus* (=*Echinospartetum iberici cytisetosum oromediterranei* Valdés 1984) represents the transit towards the upper vegetation belt (*Cytiso oromediterranei-Echinospartetum barnadesii*). It is clearly separated in the previous ordinations from the typical group (12). As mentioned in the variant of *E. arborea*, the final ordination (Figure 10, Group 15) shows the formation of a small core of groups composed by relevés taken at altitudes of over 1100 m (Groups 13-15 and 20), and which are also linked by the MST.

The variant of *Genista hystrix* (=*Genisto hystricis-Echinospartetum lusitanici* F. Navarro & C. J. Valle 1984) represents the contact between this association and *Genisto hystricis-Cytisetum multiflori*. With a Salmantino and Orensano-Sanabriense distribution, we have distinguished two variants, one for each sector, due to the separation, although slight, found in the ordinations carried out. The Orensano-Sanabriense variant is richer in chamaephytes such as *Pterospartum tridentatum, Erica cinerea* and *Calluna vulgaris*, with a notable, -albeit irregular- presence of *Genista polyga-*

liiphylla in the Salmantino variant. The representation of the two first axes (Figure 9a) shows the separation between the Orensano-Sanabriense variant and the typical subassociation, whose relevés are mixed with those of the Salmantino variant. However, axes 1 and 3 (Figure 9b) show, although slightly, the independence between them, and they were thus synthesised separately. In the final ordination (Figure 10, Groups 16 and 17, respectively) they are located near the typical Salmantino group (12), although in the MST only one of them (17, Orensano-Sanabriense) is linked to it, whereas the other (16) -composed of relevés taken between 900 and 1200 m- is linked to the groups from higher altitudes (Groups 13-15 and 20).

14. *Cytiso striati-Genistetum polygaliiphyllae* Rivas-Martínez 1981 (Tables 11 and 12)

Dense communities of retamoid and ericoid nanophanerophytes with *Genista polygaliiphylla*, *Cytisus striatus* and *Erica arborea*. Dynamically they represent the first substitution stage of Pyrenean oak forests of *Holco mollis-Quercetum pyrenaicae* and birch forests of *Saxifrago spathularidis-Betuletum celtibericae*. They are distributed in the Estrellense sector (Carpetan-Leonese subprovince), at altitudes of between 1000 and 1500 m.

In the ordination carried out on all the relevés included in this association, the typical relevés were separated with difficulty from the relevés subordinated to the rest of the subassociations. In the final ordination and MST (Figure 10, Group 18) it acts as a central core in a set of groups (14-15-13-20) which are highly polarised at the positive end of axis 1, and all from altitudes of over 1000 m. Most are Estrellense, except for Group 15 which also includes relevés from the Sierra de Gata.

The variant of *Cytisus multiflorus* (=*Cytiso-Genistetum cytisetosum multiflori* Rivas-Martínez 1984) was described for lower altitudinal and sunnier levels (1000-1200 m) of the association (Rivas-Martínez, 1984). *Cytisus multiflorus* is the differential taxon from the rest of the subassociations, and for this reason it is clearly independent in the ordination. In the final ordination and MST (Figure 10, Group 19) it is linked to the typical group (18) of this association.

The variant of *Cytisus oromediterraneus* (=*Cytiso-Genistetum cytisetosum oromediterranei* Rivas-Martínez 1984) marks the upper altitudinal limit of the variability of this association. It represents the contact with the communities of the higher Estrellense vegetation belt (*Lycopodio clavati-Juniperetum nanae* and *Teucrio salviastri-Echinospartetum pulviniformis*). The general ordination of the relevés of this association shows the almost antagonic character with regard to the previous subassociation, as it is located at the opposite end of the point cluster corresponding to the relevés of this association, although it is difficult to separate from the most typical groups. In the final ordination and MST (Figure 10, Group 20) it is located together with the other Estrellense groups in the same position as explained in the partial ordination, although linking to the typical group (18) of this association.

15. *Lavandulo sampaioanae-Cytisetum multiflori* Br.-Bl., P. Silva & Rozeira 1964 (Table 12)

Open nanophanerophytic communities dominated by white Spanish broom (*Cytisus multiflorus*) accompanied in some cases by other chamaephytes and nanophanerophytes such as *Lavandula sampaioana, Cytisus striatus* and *Adenocarpus complicatus*. These are very impoverished broom communities without characteristic plants, which makes them difficult to separate syntaxonomically from the rest of the communities in this alliance.

We have only analysed the original table (Braun-Blanquet & *al*. 1964, table 15) which has considerable internal complexity. It relevés are well separated from the rest in the ordination performed, although two relevés can be seen which deviate from the core (invs. 1 and 5 in the original table). In addition to *C. multiflorus*, they also have major cover of *Lavandula sampaioana*. We also include under this denomination the Estrellense table of Rivas-Martínez (1984, table 15) subordinated to this association, although with *Cytisus eriocarpus*. In this ordination it is clearly independent from the rest, and thus both were synthesised indepen-

dently. In the final ordination (Figure 10, Groups 21 and 22) they are clearly separated, although both are linked by means of the MST to Group 9, subordinated to *Genisto-Cytisetum multiflori lavanduletosum sampaioanae*, with similar floristic impoverishment.

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SYNTAXONOMICAL SCHEME

CYTISETEA SCOPARIO-STRIATI Rivas-Martínez 1975
Cytisetalia scopario-striati Rivas-Martínez 1974
Retamion sphaerocarpae Rivas-Martínez 1981

1. *Cytiso scoparii-Retametum sphaerocarpae* Rivas-Martínez ex V. Fuente 1986
   typical
   cytisetosum eriocarpi Rivas-Martínez ex V. Fuente 1986
2. *Cytiso multiflori-Retametum sphaerocarpae* Rivas-Martínez ex F. Navarro & *al*. 1987
3. *Lavandulo pedunculatae-Adenocarpetum aurei* Rivas-Martínez 1968
   typical
   lavanduletosum sampaioanae Rivas-Martínez & Belmonte 1987 subass. nova hoc loco

Genistion floridae Rivas-Martínez 1974

4. *Cytisetum multiflori-eriocarpi* Rivas Goday 1964 nom. mut.
5. *Adenocarpetum argyrophylli* Rivas-Martínez, Cantó, Sánchez-Mata & Belmonte 2002
   typical
   franguletosum alni Ladero 1970 subass. nova hoc loco
6. *Genisto floridae-Cytisetum scoparii* Rivas-Martínez & Cantó 1987
   typical
   genistetosum falcatae Sánchez-Mata 1989
7. *Genisto floridae-Adenocarpetum hispanici* Rivas-Martínez 1974
8. *Cytiso oromediterranei-Genistetum cinerascentis* Rivas-Martínez 1970 corr. Rivas-Martínez & Cantó 1987
   typical
   echinospartetosum barnadesii Rivas-Martínez 1970
   adenocarpetosum gredensis Rivas-Martínez 1970 corr.
9. *Pteridio aquilini-Cytisetum oromediterranei* Gavilán, Cantó, Fernández-González, Rivas-Martínez & Sánchez-Mata 2002
10. *Thymo mastichinae-Cytisetum multiflori* Rivas-Martínez 1968

Genistion polygaliiphyllae Rivas-Martínez, T.E. Díaz, F. Prieto, Loidi & Penas 1984

11. *Cytiso scoparii-Genistetum polygaliiphyllae* Rivas-Martínez, T.E. Díaz, F. Prieto, Loidi & Penas 1984
12. *Genisto hystricis-Cytisetum multiflori* Rivas-Martínez, T. E. Díaz, F. Prieto, Loidi & Penas 1984
    typical
    lavanduletosum sampaioanae subass. nova hoc loco
13. *Echinospartetum iberici* Rivas-Martínez 1974 corr. Rivas-Martínez, Lousa, T.E. Díaz, Fernández-González & J.C. Costa 1990

Ulici europaei-Genistion polygaliiphyllae Rivas-Martínez, Báscones, T.E. Díaz, Fernández-González & Loidi 1991

14. *Cytiso striati-Genistetum polygaliiphyllae* Rivas-Martínez 1981
15. *Lavandulo sampaioanae-Cytisetum multiflori* Br.-Bl., P. Silva & Rozeira 1964

FLORISTIC APPENDIX

The list below contains the ranks and accepted authorship of the taxa mentioned in the text and in an abbreviated form in the phytosociological tables, when they do not coincide with those recognised in Flora Iberica (Castroviejo & als. (Eds.), 1986-2010) and in Flora Europaea (Tutin & al. eds, Cambridge 1964-1979, 1993).

Adenocarpus gredensis = *Adenocarpus hispanicus* subsp. *gredensis* Rivas-Martínez & Belmonte (1989) *in* Opusc. Bot. Pharm. Complut. 5: 72.

Agrostis truncatula Parl. (1850) *in* Fl. Ital. 1: 185.

A*rrhenatherum elatius* (L.) Beauv. *ex* J. & K. Presl subsp. *baeticum* Romero Zarco (1985) *in* Acta Bot. Malacitana 10: 134.

Avenella iberica = *Avenella flexuosa* (L.) Drejer subsp. *iberica* (Rivas-Martínez, Izco & Costa) García Suárez, Fernández-Carvajal & Fernández-Prieto 1997.

Avenula sulcata (Gay ex Delastre) Dumort (1868) *in* Bull. Soc. Bot. Belg. 7(1): 128.

Cytisus eriocarpus = *Cytisus striatus* subsp. *eriocarpus* (Boiss. & Reuter) Rivas-Martínez (1974) *in* Anales Inst. Bot. Cavanilles 34: 540.

Dactylis hispanica Roth.

Festuca summilusitana Franco & Rocha Afonso (1980) *in* Bol. Soc. Brot. sér. 2 54: 94-95.

Genista polygaliiphylla Brot. (1804) *in* Fl. Lusit. 2: 86.

Helianthemum masguindalii = *Helianthemum appeninum* (L.) Miller subsp. *masguindalii* (Pau) Rivas-Martínez, Fernández-González & Sánchez-Mata (1990) *in* Itinera Geobot. 4: 113.

Koeleria crassipes = *Koeleria caudata* (Link.) Steudel subsp. *crassipes* (Lange) Rivas-Martínez (1980) *in* An. Jard. Bot. Madrid 36: 308.

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