New Contributions to the Ericion umbellatae Alliance in the Central Iberian Peninsula

José C. Piñar Fuentes 1, Mauro Raposo 2, Carlos J. Pinto Gomes 2, Sara del Río González 3, Giovanni Spampinato 4 and Eusebio Cano 1,*

1 Department of Animal and Plant Biology and Ecology, Section of Botany, University of Jaén, Las Lagunillas s/n, 23071 Jaén, Spain; jcpfuentes@gmail.com
2 Department of Landscape, Environment and Planning, Institute for Mediterranean Agrarian and Environmental Sciences (ICAAM), School of Science and Technology, University of Évora (Portugal), Rua Romão Ramalho, nº 59, 7000-671 Évora, Portugal; mraposo@uevora.pt (M.R.); cpngomes@uevora.pt (C.J.P.G.)
3 Department of Biodiversity and Environmental Management (Botany), Faculty of Biological and Environmental Sciences, Campus de Vegazana s/n, University of León, E-24071 León, Spain; sara.delrio@unileon.es
4 Department of Agraria, “Mediterranea” University of Reggio Calabria, Loc. Feo di Vito, 89122 Reggio Calabria, Italy; gspampinato@unirc.it
* Correspondence: ecano@ujaen.es

Abstract: The study of heathlands dominated by Erica australis, E. umbellata and Cistus populifolius in the centre and west of the Iberian Peninsula allows us to separate the eight shrubland communities. The taxonomic analysis of E. australis distinguishes two subspecies: E. australis subsp. australis and E. australis subsp. aragonensis. The statistical treatment confirms the differences between the subassociations Ericenion aragonensis and Ericenion umbellatae. This ecological, bioclimatic, biogeographical and floristic study has allowed us to differentiate three new associations from the remaining five: TCp = Teucrio oxylepis-Cistetum populifolii nova. HEau = Halimio ocymoidis-Ericetum australis nova. DEu = Drosophylo lusitanicae-Ericetum umbellatae nova. ECp = Erica australis-Cistetum populifolii Rivas Goday 1964. PDeu = Polygalo microphyllae-Cistetum populifolii Rivas Goday 1964. HDeu = Halimio ocymoidis-Ericetum australis nova. HEu = Halimio ocymoidis-Ericetum umbellatae Rivas Goday 1964. UEu = Ulici eriocladi-Ericetum umbellatae.

Keywords: association; taxonomy; heathlands; habitats; shrubs

1. Introduction

Humid and subhumid areas contain woodlands of Quercus brotero (Cout.) Rivas-Martínez & C.Sáenz (Portuguese oak), Quercus canariensis and Quercus marianna Vicioso, Quercus suber L. (cork oak) and Quercus pyrenaica Willd. (Pyrenean oak.) [1–3], all originating within the vegetation community dynamic of the Ericaceae family: Arbutus unedo L., Erica australis subsp. australis L., Erica umbellata Loefl. ex L., Erica scoparia L., and some communities of the Cistaceae family, Cistus populifolius L. Until now these communities in the central-western Iberian Peninsula have been included in the associations Halimio ocymoidis-Ericetum aragonensis, Halimio ocymoidis-Ericetum umbellatae, Ulici eriocladi-Ericetum umbellatae, and Polygalo microphyllae-Cistetum populifolii [4–13].

Heathlands are one of the most extensive and important habitats on the planet [14,15], and are among the most representative plant communities on the European continent with an Atlantic bioclimate and influence [5,16]. These formations are linked to oceanic environments, with abundant rainfall and short periods of summer drought in the case of the southern Iberian Peninsula [14,17–20], and in acidic, oligotrophic soils subject to erosion and fire [21].
From a conservation point of view, these communities have received a different treatment on the Iberian Peninsula [15] and were considered as mere replacement stages [5,21], whereas in the rest of Europe these plant formations—which harbour less diversity—are more highly regarded [15] in conservation terms. In the Habitats Directive, Erica umbellata-dominated heaths correspond to code 4030 “European dry heaths”.

The associations dominated by Erica spp., Ulex spp. and Cistus populifolius are typical of subhumid and humid ombro-types and are consequently fragile in the face of climate change, since they are affected by the increase in temperature and rainfall irregularity, as are the endemic taxa in these associations, and consequently the endemic taxa present in mountain areas [22–24]. These thickets dominated by the genus Erica are typical of rainy environments and are at their optimum in temperate Europe, although they extend to the sub-Mediterranean mountains, and connect catenally towards dry-subhumid ombro-types, with micro-forests of Juniperus oxycedrus subsp. badia (H. Gay) according to Debeaux [25,26].

On the Iberian Peninsula, this type of habitat has encountered problems in its interpretation, largely due to its extension and its bioclimatic and biogeographical diversity. The classifications proposed have disregarded the typical Mediterranean heaths, with Atlantic nuances, of the southwest Iberian Peninsula, which are of enormous floristic and biogeographical interest [15]. It should be noted that, of the three heathland subtypes considered, these Mediterranean dry heaths are the richest in endemisms.

The associations studied should be considered habitats of interest for conservation, since they dominate the middle and high mountains and include rocky habitats and wetlands with a predominance of endemic, rare and in some cases threatened species such as Coincya longirostra (Boiss.) Greuter & Burdet, Digitalis mariana Boiss., Jasione crispa subsp. tomentosa, Jasione crispa subsp. mariana (A.DC.) Rivas Mart., Dianthus lusitanus Brot., Adenocarpus hispanicus subsp. argyrophyllus (Rivas Goday), Drosophyllun lusitanicum (L.) Solenopsis laurentia (L.) C. Presl, Pinguiicula lusitanica L.

According to [22], Erica australis L. is highly variable; the species Erica aragonensis Willk. and Erica australis subsp. aragonensis (Willk.) Cout. Are not recognized and claimed to be a montane ecotype, although any convincing arguments to synonymise these taxa to E. australis are not provided; however, [23] the subsp. Aragonensis is accepted. In our opinion the character of extrorse anthers in the subsp. aragonensis compared to non-extrorse anthers in the subsp. australis is clear. We, therefore, maintain the subsp. aragonensis, which has a more northerly distribution than the subsp. australis.

The main objective of the present work is to highlight the plant diversity of scrubs dominated by different species of the genus Erica in the centre-south of the Iberian Peninsula within the Mediterranean climate domain. On the other hand, from the point of view of the sustainability of forests and accompanying shrublands, it is important to know how these heathlands provide the environmental conditions necessary for the establishment of plant stages of greater biomass. It is, therefore, necessary to know the diversity and structure of Mediterranean dry heaths for their conservation and sustainability over time.

2. Materials and Methods
2.1. Study Area

The territory in the study is located in the central-western Iberian Peninsula (Figure 1) and is dominated by siliceous materials, Palaeozoic slates, metamorphic quartzites and plutonic rocks (granite); it has a Mediterranean bioclimate with a thermo-type that ranges between the thermo- and the supra-Mediterranean, and an ombro-type between dry and humid.
Figure 1. Location of the study area including the biogeographical provinces.

2.2. Sampling

An analysis was made of 232 heathland relevés dominated by *Erica umbellata*, *E. australis* and *Cistus populifolius* in the centre and west of the Iberian Peninsula, obtained from our own field research (56 samples) and various publications (176 samples) (Table 1). These relevés belong to ten associations: SDl = *Saturejo salzmannii-Drosophylletum lusitanicii*; TC1 = *Teucrio mariani-Cistetum laurifolii*; TCp = *Teucrio oxylepis-Cistetum populifolii* (Figure 2); HEau = *Halimio ocymoidis-Ericetum australis*; ECp = *Erico australis-Cistetum populifolii*; PCp = *Polygalo microphyllae-Cistetum populifolii*; HEa = *Halimio ocymoidis-Ericetum aragonensis*; DEu = *Drosophylo lusitanicae-Ericetum umbellatae*; HEu = *Halimio ocymoidis-Ericetum umbellatae*; UEu = *Ulici eriocladi-Ericetum umbellatae*. For the authorship of the taxa, we have followed Flora Ibérica, Flora Western Andalusia and Eastern Andalusia Flora. For the authorship of syntaxa, we have followed [12].

Our own samplings were taken following the Braun-Blanquet method, modified by Van der Maarel [24].
Table 1. Origin of the vegetation samples used in this work.

| Plant Community | Bibliography | N° of Relevés |
|-----------------|--------------|--------------|
| SDl             | Galán de Mera, A. (1993) | 5 |
|                 | Junta de Andalucia | 2 |
|                 | Quezel P. et. al. (1988) | 5 |
| TCp             | Own relevés | 18 |
|                 | Rodríguez Marzal (2006) | 3 |
| TCI             | Junta de Andalucia | 1 |
|                 | Velasco Negueruela, A. (1981) | 6 |
|                 | Own relevés | 4 |
| HEa             | Own relevés | 12 |
| ECp             | Rivas Goday, S. (1964) | 5 |
|                 | Belmonte M.D. (2008) | 13 |
|                 | Muñoz, A.F.; Santa-Bábara, C. & Vicent, C. (2008) | 24 |
|                 | Rufo Nieto (2009) | 13 |
| PCp             | Melendo Luque, M. (1998) | 7 |
|                 | Rivas Goday, S. (1964) | 8 |
|                 | Belmonte M.D. (2008) | 13 |
| HEu             | Rivas Goday, S. (1964) | 5 |
|                 | Belmonte M.D. (2008) | 16 |
|                 | Melendo Luque, M. (1998) | 4 |
|                 | Muñoz, A.F.; Santa-Bábara, C. & Vicent, C. (2008) | 9 |
| Ueu             | Muñoz, A.F.; Santa-Bábara, C. & Vicent, C. (2008) | 4 |
|                 | Rivas-Martinez, S. (1979) | 8 |
|                 | Rufo Nieto (2009) | 4 |
|                 | Junta de Andalucia | 21 |
| DEu             | Own relevés | 22 |

SDl = Saturejo salzmannii-Drosophylletum lusitanici. TCI = Teucrio mariani-Cistetum laurifolii. TCp = Teucrio mariani-Cistetum populifolii. HEau = Halimio ocymoidis-Ericetum australis. ECp = Erico australis-Cistetum populifolii. PCp = Polygalo microphyllae-Cistetum populifolii. HEa = Halimio ocymoidis-Ericetum aragonensis. DEu = Drosophyllum lusitanicae-Ericetum umbellatae. HEu = Halimio ocymoidis-Ericetum umbellatae. Ueu = Ulici eriocladi-Ericetum umbellatae.

2.3. Data Analyses

Subsequently, and based on the geographic and topographic information contained in these relevés, each sampling was geo-referenced and implemented in a geographic information system (GIS) using the corresponding maps (Appendix A). They were then matched with the place names and the rest of the data from the samplings in the bibliography in order to obtain the different climatic and bioclimatic variables for each sampling. The figures for altitude, orientation and slope were determined by plotting the previously geo-referenced points on a digital terrain map (DTM) with a pixel resolution of 30 × 30 metres for the points in Portugal and Morocco, and on a digital terrain model with a resolution of 10 × 10 metres for the points in Spain. The numerical values for altitude, orientation and slope were obtained from the DTM for each sampling point by means of numerical classification methods. An ascending hierarchical classification was applied for the ordination and comparison of the different samples using Ward’s distance. For a better understanding of the results, a multivariate ordination analysis was carried out by means of detrended correspondence analysis.
Figure 2. Distribution of plant communities dominated by *Teucrium oxylepis* subsp. *marianum*. TCi = *Teucrio mariani-Cistetum laurifolii* is located in the most inland areas of the Iberian Peninsula with a major continental influence. TCp = *Teucrio mariani-Cistetum populifolii* is located in more peripheral zones with a greater Atlantic influence. TCp-Cl = *Teucrio mariani-Cistetum populifolii* is a colder and more continental variant with *Cistus laurifolius*.

### Table 1. Origin of the vegetation samples used in this work.

| Plant Community | Bibliography | N° of Relevés |
|-----------------|--------------|--------------|
| SDl             | Galán de Mera, A. (1993) | 5 |
|                 | Junta de Andalucía | 2 |
|                 | Quezel P. et. al. (1988) | 5 |
| TCl             | Own relevés | 4 |
|                 | Velasco Negueruela, A. (1981) | 6 |
|                 | Rodríguez Marzal (2006) | 3 |
| TCl             | Junta de Andalucía | 1 |
|                 | Vinas, A.F.; Santa-Bárbara, C. & Vincent, C. (2008) | 9 |
|                 | Rufo Nieto (2009) | 13 |
| TCp             | Own relevés | 18 |
|                 | Rodríguez Marzal (2006) | 3 |
|                 | Rivas Goday, S. (1964) | 5 |
|                 | Belmonte M.D. (2008) | 13 |
| ECp             | Rivas Goday, S. (1964) | 8 |
|                 | Belmonte M.D. (2008) | 16 |
|                 | Muñoz, A.F.; Santa-Bárbara, C. & Vincent, C. (2008) | 24 |
| PCp             | Melendo Luque, M. (1998) | 7 |
|                 | Rivas Goday, S. (1964) | 8 |
|                 | Belmonte M.D. (2008) | 13 |
| HEu             | Rivas Goday, S. (1964) | 5 |
|                 | Belmonte M.D. (2008) | 16 |
|                 | Melendo Luque, M. (1998) | 4 |
|                 | Muñoz, A.F.; Santa-Bárbara, C. & Vincent, C. (2008) | 9 |

3. Results

We studied the communities of *Erica umbellata* Loefl. ex L., *Erica australis* L. subsp. *australis*, *Erica australis* L. subsp. *aragonensis* (Willk.) Cout. and *Cistus populifolius* L. in the central Iberian Peninsula. The statistical analysis of the communities dominated by these taxa (Figures 2–5) reveals the existence of two groups, G1 and G2, corresponding to the suballiances *Ericenion aragonensis* Rivas Martínez 1979 and *Ericenion umbellatae* Rivas Martínez 1979. The association *Polygalo microphyllae-Cistetum populifolii* (PCp1-PCp8) was described by [1] for shady Silurian sites in Extremadura, whose relevés PCp1-PCp8 are far removed from our group of relevés and [7] for the eastern Sierra Morena, and from the relevés of [1] from which he describes the association *Erico australis-Cistetum populifolii* (ECp1-ECp5), and which have a more thermophilous character than the former (Figure 4).
Figure 3. Cluster of heathland associations in the central-western Iberian Peninsula. The hierarchical classification used is based on Euclidean distance, using Ward's agglomerative method.
Figure 3. Cluster of heathland associations in the central-western Iberian Peninsula.

Figure 4. DECORANA (Detrended analyse of variance) ordination of heathland communities in the central-western Iberian Peninsula.

Figure 5. DCA ordination of heathland communities in the central-western Iberian Peninsula.
The relevés dominated by C. populifolius in eastern Sierra Morena differ floristically from the communities described by [4] in Extremadura, as they quite frequently include Teucrium oxylepis (endemic) and Cistus laurifolius, which grow in shady sites and foothills more influenced by the cold winds from the Manchegan plateau. We therefore propose the association Teucrium mariani-Cistetum populifolii nova (Table 2 rel. TCp1-TCp18 typus rel. TCp15*).

The relevés corresponding to the association described by [5], Ulvi eriocladi-Ericetum umbellatae (UEu1-UEu8), are clearly separated and floristically, ecologically, dynamically and biogeographically differentiated from the other communities of E. australis. The association Halimio ocymoidis-Ericetum aragonensis (HEa1-HEa15), described by [5] for the territories of Guadalajara and Segovia, shows significant differences from the heathlands of E. australis in the Marianica range due to the absence in Marianican territories of E. australis subsp. aragonensis, Luzula lactea (Link) E.Mey., Genista pilosa L., Deschampsia flexuosa subsp. iberica Rivas Mart. and Helianthemum pulverulentum Pers. We therefore propose the association Halimio ocymoidis-Ericetum australis nova (Table 3 rel. HEau1-HEau11 typus rel. HEau4*), which has a more southerly character than the previous association, for supra-Mediterranean environments in the eastern Marianico-Monchiquensean sector; this heathland represents a dynamic stage of the woodlands of Sorbo torminalis-Quercetum pyrenaicae. This association is statistically close to Erica australis-Cistetum populifolii; however, the latter has a more eastern and thermophilous character ([4], Table 67, page 446).

In the group of communities of E. umbellata, the relevés given by [4,5] in the Sierra de San Pedro ( Cáceres) and Herrera del Duque (Badajoz), León and Zamora are gathered in a single compact group (HEu12-HEu21) corresponding to Halimio ocymoidis-Ericetum umbellatae; this association was described by [4] in highly oligotrophic and nutrient-poor soils. It has floristic, dynamic and biogeographical differences with the communities of Erica umbellata in the eastern Sierra Morena; the Leonese and Zamoran territories include the species Halimium alysoides, E. australis subsp. aragonensis, Ulex minor, Genista micrantha, and Agrostis setacea, which have a more oceanic character and are not present in the eastern Sierra Morena. The relevés of [7,10] are grouped with those taken recently by us in the province of Ciudad Real, where they include E. umbellata, Halimium ocymoides, Tuberaria lignosa, Pterospartum tridentatum, Drophyllum lusitanicum, Lavandula pedunculata and occasionally Festuca elegans, Coincya longirostra and Juniperus oxycedrus subsp. badia. We therefore propose the association Drosophyllo lusitanicae-Ericetum umbellatae nova (Table 4 rel. DEu1-DEu22 typus rel. DEu6 *) growing on highly washed soils (distric lithosols) with a total absence of organic matter. This association is distributed throughout the eastern Marianico-Monchiquensean sector.
Table 2. Teucrio mariani-Cistetum populifolii nova.

| Altitude | 889 | 472 | 817 | 867 | 800 | 650 | 740 | 680 | 660 | 730 | 580 | 660 | 948 | 976 | 969 | 876 | 897 | 930 | 985 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Area m²  | 200 | 200 | 100 | 200 | 200 | 100 | 150 | 150 | 200 | 200 | 150 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Coverage % | 90  | 85  | 80  | 90  | 90  | 80  | 90  | 80  | 90  | 80  | 80  | 60  | 55  | 65  | 60  | 55  | 75  | 50  | 50  |
| Inclination % | 8  | 25  | 20  | 8  | 20  | 20  | 10  | 15  | 20  | 20  | 25  | 10  | 20  | 10  | 10  | 15  | 30  | 20  | 0   |
| Orientation | N  | N   | NW  | NE  | N   | NW  | N   | W   | NW  | NE  | W   | NW  | NE  | W   | NW  | SW  | SW  | NE  | N   |
| Medium height veg. in m. | 1.80 | 0.90 | 1.70 | 1.40 | 0.80 | 0.70 | 0.70 | 0.70 | 0.70 | 0.35 | 0.70 | 0.70 | 0.70 | 0.35 | 0.70 | 0.70 | 0.70 | 0.35 |

Characteristic association species

- Teucrium oxylepis subsp. marianum
- Cistus populifolius subsp. populifolius

Characteristic species of

- Ericion umbellatae
  - Erica australis subsp. australis
  - Halimium ocymoides
  - Polygala microphylla
  - Erica umbellata

Characteristic species of Calluno-Ulicetea

- Pterospartum tridentatum subsp. lasianthum
  - Calluna vulgaris
  - Erica scoparia subsp. scoparia
  - Tuberaria lignosa

Characteristic species of Ulici-Cistion ladaniferi

- Lavandula stoechas subsp. luisieri
- Lavandula pedunculata subsp. sampaiana
- Erophaca baetica

Characteristic species of Lavanduletalia stoechas and Cisto-Lavanduletalia

- Cistus ladanifer subsp. ladanifer
- Cistus crispus
- Narcissus triandrus subsp. pallidulus
- Iberis linifolia
| Species                                      | Category                                    | Value 1 | Value 2 | Value 3 | Value 4 | Value 5 | Value 6 | Value 7 | Value 8 | Value 9 | Value 10 | Value 11 |
|----------------------------------------------|---------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Cistus salviolius                            | Cistus laurifolius                          |         |         |         |         |         |         |         |         |         |         |         |
| Halimium umbellatum subsp. viscosum          | Cistus laurifolius                          | 5       |         | 1       |         |         |         |         |         |         |         |         |
| Cistus laurifolius                           | Cistus laurifolius                          | 5       | 2       | 2       |         |         |         |         |         |         |         |         |
| Characteristic species of Querceta ilicis    | Characteristic species of Querceta ilicis   |         |         |         |         |         |         |         |         |         |         |         |
| class and lower units                        | class and lower units                        |         |         |         |         |         |         |         |         |         |         |         |
| Erica arborea                                | Erica arborea                               |         |         |         |         |         |         |         |         |         |         |         |
| Arbutus unedo                                | Arbutus unedo                               | 1       |         |         |         |         |         |         |         |         |         |         |
| Phillyrea angustifolia                        | Phillyrea angustifolia                       |         |         |         |         |         |         |         |         |         |         |         |
| Daphne gnidium                               | Daphne gnidium                              |         |         |         |         |         |         |         |         |         |         |         |
| Quercus broteroi                             | Quercus broteroi                            |         |         |         |         |         |         |         |         |         |         |         |
| Quercus suber                                | Quercus suber                               | 1       |         |         |         |         |         |         |         |         |         |         |
| Daphne gnidium                               | Daphne gnidium                              |         |         |         |         |         |         |         |         |         |         |         |
| Arbora                                       | Arbora                                      |         |         |         |         |         |         |         |         |         |         |         |
| Phillyrea angustifolia                        | Phillyrea angustifolia                       |         |         |         |         |         |         |         |         |         |         |         |
| Daphne gnidium                               | Daphne gnidium                              |         |         |         |         |         |         |         |         |         |         |         |
| Quercus broteroi                             | Quercus broteroi                            |         |         |         |         |         |         |         |         |         |         |         |
| Quercus suber                                | Quercus suber                               | 1       |         |         |         |         |         |         |         |         |         |         |
| Doronicum Plantagineum                       | Doronicum Plantagineum                      |         |         |         |         |         |         |         |         |         |         |         |
| Paeonia brother                              | Paeonia brother                             |         |         |         |         |         |         |         |         |         |         |         |
| Teucrium frutescens                          | Teucrium frutescens                         |         |         |         |         |         |         |         |         |         |         |         |
| Jasminum frutescens                          | Jasminum frutescens                         |         |         |         |         |         |         |         |         |         |         |         |
| Lonicera impex                              | Lonicera impex                              |         |         |         |         |         |         |         |         |         |         |         |
| Quercus rotundifolia                         | Quercus rotundifolia                        |         |         |         |         |         |         |         |         |         |         |         |
| Rubia peregrina subp. peregrina              | Rubia peregrina subp. peregrina             |         |         |         |         |         |         |         |         |         |         |         |
| Viburnum tinus                               | Viburnum tinus                              |         |         |         |         |         |         |         |         |         |         |         |
| Juniperus oxycedrus subsp. Badia             | Juniperus oxycedrus subsp. Badia            |         |         |         |         |         |         |         |         |         |         |         |
| Lonicera periclymenum subsp. hispuntica      | Lonicera periclymenum subsp. hispuntica      |         |         |         |         |         |         |         |         |         |         |         |
| Pistacia terebinthina                        | Pistacia terebinthina                       |         |         |         |         |         |         |         |         |         |         |         |
| Sanguisorba hybrida                          | Sanguisorba hybrida                         |         |         |         |         |         |         |         |         |         |         |         |
| Characteristic species of Cytisea scopario-striati class and lower units | Characteristic species of Cytisea scopario-striati class and lower units |         |         |         |         |         |         |         |         |         |         |         |
| Cytisus scoparius subsp. bourgaei             | Cytisus scoparius subsp. bourgaei            | 1       | 1       | 1       | 1       | 1       | 1       | 1       | 1       | 1       | 1       | 1       |
| Adenocarpus telocanus                        | Adenocarpus telocanus                       |         |         |         |         |         |         |         |         |         |         |         |
| Pteridium aquilinum                          | Pteridium aquilinum                         |         |         |         |         |         |         |         |         |         |         |         |
| Cytisus grandiflorus subsp. grandiflorus     | Cytisus grandiflorus subsp. grandiflorus    |         |         |         |         |         |         |         |         |         |         |         |
| Cytisus striatus subsp. striatus              | Cytisus striatus subsp. striatus             |         |         |         |         |         |         |         |         |         |         |         |
| Characteristic species of Querco robors-Fageteta sylvestris class and lower units | Characteristic species of Querco robors-Fageteta sylvestris class and lower units |         |         |         |         |         |         |         |         |         |         |         |
| Cephalria longifolia                         | Cephalria longifolia                        |         |         |         |         |         |         |         |         |         |         |         |
| Geum sylvaticum                              | Geum sylvaticum                              |         |         |         |         |         |         |         |         |         |         |         |

Table 2. Cont.
Table 2. Cont.

| Species                                   | Value 1 | Value 2 | Value 3 | Value 4 | Value 5 |
|-------------------------------------------|---------|---------|---------|---------|---------|
| *Quercus faginea* subsp. faginea          |         |         |         |         |         |
| *Arenaria montana* subsp. montana         |         |         |         |         |         |
| *Tamus communis*                          |         |         |         |         |         |
| *Epipactis helleborine* subsp. helleborine|         |         |         |         |         |
| *Epipactis helleborine* subsp. tremolsii  |         |         |         |         |         |
| *Quercus pyrenaica*                       |         |         |         |         |         |
| *Sorbus torminalis*                       |         |         |         |         |         |
| Companion species                         |         |         |         |         |         |
| *Pinus pinaster*                          | 5       | 4       | 5       |         |         |
| *Rosmarinus officinalis*                  | 1       | 2       | +       | 1       | 1       |
| *Thapsia villosa*                         | +       | +       | +       |         |         |
| *Thymus mastichina*                       | 1       | 1       |         |         |         |
| *Carlina corymbosa* subsp. corymbosa      |         |         | +       | 2       | 2       |
| *Agrostis capillaris* x castellana        |         |         | 3       | +       |         |
| *Cistus albidus*                          |         |         | +       |         |         |
| *Halimium halimifolium*                   |         |         | +       |         |         |
| *Castanea sativa*                         |         |         | 2       | +       |         |
| *Dactylis lusitanica*                     |         |         | +       | +       |         |
| *Holcus lanatus*                          |         |         |         |         | 2       |
| *Rubus ulmifolius*                        |         |         |         |         | +       |
| *Asphodelus albus* subsp. albus           |         |         | +       |         | 1       |
| *Briza maxima*                            |         |         |         |         | 2       |
| *Helichrysum stoechas*                    |         |         | +       |         | +       |
| *Sanguisorba verrucosa*                   |         |         | 1       | +       |         |
| *Sedum forsterianum*                      |         |         |         |         | 1       |
| *Centaura melitensis*                     | 1       |         |         |         |         |
| *Festuca rothmaleri*                      |         |         |         |         | 1       |
| *Leucanthemum sylvaticum*                 | 1       |         |         |         |         |
| *Magydaris panacifolia*                   | 1       |         |         |         |         |
| *Origanum virens*                         |         |         | +       | +       |         |
| *Avenula marginata* subsp. sulcata        |         |         | +       | +       |         |
| *Celtica gigantea*                        |         |         | +       | +       |         |
| *Dactylis glomerata* subsp. hispanica     |         |         | +       | +       |         |
| *Ranunculus gramineus*                    |         |         | +       | +       |         |
### Table 2. Cont.

| Species                              | + | + | + |
|--------------------------------------|---|---|---|
| Rosa pouziniii                        |   |   |   |
| Sanguisorba minor                    | + |   | + |
| Andryala integrifolia                |   | + |   |
| Aristolochia pistolochia             |   |   |   |
| Arrhenatherum elatius subsp. bulbosum| + |   |   |
| Campanula rapunculus                 | + |   |   |
| Cardamine hirsuta                    |   | + |   |
| Clinopodium vulgare subsp. arundanum|   | + |   |
| Conopodium marianum                  |   |   | + |
| Dorycnium pentaphyllum               | + |   |   |
| Eryngium tenue                       |   |   | + |
| Iris planifolia                      |   |   | + |
| Linum suffruticosum subsp. suffruticosum | + |   |   |
| Picris comosa                        | + |   |   |
| Piptatherum miliaceum                |   | + |   |
| Srophularia scorodonia               | + |   |   |
| Thapsia garganica                    |   | + |   |
| Tulipa sylvestris                    |   |   | + |

Typus *.

### Table 3. Halimio ocymoidis-Ericetum australis nova.

|                | HEau1 | HEau2 | HEau3 | HEau4 | HEau5 | HEau6 | HEau7 | HEau8 | HEau9 | HEau10 | HEau11 | HEau12 |
|----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|
| Altitude m.    | 820   | 1022  | 1061  | 1249  | 1229  | 742   | 752   | 800   | 760   | 1160   | 800    | 750    |
| Area m²        | 300   | 200   | 200   | 200   | 200   | 100   | 200   | 200   | 200   | 400    | 100    | 200    |
| Coverage %     | 80    | 95    | 80    | 90    | 80    | 90    | 100   | 75    | 90    | 85     | 85     | 95     |
| Slope %        | 15    | 8     | 8.5   | 8     | 10    | 8.5   | 4     | 20    | 20    | 25     | 20     | 20     |
| Orientation    | E     | NE    | NW    | N     | E-SE  | N     | N     | N     | S     | N      | S      | S      |
| Medium height veg. in m. | 1    | 1.5   | 1.5   | 1.5   | 1.20  | 0.70  | 1.8   | 1.0   | 1.0   | 1.0    | 1.0    | 1.0    |

Characteristic association species and higher syn-taxonomic units

- **Erica australis**
  - 4
  - 5
  - 4
  - 5
  - 4
  - 5
  - 5
  - 5
  - 4
  - 5
  - 5

- **Halimium ocymoides**
  - 1
  - 1
  - 2
  - 1
  - 1
  - 1
  - 1
  - 1

- **Cistus polifolius**
  - +
  - +
  - 1
  - 1
  - 1
  - 1
  - 4
  - 1
  - 1
  - 1
  - 1
| Companion species                      | HEau1 | HEau2 | HEau3 | HEau4 | HEau5 | HEau6 | HEau7 | HEau8 | HEau9 | HEau10 | HEau11 | HEau12 |
|----------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|
| *Erica umbellata*                      | 2     | 1     | 2     | 4     | 1     | 1     | 1     | 1     | 1     |        |        |        |
| *Lavandula luissieri*                   | +     |       | +     |       | +     | 1     | 1     | 1     | 1     | 2      |        |        |
| *Calluna vulgaris*                      |       |       |       | 2     |       |       |       | 1     | 1     | 1      | 1      |        |
| *Polygala microphylla*                  | +     | +     |       |       |       |       |       |       |       |        | +      |        |
| *Tuberaria lignosa*                     |       | +     | +     |       |       |       |       |       |       |        |        | 1      |
| *Erica scopara*                         |       |       |       |       |       |       |       |       |       | 2      | 2      | 1      |
| *Pterospartum tridentatum*              |       |       |       |       |       |       |       |       |       |        |        |        |
| *Cistus ladanifer*                      | 2     | 2     | 2     | 2     | 1     | 1     | 1     | 2     | 1     | 2      | 1      | 2      |
| *Arbutus unedo*                         | +     | +     | 1     | +     | 1     | +     | +     | +     | +     |        |        |        |
| *Rosmarinus officinalis*                | +     |       |       | +     |       | 1     | 2     | +     | +     |        |        | 2      |
| *Erica arborea*                         | 1     | 2     | +     |       |       |       |       |       |       |        |        |        |
| *Phillyrea angustifolia*                | +     | 1     | +     |       | +     | +     | +     | +     | +     |        |        | 2      |
| *Quercus brotero*                       |       |       |       |       |       |       |       |       |       | +      | +      | +      |
| *Festuca elegans*                       |       |       |       |       |       |       |       |       |       | +      | +      | +      |
| *Daphne gnidium*                        | +     |       |       |       |       |       |       |       |       | +      | +      | +      |
| *Quercus suber*                         |       |       |       |       |       |       |       |       |       |        |        |        |
| *Cistus salicifolius*                   |       | +     | +     | +     | +     | +     | +     | +     | +     |        |        |        |
| *Avenula sulcata subsp. occidentalis*   |       |       |       |       |       |       |       |       |       |        |        |        |
| *Juniperus oxycedrus subsp. badia*      |       |       |       |       |       |       |       |       |       |        |        |        |
| *Quercus pyrenaica*                     |       |       |       |       |       |       |       |       |       |        |        |        |
| *Thymiust mastichina*                   |       |       |       |       |       |       |       |       |       |        |        |        |
| *Asphodelus albus*                      | 1     |     | 1     |       |       |       |       |       |       |        |        |        |
| *Quercus rotundifolia*                  |       |       |       |       |       |       |       |       |       |        |        |        |
| *Saxifraga granulata*                   |       |       |       |       |       |       |       |       |       |        |        |        |
| *Hypochoeris radicata*                  |       |       |       |       |       |       |       |       |       |        |        |        |
| *Thapsia villosa*                       |       |       |       |       |       |       |       |       |       |        |        |        |
| *Rumex angiocarpus*                     |       |       |       |       |       |       |       |       |       |        |        |        |
| *Cytisus scoparius subsp. bourgaei*      |       |       |       |       |       |       |       |       |       |        |        |        |
| *Cistus crispus*                        |       |       |       |       |       |       |       |       |       |        |        |        |
| *Ranunculus sardous subsp. aleae*       |       |       |       |       |       |       |       |       |       |        |        |        |
| *Klasea abulensis*                      |       |       |       |       |       |       |       |       |       |        |        |        |
Table 3. Cont.

|                        | HEau1 | HEau2 | HEau3 | HEau4 | HEau5 | HEau6 | HEau7 | HEau8 | HEau9 | HEau10 | HEau11 | HEau12 |
|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|-------|
| *Arrhenatherum elatius subsp. bulbosum* |       |       |       |       |       |       |       |       |       |        |        |       |
| *Narcissus triandrus* |       |       |       |       |       |       |       |       |       |        |        |       |
| *Arrhenatherum album* |       |       |       |       |       |       |       |       |       |        |        |       |
| *Cardamine hirsuta* |       |       |       |       |       |       |       |       |       |        |        |       |
| *Scirpus holoschoenus* |       |       |       |       |       |       |       |       |       |        |        |       |
| *Salix atrocinerea* |       |       |       |       |       |       |       |       |       |        |        |       |
| *Osgris alba* |       |       |       |       |       |       |       |       |       |        |        |       |
| *Teucrium haenseleri* |       |       |       |       |       |       |       |       |       |        |        |       |
| *Cytisus multiflorus* |       |       |       |       |       |       |       |       |       |        |        |       |
| *Pistacia terebinthus* |       |       |       |       |       |       |       |       |       |        |        |       |
| *Juniperus oxycedrus* |       |       |       |       |       |       |       |       |       |        |        |       |

Table 4. Drosophyllo lusitanicae-Ericetum umbellatae nova.

|                        | DEu1 | DEu2 | DEu3 | DEu4 | DEu5 | DEu6 | DEu7 | DEu8 | DEu9 | DEu10 | DEu11 | DEu12 | DEu13 | DEu14 | DEu15 | DEu16 | DEu17 | DEu18 | DEu19 | DEu20 | DEu21 | DEu22 |
|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Altitude m.            | 795  | 1233 | 982  | 1042 | 1051 | 1061 | 1074 | 1095 | 742  | 599  | 830  | 1010 | 800  | 730  | 800  | 700  | 750  | 720  | 750  | 760  | 740  |
| Area m²                | 300  | 400  | 100  | 50   | 10   | 40   | 20   | 40   | 10   | 100  | 200  | 100  | 200  | 200  | 200  | 200  | 300  | 200  | 150  | 200  | 150  | 100  |
| Coverage %             | 40   | 60   | 80   | 50   | 10   | 40   | 20   | 40   | 10   | 100  | 200  | 100  | 200  | 200  | 200  | 200  | 300  | 200  | 150  | 200  | 150  | 100  |
| Slope %                | 12   | 20   | 4    | 6    | 8    | 6    | 4    | 10   | 8    | 30   | 5    | 15   | 15   | 15   | 30   | 35   | 30   | 25   | 10   | 15   |      |
| Orientation            |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Medium height veg. m.  | 0.80 | 1.5  | 0.70 | 0.40 | 0.60 | 0.50 | 0.50 | 0.50 | 0.25 | 0.35 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |
| Characteristic association species and higher syntaxonomic units |       |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| *Erica umbellata*      | 4    | 5    | 4    | 4    | 5    | 5    | 5    | 4    | 5    | 4    | 5    | 5    | 4    | 5    | 4    | 4    | 4    | 4    | 4    | 4    | 4    |
| *Halimium ocymoides*   | 4    | 4    | 4    | 4    | 4    | 4    | 1    | 4    | 1    | 1    | 4    | 1    | 4    | 4    | 5    | 4    | 5    | 4    | 5    | 4    | 5    |
| *Erica australis*      | 1    | +    | 4    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | +    | 1    | +    | 1    | +    | 1    | +    |
| *Drosophyllum lusitanicum* | 4    | 5    | 4    | 5    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    |
| *Cistus populifolius*  | 1    | 1    | +    | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| *Tuberaria lignosa*    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| *Lavandula luisieri*   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| *Pterocephrum tridentatum subsp. lasianthum* | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| *Calluna vulgaris*     | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| *Erica lusitanica*     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| *Erica scoparia*       |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Companion species      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| *Cistus ladanifer*     | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
### Table 4. Cont.

|                | DEu1 | DEu2 | DEu3 | DEu4 | DEu5 | DEu6 | DEu7 | DEu8 | DEu9 | DEu10 | DEu11 | DEu12 | DEu13 | DEu14 | DEu15 | DEu16 | DEu17 | DEu18 | DEu19 | DEu20 | DEu21 | DEu22 |
|----------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| **Rosmarinus officinalis** | +    |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Lavandula stoechas subsp. canariensis** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Briza maxima** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Tolpis barbata** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Cotinus salicifolius** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Asphodelus albus** | +    |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Arrhenatherum bulbosum subsp. elatius** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Canina crispa subsp. tomentosa** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Lavandula pedunculata** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Cytisus hypocistis** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Scirpus holoschoenus** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Salix atrocinerea** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Genista hirsuta** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Asphodelus microcarpus** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Oxysurus albus** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Gladiolus illyricus** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Thymelaea villosa** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Adenocarpus telenus** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Dactylis hispanica** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Daphne geoidium** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Arbutus unedo** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Erica arborea** |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| **Philyrea angustifolia** | +    |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |

*Typus*.
4. Discussion

The study of heathlands dominated by Erica australis subsp. australis, subsp. aragonesis, E. umbellata and Cistus populifolius contributes eight different vegetation communities. Until now the heathlands in Luso-Extremaduran territories have been included in the known associations [4,5]. However, our recent studies in the province of Ciudad Real reveal floristic differences to the associations described previously. In the taxonomic study, [22,25] do not recognise E. australis L. subsp. aragonesis (Willk.) Cout., although [5,23] recognise the aragonesis variety.

Species in the genus Erica are always found in sub-humid–humid environments and appear in the dynamics of various types of Quercus from temperate and Mediterranean European areas [27–29], but always in acid-neutral pH substrates, never in Quercus forests on basic substrates [30]. In the degradation of these scrubs, either by human action or climate change [31–34]. They are replaced by species of the genus Cistus [24]; Cistus ladanifer is the species that replaces Erica australis and Erica umbellata in the studied territory.

The association TCp is a shrubland dominated by C. populifolius and is a cold vicariant community of PCp described by [4] for the more oceanic Extremaduran territories. The new association occupies the easternmost areas of the Mariánica mountain range, which receives the influence of the climate of the Manchegan plateau and comprises differential species such as C. laurifolius and the endemism Teucrium oxylepis subsp. marianum. These communities cannot therefore be included in the association PCp. [5] Lecto typifies the association HEu described by Rivas Goday in the province of Cáceres. The floristic and ecological differences make it inadvisable to include the communities dominated by E. umbellata from the eastern Maríanica range in this association, HEu, as they grow on extremely nitrogen-poor distric lithosols that allow the presence of Drosophyllum lusitanicum; the new association is therefore a soil vicariant of HEu. This same author describes the association HEa for the provinces of Segovia and Guadalajara, and gives the typus in the locality of Puerto de San Benito (Guadalajara) at an altitude of 1840 m. The floristic, bioclimatic and biogeographical differences lead us to propose the association HEu for the Luso-Extremaduran territories (Table 5).

Table 5. Synoptic table: TCp = Teucrio oxylepis-Cistetum populifolii; HEu = Halimio ocymoidis-Ericetum australis; ECP = Erica australis-Cistetum populifolii; PCp = Polygalo microphyllae-Cistetum populifolii; HEa = Halimio ocymoidis-Ericetum aragonesis; DEu = Drosophyllum lusitanicae-Ericetum umbellatae; HEu = Halimio ocymoidis-Ericetum umbellatae.

|       | TCp | HEu | ECP | PCp | HEa | DEu | HEu | UEu |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|
| Halimium ocymoides | I   | V   | III | II  | V   | V   | V   | V   |
| Erica australis     | II  | V   | V   | IV  | II  |     |     |     |
| Cistus ladanifer    | IV  | V   | IV  |     | V   | II  |     |     |
| Erica umbellata     | I   | II  |     | V   | V   |     |     |     |
| Tuberaria liguiosa  | I   | II  | I   | III | II  |     |     |     |
| Cistus crispus      | I   | I   | II  |     |     |     |     |     |
| Lavandula luisieri  | II  | III | III |     | I   | V   |     |     |
| Erica scoparia      | I   | I   | I   | I   |     |     |     |     |
| Cistus salviolius   | II  | I   | I   |     |     |     |     | IV  |
| Quercus rotundifolia| I   | I   | II  |     |     |     |     | I   |
| Calluna vulgaris    | I   | II  | I   | V   | II  | IV  |     |     |
| Genista tridentata  | I   | III | II  | I   | II  | V   |     |     |
| Polygala microphylla| I   | I   | IV  |     |     |     | I   |     |
| Halimium umbellatum subsp viscosum | I   | II  | IV  |     |     |     | I   |     |
| Quercus pyrenaica  | I   | II  |     | I   |     |     |     |     |
| Erica arborea      | III | II  | IV  | I   | I   |     |     |     |
| Cistus populifolius | V   | V   | V   |     |     |     |     |     |
| Arbutus unedo      | III | II  | III | IV  | I   |     |     |     |
| Phillyrea angustifolia | III | III | IV  | III |     |     |     |     |
| Daphne gnidium     | II  | I   |     |     |     | I   |     |     |
| Rosmarinus officinalis | II  | III | I   |     |     |     |     | II  |
|                        | TCp | HEau | ECp | PCp | HEa | DEu | HEu | UEu |
|------------------------|-----|------|-----|-----|-----|-----|-----|-----|
| Asphodelus albus       | I   | I    | I   | I   | I   |     |     |     |
| Arrhenatherum elatius subsp bulbosum | I   | I    | I   | I   | I   |     |     |     |
| Ranunculus gramineus    | I   | I    | I   | I   | I   |     |     |     |
| Adenocarpus telonensis  | I   | III  | I   | I   | I   |     |     |     |
| Lavandula stoechas subsp sampaioana | I   | III  | I   | I   | I   |     |     |     |
| Cistus laurifolius      | I   | I    | I   | I   | I   |     |     |     |
| Quercus sieber         | II  | I    | IV  | III |     |     |     |     |
| Pistacia terebinthinus  | I   | I    | I   | IV  |     |     |     |     |
| Viburnum tinus         |     | I    | I   | III |     |     |     |     |
| Dactylis lusitanica    | I   | II   | I   | I   |     |     |     |     |
| Lonicera periclinenum   | I   | I    | II  |     |     |     |     |     |
| Bauhinia rosata        |     | I    | I   | I   |     |     |     |     |
| Rubia peregrina        | I   | I    | II  |     |     |     |     |     |
| Lonicera implexa        | I   | I    | I   |     |     |     |     |     |
| Dorycnium plantagineum | I   | II   |     | I   |     |     |     |     |
| Cytisus grandiflorus   | I   | I    | I   | I   |     |     |     |     |
| Cephalanthera longifolia| I   | I    |     | I   | I   |     |     |     |
| Arnacia montana        | I   | I    | I   | I   |     |     |     |     |
| Teucus communis        | I   |     | I   | I   | I   |     |     |     |
| Teucrium fruticans     | I   |     | I   | I   | I   |     |     |     |
| Magydaris panacifolia  | I   |     | I   | I   | I   |     |     |     |
| Astragalus lusitanicus | I   | III  | I   | I   |     |     |     |     |
| Conopodium marianum    | I   | II   | I   | I   |     |     |     |     |
| Jasminum fruticans     | I   | I    | I   | I   |     |     |     |     |
| Thapsia villosa        | I   | I    | I   | I   |     |     |     |     |
| Cytisus scoparius subsp bourgaei | I   | I    | IV  |     |     |     |     |     |
| Cardamine hirsuta      | I   | I    | IV  |     |     |     |     |     |
| Helichrysum stoechas   | I   | I    | I   | I   |     |     |     |     |
| Srophularia scorodonia | I   | I    | I   | I   |     |     |     |     |
| Origaniun vulgare subsp virens | I   | I    |     | I   |     |     |     |     |
| Cistus albidus         | I   | I    | I   | I   |     |     |     |     |
| Quercus broteroi       | III  |     | II  | I   |     |     |     |     |
| Thymus maestichina     | I   | I    |     |     |     |     |     |     |
| Juniperus oxycedrus subsp badia | I   | I    |     |     |     |     |     |     |
| Teucrium oxylepis subsp marianum | I   | I    |     |     |     |     |     |     |
| Sedum forsterianum     | I   | I    |     | I   |     |     |     |     |
| Narcissus pallidulus   | I   | I    | I   | I   |     |     |     |     |
| Cistus laurifolius     | I   | I    | I   | I   |     |     |     |     |
| Geum sylvaticum        | I   | I    | I   | I   |     |     |     |     |
| Festuca rothmaleri     | I   | I    | I   | I   |     |     |     |     |
| Rubus ulmifolius       | I   | I    | I   | I   |     |     |     |     |
| Rosa pouzini          | I   | I    | I   | I   |     |     |     |     |
| Epipactis helleborine  | I   | I    | I   | I   |     |     |     |     |
| Sorbus torminalis      | I   | I    | I   | I   |     |     |     |     |
| Tulipa sylvestris      | I   | I    | I   | I   |     |     |     |     |
| Dorycnium pentaphyllum | I   | I    | I   | I   |     |     |     |     |
| Aristolochia pistolochia | I  | I    | I   | I   |     |     |     |     |
| Piptatherum milaaceum  | I   | I    | I   | I   |     |     |     |     |
| Helminthotheca comosa  | I   | I    | I   | I   |     |     |     |     |
| Thapsia garganica      | I   | I    | I   | I   |     |     |     |     |
| Leucanthemum syltaticum | I  | I    | I   | I   |     |     |     |     |
| Iberis linifolia       | I   | I    | I   | I   |     |     |     |     |
| Centaurea melitensis   | I   | I    | I   | I   |     |     |     |     |
| Campanula rapunculus   | I   | I    | I   | I   |     |     |     |     |
| Iris planifolia        | I   | I    | I   | I   |     |     |     |     |
| Linum suffraticosum    | I   | I    | I   | I   |     |     |     |     |
| Cistus monspeliensis   | I   | I    | I   | I   |     |     |     |     |
| Sanguisorba verrucosa  | I   | I    | I   | I   |     |     |     |     |
| Plant Name                              | TCp | HEau | ECp | PCp | HEa | DEu | HEu | UEu |
|-----------------------------------------|-----|------|-----|-----|-----|-----|-----|-----|
| Teucrium haenseleri                     | I   | I    |     | I   |     |     | I   |     |
| Osyris alba                             | I   | I    | I   | I   |     |     |     |     |
| Narcissus triandrus                     | I   | I    | I   | I   |     |     |     |     |
| Scirpus holoschoenus                    | I   | I    | I   | I   |     |     |     |     |
| Cytisus multiflorus                     | I   | I    | I   |     |     |     |     |     |
| Festuca elegans                        | I   | I    | I   | I   |     |     |     |     |
| Ranunculus sardous                      | I   | I    | I   | I   |     |     |     |     |
| Klasea integrifolia                    | I   | I    | I   | I   |     |     |     |     |
| Arrhenatherum album                     | I   | I    | I   |     |     |     |     |     |
| Helictotrichia marginata               | I   | I    | I   |     |     |     |     |     |
| Salix atrocinera                       | I   | I    | I   | I   |     |     |     |     |
| Halimium lasianthum                    | III | I    |     | I   |     |     |     |     |
| Xeranthem guttula                      | IV  | I    | I   | I   |     |     |     |     |
| Pteridium aquilinum                    | I   | III  | I   |     |     |     |     |     |
| Urginea maritima                       | IV  | IV   | I   |     |     |     |     |     |
| Sanguisorba hybrida                    | I   |     | I   | I   |     |     |     |     |
| Phillyrea latifolia                    | I   | III  | I   |     |     |     |     |     |
| Asparagus acutifolius                  | III | I    | I   | I   |     |     |     |     |
| Senecio minus                          | I   | II   | I   | I   |     |     |     |     |
| Phlomis purpurea                       | III |     | I   | I   |     |     |     |     |
| Genista polyanthus                     | III | I    | I   | I   |     |     |     |     |
| Smilax mauritianica                    | III | I    | I   | I   |     |     |     |     |
| Euphorbia niaceensis                   | III | I    | I   | I   |     |     |     |     |
| Myrtus communis                        | II  |     | I   |     |     |     |     |     |
| Pistacia lentiscus                     | I   |     | I   |     |     |     |     |     |
| Bupleurum fruticosum                   | I   |     | I   |     |     |     |     |     |
| Genista falcata                         | I   |     | I   |     |     |     |     |     |
| Ruscus aculeatus                       | I   |     | I   |     |     |     |     |     |
| Quercus canariensis                    | I   |     | I   |     |     |     |     |     |
| Digitalis purpurea subsp tomentosa     | I   |     | I   |     |     |     |     |     |
| Saxifraga granulata subsp glaucescens  | I   |     | I   |     |     |     |     |     |
| Asplenium adiantum-nigrum              | I   |     | I   |     |     |     |     |     |
| Selaginella denticulata                 | I   |     | I   |     |     |     |     |     |
| Lunularia cruciata                     | I   |     | I   |     |     |     |     |     |
| Genista triacanthos                    | I   | V    | I   | I   |     |     |     |     |
| Thymelaea villosa                      | V   | I    | I   | I   |     |     |     |     |
| Drosophyllum lusitanicum               |     | I    | I   | I   |     |     |     |     |
| Quercus lusitanica                     | III |     |     | I   |     |     |     |     |
| Teucrium scorodonia                    | IV  |     |     | I   |     |     |     |     |
| Anthericum baeticum                    | III |     |     | I   |     |     |     |     |
| Ornithogalum pyrenaicum                | IV  |     |     | I   |     |     |     |     |
| Silene psammitis                       | IV  |     |     | I   |     |     |     |     |
| Thapsia nitida                         | IV  |     |     | I   |     |     |     |     |
| Cistus paludosus                       | IV  |     |     | I   |     |     |     |     |
| Genista tournfortii                    | IV  |     |     | I   |     |     |     |     |
| Smilax aspera                          | IV  |     |     | I   |     |     |     |     |
| Pterocephalus papposus                 | IV  |     |     | I   |     |     |     |     |
| Halimium halimifolium                  | I   |     |     | I   |     |     |     |     |
| Halimium atriplicifolium               | I   |     |     | I   |     |     |     |     |
| Quercus cocerasa                       | I   |     |     | I   |     |     |     |     |
| Blechnum spicant                       | I   |     |     | I   |     |     |     |     |
| Agrostis castellana                    | I   | II   | II  |     |     |     |     |     |
| Erica australis subsp aragonensis      | V   | I    |     |     |     |     |     |     |
| Polytrichum piliferum                  | III | I    |     |     |     |     |     |     |
| Avenula sulcata                        | III | I    |     |     |     |     |     |     |
| Cladonia furcata                       | I   | I    |     |     |     |     |     |     |
| Jasione montana                        | I   | I    |     |     |     |     |     |     |
| Term                        | TCp | HEau | ECp | PCp | HEa | DEu | HEu | UEu |
|----------------------------|-----|------|-----|-----|-----|-----|-----|-----|
| Luzula lactea              |     |      |     |     | V   |     |     |     |
| Deschampsia flexuosa subsp iberica |     |      |     |     | V   |     |     |     |
| Genista pilosa             |     |      |     |     | III |     |     |     |
| Artostaphylos uva-ursi subsp crassifolia |     |      |     |     | II  |     |     |     |
| Sedum brevifolium          |     |      |     |     |     |     |     |     |
| Helianthemum apenninum     |     |      |     |     |     |     |     |     |
| Lotus corniculatus subsp carpetanus |     |      |     |     |     |     |     |     |
| Vaccinium myrtillus        |     |      |     |     |     |     |     |     |
| Jasione laevis subsp carpetana |     |      |     |     |     |     |     |     |
| Erica cinerea              |     |      |     |     | I   |     |     | I   |
| Cetraria islandica         |     |      |     |     |     |     |     |     |
| Fagus sylvatica            |     |      |     |     |     |     |     |     |
| Nardus stricta             |     |      |     |     |     |     |     |     |
| Hieracium pilosella        |     |      |     |     |     |     |     |     |
| Plantago radicata          |     |      |     |     |     |     |     |     |
| Festuca durandii           |     |      |     |     |     |     |     |     |
| Juniperus nana             |     |      |     |     |     |     |     |     |
| Thymus bracteatus          |     |      |     |     |     |     |     |     |
| Genista hirsuta            |     |      |     |     |     |     |     |     |
| Cytinus hypocistis         |     |      |     |     |     |     |     |     |
| Jasione crispa subsp tomentosa |     |      |     |     | I   |     |     | I   |
| Lavandula pedunculata      |     |      |     |     |     |     |     |     |
| Erica lusitanica           |     |      |     |     |     |     |     |     |
| Asphodelus microcarpus     |     |      |     |     |     |     |     |     |
| Gladiolus illyricus        |     |      |     |     |     |     |     |     |
| Briza máxima               |     |      |     |     |     |     |     |     |
| Tolpis arbata              |     |      |     |     |     |     |     |     |
| Petrorhagia prolifera      |     |      |     |     |     |     |     |     |
| Dactylis hispanica         |     |      |     |     |     |     |     |     |
| Halimium alyssoides        |     |      |     |     |     |     |     |     |
| Cladonia verticillata      |     |      |     |     |     |     |     |     |
| Cladonia mediterranea      |     |      |     |     |     |     |     |     |
| Agrostis setacea           |     |      |     |     |     |     |     |     |
| Ulex minor                 |     |      |     |     |     |     |     |     |
| Genista micrantha          |     |      |     |     |     |     |     |     |
| Agrostis truncatula        |     |      |     |     |     |     |     |     |
| Ulex parviflorus subsp eriocladas |     |      |     |     |     |     |     |     |
| Pterospartum tridentatum   |     |      |     |     |     |     |     |     |
| Festuca ampla              |     |      |     |     |     |     |     |     |

**Syntaxonomical Checklist**

CALLUNO-U LICETEA Br.-Bl. & Tüxen ex Klika & Hadac 1944
ULICETALIA MINORIS Quantin 1935

Ericion umbellatae Br.-Bl., P. Silva, Rozeira & Fontes 1952
Ericenion umbellatae Rivas-Martínez 1979

Halimio ocymoidis-Ericetum umbellatae Rivas Goday 1964
Ulici eriocladi-Ericetum umbellatae Rivas-Martínez 1979
Drosophyllo lusitanicae-Ericetum umbellatae nova

Ericenion aragonensis Rivas-Martínez 1979

Polygalo microphyllae-Cistetum populifolii Rivas Goday 1964
Erico australis-Cistetum populifolii Rivas Goday 1964
Halimio ocymoidis-Ericetum aragonensis Rivas-Martínez 1979
Teucrio mariani-Cistetum populifolii nova
Halimio ocymoidis-Ericetum australis nova
5. Conclusions

This study reveals a set of new associations for scrub dominated by species of the genera *Erica* and *Cistus*. All these communities act as dynamic states of cork oak forests *Quercus suber*, *Q. broteroii*, *Q. pyrenaica*, *Q. mariana* and *Q. canariensis*, of which the forests of *Q. pyrenaica* and *Q. canariensis* are the most fragile, both because they are at the edge of the range and are threatened by climate change. It is therefore essential to protect these forest formations and their dynamic stages, constituted firstly by scrub of *Arbutus unedo* and secondly by heaths of *Erica* sp. and *C. populifolius*. Since all these plant communities are located in sub-humid or humid mountain environments, where a high rate of endemic, rare or threatened species thrive, protection measures must be put in place against fire and excessive livestock pressure. The territory dominated by these shrubs contains a high rate of endemisms, which is why their protection is necessary by subjecting these areas to sustainable development, with control of livestock.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Geographical and bibliographical data of the Teucrio mariani-Cistetum populifolii association.

| Inventories | Localities                        | Coord. X   | Coord. Y | References  |
|-------------|-----------------------------------|------------|----------|-------------|
| TCP1        | Sierra de San Andrés.             | 3050440046 | 4259889  | Cano 1988   |
| TCP2        | Prox. Rio Robledillo              | 3050412374 | 422579   | Cano 1988   |
| TCP3        | Umbría de Niefla                  | 3050380443 | 4266304  | Melendo 1998|
| TCP4        | Umbría de Juan Rodríguez          | 3050486460 | 4254905  | Melendo 1998|
| TCP5        | Prox. Barranco de las Palomas     | 3050440174 | 4259923  | Melendo 1998|
| TCP6        | Monte Rosalejo                    |            |          | Cano 1988   |
| TCP7        | Hontanar de Flores a Quintana     |            |          | Melendo 1998|
| TCP8        | Barranco de Valdecañas (30SUH9227)|          |          | Melendo 1998|
| TCP9        | Brezorrubios (30SUH9226)         |            |          | Melendo 1998|
| TCP10       | Barranco del Valle de En medio (30SUH9128)| |          | Melendo 1998|
| TCP11       | Barranco del Valle de En medio (30SUH9128)| |          | Melendo 1998|
| TCP12       | Prox. Cortijos de Fimia (30SUH9126)| |          | Melendo 1998|
| TCP13       | Barranco de Valdeinfierno (30SUH9428)| |          | Melendo 1998|
| TCP14       | Barranco del Cuervo (30SUH9229)  |            |          | Melendo 1998|
| TCP15       | Barranco de los Gabilanes         | 3050459282 | 4250323  | Melendo 1998|
| TCP16       | Umbría de los Gabilanes           | 3050459360 | 4250242  | Melendo 1998|
| TCP17       | Puerta del Telmo                  | 3050459676 | 4250349  | Melendo 1998|
| TCP18       | Collado de los Jardines           | 3050457259 | 4249203  | Melendo 1998|
Table A2. Geographical and bibliographical data of the *Halimio ocymoidis-Ericetum australis* association.

| Inventories | Localities                        | Coord. X | Coord. Y | References |
|-------------|-----------------------------------|----------|----------|------------|
| HEau1       | Sierra Madrona                    | 30S0405702 | 4250017  |            |
| HEau2       | Valle de Valmayor                 | 30S0394329 | 4250907  |            |
| HEau3       | Cumbres sierra Niefla             | 30S0377945 | 4266753  |            |
| HEau4       | Abulagoso                         | 30S0387149 | 4257635  |            |
| HEau5       | Sierra Navalmanzano               | 30S0392537 | 4254795  |            |
| HEau6       | Sierra Canalizos                  | 30S0362282 | 4297986  |            |
| HEau7       | V. Pilones. Sierra de los Canalizos| 30S0364121 | 4306199  |            |

Table A3. Geographical and bibliographical data of the *Drosophylla lusitanicae-Ericetum umbellatae* association.

| Inventories | Localities                        | Coord. X | Coord. Y | References |
|-------------|-----------------------------------|----------|----------|------------|
| DEu1        | Sierra Madrona                    | 30S0405425 | 4249829  |            |
| DEu2        | Abulagoso                         | 30S0385725 | 4258301  |            |
| DEu3        | Puerto de Madrona                 | 30S0406569 | 4251696  |            |
| DEu4        | Subida desde Puerto Madrona a Cumbres de Madrona | 30S0406107 | 4251824  |            |
| DEu5        | Subida desde Puerto Madrona a Cumbres de Madrona | 30S0406072 | 4251798  |            |
| DEu6        | Subida desde Puerto Madrona a Cumbres de Madrona | 30S0405918 | 4251663  |            |
| DEu7        | Subida desde Puerto Madrona a Cumbres de Madrona | 30S0405731 | 4251616  |            |
| DEu8        | Prox. Cumbres de Madrona          | 30S044993  | 4251508  |            |
| DEu9        | Sierra Canalizos                  | 30S0362282 | 4297986  |            |
| DEu10       | Finca la Tapiada. Sierra Canalizos| 30S0344784 | 4305623  |            |
| DEu11       | Ladera oeste de Sierra Quintana   | 30S0439899 | 4255085  |            |
| DEu12       | Majada del Reloj. Monte Limones   | 30S0439899 | 4255085  |            |
| DEu13       | Hontanar de Flores (Jaén)         | 30S0405702 | 4250017  |            |
| DEu14       | Hontanar de Flores (Jaén)         | 30S0405702 | 4250017  |            |
| DEu15       | Hontanar de Flores a Risquillo    | 30S0405702 | 4250017  |            |
| DEu17       | Subida a Burcio del Pino. Sierra Quintana | 30S0405702 | 4250017  |            |
| DEu18       | Ladera oeste de Sierra Quintana   | 30S0405702 | 4250017  |            |
| DEu19       | Brezorrubios. 30SUH9226           | 30S0394329 | 4250907  |            |
| DEu20       | Brezorrubios. 30SUH9226           | 30S0394329 | 4250907  |            |
| DEu21       | Brezorrubios. 30SUH9226           | 30S0394329 | 4250907  |            |
| DEu22       | Brezorrubios. 30SUH9226           | 30S0394329 | 4250907  |            |

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Table A3. Cont

| Inventories | Locality | Coord. X | Coord. Y | References |
|-------------|----------|----------|----------|------------|
| TCP5        | Prox. Barranco de las Palomas | 30S0440174 | 4259923  |            |
| TCP6        | Monte Rosalejo |                      | Cano 1988 |            |
| TCP7        | Hontanar de Flores a Quintana |                      | Cano 1988 |            |
| TCP8        | Barranco de Valdecañas (30SUH9227) |                      | Melendo 1998 |            |
| TCP9        | Brezorrubios (30SUH9226) |                      | Melendo 1998 |            |
| TCP10       | Barranco del Valle de En medio (30SUH9128) |                      | Melendo 1998 |            |
| TCP11       | Barranco del Valle de En medio (30SUH9128) |                      | Melendo 1998 |            |
| TCP12       | Prox. Cortijos de Fimia (30SUH9126) |                      | Melendo 1998 |            |
| TCP13       | Barranco de Valdeinfriero (30SUH9428) |                      | Melendo 1998 |            |
| TCP14       | Barranco del Cuervo (30SUH9229) |                      | Melendo 1998 |            |
| TCP15       | Barranco de los Gabilanes | 30S0459282 | 4250323  |            |
| TCP16       | Umbría de los Gabilanes | 30S0459360 | 4250242  |            |
| TCP17       | Puerta del Telmo | 30S0459676 | 4250349  |            |
| TCP18       | Collado de los Jardines | 30S0457259 | 4249203  |            |

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