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A survey of the orophilous shrubby vegetation of the Teide (Tenerife, Canary Islands)

With 4 Figures and 7 Tables

Summary

A survey about the orophilous shrubby vegetation of the Teide volcano (Tenerife) is provided, based on literature and unpublished data. The investigated communities are dominated by broom-shaped nanophanerophytes, chamaephytes and hemicryptophytes, well adapted to the climatic continentality characterizing their growing-sites, due to the localization above the cloud layer. From the syntaxonomical point of view, in this paper is proposed to refer this vegetation to the class Cytiso-Pinetea canariensis RIVAS GODAY & ESTEVE ex SUNDING 1972, to the order Spartocytisetalia supranubii SCHÖNFELDER & VOGGENREITER 1994 and to three alliances: Spartocytision supranubii OBERD. ex ESTEVE 1973, grouping the broom-shrublands occurring on relatively developed andosoils; **Juniperion cedri** all. nova, regarding the juniper communities colonizing steep rocky slopes; **Violion cheiranthifoliae** all. nova, grouping the hemicryptophytic communities of screes and unstable substrata. To support the syntaxonomic proposal, a multivariate numerical analysis, considering literature and personal data, has been performed. Moreover, considerations on the role that bioclimate plays on these plant-communities are given too.

Zusammenfassung

Die orophytische Buschvegetation auf dem Teide (Teneriffa, Kanarische Inseln)

Wir geben einen Überblick der orophytischen Buschvegetation des Vulkans Teide (Teneriffa), auf der Basis von Literatur und unveröffentlichten Daten. In den untersuchten Pflanzengesellschaften dominieren besenförmige Nanophanerophyten, Chamaephyten und Hemikryptophyten, die dank ihrer Lage oberhalb der Wolken gut an das kontinentale Klima ihrer Heimat angepasst sind. Vom syntaxonomischen Standpunkt aus betrachtet schlagen wir vor, diese Vegetation der Klasse Cytiso-Pinetea canariensis RIVAS GODAY & ESTEVE ex SUNDING 1972, der Ordnung Spartocytisetalia supranubii SCHÖNFELDER & VOGGENREITER 1994 und drei Verbänden zuzuordnen (Spartocytision supranubii OBERD. ex ESTEVE 1973, die die besenförmige Buschvegetation auf relativ gut entwickelten Andosols umfassen; **Juniperion cedri** all. nova für die Wacholdergesellschaften, die steile, felsige Abhänge kolonisieren; **Violion cheiranthifoliae** all. nova, welches die hemikryptophytischen Gesellschaften auf steilen Schutthängen und instabilem Untergrund einschließt). Zur Unterstützung dieses syntaxonomischen Vorschlags haben wir eine multivariate numerische Analyse auf der Grundlage von veröffentlichten und unveröffentlichten Daten durchgeführt. Wir diskutieren weiterhin den Einfluss des Bioklimas auf diese Pflanzengesellschaften.

1 Introduction

Aiming at surveying the orophilous vegetation occurring on Teide volcano in Tenerife, island of the Canarian archipelago, a syntaxonomical overview has been carried out, based on both literature and personal unpublished data. This extremely interesting vegetation, characterized by a high percentage of endemics, raised the attention of many authors. Among the main contributors, OBERDORFER (1965), ESTEVE CHUECA (1969, 1973a, 1973b), VOGGENREI-

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TER (1974, 1975), DEL ARCO & WILDPRET (1983), RIVAS-MARTÍNEZ et al. (1993), POTT et al. (2003), SCHÖNFELDER & VOGGENREITER (1994) must be mentioned. The first of them proposed a provisional alliance, Spartocytision supranubii, including the Spartocytisus supranubium Ges., two relevés of which were provided. Then, ESTEVE CHUECA (1973a) validated the Oberdorfer's alliance, that was included into the Cytiso-Pinetalia canariensis order of Cytiso-Pinetea canariensis, and described the association Spatocytisetum nubigeni, splitted in three subassociation: a typical one, corresponding to the relevé no. 33 published by OBERDORFER (1965), a rupicolous one, named aeonietosum and a subnitrophilous one, named sisymbrietosum and corresponding to the relevé no. no. 100 published by OBERDORFER (1965). Afterwards, VOGGENREITER (1975), in order to better characterize the succession of altitudinal belts observed along the South-Western slope of the Teide volcano, suggested to include the Canarian orophilous communities in two new classes, independent from the pine-woods of the above-mentioned class Cytiso-Pinetea canariensis. He proposed, as nomina nuda, the Spartiocytisetea nubigeni and the Violetea cheiranthifoliae, grouping respectively the broom-dominated vegetation of the subalpine belt and the hemicryptochamaephytic one of the alpine belt. In addition, within the class Cytiso-Pinetea canariensis, a new association, Junipero cedri-Pinetum canariensis was proposed by the same author. DEL ARCO & WILDPRET (1983) described a very localized association in the Spartocytision nubigeni, named Telinetum spachianae and linked to the steep stony slopes of the Caldera de Pedro Gil. More recently, RIVAS-MARTÍNEZ et al. (1993), reconsidered the already mentioned Spartocytisetum nubigeni and described two new associations: the Erysimo scoparii-Pterocephaletum lasiospermi and the Violetum cheiranthifoliae, all ascribed to the Spartocytision nubigeni and framed into the Cytiso-Pinetea canariensis. This syntaxonomical treatment is followed by POTT et al. (2003). Finally, SCHÖNFELDER & VOGGENREITER (1994), proposed for the Canarian orophilous shrublands a new class, named Spartiocytisetea supranubii, characterized by an own order and alliance, to which the Spartocytisetum nubigeni, with some subassociations, the Echietum auberiani and a Spartocytisus supranubius-Descurainia bourgeauana Ges. were ascribed.

In the attempt to clarify the tangled syntaxonomical treatment of this vegetation, field investigations have been extensively carried out in the Cañadas and Pico del Teide. To support the syntaxonomic proposal, a numerical analysis based on literature and personal relevés, has been performed.

2 Material and methods

This survey is based on 90 phytosociological relevés from literature and 49 unpublished ones, taken in June 1991. Size and location of the sampled areas have been determined by estimating the optimal homogeneity of the vegetation according to the Braun-Blanquet method (BRAUN-BLANQUET 1964). In the numerical analysis, a 50 relevés × 38 species matrix was processed using the package Syntax 5.0 (PODANI 1995). The relevés choosen for data processing were those characterized by highest floristic richness. In order to essay the floristic autonomy of the Teide orophilous dwarf shrublands, 12 relevés from Sideritido solutae-Pinetum canariensis published by RIVAS-MARTINEZ et al. (1993, Table 19A, relevé no. 8, 13, 16; Table 19B, relevé no. 26, 30, 32) and by SCHÖNFELDER & VOGGENREITER (1995, Table 2, relevé no. 109, 135, 139, 150, 152, 156) have been used as out-group. The species set in the processed table amounted to 38 units, since only those indicated from literature as characteristic of syntaxa have been included in the numerical analysis. As a matter of fact, all the other species in the processed relevés had low importance, owing to their scarce frequency and abundance. To evaluate the similarity among the relevés, the Euclidean Square Distance was adopted, basing on cover values sampled by means of the Braun-Blanquet's scale and transformed into the ordinal scale proposed by van der Maarel (VAN DER MAAREL 1979; NOEST et al. 1989). To obtain a hierarchical classification of relevés, complete linkage was used as agglomeration criterion.

For the bioclimatic classification, the Rivas-Martínez' approach is followed. It must be noted, however, that this author proposed different names for the Canarian bioclimatic belts: after postulating the existence of a Canarian bioclimate (RIVAS-MARTÍNEZ 1987, 1990), in recent times (RIVAS-MARTÍNEZ 2004a, 2004b; RIVAS-MARTÍNEZ et al. 1993, 2004), he preferred to ascribe it in the Mediterranean one. POTT et al. (2003) esteem better to keep the Canarian bioclimate, due to the noticeable

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differences of the Canarian climatophilous vegetation, that is closer to that of S Morocco and Tropical Africa rather than to the Mediterranean one. Without going to the hearth of this matter, the most recent proposal of RIVAS-MARTÍNEZ et al. (2004) is adopted here.

The floristic nomenclature follows SCHÖNFELDER et al. (1993).

3 Results

The climatic conditions imposed by the harsh environment of the supra- and oro-mediterranean belt selected on highly specialized flora, made of few species well adapted to the remarkable drought and wide temperature ranging of these sites. On Teidean heights, these species show a good ecological plasticity, even increased by the faint or absent inter-specific competition and by the already mentioned low number of species. For this reason, in the surveyed area there is a pool of hemicryptophytes, chamaephytes and phanerophytes that usually grow mixed together giving rise, depending on the prevailing life-forms, to pine-woods,

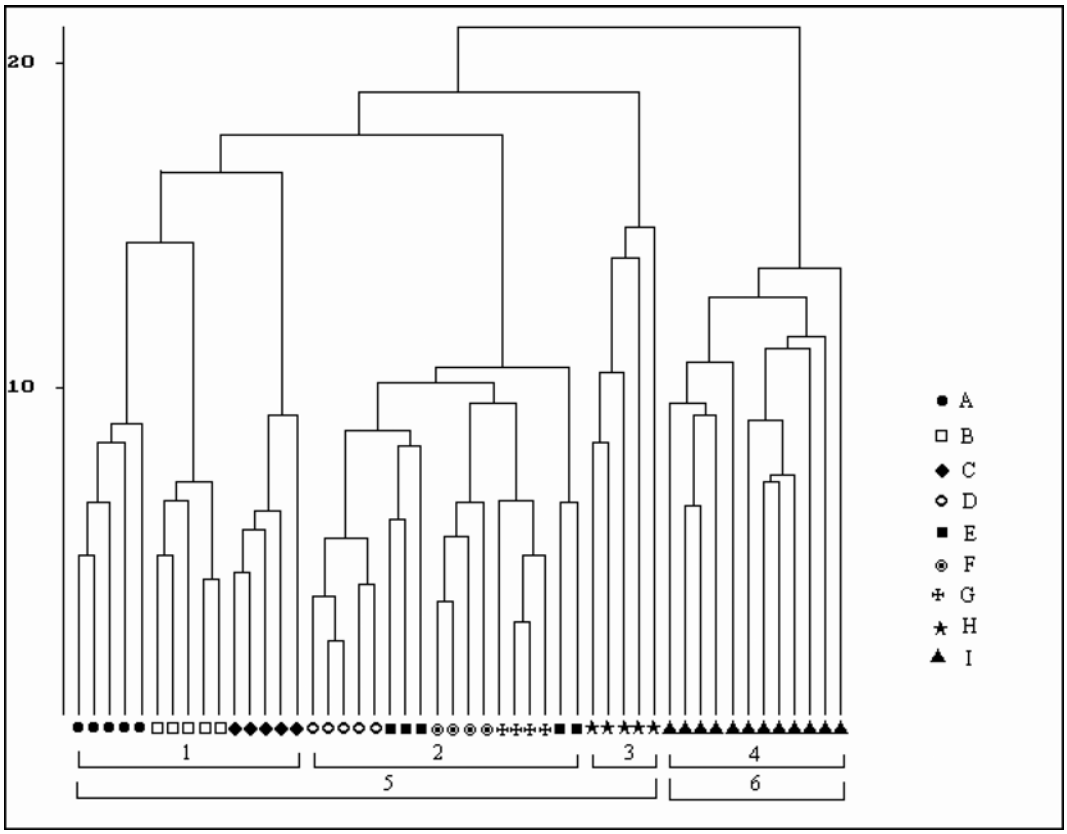

Fig. 1
Dendrogram of the surveyed associations
A — Spartocytisetum supranubii; B — Descurainio bourgaeanae-Spartocytisetum supranubii; C — Erysimo scoparii-Pterocephaletum lasiospermi; D — Echietum auberiani; E — Violetum cheiranthifoliae argyranthemetosum tenerifae; F — Violetum cheiranthifoliae silenetosum nocteolentis; G — Violetum cheiranthifoliae erigerontetosum cabrerae; H — Junipero cedri-Pinetum canariensis; I — Sideritido solutae-Pinetum canariensis
1 — Spartocytision nubigeni; 2 — Violion cheiranthifoliae; 3 — Juniperion cedri; 4 — Cisto-Pinion canariensis; 5 — Spartocytisetalia supranubii; 6 — Cytiso-Pinetalia canariensis

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broom-shrublands or hemicryptophytic communities. Therefore, in the present contribution is shared the same opinion of ESTEVE CHUECA (1973a) and RIVAS-MARTÍNEZ et al. (1993), that is to include all the above-mentioned communities into the class Cytiso-Pinetea canariensis, distinguishing then the structures at lower syntaxonomical levels. The examination of the bioclimatic, ecological and structural differences among the surveyed communities led to separate two orders, the Cytiso-Pinetalia canariensis, to which pine-woods chiefly linked to the mesomediterranean belt are ascribed, and the Spartocytisetalia supranubii, grouping all the aspects surveyed in the present study, linked to the supra- and oromediterranean belts. Within this order, six distinctive associations have been recognized, shared out in three alliances: a first one, Spartocytision supranubii, grouping the broom-shrublands occurring on relatively developed andosoils, a second one, Juniperion cedri, including the juniper communities colonizing steep rocky slopes, and a third one, Violion cheiranthifoliae, gathering the hemicrypto-chamaephytic communities of screes and unstable substrata.

The proposal is supported by the results of the numerical analysis. Among the considered relevés, the relative autonomy of the order Spartocytisetalia supranubii with respect to the order Cytiso-Pinetalia canariensis is well shown in Fig. 1 (clusters 5 and 6, respectively). Within the Cluster 5, one can furtherly recognize three subclusters, corresponding to the above mentioned alliances: clusters 1-2-3 are grouping relevés belonging, respectively, to

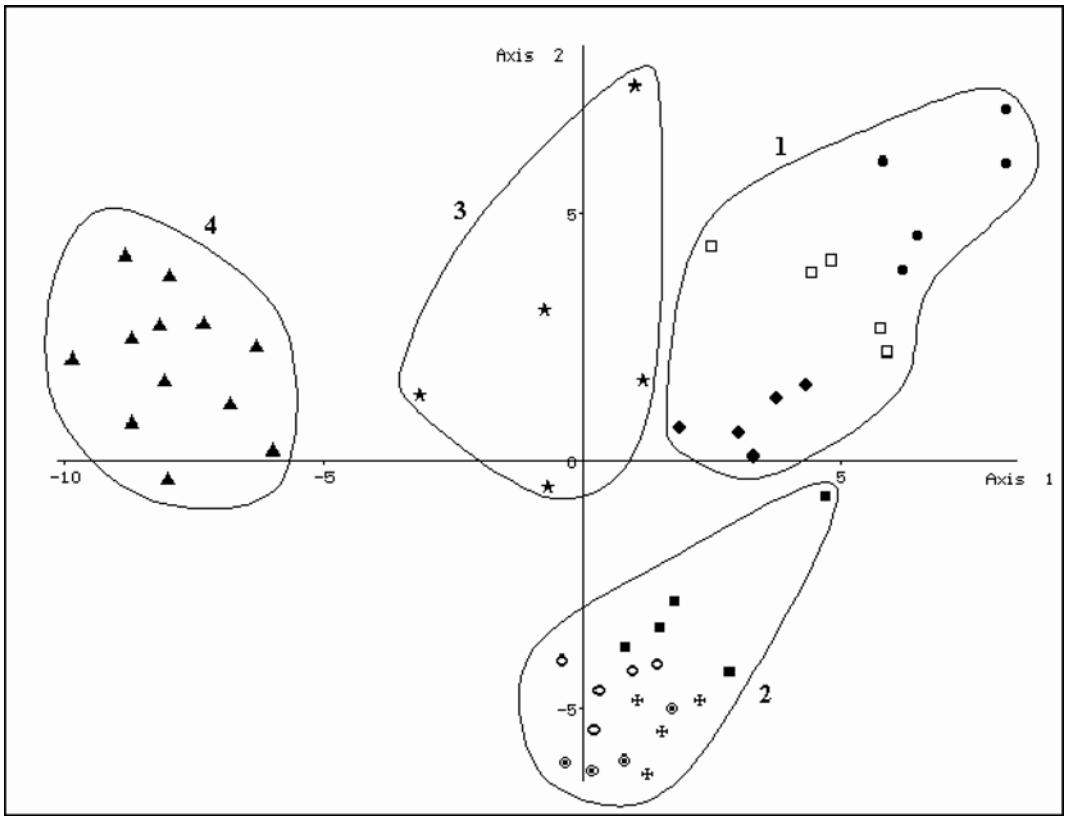

Fig. 2
PCA according to the first two axes
1 — Spartocytision nubigeni; 2 — Violion cheiranthifoliae; 3 — Juniperion cedri; 4 — Cisto-Pinion canariensis

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Spartocytision supranubii, Violion cheiranthifoliae and Juniperion cedri. The relative variance within the communities is well expressed in the PCA (Fig. 2), the first two axes of which are collecting the 80% of the total variance. In the scatter diagram, the sparse distribution of the objects is resulting from the floristic pools of the surveyed plant communities, which are differentiated more by the prevalence than by the occurrence of species, i.e. they have many species in common, but the dominance is achieved, in each case, by different species taken up by the ecological fitness. The overall distribution of the processed relevés reflects, anyway, what can be observed in the dendrogram in Fig. 1.

In the following scheme, the valid name and synonyms of each syntaxon are reported, as well as some notes on ecological, structural and floristic features.

4 Syntaxonomical scheme

Cytiso-Pinetea canariensis RIVAS GODAY & ESTEVE ex SUNDING 1972

Vid. Akad. Oslo I. Mat.-Nat. Kl, n.s., 29: 121 [Cytiso-Pinetea canariensis RIVAS GODAY & ESTEVE 1965, Anal. Inst. Bot. Cavanilles 22: 230, nom. nud. (art. 2b); Cytiso-Pinetea canariensis RIVAS GODAY & ESTEVE in ESTEVE 1969, Bol. Real. Soc. Esp. Hist. Nat. Biol. 67: 86, nom. dub. (art. 37, 38); Cytiso-Pinetea canariensis RIVAS GODAY & ESTEVE ex ESTEVE 1973, Trab. Dep. Bot. Univ. Granada 2(1): 4, nom. illeg. (art. 22); Spartocytisetea nubigeni VOGGENREITER 1974, Diss. Bot. 26: 164, nom. inval. (art. 2b, 3b); Spartocytisetea nubigeni VOGGENREITER 1975, Monogr. Biol. Canar. 6: 12, nom. nud. (art. 2b); Violetea cheiranthifoliae VOGGENREITER 1975, Monogr. Biol. Canar. 6: 11, nom. nud. (art. 2b); Spartocytisetea supranubii SCHÖNFELDER & VOGGENREITER 1994, Phytocoenologia 24: 481, nom. illeg. (art. 22)].

Holotypus: Cytiso-Pinetalia canariensis RIVAS GODAY & ESTEVE ex SUNDING 1972.

Characteristic species: *Pinus canariensis, Tolpis webbii, Descurainia gonzalezii, Adenocarpus viscosus, Pterocephalus lasiospermus, Andryala teydensis, Plantago webbii, Carlina xeranthemoides, Bistropogon origanifolius, Polycarpea tenuis, Cytisus prolifer.*

Ecology: This class comprises the pinewoods, the broom-shaped shrubs and the perennial communities both suffruticose and herbaceous occurring in the dry meso-, supra- and oro-mediterranean belt. The area covered by this vegetation is located above the cloud layer caused by trade-winds and characterized by a remarkable continentality (HÖLLERMANN 1978). The relative humidity keep less than 30% for 10–11 months/year with extreme daily temperature ranges (HÖLLERMANN 1978). This class is exclusive of the Canarian Islands and only occurs in the highest mountains, in Tenerife, La Palma and Gran Canaria (SANTOS GUERRA 1983; RIVAS-MARTÍNEZ et al. 1993; DEL ARCO et al. 1999; POTT et al. 2003).

Spartocytisetalia supranubii SCHÖNFELDER & VOGGENREITER 1994

Phytocoenologia 24: 481.

Holotypus: Spartocytision nubigeni OBERD. ex ESTEVE 1973.

Characteristic species: *Spartocytisus supranubius, Nepeta teydea, Erysimum scoparium, Scrophularia glabrata, Argyranthemum tenerifae, Arrhenatherum caldera, Pimpinella cumbrae, Micromeria lachnophylla, Sideritis eriocephala.*

Ecology: This order is well expressed in the supra- and oro-mediterranean belt, having a mesophytic dry ombrotype and only marginally penetrates into the meso-mediterranean belt. It comprises pioneer communities characterized by broom-shaped nanophanerophytes, chamaephytes and hemicryptophytes, which are well represented in Tenerife and also sporadically distributed in La Palma.

Spartocytision supranubii OBERD. ex ESTEVE 1973

Trab. Dep. Bot. Univ. Granada 2(1): 4 corr. [Spartocytision supranubii OBERD. 1965, Beitr. Naturkdl. Forsch. SW-Deutschl. 24(1): 99, nom. inval. (art. 3b); Spartocytision nubigeni ESTEVE 1969, Bol. Real. Soc. Esp. Hist. Nat. Biol. 67: 80, nom. inval. (art. 3b); Spartocytision nubigeni ESTEVE 1973, Trab. Dep. Bot. Univ. Granada 2(1): 4, nom. mut. (art. 45); Spartocytision teydeanum VOGGENREITER 1975, Monogr. Biol. Canar. 6: 25, nom. nud. (art. 2b); Echio wildpretii-Spartocytision VOGGENREITER 1975, Monogr. Biol. Canar. 6: 25, nom. nud. (art. 2b)].

Holotypus: Spartocytisetum nubigeni OBERD. ex ESTEVE (1973).

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Table 1
Spartocytisetum supranubii Oberd. ex Esteve 1973

Rel. number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Altitude (m × 10 a.s.l.)	210	210	230	240	220	215	225	225	230	240	217	220	224	225	233	219
Surface (sq meters)	20	25	10	15	20	20	25	20	10	20	20	10	20	10	20	40
Coverage (%)	60	70	70	90	90	60	70	60	30	30	-	-	-	50	30	35
Sloping (°)	30	40	40	25	45	30	30	30	40	35	-	30	-	25	8	10
Exposure	W	W	W	SW	SW	W	S	SW	SW	W	NW	W	-	S	SE	E
Char. association																
Nepeta teydea	2	3	3	2	2	1	2	3	2	2	1	2	2	1	2	1
Arrhenatherum calderae	2	3	2	3	2	2	1	+	1	2	2	1	2	1	+	1
Pimpinella cumbrae	2	1	1	1	1	1	2	.	1	1	1	.	.	+	.	+
Erigeron cabrerae	+	.	+	+	.	1	.	+	.	.	.	.	.	.	.	.
Char. Spartocytision supranubii and Spartocytisetalia supranubii																
Spartocytisus supranubius	3	2	3	2	3	3	2	2	1	2	3	5	3	+	+	2
Erysimum scoparium	2	3	2	3	2	2	1	1	1	+	+	2	+	2	1	.
Scrophularia glabrata	1	2	1	2	2	1	2	.	1	1	1	1	.	.	.	1
Argyranthemum teneriffae	+	+	2	1	1	+	1	+	1	1	+	+	1	.	.	.
Echium wildpretii	1	1	2	3	3	1	1	.	.	.	1	1	.	1	1	1
Descurainia bourgeauana	+	+	+	.	.	.	.	.	+	.	.	.	2	.	+	.
Micromeria lachnophylla	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.
Sideritis eriocephala	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Cheirolophus teydis	+	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Juniperus cedrus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stemmacantha cynaroides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Senecio palmensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Char. Cytiso-Pinetea canariensis																
Tolpis webbii	2	1	2	2	1	2	+	+	+	+	2	1	1	2	2	1
Pterocephalus lasiospermus	2	2	1	1	2	2	2	2	+	1	3	+	.	+	+	2
Adenocarpus viscosus	.	+	1	1	1	.	1	+	.	.	1	.	1	1	2	.
Andryala pinnatifida ssp. *teydensis*	.	+	+	.	.	.	.	+	.	.	1	.	+	.	+	.
Plantago webbii	.	.	+	1	.	.	2	.	+	.	.	.	.	3	.	1
Carlina xeranthemoides	.	.	.	.	1	+	+	.	.	.	.	.	.	.	.	.
Bystropogon origanifolius	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.
Cytisus prolifer	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sideritis oroteneriffae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Descurainia gonzalezii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Other species																
Bromus tectorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Melica canariensis	.	1	1	2	1	+	.	1	+	.	.	.	.	.	.	.
Bituminaria bituminosa	.	.	.	+	1	.	+	.	.	.	.	.	.	.	.	.
Polycarpaea tenuis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vulpia myuros	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Piptatherum coerulescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cheilanthes pulchella	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ferula linkii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhamnus integrifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Place and date of the relevés: rel. 1–10, Cañada del Teide, 2.6.1991 (unpubl.); rel. 11–13, Rivas-Martinez et al. (1993), 40, 41; 30–37, Esteve Chueca (1973), tab. 1 rel. 1–4, 6–8, 15; rel. 38, Schönfelder & Voggenreiter (1994), tab. 1 rel. 21.

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17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
208	219	216	207	220	233	220	227	233	243	207	222	232	230	230	235	210	210	207	210	215	203
20	20	20	20	20	40	10	20	40	20	20	40	40	200	200	200	200	200	200	200	200	15
30	40	25	30	35	40	50	30	30	60	60	70	70	25	25	40	40	70	70	50	40	30
35	20	15	15	20	20	35	35	5	30	25	15	7	20	10	-	20	20	70	40	30	30
W	NW	NW	N	NW	S	NW	SW	E	SE	NE	N	SE	S	SW	S	W	W	W	S	N	SW
1	+	1	2	1	1	2	1	1	1	2	2	2	+	3	3	2	3	2	1	1	2
2	2	2	2	2	1	1	+	+	2	2	1	.	.	.	.	.	.	.	.	.	.
1	.	.	2	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.
+	1	1	+	2	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
2	3	2	3	2	1	3	2	2	2	3	4	3	1	4	4	4	5	4	4	4	+
2	2	.	1	1	+	2	+	1	2	2	1	2	1	.	.	.	.	3	+	+	+
2	1	+	1	1	+	1	+	1	.	.	1	.	+	.	1	2	2	2	+	+	2
1	1	1	.	1	1	1	1	.	.	.	.	.	.	.	+	.	.	1	1	.	2
2	2	1	1	1	+	.	.	.	.	.	.	.	.	.	.	.	.	3	3	.	2
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.	.	+	.	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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1	1	2	1	2	2	1	2	1	1	+	.	2	.	3	2	1	1	+	1	+	+
+	2	1	1	2	+	+	2	1	.	+	2	2	2	2	.	+	.	1	1	+	2
.	.	.	.	+	2	.	.	.	2	1	1	2	+	.	+	3	4	.	4	3	+
.	.	1	.	+	+	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	+
.	.	.	.	+	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.
.	.	.	.	+	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.
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tab. 21, rel. 9, 10, 12; rel. 14–29, Schönfelder & Voggenreiter (1994), tab. 1 rel. 4, 6, 7, 9–11, 13–15, 17, 18, 20, 34, 38,

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Table 2
Descurainio bourgeauanae-Spartocytisetum supranubii Brullo & De Marco ass. nova

Rel. number	1	2	3	4	5	6	7	8	9	10	11	12	13
Altitude (m × 10 a.s.l.)	200	210	200	205	200	220	310	305	-	-	204	205	210
Surface (sq meters)	15	10	10	20	15	10	10	10	10	10	10	10	10
Coverage (%)	90	70	90	80	80	70	-	-	-	-	-	-	-
Sloping (°)	-	-	15	10	10	-	-	-	-	-	-	-	-
Exposure	-	-	E	S	SW	-	-	-	-	-	E	-	-
Char. association													
Descurainia bourgeauana	2	3	2	3	3	2	1	+	2	2	2	3	3
Char. Spartocytision supranubii and Spartocytisetalia supranubii													
Spartocytisus supranubius	4	3	3	3	2	3	2	4	4	3	3	4	4
Scrophularia glabrata	1	1	+	+	1	+	.	.	+	.	1	1	1
Erysimum scoparium	.	1	+	1	2	1	.	.	.	+	1	2	+
Argyranthemum teneriffae	+	+	1	.	.	+	+	.	.	.	.	.	+
Nepeta teydea	.	.	.	.	.	.	.	.	.	.	.	.	.
Arrhenatherum calderae	.	.	.	.	+	.	.	.	.	.	.	.	+
Echium wildpretii	.	.	.	.	+	+	.	.	.	+	.	.	.
Micromeria lachnophylla	.	.	.	.	.	.	.	.	.	.	.	.	.
Pimpinella cumbrae	.	.	.	.	.	.	.	.	.	.	.	.	.
Sideritis eriocephala	.	.	.	.	.	1	.	.	.	.	.	.	.
Erigeron cabrerae	.	.	.	.	.	.	.	.	.	.	.	.	.
Cheirolophus teydis	.	.	.	+	.	.	.	.	.	.	.	.	.
Bencomia exstipulata	.	.	.	+	.	.	.	.	.	.	.	.	.
Char. Cytiso-Pinetea canariensis													
Pterocephalus lasiospermus	2	2	3	2	3	3	.	.	.	.	2	2	2
Adenocarpus viscosus	2	1	2	1	1	.	.	.	+	2	3	+	+
Tolpis webbii	.	.	+	+	.	.	.	.	.	.	+	.	.
Andryala pinnatifida ssp. *teydensis*	.	.	.	+	.	.	.	.	.	.	.	.	.
Pinus canariensis	1	.	.	.	.	.	.	.	.	.	.	.	.
Carlina xeranthemoides	.	.	.	.	+	.	.	.	.	.	.	.	.
Cytisus prolifer	.	.	.	.	.	.	.	.	.	.	.	.	.
Descurainia gonzalezii	.	.	.	.	.	.	.	.	.	.	.	.	.
Plantago webbii	.	.	.	.	.	.	.	.	.	.	.	.	.
Lotus campylocladus	.	.	.	.	.	.	.	.	.	.	.	.	.
Other species													
Bromus tectorum	.	.	.	.	.	.	.	.	.	.	.	.	.
Ferula linkii	.	.	.	.	.	.	.	.	.	.	.	.	.
Polycarpaea tenuis	.	.	.	.	.	.	.	.	.	.	.	.	.
Piptatherum coerulescens	.	.	.	.	.	.	.	.	.	.	.	.	.
Wahlembergia lobeliodes	.	.	.	.	.	.	.	.	.	.	.	.	.

Place and date of the relevés: rel. 1–6, Cañada del Teide, 2.6.1991 (unpubl.); rel. 7–14, Rivas-Martinez et al. (1993), rel. 21–34, Schönfelder & Voggenreiter (1994), tab. 1 rel. 52, 54, 55, 57–59, 62–69.

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14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
238	200	235	225	230	230	224	230	230	195	219	215	207	218	206	221	214	230	233	213	202
10	100	200	200	200	200	200	30	40	40	40	40	10	40	40	40	40	40	40	40	40
-	20	90	70	80	60	70	60	60	50	40	50	30	45	30	20	70	70	60	40	70
-	-	-	20	-	-	45	10	10	15	5	10	5	15	15	-	15	15	15	10	20
-	-	S	N	SE	S	S	NE	E	NW	SE	SE	NE	N	N	-	N	W	W	N	W
1	2	3	1	+	1	+	1	1	2	2	3	2	2	2	2	2	2	3	3	3
3	1	5	4	4	3	3	3	2	2	2	1	1	3	2	2	4	4	3	2	4
.	+	+	3	1	.	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.
1	1	.	1	+	.	.	2	1	2	1	1	.	.	.	.	.	.	.	.	.
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tab. 21 rel.1-4,6-8,12; rel.15, Oberdorfer (1965), tab.17 rel.100; rel.16-20, Esteve Chueca (1973), tab.1 rel.14, 16-19;

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Characteristic species: *Bufonia tenerifae, Echium wildpretii, Descurainia bourgaeana, Dactylis metlesicsii, Bencomia exstipulata*.

Ecology: this alliance is linked to the mesophytic dry supra-mediterranean belt and comprises the shrub communities rich in nanophanrerophytes and chamaephytes on andosoils often well structured. It is exclusive of Tenerife.

RIVAS-MARTÍNEZ

A1) Spartocytisetum supranubii OBERD. ex ESTEVE 1973

Trab. Dep. Bot. Univ. Granada 2(1): 4, corr. [Spartocytisus supranubius GESELL OBERD. 1965, Beitr. Naturkdl. Forsch. SW-Deutschl. 24(1):99, nom. inval. (art. 3c), p.p; Spartocytisetum nubigeni OBERD. ex ESTEVE 1973, Trab. Dep. Bot. Univ. Granada 2(1): 4 nom. mut. (art. 45); Spartocytisetum nubigeni RIVAS-MARTÍNEZ et al. 1993, Itinera Geobot. 7: 240, non ESTEVE 1973, p.p.]

Lectotypus: Table 1, relevé no. 2, ESTEVE (1973), hoc loco.

Characteristic species: *Nepeta teydea, Arrhenatherum calderae, Pimpinella cumbra, Bufonia tenerifae*.

Structure and ecology: shrubby climatophilous association, characterized, in its optimal aspect, by the dominance of *Spartocytisus supranubius*, which usually grows with *Nepeta teydea*, *Arrhenatherum calderae*, *Pimpinella cumbra*, *Bufonia tenerifae* and *Echium wildpretii*. The association is localized in the dry mesophytic supra-mediterranean belt, where it colonizes hardly-sloping sites bearing outcrops-

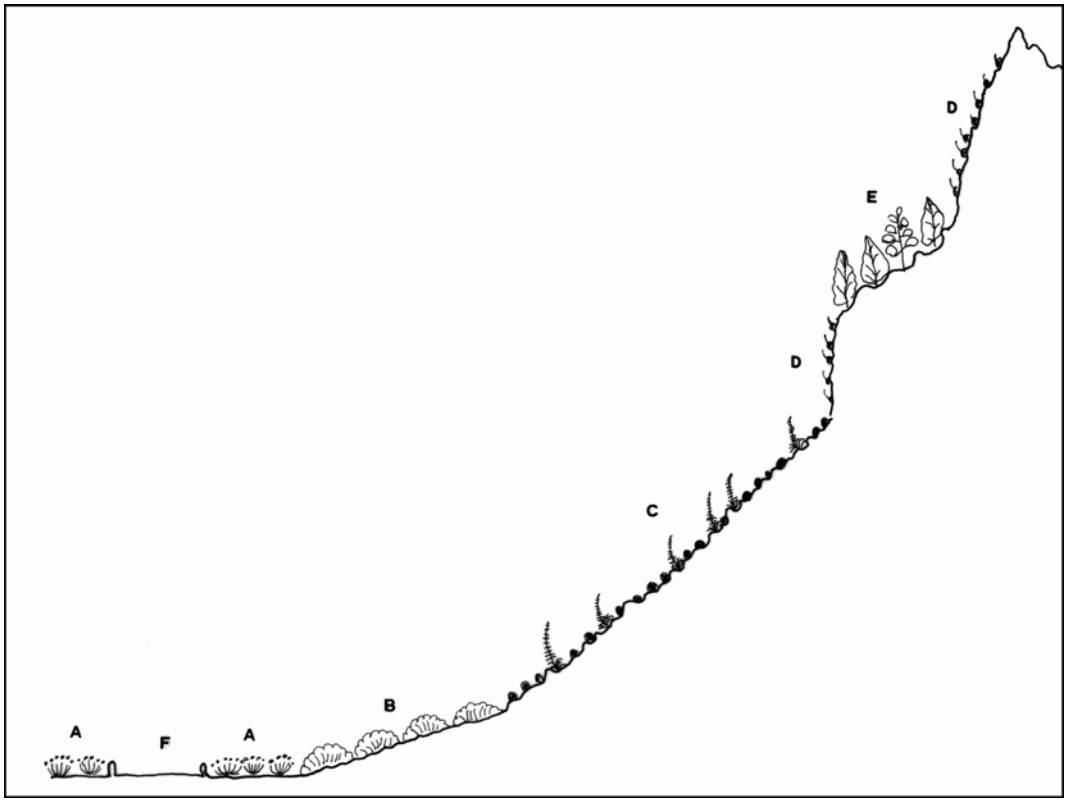

Fig. 3
Vegetation transect in "Las Cañadas", near "Roque del Cedro"
A — Erysimo scoparii-Pterocephaletum lasiospermi; B — Descurainio bourgaeanae -Spartocytisetum supranubii; C — Spartocytisetum supranubii; D — Cheilantho guanchicae-Aeonietum smithii; E — Junipero cedri-Pinetum canariensis; F — road

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of rocks and blocks, with stabilized, more or less structured ranker-type soils. On shaked soils of ravines a more pioneer variant with *Echium wildpretii* of this association is frequent (Fig. 3).

A2) Descurainio bourgaeanae-Spartocytisetum supranubii BRULLO & DE MARCO, ass. nova

[Spartocytisetum nubigeni sisymbrietosum ESTEVE 1973, Trab. Dep. Bot. Univ. Granada 2(1): 5; Spartocytisetum nubigeni RIVAS-MARTÍNEZ et al. 1993, Itinera Geobot. 7: 240, non ESTEVE 1973, p.p.; *Spartocytisus supranubius-Descurainia bourgaeana* Ges. SCHÖNFELDER & VOGGENREITER 1994, Phytocoenologia 24: 470.]

Holotypus: Table 1, relevé no. 14, ESTEVE (1973), hoc loco.

Characteristic species: *Descurainia bourgaeana*.

Structure and ecology: This association replaces the Spartocytisetum supranubii on flat or slightly sloping sites, characterized by more compact and developed soils, with minute skeleton (Fig. 3). This vegetation is clearly more mature than the previous one, as confirmed by the high cover values reached by *Spartocytisus supranubius*, which in this context is always associated to *Descurainia bourgaeana*, showing a fairly high cover values in disturbed environments. Within the association, the remarkably pioneer species characterizing the previous one are rare or absent.

A3) Erysimo scoparii-Pterocephaletum lasiospermi RIVAS-MARTÍNEZ et al. 1993

Itinera Geobot. 7: 241 [*Spartocytisus supranubius* Ges. OBERD. 1965, Beitr. Naturkdl. Forsch. SW-Deutschl. 24(1): 99, nom. inval. (art. 3c), p.p.].

Table 3
Erysimo scoparii-Pterocephaletum lasiospermi Rivas-Martínez et al. 1993

Rel. number	1	2	3	4	5	6	7	8	9	10	11	12
Altitude (m × 10 a.s.l.)	170	180	200	220	200	164	220	177	238	230	216	215
Surface (sq meters)	10	10	15	10	10	5	5	10	30	20	40	100
Coverage (%)	50	60	60	50	60	-	-	-	-	-	60	10
Sloping (°)	-	-	10	5	-	10	30	10	30	20	-	10
Exposure	-	-	W	W	-	N	W	W	E	S	-	W
Char. association												
Pterocephalus lasiospermus	3	3	4	3	4	4	3	5	2	2	3	2
Char. Spartocytision supranubii and Spartocytisetalia supranubii												
Erysimum scoparium	2	1	2	2	+	1	1	3	+	1	.	1
Scrophularia glabrata	+	+	+	+	.	+	1	.	.	1	.	+
Argyranthemum teneriffae	1	1	+	.	1	.	.	1	1	+	.	.
Nepeta teydea	+	.	+	+	.	.	.	+	.	.	.	+
Spartocytisus supranubius	.	1	1	.	1	.	.	.	.	+	.	1
Descurainia bourgeauana	1	2	+	.	1	.	.	.	.	.	.	.
Juniperus cedrus	.	.	.	.	.	.	1	.	.	.	.	.
Pimpinella cumbrae	.	.	.	.	.	.	1	.	.	.	.	.
Char. Cytiso-Pinetea canariensis												
Adenocarpus viscosus	.	1	.	1	.	.	.	.	+	1	3	+
Carlina xeranthemoides	.	.	.	.	.	.	+	+	.	.	.	.
Tolpis webbii	.	.	+	.	.	.	+	.	.	.	.	.
Bystropogon origanifolius	.	.	.	.	.	2	.	1	.	.	.	.
Echium angustissimum	.	.	.	.	.	3	.	.	.	.	.	.
Argyranthemum dugourii	.	.	.	.	.	1	.	.	.	.	.	.
Plantago webbii	.	.	.	.	.	.	.	.	.	.	.	+

Place and date of the relevés: rel. 1–5, Cañada del Teide, 2.6.1991 (unpubl.); rel. 6–10, Rivas-Martinez et al. (1993), tab. 22 rel. 1–5, rel. 11, Schönfelder & Voggenreiter (1994), tab. 1 rel. 1; rel. 12, Oberdorfer (1965), tab. 17 rel. 33.

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Table 4
Telinetum spachianae Del Arco & Wildpret 1983

Rel. number	1	2	3	4	5
Altitude (m × 10 a.s.l.)	170	145	165	165	125
Surface (sq meters)	50	100	100	100	50
Coverage (%)	40	80	80	40	60
Sloping (°)	30	40	80	80	75
Exposure	SW	NNE	N	NE	NNE
Char. association					
Teline stenopetala ssp. spachiana	3	5	4	3	2
Sideritis oroteneriffae	1	2	3	2	1
Echium virescens	2	.	1	1	1
Char. Spartocytision supranubii and Spartocytisetalia supranubii					
Descurainia bourgeauana	1	.	2	1	.
Silene nocteolens	.	.	2	+	1
Micromeria lachnophylla	1	+	.	.	.
Char. Cytiso-Pinetea canariensis					
Tolpis webbii	.	.	.	1	1
Andryala pinnatifida ssp. *teydensis*	1	.	2	.	.
Cytisus prolifer	.	2	.	1	.
Pterocephalus lasiospermus	.	.	+	.	.
Adenocarpus viscosus	.	.	.	+	.
Plantago webbii	1	.	.	.	.
Carlina xeranthemoides	.	.	.	1	.
Pinus canariensis	.	1	.	.	.
Other species					
Bituminaria bituminosa	1	+	.	2	2
Greenovia aurea	.	3	2	1	.
Carlina salicifolia	.	1	1	.	1
Festuca agustini	+	1	.	2	.
Bystropogon canariensis	.	.	1	.	1
Hypericum grandiflorum	.	.	+	+	.
Crambe scaberrima	.	.	2	.	1
Sonchus gummifer	.	.	+	.	2
Hypericum reflexum	.	.	.	1	3
Aeonium holochrysum	+	.	.	.	2
Argyranthemum foeniculaceum	.	.	2	.	+
Pimpinella dendrotragium	.	.	3	.	1
Rhamnus integrifolia	1	.	.	.	+
Erica arborea	.	2	.	.	.
Bencomia caudata	.	.	.	.	1
Aeonium spathulatum	.	+	.	.	.
Senecio heritieri	.	.	.	.	2
Lobularia cf. *intermedia*	.	.	.	.	2
Sonchus acaulis	.	.	.	.	1
Todaroa montana	.	+	.	.	.
Tinguarra cervariaefolia	.	.	.	.	1
Cheilanthes pulchella	.	.	.	.	2
Asplenium aethiopicum	.	.	.	.	1
Polypodium azoricum	.	.	.	.	1
Cheilanthes maranthae	.	.	.	.	1
Ceterach aureum	.	.	.	.	+
Descurainia millefolia	.	.	.	.	2
Galium scabrum	.	.	.	.	1
Asparagus plocamoides	.	.	.	.	+
Micromeria hyssopifolia	.	.	.	+	.

Place and date of the relevés: rel. 1–5, Del Arco & Wildpret (1983), Tab. 3

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Holotypus: Table 22, relevé no. 3, RIVAS-MARTÍNEZ et al. (1993).

Characteristic species: *Pterocephalus lasiospermus*.

Structure and ecology: this association occurs within the meso- and supra-mediterranean belt and has a clearly pioneer role. It is characterized by the dominance of chamaephytes, in particular *Erysimum scoparium* and *Pterocephalus lasiospermus*. In case of remarkable soil erosion, it replaces the Spartocytisetum supranubii as well as the pine-woods ascribed to the Sideritido-Pinetum canariensis. It is also frequent along the road-edges, where it assumes a subnitrophilous character (Fig. 3).

A4) Telinetum spachianae DEL ARCO & WILDPRET 1983

Vieraea 12(1–2): 331

Holotypus: Table 3, relevé no. 23, DEL ARCO & WILDPRET (1983).

Characteristic species: *Teline stenopetala* subsp. *spachiana, Sideritis orotenerifae, Echium virescens*.

Structure and ecology: shrubby vegetation characterized by the dominance of *Teline stenopetala* subsp. *spachiana*, a rare nanophanerophyte circumscribed to the north-eastern slopes of Teide (Caldera de Pedro Gil). This semi-rupestrian association is localized on phonolitic very steep slopes (40°–80°) within the meso- and supra-mediterranean belt. Is has its optimum on growing-sites characterized by mesic microclimatic conditions, such as shady and foggy north-facing slopes. On sub-vertical rocky faces with more xeric condition, this association is replaced by the chasmophilous communities belonging to Aeonio-Greenovietea class. Whereas, on flat or slightly sloping surfaces the pine-woods of the Cisto-Pinion canariensis are prevailing.

Juniperion cedri BRULLO & DE MARCO, all. nova

Holotypus: Junipero cedri-Pinetum canariensis VOGGENREITER 1975, hoc loco.

Characteristic species: *Juniperus cedrus, Cheirolophus teydis, Senecio palmensis*.

Ecology: This alliance comprises open phanerophytic communities linked to steep rocky sites of windy cacuminal ridges, within the mesophytic dry supra-mediterranean bioclimatic belt. It mostly occurs in Tenerife, where it can frequently be found on the rocks surrounding "Las Cañadas", but it is also sparsely represented in La Palma.

B1) Junipero cedri-Pinetum canariensis VOGGENREITER 1975

Monogr. Biol. Canar. 6: 31 [Spartocytisetum nubigeni aeonietosum ESTEVE 1973, Trab. Dep. Bot. Univ. Granada 2(1): 5; Spartocytisetum nubigeni var. of *Juniperus cedrus* RIVAS-MARTÍNEZ et al. 1993, Itinera Geobot. 7: 150.]

Holotypus: relevé no. 8, pag. 31, VOGGENREITER (1975).

Characteristic species: *Micromeria lachnophylla, Cistus osbaeckiaefolius, Helianthemum juliae*.

Structure and ecology: the association is localized on steep and rocky places surrounding "Las Cañadas" of Teide, where it dwells the highest points (Fig. 3). It looks like an open forest vegetation physiognomically characterized by *Juniperus cedrus* and *Pinus canariensis*, associated to several rare endemic chamaephytes, such as *Micromeria lachnophylla*, *Cheirolophus teydis*, *Cistus osbaeckiaefolius*, *Senecio palmensis* and *Helianthemum juliae*. On sub-vertical rocky faces this association is replaced by a chasmophytic vegetation, described as Cheilantho guanchicae-Aeonietum smithii. A quite similar community also occurs on the highest part of the caldera of La Palma (SANTOS GUERRA 1983).

Violion cheiranthifoliae BRULLO & DE MARCO, all. nova

Holotypus: Violetum cheiranthifoliae RIVAS-MARTÍNEZ et al. 1993, hoc loco.

Characteristic species: *Viola cheiranthifolia, Echium auberianum, Silene nocteolens, Stemmacantha cynaroides, Erigeron cabrerae*.

Ecology: This alliance occurs within the dry mesophytic oro-mediterranean belt on movable deposits of scoriae, lapilli and volcanic bombs. It comprises discontinuous glareicolous communities dominated by hemicryptophytes with a markedly pioneer behaviour.

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Table 5
Junipero cedri-Pinetum canariensis Voggenreiter 1975

Rel. number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Altitude (m × 10 a.s.l.)	200	225	215	201	217	215	215	220	233	235	204	207	205	203	207
Surface (sq meters)	-	200	200	200	200	200	200	100	40	20	40	10	100	15	20
Coverage (%)	-	60	25	60	30	60	80	60	60	10	60	-	-	30	30
Sloping (°)	80	40	10	75	75	75	75	80	30	20	5	35	30	30	20
Exposure	S	W	NW	W	SW	SW	SW	SW	W	S	NE	W	S	SW	N
Char. association and Juniperion cedri															
Juniperus cedrus	2	1	1	1	+	1	1	3	1	+	2	1	3	.	.
Micromeria lachnophylla	+	1	.	.	2	3	1	1	2	2	2	+	3	2	3
Cheirolophus teydis	2	2	.	2	.	.	.	1	2	.	.	3	1	.	.
Cistus osbaeckiaefolius	1	.	.	.	.	.	.	+	.	.	2	.	3	.	.
Senecio palmensis	2	.	2	+	.	.	.	.	.	.	.	.	.	.	.
Helianthemum juliae	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Char. Spartocytisetalia supranubii															
Erysimum scoparium	+	+	2	3	2	2	2	1	1	2	1	1	.	+	2
Spartocytisus supranubius	+	3	2	3	2	2	3	2	1	1	.	2	2	1	2
Scrophularia glabrata	+	1	1	2	2	2	.	+	+	.	+	.	+	.	.
Nepeta teydea	.	2	1	3	.	.	.	.	1	.	.	1	.	.	.
Argyranthemum teneriffae	.	+	+	1	.	.	.	+	.	.	.	.	.	.	1
Pimpinella cumbrae	.	+	2	1	.	.	.	.	2	.	.	2	.	.	.
Descurainia bourgeauana	+	.	.	1	.	.	+	.	.	.	+	.	.	.	.
Arrhenatherum calderae	.	.	.	.	.	.	.	.	.	.	+	+	1	.	1
Echium wildpretii	.	.	.	.	.	2	1	.	.	.	.	.	.	2	.
Sideritis eriocephala	.	1	.	2	.	.	.	.	1	.	.	.	.	.	.
Dactylis metlsicsii	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Buffonia teneriffae	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Echium auberianum	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
Char. Cytiso-Pinetea canariensis															
Adenocarpus viscosus	+	3	1	2	1	2	2	1	2	2	+	.	1	+	.
Tolpis webbii	.	1	+	1	1	1	1	+	1	2	+	.	.	+	.
Pinus canariensis	3	2	+	.	.	+	1	2	.	.	+	.	+	.	.
Carlina xeranthemoides	+	.	1	.	3	2	1	.	.	.	.	.	.	1	.
Cytisus prolifer	+	3	+	.	.	1	.	.	.	.	1	.	.	.	.
Andryala pinnatifida ssp. *teydensis*	.	.	.	.	+	1	+	.	+	.	.	.	.	+	.
Pterocephalus lasiospermus	.	1	2	2	.	.	.	.	+	.	.	.	.	.	.
Lotus campylocladus	.	.	.	.	.	1	2	.	.	.	+	.	2	.	.
Descurainia gonzalezii	.	.	.	.	.	.	+	.	.	.	.	1	.	.	.
Plantago webbii	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
Chamaecytisus angustifolius	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Other species															
Ferula linkii	.	.	.	.	.	2	1	.	+	.	+	.	.	1	.
Silene berthelotiana	.	.	.	.	.	.	.	.	+	+	1	.	.	2	+
Bituminaria bituminosa	+	.	.	.	.	.	.	.	.	.	1	.	.	2	.
Aeonium spathulatum	.	.	.	.	+	2	2	.	.	.	.	.	.	.	.
Rhamnus integrifolia	.	.	.	+	.	2	2	.	.	.	.	.	.	.	.
Cheilanthes pulchella	.	.	.	.	1	+	+	.	.	.	.	.	.	.	.
Polycarpaea tenuis	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.
Monanthes niphophila	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.
Bromus tectorum	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.
Piptatherum coerulescens	.	.	.	.	.	.	.	.	.	.	+	.	.	2	.
Tolpis lagopoda	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Aeonium smithii	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
Monanthes brachycaulon	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Cystopteris canariensis	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Dittrichia viscosa	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.

Place and date of the relevés: rel. 1, Voggenreiter (1975), rel. 8 pag. 31; rel. 2–7, Esteve Chueca (1973), tab. 1 rel. 5, 9–13; rel. 8, Cañada del Teide, 2.6.1991 (unpubl.); rel. 9–11, Schönfelder & Voggenreiter (1994), tab. 1 rel. 30, 31, 51; rel. 12, Rivas-Martinez et al. (1993), tab. 21 rel. 13; rel. 13, Rivas-Martinez et al. (1993), tab. 19E rel. 65; rel. 14, 15, Schönfelder & Voggenreiter (1994), tab. 1 rel. 5, 22.

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The alliance is restricted to Pico del Teide slopes in Tenerife, between 2200 and 3500 m of altitude.

C1) Violetum cheiranthifoliae RIVAS-MARTÍNEZ et al. 1993

Itinera Geobot. 7: 242 [Silene-Viola cheiranthifolia Ges. OBERD. 1965, Beitr. Naturkdl. Forsch. SW-Deutschl. 24(1): 100, nom. inval. (art. 3c)]

Holotypus: Table 22, relevé no. 7, RIVAS-MARTÍNEZ et al. (1993).

Characteristic species: *Viola cheiranthifolia*.

Structure and ecology: Markedly pioneer association dominated by hemicryptophytes and restricted to the "Montaña Blanca", where it dwells unstable substrata, generally rather sloping, with no or very little soil (Fig. 4).

a) silenetosum nocteolentis BRULLO & DE MARCO, subass. nova

Holotypus: Table 22, relevé no. 7, RIVAS-MARTÍNEZ et al. (1993), hoc loco.

Characteristic species: *Silene nocteolens*.

Structure and ecology: The subassociation, corresponding to the typical aspect of Violetum cheiranthifoliae, exclusively grows on sloping sites characterized by the presence of big pumice stones mixed with minute scoriae. It is differentiated by the presence of *Silene nocteolens*.

b) argyranthemetosum tenerifae BRULLO & DE MARCO, subass. nova

Holotypus: Table 6, relevé no. 14, hoc loco.

Characteristic species: *Argyranthemum tenerifae*.

Structure and ecology: This subassociation replaces the previous one on less movable deposits of ashes and volcanic lapilli. It is physiognomically differentiated by the presence of *Argyranthemum tenerifae*, a chamaephyte indicating more stable edaphic conditions.

c) erigerontetosum cabrerae BRULLO & DE MARCO, subass. nova

Holotypus: Table 6, relevé no. 24, hoc loco.

Characteristic species: *Erigeron cabrerae*.

Structure and ecology: Subassociation occurring on semi-stabilized deposits of scoriae, whose relative stability allows a feeble humus accumulation. In this context, turns out the presence of *Erigeron cabrerae*, a rare Teide endemic, which constitutes compact and rather large spots.

C2) Echietum auberianii SCHÖNFELDER in SCHÖNFELDER & VOGGENREITER 1994

Phytocoenologia 24: 470

Holotypus: Table 1, relevé no. 73, SCHÖNFELDER & VOGGENREITER (1994).

Characteristic species: *Echium auberianum, Echium auberianum* × *wildpretii*.

Structure and ecology: The association is linked to flat or gently-sloping sites characterized by small stones, mixed with scoriae (Fig. 4). It generally occurs at altitudes between 2200 and 2400 m, and bears a remarkably low cover values. The association turns out to be, if compared to the Violetum cheiranthifoliae, floristically very poor and differs from this one for the dominance of *Echium auberianum* and for the absence of *Viola cheiranthifolia*.

5 Conclusions

The plant-communities belonging to the Spartocytisetalia supranubii characterizing the supra- and oro-mediterranean belts of Teide show some relationships with the orophilous cushion-like communities found in the high mountains of the Mediterranean islands. In both cases the flora characterizing these orophilous communities is represented by species with an ancient origin, most of them local endemic. However, from a comparison of the orophilous vegetation of Teide and the Mediterranean one, many differences can be highlighted from the floristic, structural, edaphic and bioclimatic point of view. In fact, the orophilous Canarian flora is chiefly made of autochthonous and

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Table 6
Violetetum cheiranthifoliae Rivas-Martínez et al. 1993
A. silenetosum nocteolentis Brullo & De Marco subass. nova
B. argynanthemetosum teneriffae Brullo & De Marco subass. nova
C. erigerontetosum cabrerae Brullo & De Marco subass. nova

Rel. number	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
Altitude (m × 10 a.s.l.)	250	280	260	270	270	290	280	250	280	240	250	250	270	250	240	245	260	260	245	250	260	350	300	250	290	221
Surface (sq meters)	5	5	5	15	20	15	10	10	4	10	5	15	10	10	20	15	5	5	10	15	20	4	5	5	5	20
Coverage (%)	10	20	10	20	15	20	30	30	-	25	30	20	15	30	25	25	10	10	15	10	-	-	20	30	10	5
Sloping (°)	15	20	25	25	15	30	30	15	20	20	30	15	25	35	20	15	25	30	25	40	35	25	15	15	10	5
Exposure	S	S	SE	SE	S	SE	E	E	SE	SE	SE	S	E	E	E	NE	SE	E	E	NE	N	S	E	E	NE	SW
Subassociation	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	C	C	C	C
Char. association																										
Silene nocteolens	1	2	2	2	1	+	3	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Argynanthemum teneriffae	.	.	.	.	.	.	.	.	+	2	+	1	+	1	+	+	1	+	+	1	1	1	.	.	.	.
Erigeron cabrerae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	1	1
Char. Violion cheiranthifoliae																										
Viola cheiranthifolia	2	2	1	2	1	2	1	1	+	1	+	1	+	2	+	+	+	1	+	+	+	2	1	2	1	.
Echium auberianum	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.	.
Stemmacantha cynaroides	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Char. Spartocytisetalia supranubii																										
Descurainia bourgeauana	+	.	.	+	1	2	+	1	.	.	2	1	1	+	+	2	.	.	+	+	.	.	2	2	1	2
Erysimum scoparium	.	+	.	.	+	+	.	2	.	1	2	1	1	2	2	1	2	1	1	+	.	.	+	.	+	.
Nepeta teydea	.	.	.	.	.	1	.	.	.	+	1	2	.	2	2	2	+	.	.	.	.	.	+	+	.	1
Spartocytisus supranubius	.	.	.	.	.	.	.	.	.	.	2	2	.	.	1	.	.	1	.	.	+	.	.	.	.	.
Scrophularia glabrata	.	.	.	+	.	.	.	+	.	.	1	.	+	.	.	.	.	.	2	.	.	.	.	.	.	.
Char. Cytiso-Pinetea canariensis																										
Pterocephalus lasios permus	.	.	.	.	.	1	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	+	.
Tolpis webbii	.	.	.	.	.	.	+	.	.	.	.	+	.	.	+	.	.	.	.	+	.	.	.	.	.	.
Adenocarpus viscosus	.	.	.	.	.	.	.	.	.	.	2	.	1	.	.	+	.	.	.	.	.	.	.	.	.	.

Place and date of the relevés: rel. 1–8, Montagna Blanca (Teide), 5. 6. 1991 (unpubl.); rel. 9, Rivas-Martinez et al. (1993), tab. 22 rel. 7; rel. 10–20, Montagna Blanca (Teide), 5. 6. 1991 (unpubl.); rel. 21–22, Rivas-Martinez et al. (1993), tab. 22 rel. 8–9; rel. 23–25, Montagna Blanca (Teide), 5. 6. 1991 (unpubl.); rel. 26, Schönfelder & Voggenreiter (1994), tab. 1 rel. 70.

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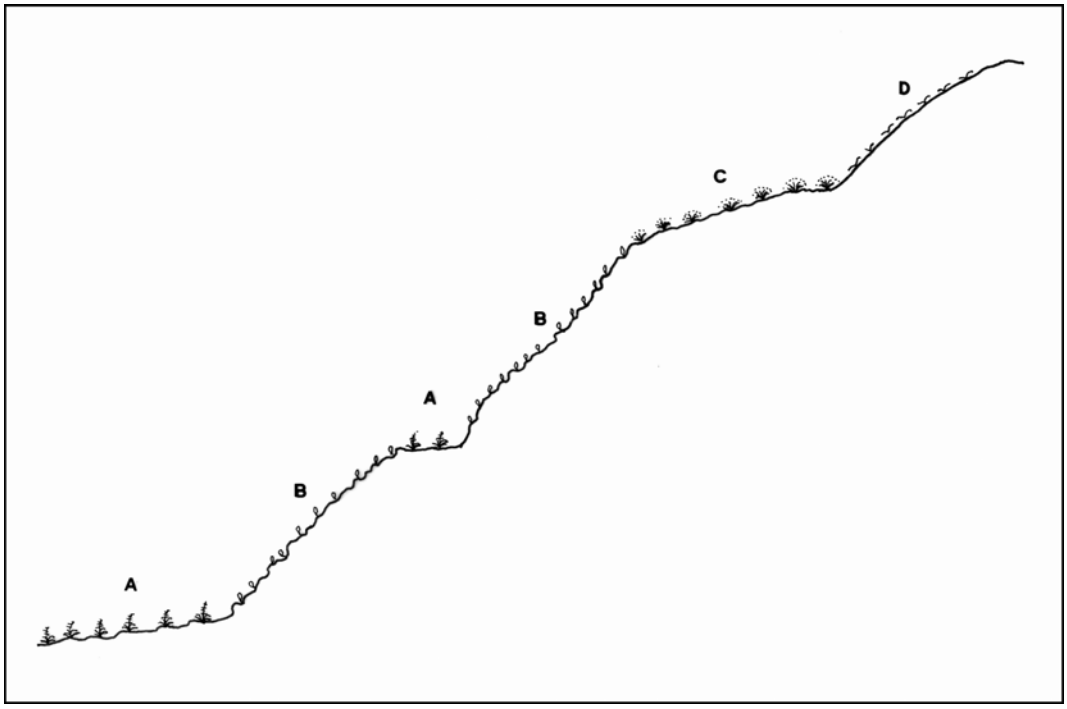

Fig. 4
Vegetation transect in "Las Cañadas", near "Montaña Blanca"
A — Echietum auberianii; B — Violetum cheiranthifoliae silenetosum nocteolentis; C — Violetum cheiranthifoliae argyranthemetosum tenerifae; D — Violetum cheiranthifoliae erigerontetosum cabrerae

taxonomically isolated species, while the Mediterranean islands are characterized by the occurrence of endemic vicariant taxa closely relatetd, most of them having a common origin from Irano-Turanian elements, that probably came into the Mediterranean Basin during the Messinian age (GUARINO et al. 2005). The Canarian plant-communities at issue are structurally characterized by the dominance of chamaephytes and nanophanerophytes with an erect habit, never thorny or pulvinate, while in the Mediterranean islands the prevailing life-form of the orophilous vegetation is that of the thorny cushion-like chamaephytes. This fundamental diversity is likely due to different environmental conditions, chiefly of bioclimatic nature, being the Cañada of Teide colonized by the Spartocytisetalia supranubii communities more sheltered against strong winds than the Mediterranean island heights, at least during the growing season. Moreover, the Cañada of Teide shows a remarkable continentality as testified by the dry ombrotype, since most of the air humidity condensates along the external slopes of the caldera, never reaching the inner part. On the contrary, the Mediterranean orophilous dwarf shrubs are experiencing subhumid to humid (rarely hyperhumid) ombrotypes, and a pulvinate, thorny dwarf habit has a twofold function: in summer, it protects the tender parts of the plant from the strong aeolian corrasion and acts as condensator of the air humidity (PIGNATTI et al. 1980).

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Table 7
Echietum auberiani Schönfelder in Schönfelder & Voggenreiter 1994

Rel. number	1	2	3	4	5	6	7	8	9
Altitude (m × 10 a.s.l.)	220	227	226	229	226	228	227	220	233
Surface (sq meters)	10	10	10	10	8	5	4	10	20
Coverage (%)	5	5	5	5	5	2	3	50	30
Sloping (°)	30	20	20	20	20	20	25	10	35
Exposure	NE	NE	NW	NE	E	SE	SW	SW	NW
Char. association and Violion cheiranthifoliae									
Echium auberianum	2	2	2	2	2	2	1	2	2
Echium auberianum × *wildpretii*	.	.	.	.	.	.	.	.	+
Char. Spartocytisetalia supranubii									
Descurainia bourgeauana	1	1	+	+	+	.	.	2	2
Spartocytisus supranubius	+	.	.	.	.	.	.	1	2
Arrhenatherum calderae	.	.	.	.	.	.	.	+	+
Erysimum scoparium	.	.	.	.	+	.	.	1	.
Argyranthemum teneriffae	.	.	.	.	+	.	.	.	1
Nepeta teydea	+	.	.	.	.	.	.	.	.
Scrophularia glabrata	.	.	.	.	.	.	.	1	.
Char. Cytiso-Pinetea canariensis									
Pterocephalus lasiospermus	.	.	+	.	+	.	+	2	+
Andryala pinnatifida ssp. *teydensis*	.	.	.	.	.	.	+	2	+
Adenocarpus viscosus	.	.	.	.	.	.	.	.	2
Tolpis webbii	.	.	.	.	.	.	.	1	.

Place and date of the relevés: rel. 1–7, Schönfelder & Voggenreiter (1984), tab. 1 rel. 71–77; rel. 8, Cañada del Teide, 5. 6. 1991 (unpubl.); rel. 9, Schönfelder & Voggenreiter (1984), tab. 1 rel. 53.

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