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Omphalodo nitidae-Coryletum avellanae, a new mesophytic woodland community of the northwest Iberian Peninsula

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Abstract

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We describe a new woodland association, Omphalodo nitidae-Coryletum avellanae, of which we present a series of relevés. On the basis of floristic composition, the new association is assigned to the European mesophytic woodland alliance Carpinion Issler em. Mayer 1937. We detail the floristic differences between the new association and its vicariants, presenting a synoptic table which summarizes the characteristics of the associations of Carpinion described to date in the northwest Iberian Peninsula. We also provide information on biogeographical, ecological and dynamic aspects of the new association.

Key words: Phytosociology, deciduous woodland, Carpinion, Galicia (NW Spain).

Introduction

The meso- to hygrophytic, neutro- to moderately acidophile deciduous woodlands of the Atlantic and Central European hill belt are generally included in the alliance Carpinion Issler 1931 em. Mayer 1937 (Rivas-Martínez et al. 1991). In the Iberian Peninsula, Tüxen et al. (1958) were the first authors to assign an association ("Corylo-Fraxinetum cantabricum", from valley bottoms in central Asturias) to Carpinion; since that time, a number of Spanish authors have described Iberian woodland communities of this alliance (see for example Rivas-Marínez 1964, Navarro 1974, Rivas-Martínez et al. 1984, Rivas-Martínez et al. 1985, Fernández-Prieto et al. 1987).

Tüxen et al. (1958) chose *Corylus avellana* and *Fraxinus excelsior* as name-giving taxa for their association in view of the constant presence of these species in their relevés, despite the fact that hazel usually forms part of the shrub, rather than the tree, layer.

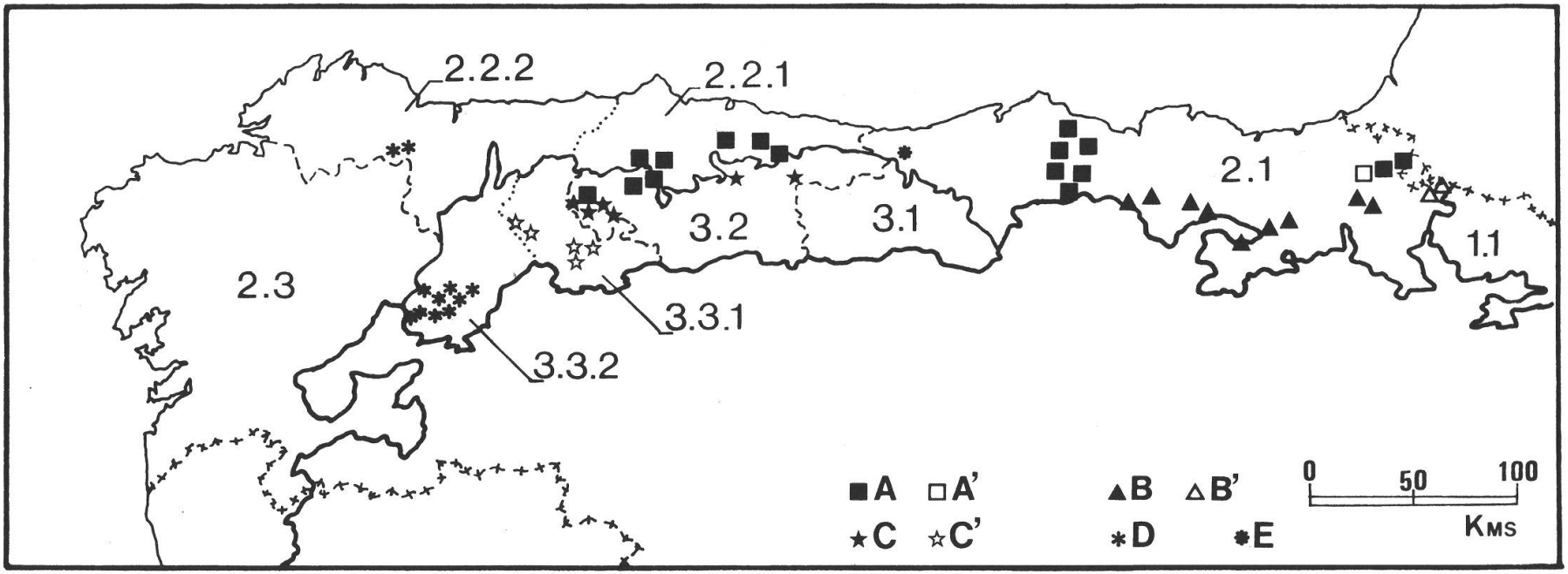

Fig. 1. Map showing the major biogeographical subdivisions of the Eurosiberian Region in northern Iberia.
Pirenaica Province: Pirenaico Central Sector (1.1).
Cántabro-Atlántica Province: Cántabro-euskaldún Sector (2.1). Galaico-asturiano Sector (2.2), divided in Ovetense Subsector (2.2.1) and Galaico-asturiano septentrional Subsector (2.2.2). Galaico-portugués Sector (2.3).
Orocantábrica Province: Campurriano-carrionés Sector (3.1). Ubiñense-picoeuropeano Sector (3.2). Laciano-ancarense Sector (3.3), divided in Laciano-narceense Subsector (3.3.1) and Naviano-ancarense Subsector (3.3.2).
Dashed lines (- - -) indicate boundaries between sectors, and dotted lines (. . .) boundaries between subsectors. Crosses (+ + +) indicate national boundaries between Spain, France and Portugal.
Location of sites of published Carpinion woodland relevés (see Tab. 1):
A: Polysticho setiferi-Fraxinetum excelsioris. A': Polysticho-Fraxinetum subass. carpinetosum betuli.
B: Crataego laevigatae-Quercetum roboris. B': Crataego-Quercetum subass. quercetosum petraeae.
C: Mercurialidi perennis-Fraxinetum excelsioris. C': Mercurialidi-Fraxinetum subass. omphalodetosum nitidae.
D: Omphalodo nitidae-Coryletum avellanae. E: Pulmonario longifoliae-Fagetum sylvaticae.

These woodlands have been subject to intense human pressure for centuries. The total wooded area has been greatly reduced as a result of clear-felling to obtain agricultural land, while selective felling of large trees for timber has greatly altered the composition of what woodland remains (in particular, increasing the abundance of hazel at the expense of that of oak and, in some cases, of beech). This perhaps explains why various authors have viewed "Corylo-Fraxinetum" as a type of mixed woodland (of ash, oak, sycamore, elm, hazel, etc.), rather than as a woodland community which, at maturity might be described as "oakwood" or "oakwood with ash" (Rivas-Martínez 1987, Díaz et al. 1992).

In the Cantabro-euskaldún Sector of the Cántabro-Atlántica Province of northern Iberia (see Fig. 1), there is still a reasonable diversity of Carpinion woodland types whose mature phases are dominated by a large forest species. For example, in addition to the mixed oakwoods of Polysticho setiferi-Fraxinetum excelsioris (=Corylo-Fraxinetum cantabricum, nom. ileg.), *Quercus robur* oakwoods (Crataego laevigatae-Quercetum roboris), *Quercus petraea* oakwoods with beech (Crataego-Quercetum subass. quercetosum petraeae), hornbeam woods (Polysticho-Fraxinetum subass. carpinetosum betuli) and even beechwoods (Pulmonario longifoliae-Fagetum sylvaticae) are all present.

In the western part of the northern Iberian Peninsula, however, there is less diversity of Carpinion woodlands, and the composition of such woodland as is present tends to be more heavily modified as a result of human pressure. In the northwest Spanish region of Galicia, this reduced diversity is reflected in the fact that there has been no unequivocal published confirmation of the presence of woodlands of this alliance. Bellot (1968) cites the presence in Galicia of the alliance "Fraxinio-Carpinion Tx. 1936", and Castroviejo (1973) cites the alliance in a description of vegetation along a vertical transect in the Sierra de Ancares (in eastern Galicia); to date, however, not even a single inventory demonstrating the presence of Carpinion in this region has been published.

In the course of an extensive study of the vegetation of limestone areas of Galicia (Giménez de Azcárate 1993), we have compiled a series of relevés which constitute proof of the presence of Carpinion woodlands in this region.

Results

The characteristics of the principal Carpinion woodland formations of the Cántabro-Atlántica and Orocantábrica Provinces are summarized in Table 1, a synoptic table based on inventories published by various authors. Apart from these communities and that described by us in this study, no other Carpinion communities have been reported from the territories to the west of the Pyrenees.

In Table 2 we present 18 relevés which exemplify the floristic composition of the new association, for which we have selected the name Omphalodo nitidae-Coryletum avellanae ass. nova (syntype: relevé 12). The basic ecological and biogeographical characteristics of the new association are as follows:

– Omphalodo-Coryletum is a woodland community characterized by high tree species diversity and very high nemoral herb species richness (mean number of species per inventory = 34).

– It is currently restricted to streamside sites and steeply sloping valley sides, generally (though not necessarily) over limestone.

– It typically occurs on deep soils (generally well-humified Cambisols), even when on steep slopes, although it has occasionally been recorded from less favourable sites: in a

Tab. 1. Synoptic table summarizing the floral characteristics of the principal Carpinion woodland formations of the Cantabro-Atlántica and Orocantábrica Provinces

Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Highest altitude (×10)	70	.	80	28	17	75	50	42	41	50	65	75	95	129
Lowest altitude (×10)	50	.	75	6	16	4	30	24	29	23	50	50	68	100
Species/relevé (mean)	27	.	31	38	34	36	.	28	37	23	33	32	29	38
Number of relevés	15	5	6	2	3	27	3	2	4	16	3	10	5	4
Tree level														
Corylus avellana	IV	V	III	2	3	V	3	2	4	V	3	V	V	4
Fraxinus excelsior	II	.	I	2	3	III	.	2	4	V	3	V	II	4
Ulmus glabra	I	.	.	.	2	II	3	.	1	I	2	II	IV	3
Ilex aquifolium	III	III	.	1	1	III	2	.	3	.	.	I	I	4
Castanea sativa	I	III	IV	1	3	IV	.	.	1	II	1	III	.	.
Fagus sylvatica	II	.	V	.	.	II	3	1	1	I	1	II	IV	.
Acer pseudoplatanus	I	.	.	1	.	+	.	.	3	IV	1	II	V	.
Quercus robur	V	V	.	2	1	V	.	1	1	IV	1	.	.	.
Prunus avium	I	.	.	.	2	III	.	1	1	I	.	I	.	3
Acer campestre	IV	.	V	.	3	IV	2	.	.	.	.	.	.	.
Salix atrocinerea	.	II	.	.	.	+	.	.	.	II	.	.	II	.
Tilia platyphyllos	.	.	.	.	.	I	.	.	4	.	1	III	.	.
Sorbus aucuparia	.	.	II	.	.	.	.	.	.	.	.	.	I	3
Quercus petraea	.	.	V	.	.	.	.	.	.	.	.	II	II	.
Tilia cordata	.	.	.	.	1	.	.	.	1	.	.	I	.	.
Salic caprea	.	.	.	.	.	.	.	.	.	.	.	I	.	2
Crataegus laevigata	IV	V	.	.	.	.	.	.	.	.	.	.	.	.
Quercus pyrenaica	.	.	.	.	1	+	.	.	.	.	.	.	.	.
Characteristic spp. All. & Or.														
Helleborus viridis spp. occidentalis	I	III	II	1	3	III	2	2	4	III	2	IV	III	1
Sanicula europaea	I	II	I	.	.	III	3	.	3	III	1	II	III	3
Polystichum setiferum	.	.	.	2	3	V	1	2	4	V	3	V	V	4
Mercurialis perennis	I	.	.	1	2	I	.	.	4	IV	3	V	V	4
Melica uniflora	.	.	IV	1	1	I	.	.	1	I	2	III	IV	3
Carex sylvatica	I	.	I	.	1	III	3	2	2	.	1	IV	III	.
Pulmonaria longifolia	IV	III	V	1	1	III	3	1	3	I	.	.	.	.
Hypericum androsaemum	I	.	.	2	3	IV	3	.	3	V	2	II	.	.
Primula vulgaris	.	.	.	.	1	II	3	2	4	V	2	IV	II	.
Phyllitis scolopendrium	.	.	.	1	1	II	.	2	3	V	3	II	.	.
Circaea lutetiana	I	III	.	1	.	.	3	1	2	I	.	.	I	.
Lamiastrum galeobdolon	I	.	.	1	1	II	2	1	3	I	.	.	.	.
Daphne laureola	.	III	.	.	2	+	2	.	.	I	1	I	.	.
Potentilla sterilis	II	.	I	2	.	II	3	.	2	I	.	.	.	.
Lilium martagon	.	.	.	.	.	.	.	.	1	II	1	I	I	2
Milium effusum	I	.	.	.	.	.	2	.	1	.	1	I	IV	.
Stachys sylvatica	I	.	.	1	1	+	.	.	.	.	.	I	.	2
Bromus ramosus	I	.	.	.	.	II	.	1	1	.	.	III	II	.
Galium odoratum	.	.	.	.	.	.	3	.	.	.	2	II	III	1
Cardamine impatiens	.	.	.	.	2	.	.	.	.	.	1	I	I	1
Symphytum tuberosum	.	.	I	.	.	I	.	.	1	II	.	.	.	2
Festuca gigantea	.	.	.	.	.	+	2	.	2	.	.	II	III	.
Allium ursinum	.	.	.	.	.	.	.	.	2	I	1	I	.	.
Polygonatum multiflorum	I	.	.	.	.	.	.	.	1	II	.	I	.	.
Carex remota	.	.	.	.	.	.	1	1	.	.	1	I	.	.

Tab. 1 (continued)

Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Highest altitude (×10)	70	.	80	28	17	75	50	42	41	50	65	75	95	129
Lowest altitude (×10)	50	.	75	6	16	4	30	24	29	23	50	50	68	100
Species/relevé (mean)	27	.	31	38	34	36	.	28	37	23	33	32	29	38
Number of relevés	15	5	6	2	3	27	3	2	4	16	3	10	5	4
Festuca altissima	.	.	.	.	.	.	.	.	.	.	1	I	.	1
Lysimachia nemorum	.	.	.	.	.	.	1	.	.	.	1	I	.	.
Veronica montana	I	.	.	1	.	+	.	.	.	.	.	.	.	.
Mycelis muralis	.	.	.	.	.	.	.	.	1	.	1	I	.	.
Scilla lilio-hyacinthus	.	.	.	.	1	.	.	1	.	I	.	.	.	.
Pimpinella major	.	.	.	1	.	+	.	.	.	.	.	I	.	.
Carex caudata	.	.	.	.	.	I	.	.	.	.	.	II	.	.
Arum maculatum	.	.	.	.	.	.	.	.	1	II	.	.	.	.
Characteristic spp. of Class														
Hedera helix	V	IV	V	2	3	V	3	2	3	III	3	V	V	.
Crataegus monogyna	V	III	II	1	3	V	2	2	3	.	1	IV	III	2
Viola sylvatica s.l.	III	V	V	2	1	IV	3	2	3	III	1	III	.	4
Stellaria holostea	II	III	II	1	.	II	2	.	2	IV	2	III	III	3
Euphorbia amygdaloides	II	IV	V	2	1	IV	2	1	1	II	.	II	III	.
Brachypodium sylvaticum	I	.	IV	2	1	V	3	2	4	.	3	V	IV	2
Saxifraga hirsuta	.	.	.	1	2	II	3	1	3	V	3	IV	II	2
Dryopteris affinis	.	.	.	2	1	III	3	2	3	IV	1	IV	II	1
Oxalis acetosella	I	IV	.	.	3	II	3	1	2	II	.	III	II	4
Ranunculus tuberosus	II	III	V	1	2	II	3	1	4	.	.	I	III	.
Lonicera periclymenum	II	III	I	1	.	IV	.	.	.	IV	2	I	I	2
Euphorbia dulcis	II	V	.	.	.	III	2	1	3	II	1	III	IV	.
Tamus communis	IV	II	.	2	2	V	.	2	4	I	2	IV	.	.
Clematis vitalba	I	.	.	1	1	III	.	.	1	.	1	II	I	1
Ruscus aculeatus	III	IV	.	.	2	III	2	.	2	.	1	II	I	.
Crepis lampsanoides	.	.	.	.	.	I	1	.	2	I	2	III	II	3
Aquilegia vulgaris	II	.	I	.	.	.	.	1	.	I	2	I	II	2
Poa nemoralis	I	.	.	.	.	+	1	.	1	.	1	I	I	4
Athyrium filix-femina	.	IV	.	2	.	I	3	1	2	III	.	.	II	.
Blechnum spicant	.	V	.	1	.	I	3	1	1	I	.	I	.	.
Dryopteris filix-mas	.	.	.	1	2	+	.	.	.	I	.	I	III	4
Cornus sanguinea	V	.	II	2	3	IV	.	.	2	.	.	I	.	.
Luzula sylvatica ssp. henriquesii	.	I	.	.	.	.	1	.	.	.	1	II	V	1
Frangula alnus	I	.	.	.	.	+	.	.	.	I	2	I	.	1
Hepatica nobilis	I	.	I	.	1	II	.	.	.	.	.	III	.	1
Teucrium scorodonia	I	II	III	1	.	II	.	.	.	.	.	.	I	.
Sambucus nigra	.	.	.	1	1	I	.	.	.	IV	.	.	I	2
Moehringia trinervia	.	.	.	1	1	.	.	1	.	.	1	I	.	1
Vicia sepium	I	.	IV	1	.	III	.	.	1	I	.	.	.	.
Rosa arvensis	V	.	V	.	1	+	.	.	3	I	.	.	.	.
Hypericum pulchrum	I	IV	I	.	.	+	.	.	.	I	.	.	.	1
Primula veris subsp. columnae	I	.	.	1	.	.	.	.	.	I	.	I	.	2
Astrantia major	I	.	.	.	.	I	.	2	2	.	.	III	.	.
Melittis melissophyllum	.	.	.	.	.	+	.	.	.	.	.	I	I	1
Lastrea limbosperma	.	I	.	.	.	.	2	.	.	I	.	I	.	.
Lathyrus montanus	I	IV	V	.	.	II	.	.	.	.	.	.	.	.
Prunus spinosa	IV	III	.	.	1	III	.	.	.	.	.	.	.	.

Tab. 1 (continued)

Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Highest altitude (×10)	70	.	80	28	17	75	50	42	41	50	65	75	95	129
Lowest altitude (×10)	50	.	75	6	16	4	30	24	29	23	50	50	68	100
Species/relevé (mean)	27	.	31	38	34	36	.	28	37	23	33	32	29	38
Number of relevés	15	5	6	2	3	27	3	2	4	16	3	10	5	4
Euonymus europaeus	I	.	.	1	.	I	.	.	2	.	.	.	.	.
Vaccinium myrtillus	.	V	.	.	.	+	1	.	.	.	.	.	.	1
Anemone nemorosa	.	.	.	.	.	+	.	1	.	I	.	.	.	2
Carex pendula	.	.	.	.	.	+	.	.	.	I	2	I	.	.
Melampyrum pratense	I	IV	V	.	.	.	.	.	.	.	.	.	.	.
Ligustrum vulgare	III	.	.	.	1	II	.	.	.	.	.	.	.	.
Rosa canina	I	III	.	.	.	.	.	.	.	.	1	.	.	.
Dryopteris dilatata	.	.	.	.	.	+	.	.	.	III	.	.	.	1
Lathyrus niger	.	.	V	.	.	+	.	.	.	.	.	.	.	1
Cardamine flexuosa	.	.	.	.	.	+	.	1	.	.	.	.	II	.
Polygonatum verticillatum	.	.	.	.	.	.	.	.	2	I	.	.	.	1
Helleborus foetidus	.	.	II	.	.	.	.	.	.	.	.	I	.	.
Festuca heterophylla	.	IV	II	.	.	.	.	.	.	.	.	.	.	.
Hieracium umbellatum	.	I	II	.	.	.	.	.	.	.	.	.	.	.
Buxus sempervirens	.	.	I	1	.	.	.	.	.	.	.	.	.	.
Sorbus torminalis	I	.	.	.	.	I	.	.	.	.	.	.	.	.
Rosa sempervirens	.	.	.	.	1	III	.	.	.	.	.	.	.	.
Holcus mollis	II	.	.	.	.	II	.	.	.	.	.	.	.	.
Lonicera xylosteum	II	.	.	.	.	.	.	.	.	.	.	.	.	1
Sorbus aria	.	.	II	.	.	+	.	.	.	.	.	.	.	.
Viburnum lantana	II	.	.	.	.	+	.	.	.	.	.	.	.	.
Buglossoides purpureocaerulea	.	.	.	.	.	II	.	.	.	.	.	I	.	.
Luzula forsteri	.	.	.	.	.	I	.	.	.	.	.	I	.	.
Hyacinthoides non-scripta	.	.	.	.	.	.	.	.	.	I	.	.	.	2
Omphalodes nitida	.	.	.	.	.	.	.	.	.	.	.	.	IV	2
Saxifraga spathularis	.	.	.	.	.	.	.	.	.	.	.	.	III	1
Other species														
Geranium robertianum	II	.	.	1	3	III	2	1	3	I	3	III	IV	3
Rubus sp.	V	III	III	1	2	I	.	1	2	I	3	III	III	.
Fragaria vesca	I	I	IV	1	.	II	.	.	.	.	1	II	.	1
Pteridium aquilinum	III	III	V	2	2	IV	1	.	.	.	.	.	.	2
Geum urbanum	.	.	I	.	1	I	.	1	2	I	2	II	.	.
Ajuga reptans	.	II	II	1	.	I	.	1	1	I	.	I	.	.
Polypodium vulgare	.	III	.	.	.	+	.	.	.	I	.	III	III	2
Veronica chamaedrys	.	I	III	.	.	II	.	.	.	.	1	I	.	1
Urtica dioica	I	.	.	1	.	.	.	1	1	.	.	I	II	.
Silene dioica	.	.	.	1	.	.	.	.	.	II	1	I	I	.
Iris foetidissima	.	.	.	.	1	I	.	.	.	I	2	I	.	.
Stachys officinalis	II	I	II	.	.	II	.	.	.	I	.	.	.	.
Arum italicum	I	.	.	2	3	II	.	.	.	.	.	I	.	.
Brachypodium pinnatum ssp. rupestre	III	.	II	1	1	I	.	.	.	.	.	.	.	.
Dactylis glomerata	I	.	IV	.	.	I	.	.	.	.	1	I	.	.
Angelica sylvestris	I	.	.	1	.	I	.	1	.	II	.	.	.	.
Deschampsia flexuosa	I	IV	V	.	.	.	3	.	.	.	.	.	.	.
Solidago virgaurea	.	I	IV	.	.	I	.	.	.	.	.	I	.	.

Tab. 1 (continued)

Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Highest altitude (×10)	70	.	80	28	17	75	50	42	41	50	65	75	95	129
Lowest altitude (×10)	50	.	75	6	16	4	30	24	29	23	50	50	68	100
Species/relevé (mean)	27	.	31	38	34	36	.	28	37	23	33	32	29	38
Number of relevés	15	5	6	2	3	27	3	2	4	16	3	10	5	4
Agrostis capillaris	II	III	I	1	.	.	.	.	.	.	.	.	.	.
Cytisus scoparius	.	I	III	1	.	.	.	.	.	.	1	.	.	.
Asphodelus albus	I	III	II	.	.	+	.	.	.	.	.	.	.	.

Additional species present in a single column only

Tree level (usually > 3 m): Acer opalus: III en 3; Betula alba: 2 en 14; Carpinus betulus: 3 en 5; Populus nigra: 3 en 14.

Characteristic spp. of All. & Or.: Actaea spicata: 1 in 14; Ornithogalum pyrenaicum: 1 in 14; Paris quadrifolia: 1 in 14; Poa chaixii: 2 in 14; Ranunculus platanifolius: 1 in 14; Stellaria nemorum: 3 in 14.

Characteristic spp. of Class: Campanula latifolia: 2 in 14; Euphorbia hyberna: 4 in 14; Polygonatum odoratum: 4 in 14; Prunella hastifolia: V in 3.

Companion species present in three or less colums are not included since we consider such species to be unimportant for the purposes of this study.

Table 1. Each column summarizes a series of relevés (see below); frequency of occurrence of each species is indicated with Roman numerals for sets of five or more relevés or with Arabic numerals for sets of less than five relevés (+ = present in less than 10%; I = present in up to 20% of relevés; II = present in 21–40% of relevés; III = present in 41–60% of relevés; IV = present in 61–80% of relevés; V = present in more than 80% of relevés).

Data from:

Column 1: Crataego laevigatae-Quercetum roboris. Rivas-Martínez et al. (1988).

Column 2: Crataego laevigatae-Quercetum roboris. Bascones (1978), Table 19, invts. 1, 2, 5 y 7.

Column 3: Crataego laevigatae-Quercetum roboris subass. quercetosum petraeae. Rivas-Martínez et al. (1991), Tabla 21, cols. 4 a 9.

Column 4: Polysticho setiferi-Fraxinetum excelsioris. Rivas-Martínez et al. (1985). Tabla 3, invts. 1 y 2.

Column 5: Polysticho setiferi-Fraxinetum excelsioris subass. carpinetosum betuli. Rivas-Martínez et al. (1985). Tabla 3, invts. 3–5.

Column 6: Polysticho setiferi-Fraxinetum excelsioris. Herrera (1988). Tabla 67.

Column 7: Pulmonario longifoliae-Fagetum sylvaticae. Rivas-Martínez (1968).

Column 8: Polysticho setiferi-Fraxinetum excelsioris ("Corylo-Fraxinetum cantabricum subass. typicum"). Tüxen et al. (1958). Tabla 87, grupo A.

Column 9: Polysticho setiferi-Fraxinetum excelsioris ("Corylo-Fraxinetum cantabricum subass. tilietosum platyphylli"). Tüxen et al. (1958). Table 87, grupo B.

Column 10: Polysticho setiferi-Fraxinetum excelsioris ("Corylo-Fraxinetum cantabricum"). Navarro (1974). Table 26.

Column 11: Polysticho setiferi-Fraxinetum excelsioris ("Corylo-Fraxinetum cantabricum"). Fernández-Prieto (1981).

Column 12: Mercurialidi perennis-Fraxinetum excelsioris. Fernández-Prieto et al. (1987). Table 5, invts. 1 a 10.

Column 13: Mercurialidi perennis-Fraxinetum excelsioris subass. omphalodetosum nitidae. Fernández-Prieto et al. (1987). Table 5, invts. 11 a 15.

Column 14: Mercurialidi perennis-Fraxinetum excelsioris subass. omphalodetosum nitidae. Puente (1988). Table 73.

Tab. 2. Omphalodo nitidae – Coryletum avellanae ass. nova

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Altitude (×10)	65	62	80	72	68	75	80	78	85	80	76	82	93	90	85	40	97	.
Slope (°)	10	40	45	40	35	10	60	35	60	45	60	30	25	30	20	40	30	.
Aspect	SE	E	W	W	NW	S	SE	NE	NW	NW	N	N	NE	N	NE	NW	N	.
Tree layer cover (%)	100	95	90	100	100	100	100	100	100	100	100	100	95	100	100	100	100	.
Sample area (m^2)	70	120	300	250	200	200	150	300	200	110	300	300	150	130	150	200	100	.
Number of species	29	41	50	41	28	29	37	39	26	32	26	44	35	27	41	26	40	29.8
Tree layer (> 3 m)																		
Corylus avellana	4.4	4.4	4.4	5.5	4.4	5.5	5.4	4.3	4.4	4.4	5.4	4.4	+	4.4	4.4	5.5	.	IV
Acer pseudoplatanus	.	+.2	1.1	1.1	2.2	+	.	.	1.1	1.1	+	2.2	2.2	.	1.1	.	+	V
Ilex aquifolium	.	.	+	+	.	.	2.2	.	.	.	.	1.2	+	2.2	1.1	.	+.2	I
Fraxinus excelsior	1.1	1.1	+	.	.	.	.	.	.	.	.	1.1	1.1	.	+	.	r	III
Quercus robur	.	.	1.1	.	.	.	+	.	.	.	.	4.4	2.2	3.3	.	1.1	2.2	I
Castanea sativa	.	.	.	1.1	.	.	.	.	.	.	.	1.1	2.2	.	1.1	.	2.2	III
Quercus pyrenaica	1.1	r	.	.	.	.	.	.	1.1	.	r	.	.	.	5.5	.	.	I
Betula celtiberica	.	.	.	.	.	.	.	.	1.1	.	.	2.2	2.2	.	.	.	3.3	II
Prunus avium	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	r	I
Sorbus aucuparia	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	2.2	.
Characteristic spp. Ass., All. & Or.																		
Polystichum setiferum	2.2	2.2	1.2	4.2	2.2	1.2	1.2	1.2	+.2	2.2	3.3	1.2	+	2.2	+	2.2	1.1	V
Primula vulgaris	1.1	+.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	+.2	+	2.2	1.1	1.1	1.1	1.1	+	IV
Mercurialis perennis	.	1.2	1.2	1.2	2.2	2.2	2.1	1.2	1.1	1.1	2.1	2.2	.	.	2.2	4.4	2.3	III
Melica uniflora	.	2.1	1.1	2.1	1.1	1.1	1.2	2.2	.	1.1	1.1	1.1	.	1.2	.	.	+	III
Daphne laureola	.	1.1	1.2	+.2	+	1.1	1.1	+.2	.	.	.	2.2	1.1	1.1	1.2	.	1.2	.
Omphalodes nitida	.	+	+	+	.	.	+	.	+	.	+	1.1	.	1.1	+	.	1.1	III
Lilium martagon	.	.	+	1.1	.	.	+	1.1	1.1	+	.	1.1	.	+	.	.	+	.
Phyllitis scolopendrium	1.2	1.1	.	1.2	1.2	1.1	.	.	.	1.2	.	.	.	.	.	+.2	.	III
Potentilla sterilis	+.2	+	+-2	+	.	.	+	+.2	.	.	.	.	.	.	1.1	.	.	.
Sanicula europaea	.	.	.	1.1	.	.	1.1	.	.	.	+	1.2	+.2	.	1.1	.	.	.
Ornithogalum pyrenaicum	r	+.2	r	r	.	.	.	.	.	.	.	.	.	+	+	.	.	.
Mycelis muralis	r	+	.	+	.	.	.	1.1	.	.	.	.	.	.	.	.	r	.
Saxifraga spathularis	.	.	.	+	+.2	.	.	+	.	1.2	1.1	.	.	.	.	.	.	.
Circaea lutetiana	.	.	.	+	.	+	.	.	.	+	+	.	.	.	.	.	.	II
Allium ursinum	.	+.2	.	+.2	.	.	.	.	.	.	.	1.2	.	+	.	.	.	II

Milium effusum	.	.	.	.	+	1.2	.	.	.	1.2	2.1	.	.	.	.	.	.	.
Neottia nidus-avis	.	.	.	+.2	.	.	.	.	+	.	.	+.2	.	.	+	.	.	.
Carex sylvatica	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	I
Characteristic species of Class																		
Hedera helix	5.4	4.3	3.2	3.3	4.4	4.4	3.3	+.2	1.2	2.2	2.2	4.4	1.2	3.3	2.3	1.2	2.2	IV
Crataegus monogyna	1.1	1.1	1.1	+	+	2.2	1.1	2.2	1.1	1.1	1.1	+	1.1	1.1	1.1	+	+	III
Tamus communis	1.2	1.2	1.1	1.1	+	1.1	1.1	1.1	1.1	+	1.1	1.1	1.1	+	+	1.1	1.1	V
Stellaria holostea	1.1	+	1.1	1.1	+	+	1.1	1.1	+	+	+	+.2	1.1	.	1.1	1.1	1.1	III
Lonicera periclymenum	1.1	+.2	+.2	1.2	+	1.1	r	.	.	1.1	+	+	1.1	+	1.1	.	1.1	III
Viola riviniana	1.1	1.1	+.2	+	.	+	.	+	1.1	+	+	1.1	.	.	+	.	+	IV
Euphorbia dulcis	.	1.1	1.1	1.1	+	.	1.1	1.1	+.2	+	.	1.1	.	.	1.1	1.1	+	IV
Ruscus aculeatus	1.2	1.1	2.2	.	1.1	1.2	+	.	.	.	.	2.2	.	+	1.1	+	+	IV
Teucrium scorodonia	+	.	+	+	.	+	r	r	.	.	.	.	1.1	+	1.1	.	1.1	III
Crepis lampsanoides	.	+	+	+	.	.	r	+	.	.	.	+	r	.	.	2.2	+	I
Vicia sepium	.	r	+	.	.	.	+	+	.	.	+	+	1.1	+	+	.	.	I
Poa nemoralis	+	1.1	1.1	1.1	+	.	1.1	+	2.1	.	.	.	.	.	.	.	.	I
Asplenium onopteris	+	r	+	.	+	.	r	.	.	.	.	+	.	+	.	.	.	II
Ranunculus tuberosus	.	+	+	.	.	.	.	r	.	.	.	+	+	.	+	.	r	I
Melittis melissophyllum	+	.	+	.	.	.	+	.	.	+	.	1.1	.	.	+	.	+	I
Clematis vitalba	+	1.1	.	1.1	+	1.1	.	.	+	.	.	.	.	.	.	+	.	.
Brachypodium sylvaticum	+	+.2	1.1	.	.	.	+	+	.	.	.	.	.	.	.	.	+.2	II
Euphorbia amygdaloides	.	.	.	+	.	.	+	+	.	+	.	.	.	+	.	.	.	III
Dryopteris filix-mas	.	.	.	.	1.2	.	+.2	.	.	+.2	+.2	.	.	.	.	.	1.1	I
Polygonatum verticillatum	.	.	+	1.1	.	.	+	.	+	.	.	1.1	.	+	.	.	.	.
Hyacinthoides non-scripta	.	.	.	.	.	.	+	1.1	.	.	.	+	1.1	.	+	.	.	II
Holcus mollis	.	.	.	.	.	.	.	.	1.1	.	.	+	2.2	.	1.1	.	2.2	I
Luzula sylvatica ssp. henriquesii	.	.	1.2	.	+.2	.	+.2	.	.	+.2	.	.	.	.	.	.	.	I
Helleborus foetidus	.	.	.	+	.	.	.	1.1	.	.	.	+	+	.	.	.	.	III
Luzula forsteri	.	+	.	.	.	.	.	r	r	.	.	.	+	.	.	.	.	I
Sambucus nigra	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	+	.	I
Oxalis acetosella	.	.	.	+.2	.	.	.	.	.	+.2	.	.	.	.	.	1.1	.	I
Polygonatum odoratum	.	.	.	.	.	.	.	+	.	.	.	+	.	.	+.2	.	.	II
Rosa canina	+	+	r	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Anemone nemorosa	.	.	+	.	.	.	+	.	2.2	.	.	.	.	.	.	.	.	.
Aquilegia vulgaris	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I

Tab. 2. (continued)

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Altitude (×10)	65	62	80	72	68	75	80	78	85	80	76	82	93	90	85	40	97	.
Slope (°)	10	40	45	40	35	10	60	35	60	45	60	30	25	30	20	40	30	.
Aspect	SE	E	W	W	NW	S	SE	NE	NW	NW	N	N	NE	N	NE	NW	N	.
Tree layer cover (%)	100	95	90	100	100	100	100	100	100	100	100	100	95	100	100	100	100	.
Sample area (m^2)	70	120	300	250	200	200	150	300	200	110	300	300	150	130	150	200	100	.
Number of species	29	41	50	41	28	29	37	39	26	32	26	44	35	27	41	26	40	29.8
Other species																		
Rubus sp.	1.2	1.1	+.2	1.2	+	+	1.1	.	1.1	+	1.2	+.2	3.3	1.1	3.3	+	1.1	V
Geranium robertianum	r	+	+	+	+	+	+	5.4	.	1.1	.	+	.	.	.	1.1	.	.
Pteridium aquilinum	.	+	+	.	.	+	.	+	+	.	.	+	1.1	.	1.1	.	1.1	I
Brachypodium pinnatum ssp. rupestre	.	.	.	.	.	.	.	.	.	.	+	1.1	3.3	+.2	3.3	1.2	.	I
Fragaria vesca	.	.	.	.	.	+	.	.	.	.	.	+	1.1	.	1.1	.	+	.
Epilobium parviflorum	.	+	+	+	.	.	.	1.1	.	+	.	.	.	.	.	.	.	.
Polypodium vulgare	.	.	.	.	.	.	+	.	+	.	.	1.2	.	.	1.1	.	1.1	.
Heracleum sphondyllium	.	.	.	.	+	.	+	.	.	+	.	.	+	.	.	.	.	III
Geum urbanum	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	+	.	I
Ajuga reptans	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	III
Rumex acetosella	.	.	+	r	.	.	.	r	.	.	.	.	.	.	.	.	.	I
Urtica dioica	.	.	.	.	1.1	+	.	+	.	.	.	.	.	.	.	+.2	.	.
Galium aparine	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1.1	.	I
Erica arborea	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	1.1	.
Lamium maculatum	+	.	.	r	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Hieracium grex murorum	.	.	+	.	.	.	.	.	.	r	.	.	+	.	.	.	.	.

Species present in 1 or 2 relevés

Characteristic species of Alliance, Order or Class:
Alnus glutinosa: I in 18; Arum italicum: + in 8, 1.1 in 16; Athyrium filix-femina: III in 18; Blechnum spicant: II in 18; Cardamine impatiens: + in 1; Carex pendula: I in 18; Dryopteris affinis: + in 12, IV in 18; Helleborus viridis subsp. occidentalis: + in 16; Hypericum androsaemum: III in 18; Hypericum pulchrum: + in 15; Juglans regia: + in 2; Melampyrum pratense: + in 15, + in 17; Physospermum cornubiense: +.2 in 13, + in 15; Pimpinella major: + in 7, + in 14; Quercus × andegavensis: + in 5; Quercus rubra: I in 18; Salix atrocinerea: 1.2 in 1; Stellaria nemorum: r in 2, 2.2 in 8; Ulmus glabra: +.2 in 12, I in 18; Vaccinium myrtillus: r in 9, +.2 in 17.

Companion species:

Angelica sylvestris: + in 10; Arrhenatherum elatius subsp. bulbosum: r in 3; Asplenium trichomanes: +.2 in 16, II in 18; Centranthus calcitrapa: + in 16; Chrysosplenium oppositifolium: I in 18; Conopodium majus: + in 8, + in 13; Cruciata laevipes: + in 15; Cuscuta epithymum: +.2 in 6; Doronicum carpetanum: + in 3; Epipactis sp.: + in 2; Festuca gr. rubra: 1.3 in 3, 1.1 in 11; Geranium sanguineum: + in 3; Lapsana communis: 1.1 in 8; Laserpitium nestleri: 1.1 in 3; Lastrea limbosperma: I in 18; Laurus nobilis: I in 18; Myosotis sp.: I in 18; Silene vulgaris: + in 17, I in 18; Stellaria neglecta: I in 18; Umbilicus rupestris: 1.2 in 16; Valeriana pyrenaica: 1.1 in 10; Veronica chamaedrys: + in 15.

Relevé locations (in all cases in Lugo Province).

1: Caurel, Ponte de Esperante. 2: Caurel, Camín Rial, between Seoane and Moreda. 3 & 4: Caurel, between Moreda and Devesa de Rogueira. 5 & 6: Caurel, near to the confluence of the Romeor and the Lor river. 7: As Nogais, Alence. 8: Caurel, between Moreda and Rogueira. 9: Caurel, Parada. 10: Caurel, between Romeor and Mostad. 11: Caurel, between Mostad and Pacios. 12: Tricastela, Cancelo. 13: As Nogais, Nullán. 14: As Nogais, between Nullán and Alence. 15: Cervantes, between O Portelo and Doiras. 16: Abadín, Samordás on the boundary with the Municipio of Mondoñedo. 17: Triacastela: between Filloval and Fonfría. 18: 5 relevés from O Incio (Romero, 1993).

plot close to our relevé 16, described by Giménez de Azcárate (1993), soil depth was only 55 cm.

– As regards altitude, it occurs most commonly in the upper hill belt (i.e. over the range 600–900 m in the study area), although it is occasionally found at lower altitudes (400 m or lower).

– Precipitation regime in areas where the association occurs is oceanic and generally hyperhumid (>1400 mm per annum), though occasionally at the upper end of humid (for example, 1345 mm per annum in Mondoñedo; Carballeira et al. 1983). Summers tend to be somewhat drier than in the regions where the more easterly Iberian Carpinion formations occur, and this is reflected in the fact that Omphalodo-Coryleta generally occurs at sites with low insolation.

– It generally occurs in areas of mild temperature regime, at sites with annual mean temperature between 9,5° and 13°. Although winters may be quite cold, active growth probably takes place for at least 9 months of the year (cf. Pav index sensu Rivas-Martínez 1987); this contrasts with the much shorter active growth period (Pav) of the Fagetalia sylvaticae beechwoods which occur in the montane belt in Galicia.

– As regards biogeography, most of the 18 relevés presented here are from the Laciano-ancarense Sector of the Orocantábrica Province, and only a few of them from the Galaico-asturiano Sector of the Cántabro-Atlántica Province. Galicia can thus be taken to represent the extreme southwestern limit of the distribution of the alliance Carpinion in Europe.

Discussion

Syntaxonomic aspects

Although there are fewer species typical of Carpinion in Omphalodo-Coryletum than in the various vicariant communities whose characteristics are summarized in Table 1, the presence of a number of such species in the relevés presented in Table 2 – for example, *Polystichum setiferum*, *Primula vulgaris*, *Potentilla sterilis*, *Phyllitis scolopendrium*, *Neottia nidus-avis*, *Prunus avium* and *Fraxinus excelsior* – provides adequate support for the assignation of the new association to Carpinion. Some of the herb species in our relevés also occur in Fagion sylvaticae woodlands (such as *Mercurialis perennis*, *Daphne laureola*, *Milium effusum* and *Carex sylvatica*) or even in Alno-Ulmion (*Circaea lutetiana*, *Allium ursinum*); this provides further confirmation that it belongs to the order Fagetalia sylvaticae.

The floristic composition of the new association differs from that of the formations summarized in Table 1 in a number of respects, as detailed herein.

– Certain species present in communities of the Cántabro-euskaldún Sector of the Cántabro-Atlántica Province (Table 1, columns 1–7) are entirely absent from the Carpinion woodlands of the Galaico-asturiano Sector of that province and from the Orocantábrica Province (Table 1, columns 8–14). These species include *Crataegus laevigata*, *Acer campestre*, *Festuca heterophylla* and *Carpinus betulus*; as is to be expected, none of these species is present in any of the Omphalodo-Coryletum relevés (Table 2). In addition, some species – particularly shrubs characteristic of the woodland fringe, such as *Ligustrum vulgare*, *Rosa arvensis* and *Cornus sanguinea* – appear to be more frequent in the Cántabro-euskaldún Sector than in more westerly parts of northern Iberia; *Ligustrum*

Tab. 3. Summary of the principal biogeographical and dynamic characteristics of the Carpinion woodland communities present in northwestern Iberia. Species useful for discriminating between the different syntaxa are also listed. The letters designating each syntaxon (A, B and C) correspond to those used on the map of the study area (Fig. 1).

	A Polysticho – Fraxinetum excelsioris	C Mercurialidi – Fraxinetum excelsioris subass. omphalodetosum nitidae: C′	D Omphalodo – Coryletum avellanae
1	Cantabro-eusk. (2.1) + Ovetense (2.2.1) Ubiñense-picoeuropeano (3.2) (rare)	Ubiñense-picoeuropeano (3.2) Laciano-narceense (3.3.1) (C′ only)	Galaico-asturiano-septentr. (2.2.2) Naviano-ancarense (3.3.2)
2	Hill (Middle to Upper)	Upper Hill + Motane (C′: Montane)	Hill (Middle to Upper)
3	Versus D Lam. galeobdolon Pulmonaria longif. Scilla lilio-hyac. Tilia platyphillos Symphytum tuberosum Versus C+C′ Lam. galeobdolon Pulmonaria longif. Potentilla steril. Quercus robur	Versus D Quercus petraea Tilia platyph. Fagus sylvatica Hepatica nobilis Carex caudata Bromus ramosus Versus A Quercus petraea Festuca altissima Galium odoratum Lilium martagon	Versus C+C′ Pontentilla steril. Asplenium onopt. Versus C′ Phyllitis scolopendrium Tamus communis Neottia nidus-avis Versus C+A Saxif. spathularis Omphalodes nitida Quercus pyrenaica
4	Rubo ulmifolii – Tametum communis subass. rosetosum sempervirentis subass. loniceretosum periclymeni	Berberidion Rubo ulmifolii – Tametum communis subass. rosetosum villosae (with C′)	Rubo ulmifolii – Tametum communis subass. origanetosum virentis
5	Genistion occidentalis + Ulicion minoris	Genistion occidentalis	Ulicion minoris

Level 1: Biogeographic sector/subsector (see Fig. 1)
Level 2: Bioclimatic belt
Level 3: Discriminant species (present in one ass. and absent from the other)
Level 4: Fringe communities
Level 5: Replacing communities following major degradation

vulgare and *Rosa arvensis* are only exceptionally present in Galicia (Romero et al. 1989, 1992).

– A number of species frequently present in Polysticho-Fraxinetum excelsioris of areas to the west of the Cántabro-euskaldún Sector (such as the Ubiñense-picoeuropeano Sector and the Ovetense Subsector of the Galaico-asturiano Sector; Table 1, columns 8–13) are absent from Omphalodo-Coryletum, namely *Lamiastrum galeobdolon*, *Pulmonaria longifolia*, *Symphytum tuberosum*, *Scilla lilio-hyacinthus* and *Tilia platyphyllos*.

– The association described as Mercurialidi-Fraxinetum excelsioris, occurring characteristically in the upper sub-belt of the hill belt and even in the montane belt, frequently contains species (such as *Carex caudata*, *Festuca altissima*, *Hepatica nobilis* and *Quercus petraea*) which are never present in Omphalodo-Coryletum. Similarly, *Festuca gigantea*, *Fagus sylvatica*, *Stachys sylvatica*, *Bromus ramosus* and *Galium odoratum* – all of which may be present in Fagion sylvaticae beechwoods in the montane belt of the Laciano-ancarense Sector (Izco et al. 1986) – are never present in Omphalodo-Coryletum, although a number of these species may occur at lower altitudes in hygrophytic Alno-Ulmion woodland (Amigo et al. 1987).

– Both *Helleborus viridis* subsp. *occidentalis* and *Saxifraga hirsuta* are almost entirely absent from Omphalodo-Coryletum. Although very frequently present in the vicariant formations summarized in Table 1, both species are very rare in Galicia and absent from Portugal (Franco 1971).

– Of the species which constitute the characteristic combination of the new association, of particular interest are *Omphalodes nitida* and *Saxifraga spathularis*, both endemic to the west/northwest Iberian Peninsula and both useful for differentiating Omphalodo-Coryletum from Polysticho-Fraxinetum excelsioris and Mercurialidi-Fraxinetum excelsioris. Note that we consider the subassociation omphalodetosum nitidae of this latter association to represent a transition towards Omphalodo-Coryletum. *Quercus pyrenaica* similarly has discriminant value; it is not uncommon in Omphalodo-Coryletum from upper hill-belt sites, but entirely absent from Polysticho-Fraxinetum excelsioris and Mercurialidi-Fraxinetum excelsioris.

– In the Laciano-ancarense Sector, Omphalodo-Coryletum (occurring in the hill belt) may adjoin beechwoods in the adjacent montane belt. The new association can be distinguished from these beechwood formations by the presence of thermophilous species such as *Fraxinus excelsior* or the herbs *Phyllitis scolopendrium, Potentilla sterilis, Neottia nidus-avis, Ruscus aculeatus, Tamus communis* and *Asplenium onopteris*. Except for *Fraxinus,* these species also serve to differentiate Omphalodo-Coryletum avellanae from Mercurialidi-Fraxinetum excelsioris subass. omphalodetosum nitidae, reported from higher altitudes in the Orocantábrica Province and with a floristic composition which, in our opinion, is closer to Fagion sylvaticae than to Carpinion (see Puente 1988, Table 73).

– It is of interest that hazel is the dominant tree-layer species in the majority of the relevés in Table 2, while a number of climbing species are present, most notably *Hedera helix* which often attains very high cover values. In northwest Iberia at least, the high presence of *Hedera helix* often clearly discriminates between hill-belt Carpinion communities and adjoining montane-belt Fagion sylvaticae communities.

In conclusion, then, Omphalodo-Coryletum typically contains a high proportion of species of Fagetalia sylvaticae. Unlike in Fagion communities, termophilous species are present. A number of the humicolous species occurring in the more easterly Iberian Carpinion communities are absent. On the other hand, Omphalodo-Coryletum is characterized by the presence of various species not found in other Carpinion communities

(including several species endemic to the west Iberian Peninsula). In Table 3 (level 3) we summarize the characteristics by which Omphalodo-Coryletum can be distinguished from its vicariant syntaxa.

Biogeographical aspects

The majority of the relevés assigned to the new association are from the Naviano-ancarense Subsector of the Laciano-ancarense Sector of the Orocantábrica Province (see Fig. 1). However, the association was also found at two sites in the Galaico-asturiano septentrional Subsector of the Galaico-asturiano Sector, which is clearly attributable to the unusual topographic and edaphic conditions due to the limestone outcrops in that subsector. In our opinion, the presence of the association at these two sites indicates that, in the past, woodlands of this type were more widely distributed, at least in limestone areas of Galicia.

The westward migration of the characteristic species group of Fagetalia sylvaticae across the northern Iberian Peninsula came to a halt, for many species, in eastern Galicia (Izco et al. 1986). Furthermore, in the Galaico-asturiano septentrional Subsector, as a result of the scarcity of limestone substrates, the more nutrient-demanding species of Fagetalia become increasingly restricted to riparian woodland communities: as part of Alno-Ulmion in the case of genuinely alder-dominated woodland (see Bellot 1968), or as part of Blechno-Quercetum roboris subass. pulmonarietosum longifoliae at streamside sides where alder is not the dominant tree (Izco et al. 1990). In this connection, we consider that the relevé table presented by Díaz (1975) as Corylo-Fraxinetum cantabricum should be interpreted as belonging to Alno-Ulmion and not Carpinion; for this reason we have not included these data in our Table 1.

In conclusion, Omphalodo-Coryletum occurs within a specific territory in the westernmost part of the Orocantábrica Province. As can be seen from Figure 1 and Table 3 (level 1), its range does not overlap with those of the other Iberian Carpinion communitries described to date.

Dynamic aspects

Degradation of Omphalodo-Coryletum avellanae due to human pressure leads to the formation of characteristic shrub or herb communities, and these communities together form a vegetation series (i.e. a Sigmetum, sensu Géhu et al. 1981) presided by Omphalodo-Coryletum. The concept of vegetation series provides a further means by which the new association can be distinguished, on the basis of dynamic considerations, from its more easterly vicariants.

Moderate disturbance of Omphalodo-Coryletum leads to the appearance of a species-poor thornscrub of Rubo ulmifolii-Tametum communis, which is often present on the woodland fringe. This association is also typical on the fringe of Polysticho-Fraxinetum excelsioris woodland, though with certain differences in species composition (as expected given the more westerly distribution of Omphalodo-Coryletum): for example, *Euonymus europaeus*, *Ligustrum vulgare*, *Rhamnus alaternus* and *Rosa sempervirens* are absent from Rubo-Tametum in the Omphalodo-Coryletum series, while *Origanum virens* and *Ulex europaeus* (absent from or very rare in Rubo-Tametum in the Polysticho-Fraxinetum series; Arnáiz et al. 1983) are present. These differences indicate a need to consid-

er Rubo-Tametum in the Omphalodo-Coryletum series as a distinct subassociation, though it will not be possible to determine an appropriate name for this subassociation until the association Rubo-Tametum communis is correctly typified. Herrera (1988), in an unpublished doctoral thesis, suggests that relevé "Tx 184" from Tüxen et al. (1958) should be taken as the syntype of the typical subassociation (subass. loniceretosum periclymeni, without thermophilous species), thus validating the name of this syntaxon and exemplifying the ways in which it differs from the low-altitude subassociation rosetosum sempervirentis. We consider this proposal to be useful, and it would facilitate the definition of a new western subassociation, corresponding to the fringe community of the Omphalodo-Coryletum series, which might be called subass. origanetosum virentis.

The upper-hill and montane belt communities which develop following disturbance of Mercurialidi-Fraxinetum are similarly thornscrub formations. However, these formations occur at higher altitude, and generally in areas of more continental climate, than Rubo-Tametum in the Omphalodo-Coryletum series, and either constitute a clearly montane variant of Rubo-Tametum (subass. rosetosum villosae; see Puente 1988) or belong to a different alliance altogether (i.e. Berberidion; see Díaz et al. 1992).

Following more severe disturbance of Omphalodo-Coryletum, several different communities may arise. The characteristics of these communities depend on traditional land-use practices and other ecological factors. Frequently, woodland areas are clear-felled in order to convert the land to agricultural use. On valley bottoms and slope bottoms, for example, especially in limestone areas, Omphalodo-Coryletum woodland has often been replaced by Arrhenatherion elatioris grassland communities (such as Trifolio-Malvetum moschatae; Izco et al. 1982). On steeply sloping or slope-top sites, on the other hand, the replacing community is often a natural Bromion erecti grassland, such as Helianthemo-Brometum erecti (Guitián et al. 1988).

Extreme degradation of Omphalodo-Coryletum, with associated reductions in soil depth, generally leads to the appearance of scrub communities of Ulicion minoris, dominated by *Ulex europaeus* or, in colder areas, by *Erica australis* and *Erica arborea*. Unlike in the vegetation series of Polysticho-Fraxinetum and Mercurialidi-Fraxinetum, spiny chamaephyte communities of Genistion occidentalis never occur in the Omphalodo-Coryletum series. Likewise, the Ulicion minoris scrub communities which may form part of the Omphalodo-Coryletum series never contain *Ulex cantabricus* or *Erica vagans*.

To characterize the fire- and grazing-resistant vegetation which often replaces Omphalodo-Coryletum, we have described a community which might be defined as a "gorse grassland". This is a hill-belt community restricted to limestone substrates, denominated Helianthemo cantabrici-Brometum erecti subass. ulicetosum europaei (Amigo et al. 1994).

In addition to the above communities which arise in response to differing degrees of disturbance of Omphalodo-Coryletum, it should be pointed out that, in the absence of disturbance, this association may possibly progress towards a more mature woodland type. Although the name chosen for the association may seem to imply hazel woodland, *Corylus* is considerably shorter than several of the tree species characteristically present, and in fact Omphalodo-Coryletum, when reasonably mature, has a multispecies upper canopy layer. Like Tüxen et al. (1958) and the name "Corylo-Fraxinetum cantabricum", we have chosen to use *Corylus* as a name-giving taxon in view of the constancy and abundance of hazel in these formations. The abundance of hazel, which may on occasions form a dense canopy of about 8–10 m in height, guarantees the maintenance of a

nemoral environment even when the wood is subject to a certain amount of felling. We are unable to confirm whether Omphalodo-Coryletum will eventually give way to oakwood (as appears to be the case with Polysticho-Fraxinetum), since we do not know of any examples of this formation of sufficient age. In one of our best examples of Omphalodo-Coryletum – that selected as syntype (Table 2, relevé 12) – *Quercus robur* is present with very high cover in the canopy layer. On the other hand, we have also found examples, within the same biogeographical subsector, in which the dominant tree species is *Quercus pyrenaica* (e.g. Table 2, relevé 16). We therefore consider it inappropriate to use "Quercetum" in the name of the new association.

Were these woodlands to enjoy adequate legal protection, we would perhaps be able to observe their progression towards a more mature stage (probably mixed oakwood). However, in view of the coppicing pressure to which these formations are invariably subject in Galicia, the name "Coryletum" – reflecting the most evident physiognomic feature of the syntaxon – seems more appropriate than a *Quercus*-derived name. Patterns of disturbance of the tree layer similar to those often affecting Omphalodo-Coryletum formations have been described in detail for English *Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland (Rodwell et al. 1991). This is probably the most similar British community to the Carpinion communities of northwest Iberia.

In conclusion, there are characteristic differences between the dynamics (as between the ecology and biogeography) of Omphalodo-Coryletum avellanae and its more easterly vicariants. In Table 3 (levels 4 and 5), we summarize the characteristics of most important of the woody formations typically arising following disturbance of the different Iberian Carpinion communities.

Conclusions

The Atlantic and Central European mesophytic decidiuous woodlands of the alliance Carpinion Issler 1931 em. Mayer 1937 reach the southwestern limit of their distribution in Galicia (northwest Iberian Peninsula).

A study of the Carpinion woodlands of Galicia and of more easterly parts of the northern Iberian Peninsula has indicated the presence of a new association: Omphalodo nitidae-Coryletum avellanae. This association can be distinguished from its more easterly vicariants by the absence of certain species and the presence of others.

The vegetation series presided by Omphalodo-Coryletum (Omphalodo-Coryleto-sigmetum) comprises formations including Pruno-Rubion ulmifolii thornscrub (characeristically occurring on the woodland fringe), heaths/gorse scrubs of Ulicion minoris and Arrhenaterion or Bromion erecti grasslands. The new association occurs in the hill belt at low to medium altitude.

The characteristic development of deep fertile soils beneath Omphalodo-Coryletum has motivated widespread clear-felling of this formation, for conversion of the land to agricultural use. In view of this situation, the few remaining examples of this vegetation type should be the object of special conservation measures.

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References

Amigo, J. and Giménez de Azcárate, J. 1994. Los pastizales de Bromion erecti W. Koch en su posición finícola suroccidental. Docum. Phytosoc., 15:10 pp. (paginación no definitiva).

Amigo, J., Guitián, J. and Fernández-Prieto, J. A. 1987. Datos sobre los bosques ribereños de aliso (*Alnus glutinosa*) Cántabro-atlánticos ibéricos. Secretariado de Publicaciones, Univ. de la Laguna, Serie Informes, 22:159–176.

Arnáiz, C. and Loidi, J. 1983. Sintaxonomía del Pruno-Rubion ulmifolii (Prunetalia) en España. Lazaroa, 4:17–22.

Báscones, J. C. 1978. Relación suelo-vegetación en la Navarra húmeda del Noroeste. Estudio florístico-ecológio. Tesis Doctoral, Univ. Navarra.

Bellot, F. 1968. La vegetación de Galicia. Anal. Inst. Bot. Cavanilles, 24:1–306.

Castroviejo, S. 1973. Notas preliminares sobre la vegetación del tramo occidental de la Cordillera Cantábrica (Sierra de los Ancares). Asturnatura, 1:59–69.

Castroviejo, S., Lainz, M., López-Gonzalez, G., Montserrat, P., Muñoz-Garmendia, Paiva, J. and Villar, L. (Eds.) 1986, 1990. Flora Iberica, Vols. I y II. Publicaciones del C.S.I.C. Madrid.

Castroviejo, S., Aedo, C., Gómez-Campo, C., Lainz, M., Montserrat, P., Morales, R., Muñoz-Garmendia, F., Nieto-Feliner, G., Rico, E., Talavera, S. and Villar, L. (Eds.) 1993. Flora Iberica, Vols. III y IV. Publicaciones del C.S.I.C. Madrid.

Carballeira, A., Devesa, C., Retuerto, R., Santillán, E. and Ucieda, E. 1983. Bioclimatología de Galicia. Fundación P. Barrié de la Maza. A Coruña.

Díaz, T. E. 1975. La vegetación del litoral occidental asturiano. Rev. Fac. Ci. Univ. Oviedo, 16:369–545.

Díaz, T. E. and Fernández-Prieto, J. A. 1992. Guía de la Excursión Geobotánica de las XII Jornadas de Fitosociología, Oviedo. Multicopia, 104 pp.

Fernández-Prieto, J. A. and Vázquez, V. M. 1987. Datos sobre los bosques asturianos orocantábricos occidentales. Lazaroa, 7:363–382.

Franco, J. do Amaral. 1971. Nova Flora de Portugal (Continente e Açores), Vol. I. Sociedade Astoria Lda., Lisboa.

Géhu, J. M. and Rivas-Martínez, S. 1981. Notions fondamentales de phytosociologie. *In* Dierschke, H. (Red.): Syntaxonomie: 5–53. J. Cramer Ed. Vaduz.

Giménez de Azcárate, J. 1993. Estudio fitosociológico de la vegetación de los afloramientos calizos de Galicia. Tesis Doctoral, Univ. Santiago de Compostela.

Guitián, J., Izco, J. and Amigo, J. 1988. El Mesobromion cantábrico y su diferenciación occidental. Doc. Phytosociol., N.S., 11:275–282.

Herrera, M. 1988. Estudio de la vegetación y flora vascular de la cuenca del río Asón (Cantabria). Tesis Doctoral, Univ. País Vasco.

Izco, J., Amigo, J. and Guitián, J. 1986. Identificación y descripción de los bosques montanos del extremo occidental de la cordillera Cantábrica. Trab. Compostelanos Biol., 13:183–202.

Izco, J., Amigo, J. and Guitián, J. 1990. Los robledales Galaico-septentrionales. Acta Bot. Malacitana, 15:267–276.

Izco, J. and Guitián, J. 1982. Los prados de siega con *Malva moschata* (Arrhenatherion elatioris) en Galicia. Pastos, 12(2):255–264

Navarro, F. 1974. La vegetación de la sierra del Aramo y sus estribaciones (Asturias). Rev. Fac. Ci. Univ. Oviedo, 15(1):111–243.

Puente, E. 1988. Flora y vegetación de la cuenca alta del río Sil (León). Institución Fray Bernardino de Sahagún, Exma. Diputación de León, 437 pp.

Rivas-Martínez, S. 1964. Esquema de la vegetación potencial y su correspondencia con los suelos en la España Peninsular. Anal. Inst. Bot. Cavanilles, 22:342–405.

Rivas-Martínez, S. 1984. Pisos bioclimáticos de España. Lazaroa, 5:33–43.

Rivas-Martínez, S. 1987. Memoria del Mapa de Series de Vegetación de España. 1:400 000. Publ. ICONA. Madrid.

Rivas-Martínez, S., Báscones, J. C., Díaz, T. E., Fernández-González, F. and Loidi, J. 1991. Vegetación del Pirineo occidental y Navarra. Itinera Geobotanica, 5:5–455.

Rivas-Martínez, S., Díaz, T. E., Fernández-Prieto, J. A., Loidi, J. and Penas, A. 1984. La vegetación de la alta montaña cantábrica: Los Picos de Europa. Ed. Leonesas, 300 pp.
Rivas-Martínez, S. and Loidi, J. 1988. Los robledales mesofíticos navarro-alaveses (Crataego laevigatae-Quercetum roboris). Lazaroa, 10:81–88.
Rivas-Martínez, S., Loidi, J., Cantó, P., Sancho, L. G. and Sánchez-Mata, D. 1985. Datos sobre la vegetación del valle del río Bidasoa (España). Lazaroa, 6:127–150.
Rodwell, J. S., Pigott, C. D., Ratcliffe, D. A., Malloch, A. J. C., Birks, H. J. B., Proctor, M. C. F., Shimwell, D. W., Huntley, J. P., Radford, E., Wigginton, M. J. and Wilkins, P. (Eds.) 1991. British Plant Communities, Vol. 1. Cambridge University Press, 395 pp.
Romero, M. I. and Amigo, J. 1992. Apuntes sobre la flora gallega, XII. Bol. Soc. Brot., Sér. 2, 65:195–203.
Romero, M. I., Buján, M. and Amigo, J. 1989. Nuevos datos sobre flora gallega. Anu. Soc. Brot., 55:11–18.
Tutin, T. G., Heywood, V. H., Burges, N. A., Moore, D. M., Valentine, D. H., Walters, S. M. and Webb, D. A. (Eds.) 1964–1980. Flora Europaea, Vols. 1, 2, 3, 4 and 5. Cambridge University Press, Cambridge.
Tüxen, R. and Oberdorfer, E. 1958. Die Pflanzenwelt Spaniens. II Teil. Eurosibirische Phanerogamen-Gesellschaften Spaniens. Veröff. Geobot. Inst. Rübel, 32:1–328.

Nomenclature

The biogeographical and bioclimatic terminology used follows that of Rivas-Martínez (1973, 1984), updated by Rivas-Martínez et al. (1984, 1991), Rivas-Martínez (1987) and Diaz et al. (1992). Names of provinces, sectors and subsectors are given in the original Spanish, since no standard translation to English exists. Taxonomic nomenclature follows that of Castroviejo et al. (1986–1993), or of Tutin et al. (1964–1980) for taxa not included in the work of Castroviejo et al. Syntaxonomic nomenclature follows that of Rivas-Martínez et al. (1991); authorities for syntaxa not included in that work are listed in the following appendix.

Appendix

Complete name and correspondent superior syntaxa of associations and subassociations cited in the text but not included in Rivas-Martínez et al. (1991).

Ass. Pulmonario longifoliae-Fagetum sylvaticae Riv.-Mart. 1964 (Carpinion, Fagetalia sylvaticae, Querco-Fagetea).
Ass. Mercurialidi perennis-Fraxinetum excelsioris Fdez.-Prieto & Vázquez 1987 (Carpinion, Fagetalia sylvaticae, Querco-Fagetea)
subass. fraxinetosum excelsioris
subass. omphalodetosum nitidae Fdez.-Prieto & Vázquez 1987
Ass. Omphalodo nitidae-Coryletum avellanae ass. nova (Carpinion, Fagetalia sylvaticae, Querco-Fagetea).
Ass. Blechno spicantis-Quercetum roboris R.Tx. & Oberd. 1958 (Quercion robori-pyrenaicae, Quercetalia roboris, Querco-Fagetea)
subass. pulmonarietosum longifoliae Izco, Amigo & Guitián 1990
Ass. Rubo ulmifolii-Tametum communis R.Tx. & Oberd. 1958 (Pruno-Rubion ulmifolii, Prunetalia spinosae, Querco-Fagetea)
subass. loniceretosum periclymeni R.Tx. & Oberd. 1958
subass. rosetosum sempervirentis Arnáiz & Loidi 1982

subass. rosetosum villosae Puente 1987
subass. origanetosum virentis nova prov.
Ass. Trifolio dubii-Malvetum moschatae Izco & Guitián 1982 (Arrhenatherion, Arrhenatheretalia, Molinio-Arrhenatheretea).
Ass. Helianthemo cantabrici-Brometum erecti Guitián, Izco & Amigo 1988
subass. brometosum erecti
subass. ulicetosum europaei Amigo & Giménez de Azcárate 1994