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SYNTAXONOMIC CONSPECTUS OF THE VEGETATION OF CATALONIA AND ANDORRA. I: HYGROPHILOUS HERBACEOUS COMMUNITIES

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ABSTRACT

The first part of a general survey of the vegetation of Catalonia and Andorra, this paper reports all the phytocoenological associations and subassociations recorded in this area. For each community, we provide the correct name and usual synonyms, its typification (where appropriate), all the references including relevés, and the most outstanding features of its structure, species composition, ecology, distribution and diversity. Moreover, associations and subassociations are ordered appropriately in a syntaxonomic scheme. Syntaxonomic ranks are considered in a fairly broad, conservative sense. This classification established 101 associations, which correspond to the classes *Lemnetea, Zosteretea, Potametea, Littorelletea, Montio-Cardaminetea, Phragmiti-Magnocaricetea, Scheuchzerio-Caricetea, Isoeto-Nanojuncetea* and *Molinio-Arrhenatheretea*.

Key words: Phytocoenology, Typification, Classification, Vegetation, Catalonia, Andorra, Mediterranean, Medioeuropean, Alpine.

Introduction

In recent years the need for vegetation surveys has become increasingly apparent at all scales, for a number of reasons. Following several decades of geographical research, syntaxonomic surveys are now seen as representing an improvement in our understanding of vegetation. In addition, land management, including conservation aspects, has highlighted the need among public bodies (at the European, state and regional levels) for vegetation catalogues and syntheses.

The surface of Catalonia and Andorra, c. 32,500 sq km, has a highly diverse vegetation. Mainly mediterranean in character, the area includes both coastal and continental lands, whose landscapes range from dry, meridional maquis (*Oleo-Ceratonion*) domains to those of the mild montane slopes (closely resembling those found in Medio-European areas); while upland areas are typified by alpine landscapes of Pyrenean glacial cirques and summits.

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Phytocoenological sampling, dating back to the fifties, has resulted in more than 14,000 relevés and 611 associations (FONT *et al.* 1998). Although some sampling irregularities are apparent, both in terms of syntaxonomy and geography, our knowledge of the communities in Catalonia and Andorra may be considered sufficient to produce a comprehensive conspectus which might serve as: a) a vegetation synthesis per se (a catalogue providing information useful for management purposes); b) a data set from which to produce conspecta or syntheses at broader geographical scales; and c) a starting point for the revision of syntaxa, providing both an initial syntaxonomic outline and as an index to all references including vegetation relevés.

The first part of this Conspectus is presented here. It includes communities that range from the free-floating carpets of *Lemnetea* and the therophytic, seasonal communities of *Isolepido-Nanojuncetea* to the meadows and herbages of *Molinio-Arrhenatheretea*. In this part, 101 associations are reported, from almost 2,000 relevés.

Study area

The study area includes the autonomous territory of Catalonia and the state of Andorra; only communities recorded in this area are considered, although complementary data from neighbouring zones are sometimes included. This area is in the north-eastern corner of the Iberian Peninsula, and lies between the eastern half of the Pyrenees to the north, the mediterranean coast to the south-east and the driest areas of the Ebre basin to the west (Figure 1).

Relief features rise from sea level to more than 3,000 m a.s.l. in the Pyrenees. The main mountain systems are the Pyrenees, which include the main chain and a number of parallel pre-Pyrenean ranges, and the Catalanidic system, which runs parallel to the coast and includes several peaks rising above 1,000 m (Montseny, 1,712 m; Ports de Beseit, 1,447 m). Other major orographic features include the Transversal system, which links the Montseny area with the eastern Pyrenees, and a series of plateaus stretching south from the pre-Pyrenees to the South Catalanidic mountains. The plains may be grouped into four systems: coastal (mainly very narrow), pre-littoral (part of the Catalanidic system, which is split in two parallel ranges), central basins (partly coinciding with the plateaus, with altitudes mainly between 200 and 600 m) and the Sicoric plain (which is the eastern part of the Iberian depression, at 150-500 m a.s.l.).

Two main basins dominate the area: the Ebre basin, including the lower course of this river and some of its main affluents (Segre, Noguera Pallaresa, Noguera Ribagorçana); and those basins extending from the eastern Pyrenees or the Catalanidic ranges to the Mediterranean sea (Fluvià, Ter, Tordera, Besòs, Llobregat, Foix, Gaià and Francolí). Pyrenean rivers have a fairly constant, nivo-pluvial regime, whereas the others are characterized by more irregular regimes.

There are also a number of small coastal ravines and "rambles" where water flows only occasionally.

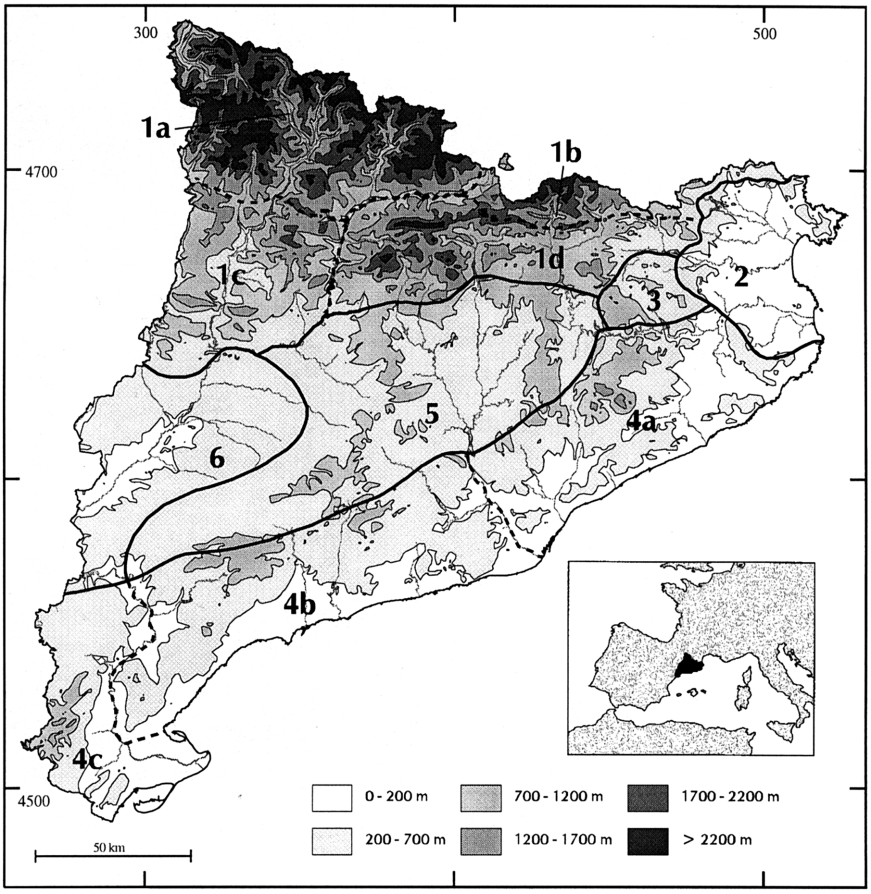

Figure 1. Location and sectorialization of the survey area. **1**, Pyrenees (**1a** & **1b**, axial Pyrenees; **1c** & **1d**, pre-Pyrenees; **1a** & **1c**, Central Pyrenees; **1b** & **1d**, Eastern Pyrenees); **2**, Ruscinic territory; **3**, Olositanic territory; **4**, Catalanidic territory (**4a**, North Catalanidic terr.; **4b**, Central Catalanidic terr.; **4c**, South Catalanidic terr.); **5**, Ausosegarric territory; **6**, Sicoric territory.

Physiographic complexity gives rise to a marked diversity in local and regional climates, which range from arid mediterranean (in the southern and western lowlands), with long periods of summer drought, to humid high mountain (in the Pyrenees), with high rainfall and low temperatures. Intermediate types include mild mediterranean (in the northern littoral areas), subatlantic and submediterranean (in most of the mountain areas). In general, two climatic

gradients can be distinguished; dryness and mean temperatures increasing north to south (in part, due to a decrease in altitude) while continentality increases from the coast westwards. Annual rainfall ranges from 400 mm to more than 1,500 mm, and mean annual temperature from 18°C (on the southern coast) to less than 3°C (in the alpine belt).

Substrata are mainly lime materials (hard limestone, conglomerate, marl), but acidic outcrops (slate, granite, sandstone) occur in large areas, mainly in the axial Pyrenees and in the northern half of the Catalanidic system. Other substrata, such as gypsum, salt soils (both coastal and inland), volcanic materials and sandy beaches complete a highly diverse ensemble.

Given this diversity of climate, altitude and substrate conditions, Catalonia not unsurprisingly boasts a rich flora (more than 3,200 broad species of higher plants) and one of the most varied European landscapes, in spite of its size. Mediterranean, Medio-European (= Eurosiberian) and Boreo-alpine elements abound in its flora, and other more specific groups (Atlantic, Pontic, Iranotu-ranian, etc.) are well represented. Zonal vegetation includes mediterranean maquis (both thermophilous and continental), Aleppo pinewoods, sclerophyllous woodlands (holm-oak and cork-oak forests), deciduous woodlands (dry and acidophilous oak forests, beechwoods, ashwoods, etc.), non-mediterranean conife-rous woodlands (forests of Salzmann pine, Scots pine, mountain pine, silver fir) and alpine pastures.

The distribution of plant communities reveals two main features: altitude zonation and physiographic sectors. The altitude gradient, which is the dominant factor, may be described throughout virtually all the mountain areas by using the alpine-type vegetation belts: Alpine, subalpine, montane and submontane, each of which may be subdivided to include humid and dry variants. All these belts have non-mediterranean landscapes: Alpine and subalpine belts, commonly referred to as high mountain, are Boreo-alpine, whereas montane and submontane belts are predominantly Medio-European, although submontane is mainly submediterranean and includes some mediterranean units in its driest areas. In the southernmost mountains, however, Medio-European communities are obscured by dominant mediterranean vegetation types even at medium altitudes, and consequently their corresponding belts are frequently referred to as mediterranean mountain. Low altitude areas mainly provide habitats for mediterranean vegetation, and are included here as lowlands.

A sectorialization of Catalonia, which is of particular use to biogeographers, has been proposed by Bolòs (1975; Bolòs & Vigo 1984; see Figure 1). It might be summarized as follows:

1) Pyrenees. These include several ranges with interspersed valleys and basins. The axial ranges (1a & 1b; mainly siliceous) roughly mark the northern boundary of Catalonia, while in the south lie the pre-Pyrenean ranges (1c & 1d; mainly calcareous). Longitudinally, the Cerdanya depression defines the Central Pyrenees

(1a & 1c; westwards) and the Eastern Pyrenees (1b & 1d; eastwards). The climate ranges from dry submediterranean to alpine and atlantic.

2) Ruscinic territory. Littoral lowland in the north-eastern corner, surrounded by mountain areas. Main substrata are granite and alluvia, and the climate is clearly mediterranean, frequently windy.

3) Olositanic territory. Roughly corresponding to the Transversal system, comprising chiefly limestone and volcanic materials. Climates are humid and range from mild mediterranean to subatlantic.

4) Catalanidic territory. This stretches along the coast and includes the Catalanidic mountain system and the associated plains. It may be split into three sections, defined by the rivers Llobregat and Ebre: North (4a; with mild mediterranean to subatlantic climatic types), Central (4b; mainly calcareous and with mediterranean to submediterranean climates) and South (4c; also calcareous but with drier climates).

5) Ausosegarric territory. This includes the central high plateaus and the central basins. Lime outcrops are dominant, and gypsum is present in places. The climate ranges from mediterranean to submediterranean, though always with a continental tendency.

6) Sicoric territory. This eastern part of the Ebre basin has mainly silty-clay and limestone substrata, and includes gypsum and salt soils. The climate is continental dry mediterranean.

Compilation and organization of the conspectus

In producing this Conspectus we began with a complete bibliographic retrieval using the Data Bank of Catalan Flora and Vegetation FLORACAT (FONT & NINOT 1995) and a critical analysis of the relevés available and the communities described. Where appropriate, synthetic tables were produced using the *ad hoc* set of programs XTRINAU (FONT & NINOT, op.cit.). In this initial synthesis of vegetation, we compiled information on associations by applying largely the criteria used by the authors in describing or discussing them. Only in cases of conflicting interpretation did we apply our own criterion, using the most appropriate rank and syntaxa. We include in small characters those associations which are based on unreliable data or on poorly-defined assemblages.

Associations are included according to their correct name and usual synonyms. The information gathered for each association has been reduced to short, standardized descriptions which are organized into five specific aspects: a) Typification (when described from Catalonia or nearby areas), b) Data (references including relevés, or syntheses of relevés, from the survey area), c) Structure (short comment on structure and composition, including main species), d) Ecology (substrata, bioclimate, dynamics) and e) Distribution (in Catalonia, on the basis of vegetation belts and physiographic territories). Two complementary

paragraphs are added where necessary: f) Variabilily (which accounts for the recognized subassociations) and g) Comments (short notes on syntaxonomical aspects). In the nomenclature of taxa cited in this paper we follow BOLÒS *et al.* 1993.

The data referenced in this paper may be easily complemented by visiting the web "http://biodiver.bio.ub.es/biocat/homepage.html", where the interested reader will find, not only an up-to-date list of references for each association, but also the transciption of each published relevé.

The Conspectus deals primarily with associations and subassociations, as these are the most "objective" vegetation ranks, and we have sought at all times to handle these syntaxa accurately, both in terms of definition and nomenclature (following the CPN, BARKMANN *et al.* 1988, as far as possible). The classification of these associations in the syntaxonomical scheme is our secondary objective. A fairly conservative classification system is applied, assuming that changes in the scheme should be clearly assessed by inductive processes, and not just by intuition, which is a frequent failing in vegetation syntheses.

Results and discussion

LEMNETEA MINORIS (Koch et Tüxen) Schwabe et Tüxen 1981
LEMNETALIA MINORIS (Tüxen) Schwabe et Tüxen 1981
LEMNION MINORIS Koch et Tüxen 1954

Lemnetum gibbae (Koch) Miyawaki et J. Tüxen 1960

[*Lemno-Azolletum* Braun-Blanquet 1952 in Braun-Blanquet et al. *lemnetosum gibbae* O. Bolòs et Masclans 1955; Lectotypus: Bolòs & Masclans 1955, *Collect. Bot.* 4 :427-428, rel. B (Sant Carles de la Ràpita, Ebre delta; designed in Bolòs 1997 :215)]

Data: BOLÒS & MASCLANS (1955), CONESA (1990, 1991a), CURCÓ (1996), GESTI (2000).

Structure: Free-floating populations of *Lemna gibba*, in places including small groups of *L. minor*.

Ecology: Eutrophic, sometimes polluted, standing fresh waters.

Distribution: Sparse throughout the area, mainly in lowlands.

Lemnetum minoris (Oberdorfer) Th. Müller et Görs 1960

[*Lemno-Azolletum* Braun-Blanquet in Braun-Blanquet et al. 1952 *lemnetosum minoris* O. Bolòs et Masclans 1955; Lectotypus: BOLÒS & MASCLANS 1955, *Collect. Bot*. 4 :427-428, rel. B (Sant Carles de la Ràpita, Ebre delta; designed in BOLÒS 1997 :215)]

Data: BOLÒS (1967), BOLÒS & MASCLANS (1955), GESTI (2000), SORIANO (1992).

Structure: Free-floating populations of *Lemna minor*, generally monospecific.

Ecology: Standing or sheltered, eutrophic waters.

Distribution: Common throughout the study area, in lowlands and in the montane belt.

RICCIO FLUITANTIS-LEMNION TRISULCAE (Tüxen et Schwabe) Schwabe et Tüxen 1981

Riccietum fluitantis Slavnic 1956

Data: CURCÓ (1996).
Structure: Free-floating populations of *Riccia fluitans*, in places accompanied by *Lemna minor, Callitriche obtusangula* or *Chlorophyta* species.
Ecology: Sheltered, oligotrophic, peat-rich waters.
Distribution: Only reported from the Ebre delta.

LEMNO-SALVINION NATANTIS Schwabe et Tüxen 1981

Lemno-Azolletum filiculoidis Braun-Blanquet in Braun-Blanquet et al. 1952

[*Lemno-Azolletum azolletosum carolinianae* (= *filiculoidis*) O. Bolòs et Masclans 1955]
Data: BOLÒS & MASCLANS (1955), CURCÓ (1996).
Structure: Free-floating populations of *Azolla filiculoides* (= *A. caroliniana*) and *Lemna minor*, in places including other hygrophytes (as *Callitriche obtusangula* or *Myriophyllum spicatum*)
Ecology: Rice fields, in eutrophic, standing waters.
Distribution: Ebre and Llobregat deltas.

ZOSTERETEA MARINAE Pignatti 1953
ZOSTERETALIA MARINAE Béginot 1941
ZOSTERION W. Christiansen 1934

Giraudio-Zosteretum noltii Boudouresque, Belsher et Marcot-Coqueugniot 1977

Data (without relevés): BALLESTEROS (1992, 1995), BALLESTEROS & ROS (1989).
Structure: Beds of *Zostera noltii,* usually with the epiphytic alga *Giraudia sphacelarioides*.
Ecology: Upper part of the infralittoral zone, permanently submerged in waters down to 5 metres deep. In closed bays.
Distribution: Only known from Creus cape and Ebre delta.

Cymodoceetum nodosae J. Feldmann 1937

Data (without relevés): BALLESTEROS (1992, 1995), BALLESTEROS & ROS (1989).
Structure: Formation of *Cymodocea nodosa*, monospecific or associated with the alga *Caulerpa prolifera*.
Ecology: Muddy sands, permanently submerged in waters down to 15-20 metres deep.
Distribution: Sparse along the coast.

POSIDONION OCEANICAE Braun-Blanquet in Braun-Blanquet et al. 1952

Posidonietum oceanicae Funk 1927
Data (without relevés): BALLESTEROS (1992, 1995), BALLESTEROS & ROS (1989).
Structure: Dense beds of *Posidonia oceanica,* the accumulation of rhizomes forming organogenic reefs.
Ecology: Sedimentary habitats, waters down to 25 (40) metres deep.
Distribution: Common along the coast.

POTAMETEA Tüxen et Preising 1942
RUPPIETALIA Tüxen 1960
RUPPION MARITIMAE Braun-Blanquet 1931

Ruppietum maritimae Hocquette 1927
Data: CURCÓ (1996).
Structure: Submerged, rooting stands of *Ruppia maritima,* in some cases including green algae populations.
Ecology: Shallow littoral pools, in waters which become strongly saline in summer.
Distribution: It has been found only in the Ebre delta.

Chaetomorpho lini-Ruppietum Braun-Blanquet in Braun-Blanquet et al. 1952
Data: CURCÓ (1996), GESTI (2000).
Structure: Submerged, rooting carpets of *Ruppia cirrhosa,* including green algae populations, mainly *Chaetomorpha crassa* and *Ch. linum.*
Ecology: Brackish pools, in waters with seasonally variable salt contents.
Distribution: It is found in the Ebre delta and in the Empordà flood plain.
Variabilily: Two subassociations are known.
- **typicum**, which corresponds to the described community.
- **potametosum pectinati** Curcó 1996. Holotypus: Curcó 1996, *Doc. phytosoc.* 16 :279, tab. 4, rel. 3 (Canal Vell, Ebre delta). Found in waters with low salinity, it includes the differential *Potamogeton pectinatus.*

POTAMETALIA Koch 1926
POTAMION PECTINATI (Koch) Libbert 1931
[*Potamion eurosibiricum* Koch 1926]

Nymphaeetum albo-luteae Nowinski 1928
(*Myriophyllo verticillati-Nupharetum* Koch 1926).
Data: GESTI (2000).
Structure: Submerged, dense carpets of *Myriophyllum spicatum* and *Ceratophyllum demersum*, including *Nymphaea alba* or other macrophytes at places.
Ecology: Fresh, still waters.

Distribution: Only found in the Ruscinic littoral (Aiguamolls de l'Empordà).

Ranunculetum baudotii Braun-Blanquet in Braun-Blanquet et al. 1952
[*Callitricheto-Ranunculetum baudotii* R. Mol. et Tallon 1970]
Holotypus: BRAUN-BLANQUET in BRAUN-BLANQUET *et al.* 1952, *Vég. France Med.* :79.
Data: FARRÀS & VELASCO (1994, sub. *Callitricheto-Ranunculetum baudotii*), GESTI (2000).
Structure: Dense, submerged assemblages of *Ranunculus baudotii, Zannichellia palustris, Callitriche* spp., *Groenlandia densa* and some *Characeae*.
Ecology: Standing, shallow, fresh- to brackish waters which become fairly warm in summer.
Distribution: Found at the coastal Ruscinic territory.

Potamo-Utricularietum Braun-Blanquet in Braun-Blanquet et al. 1952
Data: CONESA (1991b), CURCÓ (1996).
Structure: Submerged stands of *Utricularia australis* (= *U. vulgaris* auct.) in some cases including *Chara* spp. populations and rare companions.
Ecology: In standing, oligotrophic waters, rooting in peat-rich beds.
Distribution: Sparse in mediterranean lowlands (Sicoric and South Catalanidic territories).

Potametum pectinati Carstensen 1955
Data: CURCÓ (1996).
Structure: Dense to highly dense, almost monospecific populations of *Potamogeton pectinatus*, in places including some algae species.
Ecology: Eutrophic, brackish, sheltered waters of littoral permanent ponds.
Distribution: It is only found in the Ebre delta.
Variabilily: Two subassociations have been found.
- **typicum**, which corresponds to the described community.
- **ruppietosum cirrhosae** Curcó 1996. Holotypus: CURCÓ 1996 *Doc. phytosoc.* 16 :282, tab. 6, rel. 3 (Canal Vell, Ebre delta). Occurring in more saline waters, it is differentied by *Ruppia cirrhosa*.

Potametum denso-nodosi O. Bolòs 1957

Lectotypus: A. Bolòs 1950, *Veg. com. barcelonesas* :81-82 (near Besós river, N Catalanidic terr.; designed in BOLÒS 1997 :217).

Data: A. BOLÒS (1950), BOLÒS (1957b, 1959, 1962), CARRILLO & NINOT (1992), CONESA (1991a, 1991b), CURCÓ (1996), FARRÀS & VELASCO (1994), GESTI (2000).
Structure: Pond-weed, submerged formations frequently dominated by *Potamogeton densus* or *Potamogeton nodosus*, and in places containing other *Potamogeton* species or *Ceratophyllum demersum*, as well as green algae or free-floating macrophytes.
Ecology: In eutrophic, turbid, low-running waters of rivers, reservoirs and channels, rooting in fine-textured beds rich in organic matter.

Distribution: General but sparse throughout the area, in lowlands or in the submontane belt.

Potamo-Najadetum marinae Horvatic et Micevski 1963

Data: CURCÓ (1996), FARRÀS & VELASCO (1994).

Structure: Dense or sparse, monospecific populations of *Najas marina*.

Ecology: Shallow ponds drying out in summer, with fresh, eutrophic waters.

Distribution: Only found in the Ebre delta.

Comment: The community reported by FARRÀS & VELASCO (1994), from the Ruscinic plain, is only tentatively classified there, as it is mainly formed by an assemblage of *Najas minor, Ceratophyllum demersum* and *Zannichellia palustris*.

Potamo pectinati-Myriophylletum spicati Rivas Goday 1964

Data: CONESA (1990, 1991a).

Structure: Submerged populations of *Potamogeton pectinatus* and *Myriophyllum spicatum*.

Ecology: Eutrophic, warm, standing waters.

Distribution: Mediterranean, continental lowlands (Sicoric territory).

Ranunculo eradicati-Potametum alpini Ballesteros et Gacia 1991

Holotypus: BALLESTEROS & GACIA 1991, *Butll. Inst. Cat. Hist. Nat.* 59 :91, tab. 1, rel.1 (Anglós lake, 2205 m, C Pyrenees).

Data: BALLESTEROS & GACIA (1990, 1991).

Structure: Submerged community formed by some rooting, lax, narrow-leaved, alpine hygrophytes, mainly *Potamogeton berchtoldii, P. alpinus, Ranunculus trichophyllus* subsp. *eradicatus* (= subsp. *lutulentus*) and *Myriophyllum alternifolium*.

Ecology: Neutral to slightly alcaline waters of ponds and small lakes, with medium contents of calcium; settling on silt beds, 0.5 to few meters deep.

Distribution: Central Pyrenees, in the alpine and high subalpine belts.

Ranunculo tripartiti-Myriophylletum alterniflori Franquesa 1995

Holotypus: FRANQUESA 1995, *Arx. Secc. Cièn.* 109 :340, tab. 22, rel.1 (Cap de Creus, 250 m, Ruscinic terr.).

Data: FRANQUESA (1995).

Structure: Fairly dense, rooting, submerged community formed by narrow-leaved hygrophytes, such as *Myriophyllum alternifolium*, *Ranunculus tripartitus*, *Callitriche obtusangula* and bryophytes (*Fontinalis...*).

Ecology: Lime poor, slow waters, in parts of small rivulets or inside ponds.

Distribution: Only found in the Ruscinic littoral area (Creus cape).

Zannichellio palustris-Potametum colorati O. Bolòs & R. Molinier in O. Bolòs 1996

[*Potametum colorati* auct., nom. illeg.]

Holotypus: BOLÒS & MOLINIER 1958, Collect. Bot. 5 :792, sub. group. à *Potamogeton coloratus* (Santa Ponça, Mallorca; designed in BOLÒS 1996b :61)
Data: CONESA (1991a), CURCÓ (1996).

Structure: Formations of *Potamogeton coloratus*, which in places include *Chara* spp. populations and occasionaly, sparse emerged hydrophytes (such as *Apium nodiflorum*).

Ecology: It develops in lime-rich, slow-running, clean waters, rooting in fine-textured beds.

Distribution: Sparse in meridional, mediterranean lowlands, both in littoral and in continental areas.

Potamo-Vallisnerietum spiralis Braun-Blanquet 1931 **nymphaeetosum albae** Curcó 1996

Holotypus: CURCÓ 1996 *Doc. phytosoc.* 16: 283, tab. 7, rel. 5 (Ullals de Baltasar, Ebre delta).
Data: CURCÓ (1996).

Structure: Fairly dense *Nymphaea alba* stands, including *Myriophylum spicatum* or *Ceratophyllum demersum* under its floating leaves.

Ecology: Oligotrophic, lime-rich, clean waters.

Distribution: Only identified from the Ebre delta.

ISOETO-LITTORELLETEA Braun-Blanquet et Vlieger in Vlieger 1937
LITTORELLETALIA Koch 1926
LITTORELLION UNIFLORAE Koch 1926

Isoeto lacustris-Sparganietum borderei Braun-Blanquet 1948

[*Sparganio angustifolii-Isoetetum echinospori* Rivas Martínez & G. Navarro 1987 p.p.]
Lectotypus: BRAUN-BLANQUET 1948, *Vég. alp. Pyr. or.* :108, rel. B (Estany de la Llosa, 2250 m, Carlit, E Pyrenees; designed here).
Data: BALLESTEROS & GACIA (1990), BALLESTEROS *et al.* (1989), CARRILLO & NINOT (1992).

Structure: Submerged community formed by a small number of rosette-forming, narrow-leaved taxa, chiefly *Sparganium angustifolium* (with long, partially floating leaves) and the small *Isoetes lacustris, I. setacea* and *Subularia aquatica.*

Ecology: It inhabits acid, nutrient-poor waters of ponds and small lakes, rooting in fine-textured, gentle beds, from 0.5 to a few meters deep.

Distribution: Pyrenees, on acid materials, in the alpine and high subalpine belts.

ELEOCHARITION ACICULARIS Pietsch 1967

Ranunculo-Juncetum bulbosi Oberdorfer 1957
Data: CARRILLO & NINOT (1992, sub *Juncus bulbosus* comm.).
Structure: Rather dense, short carpets of *Juncus bulbosus*, including sparse *Sparganium angustifolium* and *Subularia aquatica*.
Ecology: It develops in the shallow, marginal zone of ponds and lakes, on flat surfaces emerged in summer.
Distribution: Only reported from Estany Llebreta, a high montane lake in the Central Pyrenees.

MONTIO-CARDAMINETEA Braun-Blanquet et Tüxen ex Klika et Hadac 1944
MONTIO-CARDAMINETALIA Pawlowski in Pawlowski et al. 1928
CARDAMINO-MONTION Braun-Blanquet 1926

Montietum fontanae Braun-Blanquet 1915
[*Montio-Philonotidetum fontanae* Bücker 1942, *Philonotis fontana-Montia rivularis*-Ass. (Braun-Blanquet 1915) Büker et Tüxen 1941]
Data: BOLÒS (1979), CARRILLO & NINOT (1992), SORIANO (1992), VIGO (1996).
Structure: Cushions of *Montia fontana* and *Stellaria alsine* which may cover most of the water surface. Among them, other typical spring-head plants (like *Epilobium alsinifolium* and *Veronica beccabunga*) are found.
Ecology: Springs and flushes with oligotrophic, slow running waters, generally on sandy substrata.
Distribution: Pyrenees, in the montane and submontane belts.
Variabilily: Two subassociations are known.
- **typicum**. Widespread in the central European region and reaching the Pyrenean montane belt.
- **epilobietosum pseudopalustris** O. Bolòs 1979. Holotypus: BOLÒS 1979, *Phytocoenologia* 6 :204, tab. 2, rel. 3 (Montseny: Santa Fe, 1100 m). In streams of central Catalanidic mountains (Montseny), and differentiated by *Cardamine amara* subsp. *olotensis* and *Epilobium obscurum* v. *pseudopalustre*.

Montio-Bryetum schleicheri Braun-Blanquet 1925
[*Bryetum schleicheri* Braun-Blanquet 1926, Ass. à *Bryum schleicheri* et *Philonotis seriata* Luquet 1926]
Data: BRAUN-BLANQUET (1948), CARRERAS (1993), CARRILLO & NINOT (1992), GRUBER (1978), VIGO (1996), VIÑAS (1993).
Structure: Cushions or carpets of bryophytes such as *Bryum schleicheri, B. pseudotriquetrum, Philonotis seriata*, within which small vascular plants (*Saxifraga stellaris* subsp. *alpigena, Epilobium alsinifolium, Cerastium cerastoides*, etc.) take root.
Ecology: Springs fed by oligotrophic, cold waters.
Distribution: Pyrenees, mainly in the subalpine and alpine belts.

Saxifragetum aquaticae Braun-Blanquet 1948

Lectotypus: BRAUN-BLANQUET 1948, *Vég. alp. Pyr. orient*. tab. 13, rel. 6 (Cadí valley 1980 m, Canigó, E. Pyrenees; designed here).
Data: BRAUN-BLANQUET (1948), CARRERAS (1993), CARRERAS *et al.* (1993), CARRILLO & NINOT (1992), FOLCH & FARRÀS (1979), GRUBER (1978), VIGO (1996).

Structure: Carpets of *Saxifraga aquatica* mixed with cushions of Brachythecium rivulare, Philonotis seriata and other acrocarpic mosses, which sometimes cover all the water surface; Epilobium alsinifolium and Cardamine amara may also occur.

Ecology: Springs with oligotrophic, cold, fast running waters, on rocky bedcours.

Distribution: Pyrenees, only in the subalpine and alpine belts.

Cardaminetum latifoliae Braun-Blanquet in Braun-Blanquet et al. 1952

[*Cardaminetum raphanifoliae* auct., *Cardamino raphanifoliae-Chrysosplenietum oppositifoii* Gruber 1978]
Neotypus: BOLÒS 1957a, *Collect. Bot*. 5 :509 (Lés, 1100 m, Aran valley, C Pyrenees; designed here).
Data: BOLÒS (1957a), CARRERAS (1993), CARRERAS *et al.* (1993), CARRILLO & NINOT (1992), GRUBER (1978), SORIANO (1992), VIGO (1996).

Structure: Flush community dominated by *Cardamine raphanifolia*, almost devoid of mosses.

Ecology: Mountain streams with oligotrophic running waters, with rocky bedcours.

Distribution: Pyrenees, in the montane belt.

Cardamino flexuosae-Chrysosplenietum oppositifolii O. Bolòs 1979

Holotypus: BOLÒS 1979, *Phytocoenologia* 6 :205 (Tordera river, 500 m, Montseny, N Catalanidic terr.)
Data: BOLÒS (1979)

Structure: *Chrysosplenium oppositifolium* shows a high cover in this community. This species and *Cardamine flexuosa* are territorial caracteristics.

Ecology: Shaded streams, beside alderwoods.

Distribution: Catalanidic range (Montseny).

Comment: This community could be included in the *Chrysosplenietum oppositifolii* Oberdorfer et Phil. 1977, but further data are needed.

CRATONEURION COMMUTATI Koch 1928

Cratoneuretum falcati Gams 1927

[*Cratoneuro-Arabidetum bellidifoliae* Koch 1928]
Data: BRAUN-BLANQUET (1948), CARRERAS *et al.* (1993), CARRILLO & NINOT (1992), GRUBER (1978), VIGO (1996).

Structure: Association dominated by the pleurocarpic moss *Cratoneuron commutatum*, which forms a dense yellow-orange mat at the spring-heads with several other bryophytes. Vascular species are few, only *Epilobium alsinifolium* is frequent.

Ecology: Calcareous, eutrophic spring waters.
Distribution: In the Pyrenees (including pre-Pyrenees), from the montane to the alpine belt.

PHRAGMITO-MAGNOCARICETEA Klika in Klika et Novák 1941
[*Phragmitetea* Tüxen et Preising 1942]
PHRAGMITETALIA Koch 1926
GLYCERIO-SPARGANION Braun-Blanquet et Sissingh in Boer 1942

Helosciadietum nodiflori Maire 1924
[*Apietum nodiflori* Braun-Blanquet 1931]
Holotypus: MAIRE 1924, *Mém. Soc. Sc. Nat. Maroc*, 7 :96, the only relevé (Ras-el-Ma; Morocco).
Data: A. BOLÒS (1950), BOLÒS (1959, 1962, 1967, 1983), BOLÒS & MASALLES (1983), CARRERAS (1993), CONESA (1990, 1991a, 1991b), FARRÀS & VELASCO (1994), FRANQUESA (1995), GESTI (2000). NUET (1983), ROMO (1989), ROVIRA (1986), SORIANO (1992), VIGO (1996), VIÑAS (1993).
Structure: Dense, herbaceous community dominated by *Apium nodiflorum* including other hygrophytes.
Ecology: Slow running waters, mainly on siliceous substrata.
Distribution: General, mainly in mediterranean and submontane areas.
Variabilily: Two subassociations have been described.
- **nasturtietosum** O. Bolòs 1959 [*apietosum* O. Bolòs 1983 nom. inval.] Heliophilous community.
- **cardaminetosum olotensis** O. Bolòs 1959. Lectotypus: BOLÒS 1959, *Arx. Sec. Cièn.* 26: 81, rel. 2 (Riudarenes, 80 m, N Catalanidic terr.; designed in BOLÒS 1997 :213). Sciaphilous community containing *Cardamine amara* subsp. *olotensis*, found in the north Catalanidic territory.

Glycerietum plicatae Kulczynski1928
[incl. *Glycerio-Sparganietum neglecti* Koch 1926]
Data: BOLÒS (1959, 1983), CARRERAS (1993), CARRILLO & NINOT (1992), CONESA (1991b), MOLERO & VIGO (1981), ROSELL (1978), SORIANO (1992), VIGO (1968, 1996), VIÑAS (1993).
Structure: Populations of *Glyceria fluitans* subsp. *plicata* mixed with other hygrophilous taxa (*Veronica beccabunga, Juncus buffonius, etc.*)
Ecology: Still, oligo- or mesotrophic waters, rooting in sandy or stony ground.
Distribution: Pyrenees and neighbouring zones, in the submontane and montane belts.

Glycerietum fluitantis Eggler 1933
[*Glycerietum fluitantis* Wilzek 1935, *Sparganio-Glycerietum fluitantis* Braun-Blanquet 1925 nom. nud.]
Structure: Almost monospecific populations of *Glyceria fluitans*.
Ecology: Still, clean waters.
Distribution: Only recorded from Estany Llebreta, Central Pyrenees (CARRILLO & NINOT 1992; without relevés), possibly also found in Ruscinic lowland (GESTI, 2000: sub *Glyceria fluitans* community).

Acrocladio-Eleocharitetum palustris O. Bolòs et Vigo in Bolòs 1967

[*Calliergonello-Eleocharitetum* auct.]
Lectotypus: BOLÒS 1967, *Mem. R. Acad. Cienc. Art. Bar.* 38(1) :191, t.18, rel. 2 (Prades, 950 m, C Catalanidic mountains; designed in BOLÒS 1997 :204).
Data: BOLÒS (1967), CARRERAS *et al.* (1996), CARRILLO & NINOT (1992), CONESA (1991a, 1991b), FRANQUESA (1995), GESTI (2000), MOLERO (1976), MOLERO & VIGO (1981), VIGO (1996), VIÑAS (1993).
Structure: Poor, herbaceous helophytic community, with whole dominance of *Eleocharis palustris*.
Ecology: Seasonally flooded depressions.
Distribution: Sparsely all over the country, from lowlands to the montane belt.

Catabrosetum aquaticae Rübel 1911

Data: CARRERAS *et al.* (1993), SORIANO (1992).
Structure: Community of *Catabrosa aquatica* and other hygrophilous species as *Glyceria fluitans* subsp. *plicata*, *Veronica anagallis-aquatica, V. beccabunga* and *Epilobium parviflorum.*
Ecology: Slow running waters.
Distribution: Only indicated from Barravés valley (Pyrenees) and Moixeró range, in the submontane belt.
Comment: Both the validity of the name and the occurrence of this association in the area would have to be assessed with further data.

PHRAGMITION COMMUNIS Koch 1926

Typho angustifoliae-Phragmitetum australis (Tüxen et Preising 1942) Rivas Martínez et al. 1991

[*Scirpo-Phragmitetum mediterraneum* Tüxen et Preising 1942 nom. illeg., *Schoenoplecto-Phragmitetum mediterraneum* nom. mut.]
Data: FARRÀS & VELASCO (1994).
Structure: *Phagmites communis* populations with *Calystegia sepium, Phalaris arundinacea, etc*.
Ecology: Riversides with fresh or brackish waters in permanently flooded places.
Distribution: Recorded only from Aiguamolls de l'Empordà, in the north coastal area.

Typho-Schoenoplectetum tabernaemontani Braun-Blanquet et O. Bolòs 1958

[*Typho-Schoenoplectetum glauci* Braun-Blanquet et O. Bolòs 1958]
Lectotypus: BRAUN-BLANQUET & BOLÒS 1958, *An. Est. Exp. Aula Dei* 5 :81, tab. 14, rel. 13 (Fraga, 270 m, Sicoric terr.; designed in BOLÒS 1996b :65).
Data: A. BOLÒS 1950 (sub *Phragmition*), BOLÒS (1962, 1967, 1983,1996a), BOLÒS & MASALLES (1983), BRAUN-BLANQUET & BOLÒS (1958), CONESA (1990, 1991a, 1991b), FARRÀS & VELASCO (1994), GESTI (2000), MOLERO (1976), NUET (1983), ROMO (1989), ROVIRA (1986), VILAR (1987), VIÑAS (1993).
Structure: Fresh water helophitic vegetation, which completely covers the surface at 1-3 m high, dominated by *Phragmites communis, Schoenoplectus tabernaemontanus, Typha angustifolia* subsp. *australis* or *Typha latifolia*, very species poor.
Ecology: Meanders, riversides flooded (only occasionally dried) with brackish waters.

Distribution: Main rivers and other wet lands at low altitudes.
Variabilily: Six subassociations have been described.
- **phragmitetosum australis** (Braun-Blanquet et O. Bolòs) O. Bolòs *nom. nov.* (= **typicum**, *typho-phragmitetosum australis* Braun-Blanquet et O. Bolòs 1958). Dominated by *Phragmites australis* subsp. *australis.*
- **phragmitetosum isiaci** A. et O. Bolòs ex O. Bolòs 1967 (*phragmitetosum ruscinonensis* nom. mut.). Holotypus: A. BOLÒS 1950, *Veg. comarc. barelonesas* :85 (Estany de l'Illa, Llobregat delta; the only relevé). Dominated by *Phragmites australis* subsp. *chrysanthus*.
- **juncetosum effusi** O. Bolòs 1983. Holotypus: BOLÒS 1983, *Veg. Montseny* :136 (La Batllòria near St. Celoni, 100 m, N Catalanidic terr.; the only relevé). With acidophilous taxa like *Juncus effusus, Carex punctata,...*
- **lysimachietosum vulgaris** O. Bolòs et Masalles 1983. Holotypus: BOLÒS & MASALLES 1983, *Mapa veg. Banyoles* :97 (Banyoles lake, 170 m, Olositanic terr.; the only relevé). Calcicolous.
- **schoenoplectetosum litoralis** O. Bolòs et Masalles 1983. Holotypus: BOLÒS & MASALLES 1983, *Mapa veg. Banyoles* :97 (Banyoles lake, 170 m, Olositanic terr.; the only relevé). With *Scirpus littoralis*, it roots 1-2 m depth.

Scirpetum maritimi-litoralis Braun-Blanquet ex O. Bolòs 1962
[*Scirpetum maritimi* Braun-Blanquet in Braun-Blanquet et al. 1952 nomen inval., ass. à *Scirpus maritimus* et *Scirpus litoralis* Braun-Blanquet 1931, nomen nud., *Scirpetum compacto-littoralis* Braun-Blanquet 1931 corr. Rivas Martínez, Costa, Castroviejo et Valdés Bermejo 1980]
Lectotypus: BOLÒS 1962, *Pais. veg. barcelonés*, tab. 36, rel. 1 (la Ricarda, Llobregat delta; designed here).
Data: BOLÒS (1962, 1967), BOLÒS & MASALLES (1983), CONESA (1990, 1991a, 1991b), FARRÀS & VELASCO (1994), FRANQUESA (1995), GESTI (2000), VIÑAS (1993).
Structure: Species-poor community, often containing only one species (*Scirpus maritimus, S. litoralis, Phragmites australis* subsp. *australis*, or *P. australis.* subsp. *chrysanthus*)
Ecology: Brackish still waters.
Distribution: Coastal parts of the territory and occasionally near main rivers (Ebre).
Variabilily: Two subassociations have been described
- **phragmitetosum isiaci** Braun-Blanquet in Braun-Blanquet et al. 1952 (= **typicum**, *isiacietosum*). With *Phragmites australis* subsp. *chrysanthus*.
- **schoenoplectetosum litoralis** O. Bolòs 1967. Lectotypus: Bolòs 1997, Veg. Balears :221, rel. 2679 (Illa de Mar, Ebre delta). Found in the Ebre delta, with *Scirpus litoralis* as differential.

Typhetum latifoliae Lang 1973
Data: BOLÒS (1983), CARRILLO & NINOT (1992), GESTI (2000), VIGO (1996).
Structure: Helophytic community dominated by *Typha latifolia*.
Ecology: Fresh, still waters.

Distribution: Known only from few localities of the montane belt of Montseny and Pyrenees, and from Ruscinic lowland.

MAGNOCARICION ELATAE Koch 1926

Caricetum rostratae Osvald 1923
[*Caricetum rostratae* Rübel 1911, *Caricetum rostrato-vesicariae* auct.]
Data: CARRILLO & NINOT (1992), VIGO (1996).
Structure: Helophitic community, dominated by *Carex rostrata* or *C. vesicaria*.
Ecology: Still waters, rooting in silty beds in the banks of high montane and subalpine lakes.
Distribution: Pyrenees, mainly axial.

Irido pseudacori-Polygonetum serrulati O. Bolòs 1957
[*Irido-Polygonetum salicifolii* O. Bolòs 1967 nom. mut.]
Lectotypus: BOLÒS 1957b, *Collect. Bot.* 5 :556-557, 14, rel. 1. (Estany de l'Encanyissada, Ebre delta; designed in BOLÒS 1996b :68).
Data: BOLÒS (1957b, 1967), VIÑAS (1993).
Structure: Helophytic community dominated by *Iris pseudacorus, Polygonum salicifolium, Althaea officinalis* and other tall hygrophytes.
Ecology: Edges of irrigation channels, small lakes and other water bodies.
Distribution: Sparse in lowlands (Ebre delta, etc.).

Soncho maritimi-Cladietum marisci (Braun-Blanquet et O. Bolòs 1958) Cirujano 1980
[*Typho-Schoenoplectetum glauci* Br.-Bl et O. Bolòs 1958 *cladietosum marisci* (Braun-Blanquet et O. Bolòs 1958) O. Bolòs 1967, *Mariscetum oligohalinum* Braun-Blanquet et O. Bolòs 1958]
Lectotypus: BRAUN-BLANQUET & BOLÒS 1958, *An. Est. Exp. Aula Dei*, 5 :83. table 15, rel. 2 (Chiprana pond, 140 m, Caspe, Sicoric terr.; designed in CIRUJANO 1980).
Data: BOLÒS (1967), BOLÒS & MASALLES (1983), BRAUN-BLANQUET & BOLÒS (1958), CONESA (1991a).
Structure: Dense, fresh water helophytic vegetation, dominated by *Cladium mariscus* and containing some slightly halophylous taxa (as *Oenanthe lachenalii* or *Sonchus maritimus* subsp. *maritimus*.)
Ecology: Transitional community between *Phragmition* and *Magnocaricion*. Fresh water rich in calcium.
Distribution: Sparse in lowlands, along low courses of rivers (Ebre, Segre) and in the edges of Banyoles lake.

Cypero-Caricetum otrubae R. Tüxen ex R. Tüxen et Oberdorfer 1958
Data: BOLÒS (1959, 1962, 1967), BOLÒS & MASALLES (1983), FARRÀS & VELASCO (1994), GESTI (2000).
Structure: Hemicryptophytic community dominated by large *Cyperaceae* (*Carex otrubae, C. riparia, Cyperus longus* subsp. *badius*)
Ecology: Wet soils, occasionally dry. It surrounds *Phragmition* communities externally.
Distribution: Occasional in mild lowlands (Llobregat delta, Banyoles, Empordà)

Variabilily: Two subassociations have been described
- **typicum**, which corresponds to the community described above.
- **euphorbietosum pubescentis** O. Bolòs 1962. Holotypus: BOLÒS 1962, *Pais.veg. barcelonés*, tab. 34 (Llobregat delta; the only relevé). Known only from the delta of Llobregat, and differenciated by the presence of *Euphorbia pubescens*.

Cladio-Caricetum hispidae O. Bolòs 1967

Lectotypus: BOLÒS 1967, *Mem. R. Acad. Cien. Art. Barcelona*, 38(1), t.17, rel. 3 (Santes Creus, 220 m, C Catalanidic terr.; designed in BOLÒS 1996b :67).

Data: BOLÒS (1967), BOLÒS & MASALLES (1983), CONESA (1991a, 1991b), MOLERO (1976).

Structure: Tall (1.2-1.5 m), hemicryptophytic association dominated by *Carex hispida* or *Cladium mariscus*, and with *Juncus subnodulosus, Althaea officinalis, Lycopus europaeus* and *Iris pseudacorus*.

Ecology: Riversides flooded with calcareous water.

Distribution: Sparselly occurring from Catalanidic range (Banyoles) to Ebre river, in lowlands.

SCHEUCHZERIO-CARICETEA FUSCAE Tüxen 1937
CARICETALIA DAVALLIANAE Braun-Blanquet 1949
CARICION DAVALLIANAE Klika 1934

Caricetum davallianae Dutoit 1924

[*Pinguiculo grandiflorae-Caricetum davallianae* (Braun-Blanquet 1948) Gruber 1978 p.p.]

Data: BRAUN-BLANQUET (1948), CARRERAS (1993), CARRERAS *et al.* (1993, 1996), CARRILLO & NINOT (1992), CASANOVAS (1994, 1996), FOLCH & FARRÀS (1979), GRUBER (1978), ROSELL (1978), VANDEN BERGHEN & PEETERS (1982), VIGO (1996).

Structure: Low sedge fen generally dominated by *Carex davalliana*, with a high bryophyte cover.

Ecology: Soils waterlogged with basic to neutroacidic, carbonated waters; the ground water level standing near the surface almost throughout the year.

Distribution: Axial Pyrenees in the subalpine belt (rare in the montane or alpine belts).

Variabilily: Three subassociations are recognized.
- **primuletosum integrifoliae** Braun-Blanquet 1948. Lectotypus: BRAUN BLANQUET 1948, *Vég. alp. Pyr. orient*., tab. 15, rel. 13 (Eina valley, 2210 m, E Pyrenees; designed here). Pyrenean vicariant of *Caricetum davallianae typicum* described from the Alps.
- **molinietosum caeruleae** Casanovas 1996. Holotypus: CASANOVAS 1996, *Fol. Bot. Misc*., 10 :192, t.2, rel. 1 (Pla del Catllaràs, 1620 m, E pre-Pyrenees). It grows on drier soils than the typical subassociation and is differentiated by *Molinia caerulea* and *Succisa pratensis*.
- **caricetosum nigrae** Casanovas 1996. Holotypus: CASANOVAS 1996, *Fol. Bot. Misc*., 10 :192, t.2, rel. 18 (Forau dels Aigualluts, 1930 m, Benasc, C Pyrenees). *Carex nigra* is abundant in this community, which represents a transitional situation to *Caricion fuscae*.

Carici-Pinguiculetum grandiflorae Braun-Blanquet 1948

[*Pinguiculo-Caricetum umbrosae* Braun-Blanquet 1948 nom. mut. Vigo 1996, *Pinguiculo grandiflorae-Caricetum davallianae* (Braun-Blanquet) Gruber 1978 p.p.]

Lectotypus: BRAUN-BLANQUET 1948, *Vég. alp. Pyr. orient*., tab. 15, rel. 2 (Núria, 2150 m, Ribes valley, E Pyrenees; designed here).

Data: BRAUN-BLANQUET (1948), CARRERAS *et al.*(1993), CASANOVAS (1994, 1996), GRUBER (1978), VIGO (1996).

Structure: Discontinous turf formation dominated by *Carex frigida* or *C. umbrosa. Pinguicula grandiflora* and other fen species may also be abundant.

Ecology: Rocky surfaces where carbonated, neutro-basic waters run superficially.

Distribution: Only in the Pyrenees, particularly in the subalpine belt.

Comment: This association might also be included in the alliance *Caricion bicolori-atrofuscae.*

Variabilily: Two subassociations have been described.

- **typicum**. Described above.

- **caricetosum pseudotristis** Casanovas 1996. Holotypus: CASANOVAS 1996, *Fol. Bot. Misc*. 10 :196, t.32, rel. 15 (Jaça de la Llebrada, 2190 m, Ribes valley, E. Pyrenees). Found on temporarily dry soils, where *Carex sempervirens* subsp. *pseudotristis* replaces *Carex frigida.*

Carici paniculatae-Eriophoretum latifolii O. Bolòs et Vives in O. Bolòs 1956

Lectotypus: BOLÒS 1956, *Collect. Bot*. 5(1) :219, tab. 22, rel. 1 (Taga, 1400 m, Ribes valley, E Pyrenees; designed here).

Data: BOLÒS (1956), CARRERAS (1993), CARRERAS *et al.* (1996), CARRILLO & NINOT (1992), CASANOVAS (1994), VIGO (1996).

Structure: Tall sedge fen dominated by *Carex paniculata* and *Eriophorum latifolium*. Some species related to *Molinion* grow frequently in this community.

Ecology: Damp soils flooded with neutrophilous, carbonated waters, in the transition zone between marshes and pastures.

Distribution: Montane and subalpine belts along the Pyrenees (including the pre-Pyrenean ranges).

Swertio perennis-Caricetum nigrae Vigo 1984

Holotypus: VIGO 1984, *Collect. Bot*. 15 :484, rel. 3 (Coma de Vaca, 2300 m, Ripollès, E Pyrenees).

Data: CARRERAS *et al.* (1996), CASANOVAS (1994), VIGO (1984, 1996).

Structure: Dense sedge fomation related to acidophilous mires. The dominant species is *Carex nigra* but a number of calcicolous taxa is also found.

Ecology: It grows preferentially in small ridges, surrounded by carbonated waters.

Distribution: Pyrenees, in the subalpine and alpine belts.

CARICETALIA FUSCAE Koch 1926

CARICION FUSCAE Koch 1926

Caricetum fuscae Braun-Blanquet 1915
(*Caricetum nigrae* auct.)
Data: BALLESTEROS *et al.*(1983), BRAUN-BLANQUET (1948), CARRERAS (1993), CARRILLO & NINOT (1992), CASANOVAS (1992, 1996), FOLCH & FARRÀS (1979), GRUBER (1978), SORIANO (1992), VANDEN BERGHEN & PEETERS (1982), VIGO (1996), VIÑAS (1993).
Structure: Fens dominated by sedges, the most caracteristic species being *Carex echinata*, mixed with *C. nigra, C. flava* var. *alpina* or *Juncus filiformis*, and sometimes with peat mosses.
Ecology: Marshes on pools and stream banks. Non-carbonated waters.
Distribution: Pyrenees (also pre-Pyrenees), usually common in the subalpine belt.
Variabilily: Four subassociations have been recognized.
- **typicum**. Sedge formation generally devoid of mosses.
- **sphagnetosum** Casanovas 1992. Holotypus: CASANOVAS 1992, *Act. Simp. Int. Bot. P. Font i Quer* 2 :244, rel. 5 (Plans de Boavi, 1460 m, Cardós valley, C Pyrenees). Similar to the typical subassociation but it shows a couch of peat mosses (*Sphagnum* spp.) among the sedges.
- **caricetosum curtae** Casanovas 1996. Holotypus: CASANOVAS 1996, *Fol. Bot. Misc*. 10 :198, tab. 5, rel. 3 (Pla de Boet, 1900 m, Ferrera valley, C Pyrenees). This community colonises the shores of pools and the banks of slow-flowing streems; it needs permanently flooded soils with flowing waters. *Carex curta* and other hydrophilous species act as differentials.
- **molinietosum caeruleae** Casanovas 1996. Holotypus: CASANOVAS 1996, *Fol. Bot. Misc*. 10 :200, t.6, rel. 4 (Bosc de Barres, 1680 m, Capcir, E Pyrenees). Growing in soils submitted to water table oscillations, which favour the presence of species such as *Molinia caerulea*, *Genista anglica* and some moderately hydrophilous peat mosses.

Narthecio-Trichophoretum caespitosi Braun-Blanquet 1948
[*Narthecio-Scirpetum caespitosi* nom. mut., *Pedicularieto mixtae-Narthecietum* Vanden Berghen et Peeters 1982, *Pedicularieto mixtae-Scirpetum caespitosi* Vanden Berghen et Peeters 1982]
Lectotypus: BRAUN-BLANQUET 1948, *Vég. alp. Pyr. orient.*, tab. 17, rel. 1 (Madres range, 1940 m, E Pyrenees; designed here).
Data: BALLESTEROS *et al.* (1983), BOLÒS (1957a), CANALÍS *et al.* (1984), CARRERAS *et al.* (1993), CARRILLO & NINOT (1992), CASANOVAS (1992, 1996), GRUBER (1978), VANDEN BERGHEN & PEETERS (1982).
Structure: Sedge formations dominated by *Scirpus caespitosus*. The presence of some mire species such as *Drosera rotundifolia* is a frequent feature of the community, but *Caricetalia fuscae* character-taxa (*Carex echinata*, *C. nigra*, *Viola palustris*) always show greater diversity and abundance.
Ecology: Marshes along stream banks. Oligotrophic waters.
Distribution: Axial Pyrenees, from the high montane belt to the low alpine belt.
Comment: Some authors include this association within the *Oxycocco-Sphagnetea* class, which reflects its structural and ecological features rather than its actual species composition.
Variabilily: Three subassociations.

- **typicum**. The only one with abundant *Narthecium ossifragum*, and containing certain hygrophilous bog mosses (*Sphagnum subnitens* and *S. auriculatum*) which act as differentials.
- **tofieldietosum calyculatae** Ballesteros, Baulies, Canalís et Sebastià ex Ninot et al., subass. nova [*Tofieldio-Scirpetum caespitosi* Ballesteros et al. 1983, nom. inval.]. Holotypus: BALLESTEROS *et al.* 1983, *Collect. Bot.* 14 :69, tab. 3, rel. 8 (Val de Molières, 1620 m, C Pyrenees; designed here). Community containing some calcicolous species, and rarely showing *Narthecium ossifragum*.
- **primuletosum integrifoliae** Gruber ex Ninot et al., subass. nova [*Primulo-Scirpetum caespitosi* Gruber 1978, nom. inval.]. Holotypus: BALLESTEROS *et al.* 1983, *Collect. Bot.* 14 :67, tab. 2, rel. 4 (Val de Molières, 2450 m, C Pyrenees; designed here). Less hygrophilous than the two communities described above, it is frequent at higher altitudes. Differentials are *Juncetea trifidi* character-taxa and certain mosses such as *Sphagnum capillifolium* and *S. compactum*.

Sphagno subnitentis-Ericetum tetralicis Ballesteros, Baulies, Canalís et Sebastià in Ninot et al., ass. nova

(*Ericetum tetralicis* auct. cat., non *Ericetum tetralicis* Tüxen 1937; *Sphagno subnitentis-Ericetum tetralicis* Ballesteros et al. 1983, nom. inval.)
Holotypus: BALLESTEROS *et al.* 1983, *Collect. Bot.* 14 :75, rel 3 (Val de Molières, 1650 m, C Pyrenees). Data: BALLESTEROS *et al.* (1983), BOLÒS (1957a).
Structure: Dwarf heathbog dominated by *Erica tetralix*. Some *Calluno-Ulicetalia* characteristic-species are frequent and *Sphagnum subnitens* is always abundant.
Ecology: Raised bogs surrounded by flushes. Rainwater dependent, sometimes they dry out superficially.
Distribution: Axial Pyrenees, only in the high montane belt of the Noguera Ribagorçana valley.
Comment: Closed to *Calluno-Sphagnetum subnitentis* Casanovas 1992, it is well defined by the occurrence of *Erica tetralix*. Although some authors include *Sphagno-Ericetum* in *Oxycocco-Sphagnetea*, we prefer to maintain it in *Scheuchzerio-Caricetea fuscae*, as most of the exclusive mire species do not reach the Pyrenees.

Calluno vulgaris-Sphagnetum subnitentis Casanovas 1992

Holotypus: CASANOVAS 1992, *Act. Simp. Int. Bot. P. Font i Quer* 2 :246, rel. 7 (Estany del Viver, 2140 m, les Bulloses, E. Pyrenees).
Data: CASANOVAS (1992, 1994), VANDEN BERGHEN & PEETERS (1982, sub *Sphagnum capillifolium* and *Pinus uncinata* bog).
Structure: Hummocks dominated by *Sphagnum subnitens* or *S. capillifolium*. The community also includes other mosses such as *Polytrichum strictum* and species typical of mires and wet heaths (*Calluno-Ulicetea* character-species).
Ecology: Mires with raised peat (bumps), with non-carbonated, strongly acidic waters, the pH values ranging from 3.2 to 5.7.
Distribution: Subalpine and alpine belts, only well represented in the central Pyrenees but also found in the eastern Pyrenees (Capcir).

Comment: Similar to atlantic bogs but without true *Oxycocco-Sphagnetea* character-taxa.

ISOETO-NANOJUNCETEA Braun-Blanquet et Tüxen ex Westhoff et al. 1946
[*Isoeto-Nanojuncetea* Braun-Blanquet et Tüxen 1943]
ISOETETALIA Braun-Blanquet 1936
ISOETION Braun-Blanquet 1936

Isoetetum delilei Braun-Blanquet (1931) 1935
[*Isoetetum setacei* nom. mut.]
Structure: Community comprising geophythes and therophytes, dominated by *Isoetes delilei*.
Ecology: Shallow pools, dry in summer, on siliceous substrata.
Distribution: Found in the north-eastern part of the territory, in lowlands, although no relevés have been reported.

Isoetetum duriei Braun-Blanquet (1931) 1935
[Ass. à *Isotes duriaei* et *Juncus capitatus* Braun-Blanquet 1931]
Data: BALLESTEROS (1984), A. BOLÒS (1950), BOLÒS (1959, 1967), FRANQUESA (1995), GESTI (2000).
Structure: Community composed mainly of geophytes and therophytes, and often comprising bryophytes (mosses, *Anthoceros*). It can be dominated by different taxa, mainly *Isoetes duriei, Lotus conimbricensis* or *Lythrum thymifolia*.
Ecology: Flooded or wet places almost throughout the year, or at least in spring, but dry in summer. It develops within the autumn-spring period. Stream banks, small concavities in *Cistion* scrubs. Siliceous substrata, in oligotrophic, acidic (or neutral) soils.
Distribution: Mediterranean, maritime climates. North-eastern part of the study area (Ruscinic and north Catalanidic territories), in lowlands.

NANOCYPERION Koch ex Libbert 1932
[*Nanocyperion* Koch 1926]

Stellario uliginosae-Scirpetum setacei (Koch 1926) Libbert 1932
[incl. *Junco bufonii-Isolepidetum setaceae* O. Bolòs et Masalles in O. Bolòs 1979; Holotypus: BOLÒS 1979, *Phytocoenologia* 6 :203 (Sant Martí Sacalm, 800 m, Olositanic terr.; the only relevé)].
Data: BOLÒS (1979, 1983), BOLÒS & MASALLES (1983), CARRERAS (1993), CARRILLO & NINOT (1992), FRANQUESA (1995), SORIANO (1992), VIGO (1996).
Structure: Nanotherophytic community with *Scirpus setaceus* as the dominant plant.
Ecology: Places flooded in spring and summer, often in shadow; mainly on siliceous substrata, in acidic soils. It grows near to streams and springs, and in path edges, and develops in summer or autumn.

Distribution: Pyrenees and Olositanic, Ruscinic and north Catalanidic territories from lowlands to the montane belt. It covers very small surfaces.
Comment: Fragmentary communities, formed mainly by *Juncus bufonius*, are very common.

Cyperetum flavescentis Koch ex Aichinger 1933
[*Cyperetum flavescentis* Koch 1926]
Data: BALLESTEROS (1984), BOLÒS (1956), BOLÒS & MASALLES (1983), VIGO (1968, 1996), VIÑAS (1993), VIVES (1964).
Structure: Nanotherophytic community which forms small patches, dominated by *Cyperus fuscus* or *Cyperus flavescens*, containing other therophytes and, in general, several plants from higher syntaxa.
Ecology: Seasonally non-flooded places, on diverse substrata, always in clay, non-acidic soils. It develops mainly in summer (and in autumn).
Distribution: Submontane belt of the Pyrenees and lowlands in the north-eastern part of the area (Ruscinic, Olositanic and north Catalanidic territories).

Gnaphalio uliginosi-Peplidetum portulae O. Bolòs 1979
Holotypus: BOLÒS 1979, *Phytocoenologia* 6 :203, tab. 1, rel. 3 (Santa Fe del Montseny, 1110 m, N Catalanidic range).
Data: BOLÒS (1979, 1983).
Structure: Community composed mainly of small therophytes and containing *Plantago major* subsp. *intermedia*.
Ecology: Places flooded for a large part of the year, but dry in summer. Granitic, sandy soils. Main development in summer and autumn.
Distribution: North Catalanidic territory (in the Montseny massif) in the montane belt.

Hyperico tomentosi-Cyperetum flavidi Molero 1984
Holotypus: MOLERO 1984, *Butll. Inst. Catal. Hist. Nat.* 51 :147, tab. 4, rel. 1 (Cabassers, 310 m, C Catalanidic range).
Data: MOLERO (1984), ROVIRA (1986).
Structure: Therophytic community with *Hypericum humifusum* and *Cyperus flavidus* as main species.
Ecology: Near to streams and springs, small concavities, flooded in spring. Calcareous or schistaceous substrata, in silty-sandy soils. Development in summer and in autumn .
Distribution: Central and south Catalanidic territories, in lowlands.

Ranunculo paludosi-Lythretum portulae Molero et Pujadas in Molero 1984
Holotypus: MOLERO 1984, *Butll. Inst. Catal. Hist. Nat.* 51 :144, tab. 2, rel. 2 (Prades, 840 m, S Catalanidic range).
Data: MOLERO (1984).

Structure: Therophytic community containing *Lythrum portula, Lythrum hyssopifolia* and several species characteristic of higher syntaxa. Two variants are described.
Ecology: Small concavities and ravines, flooded in winter and spring. Schistaceous or sandstone substrata, in sandy, acidic soils. Development in spring-summer.
Distribution: Central Catalanidic territory (Prades mountains).

Juncus capitatus community
Data: VIGO (1996).
Structure: Mainly therophytic community with *Juncus capitatus* as dominant species.
Ecology: Small depressions in granitic rocks, where the rain-water collects.
Distribution: East Pyrenees (Vall de Ribes), in the montane belt.

LYTHRION TRIBRACTEATI Rivas Goday et Rivas Martínez ex Rivas Goday 1970

Isolepido-Lythretum castellani Rivas Goday 1970 **kickxietosum integrifoliae** Molero 1984
Holotypus: MOLERO 1984, *Butll. Inst. Catal. Hist. Nat.* 51 :146, tab. 3, rel. 2 (La Palma d'Ebre, 340 m, C Catalanidic range).
Data: MOLERO (1976, 1984), ROVIRA (1986).
Structure: Nanotherophytic communities containing *Lythrum tribracteatum* (and *L. castiliae*) as well as some nitrophilous plants.
Ecology: Seasonally flooded places, in eutrophic, silty-clay soils, under quite continental climates. Field borders, wastelands. It develops mainly in late spring and in summer (occasionally in autumn).
Distribution: South Catalanidic territory, in lowlands, always covering small or medium-sized surfaces.

MOLINIO-ARRHENATHERETEA Tüxen 1937
ARRHENATHERETALIA ELATIORIS Pawlowski 1928
CYNOSURION CRISTATI Tüxen 1947

Cynosuro cristati-Trifolietum repentis O. Bolòs (1967) 1983
[*Cynosuretum pradense* O. Bolòs 1967, nom. illeg.; *Cynosuretum catalaunicum* Vigo 1968, nom. illeg.]
Holotypus: BOLÒS 1967, *Mem. R. Acad. Ci. Art. Barc.* 724 :48 (Prades, 950 m, C Catalanidic range).
Data: BOLÒS (1967, 1983), CARRERAS (1993), CARRERAS *et al.* (1993, 1996), CARRILLO & NINOT (1992), FRANQUESA (1995), MOLERO (1976), MOLERO & VIGO (1981), SORIANO (1992), VIGO (1968, 1996), VILLEGAS (1993).
Structure: Meadows with moderate to low species richness, formed from varying proportions of grasses (*Lolium perenne*, *Phleum pratense* subsp. *bertolonii, Cynosurus cristatus*, etc.) and other herbaceous plants, mainly legumes (*Trifolium repens, T. pratense*, etc.); a number of trampling resistant plants (e.g. *Plantago major*) are also frequent.

Ecology: Flat to gently sloping ground, on soils that remain moist in summer, irrigated in places. The community is dependent on intensive grazing and, in some places, on mowing.
Distribution: Montane and submontane belts, in the wetter areas of the Pyrenees, pre-Pyrenees and Catalanidic mountains.

Carici ornithopodae-Agrostidetum capillaris Villegas 1997
Holotypus: VILLEGAS 1997, *Butll. Inst. Cat. Hist. Nat.* 65 :33-35, rel. 1 (near Vidrà, 1320 m, E pre-Pyrenees).
Data: VILLEGAS (1997).
Structure: Fernshaws formed by a tall, dense layer of *Pteridium aquilinum* and a species-rich, ground layer including *Agrostis capillaris, Carex ornithopoda, Cynosurus cristatus, Trifolium repens, Potentilla erecta* and *Galium verum.*
Ecology: Gentle, north-facing slopes, growing on slightly acidic soils, under irregular grazing regime and without fertilization.
Distribution: In the montane belt of the eastern pre-Pyrenees (Puigsacalm).

ARRHENATHERION ELATIORIS Koch 1926

Gaudinio fragilis-Arrhenatheretum elatioris Braun-Blanquet 1931
Data: BOLÒS (1959, 1983), GESTI (2000), WATT & VILAR (1998), ZELLER (1958).
Structure: Diverse hay meadow mainly formed by tall grasses and forbs (*Holcus lanatus, Dactylis glomerata, Ranunculus acris, Rumex acetosa, Lychnis flos-cuculi*, etc.) and medium-sized herbaceous plants (e.g. *Trifolium pratense, Anthoxanthum odoratum, Taraxacum* gr. *officinale*, etc.). *Gaudinia fragilis* and other low altitude, maritime species are the main differentials of this association.
Ecology: Flat or gently sloping surfaces, on deep, fertile soils which remain moist in summer, normally due to irrigation. Regular fertilization and mowing are also required.
Distribution: Lowlands and submontane belt, in the wet mediterranean areas of Ruscinic and north Catalanidic territories.
Variabilily: Four subassociations are known in Catalonia, all of which are found in the north-eastern, wet areas.
- **geranietosum dissecti** O. Bolòs 1959. Lectotypus: BOLÒS 1959, *Arx. Sec. Cièn.* 26 :84-86, rel. 2 (Santa Coloma de Farners, 90 m, N Catalanidic terr.; designed in BOLÒS 1997 :213). Including *Alopecurus myosuroides, Geranium dissectum* and other differentials.
- **brometosum erecti** O. Bolòs 1983. Holotypus; BOLÒS 1983, *Veg. Montseny* :130-131 (Arbúcies, 310 m, N Catalanidic range). Found on rather dry soils, contains differentials which include *Bromus erectus* (frequently the dominant species), *Luzula campestris* and *Briza media*.
- **arrhenatheretosum** O. Bolòs 1983. Holotypus: BOLÒS 1983, *Veg. Montseny* :131 (Arbúcies, 320 m, N Catalanidic range). Found on medium moist soils, it is frequently dominated by *Arrhenatherum elatius*.

- **holcetosum lanati** O. Bolòs 1983. Holotypus: BOLÒS 1983, *Veg. Montseny* :131 (Arbúcies, 320 m, N Catalanidic range). Typical of wet, temporarily flooded substrata, includes hygrophytes such as *Eleocharis palustris, Equisetum arvense* and *Carex otrubae*.

Tragopogono-Lolietum multiflori P. Montserrat 1957

Lectotypus: MONTSERRAT 1957, *P. Inst. Biol. Apl.* 25 :204-205, tab 2, rel. 12 (La Seu d'Urgell, 720 m, C Pyrenees; designed here).
Data: MONTSERRAT (1957), CARRERAS (1993).

Structure: Meadows dominated by grasses (*Lolium multiflorum, Arrhenatherum elatius, Alopecurus pratensis*, etc.) and with a moderate contents of legumes (e.g. *Trifolium pratense* and *T. repens*) and other herbaceous plants.

Ecology: A community subject to irrigation, fertilization (mainly by dung) and intensive mowing from spring to autumn. It grows on flat fluvial terraces or on gentle colluvia.

Distribution: It has been identified only in the central-eastern Pyrenees, in the submontane belt of Alt Urgell area, under a quite severe continental climate.

Ophioglosso-Arrhenatheretum elatioris P. Montserrat 1957

Lectotypus: MONTSERRAT 1957, *P. Inst. Biol. Apl.* 25 :206-207, tab. 3, rel. 38 (Anserall near La Seu d'Urgell, 760 m, C Pyrenees; designed here).
Data: MONTSERRAT (1957), CARRERAS (1993), SORIANO (1992).

Structure: Diverse hay meadows dominated by several common grasses (*Arrhenatherum elatius, Trisetum flavescens, Festuca pratensis*, etc.). Other herbaceous plants occur in varying abundaces; these include *Ranunculus acris, Pimpinella major, Trifolium pratense, Lotus corniculatus* and *Picris hieracioides*. Among them, *Ophioglossum vulgatum, Crepis biennis* and *Galium mollugo* subsp. *erectum* can be considered characteristic species of the association.

Ecology: Gentle slopes, on colluvial soils which are fertilized and watered. These meadows are mowed once or twice a year, and frequently are subjected to autumn grazing.

Distribution: In the submontane (and montane) belt of central-eastern Pyrenees (Alt Urgell, Pallars Sobirà, etc.).

Variabilily: According to MONTSERRAT (1957), two subassociations may be distinguished. The well managed meadows, free of grazing, on rich, mild soils, would correspond to subassociation *typicum*; whereas on irregularly irrigated slopes, a transition community to *Bromion* including differentials such as *Ranunculus bulbosus* and *Salvia pratensis* would constitute a subassociation of *Carum carvi* and *Bellis perennis*.

Malvo moschatae-Arrhenatheretum elatioris Tüxen et Oberdorfer 1958

Data: BOLÒS (1957a, sub com. of *Narcissus poeticus* and *Heracleum setosum*).
Structure: Dense hay meadows formed by *Arrhenatherum elatius, Festuca* gr. *rubra, Sanguisorba minor, Centaurea nigra, Heracleum sphondylium* ssp. *gra-natense, Malva moschata*, etc.
Ecology: Low, gentle slopes, on acid soils fertilized with dung.
Distribution: Aran valley, in the submontane belt.

Comment: Only one relevé is known as having been classified under this association. More data are needed to assess the presence of this syntaxon in the area.

Galio-Arrhenatheretum Rivas Goday et Borja 1961 **anthoxanthetosum odorati** (O. Bolòs 1967) O. Bolòs, nom. nov.

(*Galio-Arrhenatheretum gudaricum* Rivas Goday et Borja 1961, nom. illeg.; subass. *phleo-anthoxanthetosum* Bolòs 1967, nom. illeg.)

Lectotypus: BOLÒS 1967, *Mem. R. Acad. C. Barc.* :47-48, tab. 19, rel. 1 (Ports de Tortosa, 1250 m, S Catalanidic range; designed in BOLÒS 1997 :212).

Data: BOLÒS (1967).

Structure: Small stands of meadow formed by *Arrhenatherum elatius, Poa pratensis, Anthriscus sylvestris, Lathyrus hirsutus, Brachypodium sylvaticum,* etc.

Ecology: Shaded, mild clearings in the domain of the *Pinus sylvestris* forests, irregularly mown or grazed.

Distribution: Submontane and montane belts, in the mildest areas of south Catalanidic mountains.

Odontido serotinae-Trifolietum pratensis O. Bolòs et Masalles 1983

Holotypus: BOLÒS & MASALLES 1983, *Mapa veg. Banyoles* :97 (El Sallent de Santa Pau, 410 m, Olositanic terr.).

Data: BOLÒS & MASALLES (1983), VIÑAS (1993).

Structure: Herbaceous stands formed by mesophilous hemicryptophytes, such as *Trifolium pratense, Arrhenatherum elatius, Lathyrus pratensis, Dactylis glomerata, Agrostis capillaris* and *Leucantheum vulgare*.

Ecology: It covers reduced surfaces under low exploitation pressure (ocasional grazing or mowing), within farmed areas; on deep, moist, fertile soils.

Distribution: Olositanic territory, at low altitudes.

Variabilily: It is diversified into two subassociations.

- **trifolietosum pratensis** (= **typicum**), growing in abandoned fiels with clay, dense soil, which includes differentials as *Odontides verna* subsp. *serotina* and *Agrostis stolonifera*.

- **arrhenatheretosum elatioris** O. Bolòs et Masalles 1983. Holotypus: BOLÒS & MASALLES 1983, *Mapa veg. Banyoles* :97-98 (El Sallent de Santa Pau, 380 m, Olositanic terr.). It is found at the edge of fiels or pastures, on moist soils, and is dominated by *Arrhenatherum elatius*.

Rhinantho mediterranei-Trisetetum flavescentis Vigo 1984

Holotypus: VIGO 1984, *Collect. Bot.* 15 :475-478, tab. 5, rel. 1 (Planoles, 1125 m, Ribes valley, E Pyrenees).

Data: CARRERAS *et al.* (1993, 1996), CARRILLO & NINOT (1992), Soriano (1992), VIGO (1984), VILLEGAS (1993), VIÑAS (1993), VIVES (1964, sub *Arrhenatherion*).

Structure: Typical, species rich hay meadows, formed by tall grasses (such as *Arrhenatherum elatius, Trisetum flavescens* and *Dactylis glomerata*), medium-sized, abundant legumes (e.g. *Trifolium pratense, Lotus corniculatus*, etc.) and diverse forbs (*Taraxacum* gr. *officinale, Chaerophyllum aureum, Rhinanthus mediterraneus, Achillea millefolium*, etc.).

Ecology: It develops on gentle slopes or on fluvial terraces. Soils are mainly coarse, of colluvial or alluvial nature, and hold high fertility owing to dung fertilization. In drier areas, moderate to intensive irrigation is needed in summer. Mowing is done 1 or 2 times a year in most cases, and autumn grazing is common elsewhere.
Distribution: Submontane and montane belts of the Pyrenees, where it is very general in the cultivated areas.
Variabilily: Three ecological subassociations were described.
- **typicum**, which corresponds to moist soils. It is a well characterized *Arrhenatherion* community with very low presence of *Brometalia* taxa.
- **salvietosum pratensis** Vigo in Ninot et al., subass. nova [*salvietosum pratensis* Vigo 1984, nom. inval.]. Holotypus: VIGO 1984, *Collect. Bot.* 15 :475-478, tab. 5, rel. 13 (El Baell, 1175 m, Ribes valley, E Pyrenees). A transition to calcicolous *Bromion* pastures related to drier sites and lime materials. It is differentiated by *Salvia pratensis, Onobrychis supina, Galium verum* and *Trifolium montanum*, and is very common throughout the range of the association.
- **trifolietosum campestris** Vigo in Ninot et al., subass. nova [*trifolietosum campestris* Vigo 1984, nom. inval.]. Holotypus: VIGO 1984, *Collect. Bot.* 15 :475-478, tab. 5, rel 5 (Rialb, 1150 m, Ribes valley, E Pyrenees). Also a transition community to *Bromion*, though calcifugue, as shown by differentials such as *Agrostis capillaris, Trifolium campestre* and *Euphrasia hirtella*. It is widespread, but less common than the previous subassociation.
Comment: A careful comparision between *Rhinantho-Trisetetum* and *Ophioglosso-Arrhenatheretum* could lead to being considered almost the same.

Gentiano luteae-Trisetetum flavescentis Vigo 1984
Holotypus: VIGO 1984, *Collect. Bot.* 15 :463, tab. 7, rel. 4 (near Pardines, 1350 m, Ribes valley, E Pyrenees).
Data: VIGO (1984)
Structure: Transitional meadow community between *Arrhenatherion* and *Bromion* characterized by the assemblage of species of both alliances (*Trisetum flavescens, Trifolium pratense, Plantago media, Ranunculus bulbosus,* etc.), as well as *Gentiana lutea* and some eurioic plants of pastures (e.g. *Anthoxanthum odoratum, Agrostis capillaris* and *Achillea millefolium*).
Ecology: Old hay meadows mainly grazed, in rich, mild soils.
Distribution: Only known from the montane belt of Ribes valley, in the eastern Pyrenees.

TRISETO-POLYGONION BISTORTAE Braun-Blanquet et Tüxen ex Marschall 1947

Triseto flavescentis-Heracleetum pyrenaici Braun-Blanquet ex O. Bolòs 1957
[*Heracleo-Trisetetum* auct.; incl. *Astrantio-Avenuletum pubescentis* Vigo 1984]

Holotypus: BOLÒS 1957a, *Collect. Bot.* 5 :507-508 (Ospitau de Vielha, 1550 m, C Pyrenees).
Data: BOLÒS (1957a), CARRERAS (1993), CARRERAS *et al.* (1993, 1996), CARRILLO & NINOT (1992), SORIANO (1992), VIGO (1984, sub *Astrantio-Avenuletum*; 1996).

Structure: Diverse hay meadow in which several mountain forbs stand out: *Heracleum sphondylium* subsp. *pyrenaicum* and subsp. *granatense, Pimpinella major, Crepis pyrenaica, Centaurea nigra, Polygonum bistorta,* etc. However, the bulk of the community is formed in most cases by general *Arrhenatheretalia* grasses (*Trisetum flavescens, Dactylis glomerata*, etc.), legumes (as *Trifolium pratense* and *Vicia cracca*) and other herbs (*Taraxacum* gr. *officinale, Geranium pratense, Rhinanthus mediterraneus*, etc.)

Ecology: Gentle reliefs, generally settling on Quaternary formations (such as alluvial terraces, morraines or other colluvia). Exploited for fodder through one or two mowings in summer, grazed at the end of summer in some places; fertilized by dung addition and in most cases more or less watered in summer.

Distribution: From high submontane to low subalpine belts, in axial Pyrenees.

Variabilily: Two subassociations are known.

- **typicum**, which is especially well characterized in the central Pyrenees, in areas under a somewhat atlantic influence.

- **astrantietosum majoris** Vigo 1996 [*Astrantio-Avenuletum pubescentis* Vigo 1984]. Holotypus: VIGO 1984, *Collect. Bot.* 15 :479-480, tab. 6, rel. 4 (Pardines, 1100 m, Ribes valley, E Pyrenees). From the eastern Pyrenees, it is devoid of atlantic taxa and shows more abundance of some hygrophilous differentials (such as *Trollius europaeus* and *Polygonum bistorta*), as there the association is restricted to especially wet sites.

Alchemillo xanthochlorae-Trollietum europaei Vigo in Ninot et al., ass. nova

[*Alchemillo-Trollietum* Vigo 1979, nom. inval.]
Holotypus: VIGO 1979, *Butll. Inst. Cat. Hist. Nat.* 44 :81-82, rel. 2 (Taga, 1840 m, E Pyrenees).
Data: CARRERAS (1993), CARRERAS *et al.* (1993, 1996), ROSELL (1978), SORIANO (1992), VIGO (1979, 1996).

Structure: Assemblage of hygrophilous, medium-sized forbs dominated by *Trollius europaeus* or *Polygonum bistorta*; other noticeable taxa are *Ranunculus acris, Alchemilla xanthochlora, Poa trivialis* and *Hypericum maculatum*.

Ecology: It occurs mainly as small stands on damp to flooded soils, sometimes close to rivulets or other water courses.

Distribution: Sub-alpine belt, in wet areas of the Pyrenees.

Variabilily: Two subassociations have been described.

- **typicum**, which corresponds to the general description of the association.

- **rumicetosum amplexicaulis** Carreras, Carrillo, Masalles, Ninot et Vigo in Ninot et al., subass. nova [*rumicetosum amplexicaulis* Carreras et al. 1993, nom. inval.]. Holotypus: CARRERAS *et al.* 1993, *Acta Bot. Barc.* 42 :232-233, tab. 9, rel. 6 (Castanesa, 2170 m, C Pyrenees). It is a more extensive formation of the high subalpine belt of Castanesa valley, which includes abundant *Rumex acetosa* subsp. *amplexicaulis, Poa alpina* and *Chenopodium bonus-henricus*.

MOLINIETALIA CAERULEAE Koch 1926
CALTHION PALUSTRIS Tüxen 1937
JUNCENION ACUTIFLORI (Braun-Blanquet 1947) stat. nov.

Juncetum sylvatici Braun-Blanquet 1915
[*Juncetum acutiflori* auct.; *Loto-Juncetum acutiflori* Vigo 1968 (lectotypus: VIGO 1968, *Collect. Bot.* 7 :1179, rel.1; Ribes de Freser, 1000 m, E Pyrenees; designed here)].
Data: CARRERAS (1993), CARRERAS & VIGO (1987), GRUBER (1978, sub *Pediculario-Molinietum*), VIGO (1968), VIÑAS (1993).
Structure: Herbaceous community, 50-120 cm tall, with *Juncus acutiflorus* dominant or, at least, abundant.
Ecology: Acid, wet soils, with a water table at or just below the surface for most of the year. It develops under quite atlantic climates.
Distribution: Pyrenees, in the montane and subalpine belts, always covering small areas.

Epilobio-Juncetum effusi Oberdorfer 1957
Data: CARRERAS (1993), CARRERAS & VIGO (1984, 1987), VIGO (1996).
Structure: Tall herbaceous community with *Juncus effusus* as dominant species. It also contains other *Juncus* taxa (*J. articulatus, J. acutiflorus*, etc.) and some broad-leaved plants. *Epilobium palustre* is considered a differential taxon.
Ecology: It grows on siliceous substrata and in non-oligotrophic, permanently wet soils, and often appears in contact with *Nardion* pastures or *Caricion fuscae* fens.
Distribution: Pyrenees, in the montane and subalpine belts. It is found in the Pallars Sobirà, Alt Urgell and Ripollès valleys.
Comment: *Deschampsia cespitosa* and *Juncus conglomeratus* community, reported by CARRILLO & NINOT (1992) from Vall de Boí, and *Juncus conglomeratus* community from Cerdanya (SORIANO 1992) should perhaps to be included in *Epilobio-Juncetum effusi*.

Junco-Caricetum punctatae O. Bolòs 1959
[*Carici-Juncetum acutiflori* O. Bolòs (1959) 1979 nom. invers.]
Lectotypus: BOLÒS 1959, *Arx. Sec. Cièn.* 26 :83, rel 1 (Riudarenes, 70 m, N Catalanidic terr.; designed in BOLÒS 1979 :207).
Data: BOLÒS (1959, 1979, 1983).
Structure: Rush bed, generally with *J. acutiflorus* or *J. effusus* as dominant taxa. The community is poorer in medioeuropean plants than the two communities described above.
Ecology: Acid, often oligotrophic, wet soils.
Distribution: East Pyrenees and north Catalanidic territory in lowlands and in submontane belt, where it is rare.
Variabilily: Three subassociations have been described.

- **oenanthetosum pimpinelloidis** O. Bolòs 1959 (= **typicum**). Floristically very poor, it is found in La Selva plain, and contains *Oenanthe pimpi-nelloides* and *Scirpus holoschoenus* var. *australis* as differential plants.
- **juncetosum effusi** O. Bolòs 1979. Holotypus: BOLÒS 1979, *Phytocoenol.* 6 :206, rel. 1 (Montseny massif, 1000 m, C Catalanidic range). Close to *Epilobio-Juncetum effusi*, it grows in very wet soils in the Montseny massif and contains abundant *Carex punctata*. *Anagallis tenella, Carex echinata* and *Equisetum arvense* are considered differential taxa.
- **juncetosum acutiflori** O. Bolòs 1979. Holotypus: BOLÒS 1979, *Phytocoenol.* 6 :206, rel. 3 (Montseny massif, 1100 m, C Catalanidic range). It grows in drier soils and contains notably *Juncus acutiflorus* and *Carex pallescens* as differential taxa.

CALTHENION PALUSTRIS (Tüxen 1973) Balátová-Tulácková 1978

Cirsietum rivularis Nowinski 1928 **chaerophylletosum hirsuti** Vigo et Carreras 1984

Holotypus: CARRERAS & VIGO (1984), *Collect. Bot.* 15 :123, tab. 1, rel. 2 (Montenartró, 1525 m, C Pyrenees).
Data: CARRERAS (1993), CARRERAS *et al.* (1993), CARRERAS & VIGO (1984, 1987), CARRILLO & NINOT (1992), SORIANO (1992).
Structure: Tall herbaceous community (60-130 cm), mainly containing diverse broad-leaved plants and dominated by a diversity of taxa such as *Cirsium rivulare, Deschampsia cespitosa, Filipendula ulmaria, Ranunculus platanifolius, Trollius eruropaeus, Caltha palustris*, etc. *Chaerophyllum hirsutum* is sometimes abundant and some shrubs, such as *Salix phylicifolia* subsp. *basaltica*, can also be present. This subassociation lacks several of the plants present in the typical subassociation.
Ecology: Flooded sites, edges of streams, with a constantly high water table. It is frequent on alluvial sediments and morainic substrata.
Distribution: Pyrenees, in the montane and subalpine belts. It appears in an especially poor form in the Prepyrenean zone.

Chaerophyllo hirsuti-Ranunculetum aconitifolii Oberdorfer 1952
Data: CARRILLO & NINOT (1995).
Structure: Tall herbaceous community dominated by *Crepis paludosa*. Characteristic taxa of the alliance and higher units (*Carex paniculata, Chaerophyllum hirsutum,* etc.) are rather abundant.
Ecology: Clearings in fir woods, in peaty, very wet soils, frequently with water running on the surface.
Distribution: Central Pyrenees in the higher part of the montane belt of atlantic areas, where it is rare.

Chaerophyllo hirsuti-Valerianetum pyrenaicae Carreras et Vigo 1984
[non *Chaerophyllo hirsuti-Valerianetum pyrenaicae* Rivas Martínez et al. 1984 corr. Izco et Guitian 1986 nom. illeg., non *Chaerophyllo aurei-Valerianetum pyrenaicae* Rivas Martínez et al. 1984].
Holotypus: CARRERAS & VIGO (1984), *Collect. Bot.* 15 :126, tab. 2, rel. 2 (Ribes valley, 1400 m, E Pyrenees).
Data: CARRERAS (1993), CARRERAS & VIGO (1984, 1987).
Structure: Herbaceous community, always dense and tall (1-2 m), generally dominated by *Valeriana pyrenaica* and certain species characteristic of upper units, such as *Chaerophyllum hirsutum*, *Angelica sylvestris* or *Filipendula ulmaria*.
Ecology: Wet, shady places, mainly along banks of streams runing through forests. Often in contact with *Cardamino-Montion* communities.
Distribution: Pyrenees, in the montane belt and mainly under oceanic climates.

Dactylorhizo majalis-Caricetum paniculatae Carreras et Vigo 1984
Holotypus: CARRERAS & VIGO 1984, *Collect. Bot.* 15 :128, tab. 3, rel. 1 (Pardines, Ribes valley, 1600 m, E Pyrenees).
Data: CARRERAS (1993), CARRERAS *et al.* (1993), CARRERAS & VIGO (1984, 1987), CARRILLO & NINOT (1992), SORIANO (1992).
Structure: Tall graminoid community dominated by *Carex paniculata*, but containing numerous broad-leaved taxa, characteristic of the alliance.
Ecology: Marshes, diffused springs, wet places, often with gently running water and irregular surface relief. It seems indiferent to substratum, but possibly needs carbonated waters.
Distribution: Pyrenees, in the higher part of the montane belt.

FILIPENDULENION ULMARIAE (Lomheyer in Oberdorfer et al. 1967) Balátová-Tulácková 1978

Ranunculo acris-Filipenduletum ulmariae Vigo 1975
[*Cirsio-Filipenduletum ulmariae* Romo 1983 nom. inval.].
Lectotypus: VIGO 1975, *Anal. Inst. Bot. A.J. Cav.* 32(2) :955, tab. 1, rel. 3 (Pardines, 975, Ribes valley, E Pyrenees; designed here).
Data: CARRERAS *et al.* (1993, 1996), CARRERAS & VIGO (1987), CARRILLO & NINOT (1992), ROMO (1983), SORIANO (1992), VIGO (1975, 1996).
Structure: Tall herbaceous community, generally dominated by *Filipendula ulmaria*. Poor in alliance characteristics, but containing several taxa from wet meadows as well as some nitrophilous and sciophilous plants.
Ecology: Damp soils rich in nitrogen and well drained. Mainly in forest or meadow edges and along drainage channels, it is especially associated with ash and alder forests.
Distribution: Pyrenees, in the submontane and montane belts.
Variabilily: Three subassociations have been considered.
- **typicum**. General, growing in medium damp soils.
- **eupatorietosum cannabini** Carrillo et Ninot 1992. Holotypus: CARRILLO & NINOT 1992, *Arx. Sec. Cièn.* 99(2) :178, tab. 27, rel. 11 (Espot, 1330 m, C Pyrenees). Dominated by *Eupatorium cannabinum*, it grows in very wet soils.

- **lysimachietosum vulgaris** Carreras et Vigo in Ninot et al., subass. nova [*lysimachietosum vulgaris* (Romo) Carreras et Vigo 1987 nom. inval., *Cirsio-Filipenduletum* var. of *Lysimachia vulgaris* Romo 1983 nom. inval.]. Holotypus: ROMO 1983, *Collect. Bot.* 14 :545, tab. 1, rel. 4 (Cabdella, 790 m, C Pyrenees). In damp soils. Several hygrophilous plants, such as *Lysimachia vulgaris, Lythrum salicaria, Epilobium hirsutum* and *Angelica sylvestris*, are considered differentials.
Comment: The relationship between this association —especially the subassociation *lysimachietosum*— and *Lysimachio vulgaris-Filipenduletum* Balátová-Tulácková 1978 should be considered.

MOLINION CAERULEAE Koch 1926

Molinietum caeruleae Koch 1926
Data: CARRILLO & NINOT (1992).
Structure: Grass community dominated by *Molinia caerulea* subsp. *caerulea*, developing late in summer. In the area considered it is rather poor in characteristic taxa.
Ecology: Wet, peaty soils, on slightly acid substrata.
Distribution: Central Pyrenees, in the montane belt.

Molinio-Caricetum lepidocarpae Baulies et Romo in Romo 1983
Holotypus: ROMO 1983, *Collect. Bot.* 14 :549, rel. 10 (Montsec range, C pre-Pyrenees).
Data: ROMO (1983), SORIANO (1992).
Structure: Grass community with *Carex lepidocarpa, Carex mairii, Parnassia palustris*, *Tofieldia calyculata* as local characteristic taxa. Moreover, *Molinia caerulea, Carex mairii, Carex lepidocarpa, Schoenus nigricans,* etc. are generally abundant.
Ecology: Wet, silty-sandy and well-drained soils, rich in calcium. Especially along stream banks.
Distribution: Pre-Pyrenees, in the submontane and montane belts.
Variabilily: Two subassociations were described.
- **typicum**. In permanently wet soils.
- **pinguiculetosum grandiflorae** Baulies et Romo in Romo 1983. Holotypus: ROMO 1983 :550, rel. 7 (Montsec range, C pre-Pyrenees). Open community dominated by grasses and rushes, growing in drier soils, often in small rocky shelters.
Comment: It appears to be a very local association, the exact definition of which needs to be checked.

Carici pallescentis-Molinietum Carreras et Vigo 1987
[*Gentiano-Molinietum pyrenaicum* Vigo 1968 assoc. prov.].
Holotypus: CARRERAS & VIGO 1987, *Lazaroa* 7 :503, tab. 2, rel. 1 (Pardines, 1650 m, Ribes valley, E Pyrenees).
Data: CARRERAS & VIGO (1987), VIGO (1968).

Structure: Herbaceous community dominated by *Molinia caerulea* subsp. *arundinacea* or, sometimes, by other hygrophytes such as *Juncus conglomeratus* or *Succisa pratensis*. It contains, besides plants of the alliance, some acidophilous differential taxa (*Carex pallescens, Serratula tinctoria, Danthonia decumbens*, etc.). *Gentiana pneumonanthe* and *Scorzonera humilis*, although very rare, were considered territorial characteristics.
Ecology: Wet soils with a quite fluctuating water table, neutral or slightly acid.
Distribution: East Pyrenees in montane and subalpine belts.
Comment: BALÁTOVÁ-TULÁCKOVÁ (1993) suggests this association is very similar to *Gentiano pneumonanthis-Molinietum littoralis* Ilijanic 1968.

Epipactidi palustris-Molinietum Montserrat, Soriano et Vigo in Carreras et Vigo 1987
Holotypus: CARRERAS & VIGO 1987, *Lazaroa* 7 :506, tab. 3, rel. 5 (Pardines, 1250 m, Ribes valley, E Pyrenees).
Data: CARRERAS (1993), CARRERAS & VIGO (1987), SORIANO (1992).
Structure: Herbaceous community, generally dominated by *Molinia caerulea* subsp. *arundinacea*. The orchid *Epipactis palustris* can sometimes be abundant in the association, which also contains several mediterranean taxa such as *Cirsium monspessulanum, Carex mairii,* etc.
Ecology: Basic soils rich in calcium, often clayish and poorly aerated, with fluctuating ground water level. On marly or schistaceous substrata.
Distribution: Pyrenees, mainly in the Prepyrenean zone, in the montane belt.

Violo cornutae-Euphorbietum hybernae Romo 1986
Holotypus: ROMO 1986, *Collect. Bot.* 16(2) :403-405, tab. 3, rel. 5 (Alòs d'Isil, 1620 m, C Pyrenees).
Data: ROMO (1986).
Structure: Tall herbaceous community dominated by several forbs (*Trollius europaeus, Euphorbia hyberna, Gentiana lutea, Geranium sylvaticum*, etc.). Supposed characteristic taxa of association and alliance: *Euphorbia hyberna, Viola cornuta, Festuca altissima, Silene dioica, Chaerophyllum hirsutum, Ranunculus aconitifolius*.
Ecology: Edges of damp woodlands, cool and fairly shady places, on siliceous substrata.
Distribution: Central Pyrenees, in the montane and lower subalpine belts, in the domain of the fir woods.
Comment: This very local association was the basis for the description of a new alliance, *Violion cornutae* Romo 1986, which is a poorly characterised one, including plants of *Calthion, Polygono-Trisetion* and, even, *Betulo-Adenostyletea*. The actual definition of the alliance and association needs to be tested.

AGROSTIETALIA STOLONIFERAE Oberdorfer, Th. Müller et Görs 1967
DESCHAMPSION MEDIAE Braun-Blanquet (1947) in Braun-Blanquet et al. 1952

Deschampsietum mediae Braun-Blanquet 1931
Data: Bolòs (1959, 1967), Romo (1989), Rosell (1978).
Structure: Light community mainly formed by *Deschampsia media* subsp. *media* and *Plantago maritima* subsp. *serpentina*, and also including other species of seasonally damp soils (e.g., *Carex flacca, Trifolium repens* and *T. lappaceum*)

Ecology: Small concavities, settling on dense, temporarily flooded soils, in calcareous areas.
Distribution: submediterranean areas from Central Catalanidic mountains to southern pre-Pyrenees, in lowlands and in the submontane belt.
Variabilily: In the area considered two subassociation are known.
- **holoschoenetosum vulgaris** (O. Bolòs 1959) O. Bolòs, nom. nov. (*deschampsio-holoschoenetosum* O. Bolòs 1959, nom. illeg.). Holotypus: BOLÒS 1959: *Arx. Secc. Cièn.* 26 :147-148 (Seva, 680 m, Ausosegarric terr.). Sparse in the Catalanidic and Ausosegarric territories.
- **deschampsietosum hispanicae** Romo 1989, nom. corr. Ninot et al. 1999 [*hispanicetosum* Romo 1989, nom. illeg.]. Holotypus: ROMO 1989, *Arx. Secc. Cièn.* 90 :386, rel. 1 (Montsec de Rúbies, 860 m, C pre-Pyrenees). Particular to Central pre-Pyrenees, where *Deschampsia media* subsp. *media* is replaced by subsp. *hispanica*.

Agrostio-Achilleetum agerati Braun-Blanquet in Braun-Blanquet et al. 1952
Data: BOLÒS (1983, 1996a), CONESA (1991a).
Structure: Herbaceous community dominated by *Achillea ageratum*, and containing other taxa able to colonize fine-textured soils, including *Agrostis stolonifera, Trifolium fragiferum* and *Centaurium pulchellum*.
Ecology: Small depressions, seasonally flooded, on clay, compact, lime-rich soils.
Distribution: Southern pre-Pyrenees and mild, northern mediterranean mountains, from lowlands to the submontane belt.

Plantagini serpentinae-Jasonietum tuberosae (O. Bolòs) O. Bolòs et Masalles in O. Bolòs 1983
[*Deschampsietum mediae* Braun-Blanquet 1931 *inulo-plantaginetosum serpentinae* O. Bolòs 1959, *Jasonio-Plantaginetum* O. Bolòs 1996]
Holotypus: BOLÒS 1959, *Arx. Secc. Cièn.* 26 :148 (Tona, 600 m, Ausosegarric terr.).
Data: BOLÒS (1959, 1996a), SORIANO (1992), VIGO (1996), VIÑAS (1993).
Structure: Sparse, irregular community of narrow-leaved species of seasonally damp soils, mainly *Plantago maritima* subsp. *serpentina* and *Jasonia tuberosa*; it also includes individuals of *Agrostis stolonifera, Trifolium pratense* and other meso-hygrophilous plants.
Ecology: Clay, dense, lime-rich soils of depressions, flooded in winter and dried out in summer.
Distribution: Submontane and montane belts, from eastern Pyrenees to northern Catalanidic, submediterranean areas.

Centaurio barrelieri-Jasonietum tuberosae O. Bolòs 1996
Holotypus: BOLÒS 1996a, *Mem. R. Acad. Ci. Art. Barc.* 930 :15, rel. 3 (La Llacuna, 650 m, Ausosegarric terr.).
Data: BOLÒS (1996).

Structure: Very light, herbaceous community formed by sparse narrow-leaved herbs as *Jasonia tuberosa, Centaurium quadrifolium* subsp. *barrelieri, Seseli elatum* and *Brachypodium phoenicoides*.
Ecology: Small patches within mediterranean light scrubs or pastures, settling on clay, compact, lime-rich soils which turn from damp in winter to very dry in summer.
Distribution: Ausosegarric territory, at low altitudes of mediterranean sub-continental areas.

AGROSTION STOLONIFERAE Görs 1966

Jasonio tuberosae-Tussilaginetum farfarae Vives 1964
Lectotypus: Vives 1964, *Acta Geobot. Barc.* 1 :147, rel. 1 (La Coma near Sant Llorenç de Morunys, 950 m, E pre-Pyrenees; designed in BOLÒS & MASALLES 1983 :32).
Data: BOLÒS (1996), BOLÒS & MASALLES (1983), CARRERAS *et al.* (1996), MOLERO (1976), VIVES (1964).
Structure: Irregular, medium-dense herbaceous community formed by dominant *Tussilago farfara* and also species like *Agrostis stolonifera, Jasonia tuberosa* or *Trifolium pratense.*
Ecology: Sloped or flat surfaces of clay, dense, bad structured soils (frequently colluvia) which remain damp for most of the year and rather dry in summer.
Distribution: In lowlands or in the submontane and montane belts, from the pre-Pyrenees to Central Catalanidic mountains, in lime rich areas.
Variabilily: Three subassociations have been described
- **jasonietosum tuberosae** (= **typicum**), which occurs in moderately dry conditions, in the pre-Pyrenees, and shows rather low density.
- **ranunculetosum repentis** O. Bolòs et Masalles 1983. Holotypus: BOLÒS & MASALLES 1983, *Mapa veg. Banyoles* :32 (El Sallent de Santa Pau, 500 m, Olositanic terr.). It grows in moister habitats, in the pre-Pyrenees, and correspond to dense populations of *Tussilago,* which include some hygrophylous differentials (such as *Ranunculus repens*).
- **populetosum canadensis** O. Bolòs 1996. Holotypus: BOLÒS 1996a, *Mem R. Acad. Ci. Art. Barc.* 930 :16, rel. 1 (La Llacuna, 510 m, Ausosegarric terr.). Typical of mediterranean areas, it is restricted along small stream courses, under the light shade of sparse deciduous trees (such as *Populus canadensis, P. alba* and *Sambucus nigra*).

Prunello vulgaris-Agrostietum stoloniferae O. Bolòs et Masalles 1983
Holotypus: BOLÒS & MASALLES 1983, *Mapa veg. Banyoles* :98 (El Sallent de Santa Pau, 500 m, Olositanic terr.).
Data: BOLÒS (1996), BOLÒS & MASALLES (1983), SORIANO (1992), VIÑAS (1993).
Structure: *Agrostis stolonifera* grasslands which include other plants typical of seasonally flooded, dense soils (like *Potentilla reptans, Trifolium fragiferum, T. repens* and *Ranunculus repens*).

Ecology: Small depressions on clay, seasonally flooded soils, in verges, stream sides or other open habitats, in lime-rich areas.
Distribution: From the eastern pre-Pyrenees to the Ausosegarric territory, in lowlands or in the submontane belt.

POTENTILLION ANSERINAE Tüxen 1947
[*Agropyro-Rumicion* auct.]

Junco inflexi-Menthetum longifoliae Lohmeyer 1953
[*Mentho-Juncetum inflexi*, auct.]
Data: CARRERAS *et al.* (1988, 1997), CARRILLO & NINOT (1992), MOLERO & VIGO (1981, sub *Cirsio-Menthetum*, according to VIGO 1996: 130), SORIANO (1992), VILLEGAS (1993).
Structure: Herbage mainly formed by *Mentha longifolia* and *Juncus inflexus*, also characterized by the presence of taxa such as *Agrostis stolonifera, Poa trivialis, Ranunculus repens* or *Tussilago farfara.*
Ecology: It settles on seasonally flooded, clay, dense soils, forming small stands next to springs or water courses, normally subject to cattle trampling and ruderalization.
Distribution: Pyrenees, from the upper part of the submontane belt to the basis of the subalpine belt.
Comment: *Mentho-Juncetum* is related with *Cirsio-Menthetum* (all. *Molinio-Holoschoenion*) through a gradation of intermediate forms.

Dactylido glomeratae-Festucetum arundinaceae Tüxen ex Lohmeyer 1953
Data: VIGO (1996).
Structure: Trampled grassland of *Dactylis glomerata* and *Festuca arundinacea.*
Ecology: Edge of meadows or paths, on moist, dense soils.
Distribution: Only one relevé has been tentatively referred to; perhaps sparse in the submontane and montane belts of the Pyrenees.

Rumici crispi-Agrostietum stoloniferae Moor 1958
[*Rorippo-Agrostietum stoloniferae* (Moor) Oberdorfer et Müller 1961]
Data: CARRERAS *et al.* (1988).
Structure: It corresponds to dense *Rorippa sylvestris* populations, which include both *Agropyro-Rumicion* and *Bidention* taxa such as *Agrostis stolonifera, Ranunculus repens, Bidens tripartita* and *Polygonum persicaria.*
Ecology: River beds emerging in summer.
Distribution: Only known from eastern Pyrenees, in the submontane belt.

Festuco-Caricetum hirtae O. Bolòs 1962
Lectotypus: BOLÒS 1962, *Pais. veg. barc.* :tab. 84, rel. 4 (near Llavorsí, 780 m, C Pyrenees; designed in BOLÒS 1997 :212).
Data: BOLÒS (1962), CARRERAS *et al.* (1988, 1997), MOLERO & VIGO (1981), VIÑAS (1993).
Structure: Stands of *Carex hirta* and *Festuca arundinacea* grassland, also cointaining *Ranuculus repens, Potentilla reptans, Lathyrus pratensis,...*
Ecology: Small depressions subject to flooding and disturbance (trampling, grazing, ruderalization), sometimes at the side of water courses.

Distribution: From the Pyrenees to the south Catalanidic Mountains, in the submontane and montane belts, rarely in lowlands.

HOLOSCHOENETALIA VULGARIS Braun-Blanquet (1931) 1947
MOLINIO-HOLOSCHOENION VULGARIS Braun-Blanquet (1931) 1947

Inulo viscosae-Schoenetum nigricantis Braun-Blanquet 1924
Data: BOLÒS (1962, 1996), BOLÒS & MASALLES (1983), BRAUN-BLANQUET & BOLÒS (1950, *sub* comm. of *Molinia* and *Schoenus*), CONESA (1991a, 1991b), LLANSANA (1976), MOLERO (1976), PAPIÓ *et al.* (1983), ROVIRA (1986), SORIANO (1992).
Structure: Fens mainly formed by the tall grass *Molinia caerulea* subsp. *arundinacea* and the medium-sized, rush-like *Schoenus nigricans*; other frequent species are *Scirpus holoschoenus, Cirsium monspessulanum, Agrostis stolonifera* and *Lysimachia ephemerum*.
Ecology: Dense, clay soils seasonally flooded with lime-rich water.
Distribution: From the pre-Pyrenees southwards, mainly in mediterranean mountains but also in lowlands and in the submontane belt.
Variabilily: Two subassociations have been found.
- **sonchetosum aquatilis** O. Bolòs 1962. Holotypus: BOLÒS 1962, *Pais. veg. barc.* : tab. 31, rel. 2 (Corbera, 470 m, C Catalanidic terr.). This is the general community throughout the range of the association, and sometimes contains *Sonchus maritimus* subsp. *aquatilis*.
- **dorycnietosum gracilis** O. Bolòs 1962. Holotypus: BOLÒS 1962, *Pais. veg. barc.* : tab. 31, rel. 1 (Llobregat delta). A slightly halophilous community differenced by *Dorycnium pentaphyllum* subsp. *gracile* and *Linum maritimum*, occasionally found in both maritime and inland areas.

Holoschoenetum vulgaris Braun-Blanquet in Braun-Blanquet et al. 1952
[*Cirsio monspessulani-Holoschoenetum* auct.]
Data: A. BOLÒS (1950), BOLÒS (1959, 1962, 1983, 1996), BOLÒS & MASALLES (1983), BRAUN-BLANQUET & BOLÒS (1958), CARRERAS *et al.* (1996), CARRILLO & NINOT (1992), CONESA (1990, 1991a, 1991b), FRANQUESA (1995), GESTI (2000), LLANSANA (1976), PAPIÓ *et al.* (1983), ROMO (1989), ROVIRA (1986), SORIANO (1992), VIGO (1996), VILAR (1987), VIÑAS (1993), VIVES (1964, sub *Cirsio-Menthetum*, according to VIGO 1996).
Structure: Herbaceous community in which the tall, rush-like *Scirpus holoschoenus* (= *Holoschoenus vulgaris*) is more or less dominant. Amongst its turfs, several mediterranean hygrophytes are typical, such as *Mentha suaveolens, Pulicaria dysenterica, Cirsium monspessulanum* and *Molinia caerulea* subsp. *arundinacea,* as well as other general hygrophytes; moreover, some taxa resistant to trampling (as are *Agrostis stolonifera* and *Juncus inflexus*) are also frequent.
Ecology: Damp soils near springs or water courses, subject to seasonal water table oscillations, from occasional flooding to relative drying out in summer.
Distribution: Thorough all the area, in lowlands and in the submontane belt.
Variabilily: 9 subassociations and some variants have been found, related to ecological and to phytogeographic features.

- **cirsietosum monspessulani** Braun-Blanquet et O. Bolòs 1958. Lectotypus: BRAUN-BLANQUET & BOLÒS 1958, *An. Aula Dei*, 5 :105, tab. 25, rel. 1 (Vilanova de la Barca, 180 m, Sicoric terr.; designed in BOLÒS 1997 :213). With abundant *Cirsium mospessulanum* and *Sonchus maritimus* subsp. *aquatilis* shows a rather mountain sub-continental character.

- **agrostietosum stoloniferae** (O. Bolòs 1962) O. Bolòs, nom. nov. [*agrostio-potentilletosum reptantis* O. Bolòs 1962, nom. illeg.]. Lectotypus: BOLÒS 1962, *Pais. veg. barc.* :tab. 30, rel. 5 (Cervelló, 85 m, S Catalanidic terr.; designed here). General in central and south Catalanidic areas, includes some taxa resistant to trampling, such as *Agrostis stolonifera* and *Potentilla reptans.*

- **dorycnietosum gracilis** (O. Bolòs 1962) O. Bolòs, nom. nov. [*agrostidi-dorycnietosum gracilis* O. Bolòs 1962, nom. illeg.]. Holotypus: BOLÒS 1962, *Pais. veg. barc.*: tab. 30, rel. 9 (Llobregat delta). It is known from the Llobregat delta, settling on slightly saline soils, as revealed by the presence of *Dorycnium pentaphyllum* subsp. *gracile.*

- **juncetosum inflexi** O. Bolòs et Masalles 1983. Holotypus: BOLÒS & MASALLES 1983, *Mapa veg. Banyoles* :29, rel. 2 (El Sallent de Santa Pau, 370 m, Olositanic terr.). It occurs in disturbed sites (mainly through trampling) as is evidenced by the dominance of *Juncus inflexus*, in the Olositanic territory.

- **succisetosum pratensis** O. Bolòs et Masalles 1983. Holotypus: BOLÒS & MASALLES 1983, *Mapa veg. Banyoles* :28 (Sant Miquel de Campmajor, 400 m, Olositanic terr.). Known from Olositanic and east pre-Pyrenean areas, it is differentiated by *Succisa pratensis* and *Ranunculus acris* var. *latilobus.*

- **linetosum maritimi** O. Bolòs et Masalles 1983. Holotypus: BOLÒS & MASALLES 1983, *Mapa veg. Banyoles* :30, rel. 2 (Porqueres, 180 m, Ruscinic terr.). Known from the Ruscinic area, this is a slightly halophilous subassociation which includes *Linum maritimum* as main differential.

- **phragmitetosum australis** O. Bolòs 1996. Holotypus: BOLÒS 1996a, *Mem. R. Acad. Ci. Art. Barc.* 930 :22 (Santa Maria de Miralles, 480 m, Ausosegarric terr.; the only relevé). Described from the Ausosegarric territory, this subassociation is dominated by *Phragmites communis* and occurs in intermittent water beds.

- **poetosum trivialis** O. Bolòs 1996. Holotypus: BOLÒS 1996a, *Mem. R. Acad. Ci. Art. Barc.* 930 :20, rel. 4 (Solsona, 650 m, Ausosegàrric terr.). A rather poor community, with *Poa trivialis* and *Pulicaria dysenterica*, found in the Ausosegarric territory.

- **sonchetosum aquatilis** O. Bolòs 1996. Holotypus: BOLÒS 1996a, *Mem. R. Acad. Ci. Art. Barc.* 930 :21 (La Llacuna, 510 m, Ausosegàrric terr.). Only the holotypus is known, also from the Ausosegarric territory.

Centaureo vinyalsii-Succisetum pratensis O. Bolòs 1954

[*Centaureo jaceae-Succisetum*]

Lectotypus: BOLÒS 1954, *Collect. Bot.* 4 :256-258, tab.3, rel. 2 (El Sallent de Santa Pau, 450 m, Olositanic terr.; designed in BOLÒS & MASALLES 1983 :27).

Data: BOLÒS (1954, 1996a), BOLÒS & MASALLES (1983), VIVES (1964).

Structure: Dense, herbaceous community dominated by *Succisa pratensis* and also containing *Centaurea jacea* subsp. *vinyalsii, Molinia caerulea* subsp. *arundinacea, Trifolium pratense, Potentilla reptans, Carex flacca....*
Ecology: Damp forest clearings or surfaces along small water courses, on lime rich, more or less flooded soils.
Distribution: Eastern pre-Pyrenees and neighbouring submediterranean areas, in lowlands or in the submontane belt.
Variabilily: Three subassociations have been described.
- **centaureetosum vinyalsii** (= **typicum**), where the water table fluctuates and flooding is only occasional, in eastern pre-Pyrenees and north Catalanidic mountains.
- **holoschoenetosum vulgaris** O. Bolòs et Masalles 1983. Holotypus: BOLÒS 1954, *Collect. Bot.* 4 : 256-258, tab. 3, rel. 4 (El Sallent de Santa Pau, 350 m, Olositanic terr.; designed in Bolòs & Masalles 1983 :27). Typical of more flooded soils, in the same areas as the former, it is differentiated by species related to mediterranean rush formations, such as *Scirpus holoschoenus, Equisetum telmateia* or *Mentha aquatica.*
- **molinietosum arundinaceae** O. Bolòs 1996. Holotypus: BOLÒS 1996a, *Mem. R. Acad. Ci. Art. Barc.* 930 :23, rel. 1 (Guardiola de Berguedà, 800 m, E pre-Pyrenees). A poorly characterized form found in less rainy areas, frequently dominated by *Molinia caerulea* subsp. *arundinacea.*
Comment: A transitional association between mediterranean *Holoschoenetalia* and central European *Molinietalia*.

Cirsio monspessulani-Menthetum longifoliae O. Bolòs et Vives in O. Bolòs 1956
Lectotypus: BOLÒS 1956, *Collect. Bot.* 5 :221-222, tab. 23, rel. 4 (Queralbs, 1150 m, E Pyrenees; designed in VIGO 1996 :130).
Data: BOLÒS (1956), CARRILLO & NINOT (1992), GRUBER (1978), MOLERO & VIGO (1981; vid *Junco-Menthetum*), ROSELL (1978), SORIANO (1992), VIGO (1979, 1996), VILLEGAS (1993), VIVES (1964).
Structure: Herbaceous stands dominated by *Cirsium monspessulanum* and *Mentha longifolia*, which contain *Festuca arundinacea, Poa trivialis, Equisetum arvense, Agrostis stolonifera, Trifolium pratense* and other general hygrophytes.
Ecology: Damp, lime-rich or eutrophic soils, temporarily flooded, next to rivers or other water bodies.
Distribution: Pyrenees, in the montane and submontane belts.
Comment: Intermediate examples between this association and *Junco-Menthetum* (*Agropyro-Rumicion*) are very frequent; some of the relevés classified in *Cirsio-Menthetum*, mainly in former references, should be included in *Junco-Menthetum*.
Variabilily: Two subassociations have been recognized.
- **typicum**, which corresponds to the above described community.
- **epilobietosum hirsuti** Vigo 1979. Holotypus: VIGO 1979, *Butll. Inst. Cat. Hist. Nat.* 44 : 78-80, rel. 9 (the only relevé). A transition to *Arction* communities.

Galio-Juncetum subnodulosi Braun-Blanquet 1931 **acrocladietosum cuspidati** O. Bolòs et Masalles 1983

Holotypus: BOLÒS & MASALLES 1983, *Mapa veg. Banyoles* :31 (Porqueres, 170 m, Ruscinic terr.).
Data: BOLÒS & MASALLES (1983).
Structure: Wet meadows frequently dominated by *Juncus subnodulosus* and with abundant *Succisa pratensis, Acrocladium cuspidatum, Molinia caerulea* subsp. *arundinacea, Lythrum salicaria, Oenanthe lachenalii...*
Ecology: Wet, flooding, lime-rich soils, subject to irregular mowing or grazing.
Distribution: It has been only found around Banyoles lake (Olositanic territory).

Mentho-Caricetum loscosii O. Bolòs (1957) 1967

[*Peucedano-Sonchetum aquatilis* O. Bolòs 1957 *caricetosum loscosii* O. Bolòs 1957]
Lectotypus: BOLÒS 1957b, *Collect. Bot.* 5 :558-559, rel. 6 (Rossell, 320 m, S Catalanidic terr.; designed in BOLÒS 1997 :216).
Data: BOLÒS (1957b, 1967), MOLERO (1976), ROVIRA (1986).
Structure: Rush community mainly formed by *Sonchus maritimus* subsp. *aquatilis* and *Scirpus holoschoenus*, and including as main characteristics *Carex mairii* var. *loscosii, Mentha longifolia* and *Juncus inflexus.*
Ecology: Wet, seasonally waterlogging soils next to springs or water courses.
Distribution: South Catalanidic mountains.

Peucedano hispanici-Sonchetum aquatilis O. Bolòs 1957

[*Peucedano-Sonchetum scrophularietosum aquaticae* O. Bolòs 1957, = *typicum*]
Lectotypus: BOLÒS 1957b, *Collect. Bot.* 5 :558-559, rel. 1 (Sueca, 20 m, Valencia province; designed in BOLÒS 1997 :217).
Data: BOLÒS (1957b), ROVIRA (1986).
Structure: Hygrophilous forb community including as main species *Sonchus maritimus* subsp. *aquatilis, Mentha suaveolens, Pulicaria dysenterica, Scrophularia auriculata* subsp. *pseudoauriculata* and *Peucedanum hispanicum.*
Ecology: Wet, temporarilly flooded soils bordering water courses.
Distribution: South Catalanidic lowlands.

Lysimachio-Holoschoenetum vulgaris Rivas Goday et Borja 1961

Data: CONESA (1991b).
Structure: Rush formation including *Scirpus holoschoenus, Lysimachia ephemerum, Senecio doria* and *Cirsium pyrenaicum* as main characteristics.
Ecology: Wet, flooding soils.
Distribution: Mediterranean sub-continental mountains.
Comment: Typical from Iberidic mountains, its presence in the area requires confirmation.

Prunello vulgaris-Epilobietum barcinonensis O. Bolòs 1962 prov.

Data: BOLÒS (1962: A mere relevé).
Structure: Small herbaceous stand mainly formed by *Epilobium tetragonum, Agrostis stolonifera* and *Prunella vulgaris*.
Ecology: Humid clearings within mediterranean forests.
Distribution: North Catalanidic mountains.

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Appendix

Alphabetical list of the associations treated, with the corresponding page. Those in italics are considered synonims.

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