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Italian black alder swamps: Their syntaxonomic relationships and originality within the European context

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Abstract

The aim of this study is to present a phytosociological survey of the Italian *Alnus glutinosa*-dominated swamps (*Alnion glutinosae*). The analysis highlights the occurrence of the following associations: *Corno hungaricae-Alnetum glutinosae* and *Carici elatae-Alnetum glutinosae* (northern Italy), *Hydrocotylo-Alnetum glutinosae* and *Scrophulario umbrosae-Alnetum glutinosae* (central and southern Italy). *Carici elongatae-Alnetum glutinosae*, which is widely distributed in central and northern Europe, has so far only been identified in a narrow area of the western continental sector of the Po plain; elsewhere, this association is replaced by communities generally characterized both by the lower expression of species whose main center of distribution is in the central-northern sector of Europe, and by the presence of differential entities. The comparison of data from southern, central and northern Europe confirms the syntaxonomic autonomy of most of the Italian Black Alder swamps. Moreover, the study reveals the existence of a north-to-south phytogeographic gradient, according to which the sub-boreal phytocoenoses are gradually being replaced by the central-European temperate communities as well as by the last southern European phytocoenoses occurring in the temperate and Submediterranean/Mediterranean contexts.

Keywords: *Alnion glutinosae*, Italian communities, phytogeographic gradient, syntaxonomy

Introduction

The swamp woodlands and forests belonging to the *Alnetea glutinosae* class are ecologically well characterized (Noirfalise & Dethioux 1984; Ellenberg 1988; Döring-Mederake 1990; Oberdorfer 1992; Geißelbrecht-Taferner & Wallnöfer 1993; Amigo et al. 2004). These communities are mainly distributed in the lowland-submontane belt; they occur in marshy areas, along the edges of ponds and lakes or in abandoned meanders and on swampy soils that are generally rich in organic matter; the soils are periodically flooded during spring and the water table remains close to the surface even in summer; all these features inhibit the mineral enrichment and the nitrification processes of the soil. Another distinctive feature of the *Alnion glutinosae* communities is the abundance both of reed and sedge bed species (in most cases belonging to *Phragmites-Magnocaricetea*) and of moist-soil meadows entities (*Molinietalia*). All

these features differentiate the *Alnion glutinosae* communities from the alluvial and riparian communities of *Alnion incanae*, *Osmundo-Alnion* and *Populion albae* of the *Quercus-Fagetea* class (Ellenberg 1988; Amigo et al. 2004; Landi & Angiolini 2010). Although the ecological features confer an azonal character on the black alder swamps, their broad Eurosibian distribution has led to some authors identifying significant floristic differences on both a west-east and north-south gradient (Bodeux 1955; Matuszkiewicz et al. 1958; Sólinska-Górnicka 1987; Schönert 1989; Döring-Mederake 1991).

The *Alnus glutinosa*-dominated swamp forests of central and northern Europe have been studied in detail by several authors; particularly noteworthy are the large phytosociological synthesis by Bodeux (1955) and the studies conducted on smaller geographic areas by Noirfalise and Dethioux (1984), Sólinska-Górnicka (1987), Döring-Mederake (1990, 1991), Oberdorfer (1992), Geißelbrecht-

Taferner and Wallnöfer (1993), Prieditis (1997), Franz and Willner (2007), Douda (2008) and Paal et al. (2008).

As far as the southern Europe is concerned, phytosociological syntheses have only been published for Croatia and the Iberian Peninsula (Horvat et al. 1974; Amigo et al. 2004). As regards the Italian communities that can be ecologically attributed to meso-eutrophic and eutrophic woods that are rich in large sedges (mainly *Carex acutiformis*, *C. elata* and *C. riparia*), papers have been published exclusively on small areas, which means a general synthesis is lacking. Indeed, Italian authors refer from time to time to different typologies depending on the model adopted.

The aim of this study is to propose a comprehensive and coherent syntaxonomic scheme of the Italian black alder swamps that may be compared with the corresponding *Alnion glutinosae* communities present in other European regions.

Materials and methods

The analysis was carried out on 104 relevés, both published and unpublished, obtained by means of the Braun-Blanquet (1964) methodology. The published data come mainly from northern Italy and, to a lesser extent, from the Italian peninsular sector. A critical bibliographic research allowed the inclusion of some relevés originally not attributed by Gerdol (1987) and Venanzoni et al. (2003) to *Alnetea glutinosae*.

Relevés were elaborated on the basis of hierarchical classifications using the package Syn-tax 2000 (Podani 2001); data transformation was based on the method proposed by Van der Maarel (1979). Analytic tables were arranged according to the results of the multivariate classifications. The synthetic tables of the main Italian communities were then compared with data in the literature from different European areas. Considering the large body of data available for central Europe (e.g. see Dierschke 2010) and the aim of the present study, only data fulfilling the following criteria were selected: (a) tables concerning meso-eutrophic and eutrophic communities (meso-oligotrophic atlantic *Carici laevigatae-Alnetum* and oligotrophic boreal *Sphagno squarrosi-Alnetum* were not considered); (b) tables consisting of at least five, if possible floristically complete, relevés, which allowed their conversion into the standard model of frequency classes. The 28 synthetic tables from Croatia, Slovenia, Spain, Portugal, Austria, France, Belgium, Germany, the Czech Republic, Poland, Estonia, Latvia, Byelorussia, and Sweden were then compared with ours. The synoptic table was then subjected to a hierarchical classification.

The concept of differential species is in accordance with Mucina (1993). The taxonomic nomenclature corresponds to Pignatti (1982), Conti et al. (2005) and Tutin et al. (1964–1980). The chorotypes follow Oberdorfer (2001) and, in part, Pignatti (1982) and Aeschimann et al. (2004). Data concerning the analytic tables (locations, dates, names of the authors and sources of the relevés) are quoted in the Appendix. The sources of the relevés and the original syntaxa names of the communities in the synoptic European table are cited in the table.

Results

The dendrogram of the Italian relevés highlights the presence of two main clusters (1 and 2 in Figure 1).

Cluster 1: this group includes coenoses from northern Italy alone (from Piedmont to Friuli) and can be divided into two subclusters (1a and 1b) which correspond to stands that are rich in *Carex acutiformis* (1a) and *C. elata* (1b). Considering the relatively high number of relevés for each subcluster, the data were reclassified (Figures 2 and 3) and two different phytosociological tables were thus created (Tables I and II).

On the whole, the *Carex acutiformis*-rich relevés display a higher degree of frequency of *Cornus sanguinea* ssp. *hungarica*; even species such as *Rubus caesius*, *Sambucus nigra*, *Solanum dulcamara* and *Symphytum officinale* are more frequent in these stands. If unpublished data are excluded, the *Carex acutiformis*-*Alnus glutinosa* group includes relevés previously attributed by their authors to *Carici acutiformis-Alnetum glutinosae* (Pedrotti & Gafta 1994; Pedrotti 1995; Sarzo et al. 1999; Tasinazzo & Fiorentin 2003; D'Auria & Zavagno 2008), *Carici elongatae-Alnetum glutinosae* (Zanotti Censoni & Corbetta 1981; Bracco et al. 1984) and *Alno-Fraxinetum oxycarpae* (Gerdol 1987). The hierarchical classification allows two principal clusters to be identified (1 and 2 in Figure 2). In the first cluster, species such as *Rubus caesius*, *Sambucus nigra* and *Viburnum opulus* frequently occur; on the basis of the multivariate classification, cluster 1 can be further subdivided in two subclusters (1a and 1b in Figure 2), which are respectively differentiated by *Valeriana dioica*, *Carex elata* and *Caltha palustris* (1a) and by *Humulus lupulus*, *Quercus robur*, *Ligustrum vulgare*, *Tamus communis* and *Polygonatum multiflorum* (1b). The second cluster (cluster 2 in Figure 2) differs from the first cluster insofar as it displays a higher frequency of some species (*Urtica dioica*, *Rubus ulmifolius*, *Dryopteris filix-mas*, *Carex brizoides*, *Typhoides arundinacea*, *Galium aparine*) and for lower floristic diversity.

The *Carex elata*-rich relevés differ from those of the *Carex acutiformis*-*Alnus glutinosa* group for the

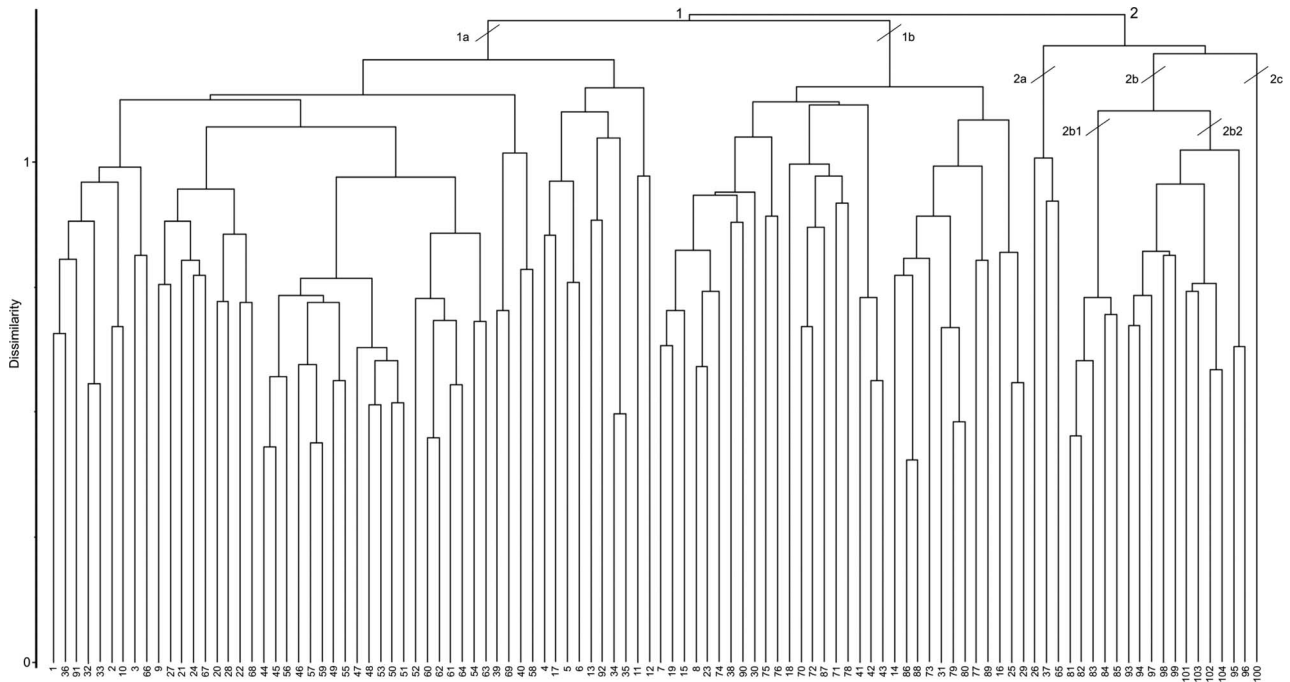


Figure 1. Dendrogram of the 104 Italian relevés. Algorithm: complete link, chord distance; cover data.

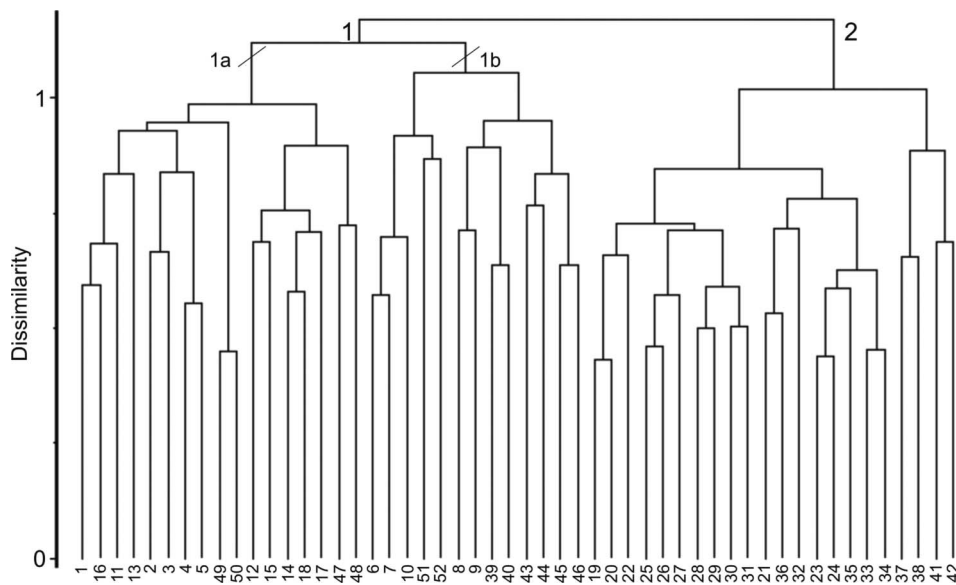


Figure 2. Dendrogram of the 52 relevés of Table I. Algorithm: complete link, chord distance; cover data.

higher frequency of species such as *Lycopus europaeus*, *Lysimachia vulgaris*, *Frangula alnus*, *Galium palustre* aggr., *Thelypteris palustris* and *Phragmites australis*. On the whole, these relevés are fairly homogeneous, the main differences concern the high frequencies and cover values in distinct groups (1a and 2 in Figure 3) of two *Alnetea glutinosae* species (*Salix cinerea* and *Thelypteris palustris*). The *Carex elata-Alnus glutinosa* group includes unpublished relevés and data previously attributed by their authors to *Carici elatae-Alnetum glutinosae*

(Pedrotti 2004; Lonati & Lonati 2005; Tisi et al. 2007), *Carici elongatae-Alnetum glutinosae* (Guglielmetto Mugion & Montacchini 1993–1994), *Thelypterido-Alnetum glutinosae* (Pedrotti 1991; 1994), *Hottonio-Alnetum* (Tisi et al. 2007) and *Alno-Fraxinetum oxycarpae* (Gerdol 1987).

Cluster 2: this group includes 20 relevés from both northern and peninsular Italy. On the basis of the hierarchical classification and the floristic-sociological analysis, cluster 2 can be further subdivided (subclusters 2a–2b and the single relevé 2c in

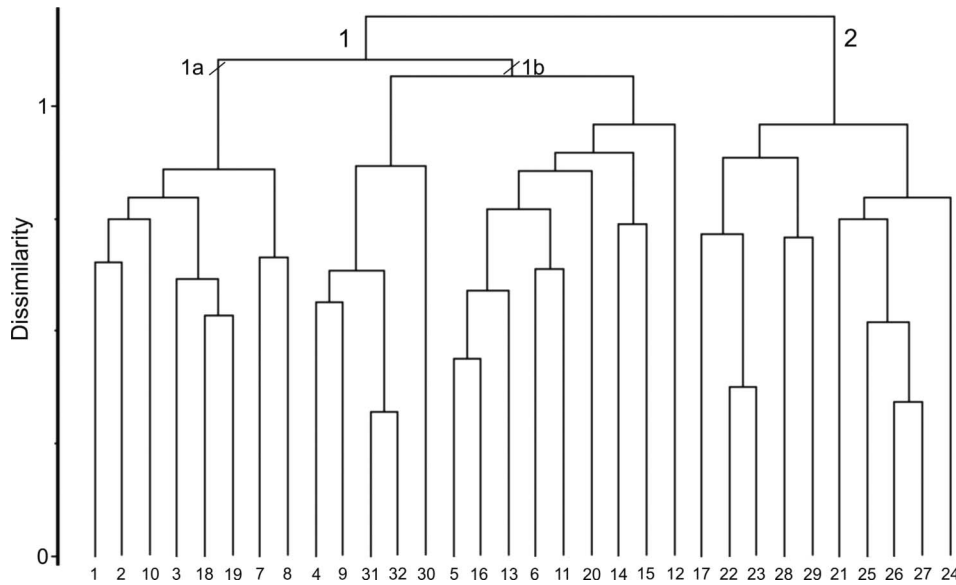


Figure 3. Dendrogram of the 32 relevés of Table II. Algorithm: complete link, chord distance; cover data.

Figure 1). Subcluster 2a includes three stands that are rich in *Carex riparia* from northern Italy. The relevés of subcluster 2b share the presence of species such as *Carex remota*, *Hedera helix*, *Mentha aquatica*, *Ranunculus repens*, *Agrostis stolonifera*, *Fraxinus angustifolia* ssp. *oxycarpa*, *Populus alba* and *Rumex sanguineus*; two subgroups may be recognized within this context (2b1 and 2b2 in Figure 1). The first subgroup includes five relevés from Tuscany attributed by Gellini et al. (1986) to *Hydrocotylo-Alnetum glutinosae*, which are clearly differentiated by a number of exclusive or high-frequency species (*Hydrocotyle vulgaris*, *Periploca graeca*, *Juncus effusus*, *Ulmus minor*, *Samolus valerandi*, etc.). The second subgroup includes seven relevés from Basilicata attributed by Venanzoni et al. (2003) to *Carici remotae-Fraxinetum oxycarpae alnetosum glutinosae* and four relevés sampled by Cianfaglione (2009) in central Italy and attributed to *Carici ripariae-Alnetum glutinosae*; *Carex riparia* is constantly present in these stands and *Scrophularia umbrosa*, *Apium nodiflorum*, *Poa trivialis*, *Sparganium erectum* and *Eupatorium cannabinum* frequently occur. The last relevé in cluster 2 (2c in Figure 1) is differentiated by the absence of large sedges (*Carex acutiformis*, *C. elata*, *C. riparia*) and by the high cover value of *Carex elongata*; this single stand comes from northern Italy (Piedmont).

Two principal clusters can be identified in the dendrogram of the European synoptic table (1 and 2 in Figure 4), each of which can be divided into two subclusters (1a, 1b and 2a, 2b). Cluster 1 includes the southern European communities, while those from central and northern Europe are included in cluster 2. A synoptic table illustrating these results was created (Table III). The Iberian *Carici lusitani-*

cae-Alnetum glutinosae (synthetic tables 1–2 in Table III) is clearly differentiated by a number of exclusive entities (*Carex paniculata* ssp. *lusitanica*, *Salix atrocinerea*, *Peucedanum lancifolium*, *Laurus nobilis*, *Oenanthe crocata*, etc.). By contrast, Submediterranean and Mediterranean entities (*Carex remota*, *Populus alba*, *Arum italicum* ssp. *italicum*), as well as the circumboreal *Agrostis stolonifera*, differentiate the Italian *Hydrocotylo-Alnetum glutinosae* and the *Scrophularia umbrosa-Alnus glutinosa* community (synthetic tables 3–4 in Table III); furthermore, the Subatlantic-Submediterranean *Hedera helix* and *Carex pendula* may be considered as differential species of both the Iberian and the Italian peninsular communities, while *Fraxinus angustifolia* ssp. *oxycarpa* only occurs in the Italian, Slovenian and Croatian communities. Subcluster 1b includes the Italian “*Carex acutiformis-Alnus glutinosa*” and “*Carex elata-Alnus glutinosa*” groups (synthetic tables 5–6 in Table III), the Croatian *Frangulo-Alnetum glutinosae* and relevés attributed to *Carici elongatae-Alnetum glutinosae* from Croatia and Slovenia (synthetic tables 7–11 in Table III); entities distributed throughout southern-Europe are more frequent in this group (*Rubus caesius*, *Sambucus nigra*, *Cornus sanguinea*, *Rhamnus catharticus*, *Leucosium aestivum*, *Cerastium sylvaticum* etc.), while Nordic or more continental species (*Carex elongata*, *Caltha palustris*, *Peucedanum palustre*; *Cardamine amara*, *Prunus padus*) show greater affinities for the *Carici elongatae-Alnetum glutinosae* of Slovenia and Croatia.

In the central and northern European communities (subclusters 2a and 2b; synthetic tables 12–23 and 24–32 in Table III), species with a Nordic distribution such as *Calamagrostis canescens*, *Sorbus aucuparia*, *Equisetum palustre*, *E. fluviatile*, *Rubus*

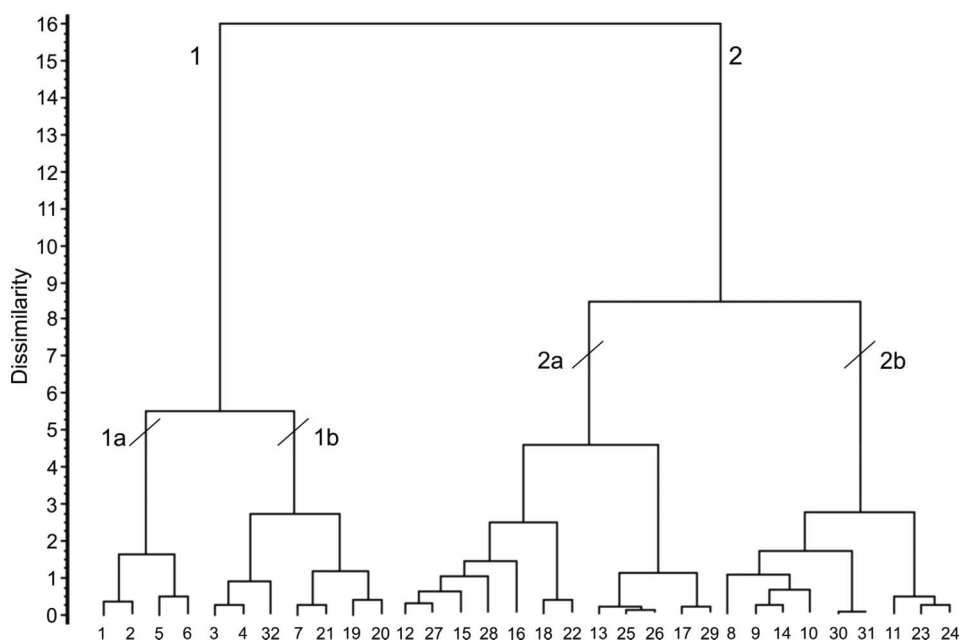


Figure 4. Dendrogram of the European synoptic Table. Algorithm: SSA, chord distance; binary data.

idaeus, *Viola palustris*, *Salix aurita*, *Betula* sp. pl. (except the Iberic *Betula pubescens* ssp. *celtibérica*) and the Subatlantic *Fraxinus excelsior* are more frequent; the boreal element is particularly well represented in subcluster 2b (*Ribes nigrum*, *Picea excelsa*, *Lysimachia thyrsoiflora*, *Chrysosplenium alternifolium*, *Calla palustris*, *Cicuta virosa*). Subcluster 2a includes tables from Belgium, northern France, Austria, western and north-western Germany and the Czech Republic, while tables from the continental and central-northern sectors of Europe (central-eastern Germany, Poland, Estonia, Latvia, Byelorussia and southern Sweden) are included in subcluster 2b, with the exception of the prealpine relevés by Oberdorfer (1992).

Discussion

Previous studies on Italian black alder swamps have always been referred to phytosociological models described for the central and northern Europe, *Hydrocotylo-Alnetum* being the only association recognized as autonomous. This kind of approach is likely to be due to the generally accepted interpretation of these communities as azonal vegetation that develops in temperate-oceanic/temperate-continental bioclimatic conditions resembling those found in central Europe, even if they are found within a different phytogeographic context (Rivas-Martínez et al. 2004a, b).

The analysis of the synoptic European table however points to the existence of groups of species that may be considered as differential entities belonging to well-defined phytogeographic sectors.

For example, *Hedera helix* and *Carex pendula* are species that clearly differentiate the Italian-peninsular and western Iberian communities, while the *Calamagrostis canescens*-*Sorbus aucuparia*-*Equisetum palustre*-*E. fluviatile*-*Rubus idaeus* group well differentiates the central and northern European communities. As far as the Italian and the Iberian communities are concerned, it is evident that, according to the Eurosibiric distribution of the *Alnetea glutinosae* class (Ellenberg 1988; Geißelbrecht-Taferner & Wallnöfer 1993; Géhu 2006), species such as *Dryopteris carthusiana*, *Carex elongata*, *Calamagrostis canescens*, *Salix aurita* and *Ribes nigrum* contribute little to the characterization of this class.

The analysis thus reveals a phytogeographic gradient, in which the Submediterranean/Submediterranean-suboceanic/temperate Southern European communities (synthetic tables 1–11 in Table III) are gradually replaced by the temperate central European and temperate-continental/sub-boreal communities (respectively synthetic tables 12–23 and 24–32 in Table III). On the whole, the comparison of the European tables seems to confirm and complete the phytogeography-based scheme of Bodeux (1955).

As regards the syntaxonomic position of the Italian coenoses, this study suggests that the peninsular communities are quite distinct from those of northern Italy; the presence, often accompanied by high frequency values, of *Hydrocotyle vulgaris*, *Potentilla reptans*, *C. sylvatica*, *Periploca graeca* and *Samolus valerandi* in *Hydrocotylo-Alnetum* and of *Scrophularia umbrosa* and *Apium nodiflorum* in the *Scrophularia umbrosa*-*Alnus glutinosa* community confers a clearly original character upon these coenoses even if

Table II. *Carici elatae-Alnetum glutinosae*.

N. of order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
N. of relevé (dendrogram of Figure 3)	1	2	10	3	18	19	7	8	4	9	31	32	30	5	16	13	6	11	20	14	15	12	17	22	23	28	29	21	25	26	27	24	
N. of relevé (dendrogram of Figure 1)	7	19	75	15	41	42	38	90	8	30	25	29	16	23	71	70	74	76	43	72	87	18	78	86	88	77	89	14	31	79	80	73	
Differential species of <i>Carici elatae-Alnetum glutinosae</i>																																	
<i>Carex elata</i>	3	3	2	3	4	3	1	2	3	2	3	3	2	3	2	2	4	2	3	+	2	2	2	2	2	3	2	3	+	2	1	2	
<i>Alnetea glutinosae</i>																																	
<i>Alnus glutinosa</i>	3	3	3	3	4	3	3	4	5	5	5	5	3	5	5	5	5	5	2	5	5	3	5	5	4	3	3	4	4	4	4	3	
<i>Lycopus europaeus</i>	+	+	.	1	+	.	.	.	+	+	+	+	+	+	.	+	.	.	+	2	+	.	+	.	.	2	.	.	+	+	+	.	
<i>Frangula alnus</i>	1	+	.	1	2	+	.	.	+	1	+	1	1	+	.	.	.	.	.	.	.	+	.	.	.	3	2	+	.	+	1	.
<i>Thelypteris palustris</i>	.	.	.	+	.	.	1	+	1	+	.	.	2	3	2	3	2	2	2	2	2	3
<i>Galium palustre</i> aggr.	1	+	.	+	+	+	.	.	+	+	+	+	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.
<i>Salix cinerea</i>	2	2	3	2	1	2	1	1	+	1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Solanum dulcamara</i>	+	+	.	.	+	+	+	1	+	2
<i>Dryopteris carthusiana</i>	+	+	.	.	+	+	1
<i>Scutellaria galericulata</i>	+	+	+	+	+	.
<i>Calamagrostis canescens</i>	.	.	+	+
Other species																																	
<i>Lysimachia vulgaris</i>	+	.	2	+	2	+	+	.	+	.	+	+	.	+	+	.	1	2	+	1	+	+	1	1	1	2
<i>Iris pseudacorus</i>	.	+	.	.	.	.	.	+	+	+	.	+	.	+	+	.	.	.	.	.	+	+	2	.	.	2	.	.	+	+	1	+
<i>Lythrum salicaria</i>	1	+	2	+	.	.	+	.	1	.	1	+	1	.	.	.	.	.	2	.	.	.	+	.	.	.	.	.	+	+	+	.
<i>Phragmites australis</i>	1	.	.	.	.	.	+	.	.	.	+	+	2	.	.	1	.	.	.	.	3	.	.	+	.	.	.	1	1	+	+	2
<i>Fraxinus excelsior</i>	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	1	.	+	+	.	.	2	.	+	+	.	
<i>Urtica dioica</i>	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	1	.	+	.	.	+	.	+	.	
<i>Humulus lupulus</i>	.	.	.	+	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	2	2	1	.	+	.	.	.	+	+	+	.
<i>Calystegia sepium</i>	+	.	.	.	.	.	+	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	+	.
<i>Carex remota</i>	.	1	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	+	+	.	3	2	.	.	.	.	.	.	.
<i>Filipendula ulmaria</i>	.	.	.	+	.	.	.	.	.	.	.	.	2	.	.	.	1	.	.	.	.	.	+	.	.	.	.	2	+	2	2	.
<i>Cornus sanguinea</i> ssp. <i>hungarica</i>	+	.	.	.	.	.	.	+	2	+	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Rubus caesius</i>	+	+	.	.	.	.	.	1	.	+	+	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Valeriana dioica</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	1	.	.	.	.	+	+	+	.
<i>Carex acutiformis</i>	.	.	.	.	.	.	.	.	+	1	.	.	.	1	.	.	.	.	.	.	.	.	+	.	1	1	.	.	.	.	.
<i>Viburnum opulus</i>	+	2	2	.	+	+
<i>Molinia caerulea</i>	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	2	.
<i>Bidens frondosa</i>	.	+	1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Angelica sylvestris</i>	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+	.
<i>Molinia arundinacea</i>	.	.	.	.	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Populus tremula</i>	.	.	.	.	+	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.
<i>Salix alba</i>	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	1	.	.	.	.
<i>Rubus</i> sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Schoenoplectus lacustris</i>	.	.	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<i>Mentha aquatica</i>	+	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

(continued)

Table II. (Continued).

N. of order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32				
N. of relevé (dendrogram of Figure 3)	1	2	10	3	18	19	7	8	4	9	31	32	30	5	16	13	6	11	20	14	15	12	17	22	23	28	29	21	25	26	27	24				
N. of relevé (dendrogram of Figure 1)	7	19	75	15	41	42	38	90	8	30	25	29	16	23	71	70	74	76	43	72	87	18	78	86	88	77	89	14	31	79	80	73				
<i>Quercus robur</i>	.	.	.	+	+	2	.	.	.	.	.
<i>Equisetum telmateja</i>	+	+	1	.	.	.			
<i>Scirpus sylvaticus</i>	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
<i>Sambucus nigra</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Corylus avellana</i>	+	1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Symphytum officinale</i>	+	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ranunculus repens</i>	+	+	+	.	
<i>Euonymus europaeus</i>	+	+	
<i>Equisetum palustre</i>	+	+	+	
<i>Valeriana officinalis</i>	.	.	.	+	+	+	
<i>Equisetum arvense</i>	+	.	+	.	.	.	+	
<i>Peucedanum palustre</i>	+	+	+	.

Species with low frequency: *Acer campestre*: 27, 30; *Agropyron repens*: 3 (2); *Artemisia verlotorum*: 20; *A. vulgaris*: 29; *Aster novi-belgii*: 4; *Athyrium filix-foemina*: 4, 21 (1); *Bidens tripartita*: 23 (2), 32 (1); *Bryonia dioica*: 29; *Calitha palustris*: 28, 31; *Carex brizoides*: 8 (2); *C. flava*: 1 (1); *C. gracilis*: 17 (1); *C. otrubae*: 22; *C. pseudocyperus*: 18 (3); *C. riparia*: 8; *Cerastium sylvaticum*: 22; *Cirsium oleraceum*: 4, 13 (1); *C. palustre*: 30; *Cladium mariscus*: 12 (2); *Crataegus monogyna*: 13 (1); *Cyperus flavescens*: 18 (1); *Deschampsia cespitosa*: 16; *Dryopteris filix-mas*: 17 (2); *Duchesnea indica*: 24; *Echinochloa crus-galli*: 18; *Erigeron annuus*: 20 (1); *Eupatorium cannabinum*: 27 (1); *Galeopsis pubescens*: 8; *Geum urbanum*: 24, 31; *Glechoma hederacea*: 10 (1), 21 (3); *Gratiola officinalis*: 17; *Hedera helix*: 10; *Hottonia palustris*: 9, 15 (5); *Hypericum tetrapterum*: 4; *Juncus conglomeratus*: 6 (1); *J. inflexus*: 1; *Leucosium aestivum*: 12, 22; *Ligustrum vulgare*: 13; *Lonicera alpigena*: 28 (1); *L. xylosteum*: 23 (2); *Lysimachia nummularia*: 10 (2), 22; *Myosotis scorpioides*: 22; *Nasturtium officinale*: 8, 20; *Nymphaea alba*: 4 (r); *Oxalis acetosella*: 30, 31; *Paris quadrifolia*: 28 (r); *Platanus hispanica*: 21 (2), 22 (2); *Poa palustris*: 10; *P. trivialis*: 22; *Polygonum minus*: 18; *P. mite*: 19, 22 (1); *P. persicaria*: 20; *Populus nigra*: 2; *Potentilla reptans*: 10; *Prunus avium*: 5, 30; *Rhamnus catharticus*: 13; *Ribes rubrum*: 31; *Rorippa amphibia*: 18 (2); *Rubus idaeus*: 29; *Rumex crispus*: 3 (1); *Salvia glutinosa*: 24; *Selinum carvifolia*: 2; *Solanum nigrum*: 7; *Solidago canadensis*: 21; *S. gigantea*: 4; *S. virgaurea*: 4; *Sorbus aucuparia*: 28 (1); *Stachys palustris*: 7 (1), 8; *Thalictrum aquilegifolium*: 28; *Th. lucidum*: 4, 29; *Typha latifolia*: 3 (1), 5 (1); *Ulmus glabra*: 30, 31; *U. minor*: 7 (1), 10; *Utricularia australis*: 6; *Verbena officinalis*: 20 (1); *Vicia tenuifolia*: 13; *Viola reichenbachiana*: 28 (r).

Table III. 1: *Carici lusitanicae-Alnetum glutinosae* T.E. Díaz et F.-Pietro 1994; C-Portugal; Espirito Santo et al. (2002) Tab. 1. 2: *Carici lusitanicae-Alnetum glutinosae* T.E. Díaz et F.-Pietro 1994; NW-Spain; Amigo et al. (2004) Tab. 1. 3: *Hydrocotylo-Alnetum glutinosae* Gellini, Pedrotti et Venanzoni 1986; C-Italy; Gellini et al. (1986) Tab. 1. 4: *Scrophulario umbrosae-Alnetum glutinosae*; CS-Italy; Tab. VI this paper. 5: *Corno hungaricae-Alnetum glutinosae*; N-Italy; Tab. I this paper. 6: *Carici elatae-Alnetum glutinosae*; N-Italy; Tab. II this paper. 7: *Frangulo-Alnetum glutinosae typicum* Rauš 1971; Croatia; Rauš (1975) Tab. 1 ré 7, 25, 26, 27, 44. 8: *Carici elongatae-Alnetum glutinosae* W. Koch 1926; Croatia; Vukelić et al. (2006) Tab. 1 col. 1. 9: *Carici elongatae-Alnetum glutinosae* W. Koch 1926; Croatia; (Glavač 1960 in Vukelić et al. 2006) Tab. 1 col. 2. 10: *Carici elongatae-Alnetum glutinosae* (W. Koch 1926) Bodeux 1955 var. *Leucojum aestivum*; SE-Slovenia; Accetto (1994) Tab. 2. 11: *Carici elongatae-Alnetum glutinosae* (W. Koch 1926) Bodeux 1955 var. *Geum rivale*; SE-Slovenia; Accetto (1994) Tab. 3. 12: *Carici elongatae-Alnetum glutinosae typicum* Meijer Drees 1936; NW-Germany; Döring-Mederake (1990) Tab. 1 col. 2.1. 13: *Alnetum glutinosae typicum* (Jonas 1932) Meijer Drees 1936; NW-Germany; Tuxen (1937) Tab. 3a, p 136. 14: *Cariceto elongatae-Alnetum*; CW-Germany; Knorzer (1957 in Verbücheln et al. 1990) Tab. 4 col. 5. 15: *Peucedano-Alnetum* Noirfalise et Sougnez 1961; Belgium; Noirfalise, Sougnez (1961) Tab. 5 ré 9-20. 16: *Carici elongatae-Alnetum typicum* var. *Rubus idaeus*; N-Germany; Schrautzer et al. (1991) Tab. 2 col. 5. 17: *Alnetum glutinosae*; N-France; Gehu (1961) Tab. 26. 18: *Alnetum glutinosae caricetosum ripariae* Duvigneaud 1959; Belgium; Duvigneaud (1959) Tab. 1. 19: *Carici elongatae-Alnetum caricetosum acutiformis* Pfadenh. 1969; Austria; Willner and Grabherr (2007) Tab. 12, col. 4. 20: *Carici elongatae-Alnetum typicum*; Austria; Willner, Grabherr (2007) Tab. 12 col. 5. 21: *Carici elongatae-Alnetum caricetosum elatae* Franz et Willner 2007; Austria; Willner, Grabherr (2007) Tab. 12 col. 6. 22: *Carici acutiformis-Alnetum glutinosae* Scamoni 1935; Czech Republic; Douda (2008) Tab. 2 col. 3. 23: *Carici elongatae-Alnetum glutinosae* Schwickerath 1933; Czech Republic; Douda (2008) Tab. 2 col. 2. 24: *Carici elongatae-Alnetum glutinosae caricetosum acutiformis* Pfadenh. 1969; S-Germany; Oberdorfer (1992) Tab. 251 col. 5b. 25: *Alnus glutinosa-Carex acutiformis* Assoziation; CE-Germany; Scamoni (1935) Tab. p 575 col. 1. 26: *Ribo nigri-Alnetum symphytetosum*; Poland; Sólinska-Górnicka (1987) Tab.1, col. 8. 27: *Carici elongatae-Alnetum glutinosae typicum* Meijer Drees 1936; Estonia; Paal et al. (2008) Appendix. 28: *Cariceto elongatae-Alnetum medioeuropaeum* Tx., Bodeux 1955; Poland; Matuszkiewicz et al. (1958) Tab. a, p 36-38. 29: *Cariceto elongatae-Alnetum dryopteridetosum cristatae* (Tx., Bod. 1955) em. Mat. 1958; Poland; Matuszkiewicz et al. (1958) Tab. b, p 36-38. 30: *Carici elongatae-Alnetum glutinosae typicum* Meijer Drees 1936; Latvia; Prieditis (1997) Tab. 5 col. 12. 31: *Carici elongatae-Alnetum typicum* Meijer Drees 1936; S-Sweden; Prieditis (1997) Tab. 5 col. 18. 32: *Carici elongatae-Alnetum cardaminetosum* Meijer Drees 1936; Byelorussia; Prieditis (1997) Tab. 5 col. 22.

(*) species of *Alnetea glutinosae*

Dendrogram clusters (Figure 4)	1											2																					
	1a				1b							2a							2b														
N. of order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
N. of Tables (dendrogram of Figure 4)	1	2	5	6	3	4	32	7	21	19	20	12	27	15	28	16	18	22	13	25	26	17	29	8	9	14	10	30	31	11	23	24	
N. of relevés	5	38	5	11	52	32	5	7	13	11	11	7	13	14	12	25	10	10	101	88	102	24	64	11	s.d.	172	12	s.d.	s.d.	8	18	22	
<i>Carex paniculata</i> ssp. <i>lusitanica</i>	V	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Salix atrocinerea</i> (*)	III	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Peucedanum lancifolium</i>	III	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Laurus nobilis</i>	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Oenanthe crocata</i>	IV	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Fraxinus angustifolia</i> ssp. <i>angustifolia</i>	IV	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Scutellaria minor</i>	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carex laevigata</i>	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Scrophularia auriculata</i>	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hydrocotyle vulgaris</i>	I	I	V	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Potentilla reptans</i>	.	.	IV	I	I	I	I	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carex sylvatica</i>	.	.	IV	.	I	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Periploca graeca</i>	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Samolus valerandi</i>	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Scrophularia umbrosa</i>	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Apium nodiflorum</i>	.	I	.	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carex remota</i>	.	II	V	IV	II	II	.	II	I	I	I	.	.	.	II	.	II	II	I	I	I	I	I	.	.	.	.	II	I	.	.	.	
<i>Agrostis stolonifera</i>	.	I	IV	III	I	.	.	I	I	.	.	I	.	.	II	I	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.

(continued)

Table III. (Continued).

(*) species of *Alnetea glutinosae*

Dendrogram clusters (Figure 4)	1											2																								
	1a				1b							2a							2b																	
Dendrogram subclusters (Figure 4)																																				
N. of order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32				
<i>Populus alba</i>	.	.	II	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Arum italicum</i> ssp. <i>italicum</i>	.	.	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Fraxinus angustifolia</i> ssp. <i>oxycarpa</i>	.	.	IV	II	I	.	V	IV	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Crataegus monogyna</i>	.	I	IV	.	I	I	.	II	III	.	I	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ulmus minor</i>	.	.	V	.	I	I	.	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.
<i>Rubus caesius</i>	.	.	.	II	III	II	I	V	III	I	I	.	.	II	.	.	III	I	I	I	I	I	I	.	.	.	.	.	.	.	.	.	.
<i>Sambucus nigra</i>	.	I	.	III	III	I	.	III	II	.	III	.	.	.	I	.	I	I	I	I	I	I	.	.	.	.	.	.	.	.	.	.	.
<i>Euonymus europaeus</i>	.	.	.	II	I	I	.	I	V	I	II	.	.	.	I	.	I	II	I	I	I	I	.	.	.	.	.	.	.	.	.	.	.
<i>Corpus sanguinea</i>	.	.	.	II	IV	II	.	I	II	.	I	.	.	.	.	.	.	I	I	I	.	.	.	.	II	.	.	.	.	.	.	.	.
<i>Ligustrum vulgare</i>	.	.	.	I	II	I	.	.	II	.	I		
<i>Rhamnus catharticus</i>	I	I	I	.	IV	I	IV	II	I	II	I		
<i>Leucojum aestivum</i>	I	I	.	I	I	V	I		
<i>Solidago gigantea</i>	I	I	.	II	IV	.	I		
<i>Cerastium sylvaticum</i>	I	I	.	II	II	.	I		
<i>Dryopteris filix-mas</i>	II	I	.	I	I		
<i>Viburnum opulus</i>	.	I	.	I	II	I	IV	III	IV	V	V	I	IV	II	II	I	I	IV	II	II	II	.	.	I	II	I	.	.	.	.	.	.	II
<i>Valeriana dioica</i>	.	II	.	.	II	II	.	I	V	V	IV	I	II	.	I	.	I	II	II	I	I	I	II	I	.	.	.	.	.	.	.	.	.
<i>Typhoides arundinacea</i>	II	.	.	III	III	I	I	.	.	II	II	III	II	II	.	.	.	II	III	.	.	I	.	I	I		
<i>Galium aparine</i>	I	.	.	.	I	.	.	II	I	.	.	II	II	II	.	.	I	I	I	.	I	II	I	I	I	I	.	.	.	.	.	.	.
<i>Glechoma hederacea</i>	I	I	IV	IV	I	I	.	.	II	I	I	I	.	III	I	I	I	I	I		
<i>Carex brizoides</i>	II	I	.	I	II	I	II	I	I	I	II	III		
<i>Fraxinus excelsior</i>	.	I	.	.	I	II	.	.	.	.	II	I	II	I	II	II	I	V	II	II	II	II	I	III	I	III	III	II	I	III	III	II	.
<i>Calamagrostis canescens</i> (*)	I	.	.	.	.	.	III	II	IV	I	II	II	.	I	I	I	.	III	.	I	III	I	III	IV	IV	IV	IV	II			
<i>Sorbus aucuparia</i>	I	III	IV	.	I	I	.	.	I	I	I	I	II	II	II	II	II	II	I	III	II	II	II	.		
<i>Betula</i> sp. pl. (<i>B. pubescens</i> p.max p.)	.	I	.	.	.	.	.	.	.	.	.	III	II	II	II	I	.	.	I	.	I	I	II	I	I	II	V	III	III	V	IV	IV	.
<i>Equisetum palustre</i>	I	I	.	.	.	.	.	.	II	III	III	I	I	I	.	.	.	II	I	III	I	I	I	I	I	II	II	.	.			
<i>Equisetum fluviatile</i>	I	II	III	.	IV	II	.	I	I	I	I	II	II	I	III	II	III	I	II	.	I	.	.			
<i>Rubus idaeus</i>	I	III	IV	II	I	III	.	.	I	I	I	II	II	.	.	III	II	III	II	I	II	II	.	.		
<i>Salix aurita</i> (*)	II	.	V	I	II	I	II	I	I	.	.	.	I	I	.	I	II	I	II	II	.	.		
<i>Viola palustris</i>	.	II	I	II	.	II	.	.	.	I	I	I	II	II	III	II	IV	V	III	.	.		
<i>Ribes nigrum</i> (*)	II	.	II	II	I	I	II	II	I	I	IV	I	III	II	IV	II	II	.	.		
<i>Picea excelsa</i>	I	I	II	II	.	II	.	II	.	I	III	II	IV	I	IV	II	.	.		
<i>Lysimachia thyriflora</i>	I	III	.	II	I	I	I	II	IV	II	IV	III	.	.	
<i>Chrysosplenium alternifolium</i>	II	.	I	I	I	I	.	III	I	.	II	I	.	I	III	.	.	
<i>Calla palustris</i>	I	.	I	II	III	I	IV	I	I	IV	.	.	.	
<i>Cicuta virosa</i>	I	II	II

(continued)

Table III. (Continued).

(*) species of *Alnetea glutinosae*

Dendrogram clusters (Figure 4)	1											2																						
Dendrogram subclusters (Figure 4)	1a				1b							2a							2b															
N. of order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
<i>Hedera helix</i>	V	IV	III	III	I	I	II	.	.	.	I
<i>Carex pendula</i>	IV	I	IV	I	I
<i>Angelica sylvestris</i>	III	III	.	II	I	I	.	III	I	IV	I	II	II	III	III	I	I	II	I	I	IV	II	.	.	.	.	I	.	.	.	I	II
<i>Mentha aquatica</i>	III	III	V	III	I	I	V	I	II	I	IV	.	II	II	II	V	III	III	.	.	.	II	I	.	I	
<i>Rubus fruticosus</i> aggr.	IV	IV	V	II	II	I	.	V	.	.	IV	III	IV	III	II	.	I	I	I	.	I	II	I	
<i>Circaea lutetiana</i>	.	I	.	I	I	.	III	III	.	II	I	I	.	I	.	I	.	I	.	.	I
<i>Carex acutiformis</i>	V	I	.	IV	I	II	.	III	.	IV	I	V	.	V	I	I	III	I	.	V	V	V	III	I	II	V	.	.	.	
<i>Caltha palustris</i>	I	I	.	.	I	I	I	III	V	IV	V	.	II	III	III	II	IV	.	IV	II	II	V	IV	IV	I	III	V	III	IV	III	III	III		
<i>Carex elongata</i> (*)	.	.	.	.	I	.	.	III	III	V	III	V	III	IV	IV	I	III	III	II	II	III	II	IV	V	III	IV	III	V	IV	IV	IV	I
<i>Dryopteris carthusiana</i> (*)	.	I	.	.	II	I	.	V	V	V	I	IV	V	II	III	II	.	.	IV	III	II	I	IV	IV	IV	III	I	III	I	IV	IV	IV		
<i>Peucedanum palustre</i>	.	.	.	.	I	I	I	I	V	IV	.	I	IV	IV	III	II	.	.	II	II	III	.	III	II	V	III	I	III	V	II	I	II
<i>Cardamine amara</i>	.	.	.	.	I	.	.	III	I	I	II	.	.	.	III	II	.	.	II	I	I	III	II	II	I	II	II	I	II	.	I	II
<i>Scirpus sylvaticus</i>	.	.	.	.	I	I	.	.	I	I	II	.	II	.	II	.	III	I	II	II	I	V	III	.	I	.	.	II	.	.	.	.
<i>Impatiens noli-tangere</i>	.	.	.	.	I	.	.	III	.	I	.	.	.	I	.	.	.	III	I	I	I	III	III	II	II	III	I	II	II	.	.	IV
<i>Prunus padus</i>	.	.	.	.	.	.	.	II	IV	III	V	I	.	.	.	II	.	.	III	II	I	I	II	.	II	III	III	.	.	IV	III	II
<i>Alnus glutinosa</i> (*)	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	
<i>Solanum dulcamara</i> (*)	V	IV	III	III	III	II	V	IV	V	III	I	IV	V	IV	V	III	III	III	III	III	III	IV	IV	IV	V	V	V	V	IV	V	III	V		
<i>Lysimachia vulgaris</i>	IV	I	I	II	II	IV	V	III	V	V	I	V	IV	V	III	IV	II	IV	II	III	IV	V	V	IV	III	IV	II	V	V	V	V	V		
<i>Lycopus europaeus</i> (*)	IV	III	IV	I	II	III	III	III	V	V	V	III	IV	IV	V	IV	V	III	II	II	II	III	IV	.	II	V	IV	IV	IV	V	III	IV		
<i>Lythrum salicaria</i>	IV	III	III	I	II	III	IV	I	IV	I	III	III	II	IV	III	.	III	IV	I	I	I	II	II	IV	I	III	II	II	III	.	I	II		
<i>Galium palustre</i> aggr. (*)	II	IV	V	V	II	III	V	III	V	V	.	II	IV	V	IV	.	III	V	I	I	I	V	V	V	II	V	II	III	V	V	V	III		
<i>Urtica dioica</i>	.	I	IV	III	II	II	II	V	II	I	III	III	III	III	IV	III	V	II	I	I	IV	IV	.	II	IV	I	IV	III	.	II	III			
<i>Iris pseudacorus</i>	III	III	II	III	III	III	III	V	III	.	.	III	II	V	IV	I	V	IV	I	I	I	III	.	V	V	V	III	III	IV	III	III			
<i>Ranunculus repens</i>	V	II	III	IV	I	I	III	III	IV	III	IV	.	.	I	I	III	III	II	I	I	I	III	III	.	I	II	IV	III	III	I	III	III		
<i>Athyrium filix-foemina</i>	II	IV	.	.	I	I	.	I	II	III	I	III	IV	II	II	II	II	.	II	II	II	II	III	IV	II	IV	I	III	III	.	III	V		
<i>Frangula alnus</i> (*)	III	II	.	.	II	III	V	I	V	IV	I	I	IV	II	II	.	III	.	II	III	III	III	III	III	II	III	IV	IV	IV	.	III	II		
<i>Filipendula ulmaria</i>	.	II	.	II	II	.	.	.	IV	V	.	IV	III	IV	II	V	IV	II	I	I	V	III	II	.	III	V	I	III	V	V	IV	II		
<i>Scutellaria galericulata</i> (*)	.	.	III	.	I	I	I	.	II	.	.	III	II	.	III	II	III	IV	I	II	II	III	II	I	II	II	III	III	V	II	II	II		
<i>Thelyperis palustris</i> (*)	I	I	V	.	II	III	III	.	V	.	.	I	I	II	.	I	.	.	II	II	II	.	I	III	V	IV	III	V	V	V	IV	II		
<i>Quercus robur</i>	.	I	.	.	II	I	.	I	II	III	.	III	II	.	I	I	II	V	I	I	I	.	I	.	I	I	I	I	II	I	I	II		
<i>Humulus lupulus</i>	.	I	.	III	II	II	V	I	IV	I	II	.	III	III	V	III	II	.	I	I	I	I	I	.	III	V	I	I	.	.	.	.
<i>Deschampsia cespitosa</i>	.	II	.	.	I	I	.	I	I	.	I	III	III	II	I	I	.	II	II	II	I	IV	III	I	II	II	.	IV	II	.	V	.		
<i>Salix cinerea</i> (*)	.	.	.	I	III	II	I	.	II	.	II	.	I	IV	V	II	V	V	I	I	I	II	II	.	.	II	.	I	III	II	III	II		
<i>Myosotis scorpioides</i> s.l.	I	I	.	II	II	I	IV	III	IV	V	.	.	.	.	II	I	II	I	I	I	I	IV	III	II	I	III	.	I	III	.	.	.
<i>Phragmites australis</i>	II	.	.	I	II	III	.	.	.	.	.	.	II	III	.	III	.	.	I	II	II	I	II	IV	I	II	I	I	III	II	I	III
<i>Juncus effusus</i>	III	III	V	II	IV	III	II	III	IV	III	III	.	III	II	III	I	.	II	I	.	III	II	.	I	.	

(continued)

Table III. (Continued).

(*) species of *Alnetea glutinosae*

Dendrogram clusters (Figure 4)	1											2																				
	1a				1b							2a							2b													
Dendrogram subclusters (Figure 4)																																
N. of order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
<i>Cirsium palustre</i>	III	III	.	.	I	I	.	.	II	.	.	I	III	III	II	II	.	.	II	II	I	III	II	.	II	I	.	II	II	.	.	.
<i>Carex vesicaria</i>	.	.	.	.	I	.	.	I	IV	IV	.	.	.	.	.	.	II	III	.	II	II	II	II	II	I	I	IV	I	III	V	I	I
<i>Eupatorium cannabinum</i>	.	I	.	III	I	I	.	.	III	.	III	I	II	III	.	IV	.	I	II	I	I	.	.	.	II	II	.	.	.	.	.	.
<i>Poa trivialis</i>	.	I	I	IV	I	.	III	.	V	.	.	III	II	II	II	III	.	.	.	.	.	IV	III	.	.	II	.	II	I	.	.	.
<i>Polygonum hydropiper</i>	.	I	.	.	I	.	III	IV	III	I	I	.	.	.	I	.	.	.	I	I	I	I	II	.	I	I	I	II	.	.	.	.
<i>Oxalis acetosella</i>	.	.	.	.	.	I	.	.	II	.	.	I	.	.	.	.	.	.	I	I	I	I	II	III	.	I	I	III	I	.	I	III
<i>Cirsium oleraceum</i>	.	.	.	.	I	I	.	.	I	III	.	.	.	.	I	II	I	.	II	II	I	III	I	.	.	II	I	.	.	.	.	.
<i>Calystegia sepium</i>	III	II	II	II	I	II	.	I	IV	.	.	.	.	.	.	II	.	II	II	I	.	I	.	.	.	II	.	.	.	.	.	.
<i>Carex elata</i>	.	.	III	.	I	V	.	.	.	IV	.	.	.	.	V	I	.	.	.	II	I	V	.	I	I	I	.	.	.	.	II	.
<i>Stachys palustris</i>	.	.	.	I	I	I	III	V	III	.	.	.	.	.	I	.	.	IV	.	I	I	I	.	.	.	III	III	.	.	.	.	.
<i>Glyceria fluitans</i>	I	I	.	.	.	IV	.	III	.	.	.	II	.	.	II	.	.	.	.	.	I	I	.	III	I	.	.	II	.	I	II	II
<i>Symphytum officinale</i>	.	.	.	.	II	I	IV	III	I	.	.	.	.	.	.	.	.	IV	I	.	.	I	I	.	IV	III	I	.	.	.	.	.
<i>Ajuga reptans</i>	I	I	.	I	.	.	.	.	II	.	.	.	.	I	.	I	.	I	I	I	I	I	.	.	.	.	.	.	.	.	.	.
<i>Dryopteris dilatata</i>	I	II	.	.	I	.	.	.	IV	I	.	.	.	.	.	III	.	.	I	I	I	III	II	.	.	I	.	.	.	.	.	.
<i>Corylus avellana</i>	I	I	.	.	I	I	.	I	.	I	.	.	.	.	.	I	.	II	.	.	.	.	I	.	.	II	I	.	.	.	.	.
<i>Lysimachia nummularia</i>	.	.	.	.	I	I	V	III	II	.	I	.	.	.	.	.	.	.	.	.	.	II	II	.	I	II	IV	.	.	.	.	.
<i>Lychnis flos-cuculi</i>	I	I	.	I	.	.	.	.	III	I	.	.	.	.	II	.	.	.	.	.	.	II	I	.	.	I	.	I	II	.	.	.
<i>Cardamine pratensis</i>	.	II	.	.	.	.	.	II	I	III	I	.	II	IV	IV	.	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Geum urbanum</i>	.	I	.	II	I	I	.	III	.	.	.	.	.	.	.	I	.	.	II	I	.	II	I	.	.	.	.	.	.	.	.	.
<i>Equisetum arvense</i>	.	I	.	I	I	I	.	I	II	.	II	.	.	.	.	I	.	.	.	.	.	III	I	.	.	.	.	.	.	.	.	.
<i>Crepis paludosa</i>	.	.	.	.	I	.	.	.	I	.	IV	.	.	.	.	I	.	.	I	I	I	II	I	.	.	.	.	.	.	.	.	II
<i>Valeriana officinalis</i>	.	.	.	I	I	I	.	.	.	.	.	I	III	.	.	II	II	III	.	.	.	.	.	.	.	.	II	I	.	.	.	.
<i>Poa palustris</i>	.	.	.	.	I	I	.	.	III	.	.	.	.	.	I	.	.	.	.	I	.	I	I	.	.	.	II	I	.	.	.	II
<i>Maianthemum bifolium</i>	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	I	I	I	.	I	.	.	.	I	I	I	I	II	.
<i>Ranunculus ficaria</i>	.	.	.	II	I	.	.	II	.	I	I	.	.	.	.	I	.	I	I	I	.	.	I	.	.	.	.	.	.	.	.	.
<i>Carex pseudocyperus</i>	.	I	.	II	.	I	.	.	.	.	.	.	II	II	II	.	.	.	.	.	.	.	.	.	.	I	I	III	II	.	.	.
<i>Alisma plantago-aquatica</i>	I	I	I	I	I	.	.	III	III	.	.	.	.	.	II	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.
<i>Geranium robertianum</i>	I	I	.	.	.	.	.	I	II	.	.	.	.	.	.	I	.	.	.	.	I	I	.	.	.	I	.	II	I	.	.	.
<i>Sparganium erectum s.l.</i>	II	I	.	III	I	.	V	.	II	.	.	.	.	.	II	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rumex sanguineus</i>	.	.	II	II	I	.	III	II	II	.	.	.	.	.	I	.	.	II	.	.	.	.	I	.	.	.	.	.	.	.	.	.
<i>Scrophularia nodosa</i>	.	.	.	.	I	.	.	I	I	I	.	.	.	.	.	.	.	I	.	.	.	I	I	.	I	II	.	.	.	.	.	.
<i>Carex stellulata</i>	I	I	.	.	I	.	.	.	.	.	.	.	.	.	I	.	.	.	I	I	I	I	I	.	.	.	.	.	.	.	.	.
<i>Hottonia palustris</i>	.	.	.	.	.	I	V	.	II	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	II	I	.	I	.	.	.	.
<i>Carex gracilis</i>	.	.	.	.	.	I	.	.	.	.	.	II	.	.	I	.	IV	I	.	.	.	I	I	.	.	.	II	.	.	.	.	.
<i>Anemone nemorosa</i>	.	.	.	.	I	.	.	.	I	.	.	.	.	.	.	I	.	.	I	II	I	II	I	.	.	.	.	.	.	.	.	.
<i>Carex paniculata ssp. paniculata</i>	.	.	.	.	I	.	.	.	.	.	.	II	II	III	I	II	.	.	.	.	.	II	I	.	.	.	.	.	.	.	.	.

(continued)

Table III. (Continued).

(*) species of *Alnetea glutinosae*

Dendrogram clusters (Figure 4)	1											2																						
	1a				1b							2a							2b															
Dendrogram subclusters (Figure 4)																																		
N. of order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
<i>Galeopsis tetrahit</i>	I	.	.	.	.	III	II	.	III	.	.	I	.	.	.	I	I	.	I	.	.	.	.	.	.	.	.	.
<i>Ranunculus flammula</i>	III	II	I	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.	I	I	.	I	I	.	.	.	.	II	.	.	.	.
<i>Paris quadrifolia</i>	I	.	.	.	I	.	.	.	.	.	.	.	I	I	I	.	I	.	.	.	.	.	.	.	.	.	I	II	.
<i>Pinus sylvestris</i>	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	.	I	.	.	.	.	I	III	.	I	.	.	.	
<i>Holcus lanatus</i>	I	II	.	I	.	.	.	.	II	.	.	I	.	.	I	.	.	.	.	.	I	I	.	I	I	.	.	.	.	.	.	.	.	.
<i>Carex fusca</i>	I	.	.	.	I	I	I	I	I	.	.	.	.	.	.	.	I	I	.	.
<i>Carex riparia</i>	.	.	.	V	I	I	.	.	.	.	.	.	.	.	.	II	V	.	.	.	.	.	.	.	.	III	II	.	.	.	.	.	.	.
<i>Molinia caerulea</i> aggr.	.	II	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	I	II	II	.	I	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carex canescens</i>	I	.	.	.	.	I	.	I	I	.	.	.	.	II	I	.	.	.	.	II
<i>Chaerophyllum hirsutum</i>	.	.	.	I	.	.	.	.	.	.	II	.	.	.	.	.	.	I	I	I	II	I	.	.	.	.	.	.	.	.	.	.	.	.
<i>Geum rivale</i>	II	.	.	.	I	.	.	.	.	.	I	I	.	.	.	.	.	.	.	II	IV	II	.	.
<i>Glyceria maxima</i>	.	.	.	I	.	I	.	.	.	.	.	.	.	II	III	.	.	.	.	.	I	II	.	.	.	I	.	.	.	.	.	.	.	.
<i>Menyanthes trifoliata</i>	.	I	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	I	I	.	.	.	.	.	.	II	.	II	.	II	.	I	.
<i>Lonicera periclymenum</i>	V	IV	.	.	.	.	.	.	.	.	.	III	III	.	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Salix alba</i>	I	.	.	II	II	I	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aegopodium podagra ria</i>	V	.	.	.	.	.	.	.	I	.	I	I	I	.	.	.	.	.	.	.	.	.	.	II
<i>Epilobium palustre</i>	I	.	.	I	.	.	.	.	.	.	I	.	I	.	I	.	I	.	.	.	IV	.	.
<i>Rorippa amphibia</i>	I	V	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	II	.	.	.	.	.	.	.
<i>Galium uliginosum</i>	I	.	.	.	I	I	I	.	.	.	.	I	V	.	.	.	.	.	.	.
<i>Salix fragilis</i>	I	I	.	.	.	.	.	.	.	.	.	.	.	I	.	.	II	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Prunella vulgaris</i>	.	I	I	.	.	.	I	.	I	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.
<i>Acer pseudoplatanus</i>	.	.	.	I	I	.	.	.	.	.	I	.	.	.	I	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.
<i>Bidens tripartita</i>	.	.	.	I	I	I	V	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sium latifolium</i>	V	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II	I	.	.	.	.	.	.	.
<i>Ranunculus lingua</i>	I	.	.	.	.	.	.	.	.	.	.	I	III	I	II	.	.	.	.	.
<i>Brachypodium sylvaticum</i>	.	II	I	I	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Agrostis canina</i>	I	I	.	.	.	.	.	.	.	I	.	.	.	.	.	.	I	I	.	.	.
<i>Prunus spinosa</i>	.	I	.	.	.	.	.	I	I	.	.	.	.	.	.	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Alnus incana</i>	I	I	.	.	.	.	.	I	I	.	.	.	II	.	.	.	.	.	.	.
<i>Ranunculus auricomus</i> aggr.	I	.	I	I	.	.	.	.	.	.	.	.	.	.	.	II	I	.	.	.	.	.	.	.	.	.	.	.
<i>Osmunda regalis</i>	I	II	.	.	.	.	.	.	.	.	.	.	I	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.
<i>Ribes rubrum</i>	I	.	.	.	.	.	.	.	.	I	I	.	.	.	.	II	I	.	.	.	.	.
<i>Vaccinium myrtillus</i>	I	I	I	.	I	.	.	.	.	.	.	.	.	I	.	.
<i>Viola reichenbachiana</i>	.	.	.	I	I	I	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.
<i>Lamium maculatum</i>	.	I	.	.	I	.	.	.	.	I	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.

compared with that of the other European communities. In any case, even if considered as azonal vegetation on account of their ecological features, the afore-mentioned communities share a significant group of Mediterranean and Submediterranean-Subatlantic species (*Carex remota*, *Hedera helix*, *Fraxinus angustifolia* ssp. *oxycarpa*, *Populus alba*, *Rumex sanguineus*, *Arum italicum* ssp. *italicum*). For these reasons, the autonomy of *Hydrocotylo-Alnetum* is confirmed and the stands of the *Scrophularia umbrosa-Alnus glutinosa* community are attributed to a new association named *Scrophulario umbrosae-Alnetum glutinosae*.

The syntaxonomic attribution of the northern Italian black alder swamps (so far referred to as the *Carex acutiformis-Alnus glutinosa* and *Carex elata-Alnus glutinosa* groups) is somewhat more complicated. The results of the cluster analysis group these coenoses with the Slovenian and Croatian associations; with the exception of *Frangulo-Alnetum glutinosae*, described by Rauš (1975) as an autonomous syntaxon, these communities have constantly been attributed to *Carici elongatae-Alnetum* (Glavač 1960; Horvat et al. 1974; Accetto 1994; Vukelić et al. 2006). The high frequency of hydro-hygrophilous species (*Hottonia palustris*, *Rorippa amphibia*, *Sium latifolium*, *Glyceria fluitans*) and of *Lysimachia nummularia* and *Bidens tripartita* in *Frangulo-Alnetum*, combined with the absence of large sedges, does not support the attribution of the Italian coenoses to this association. The comparison with the Slovenian and Croatian tables of *Carici elongatae-Alnetum* reveals that *Carex elongata*, a Eurosibiric entity considered by many authors to be a characteristic species of this association (Döring-Mederake 1991; Geißelbrecht-Taferner & Wallnöfer 1993; Pott 1995; Oberdorfer E. 2001; Vukelić et al. 2006; etc.) is either only accidentally present or completely absent in the Italian coenoses. Indeed, *Carex elongata* is very rare in Italy (Pedrotti & Gafta 1996; Curti & Scortegagna 1998; Poldini 2002; Tisi et al. 2007), its areal not extending further south than the Po plain (Meusel et al. 1965). Even the Nordic *Prunus padus*, *Caltha palustris* and, to a lesser degree, *Peucedanum palustre* and *Carex vesicaria* may be considered as differential species of the Slovenian and Croatian communities from the Italian ones. Thus, the occurrence of species that are prevalently distributed in northern Europe is significantly lower in the Italian communities than in the central and central-northern European coenoses, or even in the north-illyric ones.

Within this general context, Italian *Carex acutiformis*-rich communities seem to be well differentiated from the other European coenoses by the high frequency of *Cornus sanguinea*; in all the Italian relevés, this entity is represented by the subspecies *hungarica* which is probably prevalently distributed in

southern and south-eastern Europe (Poldini & Oriolo 2002). For all these reasons, we attribute the *Carex acutiformis-Alnus glutinosa* group to the new association *Corno hungaricae-Alnetum glutinosae*.

Cornus sanguinea ssp. *hungarica* and, more generally, species prevalently distributed in southern Europe, occur less frequently in the northern Italian *Carex elata*-rich community. As explained in more detail below, even the ecological features of this coenosis are quite different from those of the aforementioned association. *Carex elata*-rich black alder swamps were described as *Carici elatae-Alnetum glutinosae* by Franz (1990) and the tufted sedge is also fairly frequent even in *Carici elongatae-Alnetum* (Verbücheln et al. 1990; Prieditis 1993, 1997; Accetto 1994; Franz & Willner 2007). The Italian relevés actually display a closer affinity with the association described by Franz (1990); indeed, even if *Galium uliginosum*, *Dryopteris dilatata*, *Cardamine trifolia*, and *Leucojum vernum* are not present in the Italian stands, they share the absence of *Carex elongata*, that Geißelbrecht-Taferner & Wallnöfer (1993) consider as a distinctive feature of *Carici elatae-Alnetum*. The previous reports of this association in some sectors of northern Italy (Pedrotti 2004; Lonati & Lonati 2005; Brusa et al. 2006; Tisi et al. 2007) are thus confirmed.

The synoptic table of the Italian communities (Table IV) shows the floristic-sociological differences between the Italian coenoses.

Description of the Italian communities

***Corno hungaricae-Alnetum glutinosae* ass. nova** (Table I); *holotypus*: rel. 1 in Table I

Pseudonyms: *Carici elongatae-Alnetum glutinosae* sensu Auct. Ital. non Koch 1926 nom. inval. (Art. 4); *Carici elongatae-Alnetum glutinosae* sensu Auct. Ital. non (Koch 1926) Tüxen et Bodeux 1955 nom. inval. (Art. 4); *Carici elongatae-Alnetum glutinosae* sensu Auct. Ital. non (W. Koch 1926) Bodeux 1955 nom. inval. (Art. 4); *Carici acutiformis-Alnetum glutinosae* sensu Auct. Ital. non Scamoni 1935; *Alno-Fraxinetum oxycarpae* sensu Gerdol 1987 p.p. non Tchou 1946

Corno hungaricae-Alnetum glutinosae typicum subass. nova; *holotypus*: rel. 1, Table I

Corno hungaricae-Alnetum glutinosae quercetosum roboris subass. nova; *holotypus*: rel. 20, Table I

Corno hungaricae-Alnetum glutinosae ulmetosum ulmi-folii subass. nova; *holotypus*: rel. 48, Table I

Syntaxonomy: the results of the cluster analysis (Figure 2) and the analysis of Table I allow us to recognise three different aspects. Relevés 1–17 represent the typical feature of the association (subass. *typicum*) that occurs on soils that are flooded in spring and remain wet all year round; *Valeriana*

Table IV. 1: *Corno hungaricae-Alnetum glutinosae* (1a: *Corno hungaricae-Alnetum glutinosae typicum*; 1b: *Corno hungaricae-Alnetum glutinosae quercetosum roboris*; 1c: *Corno hungaricae-Alnetum glutinosae rubetosum ulmifolii*); 2: *Carici elatae-Alnetum glutinosae*; 3: *Hydrocotylo-Alnetum glutinosae*; 4: *Scrophulario umbrosae-Alnetum glutinosae*; 5: *Carex riparia-Alnus glutinosa* community; 6: *Carici elongatae-Alnetum glutinosae*

	1			2	3	4	5	6
	1a	1b	1c					
N. of relevé	17	13	22	32	5	11	3	1
<i>Carex acutiformis</i>	100	100	100	19	.	.	.	.
<i>Cornus sanguinea</i> ssp. <i>hungarica</i>	65	77	50	22	.	27	.	.
<i>Valeriana dioica</i>	76	31	.	22	.	.	1	.
<i>Callitha palustris</i>	47	15	.	6	.	.	2	.
<i>Humulus lupulus</i>	24	77	14	28	.	45	2	.
<i>Quercus robur</i>	12	62	18	9	.	.	.	.
<i>Ligustrum vulgare</i>	29	54	.	3	.	9	.	.
<i>Tamus communis</i>	12	54	.	.	.	.	1	.
<i>Polygonatum multiflorum</i>	6	38	.	.	.	.	.	+
<i>Urtica dioica</i>	12	23	68	28	80	55	2	.
<i>Rubus ulmifolius</i>	.	15	73	.	100	36	1	.
<i>Dryopteris filix-mas</i>	.	23	64	3	.	.	.	.
<i>Carex brizoides</i>	.	8	59	3	.	.	.	.
<i>Typhoides arundinacea</i>	12	15	45	.	.	.	2	.
<i>Galium aparine</i>	6	8	36	.	.	.	1	.
<i>Carex elata</i>	53	.	.	100	60	.	1	.
<i>Hydrocotyle vulgaris</i>	.	.	.	.	100	.	.	.
<i>Ulmus minor</i>	6	31	.	6	100	.	1	.
<i>Juncus effusus</i>	.	.	.	.	100	27	.	.
<i>Crataegus monogyna</i>	18	15	.	3	80	.	.	.
<i>Carex pendula</i>	12	8	.	.	80	9	.	.
<i>Potentilla reptans</i>	12	.	.	3	80	9	.	.
<i>Carex sylvatica</i>	.	31	.	.	80	.	.	.
<i>Samolus valerandi</i>	.	.	.	.	80	.	1	.
<i>Periploca graeca</i>	.	.	.	.	80	.	.	.
<i>Carex riparia</i>	12	8	.	3	.	100	3	.
<i>Scrophularia umbrosa</i>	.	.	.	.	.	64	.	.
<i>Poa trivialis</i>	12	.	.	3	20	64	1	.
<i>Apium nodiflorum</i>	6	.	5	.	.	55	.	.
<i>Sparganium erectum</i>	6	.	.	.	.	55	.	.
<i>Eupatorium cannabinum</i>	18	15	.	3	.	45	.	.
<i>Alnetea glutinosae</i>								
<i>Alnus glutinosa</i>	100	100	100	100	100	100	3	5
<i>Solanum dulcamara</i>	88	31	45	25	60	55	2	.
<i>Lycopus europaeus</i>	59	15	14	59	80	18	2	+
<i>Salix cinerea</i>	71	38	23	34	.	18	2	.
<i>Thelypteris palustris</i>	24	31	14	47	100	.	.	2
<i>Galium palustre</i> aggr.	41	31	.	41	100	82	.	.
<i>Frangula alnus</i>	76	46	.	53	.	.	1	.
<i>Dryopteris carthusiana</i>	35	31	50	16	.	.	.	.
<i>Scutellaria galericulata</i>	24	.	.	16	60	.	.	.
<i>Carex elongata</i>	.	.	32	.	.	.	1	4
<i>Calamagrostis canescens</i>	.	.	.	6	.	.	.	.
Differential species of the Italian peninsular communities								
<i>Carex remota</i>	35	46	.	25	100	73	1	.
<i>Hedera helix</i>	29	31	.	3	60	55	.	2
<i>Mentha aquatica</i>	12	.	9	9	100	45	2	.
<i>Ranunculus repens</i>	24	8	.	9	60	73	.	.
<i>Agrostis stolonifera</i>	6	.	.	.	80	45	.	.
<i>Fraxinus angustifolia</i> ssp. <i>oxycarpa</i>	12	.	.	.	80	36	.	.
<i>Populus alba</i>	6	.	.	.	40	36	.	.
<i>Rumex sanguineus</i>	.	8	.	.	40	36	.	.
<i>Arum italicum</i> ssp. <i>italicum</i>	.	.	.	.	20	27	.	.
Other species								
<i>Rubus caesius</i>	76	100	5	22	.	27	2	.

(continued)

Table IV. (Continued).

	1			2	3	4	5	6
	1a	1b	1c					
N. of relevé	17	13	22	32	5	11	3	1
<i>Sambucus nigra</i>	47	69	36	9	20	53	3	.
<i>Viburnum opulus</i>	53	85	.	16	.	18	1	3
<i>Iris pseudacorus</i>	71	23	50	47	40	55	1	.
<i>Lythrum salicaria</i>	53	15	36	44	60	18	3	.
<i>Lysimachia vulgaris</i>	41	23	14	66	20	36	1	.
<i>Filipendula ulmaria</i>	41	46	23	25	20	36	1	.
<i>Phragmites australis</i>	29	38	9	41	.	9	1	.
<i>Salix alba</i>	29	15	32	9	.	36	1	.
<i>Myosotis scorpioides</i>	12	15	45	3	.	27	2	.
<i>Calystegia sepium</i>	29	38	.	28	40	36	.	.
<i>Symphytum officinale</i>	53	15	45	9	.	.	1	.
<i>Athyrium filix-foemina</i>	24	38	5	6	.	.	2	.
<i>Brachypodium sylvaticum</i>	12	23	5	.	20	9	.	.
<i>Geum urbanum</i>	12	31	5	6	.	36	.	.
<i>Bidens tripartita</i>	12	23	.	6	.	9	.	.
<i>Angelica sylvestris</i>	18	15	.	13	.	36	.	.
<i>Euonymus europaeus</i>	35	23	.	9	.	27	.	.
<i>Equisetum telmateja</i>	41	8	.	9	.	27	.	.
<i>Equisetum palustre</i>	29	23	9	9	.	.	.	.
<i>Fraxinus excelsior</i>	12	31	.	31	.	.	.	.
<i>Circaea lutetiana</i>	18	23	14	.	.	9	.	.
<i>Valeriana officinalis</i>	12	23	.	9	.	18	.	.
<i>Equisetum arvense</i>	18	15	.	9	.	9	.	.
<i>Corylus avellana</i>	6	15	.	9	.	.	.	.
<i>Cirsium palustre</i>	12	8	.	3	.	.	2	.
<i>Prunus avium</i>	6	23	.	6	.	9	.	.
<i>Populus nigra</i>	12	15	.	3	20	.	.	.
<i>Typha latifolia</i>	6	.	9	6	.	.	1	.
<i>Alisma plantago-aquatica</i>	6	.	.	.	20	9	1	.
<i>Solidago gigantea</i>	.	8	5	3	.	.	1	.
<i>Scirpus sylvaticus</i>	29	.	.	9	.	.	1	.
<i>Cardamine amara</i>	12	8	23	.	.	.	.	.
<i>Rhamnus catharticus</i>	12	38	.	3	.	.	.	.
<i>Lonicera caprifolium</i>	24	15	.	.	20	.	.	.
<i>Peucedanum palustre</i>	18	8	.	9	.	.	.	.
<i>Lysimachia nummularia</i>	12	.	9	6	.	.	.	.
<i>Molinia caerulea</i>	6	8	.	13	.	.	.	.
<i>Platanus hispanica</i>	12	15	.	6	.	.	.	.
<i>Poa palustris</i>	24	8	.	3	.	.	.	.
<i>Polygonum hydropiper</i>	6	8	18	.	.	.	.	.
<i>Duchesnea indica</i>	.	8	5	3	.	.	.	.
<i>Cirsium oleraceum</i>	12	8	.	6	.	.	.	.
<i>Deschampsia cespitosa</i>	6	23	.	3	.	.	.	.
<i>Stachys palustris</i>	.	15	.	6	.	9	.	.
<i>Acer campestre</i>	6	8	.	6	.	.	.	.
<i>Leucocjum aestivum</i>	.	8	.	6	.	.	2	.
<i>Clematis vitalba</i>	.	8	.	.	20	9	.	.
<i>Cucubalus baccifer</i>	.	8	5	.	.	9	.	.
<i>Polygonum persicaria</i>	.	.	.	3	.	9	1	.
<i>Populus canadensis</i>	.	8	5	.	.	9	.	.
<i>Thalictrum aquilegifolium</i>	6	8	.	3	.	.	.	.
<i>Viola reichenbachiana</i>	6	8	.	3	.	.	.	.
<i>Gratiola officinalis</i>	.	.	.	3	40	.	.	.
<i>Ranunculus ficaria</i>	12	.	.	.	.	36	.	.
<i>Carex pseudocyperus</i>	.	.	.	3	.	27	.	.
<i>Molinia arundinacea</i>	.	23	.	9	.	.	.	.
<i>Myosoton aquaticum</i>	.	.	18	.	.	9	.	.
<i>Nasturtium officinale</i>	18	.	.	6	.	.	.	.
<i>Hypericum tetrapterum</i>	.	.	.	3	.	18	.	.

(continued)

Table IV. (Continued).

	1			2	3	4	5	6
	1a	1b	1c					
N. of relevé	17	13	22	32	5	11	3	1
<i>Bidens frondosa</i>	.	8	.	13	.	.	.	.
<i>Crepis paludosa</i>	12	8	.	.	.	.	.	.
<i>Berula erecta</i>	18	.	.	.	.	.	1	.
<i>Glechoma hederacea</i>	12	.	.	6	.	.	.	.
<i>Acer pseudoplatanus</i>	.	8	.	.	.	9	.	.
<i>Verbena officinalis</i>	.	.	.	3	.	9	.	.
<i>Thalictrum lucidum</i>	.	8	.	6	.	.	.	.
<i>Sanguisorba officinalis</i>	6	8	.	.	.	.	.	.
<i>Symphytum tuberosum</i>	.	8	5	.	.	.	.	.
<i>Cerastium sylvaticum</i>	.	8	.	3	.	.	.	.
<i>Cladium mariscus</i>	.	8	.	3	.	.	.	.
<i>Galeopsis pubescens</i>	.	8	.	3	.	.	.	.
<i>Carex otrubae</i>	6	.	.	3	.	.	.	.
<i>Selinum carvifolia</i>	6	.	.	3	.	.	.	.
<i>Solanum nigrum</i>	.	.	5	3	.	.	.	.
<i>Polygonum mite</i>	.	.	.	6	.	.	1	.
<i>Carex gracilis</i>	.	.	.	3	.	.	1	.

dioica, *Carex elata*, *Caltha palustris*, and some *Alnetea glutinosae*-character species (*Solanum dulcamara*, *Salix cinerea*, *Frangula alnus*, *Lycopus europaeus*, and *Galium palustre* aggr.) are more frequent in these stands. By contrast, relevés 18–30 (subass. *quercetosum roboris*) occur on less waterlogged soils and are in contact with *Erythronio-Carpinion* and *Carpinion* woods; this is confirmed by the higher frequency of *Humulus lupulus*, *Quercus robur*, *Ligustrum vulgare*, *Tamus communis* and *Polygonatum multiflorum*. Both these subassociations share species such as *Viburnum opulus*, *Rubus caesius* and *Sambucus nigra* which locally contribute to their physiognomic characterization. The remaining relevés (31–52) are differentiated by a higher frequency of species such as *Urtica dioica*, *Rubus ulmifolius*, *Dryopteris filix-mas*, *Carex brizoides*, *Typhoides arundinacea*, and *Galium aparine*, and share an overall floristic impoverishment; these stands occur in areas subjected to anthropic disturbance and are attributed to another distinct subassociation (subass. *ulmetosum ulmifolii*) that corresponds to the most degraded samples of the association; despite this, even in these relevés non-native species (Celesti-Grapow et al. 2009) only sporadically occur.

Synecology and *synchorology*: *Corno hungaricae-Alnetum glutinosae* is a eutrophic community that occurs in the lowland-hilly (submontane) belt; until now, the association has so far been found in a large part of northern Italy (Lombardy, Trentino, Veneto and Friuli).

Carici elatae-Alnetum glutinosae Franz ex Sburilino, Poldini, Venanzoni et Ghirelli ass. nova (Table II); *holotypus*: rel. 152, Table of Franz 1990: 22–23

Syn.: *Carici elatae-Alnetum glutinosae* Franz 1990 nom. inval. (Art. 2)

Pseudonyms: *Carici elongatae-Alnetum glutinosae* sensu Guglielmetto Mugion et Montacchini non Koch 1926 nom. inval.; *Thelypterido-Alnetum glutinosae* sensu Pedrotti 1991, 1994 non Klika 1940; *Alno-Fraxinetum oxycarpae* sensu Gerdol 1987 p.p. non Tchou 1946

Corresponding name: *Carici elongatae-Alnetum glutinosae caricetosum elatae* Franz et Willner 2007 nom. inval. (Art. 4)

Syntaxonomy: Although the general context is one of floristic-sociologic omogeneity, the analysis of the association table reveals different aspects. Relevés 1–8 correspond to less mature coenoses, as confirmed both by the overall lower cover values of *Alnus glutinosa* and by the higher frequency and abundance of *Salix cinerea*; in fact, the latter species characterizes the shrub communities of *Salicion cinereae*, which frequently precede the black alder swamp forests in the process of succession (Ellenberg 1988; Oberdorfer 1992; Geißelbrecht-Taferner & Wallnöfer 1993; Pedrotti & Gafra 1994). Relevés 23–32 share a significant presence of *Thelypteris palustris*, which is commonly considered a characteristic species of *Alnion glutinosae* (Geißelbrecht-Taferner & Wallnöfer 1993; Pott 1995; Oberdorfer 2001; Rivas-Martínez et al. 2002; etc.); Pedrotti (1991, 1994) attributed some of these relevés to *Thelypterido-Alnetum glutinosae*, an association described by Klika (1940) for the Czech Republic; Klika's stands and Douda's analysis (2008) actually reveal that *Thelypterido-Alnetum* inhabits nutrient-poor sites, where boreal species such as *Carex canescens*, *C. vesicaria*, *C. fusca*, *Viola palustris*, *Betula pubescens*, *Lysimachia thyrsiflora*

are frequent; these features are not shared by the Italian relevés, which may, in our opinion, simply be attributed to a *Thelypteris palustris*-rich facies of *Carici elatae-Alnetum*. Lastly, relevé 15 was attributed by Tisi et al. (2007) to *Hottonio-Alnetum* on account of the high cover of *Hottonia palustris*; this is actually a sciaphilous entity that is considered as characteristic species of *Hottonietum palustris* (Meriaux 1978; Schrott 1993; Pott 1995) and even occurs in several tables of black alder swamps (Scamoni 1935; Matuszkiewicz et al. 1958; Rauš 1975; Prieditis 1993; Vukelić et al. 2006, Franz & Willner 2007; etc.). Döring-Mederake (1991), Prieditis (1997) and Franz & Willner (2007) do not recognize the syntaxonomic autonomy of *Hottonio-Alnetum*, which is an opinion we share; indeed, admitting the spatial superposition of two different associations sharing the same differential species is questionable; for these reasons we prefer to attribute relevé 15 to a variant of *Carici elatae-Alnetum*.

Synecology and synchorology: *Carici elatae-Alnetum* mainly occurs in the lowland-hilly belt; relevés of submontane and montane areas have so far been collected in Trentino alone by Pedrotti (1991, 1994, 2004). This is a meso-eutrophic association that develops prevalently on waterlogged soils that present a great content of undecomposed organic matter, even peaty. It is distributed throughout northern Italy (Piedmont, Lombardy, Trentino, Veneto and Friuli).

Carex riparia-Alnus glutinosa community (Table V)

This community includes three *Carex riparia*-rich relevés coming from Lombardy and Veneto. Sartori (1981) and Bracco et al. (1984) tentatively attributed the Lombard stands to *Carici-elongatae-Alnetum*; however, the presence in the table, even if discontinuous, of species prevalently distributed in southern Europe (*Leucojum aestivum*, *Sambucus nigra*, *Rubus caesius*, *Ulmus minor*, *Salix alba*, *Samolus valerandi*, *Tamus communis*) does not support this interpretation. The ecology and floristic composition of these relevés clearly differ even from *Carici ripariae-Alnetum*, described by Weisser (1970) for eastern Austria. In view of the limited available data, we prefer to attribute this coenosis to the abstract vegetation unit of “community”.

Carici elongatae-Alnetum (relevé 6 in Table IV)

The only relevé that can be attributed to this association, even if only as a fragmentary sample, comes from the western-most sector of northern Italy (Tisi et al. 2007). Unlike the other Italian communities, large sedges do not occur in this relevé

Table V. *Carex riparia-Alnus glutinosa* community.

N. of order	1	2	3
N. of relevé (dendrogram of Figure 1)	26	37	65
Alnetea glutinosae			
<i>Alnus glutinosa</i>	4	3	3
<i>Lycopus europaeus</i>	1	+	.
<i>Solanum dulcamara</i>	+	.	+
<i>Salix cinerea</i>	+	+	.
<i>Frangula alnus</i>	1	.	.
<i>Carex elongata</i>	.	.	1
Other species			
<i>Carex riparia</i>	3	5	3
<i>Lythrum salicaria</i>	1	1	+
<i>Sambucus nigra</i>	+	+	1
<i>Urtica dioica</i>	.	2	2
<i>Leucojum aestivum</i>	1	.	2
<i>Rubus caesius</i>	.	1	1
<i>Athyrium filix-foemina</i>	.	2	1
<i>Caltha palustris</i>	2	.	1
<i>Myosotis scorpioides</i>	1	.	+
<i>Mentha aquatica</i>	+	1	.
<i>Typhoides arundinacea</i>	1	.	+
<i>Humulus lupulus</i>	.	+	+
<i>Cirsium palustre</i>	.	+	+
<i>Rubus ulmifolius</i>	.	3	.
<i>Poa trivialis</i>	.	.	3
<i>Iris pseudacorus</i>	2	.	.
<i>Typha latifolia</i>	.	.	2
<i>Osmunda regalis</i>	.	.	2
<i>Carex remota</i>	.	1	.
<i>Salix alba</i>	1	.	.
<i>Galium aparine</i>	.	.	1
<i>Berula erecta</i>	1	.	.
<i>Carex gracilis</i>	.	1	.
<i>Carex elata</i>	+	.	.
<i>Lysimachia vulgaris</i>	.	.	+
<i>Filipendula ulmaria</i>	.	.	+
<i>Viburnum opulus</i>	.	+	.
<i>Phragmites australis</i>	+	.	.
<i>Symphytum officinale</i>	.	+	.
<i>Valeriana dioica</i>	+	.	.
<i>Ulmus minor</i>	+	.	.
<i>Tamus communis</i>	.	+	.
<i>Scirpus sylvaticus</i>	.	+	.
<i>Samolus valerandi</i>	+	.	.
<i>Alisma plantago-aquatica</i>	+	.	.
<i>Solidago gigantea</i>	.	+	.
<i>Polygonum mite</i>	.	+	.
<i>Polygonum persicaria</i>	.	.	+
<i>Prunus padus</i>	.	.	+
<i>Senecio paludosus</i>	+	.	.

whereas the cover value of *Carex elongata* is high. The presence of species such as *Viburnum opulus*, *Polygonatum multiflorum*, *Fraxinus excelsior*, and *Majanthemum bifolium* points to the occurrence of a close spatial contact with the *Carpinion* woods. Further investigations in the most continental sector of north-western Italy may shed more light on the distribution of this rare association.

Table VI. *Scrophulario umbrosae-Alnetum glutinosae*.

N. of order	1	2	3	4	5	6	7	8	9	10	11
N. of relevé (dendrogram of Figure 1)	93	94	97	98	99	101	103	102	104	95	96
Differential species of <i>Scrophulario umbrosae-Alnetum glutinosae</i>											
<i>Scrophularia umbrosa</i>	.	+	.	+	.	+	+	+	+	.	+
<i>Apium nodiflorum</i>	.	1	.	+	+	.	+	+	.	.	+
<i>Alnetea glutinosae</i>											
<i>Alnus glutinosa</i>	4	4	5	5	4	5	5	5	5	4	4
<i>Galium palustre</i> aggr.	+	.	+	+	+	+	1	1	+	.	+
<i>Solanum dulcamara</i>	+	.	+	.	.	+	2	+	.	+	.
<i>Salix cinerea</i>	+	.	.	.	.	.	.	.	.	1	.
<i>Lycopus europaeus</i>	+	.	.	.	.	.	+	.	.	.	.
Other species											
<i>Carex riparia</i>	4	4	4	3	3	3	2	4	2	2	2
<i>Carex remota</i>	2	1	.	.	2	2	+	+	.	3	2
<i>Ranunculus repens</i>	.	+	.	2	+	+	1	1	1	+	.
<i>Poa trivialis</i>	+	.	.	2	+	+	.	+	+	+	.
<i>Hedera helix</i>	.	+	.	.	+	+	+	.	.	2	2
<i>Urtica dioica</i>	+	+	.	+	.	+	.	.	.	2	1
<i>Iris pseudacorus</i>	+	.	+	.	.	.	1	1	+	+	.
<i>Sambucus nigra</i>	.	+	.	.	.	+	.	+	1	+	1
<i>Sparganium erectum</i>	+	.	.	+	.	+	+	.	.	+	1
<i>Eupatorium cannabinum</i>	.	.	.	.	1	1	+	+	1	.	.
<i>Humulus lupulus</i>	.	.	.	.	.	+	+	+	.	1	1
<i>Agrostis stolonifera</i>	+	.	+	1	1	.	.	.	.	.	+
<i>Mentha aquatica</i>	.	.	+	+	1	.	.	+	.	+	.
<i>Fraxinus angustifolia</i> ssp. <i>oxycarpa</i>	2	1	.	.	.	.	.	.	.	2	2
<i>Rubus ulmifolius</i>	.	.	.	1	.	.	.	.	+	2	2
<i>Lysimachia vulgaris</i>	2	1	.	.	.	.	.	.	.	2	1
<i>Populus alba</i>	+	.	.	1	.	.	.	.	.	1	2
<i>Angelica sylvestris</i>	.	+	.	.	2	+	.	.	.	.	+
<i>Ranunculus ficaria</i>	+	.	.	+	.	.	.	.	.	1	2
<i>Filipendula ulmaria</i>	.	.	.	.	.	2	+	+	+	.	.
<i>Calystegia sepium</i>	.	.	.	.	.	+	.	+	.	+	1
<i>Salix alba</i>	.	.	+	.	.	+	.	+	.	.	1
<i>Geum urbanum</i>	+	+	.	+	.	.	.	.	.	.	+
<i>Rumex sanguineus</i>	+	.	.	+	.	.	.	.	.	+	+
<i>Rubus caesius</i>	.	.	.	.	.	1	.	+	1	.	.
<i>Taxodium distichum</i>	+	1	.	.	.	.	.	.	.	.	1
<i>Cornus sanguinea</i> ssp. <i>hungarica</i>	.	+	.	.	.	1	+	.	.	.	.
<i>Arun italicum</i> ssp. <i>italicum</i>	+	.	.	.	+	.	.	.	.	1	.
<i>Myosotis scorpioides</i>	.	.	.	.	.	+	.	1	+	.	.
<i>Carex pseudocyperus</i>	+	.	.	+	1	.	.	.	.	.	.
<i>Euonymus europaeus</i>	.	.	.	.	.	+	.	+	.	.	+
<i>Equisetum telmateja</i>	.	.	.	.	.	+	.	+	+	.	.
<i>Juncus effusus</i>	.	+	+	+	.	.	.	.	.	.	.

Species with low frequency: *Acer monspessulanum*: 11; *A. pseudoplatanus*: 6; *Ajuga reptans*: 6; *Alisma plantago-aquatica*: 3; *Alliaria petiolata*: 4; *Anthriscus nemorosa*: 5, 11; *Bidens tripartita*: 4; *Brachypodium sylvaticum*: 6; *Bromus ramosus*: 4, 11; *Carex pendula*: 6 (1); *Chaerophyllum hirsutum*: 5; *Circaea lutetiana*: 10 (1); *Cirsium creticum*: 8, 9; *Clematis vitalba*: 6; *Cucubalus baccifer*: 8; *Dipsacus fullonum*: 1, 4; *Epilobium hirsutum*: 3, 11; *Equisetum arvense*: 6; *Galium verum*: 1, 4; *Geranium versicolor*: 5, 11; *Holcus lanatus*: 4, 8; *Hypericum tetrapterum*: 5, 6; *Juncus articulatus*: 3; *Ligustrum vulgare*: 6; *Lythrum salicaria*: 7, 8; *Malus sylvestris*: 11; *Mycelis muralis*: 4; *Myosoton aquaticum*: 9; *Pastinaca sativa* ssp. *urens*: 8; *Petasites hybridus*: 5; *Phragmites australis*: 6; *Plantago lanceolata*: 4; *Polygonum persicaria*: 4; *Populus canadensis*: 10 (1); *Potentilla reptans*: 8; *Prunus avium*: 6; *Ranunculus lanuginosus*: 6 (1), 9; *R. sceleratus*: 4; *Rumex conglomeratus*: 6, 10; *Sparganium emersum* ssp. *emersum*: 1 (2); *Stachys palustris*: 9; *S. sylvatica*: 3; *Valeriana officinalis*: 6, 8; *Verbena officinalis*: 2; *Veronica beccabunga*: 2; *Viburnum opulus*: 6, 7; *Vitis berlandieri*: 8.

Hydrocotylo-Alnetum glutinosae (synthetic table 3 in Table IV)

This association is only present in a narrow area of the Tuscan coast, where it occurs in interdunal wetlands, mostly on waterlogged soils that contain a large amount of undecomposed organic matter

(Gellini et al. 1986). The Mediterranean, Submediterranean and Submediterranean-Subatlantic chorotypes, represented by species such as *Periploca graeca*, *Hydrocotyle vulgaris*, *Samolus valerandi* and *Ulmus minor*, reach their highest level of expression in this community. Even *Juncus effusus*, *Crataegus monogyna*, *Carex sylvatica*, *C. pendula* and *Potentilla*

reptans differentiate this association from the other Italian coenoses. The single *Osmunda regalis*-rich relevé, attributed by Gellini et al. (1986) to *Osmundo-Alnetum*, may instead be considered a local variant of *Hydrocotylo-Alnetum*; indeed, this relevé is lacking in species such as *Salix atrocinerea*, *Carex paniculata* ssp. *paniculata*, *Equisetum fluviatile*, *Myrica gale*, *Cardamine pratensis*, *Oenanthe crocata* and *Cicuta virosa*, which occur in the association described by Vanden Berghen (1971) for south-western France. An exhaustive description of *Hydrocotylo-Alnetum* is provided in the original paper by Gellini et al. (1986).

Scrophulario umbrosae-Alnetum glutinosae

ass. nova (Table VI); *holotypus*: rel. 8 in Table VI
Pseudonyms: *Carici remotae-Fraxinetum oxycarpae alnetosum glutinosae* sensu Venanzoni, Apruzzese, Gigante, Suanno et Vale 2003 non Gellini, Pedrotti et Venanzoni 1986; *Carici ripariae-Alnetum glutinosae* sensu Cianfaglione 2009 non Weisser 1970
Syntaxonomy: The only data published on the occurrence of *Alnion glutinosae* communities in central-southern Italy are those by Presti et al. (2004) and Cianfaglione (2009) respectively for Lazio and Abruzzo. However, Presti et al.'s relevés (2004), as clearly explained by the authors, are too fragmentary and species-poor to be considered at the association level. By contrast, floristically and structurally well-defined coenoses have been described for Basilicata by Venanzoni et al. (2003) and attributed by these authors to the riparian *Carici remotae-Fraxinetum oxycarpae alnetosum glutinosae* (*Populion albae*); the ecological and floristic features of these *Carex riparia*-rich coenoses, which occur along the banks of the Monticchio Lakes, actually correspond to those of the *Alnion glutinosae* alliance. In addition to the afore-mentioned relevés in Basilicata, the stands in Abruzzo attributed by Cianfaglione (2009) to *Carici ripariae-Alnetum* are included in the new association; indeed, the occurrence in the Italian stands of species such as *Scrophularia umbrosa*, *Carex remota*, *Apium nodiflorum*, *Ranunculus repens*, *Poa trivialis*, and *Sparganium erectum* clearly distinguishes them from the original relevés of the association described by Weisser (1970); to a large extent, these species, which are shared by both the relevés of Cianfaglione (2009) and those of Venanzoni et al. (2003), even differentiate *Scrophulario umbrosae-Alnetum* from the other Italian communities (Table IV).

Synecology and *synchorology*: The association occurs in the hilly-submontane belt, and develops on fluvial-lacustrine deposits in marshy areas or along the edges of lakes; the soil is periodically flooded and remains wet all year round. The distribution of the association at present includes narrow areas of Abruzzo and

Basilicata, though further investigations might extend its areal to other sectors in central and southern Italy.

Syntaxonomic scheme

- Alnetea glutinosae* Br.-Bl. et Tüxen ex Westhoff, Dijk et Passchier 1946
Alnetalia glutinosae Tüxen 1937
Alnion glutinosae Malcuit 1929
Incl. *Carici acutiformis-Alnion glutinosae* Ubaldi 2008 nom. inval. (Art. 2, 8)
Corno hungaricae-Alnetum glutinosae ass. nova
Corno hungaricae-Alnetum glutinosae typicum subass. nova
Corno hungaricae-Alnetum glutinosae quercetosum roboris subass. nova
Corno hungaricae-Alnetum glutinosae rubetosum ulmifolii subass. nova
Carici elatae-Alnetum glutinosae Franz ex Sburilino, Poldini, Venanzoni et Ghirelli ass. nova
Hydrocotylo-Alnetum glutinosae Gellini, Pedrotti et Venanzoni 1986
Scrophulario umbrosae-Alnetum glutinosae ass. nova
Carici elongatae-Alnetum glutinosae Schwickerath 1933
Carex riparia-Alnus glutinosa community

References

- Accetto M. 1994. Močvirni in poplavni gozdovi. Ljubljana: Biološki Inštitut ZRC SAZU. 18 p.
Aeschmann D, Lauber K, Moser DM, Theurillat JP. 2004. Flora alpina. Bologna: Zanichelli.
Amigo J, Izco J, Lugo R. 2004. Swamp alder woodlands in Galicia (NW Spain): Phytosociological interpretation. Ecological and floristic contrast to western European swamp woodlands and delimitation versus riparian alder woodlands in southern Europe and northern Africa. *Phytocoenologia* 34: 613–638.
Bodeux A. 1955. *Alnetum glutinosae*. *Mitt Florist-Soziol Arb gem* 5: 114–137.
Bracco F, Sartori F, Terzo V. 1984. Indagine geobotanica per la valutazione di un'area della bassa padania occidentale. *Atti Ist Bot Lab Critt* 3: 5–50.
Braun-Blanquet J. 1964. *Pflanzensoziologie*. 3rd ed. Wien: Springer.
Brusa G, Raimondi B, Cerabolini B. 2006. La vegetazione della Riserva Naturale "Lago di Biandronno" (Lombardia, Italia Settentrionale). *Fitosociologia* 43: 111–128.
Celesti-Grapow L, Alessandrini A, Arrigoni PV, Banfi E, Bernardo L, Bovio M, et al. 2009. Inventory of the non-native flora of Italy. *Plant Biosyst* 143: 386–430.
Cianfaglione K. 2009. The hygrophylous vegetation of the Sulmona Basin (Abruzzo, Italy). *Contributii Botanicae. Grădina Botanică "Alexandru Borza"* 44: 49–56.
Conti F, Abbate G, Alessandrini A, Blasi C, editors. 2005. An annotated checklist of the Italian vascular flora. Roma: Palombi & Partner.
Curti L, Scortegagna S. 1998. Check-list delle piante vascolari della Provincia di Vicenza. *Natura Vicentina* 2: 3–46.

- D'Auria G, Zavagno F. 2008. Aspetti floristici e vegetazionali dei Siti di Importanza Comunitaria (SIC) in provincia di Cremona. *Pianura* 22: 15–84.
- Dierschke H. 2010. Über 80 Jahre wissenschaftliche Begleitung pflanzensoziologischer Feldforschung in Mitteleuropa – Übersicht der in den Mitteilungen und in *Tuexenia* publizierten Vegetationsaufnahmen (1928–2009). *Tuexenia* 30: 319–348.
- Döring-Mederake U. 1990. Alnion forests in Lower Saxony (FRG), their ecological requirements, classification and position within *Carici elongatae-Alnetum* of Northern Central Europe. *Vegetatio* 89: 107–119.
- Döring-Mederake U. 1991. Feuchtwälder im nordwestdeutschen Tiefland; Gliederung – Ökologie - Schutz. *Scripta Geobot* 19: 1–122.
- Douda J. 2008. Formalized classification of the vegetation of alder carr and floodplain forests in the Czech Republic. *Preslia* 80: 199–224.
- Duvigneaud J. 1959. La forêt alluviale du Mont-Dieu. *Vegetatio* 7: 298–332.
- Ellenberg H. 1988. *Vegetation ecology of central Europe*. 4th ed. Cambridge: Cambridge University Press. p. 731.
- Espírito Santo MD, Rodríguez P, Bingre P. 2002. Amiais paludosos de Portugal Continental. *Quercetea* 3: 183–195.
- Franz WR. 1990. Zum Vorkommen von *Cardamine trifolia* L. in azonal verbreiteten Pflanzfitten Kärnten (Österreich). In: Szabó I, editor. *Illyrische Einstrahlungen im ostalpin-dinarischen Raum*. Keszthely: Pannon Agraruniversität. pp. 19–32.
- Franz WR, Willner W. 2007. *Alnetea glutinosae* Br.-Bl. & Tx. 1943. In: Willner W, Grabherr G, editors. *Die Wälder und Gebüsche Österreichs. 1 Textband*. München: Spektrum Akademischer. München: Spektrum Akademischer. pp. 89–93.
- Géhu J-M. 1961. Les groupements végétaux du Bassin de la Sambre française. *Vegetatio* 10: 69–372.
- Géhu J-M. 2006. *Dictionnaire de sociologie et synécologie végétales*. Berlin, Stuttgart: J. Cramer.
- Geißelbrecht-Taferner L, Wallnöfer S. 1993 – *Alnetea glutinosae*. In: Mucina L, Grabherr G, Wallnöfer S, editors. *Die Pflanzengesellschaften Österreichs. 1. Wälder und Gebüsche*. Jena: G. Fischer. pp. 26–43.
- Gellini R, Pedrotti F, Venanzoni R. 1986. Le associazioni forestali ripariali e palustri della Selva di San Rossore (Pisa). *Doc Phytosoc n.s.* 10: 27–41.
- Gerdol R. 1987. Geobotanical investigations in the small lakes of Lombardy. *Atti Ist Bot Lab Critt* 6: 5–49.
- Glavač V. 1960. Crna johna u posavskoj i podravskoj Hrvatskoj s ekološkog i šumskouzgojnog gledišta [dissertation]. Zagreb: Šumarski fakultet Sveučilišta. p. 141.
- Guglielmetto Mugion L, Montacchini F. 1993–1994. La vegetazione del Lago di Viverone. *Allionia* 32: 7–25.
- Horvat I, Glavač V, Ellenberg H. 1974. *Vegetation Südosteuropas*. Stuttgart: G. Fischer.
- Klika J. 1940. Die Pflanzengesellschaften des Alnion-Verbandes. *Preslia* 18–19: 97–112.
- Landi M, Angiolini C. 2010. *Osmundo-Alnion* woods in Tuscany (Italy): A phytogeographical analysis from a west European perspective. *Plant Biosyst* 144: 93–110.
- Lonati M, Lonati S. 2005. Le comunità a *Carex elata* All. della torbiera di Vanzone (Piemonte, Vercelli). *Fitosociologia* 42: 15–21.
- Matuszkiewicz W, Traczyk H, Traczyk T. 1958. Materiały do fitosocjologicznej systematyki zespołów olsowych w Polsce (*Zur Systematik der Bruchwaldgesellschaften (Alnetalia glutinosae) in Polen*). *Acta Societatis Botanicorum Poloniae* 27: 21–44.
- Meriaux J-L. 1978. Etude analytique et comparative de la végétation aquatique d'étangs et marais du Nord de la France (vallee de la Sensée et Bassin Houiller du Nord – Pas-de-Calais). *Doc Phytosoc n.s.* 3: 1–244.
- Meusel H, Jäger E, Weinert E. 1965. *Vergleichende Chorologie der zentraleuropäischen Flora. 1*. Jena: Fischer.
- Mucina L. 1993. Nomenklatorische und syntaxonomische Definitionen, Konzepte und Methoden. In: Mucina L, Grabherr G, Ellmauer T, editors. *Die Pflanzengesellschaften Österreichs 1. Anthropogene Vegetation*. Jena: G Fischer. pp. 19–28.
- Noirfalise A, Dethioux M. 1984. Synopsis des forets alluviales de Belgique. *Coll Phytosoc* 9: 217–226.
- Noirfalise A, Sougniez N. 1961. Les forêts riveraines de Belgique. *Bull Jard Bot État Bruxelles* 31: 199–288.
- Oberdorfer E. 1992. *Süddeutsche Pflanzengesellschaften. IV. Wälder und Gebüsche*. Stuttgart: G. Fischer. p. 282 (Textband) + p 580 (Tabellenband).
- Oberdorfer E. 2001. *Pflanzensoziologische Exkursionsflora*. 8th ed. Stuttgart: E. Ulmer.
- Paal J, Prieditis N, Rannik R, Jeletsky E-M. 2008. Classification structure of floodplain forests in Estonia: A comparison of two classification approaches. *Ann Bot Fennici* 45: 255–268.
- Pedrotti F. 1991. Note sulla flora e la vegetazione del Lago di Madrano (Trentino). *Inform Bot Ital* 22: 182–193.
- Pedrotti F. 1994. Il Lago di Levico. In: Pedrotti F, editor. *Guida all'escursione della Società Italiana di Fitosociologia in Trentino (1–5 luglio 1994)*. Camerino: Dipartimento Botanica Ecologia. pp. 114–129.
- Pedrotti F. 1995. Nota sulla vegetazione degli ambienti umidi della Bassa Valsugana (Trentino). *Doc Phytosoc (n.s.)* 15: 417–449.
- Pedrotti F. 2004. Ricerche geobotaniche al Laghestel di Piné (1967–2001). *Braun-Blanquetia* 35: 3–55.
- Pedrotti F, Gafta D. 1994. La Palude di Roncegno. In: Pedrotti F, editor. *Guida all'escursione della Società Italiana di Fitosociologia in Trentino (1–5 luglio 1994)*. Camerino: Dipartimento Botanica Ecologia. pp. 123–129.
- Pedrotti F, Gafta D. 1996. Ecologia delle foreste ripariali e paludose dell'Italia. *L'Uomo e l'Ambiente* 23: 1–165.
- Pignatti S. 1982. *Flora d'Italia*. Bologna: Edagricole.
- Podani J. 2001. *SYN-TAX 2000*. Computer programs for data analysis in ecology and systematics. Budapest: Scientia Publishing.
- Poldini L. 2002. *Nuovo Atlante Corologico delle Piante Vascolari nel Friuli-Venezia Giulia*. Udine: Regione Autonoma Friuli-Venezia Giulia. p. 529.
- Poldini L, Oriolo G. 2002. Alcune entità nuove e neglette per la flora italiana. *Inform Bot Ital* 34: 105–114.
- Pott R. 1995. *Die Pflanzengesellschaften Deutschlands*. Stuttgart: Ulmer.
- Presti G, Di Filippo C, Blasi C. 2004. La vegetazione igrofila del Monumento Naturale Pantane e Lagusiello (Lazio centrale). *Inform Bot Ital* 36: 401–408.
- Prieditis N. 1993. Black Alder Swamps on Forested Peatlands in Latvia. *Folia Geobot. Phytotax* 28: 261–277.
- Prieditis N. 1997. *Alnus glutinosa* – dominated wetland forests of the Baltic Region: Community structure, syntaxonomy and conservation. *Plant Ecol* 129: 49–94.
- Rauš D. 1975. Šuma crne johe (*Fragulo-Alnetum glutinosae* Rauš 68) u bazenu Spačva. *Šumarski List* 99: 431–446.
- Rivas-Martínez S, Díaz TE, Fernández-González F, Izco J, Loidi J, Lousã M, Penas A. 2002. Vascular plant communities of Spain and Portugal. Addenda to the Syntaxonomical checklist of 2001. *Itinera Geobotanica* 15: 433–922.
- Rivas-Martínez S, Penas A, Díaz TE. 2004a. Biogeographic map of Europe (scale 1:16.000.000). University of Leon: Cartographic Service.
- Rivas-Martínez S, Penas A, Díaz TE. 2004b. Bioclimatic map of Europe (scale 1:16.000.000). University of Leon: Cartographic Service.

- Sartori F. 1981. Resoconto dell'escursione della Società Italiana di Fitosociologia nel Parco Lombardo della Valle del Ticino (22 maggio 1981). *Not Fitosoc* 17: 69–72.
- Sarzo A, Prosser F, Frisinghelli M. 1999. Flora e vegetazione della zona umida di Bolzonella (Provincia di Padova – Italia settentrionale). *Arch Geobot* 3: 179–200.
- Scamoni A. 1935. Vegetationsstudien im Forst Sarnow. *Z Forst- u Jagdwirt* 67: 561–648.
- Schönert T. 1989. Die Bruchwald-Gesellschaften der Schneifel (Westliche Hocheifel) und ihre Standortbedingungen Teil I: Floristisch-pflanzensoziologische Untersuchungen. *Tuexenia* 9: 417–430.
- Schratt L., 1993. Potametea. In: Grabherr G, Mucina L, editors. Die Pflanzengesellschaften Österreichs 2. Natürliche waldfreie Vegetation. Jena, Stuttgart, New York: G. Fischer. pp. 31–44.
- Schrautzer J, Härdtle W, Hemprich G, Wiebe C. 1991. Zur Synökologie und Synsystematik gestörter Erlenwälder im Gebiet der Bornhöveder Seenkette (Schleswig-Holstein). *Tuexenia* 11: 293–307.
- Sólínska-Górnicka B. 1987. Alder (*Alnus glutinosa*) carr in Poland. *Tuexenia* 7: 329–346.
- Tasinazzo S, Fiorentin R. 2003. I relitti boschetti ad *Alnus glutinosa* delle risorgive vicentine (pianura veneta). *Ann Mus civ Rovereto* 17: 125–135.
- Tisi A, Minuzzo C, Siniscalco C, Caramiello R. 2007. La vegetazione acquatica e palustre della zona dei “Cinque Laghi” di Ivrea. *Riv Piem St Nat* 28: 87–126.
- Tutin TG, Burges NA, Charter AO, Edmondson JR, Heywood VH, Moore DM, et al. , editors. 1964–1980. *Flora Europaea*. Cambridge: Cambridge University Press.
- Tüxen R. 1937. Die Pflanzengesellschaften Nordwestdeutschlands. *Mitt Florist-Soziol Arb gem Niedersachsen* 3: 1–170.
- Vanden Berghen C. 1971. Notes sur la végétation du sud-ouest de la France. VIII. – Les fourrés et les bois fangeux. *Bull. Jard. Bot. Nat. Belg* 41: 383–395.
- Van der Maarel E. 1979. Transformation of cover-abundance values in phytosociology and its effect on community similarity. *Vegetatio* 39: 97–114.
- Venanzoni R, Apruzzese A, Gigante D, Suanno G, Vale F. 2003. Contributo alla conoscenza della vegetazione acquatica e igrofitica dei Laghi di Monticchio. *Inform Bot Ital* 35: 69–80.
- Verbücheln G, Krechel R, Wittig R. 1990. Die erleichen Waldgesellschaften der Schwalm-Nette-Platten und ihrer Randgebiete. Mit einer Übersicht der niederrheinischen Erlenwälder. *Tuexenia* 10: 419–432.
- Vukelić J, Baričević D, List Z, Šango M. 2006. Prilog fitocenološkim istraživanjima šuma crne joha (*Alnus glutinosa* Gaertn) u Podravini. (*A contribution to the phytocoenological research of forests of Common Alder (Alnus glutinosa Gaertn) in Podravina*). *Šumarski List* 130: 479–492.
- Weber HE, Moravec J, Theurillat J-P. 2000. International code of phytosociological nomenclature. *J Veg Sci* 11: 739–768.
- Weisser P. 1970. Die Vegetationsverhältnisse des Neusiedlersees. *Wissenschaftliche Arbeiten Burgenland* 45: 1–83.
- Willner W, Grabherr G. 2007. Die Wälder und Gebüsche Österreichs. 2 Tabellenband. München: Spektrum Akademischer. p. 290.
- Zanotti Censoni AL, Corbetta F. 1981. Boschi igrofilii ad *Alnus glutinosa* in Lomellina. *Not Fitosoc* 17: 33–44.

Appendix

Nomenclatural notes

The name *Carici elongatae-Alnetum glutinosae* Koch ex Tüxen 1931, still largely quoted in the phytosociological literature, is a *nomen invalidum* on the basis of the Articles 2 and 7 of the

International Code of Phytosociological Nomenclature (Weber et al. 2000), the valid name being *Carici elongatae-Alnetum glutinosae* Schwickerath 1933; for further informations see Döring-Mederake (1991). Consequently, the names of the subassociations described by Franz and Willner (2007) and nomenclaturally based on the name *Carici elongatae-Alnetum glutinosae* Koch ex Tüxen 1931 are not validly published (Art. 4).

Locations and sources of the relevés

Table I

Rel.1: Camposampiero (Padova), 28/05/2009, L. Ghirelli and G. Sburlino; 2, 3: Casonetto-Portesine (Rosolina, Rovigo), 05/06/2007, L. Ghirelli and G. Sburlino; 4: Piacenza d Adige (Padova), 17/06/2005, L. Ghirelli and G. Sburlino; 5: Bracco et al. (1984), Tab. 19 rel. 1; 6: Gerdol (1987), Tab. 23 rel. 5; 7, 8: Pedrotti (1995), Tab. 22 rel. 1, 2; 9, 10: Pedrotti, Gafta (1994), Tab. 1 rel. 1-2; 11: Bolzonella (S. Giorgio in Bosco, Padova), 02/09/06, G. Sburlino; 12: Onara (Padova), 19/05/1983, S. Marchiori and G. Sburlino; 13, 14: Tasinazzo and Fiorentin (2003), Tab. 1 rel. 2-5; 15: Brenta di Piave (Treviso), 06/09/2006, G. Sburlino; 16: Fagagna (Udine), 16/05/2004, G. Oriolo; 17: Gerdol (1987), Tab. 23 rel. 8; 18: Cavazzo Carnico (Udine), 17/08/2009, L. Poldini and G. Sburlino; 19: Cavazzo Carnico (Udine), 27/05/1997, S. Comin, L. Poldini and M. Vidali; 20: Talmassons (Udine), 21/07/2004, L. Poldini; 21: Flambro (Udine), 11/05/1997, S. Comin and L. Poldini; 22: Castions di Strada (Udine), 17/09/2004, L. Poldini; 23: Virco (Bertiolo, Udine), 21/07/2004, L. Poldini; 24: Sarzo et al. (1999), rel. 37; 25: Bracco et al. (1984), Tab. 19 rel. 4; 26: D Auria, Zavagno (2008), Tab. 1 rel. 1; 27: Castello di Gonars (Udine), 17/07/1997, G. Sburlino; 28: Moruzzo (Udine), 10/06/1996, L. Poldini; 29: Maiano (Udine), 15/07/2008, L. Poldini; 30: Lago di Ragogna (Udine), 15/07/2008, L. Poldini; 31, 32, 33: Zanotti Censoni and Corbetta (1981), note rel. 1, 2, 4; 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 52: Zanotti Censoni and Corbetta (1981), rel. 5, 14, 2, 3, 11, 7, 8, 15, 30, 10, 17, 21, 24, 22, 25, 13, 29, 19; 51: Bracco et al. (1984), Tab. 19 rel. 5.

Table II

Rel. 1: Comerzo (Majano, Udine), 14/05/2009, L. Poldini and G. Sburlino; 2: Preval (Cormons, Gorizia), 31/07/2008, L. Poldini; 3: Tisi et al. (2007), Tab. 3 rel. 70; 4: Lago di Ragogna (Udine), 09/10/1997, S. Comin, L. Poldini and M. Vidali; 5, 6: Lonati and Lonati (2005) Tab. 1 rel. 7-8; 7:

Bracco et al. (1984), Tab. 19 rel. 3; 8: Gerdol (1987), Tab. 23 rel. 1; 9: Piacenza d'Adige (Padova), 17/06/2005, L. Ghirelli and G. Sburlino; 10: Salzano (Venezia), 23/09/2005, L. Ghirelli; 11: Conca di Rame (Rovigo), 17/06/2005, L. Ghirelli and G. Sburlino; 12: Bibione (Venezia), 10/05/2008, G. Buffa, L. Ghirelli and G. Sburlino; 13: Somplago (Udine), 23/07/1976, L. Poldini; 14: Sernaglia (Treviso), 14/06/2005, G. Fruscalzo and G. Sburlino; 15: Tisi et al. (2007), Tab. 3 rel. 61; 16: Pedrotti (2004), Tab. 8; 17, 18: Tisi et al. (2007), Tab. 3 rel. 69, 71; 19: Lonati and Lonati (2005) Tab. 1 rel. 9; 20: Tisi et al. (2007), Tab. 3 rel. 62; 21: Guglielmetto Mugion and Montacchini (1993–1994), Tab. 5 rel. 2; 22: Fagagna (Udine), 16/05/2004, G. Oriolo; 23: Tisi et al. (2007), Tab. 3 rel. 74; 24, 25: Guglielmetto Mugion and Montacchini (1993–1994), Tab. 5 rel. 1, 3; 26: Tisi et al. (2007), Tab. 3 rel. 73; 27: Guglielmetto Mugion and Montacchini

(1993–1994), Tab. 5 rel. 5; 28: Cima Corso (Ampezzo, Udine), 18/06/2003, G. Oriolo and M. Vidali; 29: Pedrotti (1991), Tab. 8; 30, 31: Pedrotti (1994), Tab. 1 rel. 1, 2; 32: Tisi et al. (2007), Tab. 3 rel. 63.

Table V

Rel. 1: near the mouth of the Adige river (Chioggia, Venezia), 25/05/2006, L. Ghirelli and G. Sburlino; 2: Bracco et al. (1984), Tab. 19 rel. 2; 3: Sartori (1981), single relevé in the text.

Table VI

Rel. 1, 2, 3, 4, 5: Venanzoni et al. (2003), Tab. 3 rel. 1, 2, 5, 6, 7; 6, 7, 8, 9: Cianfaglione (2009), Tab. 2 rel. 1, 3, 2, 4; 10, 11: Venanzoni et al. (2003), Tab. 3 rel. 95, 96.