

## Forest vegetation of the Upper Valley of the Vomano River (central Italy)

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### Abstract

Here we present a phytosociological study of the forest vegetation of the Upper valley of the Vomano River, located on the Adriatic side of the central Apennines. The study area belongs to the National Park of Gran Sasso and Monti della Laga and is located in a particular area having a high lithological, geomorphological, landscape and biological diversity.

Ten forest associations were here found, which five are here described for the first time together with twelve new subassociations. The high diversity of the woods, demonstrates the important environmental diversity.

Key words: forest biodiversity, forest vegetation, phytosociology, Upper Valley of Vomano River.

### Riassunto

*La vegetazione forestale dell'Alta Valle del Vomano (Italia centrale).* Viene presentato lo studio fitosociologico della vegetazione forestale dell'Alta Valle del Fiume Vomano, situata nell'Appennino Centrale, nel versante a gravitazione adriatica. L'area indagata è compresa nel Parco Nazionale del Gran Sasso Monti della Laga, in un settore caratterizzato da un'elevata diversità litologica, geomorfologica, paesaggistica e biologica.

Vengono individuate dieci associazioni forestali delle quali cinque risultano di nuova segnalazione assieme a dodici nuove subassociazioni. L'elevata diversità forestale riscontrata testimonia le forti diversità ambientali.

Parole chiave: Alta Valle del Vomano, biodiversità forestale, fitosociologia, vegetazione forestale.

### Introduction

Here we present a phytosociological study of the forest vegetation of the Upper Valley of the Vomano River, located on the Adriatic side of the central Apennines. The study area is within the National Park of Gran Sasso and Monti della Laga in an area characterised by great lithological, geomorphological, landscape and biological diversity within which there is the joining of the argillous-arenaceous chain of the Monti della Laga and the calcareous-dolomitic massif of Gran Sasso. The floristic and ecological particularities of some of the phytocoenoses described are detailed and compared with the literature data. The results confirm the interest in the ecological and biogeographical profile of this Apennine area that still maintains 'ancient wood' aspects despite the strong impact that human activities have had on the forests in past times.

### The study area

The study area is within the central section of the National Park of Gran Sasso and Monti della Laga,

where it is known as the Touristic-Cultural District of the 'Strada Maestra'. This follows a stretch of state road 80 (SS80) that has its origins in the Roman era (as Via Caecilia) and involves a territory of around 42,000 ha within the Municipalities of L'Aquila, Capitignano, Pizzoli and Campotosto in the Province of L'Aquila, and of Crognaleto, Fano Adriano, Montorio al Vomano and Pietracamela in the Province of Teramo (Fig. 1). The study area is characterised by great lithological, geomorphological, landscape and biological diversity.

The area extends between the argillous-arenaceous chain of the Monti della Laga and the calcareous-dolomitic massif of Gran Sasso, separated by a long stretch of the River Vomano that has dug out its own valley specifically in the transition zone of these two different lithologies; it also includes the Chiarino Valley and Campotosto Lake (Fig. 2).

The northern sector of the District includes arenaceous substrata of the Laga Flysch and it is characterised by an undulating morphology with ranges of modest altitude, the peaks of which reach maximum heights of 1500-1700 m above sea level (asl). The plant landscape appears rather homogeneous, dominated by extensive woods that have grown along the slopes of the ridge, which alternate with grasslands used for animal grazing.



Fig. 1 - The Strada Maestra District

The southern sector includes the greater mountain heights, particularly in the areas that have developed on substrata of a carbonatic nature. Consequently, the landscape is harsher, with very steep slopes that are in part eroded. The predominant vegetal formations are represented by mesophilous woods and quite extensive

shrub communities that alternate with wide grasslands. The western sector of the District consists of the large basin of Campotosto Lake, on the banks of which there are fragmentary aspects of marsh vegetation.

**Materials and Methods**

The bioclimate study

For the climate classification, the data relative to the 30 years from 1967 to 1996 have been analysed from the thermopluviometric stations of Assergi (1040 m asl), Barisciano (810 m asl), Campo Imperatore (2140 m asl), Campotosto (1430 m asl) and Pietracamela (1030 m asl), and from the pluviometric stations of Cantoniera Ortolano (1010 m asl), Nerito (800 m asl), Fano Adriano (750 m asl) and Villa Vallucci (500 m asl). The bioclimate of the first five of these stations, for which the ombrothermic diagrams have been constructed according to Walter & Lieth (1960-67) (Figs. 6-10), was analysed through the bioclimate indices and classification of Rivas-Martínez (1996; Rivas-Martínez *et al.*, 2002). Moreover, the monthly stress indices of cold and dryness of Mitrakos (1980, 1982) have been calculated.

In the picture 3, 4, 5 the part relative to the study area of an unpublished phytoclimatic map of the Abruzzo

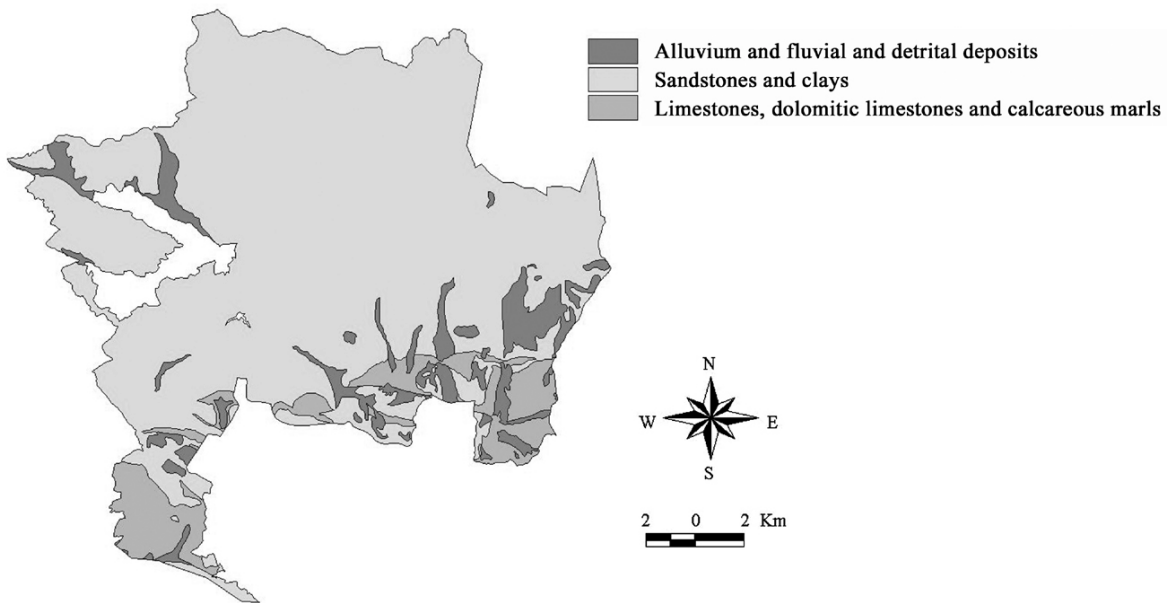


Fig.2 - Simplified lithological scheme of the Strada Maestra District

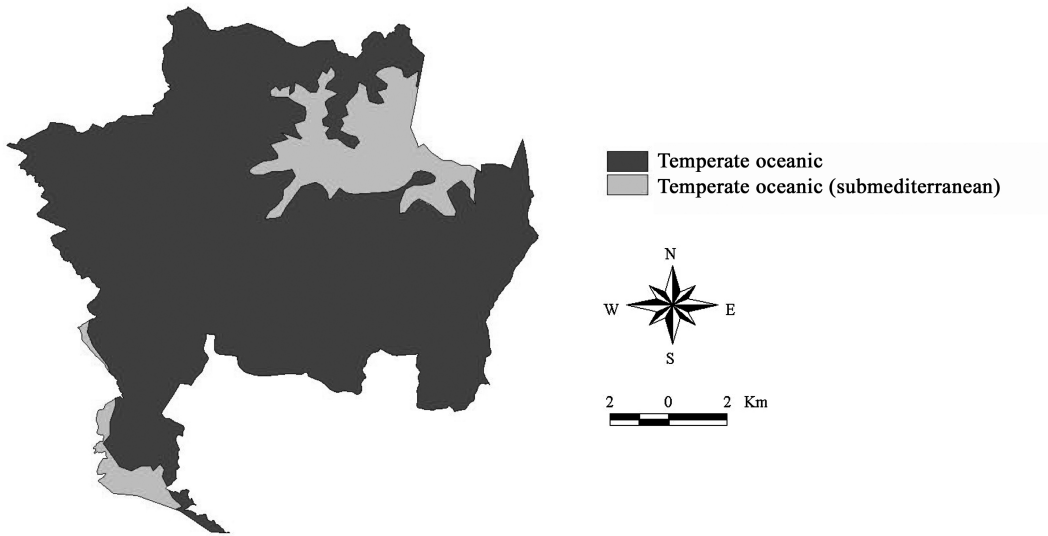


Fig. 3 - Bioclimate scheme

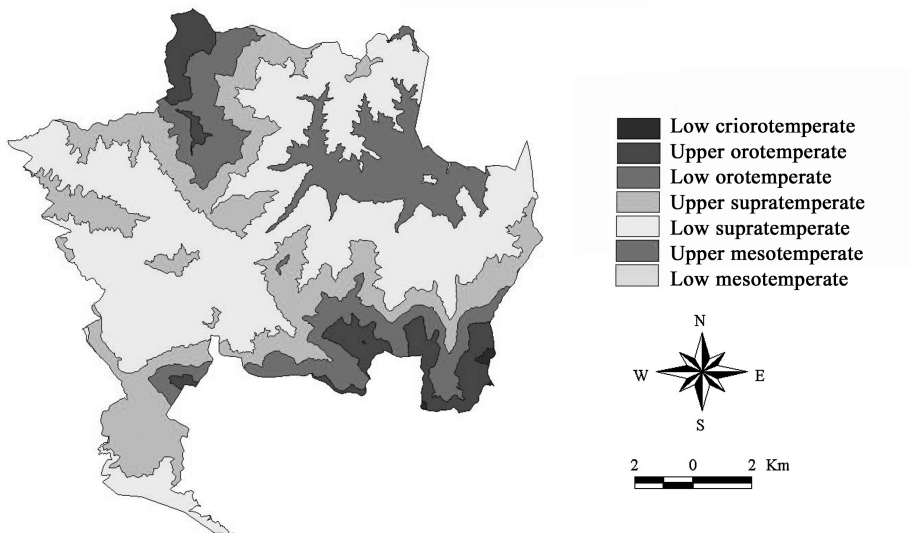


Fig. 4 - Thermotype scheme

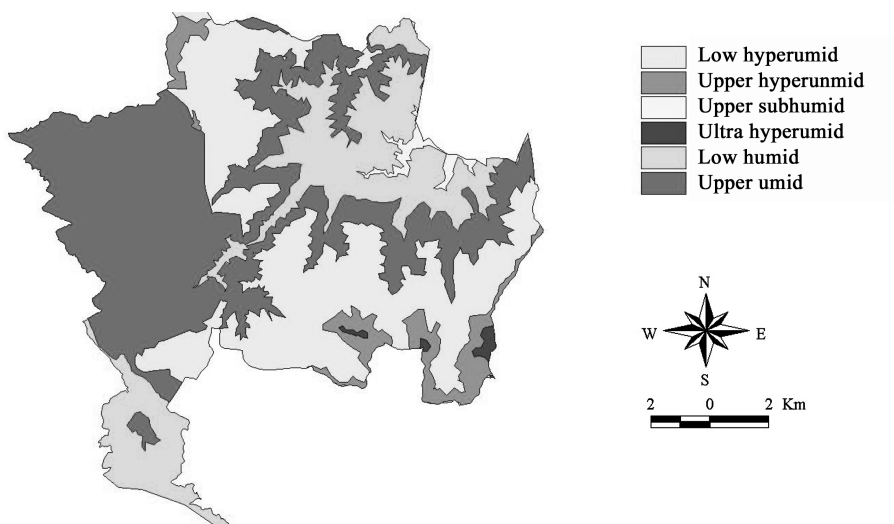
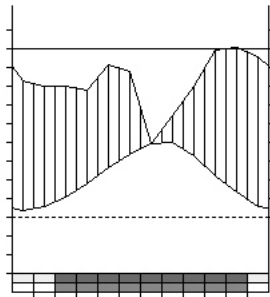


Fig. 5 - Ombrotype scheme

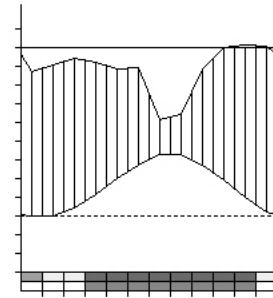
P= 903      42°25'N      013°30'E      1040 m.  
 T= 11      Ic= 18.1      Tp= 1262      Tn= 0  
 m= -2.7      M= 6.2      Itc= 141      Io= 7.2



TEMPERATE OCEANIC (SUBMEDITERRANEAN)  
 LOW SUPRATEMPERATE LOW HUMID

Fig. 6 - Thermopluviometric diagram of the Assergi station

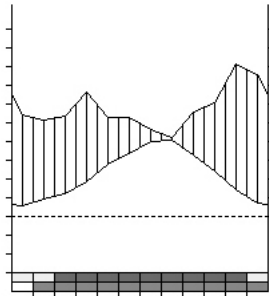
P= 995      42°33'N      013°22'E      1430 m  
 T= 8      Ic= 16.6      Tp= 939      Tn= 2  
 m= -3.6      M= 3.3      Itc= 75      Io= 9.8



TEMPERATE OCEANIC  
 UPPER SUPRATEMPERATE UPPER HUMID

Fig. 9 - Thermopluviometric diagram of the Campotosto station

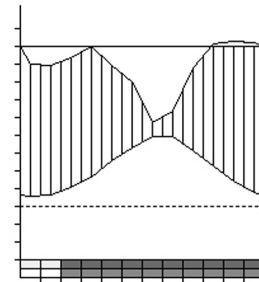
P= 695      42°17'N      013°35'E      810 m  
 T= 11      Ic= 17.7      Tp= 1341      Tn= 0  
 m= -1.1      M= 6.6      Itc= 167      Io= 5.2



TEMPERATE OCEANIC (SUBMEDITERRANEAN)  
 LOW SUPRATEMPERATE UPPER SUBHUMID

Fig. 7 - Thermopluviometric diagram of the Barisciano station

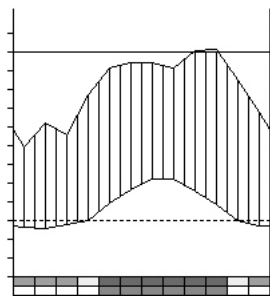
P= 1036      42°31'N      013°33'E      1015 m  
 T= 11      Ic= 16.7      Tp= 1265      Tn= 0  
 m= -0.6      M= 6.3      Itc= 162      Io= 8.2



TEMPERATE OCEANIC (SUBMEDITERRANEAN)  
 LOW SUPRATEMPERATE LOW HUMID

Fig. 10 - Thermopluviometric diagram of the Pietracamela station

P= 899      42°26'N      013°41'E      2140 m  
 T= 3      Ic= 15.2      Tp= 474      Tn= 124  
 m= -6.5      M= -1.5      Itc= -51      Io= 14.9



TEMPERATE OCEANIC  
 UPPER OROTEMPERATE LOW HYPERHUMID

Fig. 8 - Thermopluviometric diagram of the Campo Imperatore station

region (1:200.000) is shown. The map was made through the interpolation of thermo-pluviometric data, relative to the same period, collected by 136 stations. The regressions were calculated for geographic areas characterized by prevailing expositions inside the idrographic basins; regressions with a coefficient > 0.7 were considered good. Rivas-Martinez indexes and classification (Rivas-Martinez, 1996; Rivas-Martinez *et al.*, 2002) were applied to the spazialized data.

The vegetation study

The vegetation survey was carried out in accordance with the phytosociological method of the sigmatista school of Zurich-Montpellier that was later integrated (Tüxen, 1978; Géhu & Rivas-Martinez, 1981; Biondi, 1994, 1996; Rivas-Martinez 1987; Rivas-Martinez *et al.*, 2002; Rivas-Martinez, 2005; Géhu, 1988; Theurillat, 1992).

In the period of 2005 to 2007, 135 phytosociological relevés were taken in the study area. To these there have been added some relevés that have already been published, which are specifically from: Pedrotti (1982), as Tab. 1, of the eight relevés numbered 1, 2, 3, 4, 5, 7, 9, 12; from Biondi *et al.* (2002a), as Tab. 3, relevés 1-2, Tab. 4, relevés 1-5, Tab. 5, relevés 1-2, and Tab. 8, relevés 1-2 and Pirone (2000), as Tab. 8, relevés 1-4. In this way, a single phytosociological Table has been constructed that was subjected to multivariate analysis with the classification and ordering programmes of the Syntax 2000 package (Podani, 2001), from which we present the dendrogram of Fig. 11, with comments in the Discussion on the individual typologies. Moreover, this includes a comparison between these relevés and others referring to analogous formations reported in the literature.

The syntaxonomic classification used takes reference mainly from Rivas-Martínez *et al.* (2002), Biondi *et al.* (2002b) and Blasi *et al.* (2004).

### The bioclimate

The bioclimate investigation of the study area was carried out on the basis of the data available for the five thermopluviometric stations (Assergi, Barisciano, Campo Imperatore, Campotosto and Pietracamela) for the observation period of 1960 to 1990. The bioclimate classification was carried out according to the method of Rivas-Martínez (Rivas-Martínez *et al.*, 1999, 2002), and is given in Tab. 1. The calculation of the corrected summer ombrothermic index according to Rivas-Martínez

( $I_{ovc}$ ) indicated that all the stations are of a temperate oceanic bioclimate. The thermic index ( $I_t$ ) and the corrected thermic index ( $I_{tc}$ ) revealed the presence of sub-supraMediterranean, upper supratemperate, and upper orotemperate bioclimate belts. The ombrotypes are between upper subhumid and low hyperhumid.

The spatial analysis of the data based on the above-mentioned methodology allowed the construction of the bioclimate schemes reported in Fig. 3, 4 and 5.

### The vegetation

The relevés from the woods were initially grouped in a single phytosociological table and then subjected to cluster analysis with the aim of revealing not only similarities between the individual relevés, but in particular also the main groups that define their likenesses and analogies at different syntaxonomic levels. In this way, it was possible to obtain the dendrogram shown in Fig. 11, in which it can be seen that the woods with a prevalence of turkey oak are linked to those with beech and with fir, and that they can therefore be attributed to the same syntaxonomic order: *Fagetalia sylvaticae* (group III). At the same time, there is an easily recognisable group I that joins the woody formations attributed to the *Laburno-Ostryenion* suballiance (hornbeam woods) that is well separated from the white oak woods (group II). In the same way, it can be seen that the group that comprises the aspen woods of *Populus tremula* and the hazel woods (group IV) is clearly autonomous.

Tab. 1 - Bioclimate classification based in the indices of Rivas-Martínez

STATION	ALTITUDE	MACROBIOCLIMATE	BIOCLIMATE	BIOCLIMATE BELT	OMBROTYPE
Assergi	1040	Temperate	Oceanic	Sub-supraMediterranean	low humid
Barisciano	810	Temperate	Oceanic	Sub-supraMediterranean	upper sub-humid
Campo Imperatore	2140	Temperate	Oceanic	Upper orotemperate	low hyperhumid
Campotosto	1430	Temperate	Oceanic	Upper supratemperate	upper humid
Pietracamela	1015	Temperate	Oceanic	Sub-supraMediterranean	low humid

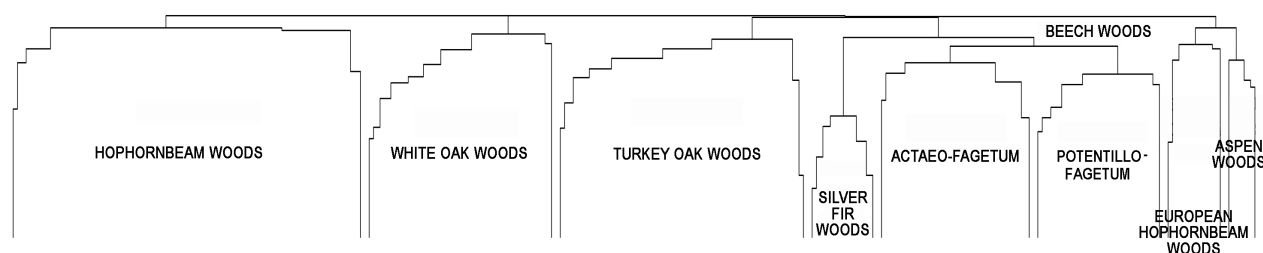


Fig. 11 - Dendrogram of all of the phytosociological relevés considered, published and not published

### Beech and silver fir woods

In the study area, the beech woods are found between the altitudes of 900 m asl and about 1680 m asl, on various lithologies (limestone, marl, Gran Sasso and Laga Flysch). They are mainly of old growth coppices, often in high forest conversion and including examples of seed regenerated high forests. The dendrogram analysis (Fig. 12) shows two main clusters that can be interpreted as:

Cluster I: includes the beech and silver fir woods from the Illyrian-Apennine alliance *Aremonio-Fagion* and the Apennine suballiance *Cardamino kitaibelii-Fagenion sylvaticae*. This includes two subclusters:

Ia: grouping the relevés of dominant *Abies alba* of the new association *Cirsio erisithalis-Abietetum albae*;

Ib: grouping the slightly acidophilous microthermal beech woods of the higher altitudes, referred to the new association *Actaeo spicatae-Fagetum sylvaticae*, which is in turn made up of two subclusters:

Ib1: including the subassociation *lathyretosum veneti* and the subassociation *pyroletosum secundae*;

Ib2: including the type subassociation (*actaeoetosum spicatae*);

Cluster II: includes the more thermophilous beech woods attributed to the new association *Potentillo micranthae-Fagetum sylvaticae* of the alliance *Geranio versicoloris-Fagion* and the relevés that have been attributed to the association *Scutellario columnae-Ostryetum carpinifoliae* in the

subassociation *facetosum sylvaticae* (this phytocoenosis will be commented upon together with the hop hornbeam woods)

To attribute the beech wood relevés to the associations which will be described in the following pages, a comparison was carried out with the syntaxa described for adjacent areas or those with analogous ecological characteristics. In particular, the comparison was carried out with the following (Tab. 2):

- *Cardamino kitaibelii-Fagetum sylvaticae* Ubaldi *et al.* ex Ubaldi 1995 (Tab. 1 in Biondi *et al.*, 2002b), an association described for the Umbria-Marche calcareous Apennines;

- *Dactylorhizo fuchsii-Fagetum* Izco & Biondi 1992 (rel. 1-9 of Tab. 9 in Biondi *et al.*, 1989), an association described for the Serre di Burano, northern Umbria-Marche arenaceous Apennines;

- *Solidagini-Fagetum* Ubaldi 1995: (frequency columns of Tab. 1, 2 and 3 in Longhitano & Ronsisvalle, 1974), relevés from southern Laga.

Moreover, the matrix of the synoptic columns was subjected to cluster analysis (binary similarity matrix between the columns to which the algorithm of complete linkage was applied) and the dendrogram of Fig. 13 was obtained. From the comparison, it is seen that the association *Dactylorhizo fuchsii-Fagetum* is very well differentiated with respect to the beech woods in the District, by the presence of a good number of species, including: *Carex sylvatica*, *Polystichum setiferum*, *Moehringia trinervia*, *Euphorbia dulcis*, *Veronica montana*, *Circaea lutetiana*, *Carpinus betulus* and *Arisarum proboscideum*. The association *Cardamino kitaibelii-Fagetum* shows both its ecological and floristic autonomy.

However, for the autonomy of the association *Solidagini-Fagetum*, it should be noted that the relevé chosen to typify the syntaxon (rel. 5 of Tab. 2 in Longhitano & Ronsisvalle, 1974) reveals aspects of short and strongly impoverished beech wood, missing the differential species, the same *Moehringia trinervia*, chosen to denominate the subassociation type (Ubaldi *et al.*, 1987). Therefore, this indicates that the association was badly described and does not correspond to actual aspects of the beech wood found in the context of the Laga. Hence the choice was for

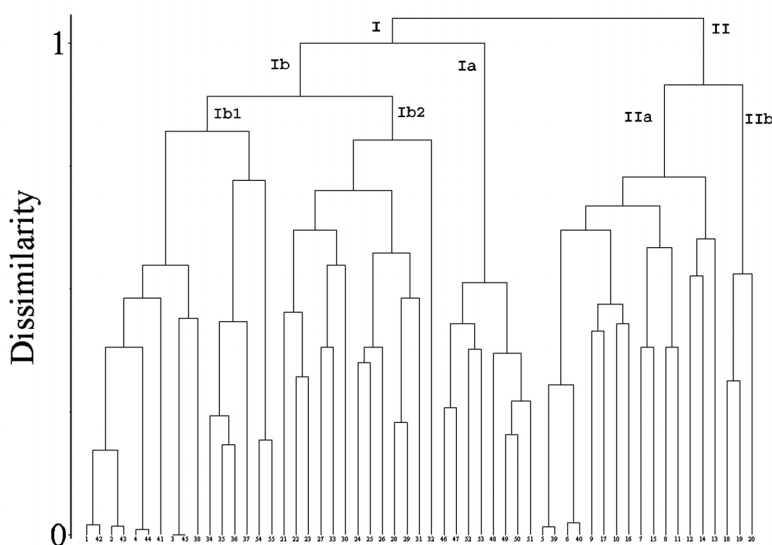


Fig. 12 - Dendrogram of the beech and silver fir woods relevés carried out in the studied area

Tab. 2 - Synoptic table of beech and silver fir woods

Associations	1	8	6	7	2	3	4	5	Pres.
1 = <i>Cirsio erisithalis-Abietetum albae</i> (tab. 1 in Pedrotti, 1982)									
2 = <i>Cardamino kitaibelii-Fageum sylvaticae</i> (tab. 1 in Biondi <i>et al.</i> , 2002b)									
3 = <i>Actaeo spicatae-Fagetum sylvaticae</i> (ass. nova)									
4 = <i>Potentillo micranthae-Fagetum sylvaticae</i> (ass. nova)									
5 = <i>Dactylorhizo fuchsii-Fagetum sylvaticae</i> (rel. 1-9 of Table 9 in Biondi <i>et al.</i> , 1989)									
6 = <i>Solidagini-Fagetum sylvaticae</i> (tab. 2 in Longhitano & Ronsisvalle, 1974)									
7 = <i>Solidagini-Fagetum sylvaticae</i> (tab. 1 Longhitano & Ronsisvalle, 1974)									
8 = <i>Solidagini-Fagetum sylvaticae</i> (tab. 3 Longhitano & Ronsisvalle, 1974)									
Species of the association <i>Cirsio erisithalis-Abietetum albae</i>									
<i>Abies alba</i> Miller	V	V	.	.	.	.	II	.	3
<i>Cirsium erisithales</i> (Jacq.) Scop.	V	I	I	I	.	.	.	.	4
<i>Vaccinium myrtillus</i> L.	V	.	I	III	.	I	.	.	4
<i>Pyrola secunda</i> L.	V	.	.	I	.	II	.	.	3
<i>Daphne mezereum</i> L.	V	.	I	I	.	II	.	.	4
<i>Veronica urticifolia</i> Jacq.	IV	III	II	II	.	II	III	.	6
<i>Rosa pendulina</i> L.	IV	.	.	.	.	I	.	.	2
<i>Calamagrostis arundinacea</i> (L.) Roth	III	I	.	.	.	.	.	.	2
Species of the association <i>Solidagini-Fagetum sylvaticae</i>									
<i>Galium rotundifolium</i> L.	.	II	II	II	.	.	.	.	3
Species of the association <i>Cardamino kitaibelii-Fageum sylvaticae</i>									
<i>Anemone nemorosa</i> L.	.	.	.	.	IV	.	.	.	1
<i>Aodoxa moschatellina</i> L.	.	.	.	.	I	.	.	.	1
Species of the association <i>Actaeo spicatae-Fagetum sylvaticae</i>									
<i>Lathyrus vernus</i> (L.) Bernh.	III	II	II	I	.	IV	I	.	6
<i>Taxus baccata</i> L.	II	II	I	I	IV	III	.	.	6
<i>Oxalis acetosella</i> L.	II	IV	I	I	.	II	.	.	5
<i>Actaea spicata</i> L.	II	.	.	.	I	III	.	.	3
<i>Festuca altissima</i> All.	II	.	.	.	.	II	.	.	2
<i>Epipactis atropurpurea</i> Rafin.	.	.	.	.	.	II	.	.	1
Species of the association <i>Potentillo micranthae-Fagetum sylvaticae</i>									
<i>Lilium bulbiferum</i> L. ssp. croceum (Chaix) Baker	I	.	.	.	I	I	II	II	5
<i>Potentilla micrantha</i> Ramond	I	.	.	.	.	.	III	I	3
<i>Quercus cerris</i> L.	.	.	.	.	.	II	IV	IV	3
<i>Teucrium siculum</i> Rafin.	.	.	I	I	.	.	I	.	3
Species of the association <i>Dactylorhizo fuchsii-Fagetum sylvaticae</i>									
<i>Carex sylvatica</i> Hudson	II	III	I	I	.	I	.	IV	6
<i>Polystichum setiferum</i> (Forsskal) Woynar	.	.	.	.	IV	II	I	IV	4
<i>Euphorbia dulcis</i> L.	III	.	.	.	II	.	I	III	4
<i>Veronica montana</i> L.	.	I	.	I	.	I	.	III	4
<i>Moehringia trinervia</i> (L.) Clairv.	.	.	II	I	.	.	.	III	3
<i>Carpinus betulus</i> L.	.	.	.	.	.	.	I	II	2
<i>Circaea lutetiana</i> L.	.	.	.	.	.	.	.	III	1
<i>Arisarum proboscideum</i> (L.) Savi	.	.	.	.	.	.	.	II	1
Characteristic and differential species of the suballiance <i>Cardamino kitaibelii-Fagenion</i> and of the alliance <i>Aremonio-Fagion</i>									
<i>Epilobium montanum</i> L.	III	I	III	II	II	II	I	I	8
<i>Saxifraga rotundifolia</i> L.	IV	III	I	I	IV	IV	I	.	7
<i>Adenostyles australis</i> (Ten.) Nyman	IV	III	II	I	IV	IV	I	.	7
<i>Polystichum aculeatum</i> (L.) Roth	III	II	II	I	III	IV	I	.	7
<i>Cardamine enneaphyllos</i> (L.) Crantz	II	I	.	I	IV	III	I	.	6
<i>Geranium nodosum</i> L.	IV	.	.	I	V	IV	II	V	6
<i>Polygonatum multiflorum</i> (L.) All.	.	.	II	I	.	III	II	.	4
<i>Cardamine kitaibelii</i> Becherer	.	.	.	.	IV	III	I	.	3
<i>Cardamine heptaphylla</i> (Vill.) O. E. Schulz	.	.	.	.	III	.	.	.	1
<i>Anemone ranunculoides</i> L.	.	.	.	.	II	.	.	.	1
<i>Anemone trifolia</i> L. ssp. trifolia	.	.	.	.	I	.	.	.	1
Characteristic and differential species of the alliance <i>Geranio versicoloris-Fagion</i>									
<i>Daphne laureola</i> L.	III	III	V	II	V	IV	V	.	7
<i>Acer obtusatum</i> W. et K.	I	II	I	.	.	II	III	II	6
<i>Pulmonaria apennina</i> Cristof. & Puppi	.	.	.	.	I	IV	IV	IV	4
<i>Pulmonaria officinalis</i> L.	II	I	II	I	.	.	.	.	4
<i>Lathyrus venetus</i> (Miller) Wohlf.	.	.	.	.	I	II	III	III	4
<i>Cyclamen hederifolium</i> Aiton	.	.	.	.	I	I	II	.	3

Characteristic species of the order *Fagetalia sylvaticae*

Fagus sylvatica L.	V	V	V	V	V	V	V	V	8
Galium odoratum (L.) Scop.	V	IV	II	II	IV	V	I	III	8
Orchis maculata L. ssp. fuchsii (Druce) Hylander	V	II	III	II	II	III	III	IV	8
Cardamine bulbifera (L.) Crantz	II	III	III	I	IV	IV	II	II	8
Melica uniflora Retz.	IV	.	I	I	I	IV	III	V	7
Neottia nidus-avis (L.) L. C. Rich.	II	I	II	I	I	II	II	.	7
Poa nemoralis L.	II	I	I	IV	.	I	I	I	7
Dryopteris filix-mas (L.) Schott	II	II	III	I	II	I	.	II	7
Aremonia agrimonoides (L.) DC.	III	I	II	I	.	IV	IV	.	6
Sorbus aucuparia L.	IV	I	I	I	.	II	.	.	5
Stellaria nemorum L.	I	II	I	I	.	I	.	.	5
Pyrola minor L.	III	III	II	I	.	I	.	.	5
Paris quadrifolia L.	I	II	.	I	I	I	.	.	5
Arum maculatum L.	.	I	I	.	III	II	.	I	5
Lilium martagon L.	III	.	.	.	III	III	I	.	4
Acer pseudoplatanus L.	III	.	.	.	I	II	III	.	4
Ilex aquifolium L.	II	.	I	.	III	II	.	.	4
Salvia glutinosa L.	II	.	II	.	.	.	I	I	4
Euonymus latifolius (L.) Miller	I	.	.	.	.	II	II	.	3
Listera ovata (L.) R.Br.	.	.	.	.	.	II	I	II	3
Rosa arvensis Hudson	.	.	.	.	III	I	III	.	3
Epipactis microphylla (Ehrh.) Swartz	.	.	.	.	I	I	I	.	3
Milium effusum L.	.	.	I	.	I	I	.	.	3
Stellaria holostea L.	.	.	.	.	II	II	I	.	3
Athyrium filix-foemina (L.) Roth	II	.	.	I	.	.	.	.	2
Acer platanoides L.	I	.	I	.	.	.	.	.	2
Poa sylvicola Guss.	.	.	.	.	.	II	.	I	2
Tilia platyphyllos Scop.	.	.	.	.	.	I	II	.	2
Allium ursinum L. (s.l.)	.	.	.	.	II	I	.	.	2
Ulmus glabra Hudson	.	.	.	.	.	I	.	I	2
Bromus ramosus Hudson	.	I	I	.	.	.	.	.	2
Doronicum columnae Ten.	.	.	.	.	I	I	.	.	2
Symphytum tuberosum L.	.	.	.	.	II	.	I	.	2
Polystichum lonchitis (L.) Roth	II	.	.	.	.	.	.	.	1
Epipogium aphyllum (Schmidt) Swartz	I	.	.	.	.	.	.	.	1
Galanthus nivalis L.	.	.	.	.	I	.	.	.	1
Corydalis cava (L.) Schweigg. et Koerte	.	.	.	.	I	.	.	.	1
Scilla bifolia L.	.	.	.	.	I	.	.	.	1
Epipactis gracilis B. & H. Baumann	.	.	.	.	I	.	.	.	1
Anemone apennina L.	.	.	.	.	I	.	.	.	1
Epipactis muelleri Godfery	.	.	.	.	I	.	.	.	1
Polygonatum odoratum (Miller) Druce	.	.	.	.	I	.	.	.	1
Hordelymus europaeus (L.) Harz	.	.	.	.	.	I	.	.	1
Crataegus laevigata (Poir.) DC.	.	.	.	.	.	.	II	.	1
Asperula taurina	.	.	.	.	.	.	I	.	1
Fraxinus excelsior L.	.	.	.	.	.	.	I	.	1
Primula veris L.	.	.	.	.	.	.	I	.	1
Pulmonaria picta	.	.	.	.	.	.	I	.	1

Characteristic species of the class *Quercu-Fagetea*

Viola reichenbachiana Jordan ex Boreau	IV	V	V	IV	V	V	V	V	8
Mycelis muralis (L.) Dumort.	IV	III	IV	III	III	IV	IV	III	8
Sanicula europaea L.	IV	V	IV	III	V	V	V	V	8
Primula vulgaris Hudson	I	II	III	III	IV	III	IV	I	8
Hepatica nobilis Miller	I	I	I	II	IV	IV	III	II	8
Solidago virgaurea L.	IV	I	I	II	II	III	II	IV	8
Euphorbia amygdaloides L.	III	II	IV	I	II	IV	V	.	7
Prenanthes purpurea L.	V	IV	.	II	I	IV	I	II	7
Ajuga reptans L.	II	.	I	I	II	III	I	V	7
Hieracium gr. murorum	V	V	III	IV	.	I	I	IV	7
Luzula sylvatica (Hudson) Gaudin	V	.	II	III	I	I	II	III	7
Brachypodium sylvaticum (Hudson) Beauv.	III	.	I	II	I	II	II	III	7
Campanula trachelium L.	.	.	I	I	II	II	II	II	6
Geum urbanum L.	III	IV	IV	IV	II	.	I	.	6
Hedera helix L.	.	.	I	I	II	I	III	IV	6
Cephalanthera longifolia (Hudson) Fritsch	.	III	I	I	II	I	II	.	6
Festuca heterophylla Lam.	IV	.	.	.	IV	III	V	III	5
Ruscus hypoglossum L.	I	I	.	.	I	I	.	II	5
Monotropa hypopitys L.	.	.	I	I	I	I	I	.	5
Sorbus aria (L.) Crantz	IV	.	I	.	.	II	I	.	4
Carex digitata L.	IV	.	.	.	.	I	I	III	4
Laburnum anagyroides Medicus	II	.	I	.	.	.	I	II	4
Acer campestre L.	.	.	I	.	.	II	II	III	4
Luzula forsteri (Sm.) DC.	IV	.	.	.	I	I	III	.	4



Hieracium sylvaticum (L.) L.	II	.	.	.	II	III	III	.	4
Tamus communis L.	.	.	.	.	.	I	III	IV	3
Cephalanthera damasonium (Miller) Druce	.	.	.	.	.	III	I	I	3
Prunus avium L.	.	.	I	.	.	.	I	II	3
Quercus pubescens Willd.	I	.	I	I	.	.	.	.	3
Viola alba Besser ssp. dehnhardtii (Ten.) W. Becker	.	.	.	.	.	I	III	II	3
Fraxinus ornus L.	.	.	I	.	.	.	II	II	3
Corylus avellana L.	.	.	I	.	.	.	III	I	3
Cephalanthera rubra (L.) L. C. Rich.	.	.	I	.	.	I	I	.	3
Mercurialis perennis L.	.	.	.	.	I	II	II	.	3
Luzula sieberi Tausch	.	II	.	.	.	I	.	.	2
Ostrya carpinifolia Scop.	.	.	I	.	.	.	II	.	2
Viburnum lantana L.	.	.	.	I	.	I	.	.	2
Rubus caesius L.	.	.	.	.	.	II	II	.	2
Vicia sepium L.	.	.	.	.	.	I	II	.	2
Hieracium racemosum W. et K.	.	.	.	.	.	I	I	.	2
Lonicera xylosteum L.	.	.	.	.	.	.	I	II	2
Populus tremula L.	.	.	I	.	.	.	.	.	1
Pyrus communis L.	.	.	I	.	.	.	.	.	1
Sambucus nigra L.	.	.	.	.	.	I	.	.	1
Carpinus orientalis Miller	.	.	.	.	.	.	I	.	1
Platanthera chlorantha (Custer) Rchb.	.	.	.	.	.	.	I	.	1
Sorbus torminalis (L.) Crantz	.	.	.	.	.	.	I	.	1
Laburnum alpinum (Miller) Berchtold et Presl	.	.	.	.	.	.	I	.	1
Sorbus domestica L.	.	.	.	.	.	.	.	I	1
Melittis melissophyllum L.	.	.	.	.	.	.	.	I	1
Other species									
Fragaria vesca L.	V	II	III	II	IV	III	III	I	8
Geranium robertianum L.	III	IV	III	II	III	III	I	II	8
Ranunculus lanuginosus L.	I	I	II	III	I	I	III	II	8
Juniperus communis L.	III	.	II	I	.	I	III	I	6
Veronica officinalis L.	IV	II	II	II	.	I	I	.	6
Epipactis helleborine (L.) Crantz	.	III	III	II	.	II	II	II	6
Aquilegia vulgaris	II	I	I	I	.	I	.	.	5
Pteridium aquilinum (L.) Kuhn	.	.	I	II	.	I	V	IV	5
Rosa canina L. sensu Bouleng.	.	I	I	I	.	I	I	.	5
Crataegus monogyna Jacq.	.	I	I	.	III	I	.	IV	5
Rubus glandulosus Bellardi	V	V	V	IV	.	.	.	.	4
Clematis vitalba L.	.	.	I	I	.	.	II	IV	4
Platanthera bifolia (L.) Rchb.	.	.	I	.	.	I	I	II	4
Heracleum sphondylium L. ssp. ternatum (Velen.) Brummit	.	I	I	.	.	I	I	.	4
Rubus idaeus L.	II	.	I	.	.	I	I	.	4
Polypodium vulgare L.	.	.	I	I	I	I	.	.	4
Aegopodium podagraria L.	.	.	.	.	.	III	II	III	3
Digitalis micrantha Roth	II	.	I	.	.	.	I	.	3
Erica arborea L.	III	.	I	I	.	.	.	.	3
Rubus hirtus W. et K.	.	.	.	.	IV	IV	III	.	3
Veronica chamaedrys L.	.	.	I	I	.	I	.	.	3
Lonicera caprifolium L.	.	.	.	.	.	I	I	II	3
Cruciata glabra (L.) Ehrend.	.	.	I	.	.	.	III	II	3
Cornus sanguinea L.	.	.	I	.	.	.	I	I	3
Dactylis glomerata L.	.	.	I	I	.	.	I	.	3
Cytisus scoparius (L.) Link	.	.	I	II	.	.	I	.	3
Agrostis tenuis Sibth.	.	I	III	IV	.	.	.	.	3
Acinos arvensis (Lam.) Dandy	.	I	II	I	.	.	.	.	3
Melampyrum sylvaticum L.	.	III	I	I	.	.	.	.	3
Myosotis discolor Pers.	.	I	I	II	.	.	.	.	3
Serapias lingua L.	.	I	I	I	.	.	.	.	3
Helleborus foetidus L.	.	.	.	.	I	I	I	.	3
Salix caprea L.	.	.	.	.	I	I	I	.	3
Senecio fuchsii Gmelin	.	.	.	.	II	I	I	.	3
Accidental species	2	9	27	17	3	20	23	10	

the attribution of the subacidophilous beech woods to two new syntaxa, which identify one corresponding to *Potentillo micranthae-Fagetum*, with aspects of thermophilous short beech woods, and the other identified with the association *Actaeo spicatae-Fagetum* refers to microthermic mesophilous beech woods of altitudes greater than 1400 m asl and spreading at lower heights into fresh and humid areas only.

*ACTAEO SPICATAE-FAGETUM SYLVATICAE* ass. nova (Tab. 3)

*actaeaeetosum spicatae* subass. typus (rel. type n. 3 of Tab. 3)

*aceretosum obtusati* subass. nova (rel. type n. 12 of Tab. 3)

*pyroletosum secundae* subass. nova (rel. type n. 17 of Tab. 3)

This new association includes the beech woods of the upper supratemperate bioclimatic belt that grow on

the formations of Gran Sasso Flysch in part covered by large sparse masses and by calcareous deposits of fluvio-glacial origins, and on the carbonatic substrata of Mount San Franco that have been decarbonated due to leaching. These woods grow on deep and acidic soils, in different locations within the study area and mainly in Prati di Tivo and in the Rio Arno Valley. These are ancient woods that are very important from the conservation point of view, made up of floristically rich microthermic beech woods, for which the composition is slightly acidophilous, with different differential species with respect to the high neutro-basophilous beech woods of

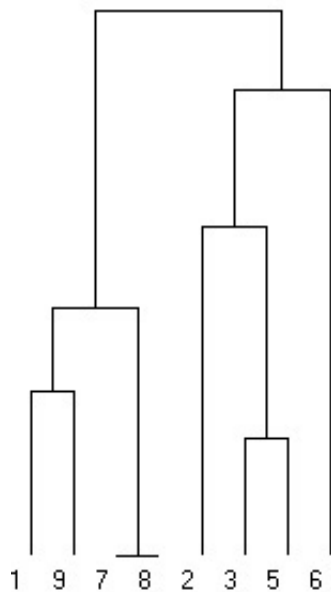


Fig. 13 - Dendrogram of the comparison among beech and silver fir woods of Apennines (1 = *Cirsio erisithalis-Abietetum albae*; 2 = *Cardamino kitaibelii-Fagetum sylvaticae*; 3 = *Actaeo spicatae-Fagetum sylvaticae*; 5 = *Potentillo micranthae-Fagetum sylvaticae*; 6 = *Dactylorhizo fucsii-Fagetum sylvaticae*; 7-9 = *Solidagini-Fagetum sylvaticae*)

the association *Cardamino kitaibelii-Fagetum sylvaticae*, for which it represents the ecological and biogeographical vicariante.

The characteristic species of the new association are: *Actaea spicata*, *Lathyrus vernus*, *Epipactis atrorubens*, *Festuca altissima* and *Daphne mezereum*, which are species with a prevalence in central Europe-Asia, while the acidophilous differential species with respect to *Cardamino-Fagetum* are: *Oxalis acetosella*, *Veronica urticifolia* and *Prenanthes purpurea*. On the contrary, *Pulmonaria apennina* indicates the marly component of the substrate and the mesophily of the phytocoenosis.

The association *Actaeo spicatae-Fagetum sylvaticae*

is included within the alliance *Aremonio agrimonoidis-Fagion sylvaticae* and the suballiance *Cardamino kitaibelii-Fagenion sylvaticae*.

The details in Tab. 3, as shown in Fig. 12, allow three distinct aspects to be revealed for the association *Actaeo spicatae-Fagetum sylvaticae*, which are interpreted as different subassociations:

subassociation *actaeetosum spicatae* (subcluster 1a):

corresponding to the typical form of the beech wood;

subassociation *pyroletosum secundae* (subcluster 1b):

refers to the higher altitude aspects, found at the foot of Mount San Franco, on carbonatic substrata, under geomorphological conditions of low slope where there is reasonable acidification of the soil, as shown by the presence of the following differential species: *Pyrola secunda* and *Pyrola minor*;

subassociation *aceretosum obtusati* (cluster 1c):

includes the more thermophilous formations of lower altitudes, in areas of the low, supratemperate bioclimatic belt, characterised by the descent of mesophilous elements, corresponding to the characteristic and differential species of the association, of the alliance and of the suballiance of the upper, supratemperate bioclimatic belt. They can therefore be interpreted as transition phytocoenosis with the association *Potentillo micranthae-Fagetum sylvaticae*, of the alliance *Geranio versicoloris-Fagion*.

The differential species of the subassociation are: *Acer obtusatum*, *Quercus cerris*, *Mercurialis perennis*, *Prenanthes purpurea*, *Poa sylvicola*, *Actaea spicata* and *Listera ovata*.

#### *POTENTILLO MICRANTHAE-FAGETUM SYLVATICAE* ass. nova (Tab. 4)

*fagetosum sylvaticae* subass. nova (rel. type n. 2 of Tab. 4)

*abietetosum albae* subass. nova (rel. type n. 11 of Tab. 4)

Within the thermophilous beech woods of the low supratemperate bioclimatic belt, the dendrogram of Fig. 12 separates a group of relevés (IIa) that are referred to the new association *Potentillo micranthae-Fagetum sylvaticae*, included in the central-southern Apennine alliance *Geranio versicoloris-Fagion sylvaticae*.

The species that are characteristic and differential of the new *syntaxon* are: *Quercus cerris*, *Potentilla micrantha*, *Acer pseudoplatanus*, *Crataegus laevigata*, *Lathyrus vernus*, *Cytisus villosus* and *Knautia drymeia*. These are differential with respect to *Lathyro veneti-Fagetum sylvaticae*: *Pulmonaria apennina*, *Aremonia agrimonoides*, *Orchis maculata*, *Luzula sylvatica*, *Lilium bulbiferum* ssp. *croceum*, *Cephalanthera*

Tab. 3 - *Actaeo spicatae-Fagetum sylvaticae* ass. nova subass. *actaeotosum spicatae* subass. typus (rel. type n. 3) subass. *aceretosum obtusari* (subass. nova) (rel. type n. 12) subass. *pyroletosum secundae* (subass. nova) (rel. type n. 17)

Rel. n.	1	2	3*	4	5	6	7	8	9	10	11	12*	13	14	15	16	17*	18	Pres.
Altitude (m asl)	1455	1387	1360	1419	1391	940	1400	1098	1360	1680	1528	1015	1015	1030	1030	1420	1680	1670	
Exposure	NW	W-NW	NE	W	NNW	NW	NNO	N	ONO	NW	N	N	N	N	N	N-NW	NW	N	
Slope (°)	40	15	40	35	12	30	10	40	10	30-35	10	40	40	45	45	15	15	15	
Coverage(%)	100	100	90	100	100	100	100	100	100	100	100	100	100	100	100	95	85	85	
Area (m <sup>2</sup> )	500	400	250	500	300	300	200	400	300	500	250	250	250	300	300	200	150	150	

Characteristic and differential species of the association *Actaeo spicatae-Fagetum sylvaticae*

G rhiz	EURASIAT.	2.2	3.3	2.2	1.2	2.2	1.2	1.1	.	2.3	.	2.2	.	1	1	1	1	2	14
H scap	EUROP.-CAUC.	1.2	1.1	2.3	.	+	1.2	.	+	1.2	2.2	.	1	1	+	.	.	.	12
H scap	ENDEM.	+	1.1	+	.	1.2	1.2	.	+	+	+	1	1	1	1	.	.	.	11
G rhiz	EURASIAT.	2.2	.	1.2	.	1.2	+	+	+	+	.	1	1	+	+	.	.	.	10
NP	EUROSIB.	.	+	2	.	+	+	1.1	.	+	+	1.1	.	.	.	.	.	.	7
G rhiz	EUROP.-CAUC.	1.1	+	2	.	1.1	+	.	.	1.2	+	.	.	.	.	.	.	.	6
H caesp	C EUROP.-SUBATL.	2.3	.	+	+	.	.	.	+	2.3	.	.	.	.	.	.	.	.	5
H scap	CENTROEUROP.	.	.	1.2	.	+	+	+	+	1.2	.	.	.	.	.	.	.	.	5
G rhiz	CIRCUMBOR.	.	.	+	+	.	.	+	.	2.3	.	.	.	.	.	.	.	.	4

Differential species of the subass. *aceretosum obtusari*

P scap	SEEUROP.	.	+	2	.	.	.	.	.	.	.	.	.	1	1	1	1	.	6
G rhiz	EURASIAT.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	4
G rhiz	CENTRO-EUROP.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	4
H caesp	EURIMEDIT.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	1	.	4
G rhiz	EUROP.-CAUC.	.	.	.	.	.	.	.	.	.	.	.	.	3	3	3	3	.	4
P scap	NEURIMEDIT.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	1	.	4

Differential species of the subass. *pyroletosum secundae*

Ch rept	CIRCUMBOR.	+	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	6
H ros	CIRCUMBOR.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3

Characteristic and differential species of the all. *Arenonio agrimonoidis-Fagion sylvaticae* and of the suball. *Cardamino kitaibelti-Fagion sylvaticae*

G rhiz	NMEDIT.MONT.	1.2	2.2	3.4	2.2	1.2	3.3	2.2	.	2.3	2.2	.	2	2	2	.	+	.	14
H ros	NESTENOMEDIT.	1.2	1.1	1.2	2.2	1.2	.	+	+	+	+	+	1	1	1	.	+	+	14
H scap	OROF. SEUROP.	1.2	1.2	1.2	1.1	1.2	+	+	+	1.2	+	+	1	1	2	.	.	.	14
G rhiz	EURASIAT.	1.1	+	.	.	+	.	+	.	.	.	.	1	1	+	.	1	2	11
H scap	NE-MEDIT.-MONT.	1.2	.	1.2	1.2	1.2	+	1.1	+	2.2	.	.	.	.	.	1	+	.	11
G rhiz	OROF. SE-EUROP.	+	.	.	.	.	.	1.1	.	.	.	.	1	1	2	1	1	+	10
G rhiz	EURASIAT.	+	.	.	.	.	.	+	.	1.2	+	+	1	1	.	.	.	.	10
G rhiz	SE-EUROP.	.	.	.	.	.	.	2.2	+	.	+	+	1	.	.	2	2	2	8
P scap	PALEOTEMP.	3.3	.	.	3.3	+	+	1.1	.	+	2.2	.	.	.	.	.	.	.	8
H scap	EURASIAT.	1.2	1.1	1.1	1.2	+	+	.	.	.	.	.	.	.	.	.	.	.	7
P caesp	EUROP.	.	+	2	.	.	+	.	.	.	.	.	.	.	.	1	.	.	5









*longifolia* and *Epipactis helleborine*.

The association describes the thermophilous and subacidophilous beech woods on Grand Sasso and Laga flysch, within a low, supratemperate bioclimate, and in the Abruzzo Apennines it substitutes the association *Staphyleo pinnatae-Fagetum sylvaticae* described for the flyschoid substrata of the Tuscany-Romagna and Marche Apennines (Ubaldi & Speranza, 1985). In the Upper Valley of the Vomano it is one of the most common forest typologies.

The subassociation *abietetosum albae* includes aspects of the rocky beech wood with *Abies alba* on sandstone and large conglomerates. The subassociation is differentiated by *Veronica urticifolia* and *Abies alba* and by the absence of species that need deeper soil (eg. *Lathyrus vernus*, *Lilium croceum*, *Cephalanthera longifolia*, etc.).

*CIRSIO ERISITHALIS-ABIETETUM ALBAE* ass. nova (Tab. 5)

*abietetosum albae* (rel. type n. 1 of Tab. 5)

*ericetosum arboreae* (rel. type n. 6 of Tab. 5)

In the Laga district, fir woods are not very frequent and often they are seen as mixed woods with beech and silver fir. In the studied area, the fir woods form nuclei of very limited sizes that grow within almost pure beech woods, corresponding to the dry rocky outcrops where they find the optimum for their growth as they have no inhibiting competition from the beech.

In 1982, during the International Phytosociology Excursion in Italy, Pedrotti published a Table in the guide book for the excursion concerning the fir-beech woods seen in the context of the northern Laga, between Marche (Corte Valley) and Abruzzo (Martese Wood). The 16 relevés in the Table were attributed to the association *Veronico urticifoliae-Fagetum* Montacchini 1972, analogous to that published in the same year by Feoli & Lagonegro (1982) that attributed the beech wood relevés of the Laga published by Longhitano & Ronsisvalle (1974) to this syntaxon. Later, in a revision study of the mesophilous woods of the Italian peninsula, the same relevés were attributed to a new association named *Dactylorhizo-Fagetum* (Ubaldi *et al.*, 1987), for which, and still with reference to the three Tables published by Longhitano & Ronsisvalle (1974), there are four subassociations: *juniperetosum*, *vaccinietosum*, *moehringietosum* and *abietetosum*. The association *Dactylorhizo-Fagetum* was incorrectly described, in that it was not given the type relevé and moreover the name had already been used by Izco & Biondi (1992), and therefore, a few years later, this was corrected with the

name *Solidagini-Fagetum* Ubaldi 1995 and at the same time the previously described subassociations were validated (Ubaldi, 1995).

From an analysis of the Table of Pedrotti and a comparison with the beech woods that we have described for the Strada Maestra District, it actually emerges that a large number of the relevés closely represent the actual fir woods that definitely have their own autonomy, both floristic and ecological, with respect to the corresponding beech woods. Indeed, these are woods with a dominance of silver fir, with the beech dominated, which are differentiated by the following group of species: *Abies alba*, *Vaccinium myrtillus*, *Pyrola secunda*, *Cirsium erisithales*, *Daphne mezereum*, *Veronica urticifolia*, *Pyrola minor*, *Oxalis acetosella* and *Festuca altissima*. From the same, there is also the identification of the subassociation *ericetosum arboreae* (rel. type subass. n. 6 of Tab. 5), differentiated by: *Calamagrostis arundinacea*, *Erica arborea*, *Brachypodium sylvaticum*, *Melampyrum nemorosum* and *Digitalis micrantha* that represent the more aridophilous and thermophilous aspects.

#### Turkey oak woods

In the Upper Valley of the Vomano, after the beech woods, the turkey oak woods represent the most extended forest typology, mainly managed as coppice with standards. For a comparison of the data of the same physiognomies relative to the adjacent territories, the relevés of turkey oak in the study area were compared with other mesophilous Apennine turkey oak woods of the suballiance *Pulmonario apenninae-Carpinion betuli* of the alliance *Erythronio dentis-canis-Carpinetum betuli* to reveal analogies with syntaxa already described or, in contrast, to look for possible differences. With this aim, the synoptic Table (6) was created, the columns of which represent the synthetic values of the following syntaxa:

*Carici sylvaticae-Quercetum cerris* Catorci & Orsomando 2001;

*Centaureo montanae-Carpinetum betuli* Ubaldi *et al.* 1987 ex Ubaldi 1995;

*Salvio glutinosae-Quercetum cerris* Ubaldi 2003,

*Salvio glutinosae-Quercetum cerris* subass. *arisaretosum* Ubaldi 2003,

*Listero ovatae-Quercetum cerris* Di Pietro & Tondi 2005,

*Aremonio agrimonoidis-Quercetum cerris* Blasi, Fortini, Grossi & Presti 2005.

The synoptic Table was subjected to cluster analysis



Tab. 5 - *Cirsio eristhialis-Abietetum albae* ass. nova  
subass. *abietetosum albae* (rel. type n. 3)  
subass. *erictosum arboreae* (rel. type n. 6)

Rel. n.	1*	2	3	4	5	6*	7	8	Pres.
Altitude (m asl)	1450	1350	1500	1375	1350	1480	1450	1400	
Exposure	NW	NW	N	NE	W-NW	W-NW	W-NW	W-NW	
Slope (%)	55	55	30	20	35	50	45	55	
Coverage(%)	100	100	98	100	100	100	100	100	
Area (m <sup>2</sup> )	800	500	200	400	500	500	500	400	
Characteristic and differential species of the association									
P caesp									
Ch frut	5.2	5.3	5.3	5.2	3.3	5.2	4.4	4.3	8
Ch rept	2.3	2.2	3.4	1.2	2.3	4.4	4.4	4.4	8
H scap	+2	+	+2	+2	+2	+2	1.2	+2	8
NP	+	+	+	+	1.1	+	+	+	7
H scap	+	+	+	+	+2	+	+	+	7
H ros	.	.	1.2	1.1	1.1	1.2	1.1	+2	6
G thiz	.	1.1	+2	+	.	+	.	.	4
H caesp	1.2	1.2	+2	.	.	.	.	.	3
	+	.	+	+	.	.	.	.	3
Characteristic and differential species of the subass. <i>erictosum arboreae</i>									
H caesp	.	.	1.1	.	.	2.2	+2	1.1	4
P caesp	.	.	.	.	+	+	+2	+2	4
H caesp	.	.	.	.	1.2	+2	+2	1.1	4
T scap	.	.	.	.	+2	2.3	1.1	1.1	4
H scap	.	.	.	.	.	+	+	+	3
Characteristic and differential species of the all. <i>Arenonio agrimonioideis-Fagion sylvaticae</i> and of the suball. <i>Cardamino kitaibelii-Fagenion sylvaticae</i>									
P caesp	+	+	+2	.	+	+	1.1	+	7
H scap	1.1	+	+	.	.	+	+2	.	6
G thiz	2.2	2.2	.	.	1.2	1.1	1.1	+2	6
H scap	1.2	+2	+	.	+2	+	.	.	5
G thiz	1.2	1.1	.	.	+2	.	+	.	4
H scap	+	+	.	.	+	+	.	.	4
G thiz	+	+	1.1	.	+	.	.	.	4
G thiz	+	+	.	.	.	.	.	.	2
P caesp	.	+	.	.	.	.	.	.	1
Characteristic and differential species of the order <i>Fagatalia sylvaticae</i>									
P scap	4.3	3.3	1.1	4.2	3.3	2.2	3.3	2.2	8
H scap	1.1	+	1.1	1.1	+	1.1	+	+	7
G thiz	1.2	1.1	+2	+	1.1	+2	+	.	7
G bulb	+	+	+	+	+	+	+	+	7
H caesp	+	+	.	.	+	+	+	+	6
H scap	1.2	1.1	+	.	1.1	+	+	+	5
H rept	1.1	.	.	+	.	+	1.1	+	5
H ros	+2	.	+2	.	.	+	+2	+	4
G thiz	+	+	.	+	.	+	+	+	4
G thiz	+	+	.	+	.	.	.	.	3
G thiz	+	+	.	+	.	.	.	.	3
H ros	+	.	+2	+	.	.	.	.	3



(similarity matrix between columns, binary similarity ratio, complete linkage algorithm) from which the dendrogram shown in Fig. 14 was obtained. This demonstrates clearly how the turkey oak woods of the Upper Valley of the Vomano (cluster II) are different from both those of the Tuscany-Marche and Umbria-Marche arenaceous marl Apennines (cluster Ib), as well as those of the Lazio slopes of Monti della Laga and of Umbria and Molise (cluster Ia). In particular, with respect to the turkey oak woods of *Listero ovatae-Quercetum cerris*, which are geographically the closest with respect to those we have studied, those of the Upper Valley of the Vomano have numerous differential species, including: *Cytisus villosus*, *Melica uniflora*, *Teucrium siculum*, *Carpinus betulus*, *Hedera helix*, *Lathyrus vernus*, *Veronica urticifolia*, *Tamus communis*, etc. In the final analysis, the turkey oak woods in the study sector were indeed more thermophilous and less hygrophilous with respect to those described for the Lazio slopes of Monti della Laga, also because of the looser substrata with less water retention. Therefore, it is necessary to describe a new association, which is illustrated below.

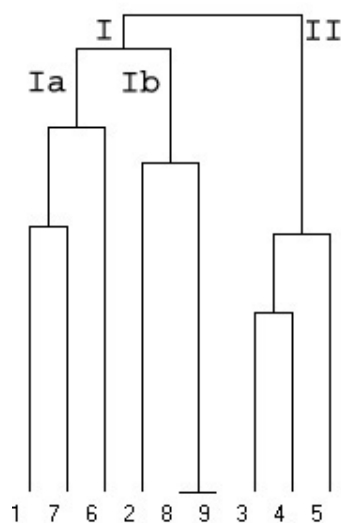


Fig. 14 - Dendrogram of the comparison among turkey oak woods of Apennines belonging to the suballiance *Pulmonario apenninae-Carpinenion betuli*. (1= *Carici sylvaticae-Quercetum cerris*; 7= *Aremonio agrimonoidis-Quercetum cerris*; 6= *Listero ovatae-Quercetum cerris*; 2= *Centaureo montanae-Carpinetum betuli*; 8= *Salvio glutinosae-Quercetum cerris*; 9= *Salvio glutinosae-Quercetum cerris* subass. *arisaretosum*; 3= *Cytiso villosi-Quercetum cerris* subass. *cytisetosum villosi*; 4= *Cytiso villosi-Quercetum cerris* subass. *aceretosum obtusati*; 5= *Cytiso villosi-Quercetum cerris* subass. *stellarietosum holostei*)

*CYTISO VILLOSI-QUERCETUM CERRIS* ass. nova  
*cytisetosum villosi* subass. nova holotypus Tab. 7 Rel. n. 2  
*aceretosum obtusati* subass. nova holotypus Tab. 7 Rel. n. 20

*stellarietosum holostei* subass. nova Holotype Tab. 7 Rel. n. 26

This association includes the subacidophilous and semimesophilous turkey oak woods of the low, supratemperate bioclimatic belt, which becomes mesotemperate only in the cooler areas. These turkey oak woods grow on flyschoid substrata with a prevalently south-eastern exposure, often in contact with chestnut woods. The association is included in the Apennine suballiance *Pulmonario-Carpinenion betuli* of the eastern alliance *Erythronio dentis-canis-Carpinenion betuli*.

The characteristic and differential species are: *Cytisus villosus*, *Melica uniflora*, *Carpinus betulus*, *Teucrium siculum* and *Fraxinus ornus*.

Within the new syntaxon, the typical aspect is represented by the subassociation *cytisetosum villosi*, for which the differential species coincide with those characteristics of the association. Two further aspects have also been identified, formalised at the level of subassociation:

- *aceretosum obtusati* (Tab. 7 rels. 15-25), of lower heights, relative to coenoses of more thermoxerophilous character, for which the differential species are: *Ostrya carpinifolia*, *Acer obtusatum*, *Cephalanthera longifolia*, *Rubus caesius*, *Hepatica nobilis*, *Hieracium sylvaticum*, and *Carpinus orientalis*, almost all with an eastern barycentre and typical of submontane oak woods.

- *stellarietosum holostei* (Tab. 7 rels. 26-29), relative to the coenoses of a mesohygrophilous character, for which the differential species are: *Stellaria holostea*, *Lilium bulbiferum* subsp. *croceum*, *Carex sylvatica*, *Polygonatum multiflorum* and *Cephalanthera damasonium*. The subassociation is also differentiated by the abundant presence of *Carpinus betulus*.

#### White oak woods

In the Upper Valley of the Vomano, the white oak woods cover a fairly limited area, growing in the upper, mesotemperate bioclimate belt and they are also found in the upper, mesotemperate belt with edapho-xerophilous aspects. From the studies carried out, it has been shown that in the territory it is possible to recognise two typologies of white oak woods, of which one is neutro-basophilous and grows on calcareous-marl and Bisciario formation substrata, and the other is sub-acidophilous and typical of the flyschoid substrata of the Laga Flysch formations.

Tab. 6 - Synoptic table of turkey oak woods

Associations	1	7	6	2	8	9	3	4	5	Pres.
Species of the association <i>Carici sylvaticae-Quercetum cerris</i>										
Platanthera chlorantha (Custer) Rchb.	V	.	II	II	.	.	II	I	.	5
Lilium martagon L.	IV	I	I	II	.	.	.	.	II	5
Cyclamen hederifolium Aiton	IV	I	I	I	.	.	.	I	.	5
Sorbus aria (L.) Crantz	III	I	I	.	.	.	.	.	.	3
Anemone apennina L.	III	I	.	.	.	.	.	.	.	2
Galanthus nivalis L.	IV	.	I	.	.	.	.	.	.	2
Cardamine kitaibelii Becherer	III	I	.	.	.	.	.	.	.	2
Silene viridiflora L.	II	.	I	.	.	.	.	.	.	2
Anemone nemorosa L.	III	.	.	.	.	.	.	.	.	1
Aristolochia pallida Willd.	III	.	.	.	.	.	.	.	.	1
Scilla bifolia L.	III	.	.	.	.	.	.	.	.	1
Senecio fuchsii Gmelin	II	.	.	.	.	.	.	.	.	1
Quercus petraea (Mattuschka) Liebl.	II	.	.	.	.	.	.	.	.	1
Ruscus aculeatus L.	I	.	.	.	.	.	.	.	.	1
Adoxa moschatellina L.	I	.	.	.	.	.	.	.	.	1
Cardamine graeca L.	I	.	.	.	.	.	.	.	.	1
Luzula sieberi Tausch	I	.	.	.	.	.	.	.	.	1
Ribes alpinum L.	I	.	.	.	.	.	.	.	.	1
Doronicum columnae Ten.	I	.	.	.	.	.	.	.	.	1
Species of the association <i>Aremonio agrimonoidis-Quercetum cerris</i>										
Aremonia agrimonoides (L.) DC.	II	V	V	I	II	III	I	V	IV	9
Primula vulgaris Hudson ssp. vulgaris	V	IV	V	IV	IV	V	IV	III	II	9
Ligustrum vulgare L.	II	V	I	V	II	.	.	.	.	5
Geranium versicolor L.	.	IV	.	.	.	.	.	I	.	2
Fraxinus excelsior L.	.	I	.	.	.	.	.	.	.	1
Cardamine heptaphylla (Vill.) O. E. Schulz	.	I	.	.	.	.	.	.	.	1
Allium pendulinum Ten.	.	I	.	.	.	.	.	.	.	1
Luzula sieberi Tausch ssp. sicula (Parl.) Pign.	.	I	.	.	.	.	.	.	.	1
Acer lobelii Ten.	.	I	.	.	.	.	.	.	.	1
Species of the association <i>Listero ovatae-Quercetum cerris</i>										
Dactylorhiza fuchsii (Druce) Soo subsp. fuchsii	.	I	IV	III	V	V	III	II	.	7
Listera ovata (L.) R.Br.	.	I	IV	.	IV	.	III	.	.	4
Knautia drymeia Heuffel	.	.	IV	.	.	.	II	.	III	3
Viola odorata L.	.	I	V	.	.	.	.	.	.	2
Moehringia trinervia (L.) Clairv.	.	.	II	.	.	.	.	.	.	1
Ranunculus nemorosus DC.	.	.	I	.	.	.	.	.	.	1
Aruncus dioicus (Walter) Fernald	.	.	I	.	.	.	.	.	.	1
Hieracium lachenalii Gmelin	.	.	I	.	.	.	.	.	.	1
Viola canina L.	.	.	I	.	.	.	.	.	.	1
Species of the association <i>Centaureo montanae-Carpinetum betuli</i>										
Carpinus betulus L.	V	IV	I	V	II	V	III	II	.	8
Lonicera xylosteum L.	.	.	V	III	.	IV	IV	I	.	5
Asarum europaeum L.	.	.	.	V	.	III	.	.	.	2
Centaurea montana L.	.	.	.	III	.	.	.	.	.	1
Anemone trifolia L.	.	.	.	III	II	.	.	.	.	2
Iris graminea L.	.	.	.	III	.	.	.	.	.	1
Species of the association <i>Salvia glutinosae-Quercetum cerris</i>										
Luzula forsteri (Sm.) DC.	V	.	II	.	V	III	IV	IV	III	7
Salvia glutinosa L.	.	.	IV	.	IV	III	III	III	II	6
Species of the subassociation <i>arisaretosum</i>										
Astragalus glycyphyllos L.	.	I	IV	I	.	IV	IV	II	II	7
Potentilla micrantha Ramond	I	I	III	.	.	III	.	III	III	6
Arisarum proboscideum (L.) Savi	.	.	.	.	.	III	.	.	.	1
Arum maculatum L.	.	.	.	.	.	V	.	.	.	1
Carex digitata L.	.	.	.	.	.	II	.	.	.	1
Species of the association <i>Cytiso villosi-Quercetum cerris</i> subass. <i>cytisetosum villosi</i>										
Cytisus villosus Pourret	.	.	.	.	.	.	IV	III	III	3
Teucrium siculum Rafin.	.	.	.	.	.	.	III	III	.	2

Species of the subassociation *aceretosum obtusati*

Ostrya carpinifolia Scop.	I	.	II	.	IV	III	II	V	II	7
Acer obtusatum W. et K.	IV	III	II	IV	III	IV	.	V	.	7
Cephalanthera longifolia (Hudson) Fritsch	I	.	I	.	.	.	I	IV	.	4
Rubus caesius L.	I	.	.	V	.	.	.	IV	.	3
Carpinus orientalis Miller	.	I	.	.	.	.	.	I	.	2
Ptilostemon strictus (Ten.) Greuter	.	.	.	.	.	.	II	IV	.	2

Species of the subassociation *stellarietosum holostei*

Lilium bulbiferum L. ssp. croceum (Chaix) Baker	III	II	I	II	IV	III	I	I	V	9
Polygonatum multiflorum (L.) All.	I	II	.	I	.	II	I	I	III	7
Stellaria holostea L.	II	II	.	.	.	.	I	.	V	4
Senecio nemorensis L.	.	.	.	.	.	.	.	.	III	1

Characteristic and differential species of the all. *Erythronio dentis-canis-Carpinion betuli* and of the suball. *Pulmonario apenninae-Carpinion betuli*

Pulmonaria apennina Cristof. & Puppi	IV	IV	IV	III	III	III	II	I	V	9
Rosa arvensis Hudson	V	V	V	V	V	V	IV	IV	V	9
Daphne laureola L.	V	V	I	IV	.	III	V	V	V	8
Carex sylvatica Hudson	IV	I	I	III	IV	IV	.	I	IV	8
Crataegus laevigata (Poir.) DC.	IV	III	IV	IV	IV	V	.	II	IV	8
Cornus mas L.	III	I	.	II	IV	III	II	I	.	7
Acer pseudoplatanus L.	I	I	III	I	.	.	III	II	III	7
Euonymus latifolius (L.) Miller	II	II	.	III	.	.	II	I	IV	6
Pyrus pyraeaster Burgsd.	II	II	V	V	III	.	.	.	.	5
Aegopodium podagraria L.	.	.	I	I	.	III	.	II	V	5

Characteristic species of the order *Fagetalia sylvaticae*

Festuca heterophylla Lam.	V	I	V	V	II	III	IV	V	V	9
Melica uniflora Retz.	V	IV	I	V	IV	V	II	IV	V	9
Fagus sylvatica L.	IV	IV	II	III	II	IV	III	II	IV	9
Cruciata glabra (L.) Ehrend.	IV	I	IV	II	V	IV	IV	III	IV	9
Sanicula europaea L.	III	III	III	.	V	V	IV	V	II	8
Prunus avium L.	III	I	V	.	IV	IV	IV	III	II	8
Geranium nodosum L.	.	.	I	IV	III	V	II	II	III	7
Poa nemoralis L.	III	I	IV	.	.	.	III	I	II	6
Brachypodium sylvaticum (Hudson) Beauv.	IV	III	V	I	.	.	II	V	.	6
Cardamine bulbifera (L.) Crantz	III	III	.	II	.	III	.	I	III	6
Ilex aquifolium L.	I	II	.	III	.	.	I	I	II	6
Ulmus glabra Hudson	.	I	I	I	.	.	I	I	III	6
Euphorbia dulcis L.	III	.	II	I	.	III	I	.	.	5
Galium odoratum (L.) Scop.	II	II	I	I	.	III	.	.	.	5
Symphytum tuberosum L.	III	.	I	II	.	III	.	.	.	4
Polystichum setiferum (Forsskal) Woyнар	II	I	.	.	.	.	II	I	.	4
Lathyrus vernus (L.) Bernh.	.	I	.	I	.	.	II	I	.	4
Dryopteris filix-mas (L.) Schott	.	.	I	I	.	.	I	II	.	4
Populus tremula L.	I	.	II	.	.	.	I	I	.	4
Hieracium murorum L. s.l.	.	.	.	I	.	.	III	II	II	4
Veronica officinalis L.	II	.	.	.	.	.	I	I	.	3
Saxifraga rotundifolia L.	I	I	.	.	.	.	.	I	.	3
Tilia platyphyllos Scop.	.	I	.	.	.	.	.	II	II	3
Anemone ranunculoides L.	I	I	.	.	.	.	.	.	.	2
Mercurialis perennis L.	I	II	.	.	.	.	.	.	.	2
Ruscus hypoglossum L.	I	I	.	.	.	.	.	.	.	2
Hieracium sylvaticum (L.) L.	II	.	I	.	.	.	.	.	.	2
Sorbus aucuparia L.	.	.	.	.	.	.	I	I	.	2
Abies alba Miller	.	I	.	.	.	.	I	.	.	2
Milium effusum L.	.	I	.	.	.	.	.	I	.	2
Asperula taurina L.	.	I	.	.	.	.	.	I	.	2
Lamium galeobdolon ssp. flavidum (F.Hermann) Ehrend. et Pola. cfr.	.	I	.	.	.	.	.	I	.	2
Poa sylvicola Guss.	.	.	I	.	.	.	II	.	.	2
Myosotis sylvatica Hoffm.	.	.	.	.	.	.	I	I	.	2
Hordelymus europaeus (L.) Harz	.	.	.	I	.	.	.	I	.	2
Acer platanoides L. pl.	.	.	.	.	.	.	.	II	II	2
Epipactis purpurata Sm.	.	.	.	.	.	.	I	I	.	2
Veronica urticifolia Jacq.	.	.	.	.	.	.	I	I	.	2
Prenanthes purpurea L.	.	.	.	.	.	.	.	I	II	2
Tilia cordata Miller	.	.	.	.	.	.	I	.	.	1
Stellaria nemorum L. ssp. glochidisperma Murb.	.	.	.	.	.	.	.	I	.	1
Primula veris L.	.	.	.	.	.	.	.	I	.	1
Lathraea squamaria L.	.	.	.	.	.	.	.	I	.	1
Euonymus verrucosus Scop.	.	.	.	.	.	.	.	I	.	1
Polystichum aculeatum (L.) Roth	.	.	.	.	.	.	.	I	.	1

Characteristic species of the class *Quercio-Fagetea*

Quercus cerris L.	V	V	V	V	V	V	V	V	V	9
Hedera helix L.	IV	V	I	V	IV	V	IV	V	III	9
Acer campestre L.	III	V	V	V	V	V	II	III	V	9
Viola reichenbachiana Jordan ex Boreau	V	III	V	II	V	V	III	V	III	9
Corylus avellana L.	III	III	III	I	II	V	III	III	V	9
Lathyrus venetus (Miller) Wöhlf.	V	II	III	III	III	V	I	III	III	9

<i>Viola alba</i> Besser ssp. <i>dehnhardtii</i> (Ten.) W. Becker	.	II	II	III	III	II	III	IV	V	8
<i>Lonicera caprifolium</i> L.	III	V	V	V	V	V	.	IV	IV	8
<i>Campanula trachelium</i> L.	III	I	II	.	II	III	I	IV	V	8
<i>Bromus ramosus</i> Hudson	.	I	V	III	III	III	III	I	III	8
<i>Fraxinus ornus</i> L.	II	II	.	I	III	.	III	IV	III	7
<i>Cephalanthera damasonium</i> (Miller) Druce	II	I	I	.	II	II	I	.	III	7
<i>Hepatica nobilis</i> Miller	V	I	I	III	II	IV	.	III	.	7
<i>Euphorbia amygdaloides</i> L.	III	III	I	III	.	.	III	V	IV	7
<i>Mycelis muralis</i> (L.) Dumort.	II	II	III	I	.	.	IV	IV	III	7
<i>Sorbus torminalis</i> (L.) Crantz	II	I	.	V	II	.	I	I	III	7
<i>Neottia nidus-avis</i> (L.) L. C. Rich.	II	III	III	II	.	.	II	I	II	7
<i>Tamus communis</i> L.	.	III	.	I	V	IV	II	III	III	7
<i>Ajuga reptans</i> L.	.	I	I	.	IV	V	II	III	III	7
<i>Epipactis helleborine</i> (L.) Crantz ssp. <i>Muelleri</i>	.	II	III	I	.	.	III	II	IV	6
<i>Malus sylvestris</i> Miller	II	I	III	I	.	III	.	III	.	6
<i>Solidago virgaurea</i> L. ssp. <i>virgaurea</i>	II	.	I	I	II	V	.	II	.	6
<i>Digitalis micrantha</i> Roth	.	.	II	.	.	.	III	III	II	4
<i>Melittis melissophyllum</i> L.	III	I	.	I	.	.	.	I	.	4
<i>Quercus pubescens</i> Willd.	II	.	I	.	.	.	I	I	.	4
<i>Laburnum anagyroides</i> Medicus	II	.	I	.	.	.	II	I	.	4
<i>Sorbus domestica</i> L.	II	.	I	.	.	.	I	.	.	3
<i>Ornithogalum pyrenaicum</i> L.	I	I	I	.	.	.	.	.	.	3
<i>Pyrus communis</i> L.	.	.	.	.	.	.	II	I	IV	3
<i>Rubus canescens</i> DC.	.	.	I	.	.	.	.	I	.	2
<i>Stachys officinalis</i> (L.) Trevisan	.	.	I	II	.	.	.	.	.	2
<i>Castanea sativa</i> Miller	.	.	II	.	.	.	.	II	.	2
<i>Polypodium vulgare</i> L.	.	.	I	.	.	.	.	I	.	2
<i>Cephalanthera rubra</i> (L.) L. C. Rich.	I	.	I	.	.	.	.	.	.	2
<i>Viburnum lantana</i> L.	.	.	I	II	.	.	.	.	.	2
<i>Lathyrus niger</i> (L.) Bernh.	.	.	.	II	.	II	.	.	.	2
<i>Serratula tinctoria</i> L.	.	.	I	I	.	.	.	.	.	2
<i>Hieracium racemosum</i> W. et K.	.	.	I	.	.	.	.	I	.	2
<i>Ulmus minor</i> Miller pl.	.	.	I	.	.	.	.	I	.	2
<i>Oenanthe pimpinelloides</i> L.	I	.	.	.	.	.	.	.	.	1
<i>Acer monspessulanum</i> L.	.	I	.	.	.	.	.	.	.	1
Other species										
<i>Fragaria vesca</i> L.	V	II	V	I	IV	IV	V	V	IV	9
<i>Prunus spinosa</i> L.	I	.	IV	I	IV	V	III	III	II	8
<i>Cornus sanguinea</i> L.	I	III	III	II	V	V	.	III	V	8
<i>Juniperus communis</i> L.	I	.	IV	I	II	II	IV	II	IV	8
<i>Geum urbanum</i> L.	II	III	V	.	II	II	V	III	IV	8
<i>Crataegus monogyna</i> Jacq.	III	IV	V	III	V	V	.	IV	.	7
<i>Pteridium aquilinum</i> (L.) Kuhn	II	I	II	.	III	V	V	IV	.	7
<i>Vicia sepium</i> L.	.	II	I	I	.	III	I	IV	III	7
<i>Clematis vitalba</i> L.	.	II	V	.	IV	III	III	II	II	7
<i>Brachypodium rupestre</i> (Host) R. et S. ssp. <i>rupestre</i>	.	.	I	I	III	II	I	I	V	7
<i>Rubus hirtus</i> W. et K.	.	V	V	.	II	.	III	II	III	6
<i>Veronica chamaedrys</i> L.	.	.	III	I	II	.	IV	I	II	6
<i>Carex flacca</i> Schreber ssp. <i>flacca</i>	.	.	I	I	II	II	III	II	.	6
<i>Euonymus europaeus</i> L.	IV	III	.	I	II	III	.	IV	.	5
<i>Silene italica</i> (L.) Pers.	I	.	I	.	.	.	II	II	II	5
<i>Rubus ulmifolius</i> Schott	.	.	I	.	III	IV	II	II	.	5
<i>Dactylis glomerata</i> L.	.	.	IV	.	II	.	IV	II	III	5
<i>Ranunculus lanuginosus</i> L.	.	II	III	.	.	.	II	III	III	5
<i>Clinopodium vulgare</i> L.	I	.	III	I	.	.	.	IV	.	4
<i>Helleborus bocconei</i> Ten.	II	.	.	II	IV	IV	.	.	.	4
<i>Epilobium montanum</i> L.	I	.	I	.	.	.	II	I	.	4
<i>Geranium robertianum</i> L.	.	II	IV	.	.	.	.	II	II	4
<i>Genista tinctoria</i> L. ssp. <i>tinctoria</i>	.	.	I	.	.	.	II	I	II	4
<i>Rosa canina</i> L. sensu Bouleng.	.	.	.	.	III	III	.	I	II	4
<i>Coronilla emerus</i> L. ssp. <i>emeroides</i> (Boiss. et Spruner) Hayek	.	.	I	.	.	II	I	I	.	4
<i>Hypericum montanum</i> L.	II	.	I	.	.	.	I	.	.	3
<i>Cruciata laevipes</i> Opiz	III	.	I	.	.	.	.	III	.	3
<i>Cytisus sessilifolius</i> L.	I	I	II	.	.	.	.	.	.	3
<i>Galium aparine</i> L.	.	III	II	.	.	.	II	.	.	3
<i>Helleborus foetidus</i> L.	.	II	.	.	.	.	I	II	.	3
<i>Buglossoides purpurocaerulea</i> (L.) Johnston	.	I	I	.	.	.	.	I	.	3
<i>Cytisus scoparius</i> (L.) Link	.	.	III	.	.	.	II	II	.	3
<i>Sedum cepaea</i> L.	.	.	I	.	.	.	I	I	.	3
<i>Aquilegia vulgaris</i> L.	.	.	I	.	.	.	I	.	II	3
<i>Thalictrum aquilegifolium</i> L.	.	.	.	I	.	.	.	I	II	3
<i>Arum italicum</i> Miller	I	I	.	.	.	.	.	.	.	2
<i>Rumex sanguineus</i> L.	.	I	I	.	.	.	.	.	.	2
<i>Ribes uva-crispa</i> L.	.	I	I	.	.	.	.	.	.	2
<i>Alliaria petiolata</i> (Bieb.) Cavara et Grande	.	I	I	.	.	.	.	.	.	2
<i>Chaerophyllum hirsutum</i> L.	.	I	II	.	.	.	.	.	.	2
<i>Scutellaria columnae</i> All.	.	I	.	.	.	.	.	I	.	2
<i>Chaerophyllum temulum</i> L.	.	.	III	.	.	.	.	I	.	2
<i>Heracleum sphondylium</i> L. ssp. <i>ternatum</i> (Velen.) Brummit	.	.	III	.	.	.	II	.	.	2
<i>Orchis purpurea</i> Hudson	.	.	II	.	II	.	.	.	.	2
<i>Prunella vulgaris</i> L.	.	.	I	.	.	.	II	.	.	2

Campanula rapunculus L.	.	.	I	.	.	.	III	.	.	2
Trifolium medium L.	.	.	I	.	.	.	II	.	.	2
Campanula persicifolia L.	.	.	I	.	.	.	I	.	.	2
Lapsana communis L. ssp. communis	.	.	I	.	.	.	I	.	.	2
Chaerophyllum aureum L.	.	.	I	.	.	.	I	.	.	2
Teucrium chamaedrys L.	.	.	I	.	.	.	.	II	.	2
Cyclamen repandum S. et S.	.	.	.	III	II	.	.	.	.	2
Bunium bulbocastanum L.	.	.	.	II	II	.	.	.	.	2
Vicia cracca L.	.	.	.	.	.	.	I	I	.	2
Urtica dioica L.	.	.	.	.	.	.	I	I	.	2
Epipactis microphylla (Ehrh.) Swartz	.	.	.	.	.	.	II	.	III	2
Trifolium ochroleucum HUDSON	.	.	.	.	.	.	III	.	II	2
Silene vulgaris (Moench) Garcke	.	.	.	.	.	.	.	I	II	2
Arabis turrita L.	.	.	.	.	.	.	.	I	II	2
Peucedanum verticillare (L.) Koch	.	.	.	.	.	.	.	II	II	2
Accidental species	4	-	8	7	-	-	12	3	-	

### CYTISO SESSILIFOLII-QUERCETUM PUBESCENTIS

Blasi, Feoli & Avena 1982 (Tab. 8: ril. 1-4)

This association describes the deciduous woods with a dominance of white oak, with subcontinental character, rich in central European and Euro-Asiatic elements (Blasi *et al.*, 1982).

The characteristic and differential species are: *Juniperus oxycedrus* subsp. *oxycedrus*, *Cytisus sessilifolius*, *Cytisus spinescens*, *Rosa canina* and *Teucrium chamaedrys*, all included in Tab. 8. To these can be added, as local differentiators, *Sorbus aria* and *Digitalis micrantha*.

These woods are often degraded and are strongly cut, and they grow in the more western sectors of the territory, in correspondence with the calcareous-marl outcrops of the Marl with Cerroigna and of the Bisciario formations. The most significant nuclei woods of this association are found in the Cerqueto and Arischia territories, while a large part of the areas with potential for this forest typology are often occupied by substitution coenoses, in particular made up of anthropic planting of the European black (Austrian) pine (*Pinus nigra*).

### CHAMAECYTISO HIRSUTI-QUERCETUM PUBESCENTIS

ass. nova

(Tab. 8: ril. 5-18; holotypus ril. 13)

A peculiar typology of the wood of *Quercus pubescens* is that which is found on Laga Flysch substrata (with alternating arenaceous and turbiditic clay), in a mesotemperate bioclimatic belt. The major part of these coenoses is located between 680 and 940 m asl. These are oak woods with a subacidophilous character, which are different in comparison with the other coenoses of *Quercus pubescens*, for which we propose the new associated *Chamaecytisus hirsuti-Quercetum pubescentis*, for which the characteristic and differential species are: *Chamaecytisus hirsutus*,

*Sesleria nitida*, *Quercus dalechampii*, *Carpinus orientalis*, *Loranthus europaeus*, *Cephalanthera longifolia*, *Colutea arborescens* and *Genista tinctoria*.

The association therefore describes the subacidophilous oak woods of the Valley of the Vomano dominated by *Quercus pubescens*, with a local co-dominance of *Quercus virgiliana* and *Quercus dalechampii*, chorologically characterised by the relevant presence of eastern elements.

For the positioning in the superior syntaxonomic unit, reference is made to the suballiance *Cytiso sessilifolii-Quercenion pubescentis* and to the alliance *Carpinion orientalis*.

### Hop hornbeam woods

The mixed woods with a dominance of hop hornbeam are overall little represented in the study area, and they are found with limited stretches along the slopes of the low, upper-supratemperate, mesotemperate bioclimatic belt, in contact with the turkey oak woods of the association *Cytiso villosi-Quercetum cerris* with respect to which they represent the edapho-xerophilous aspects. Indeed, these woods grow in correspondence to the arenaceous and dry conglomerate outcrops where water drains more rapidly.

The relevés in the territory of the Strada Maestra District show strong analogies with the Apennine endemic association *Scutellario columnae-Ostryetum* to which they have therefore been attributed, and within which they possibly represent a slightly more acidophilous aspect.

### SCUTELLARIO COLUMNAE-OSTRYETUM CARPINIFOLIAE

Pedrotti, Ballelli & Biondi ex Pedrotti, Ballelli, Biondi, Cortini & Orsomando 1980 (Tab. 9)

This association has been described for the calcareous













sectors of the Umbria-Marche Apennines (Pedrotti *et al.*, 1979, 1982), and here it has a large enough ecological value.

The characteristic and differential species are: *Fraxinus ornus*, *Scutellaria columnae* ssp. *columnae*, *Helleborus bocconei* and *Melampyrum italicum*.

From the cluster analysis (see Fig. 15), it can be seen that there are three different aspects that have been interpreted as three subassociations:

- *cytisetosum villosi* subass. nova (rel. type n.10 Tab. 9): this represents the more acidophilous and medium mesophilous aspect characterised by the presence of some species that are common in the undergrowth of the turkey oak woods (*Pteridium aquilinum*, *Teucrium siculum*, etc.) and of numerous species of the order *Fagetalia* (*Carpinus betulus*, *Rosa arvensis*, *Ulmus glabra*, *Geranium nodosum*, *Crataegus laevigata*, etc.). The woods attributed to the subassociation grow along the slopes in correspondence with arenaceous outcrops. The differential species are: *Cytisus villosus*, *Pteridium aquilinum*, *Rosa arvensis*, *Epipactis helleborine*, *Quercus cerris*, *Carpinus betulus*, *Lathyrus venetus*, and *Teucrium siculum*.

- *fagetosum sylvaticae* Pedrotti, Ballelli & Biondi (1979) 1982 em. Catorci & Orsomando 1997: this represents the more mesophilous aspect of the *Scutellario-Ostryetum*, differentiated by a good level of mesophilous species of the order *Fagetalia* in the undergrowth. The subassociation has been described for the Umbria-Marche calcareous Apennines, to include the flowering ash and hornbeam woods in transition towards the beech woods. It is characterised by the presence of a lot of beech in the arboreal layer, next to thermophilous species, including holm oak (*Quercus ilex*) and eastern hop hornbeam (*Carpinus*

*orientalis*). For the Valley of the Vomano, Biondi *et al.* (2002a) described a variant of *Fagus sylvatica*, placed with this subassociation, for the mesophilous aspects of the flowering ash and hornbeam woods found along the ravines and the fall lines of the mountain slopes.

The differential species are: *Fagus sylvatica* and *Geranium nodosum*.

- *carpinetosum orientalis* Biondi, Allegrezza, Taffetani, Ballelli & Zuccarello 2002: this subassociation has been described for these same territories and precisely along the road that ascends to Pietracamela from the Vomano (Biondi *et al.*, 2002a). It represents the woods in transition between the thermophilous flowering ash and hornbeam woods of the suballiance *Lauro nobilis-Quercenion* and those more mesophilous of the suballiance *Laburno anagyroidis-Ostryenion*.

The differential species are: *Carpinus orientalis* and *Pyracantha coccinea*.

Also included in the subassociation, there are the periodically cut flowering ash and hornbeam woods that grow on the arenaceous outcrops with superficial soil on well exposed slopes, characterised by the large presence of *Carpinus orientalis* in the dominated arboreal layer and of numerous shrubs in the shrub layer, which include: *Pyracantha coccinea*, *Crataegus monogyna* and *Chamaecytisus hirsutus* ssp. *polytrichus*.

#### Chestnut woods

In the Upper Valley of the Vomano, chestnut woods were very common and extensive in the past as they were planted and nurtured by man for the production of chestnuts, which represented an important element for human consumption. Today the cultivation of chestnuts

has been to a large part abandoned, and the chestnut woods are no longer nurtured by man, and are slowly evolving towards the potential forest formations that are represented here by the hop hornbeam woods. However, there are still a few nuclei present that are in a discrete state of conservation that in some cases are host to hundreds of years old examples of impressive size, which take on the characteristics of "ancient woods". These woods are attributed to the association *Melampyro italicum-Castanetum sativae*, specifically described for the area of the Laga (Hruska, 1988), where still today they are particularly common in the northern areas.

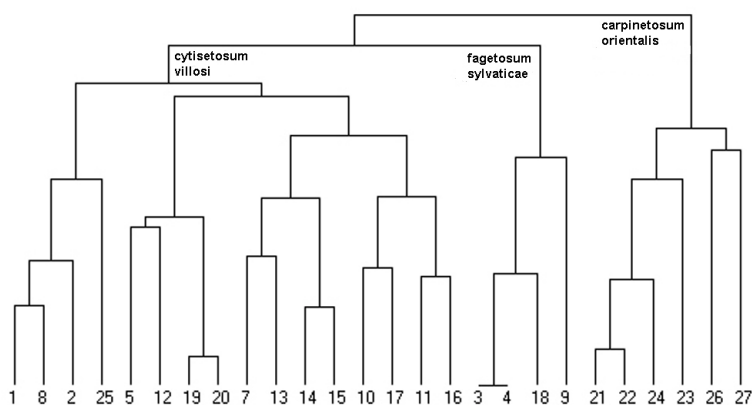


Fig. 15 - Dendrogram of the hop hornbeam woods belonging to the association *Scutellario columnae-Ostryetum carpinifoliae* found in the study area

Tab. 9 - *Scutellaria colanmae-Ostryetum carpinifoliae* Pedrotti, Ballesi & Biondi ex Pedrotti, Ballesi, Biondi, Cortini & Orsomando 1980  
subsp. *cyisetosum villosi* subsp. nova (red. type n. 10)  
subsp. *lagetosum sylvaticae* Pedrotti, Ballesi & Biondi (1979) 1982 em. Catorci & Orsomando 1997  
subsp. *carpinetosum orientalis* Biondi, Aliegrezza, Taffeani, Ballesi & Zaccarelli 2002

Table with 28 columns (1-28) representing different geographical locations and environmental data. Rows include: Altitude (m asl), Exposure, Slope (°), Coverages (%), Area (m²), and various species names with their distribution patterns (e.g., 1, 2, 3, 4, 5, 6, 7, 10\*, 890, 896, 812, 806, 751, 812, 806, 751, 812, 806).

Characteristic and differential species of the association *Scutellaria colanmae-Ostryetum carpinifoliae*

Detailed species distribution table for the association. Rows list species like *Ostrya carpinifolia* Scop., *Fraxinus ornus* L., *Viola reichenbachiana* Jordan ex Boreau, etc. Columns show presence/absence across locations 1-28. Includes sub-sections for other species groups like *Cysetosum villosi* and *Lagetosum sylvaticae*.

Differential species of the subsp. *carpinetosum orientalis*

Detailed species distribution table for subsp. *carpinetosum orientalis*. Rows list species like *Carpinus orientalis* Miller, *Juniperus oxycedrus* L., *Viburnum tinus* L., etc. Columns show presence/absence across locations 1-28.

Characteristic and differential species of the all. *Carpinion orientalis* and of the suball. *Ladurno-Ostryetum*

Detailed species distribution table for the all. *Carpinion orientalis* and suball. *Ladurno-Ostryetum*. Rows list species like *Acer obtusatum* W. et K., *Digitalis nicaebartha* Roth, *Lithum bulbiferum* L. sp. croceum (Chaix) Baker, etc. Columns show presence/absence across locations 1-28.

Characteristic and differential species of the order *Faggetalia sylvaticae*

Detailed species distribution table for the order *Faggetalia sylvaticae*. Rows list species like *Samolus europaeus* L., *Nicotiana glauca* (L.) J. C. Rich., *Comus mas* L., etc. Columns show presence/absence across locations 1-28.







**MELAMPYRO ITALICI-CASTANETUM SATIVAE**

Hurska 1988

The characteristic species are: *Melampyrum italicum* and *Teucrium siculum*.

The association is now attributed to the order *Fagetalia sylvaticae*, of the alliance *Erythronio dentis-canis-Carpinion betuli* and the endemic Apennine suballiance *Pulmonario apenninae-Carpinenion betuli* that unites the mesophilous woods of turkey oak, hop hornbeam and chestnut of the central-northern and central Apennines.

## Aspen Poplar woods

In the Upper Valley of the Vomano there are small nuclei of woods with a dominance of the aspen *Populus tremula* that are referred to the association *Melico uniflorae-Populetum tremulae*, described by Pedrotti (1995) for Monti della Laga.

For the positioning into the superior units, Taffetani (2000) recently proposed for the coenoses of the central-southern Apennines a new suballiance of *Corylo-Populion tremulae*, denominated *Aceri obtusati-Populenion tremulae*, that groups the pre-forest and forest formations with a dominance of *Populus tremula* of the central-southern Apennines.

The characteristic and differential species are: *Acer obtusatum*, *Laburnum anagyroides*, *Sorbus aria*, *Lonicera etrusca*, *Euonymus latifolius*, *Prunus avium*, *Rosa arvensis* and *Chamaecytisus hirsutus*.

The coenoses that are part of the suballiance considered here grow in deep, cool and well drained soils, which derive from arenaceous and marl-arenaceous substrata, characterised by subacidic and weakly acidic soils. From the synchorological point of view, the suballiance is linked to the mountain and hill plains (around 600-1,400 m asl) of the central-southern Apennine sector, where it substitutes the Alpine suballiance *Corylo-Populenion tremulae* Br.-Bl. ex Theurillat *et al.* 1995, from which it is differentiated by the presence of a high level of endemic taxa with an eastern and southern European and a Mediterranean area.

**MELICO UNIFLORAE-POPULETUM TREMULAE**

Pedrotti 1995 em. Taffetani 2000 (Tab. 10)

The formations with a dominance of the aspen (*Populus tremula*), a heliophilous and colonising species, are found along the fall lines and at the margins of the woods with which they make up the pre-forest pioneer formations that lead to the beech woods and

the mesophilous turkey oak woods. They grow on deep, cool and well drained soils that are derived from the arenaceous and marl-arenaceous substrata, characterised by subacid to weakly acid soils.

In the arboreal layer, there are local abundances of *Corylus avellana*, *Fraxinus ornus* and *Ostrya carpinifoliae*, while in the herbaceous layer there are: *Pteridium aquilinum*, *Melica uniflora*, *Viola reichembachiana*, etc.

## European hornbeam woods

In the Upper Valley of the Vomano, the woods with a dominance of European hornbeam are not very extensive; nevertheless, small nuclei are frequently found along the fall lines, on terraces that have human or natural origins, along slopes or on the lower parts of the slopes, in correspondence with which the soils are deep, humid and rich in nutrients.

**GERANIO NODOSI-CARPINETUM BETULI** Pedrotti, Ballelli & Biondi 1982

*aceretosum obtusati* subass. nova Holotype Tab. 11 Rel. n. 3

Mesophilous wood of European hornbeam that are present in the lower part of the valley slopes due to streams with torrential characteristic that come from the upper part of the mountain. These European hornbeam woods grow on the terraces along the slopes, partially created by human activity for the cultivation of chestnuts. They develop on deep soils together with other trees typical of mesophilous turkey oak woods as: *Quercus cerris*, *Acer obtusatum*, *A. pseudoplatanus* e *Fagus sylvatica*.

The association *Geranio nodosi-Carpinetum betuli* to which these woods are attributed, was described for Gubbio plain (Umbria) that originates from the drying up of ancient lakes of Villafranchiano. The hydrographical network running through the plain has originated small valley and along their slopes these European hornbeam woods grow having little floristic similarities with those present in the study area. In fact, except for the characteristic species shown in the table: *Carpinus betulus*, *Geranium nodosum*, *Rosa arvensis* e *Prunus avium*, in the Gubbio woods several differential species are present, which are absent in the woods under investigation, such as: *Vinca minor*, *Anemone nemorosa*, *Asarum europaeum*, *Quercus petraea*, *Frangula alnus*, *Quercus robur*, *Serratula tinctoria*, *Viburnum opalum* etc. On the other hand, in Tab. 11, some species absent in the territories

Tab. 10 - *Melico uniflorae-Populetum tremulae* Pedrotti 1995

		Rel. n.	1	2	3	4	5	6	7	8	Pres.
		Altitude (m asl)	759	1250	783	719	893	1250	1230	1150	
		Exposure	NW	SE	N-NW	E	N	SW	SW	ESE	
		Slope (°)	10	10	35	20	14	15	25	30	
		Coverage(%)	95	100	100	100	95	100	100	100	
		Area (m <sup>2</sup> )	300	150	250	250	250	150	400	250	
		Alt. strato arbor. (m.)	18	15	25	12	8	22	20	25	
		Alt. strato alto arbus. (m.)	2,5	-	-	-	1	22			
		Alt. strato basso arbus. (m.)	-	-	-	-	-	1,5	1,5	2	
		Ricoprim. strato arbust. (%)	-	-	-	-	-	40	50	50	
		Ricoprim. strato erbaceo (%)	-	-	-	-	-		50	70	
<hr/>											
Characteristic and differential species of the association <i>Melico uniflorae-Populetum tremulae</i>											
P scap	EUROSIB.	<i>Populus tremula</i> L.	5,5	4,4	5,5	4,4	4,4	4	4	5	8
G rhiz	COSMOPOL.	<i>Peridium aquilinum</i> (L.) Kuhn	2,2	.	1,1	+2	.	3	1	.	5
NP	SMEDIT.SUBATL.	<i>Rosa arvensis</i> Hudson	.	.	1,2	+	.	.	1	+	4
H caesp	PALEOTEMP.	<i>Melica uniflora</i> Retz.	1,1	.	1,1	.	.	.	.	.	2
NP	PALEOTEMP.	<i>Rosa canina</i> L. sensu Bouleng.	.	.	.	.	.	1	.	+	2
Characteristic and differential species of the suball. <i>Aceri obtusati-Populenion tremulae</i> and of the all. <i>Corylo-Populion</i>											
P caesp	EUROP.CAUC.	<i>Corylus avellana</i> L.	.	.	4,4	1,2	2,2	2	3	3	6
P scap	SEEUEOP.	<i>Acer obtusatum</i> W. et K.	1,1	+	2,3	.	1,1	.	.	+	5
P scap	EUROP.CAUC.	<i>Acer campestre</i> L.	.	.	1,2	+	1,1	.	+	1	5
P scap	PONTICO	<i>Prunus avium</i> L.	.	.	1,2	+	1,1	.	1	.	4
P lian	EURIMEDIT.	<i>Lonicera etrusca</i> Santi	.	+	.	.	.	.	1	.	2
P caesp	PALEOTEMP.	<i>Sorbus aria</i> (L.) Crantz	.	.	.	.	.	.	+	.	1
P caesp	MEDIT.MONT.	<i>Euonymus latifolius</i> (L.) Miller	.	.	2,2	.	.	.	.	.	1
P scap	EUROP.CAUC.	<i>Acer pseudoplatanus</i> L.	.	.	.	+	.	.	.	.	1
Characteristic and differential species of the order <i>Fagetalia sylvaticae</i>											
H scap	PALEOTEMP.	<i>Sanicula europaea</i> L.	3,3	1,2	2,2	+	1,2	.	.	+	6
H ros	NESTENOMEDIT.	<i>Aremonia agrimonoides</i> (L.) DC.	+	+	.	.	.	+	1	+	5
H scap	EUROSIB.	<i>Viola reichenbachiana</i> Jordan ex Boreau	1,1	+2	2,2	.	.	+	2	.	5
P caesp	SUBATL.	<i>Daphne laureola</i> L.	1,1	+	1,1	.	2,2	.	.	.	4
H ros	EURIMEDIT.	<i>Potentilla micrantha</i> Ramond	.	.	.	+	.	.	+	1	3
G rhiz	EURASIAT.	<i>Neottia nidus-avis</i> (L.) L. C. Rich.	+	.	+	.	+	.	.	.	3
G bulb		<i>Orchis maculata</i> L. ssp. <i>fuchsii</i> (Druce) Hylander	+	.	.	.	+	+	.	.	3
P scap	CEUROP.CAUCAS.	<i>Carpinus betulus</i> L.	1,2	.	+	.	.	.	.	.	2
P scap	CENTROEUROP.	<i>Fagus sylvatica</i> L.	.	1,1	.	.	.	.	+	.	2
H scap	ENDEM.	<i>Pulmonaria apennina</i> Cristof. & Puppi	1,1	.	1,2	.	.	.	.	.	2
G rhiz	NMEDIT.MONT.	<i>Geranium nodosum</i> L.	.	.	2,2	.	.	+	.	.	2
H scap	OROF. EURASIAT.	<i>Salvia glutinosa</i> L.	+	.	1,2	.	.	.	.	.	2
H scap	EURASIAT.	<i>Cruciata glabra</i> (L.) Ehrend.	+	.	.	.	.	1	.	.	2
P scap	EUROP.-CAUC.	<i>Tilia platyphyllos</i> Scop.	.	+	+2	.	.	.	.	.	2
H caesp	EUROP.-WESTASIAT.	<i>Carex sylvatica</i> Hudson	+	1,2	.	.	.	.	.	.	2
G rhiz	EURASIAT.	<i>Lathyrus vernus</i> (L.) Bernh.	1,1	.	.	.	.	.	.	.	1
G rhiz	SEUROP.SUDSIB.	<i>Lathyrus venetus</i> (Miller) Wohlff.	.	+	.	.	.	.	.	.	1
P caesp	CENTROEUROP.	<i>Crataegus oxyacantha</i> L.	2,2	.	.	.	.	.	.	.	1
P caesp	CENTRO-EUROP.	<i>Crataegus laevigata</i> (Poir.) DC.	.	.	+2	.	.	.	.	.	1
G rhiz	CENTRO-EUROP.	<i>Cardamine bulbifera</i> (L.) Crantz	.	.	.	.	.	+	.	.	1
H scap	OROF. S-EUROP.	<i>Saxifraga rotundifolia</i> L.	.	.	.	.	.	+	.	.	1
H scap	EUROP.-CAUC.	<i>Stellaria nemorum</i> L.	.	.	.	.	.	+	.	.	1
Characteristic and differential species of the class <i>Quercio-Fagetea</i>											
H ros	EUROP.CAUC.	<i>Primula vulgaris</i> Hudson	1,1	+	1,2	.	.	1	1	2	6
Ch suffr	EUROP.CAUC.	<i>Euphorbia amygdaloides</i> L.	1,1	.	2,2	.	.	+	1	1	5
G rad	EURIMEDIT.	<i>Tamus communis</i> L.	+	.	+	+	+	.	2	.	5
P scap	SEUROP.SUDSIB.	<i>Fraxinus ornus</i> L.	+	.	2,2	1,1	1,1	.	1	.	5
P caesp	CIRCUMBOR.	<i>Ostrya carpinifolia</i> Scop.	1,1	.	1,2	+	2,2	.	.	.	4
H caesp	EUROP.CAUC.	<i>Festuca heterophylla</i> Lam.	1,1	+2	+	.	.	2	.	.	4
P lian	EURIMEDIT.	<i>Hedera helix</i> L.	2,2	.	3,4	+	+	.	.	.	4
H ros		<i>Viola alba</i> Besser ssp. <i>dehnhardtii</i> (Ten.) W. Becker	.	.	1,2	+	+	.	.	1	4
G rhiz	EURASIAT.	<i>Cephalanthera longifolia</i> (Hudson) Fritsch	+	+	.	+	+	.	.	.	4

P scap	NEURIMEDIT.	Quercus cerris L.	.	.	2.2	.	.	1	.	+	3
P scap	SEEUEOP.	Castanea sativa Miller	+	.	.	+	+	.	.	.	3
H scap	EUROSIB.	Hieracium sylvaticum (L.) L.	1.1	.	.	+	1.1	.	.	.	3
P lian	EUROP.CAUC.	Clematis vitalba L.	.	.	2.3	+	+	.	.	.	3
H scap	CIRCUMBOR.	Geum urbanum L.	.	.	+	.	.	1	.	1	3
G rhiz	PALEOTEMP.	Epipactis helleborine (L.) Crantz	.	.	.	.	+	.	1	1	3
P caesp	SEEUEOP.	Quercus pubescens Willd.	1.1	.	.	1.1	.	.	.	.	2
H caesp	PALEOTEMP.	Brachypodium sylvaticum (Hudson) Beauv.	1.1	.	+	.	.	.	.	.	2
H scap	PALEOTEMP.	Campanula trachelium L.	.	.	1.1	.	.	.	+	.	2
H scap	ENDEM.	Teucrium siculum Rafin.	+	.	.	.	+	2	.	.	2
G rhiz	EURIMEDIT.	Cephalanthera damasonium (Miller) Druce	.	+	.	.	.	.	+	.	2
P caesp	EUROP.CAUC.	Lonicera xylosteum L.	.	.	1.2	.	.	.	.	+	2
H scap	EUROP.CAUC.	Hieracium racemosum W. et K.	+	.	.	.	+	2	.	.	2
P scap	EURIMEDIT.	Sorbus domestica L.	+	.	.	.	+	.	.	.	2
P caesp	SEEUEOP.	Quercus pubescens Willd. pl.	.	.	.	.	2.2	.	+	.	2
H caesp	EURASIAT.	Bromus ramosus Hudson	.	.	.	+	.	.	.	1	2
H caesp	EURIMEDIT.	Luzula forsteri (Sm.) DC.	.	.	.	.	.	1	.	1	2
H scap		Solidago virgaurea L. ssp. virgaurea	2.2	.	.	.	.	.	.	.	1
H scap	EUROP.CAUC.	Mycelis muralis (L.) Dumort.	1.1	.	.	.	.	.	.	.	1
H rept	EUROP.CAUC.	Ajuga reptans L.	+	.	.	.	.	.	.	.	1
H caesp	OROF. SEEUEOP.	Luzula sylvatica (Hudson) Gaudin	.	.	.	.	1.2	.	.	.	1
H scap	PONTICA	Buglossoides purpureoacerulea (L.) Johnston	.	.	.	+	.	.	.	.	1
H scap	CIRCUMBOR.	Solidago virgaurea L.	.	.	1.1	.	.	.	.	.	1
P caesp	AVV.	Robinia pseudoacacia L.	.	.	.	+	.	.	.	.	1
P caesp	EUROP.-CAUC.	Ulmus minor Miller pl.	.	.	.	+	.	.	.	.	1
G bulb		Lilium bulbiferum L. ssp. croceum (Chaix) Baker	.	.	.	.	.	.	+	.	1
H scap	C-EUROP.	Melittis melissophyllum L.	.	.	.	.	.	.	1	.	1
P scap	AVV.	Pyrus communis L.	.	.	.	.	.	.	.	1	1
P caesp	C-EUROP.	Viburnum lantana L.	.	.	.	.	.	.	2	.	1
H ros	PALEOTEMP.	Silene nutans L.	.	.	.	.	.	1	.	.	1
P caesp	PALEOTEMP.	Sorbus torminalis (L.) Crantz	.	.	.	.	.	2	.	.	1
G rhiz	CIRCUMBOR.	Hepatica nobilis Miller	.	.	.	.	.	.	2	.	1
Other species											
H rept	EUROSIB.	Fragaria vesca L.	1.1	.	2.2	+	+	2	1	1	6
P caesp	CIRCUMBOR.	Juniperus communis L.	2.2	+	.	.	1.1	2	1	1	6
P caesp	EURASIAT.	Cornus sanguinea L.	1.1	.	3.3	+	2	1.1	.	+	5
P caesp	PALEOTEMP.	Crataegus monogyna Jacq.	.	.	+	2	.	2	+	1	4
H scap	CIRCUMBOR.	Clinopodium vulgare L.	+	.	.	+	+	.	.	1	4
H caesp	SUBATL.	Brachypodium rupestre (Host) R. et S.	.	.	.	+	2.2	.	3	2	4
H scap	EURASIAT.	Vicia cracca L.	+	.	.	+	.	.	1	+	4
P caesp	W-STENOMEDIT.	Cytisus villosus Pourret	+	.	.	.	1.1	.	.	+	3
P caesp	EUROP.CAUC.	Prunus spinosa L.	.	.	1.2	.	1.1	.	.	2	3
H rept	SEUEOP.SUDSIB.	Astragalus glycyphyllos L.	+	.	.	.	+	.	.	+	3
NP		Coronilla emerus L. ssp. emeroides (Boiss. et Spruner) Hayek (pl.)	.	.	.	+	+	.	.	+	3
H scap	EUROSIB.	Vicia sepium L.	+	.	.	.	+	.	.	.	2
P lian	SEUEOP.SUDSIB.	Lonicera caprifolium L.	+	.	.	.	+	.	.	.	2
H scap	SEEUEOP.	Ptilostemon strictus (Ten.) Greuter	1.1	.	.	.	+	.	.	.	2
H scap	EUROP.CAUC.	Ranunculus lanuginosus L.	.	.	.	.	+	1	.	.	2
G rhiz	EUROSIB.	Aegopodium podagraria L.	.	.	1.2	.	.	.	1	.	2
H scap	ENDEM.	Digitalis micrantha Roth	.	.	+	.	.	.	.	+	2
G rhiz		Carex flacca Schreber ssp. flacca	.	.	.	.	1.1	.	.	2	2
H ros	SUBTROP. NESICOLA	Asplenium onopteris L.	+	.	.	.	+	.	.	.	2
G rhiz	CIRCUMBOR.	Equisetum telmateja Ehrh.	.	.	+	1.3	.	.	.	.	2
H caesp	ENDEM.	Sesleria nitida Ten.	.	+	2	.	+	2	.	.	2
NP	CIRCUMBOR.	Rubus idaeus L.	.	+	.	.	.	.	+	.	2
H caesp	PALEOTEMP.	Dactylis glomerata L.	.	.	.	.	.	2	+	.	2
P caesp	EUROP.	Cytisus scoparius (L.) Link	.	.	.	.	.	+	.	+	2
Ch suffr	EURIMEDIT.	Teucrium chamaedrys L.	.	.	.	.	.	.	+	+	2
Accidental species			6	-	4	2	2	5	9	8	

Tab. 11 - *Geranio nodosi-Carpinetum betuli* Pedrotti, Ballelli & Biondi 1982  
subass. *aceretosum obtusati* (subass. nova) (rel. type n. 3)

Rel. n.	1	2	3*	4	5	6	7	8	9	10	11	12	13	14	Pres.
Altitude (m asl)	750	844	619	710	1253	1250	672	740	803	783	700	710	735	740	
Exposure	N	W	-	W-NW	-	-	N-W	-	NW	W	NNW	NW	-	-	
Slope (°)	20	45	20	40	-	-	25	15	10	6	40	30	-	-	
Coverage(%)	100	100	100	95-100	100	100	100	100	100	100	90	100	70	80	
Area (m <sup>2</sup> )	400	400	200	300	200	250	200	-	350	150	50	150	30	150	

Characteristic and differential species of the association <i>Geranio nodosi-Carpinetum betuli</i>																	
P scap	CEUROP.CAUCAS.	Carpinus betulus L.	4.5	4.5	4.4	3.4	1.2	.	4.4	4.5	2.2	2.2	4	4	3	3	13
G rhiz	NMEDIT.MONT.	Geranium nodosum L.	2.3	2.3	1.2	3.3	2.3	2.3	.	.	2.2	2	2	+	+	1	11
NP	SMEDIT.SUBATL.	Rosa arvensis Hudson	2.2	1.2	.	2.2	.	.	.	.	.	.	+	.	+	.	5
P scap	PONTICO	Prunus avium L.	.	.	.	.	2.3	1.2	2.2	1.1	.	.	.	.	.	.	4
Differential species of the subass. <i>aceretosum obtusati</i>																	
P scap	SEEUROP.	Acer obtusatum W. et K.	+	2.2	+	+	.	+	+	.	1.1	4.4	.	1	+	.	10
P scap	SEEUROP.	Castanea sativa Miller	3.4	1.2	1.1	2.2	2.2	.	1.1	2.2	+2	.	.	1	.	.	9
P scap	CENTROEUROP.	Fagus sylvatica L.	2.2	3.3	1.1	1.2	2.2	1.2	.	.	.	.	.	.	+	+	8
P scap	EUROP.CAUC.	Acer pseudoplatanus L.	.	.	+	+	.	.	+	+	.	.	+	+	.	.	6
P caesp	CIRCUMBOR.	Ostrya carpinifolia Scop.	.	2.2	.	.	.	.	1.1	1.1	.	.	.	.	+	.	4
G rhiz	EURASIAT.	Lathyrus vernus (L.) Bernh.	.	.	1.2	.	.	.	+2	.	.	.	+	+	.	.	4
Differential species of the suball. <i>Pulmonario-Carpinion betuli</i>																	
P caesp	SUBATL.	Daphne laureola L.	1.2	1.2	+2	2.2	+	.	+	.	1.2	.	+	+	+	+	11
H scap	ENDEM.	Pulmonaria apennina Cristof. & Puppi	2.3	2.2	.	2.2	2.2	2.2	.	.	+2	+	.	+	.	.	8
G bulb		Orchis maculata L. ssp. fuchsii (Druce) Hylander	.	.	.	+	+	+	.	.	.	.	+	+	+	1	7
P caesp	EUROP.CAUC.	Lonicera xylosteum L.	1.1	2.2	+	1.2	.	.	+	.	.	.	.	.	+	.	6
H ros		Viola alba Besser ssp. dehnhardtii (Ten.) W. Becker	.	1.2	+2	+2	.	.	+	+	.	.	.	.	.	.	5
P caesp	MEDIT.MONT.	Euonymus latifolius (L.) Miller	1.2	1.1	.	.	.	.	.	.	+	.	1	.	.	.	4
G bulb	NSTENOMEDIT.	Cyclamen hederifolium Aiton	2.2	2.3	.	.	.	.	.	.	1.2	.	.	.	.	.	3
G Bulb	OROF. CENTROEUROP.	Lilium bulbiferum L. ssp. croceum (Chaix) Baker	.	2.2	.	+2	.	.	.	.	+	.	.	.	.	.	3
G rhiz	ENDEM.	Helleborus bocconeii Ten.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	2
Characteristic and differential species of the all. <i>Erythronio-Carpinion</i>																	
H ros	EUROP.CAUC.	Primula vulgaris Hudson	2.2	1.2	+2	2.2	2.2	1.2	+	+2	2.2	.	+	+	+	+	13
P scap	SEUROP.SUDSIB.	Fraxinus ornus L.	+	2.2	1.2	+2	1.2	.	2.2	+2	1.2	+	.	.	+	.	10
H ros	NESTENOMEDIT.	Arenonia agrimonoides (L.) DC.	.	.	+	.	.	.	+2	+2	+2	.	.	.	.	+	5
P lian	SEUROP.SUDSIB.	Lonicera caprifolium L.	.	.	.	.	.	.	.	.	+2	.	.	+	1	.	3
H scap	EURASIAT.	Cruciata glabra (L.) Ehrend.	+2	.	.	.	.	.	.	.	.	.	.	.	+	.	2
P caesp	CENTROEUROP.	Crataegus oxyacantha L.	.	.	.	.	.	.	+	.	1.1	.	.	.	.	.	2
P caesp	SEUROP.SUDSIB.	Cornus mas L.	.	.	.	.	.	.	.	.	.	2.2	.	.	.	.	1
Characteristic and differential species of the order <i>Fagetalia sylvaticae</i>																	
H caesp	PALEOTEMP.	Melica uniflora Retz.	2.2	1.2	+2	1.2	2.2	1.2	+2	.	1.2	1.1	1	1	2	1	13
P caesp	EUROP.CAUC.	Corylus avellana L.	2.3	2.3	1.1	4.5	.	4.5	2.2	2.2	2.2	3.2	3	3	4	3	13
H scap	PALEOTEMP.	Sanicula europaea L.	2.3	2.2	1.2	2.2	.	1.2	1.2	+3	2.2	.	1	1	1	+	12
H scap	EUROSIB.	Viola reichenbachiana Jordan ex Boreau	1.2	2.2	+2	2.2	1.2	2.2	+2	+	+2	+	1	1	.	.	12
H scap	OROF. EURASIAT.	Salvia glutinosa L.	1.2	1.2	2.3	+	1.2	1.2	+2	1.2	1.2	.	+	+	.	1	12
G rhiz	SEUROP.SUDSIB.	Lathyrus venetus (Miller) Wohlff.	1.1	1.2	.	1.2	+	.	+	+2	+2	.	.	.	.	1	8
G rhiz	CIRCUMBOR.	Polystichum setiferum (Forsskal) Woyнар	.	.	+	2.3	3.3	2.2	.	.	+	.	.	1	.	+	7
H caesp	EUROP.-WESTASIAT.	Carex sylvatica Hudson	1.2	1.2	.	1.2	.	.	.	+	.	.	.	.	+	.	5
H scap	OROF. SEUROP.	Saxifraga rotundifolia L.	.	+2	.	+	1.2	+	+2	.	.	.	.	.	.	.	5
P scap	EUROSIB.	Populus tremula L.	2.3	1.2	2.2	.	.	.	.	.	.	.	+	.	.	.	4
P scap	EUROP.-CAUC.	Tilia platyphyllos Scop.	+	.	.	1.2	.	.	.	.	.	2.2	.	.	.	.	3
G rhiz	EURASIAT.	Polygonatum multiflorum (L.) All.	+2	.	.	.	.	.	.	.	.	.	+	.	+	.	3
G rhiz	CENTROEUROP.	Euphorbia dulcis L.	.	+	.	.	.	.	+	.	.	.	.	+	.	.	3
G rhiz	CENTROEUROP.	Cardamine bulbifera (L.) Crantz	.	.	.	.	.	+	.	.	.	1.1	.	.	.	1	3
P scap	EUROP.CAUC.	Ulmus glabra Hudson	.	.	.	.	.	+	.	.	2.1	2.2	.	.	.	.	3
H scap	EUROP.-CAUC.	Prenanthes purpurea L.	+2	.	.	.	.	.	.	.	.	.	.	.	.	1	2
H scap	N-E-CENTRO-EUROP.	Campanula rotundifolia L.	.	.	.	.	.	.	.	.	.	.	1	.	.	+	2
H caesp	SUBATL.	Festuca altissima All.	.	.	.	.	.	.	.	+2	.	.	+	.	.	.	2
G rhiz	EURASIAT.	Neottia nidus-avis (L.) L. C. Rich.	.	.	.	.	.	.	.	.	+2	.	.	+	.	.	2
G bulb	EUROP.CAUC.	Corydalis cava (L.) Schweigg. et Koerte	.	.	.	.	+	+	.	.	.	.	.	.	.	.	2
H scap	EUROP.-CAUC.	Stellaria nemorum L.	+2	.	.	.	.	.	.	+2	.	.	.	.	.	.	2
H scap	NE-MEDIT.-MONT.	Adenostyles australis (Ten.) Nyman	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1
H scap	EUROP.-CAUC.	Senecio nemorensis L.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1
H caesp	EURIMEDIT.	Poa sylvicola Guss.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1
G rhiz	ENDEM.	Arisarum proboscideum (L.) Savi	.	.	.	.	.	.	.	.	.	1.1	.	.	.	.	1
G bulb	EUROSIB.	Platanthera chlorantha (Custer) Rchb.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1
P scap	EUROP.-CAUC.	Fraxinus excelsior L.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1
Characteristic and differential species of the class <i>Quercio-Fagetea</i>																	
Ch suffr	EUROP.CAUC.	Euphorbia amygdaloides L.	1.1	2.2	+2	+	+2	1.2	+	+2	.	+	+	1	+	1	13
P lian	EURIMEDIT.	Hedera helix L.	2.2	3.3	2.3	3.5	.	+2	2.3	1.2	3.2	+	1	1	.	1	12
P scap	NEURIMEDIT.	Quercus cerris L.	1.2	1.2	.	1.2	2.2	1.2	2.2	1.1	2.1	.	+	.	.	+	10

P scap	EUROP.CAUC.	Acer campestre L.	1.2	1.2	2.2	1.2	.	.	1.1	1.1	+	1.1	.	+	.	.	9
H scap	PALEOTEMP.	Campanula trachelium L.	.	+	+	+	.	.	+	+	.	.	1	+	.	.	7
H scap	EUROP.CAUC.	Mycelis muralis (L.) Dumort.	.	.	+	+	.	.	+	+	1.2	.	.	+	.	.	7
H caesp	PALEOTEMP.	Brachypodium sylvaticum (Hudson) Beauv.	.	1.2	+2	1.2	.	.	1.2	2.2	+2	.	.	.	.	.	6
P lian	EUROP.CAUC.	Clematis vitalba L.	1.2	.	+2	2.3	.	1.2	+2	.	.	.	.	+	.	.	6
H scap	CIRCUMBOR.	Geum urbanum L.	+2	1.2	.	+	.	+	.	+2	.	.	.	+	.	.	6
G rad	EURIMEDIT.	Tamus communis L.	.	.	+	+	1.2	1.2	.	.	+	.	.	.	.	1	6
H caesp	EUROP.CAUC.	Festuca heterophylla Lam.	2.2	2.2	.	1.2	.	.	.	.	.	+2	.	.	.	.	4
G rhiz	CIRCUMBOR.	Hepatica nobilis Miller	1.2	2.2	.	1.2	.	.	.	.	.	+2	.	.	.	.	4
H scap	EUROP.CAUC.	Hieracium racemosum W. et K.	+2	.	+2	.	.	.	.	+	+2	.	.	.	.	.	4
P scap	EURIMEDIT.	Sorbus domestica L.	+	.	+	.	.	.	+	+	.	.	.	.	.	.	4
P caesp	SEEUROP.	Quercus pubescens Willd. pl.	+	.	.	.	+	.	1.1	+	.	.	.	.	.	.	4
H scap	CIRCUMBOR.	Solidago virgaurea L.	1.2	1.2	.	+2	.	.	.	.	.	.	.	.	.	.	3
H scap	EUROSIB.	Hieracium sylvaticum (L.) L.	2.2	2.2	+	.	.	.	.	.	.	.	.	.	.	.	3
H caesp	EURIMEDIT.	Luzula forsteri (Sm.) DC.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	3
H caesp	EURASIAT.	Bromus ramosus Hudson	.	+	.	.	.	.	.	.	.	.	.	+	.	+	3
H ros	EURIMEDIT.	Potentilla micrantha Ramond	1.1	.	.	.	.	.	.	+	+	.	.	.	.	.	3
P scap	CENTROEUROP.	Malus sylvestris Miller	+	.	+	.	.	.	.	.	.	.	.	.	.	.	2
G rhiz	EURASIAT.	Cephalanthera longifolia (Hudson) Fritsch	+	.	+	.	.	.	.	.	.	.	.	.	.	.	2
G rhiz	EUROP.-CAUC.	Mercurialis perennis L.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	2
P scap	AVV.	Juglans regia L.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	2
H rept	EUROP.CAUC.	Ajuga reptans L.	.	.	.	.	.	.	.	.	+2	+	.	.	.	.	2
P caesp	SEEUROP.	Quercus pubescens Willd.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1
H scap	ENDEM.	Teucrium siculum Rafin.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1
P caesp	SEEUROP.SUDSIB.	Laburnum anagyroides Medicus	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1
P caesp	PALEOTEMP.	Sorbus torminalis (L.) Crantz	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	1
P scap	S-EUROP.-SUDSIB.	Fraxinus oxycarpa Bieb.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1
P caesp	PALEOTEMP.	Sorbus aria (L.) Crantz	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	1
P scap	PALEOTEMP.	Populus nigra L.	.	.	1.1	.	.	.	.	.	.	.	.	.	.	.	1
H caesp	CIRCUMBOR.	Agropyron caninum (L.) Beauv.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
H scap	PONTICA	Buglossoides purpurocerulea (L.) Johnston	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1
Other species																	
P caesp	EURASIAT.	Cornus sanguinea L.	1.2	1.2	1.2	1.2	+	1.2	1.2	+2	1.1	.	2	+	2	1	13
G rhiz	COSMOPOL.	Pteridium aquilinum (L.) Kuhn	.	1.1	+2	1.1	.	1.2	+2	1.2	2.2	.	.	+	2	.	9
H rept	EUROSIB.	Fragaria vesca L.	1.2	.	+	.	.	.	+2	.	+2	.	+	.	+	+	7
T scap	SUBCOSMOP.	Geranium robertianum L.	.	.	+	+	1.2	+	.	.	.	1.1	1	.	.	1	7
NP	EURASIAT.	Rubus caesius L.	2.2	2.3	.	2.2	2.3	2.3	+2	.	+	.	.	.	.	.	7
P caesp	PALEOTEMP.	Crataegus monogyna Jacq.	2.2	2.2	.	1.2	2.2	1.2	.	.	1.2	.	.	.	.	.	6
H scap	EUROSIB.	Vicia sepium L.	+	1.2	.	.	.	+	+	.	+	.	+	.	.	.	6
H ros	SUBTROP. NESICOLA	Asplenium onopteris L.	+2	1.2	+	+	.	.	.	.	+	.	.	.	.	.	5
G rhiz	EUROSIB.	Aegopodium podagraria L.	.	.	.	2.3	2.3	3.3	.	.	1.1	1.1	.	.	.	.	5
G rhiz	EURASIATICA	Petasites hybridus (L.) Gaertn.	.	.	+	.	.	.	.	.	.	2.2	1	.	.	+	4
H scap	S-EUROP.-SUDSIB.	Veronica chamaedrys L.	+2	.	+	.	.	.	.	.	+	.	.	.	.	+	4
NP		Rubus hirtus W. et K.	.	.	.	.	.	.	.	+2	.	.	2	2	.	1	4
H scap	EUROP.CAUC.	Ranunculus lanuginosus L.	.	.	.	.	1.2	1.2	.	.	.	.	+	.	.	.	4
H ros		Asplenium trichomanes L. ssp. quadrivalens D. E. Meye	.	.	+	.	.	.	+2	.	+	.	.	.	.	.	3
H scap	CIRCUMBOR.	Circaea lutetiana L.	+	.	.	.	+	+	.	.	.	.	.	.	.	.	3
H scap	EUROSIB.	Stachys sylvatica L.	.	.	.	.	1.2	2.2	.	.	.	.	.	.	.	+	3
Ch suffr	SUBATL.	Helleborus foetidus L.	+	.	.	.	+	.	.	.	.	.	.	.	.	+	3
H ros	CIRCUMBOR.	Polypodium vulgare L.	.	.	+2	.	.	.	.	.	+2	+	.	.	.	.	3
Accidental species																	
			7	3	4	3	4	3	4	1	8	6	-	1	2	-	

of Gubbio are listed, that are considerate differential species with respect to the typical aspect of the association, as: *Acer obtusatum*, *Castanea sativa*, *Fagus sylvatica*, *Acer pseudoplatanus*, *Ostrya carpinifolia*, *Lathyrus vernus*.

The new subassociation is here indicated as *aceretosum obtusati* while with the name *anemonetosum nemorosae* subass. nova the subassociation type is denominated. The latter corresponds to a different forest physiognomy which is in contact with plain woods of the association *Hieracio racemosi-Quercetum petraeae* (Pedrotti *et al.*, 1982). Within the Abruzzo vegetation, it is also

described a *Castanea sativa* variant which takes origin from the abandoned chestnut woods which, even if still magnificent, are degenerating also because of the chestnut cancer disease. This condition is particularly evident in the monumental chestnut wood of Senarica.

The subassociation *arisaretosum proboscidei* (Biondi *et al.*, 1989), belonging to the same *Geranio nodosi-Carpinetum betuli* association, was described for the sandstone chain of Serre di Burano (northern Marche). It shows more important floristic and ecological similarities with the European hornbeam under investigation, even if significant analogies are also evident.

### Syntaxonomical list

*Quercus-Fagetum* Br.-Bl. & Vlieger in Vlieger 1937

*Fagetalia sylvaticae* Pawlowski in Pawlowski, Sokolowski & Wallisch 1928

\**Aremonio-Fagion sylvaticae* (Horvat 1938) Torok, Podani & Borhidi 1989

*Cardamino kitaibelii-Fagenion sylvaticae* Biondi, Casavecchia, Pinzi, Allegranza & Baldoni 2002

*Cirsio erisithalis-Abietetum albae* ass. nova

*abietetosum albae* ass. nova

*ericetosum arboreae* ass. nova

*Actaeo spicatae-Fagetum sylvaticae* ass. nova

*actaeetosum spicatae* subass. nova

*pyroletosum secundae* subass. nova

*aceretosum obtusati* subass. nova

\**Geranio versicoloris-Fagion sylvaticae* Gentile 1970

*Doronicio orientalis-Fagenion sylvaticae* (Ubaldi, Zanotti, Puppi, Speranza & Corbetta ex Ubaldi 1995) Di Pietro, Izco & Blasi 2004

*Potentillo micranthae-Fagetum sylvaticae* ass. nova

*fagetosum sylvaticae* subass. nova

*abietetosum albae* subass. nova

\**Erythronio dentis-canis-Carpinion betuli* (Horvat 1958) Marincek in Wallnöfer, Mucina & Grass 1993

*Pulmonario apenninae-Carpinion betuli* Biondi, Casavecchia, Pinzi, Allegranza & Baldoni 2002

*Cytiso villosi-Quercetum cerris* ass. nova

*cytisetosum villosi* subass. nova

*aceretosum obtusati* subass. nova

*stellarietosum holostei* subass. nova

*Melampyro italici-Castanetum sativae* Hurska 1988

*Geranio nodosi-Carpinetum betuli* Pedrotti, Ballelli & Biondi 1982

*aceretosum obtusati* subass. nova

\**Corylo-Populion tremulae* (Br.-Bl. ex O. Bolos 1973) Riv.-Mart. et Costa 1998

*Aceri obtusati-Populion tremulae* Taffetani 2000

*Melico uniflorae-Populetum tremulae* Pedrotti 1995 em. Taffetani 2000

*Quercetalia pubescentis* Klika 1933

\**Carpinion orientalis* Horvat 1958

*Cytiso sessilifolii-Quercenion pubescentis* Ubaldi 1995

*Cytiso sessilifolii-Quercetum pubescentis* Blasi, Feoli & Avena 1982

*Chamaecytiso hirsuti-Quercetum pubescentis* ass. nova

*Laburno anagyroidis-Ostryenion carpinifoliae* (Ubaldi 1981) Poldini 1990

*Scutellario columnae-Ostryetum carpinifoliae* Pedrotti, Ballelli & Biondi ex Pedrotti, Ballelli, Biondi, Cortini & Orsomando 1980

*cytisetosum villosi* subass. nova

*fagetosum sylvaticae* Pedrotti, Ballelli & Biondi (1979) 1982 em. Catorci & Orsomando 1997

*carpinetosum orientalis* Biondi, Allegranza, Taffetani, Ballelli & Zuccarello 2002

## Conclusions

The present contribution increases the phytosociological knowledge on the marly-arenaceous Apennine (flyschoid formations) that, contrary to the better known calcareous Apennine, was in the years only partially studied. In particular, as regards the Monti della Laga district, phytosociological researches about forest vegetation were carried out through the years only in the territories of Valle Castellana, in the border area among Marche, Abruzzo and Latium, while the forest vegetation of Upper Valley of the Vomano River was still today practically unknown.

Through the analysis of the woods of this territory, a great originality of forest communities is emerged; it is principally due to the litho-morphological conditions because in this area, as was already put in evidence, there is the transition between the arenaceous formation of Flysch della Laga, through the Flysch del Gran Sasso, and the calcareous-dolomitic formation of Gran Sasso. This fact has a correspondence with the presence of forest communities of transition between those strictly acidophilous of the arenaceous formations of Laga and these ones more clearly calcicolous of the calcareous Apennine.

In the same time, other phytosociological studies are in progress, that have the aim to know the substitution vegetation, shrubs and grasslands, in order to establish the dynamic relationships among these and the potential forest formations, useful for the interpretation of the plant landscape.

## References

- Ballelli S., Biondi E. & Pedrotti F., 1982. L'associazione *Scutellario-Ostryetum* nell'Appennino centrale. Guide Itinéraire. Excursion Internazionale de Phytosociologie en Italie centrale (2-11 juillet 1982) Univ. Camerino: 565-569.
- Biondi E., 1994. The phytosociological approach to landscape study. *Ann. Bot. (Roma)* 52: 135-141.
- Biondi E., Allegrezza M., Ballelli S., Guitian J. & Taffetani F., 1989. La componente vegetale: flora, vegetazione e rappresentazioni cartografiche. In "Sistemi agricoli marginali. Lo scenario della Comunità Montana Catria-Nerone" CNR Progetto Finalizzato IPRA: 183-252.
- Biondi E., Allegrezza M., Taffetani F., Ballelli S. & Zuccarello V., 2002a. Excursion to the National Park of Gran Sasso and Monti della Laga. *Fitosociologia* 39 (1): 43-90.
- Biondi E., Casavecchia S., Pinzi M., Allegrezza M., & Baldoni M., 2002b. The syntaxonomy of the mesophilous woods of the central and Northern Apennines (Italy). *Fitosociologia* 39(2): 71-94.
- Blasi C., Di Pietro R. & Filesi L., 2004. Syntaxonomical revision of *Quercetalia pubescenti-petraeae* in the Italian Peninsula. *Fitosociologia* 41 (1): 87-164.
- Blasi C., Feoli E. & Avena G.C., 1982. Due nuove associazioni dei *Quercetalia pubescentis* dell'Appennino Centrale. *Studia Geobotanica* 2: 155-167.
- Blasi C., Fortini P., Grossi G. & Presti G., 2005. Faggete e cerrete mesofile dell'Alto Molise. *Fitosociologia* 42 (2): 67-81.
- Catorci A. & Orsomando E., 2001. Note illustrative della carta della vegetazione del Foglio Nocera Umbra (N. 312 – Carta d'Italia I.G.M. – 1:50.000). *Braun-Blanquetia* 23: 3-99.
- Di Pietro R. & Tondi G., 2005. A new mesophilous turkey-oak woodland association from Laga mts. (Central Italy). *Hacquetia* 4 (2): 5-25.
- Feoli E. & Lagonegro M., 1982. Syntaxonomical analysis of beech woods in the Apennines (Italy) using the program package IAHOPA. *Vegetatio* 50: 129-173.
- Géhu J.-M. & Rivas-Martinez S., 1981. Notions fondamentales de phytosociologie. *Ber. Int. Symp. Ver. Vegetationskunde*: 5-33.
- Géhu J.-M., 1988. L'analyse symphytosociologique et géosymphytosociologique de l'espace. *Théorie et méthodologie. Colloq. Phytosoc.* 17: 11-46.
- Hruska K., 1988. I castagneti dei Monti della Laga (Italia Centrale). *Braun-Blanquetia* 2: 117-125.
- Izco J. & Biondi E., 1992. La homonimia de *Carici sylvaticae-Fagetum*. *Lazaroa* 13: 171-172.
- Longhitano N. & Ronsisvalle G.A., 1974. Osservazioni sulle faggete dei Monti della Laga (Appennino centrale). *Not. Fitosoc.* 9: 55-82.
- Pedrotti F., 1982. La végétation des Monts de la Laga. Guide-Itinéraire Excursion Internationale de Phytosociologie en Italie centrale (Camerino, 2-11 juillet 1982): 365-371.
- Pedrotti F., 1995. I pioppeti di Pioppo tremulo nell'Appennino centrale. *Studi Trentini di Scienze Naturali. Acta Biologica* 70: 99-105.
- Pedrotti F., Ballelli S. & Biondi E., 1979. Boschi di *Ostrya carpinifolia* dell'Appennino umbro-marchigiano. *Ostrya-Symposium. Trieste*: 64-67.
- Pedrotti F., Ballelli S. & Biondi E., 1982. La végétation de l'ancien bassin lacustre de Gubbio (Italie centrale). *Doc. Phytosoc. N. S.* 6: 221-243.
- Pirone G., 2000. La vegetazione ripariale nei versanti nord-orientali del Gran Sasso e dei Monti della Laga (Abruzzo, Italia). *Fitosociologia* 37 (2): 65-86.
- Podani J., 2001. *Sin-Tax 2000*, Computer programs for data analysis in ecology and Systematics.
- Rivas-Martínez S., 1987. Nociones sobre Fitosociología,

- Biogeografía, Bioclimatología. In: Universidad de Alcalá de Hanares (Ed.), La vegetación de España: 19-45.
- Rivas-Martínez S., 1996. Geobotánica y climatología. Discurso investidura Dr. "honoris causa" Universidad de Granada. Serv. Publ. Universidad de Granada. 98 p. Granada.
- Rivas-Martínez S., Díaz T. E., Fernández-González F., Izco J., Lousã M. & Penas A., 2002. Vascular plant communities of Spain and Portugal. Addenda to the syntaxonomical checklist of 2001. *Itinera Geobot.* 15 (1): 5-432.
- Rivas-Martínez S., Sanchez-Mata D. & Costa M., 1999. North American Boreal and western temperate forest vegetation. *Itinera Geobot.* 12: 5-316.
- Rivas-Martínez, 2005. Avances en Geobotánica. Publicaciones Academia Nacional de Farmacia. Madrid.
- Taffetani F., 2000. Serie di vegetazione del complesso geomorfologico del Monte dell'Ascensione (Italia centrale). *Fitosociologia* 37 (1): 93-152.
- Theurillat JP., 1992. Etude et cartographie du paysage végétal (symphytosociologie) dans la Région d'Aletsch (Valais, Suisse). 2 vols. Centre alpin de phytogéographie. Champex et Conservatoire et Jardin botaniques de la ville de Genève, Krypto, Teufen.
- Tüxen R., 1978. Assoziationskomplexe (Sigmäten). Ber. Intern. Symposium, 1977, in Rinteln.
- Ubaldi D., 2003. La vegetazione boschiva d'Italia. Manuale di fitosociologia forestale. CLUEB, Bologna.
- Ubaldi D., 1995. Tipificazione di syntaxa forestali appenninici e siciliani. Studi sul territorio. *Ann. Bot. (Roma)*, 51 (1 parte): 113-126.
- Ubaldi D. & Speranza M., 1985. Quelques hertraies du *Fagion* et du *Laburno-Ostryon* dans l'Apennin septentrional (Italie). *Doc. Phytosoc. N.S.* 9: 51-71.
- Ubaldi D., Zanotti A. L., Puppi G., Speranza M. & Corbetta F., 1987. Sintassonomia dei boschi caducifogli mesofili dell'Italia peninsulare. *Not. Fitosoc.* 23: 31-62.

## Addenda

### Tab. 2

#### Accidental species

Column 1: *Melampyrum nemorosum* L. III, *Avenella flexuosa* (L.) Parl. II; Column 2: *Myosotis sylvatica* Hoffm. I, *Ranunculus ficaria* L. I, *Digitalis lutea* L. I; Column 3: *Agrimonia eupatoria* L. I, *Myosotis sylvatica* Hoffm. I, *Rubus ulmifolius* Schott I, *Silene dioica* (L.) Clairv. I, *Silene italica* (L.) Pers. I, *Anthriscus nemorosa* I, *Laserpitium latifolium* I, *Geranium pyrenaicum* Burm. f. I, *Lamium album* L. I, *Myosotis ramosissima* Rochel in Schultes I, *Stachys sylvatica* L. I, *Polypodium cambricum* L. I, *Arctium minus* (Hill) Bernh.

I, *Chaerophyllum aureum* L. I, *Equisetum telmateja* Ehrh. I, *Euonymus europaeus* L. I, *Euphorbia cyparissias* L. I, *Arabis alpina* L. ssp. *caucasica* (Willd) Briq. I, *Ptilostemon strictus* (Ten.) Greuter, I, *Rosa pimpinellifolia* L. I; Column 4: *Cruciata laevipes* Opiz I, *Prunella vulgaris* L. I, *Thalictrum aquilegifolium* L. I, *Urtica dioica* L. I, *Asplenium adiantum-nigrum* L. I, *Rubus ulmifolius* Schott, I, *Silene dioica* (L.) Clairv. I, *Silene italica* (L.) Pers. I, *Cornus mas* L. I, *Helleborus bocconei* Ten. I, *Brachypodium rupestre* (Host) R. et S. I, *Asplenium trichomanes* L. ssp. *quadrivalens* D. E. Meyer I, *Clinopodium vulgare* L. I, *Cytisus villosus* Pouret I, *Knautia drymeia* Heuffel, I, *Sesleria nitida* Ten. I, *Astragalus glycyphyllos* L. I, *Colchicum neapolitanum* Ten. I, *Peucedanum cervaria* (L.) Lepeyr. I, *Valeriana tripteris* L. I, *Campanula rapunculus* L. I, *Galium mollugo* L. I, *Inula conyza* DC. I; Column 5: *Pyracantha coccinea* M. J. Roemer I, *Cornus mas* L. I, *Helleborus bocconei* Ten. I, *Ornithogalum pyrenaicum* L. II, *Rumex conglomeratus* Murray, II, *Carex flacca* Schreber I, *Hypericum montanum* L. I, *Prunus spinosa* L. I, *Cyclamen repandum* S. et S. I, *Veratrum nigrum* L. I; Column 6: *Calystegia sepium* (L.) R. Br. I, *Circaea alpina* L. I, *Sambucus ebulus* L. I, *Agrimonia eupatoria* L. I, *Cruciata laevipes* Opiz, I, *Pyracantha coccinea* M. J. Roemer, I, *Hypericum perforatum* L. II, *Bromus madritensis* L. I, *Cystopteris fragilis* (L.) Bernh. I, *Rumex acetosella* L. I, *Ranunculus montanus* Willd. I, *Thalictrum aquilegifolium* L. I, *Urtica dioica* L. I, *Asplenium adiantum-nigrum* L. I, *Scrophularia nodosa* L. I, *Chaerophyllum hirsutum* L. I, *Chamaecytisus hirsutus* (L.) Link, I, *Lapsana communis* L. I, *Rubus canescens* DC. I, *Rumex acetosa* L. I, *Valeriana officinalis* L. I, *Tanacetum parthenium* (L.) Sch. -Bip. I, *Alnus viridis* (Chaix) DC. I, *Rumex obtusifolius* L. I, *Euphorbia segetalis* L. I, *Galium parisiense* L. I, *Cardamine amara* L. I; Column 7: *Carex stellulata* Good. II, *Bupleurum rigidum* L. I, *Hypericum perforatum* L. II, *Bromus madritensis* L. I, *Cystopteris fragilis* (L.) Bernh. I, *Rumex acetosella* L. I, *Ranunculus montanus* Willd. I, *Prunella vulgaris* L. I, *Campanula rotundifolia* L. II, *Genista tinctoria* L. I, *Galium aparine* L. I, *Festuca pratensis* Hudson, I, *Sedum anacampseros* L. I, *Bellis perennis* L. I, *Polygonum viviparum* L. I, *Brachypodium pheonicoides* (L.) R. et S. I, *Opopanax chironium* (L.) Koch, I; Column 8: *Calystegia sepium* (L.) R. Br. I, *Circaea alpina* L. I, *Sambucus ebulus* L. I, *Carex stellulata* Good. I, *Bupleurum rigidum* L. I, *Festuca paniculata* (L.) Sch. et Th. II, *Ruscus aculeatus* L. I, *Campanula glomerata* L. I, *Knautia dipsacifolia* Kreutzer.

### Tab. 3

#### Accidental species

rel. 2: *Silene dioica* (L.) Clairv. 1.1, *Pteridium aquilinum* (L.) Kuhn +, *Lonicera caprifolium* L. +, *Chaerophyllum aureum*



L. +, *Equisetum telmateja* Ehrh. +.2, *Euphorbia cyparissias* L. +; rel. 3: *Polypodium vulgare* L. +.1; rel. 4: *Arabis alpina* L. ssp. *caucasica* (Willd.) Briq. +, *Euonymus europaeus* L. +; rel. 5: *Salix caprea* L. 1.2, *Vaccinium myrtillus* L. (+.1); rel. 6: *Rubus idaeus* L. +; rel. 9: *Agrimonia eupatoria* L. +, *Rosa pimpinellifolia* L., +; rel. 10: *Heracleum sphondylium* L. ssp. *ternatum* (Velen.) Brummit +, *Myosotis sylvatica* Hoffm. +.2, *Senecio fuchsii* Gmelin +.2; rel. 16: *Geranium pyrenaicum* Burm. f. 1; rel. 17: *Stachys sylvatica* L. 1, *Lamium album* L. +, *Helleborus foetidus* L. +; rel. 18: *Rubus ulmifolius* Schott 1, *Myosotis ramosissima* Rochel in Schultes +.

Locality and date of the relevés:

rel.1: Prati di Tivo, F.te Tassete. (21.09.2006); rel.2: Prati di Tivo, (05.09.2005); rel.3: near Prati di Tivo, (08.07.2006); rel.4: Prati di Tivo, F.te Tassete. (21.09.2006); rel.5: Prati di Tivo, (08.07.2006); rel.6: Prati di Tivo, (21.09.2006); rel.7: Prati di Tivo (08.07.2002); rel.8: San Giorgio, (31.05.2007); rel.9: Prati di Tivo (08.07.2002); rel.10: presso Prati di Tivo, (21.09.2006); rel.11: 1 km to Prati di Tivo, on the right side of the road, (05.09.2005); rel.12: Ortolano, (21.05.2007); rel.13: Ortolano, (21.05.2007); rel.14: Ortolano, (21.05.2007); rel.15: Ortolano, (21.05.2007); rel.16: Monte San Franco (20.06.2005); rel.17: Monte San Franco beneath A. Panepucci's refuge (21.06.2005); rel.18: Monte San Franco beneath A. Panepucci's refuge (21.06.2005);

Tab. 4

Accidental species

rel. 1: *Salvia glutinosa* L. +, *Asplenium trichomanes* L. ssp. *quadrialeans* D. E. Meyer +; rel. 2: *Salix caprea* L. 3.2; rel. 4: *Valeriana tripteris* L. +; rel. 5: *Clinopodium vulgare* L. +, *Rubus ulmifolius* Schott 1, *Dactylis glomerata* L. +; rel. 6: *Salvia glutinosa* L. 2.2, *Rubus ulmifolius* Schott 1.2, *Sesleria nitida* Ten. 1.2, *Digitalis micrantha* Roth 1.2, *Silene italica* (L.) Pers. 1.2, *Cytisus scoparius* (L.) Link 1.2, *Inula conyza* DC. +, *Asplenium adiantum-nigrum* L. +, *Astragalus glycyphyllos* L. +; rel. 7: *Asplenium trichomanes* L. ssp. *quadrialeans* D. E. Meyer +, *Galium mollugo* L. +, *Cruciata laevipes* Opiz +; rel. 9: *Digitalis micrantha* Roth +, *Cornus sanguinea* L. +, *Silene dioica* (L.) Clairv. +, *Rosa canina* L. sensu Bouleng. +, *Colchicum neapolitanum* Ten. +, *Peucedanum cervaria* (L.) Lepeyr. +; rel. 11: *Heracleum sphondylium* L. ssp. *ternatum* (Velen.) Brummit +, *Campanula rapunculus* L. +, *Clinopodium vulgare* L. +, *Sesleria nitida* Ten. +; rel. 14: *Geranium robertianum* L. +; rel. 15: *Geranium robertianum* L. +.

Locality and date of the relevés:

rel. 1: Case Paladini (07.07.2006); rel. 2: Crognaleto (08.07.2006); rel. 3: Cerqueto, F.te Impreta, (11.07.2006); rel. 4: Rio Arno, on the right side (30.05.2007); rel. 5: Nerito (20.07.2005); rel. 6: Fosso dell'Acero (30.09.2006); rel. 7:

Intermesoli (07.07.2006); rel. 8: Costa della Rocca (05.07.2006); rel. 9: Crognaleto (19.07.2005); rel. 10: along the road to Prato Selva from Fano Adriano (20.07.2005); rel. 11: Piano del Rosario (19.07.2005); rel. 12: Ortolano; rel. 13: Ortolano, (21.05.2007); rel. 14: Ortolano (21.05.2007); rel. 15: Ortolano (21.05.2007).

Tab. 5

Locality and date of the relevés:

Rel. 1, 2, 3, 4, 5, 7, 9, 12 of Table 1 in Pedrotti, 1982 (Marche: Valle della Corte and Abruzzo: Bosco Martese)

Tab. 6 - Synoptic table of turkey oak woods

Accidental species

Column 1: *Lonicera etrusca* Santi, I, *Rubus bellardii* Weihe et Nees, I, *Asplenium onopteris* L. I, *Hieracium piloselloides* Vill. I, *Calamintha sylvatica* Bromf. II; Column 2: *Ornithogalum sphaerocarpum* Kerner, II, *Carex pendula* Hudson I, *Coronilla emerus* L. ssp. *emerus* I, *Molinia arundinacea* Schrank, I, *Arctium nemorosum* Lej. et Court I, *Chamaecytisus hirsutus* (L.) Link, I, *Galium album* Miller I; Column 3: *Anthriscus sylvestris* (L.) Hoffm. II, *Silene latifolia* Poiret II, *Angelica sylvestris* L. II, *Lathyrus pratensis* L. II, *Trifolium campestre* Schreber, I, *Hypericum perforatum* L. I, *Ranunculus bulbosus* L. I, *Silene nutans* L. I, *Vicia incana* Gouan, I, *Poa trivialis* L. I, *Senecio nemorensis* L. ssp. *stebianus* (Lacaita) Pign. I, *Origanum vulgare* L. I; Column 4: *Asplenium trichomanes* L. ssp. *quadrialeans* D. E. Meyer I, *Salix caprea* L. I, *Lathyrus sylvestris* L. I; Column 6, *Rosa corymbifera*, II, *Agrimonia eupatoria* L. II, *Lychnis flos cuculi* L. I, *Inula conyza* DC. I, *Sesleria italica* (Pamp.) Ujhelyi I, *Hypericum hirsutum* L. I, *Cerastium arvense* L. I.

Tab. 7

Accidental species

ril. 2: *Urtica dioica* L. +, *Aquilegia vulgaris* L. +, *Angelica sylvestris* L. +, *Campanula persicifolia* L. +; ril. 3: *Lathyrus pratensis* L. +, *Urtica dioica* L. +, *Angelica sylvestris* L. +, *Origanum vulgare* L. +; ril. 4 *Campanula persicifolia* L. +, *Silene nutans* L. +, *Hypericum montanum* L. +; ril. 5: *Lathyrus pratensis* L. +, *Aquilegia vulgaris* L. +, *Silene latifolia* Poiret +, *Origanum vulgare* L. +, *Poa trivialis* L. +, *Trifolium campestre* Schreber +; ril. 6: *Heracleum sphondylium* L. ssp. *ternatum* (Velen.) Brummit 1; ril. 7: *Galium aparine* L. +, *Hypericum perforatum* L. +, *Silene nutans* L. +, *Myosotis sylvatica* Hoffm. +, *Vicia incana* Gouan +; ril. 8: *Lathyrus pratensis* L. +, *Silene latifolia* Poiret +, *Angelica sylvestris* L. +, *Hypericum perforatum* L. +; ril. 9: *Heracleum sphondylium* L. ssp. *ternatum* (Velen.) Brummit +; ril. 10: *Heracleum sphondylium* L. ssp. *ternatum* (Velen.) Brummit 1, *Galium aparine* L. 1; ril. 11: *Vicia cracca* L. +; ril. 12: *Senecio*

*nemorensis* L. ssp. *stebianus* (Lacaita) Pign. +; ril. 13: *Galium aparine* L. +, *Silene latifolia* Poiret +, *Ranunculus bulbosus* L. +, *Coronilla emerus* L. ssp. *emeroides* (Boiss. et Spruner) Hayek (pl.) +; ril. 14: *Ranunculus bulbosus* L. +; ril. 16: *Polypodium vulgare* L. +; ril. 17: *Rosa canina* L. sensu Bouleng. 1.2; ril. 18: *Polypodium vulgare* L. +; ril. 19: *Rubus canescens* DC. 2.2; ril. 20: *Asplenium trichomanes* L. ssp. *quadri-valens* D. E. Meyer +, *Buglossoides purpureo-caerulea* (L.) Johnston 1.1; ril. 22: *Urtica dioica* L. +, *Rosa canina* L. sensu Bouleng. +, *Salix caprea* L. +, *Chaerophyllum aureum* L. +; ril. 23: *Salix caprea* L. 1.1; ril. 24: *Arabis turrata* L. +, *Silene vulgaris* (Moench) Garcke +, *Coronilla emerus* L. ssp. *emeroides* (Boiss. et Spruner) Hayek (pl.) +.2, *Vicia cracca* L. +, *Myosotis sylvatica* Hoffm. +, *Buglossoides purpureo-caerulea* (L.) Johnston +.2, *Lathyrus sylvestris* L. +; ril. 25: *Arabis turrata* L. +, *Thalictrum aquilegifolium* L. +, *Asplenium trichomanes* L. ssp. *quadri-valens* D. E. Meyer +; ril. 26: *Aquilegia vulgaris* L. +; ril. 27: *Arabis turrata* L. +; ril. 28: *Silene vulgaris* (Moench) Garcke +, *Teucrium chamaedrys* L. +; ril. 29: *Rosa canina* L. sensu Bouleng. +, *Thalictrum aquilegifolium* L. +.

Locality and date of the relevés:

rel. 1: Casagrega (30.06.2005); rel. 2: Cesacastina (06.07.2005); rel. 3: Cesacastina Fosso della Lagnetta (07.07.2005); rel. 4: Cesacastina-Figliola Micciola (Fosso Malbove) (13.07.2005); rel. 5: Cesacastina Fosso della Lagnetta (06.07.2005); rel. 6: Fosso della lagnetta, Cesacastina (06.07.2005); rel. 7: Mascioni, Colle Poggiani (07.07.2005); rel. 8: Valle del Chiarino, Diga di Provvidenza (27.07.2005); rel. 9: Alvi (28.06.2005); rel. 10: Alvi (28.06.2005); rel. 11: Alvi (28.06.2005); rel. 12: Alvi (28.06.2005); rel. 13: on the road to Frattoli, after the crossroads to Crognaleto (30.06.2005); rel. 14: on the road to Frattoli, after the crossroads to Crognaleto (05.07.2005); rel. 15: Nerito (07.07.2003); rel. 16: Nerito (07.07.2003); rel. 17: Nerito (20.07.2005); rel. 18: Costa della Rocca (05.07.2006); rel. 19: Costa della Rocca (05.07.2006); rel. 20: Torrente Venaquaro on the right side (07.07.2006); rel. 21: along the road between Aiello and Figliola (08.07.2006); rel. 22: Fonte Gelata (near Nerito) on the left side of Torrente Rocchetta. (27.07.2005); rel. 23: Fonte Gelata (near Nerito) on the left side of Torrente Rocchetta (27.07.2005); rel. 24: on the road to Aprati, near Cervaro (06.09.2005); rel. 25: between Ortolano and Case Paladini (20.09.2006); rel. 26: Valle Chiarino (07.07.2003); rel. 27: Valle Chiarino (07.07.2003); rel. 28: Valle Chiarino (07.07.2003); rel. 29: Valle del Chiarino (31.07.1996).

Tab. 8

Accidental species

ril. 1: *Stachys recta* L. +, *Phleum ambiguum* Ten. +, *Juglans regia* L. +, *Amelanchier ovalis* Medicus +, *Galeopsis*

*angustifolia* Ehrh. +; ril. 2: *Stachys recta* L. +, *Phleum ambiguum* Ten. +, *Arabis hirsuta* (L.) Scop. +; ril. 3: *Centaurea nigrescens* Willd. +; ril. 4: *Peucedanum austriacum* (Jacq.) Koch 1.1, *Orobanche hederæ* Duby +; ril. 5: *Carex flacca* Schreber ssp. *flacca*, 1.2, *Vicia sepium* L. 1.2, *Cruciata glabra* (L.) Ehrend. 1.2, *Fragaria vesca* L. 1.2, *Polypodium cambricum* L. +, *Ranunculus lanuginosus* L. +; ril. 6: *Carex flacca* Schreber ssp. *flacca* 1.1, *Bromus erectus* Hudson +.2, *Galium album* Miller +, *Arabis collina* Ten. 1.1, *Sedum album* L. +; ril. 7: *Bromus erectus* Hudson 3.3, *Cistus creticus* L. ssp. *creticus*, 2.2, *Astragalus monspessulanus* L. 2.2, *Phleum bertolonii* DC. 2.2, *Trifolium ochroleucum* Hudson 1.1, *Anthyllis vulneraria* L. s.L. 1.1, *Dianthus carthusianorum* L. +, *Thymus striatus* Vahl +, *Leontodon hispidus* L. +, *Polygala nicaeensis* Risso ssp. *mediterranea* Chodat +, *Sedum rupestre* L. ssp. *rupestre* +, *Centaurea erithraea* Rafn. +, *Scabiosa columbaria* L. +; ril. 8: *Veronica chamaedrys* L. +, *Linum viscosum* L. +; ril. 9: *Pinus nigra* Arnold, +, *Argyrolobium zanonii* (Turra) P. W. Ball +.2, *Scabiosa maritima* L. +, *Carlina vulgaris* L. +; ril. 10: *Trifolium medium* L. ssp. *medium*, +; ril. 11: *Origanum vulgare* L. +, *Asparagus acutifolius* L. +, *Quercus ilex* L. 1.1; ril. 12: *Origanum vulgare* L. (+), *Carlina utzka* Hacq. +; ril. 13: *Cytisus scoparius* (L.) Link. +, *Osyris alba* L. 1.1; ril. 15: *Cruciata laevipes* Opiz +, *Asplenium trichomanes* L. ssp. *quadri-valens* D. E. Meyer +, *Dorycnium hirsutum* (L.) Ser. +, *Orchis purpurea* Hudson, +, *Cyclamen repandum* S. et S. 2.2, *Asplenium onopteris* L. +; ril. 16: *Polypodium vulgare* L. +, *Arabis alpina* L. +; ril. 17: *Cruciata glabra* (L.) Ehrend. +.2, *Cruciata laevipes* Opiz +, *Platanthera bifolia* (L.) Rchb. +, *Rubus caesius* L. +, *Potentilla micrantha* Ramond, +; ril. 18: *Vicia sepium* L. +, *Veronica chamaedrys* L. +, *Polypodium vulgare* L. +.2, *Pyracantha coccinea* M. J. Roemer 1.2, *Rubus canescens* DC. +.2.

Locality and date of the relevés:

rel. 1: Arischia (01.06.2005); rel. 2: Arischia (06.07.2006); rel. 3: along the path n. 155 from Cerqueto (26.07.2006); rel. 4: along the path n. 155 from Cerqueto (26.07.2006); rel. 5: along the road to Prato Selva from Fano Adriano (20.07.2005); rel. 6: Pietracamela. (05.09.2005); rel. 7: along the path from Piano Vomano to Costa della Rocca (06.07.2006); rel. 8: along the road to Pietracamela (14.09.2006); rel. 9: along the road from Senarica to Piano Vomano (28.09.2006); rel. 10: from Piano Vomano to Senarica (29.09.2006); rel. 11: between Fano Adriano and Intermesoli (04.10.2006); rel. 12: along the road from Pietracamela to Intermesoli (22/09/2006); rel. 13: along the road to Pratoselva, 1 km far from Fano Adriano (11.04.2007); rel. 14: along the road to Pietracamela, 300 m from the crossroad to Intermesoli (20.04.2007); rel. 15: along the road to Pietracamela (20.04.2007); rel. 16: along the road to Pratoselva from Fano Adriano, near the village (29.05.2007); rel. 17: along the road to Prato Selva from Fano Adriano (29.05.2007); rel. 18: along the road to Prato Selva

from Fano Adriano (29.05.2007).

Tab. 9

Accidental species

ril. 1: *Populus tremula* L. +2; ril. 2: *Populus tremula* L. +2, *Polypodium cambricum* L. +; ril. 3: *Rosa canina* L. sensu Bouleng. +, *Prunella vulgaris* L. 1.2, *Silene vulgaris* (Moench) Garcke 1.2, *Rubus canescens* DC. 2.2; ril. 4: *Agrimonia eupatoria* L. +, *Vicia cracca* L. +, *Genista tinctoria* L. +2, *Bromus erectus* Hudson 1.2, *Euphorbia cyparissias* L. +, *Asperula purpurea* (L.) Ehrend. +, *Helianthemum nummularium* (L.) Miller ssp. *obscurum* (Celak.) Holub. +; ril. 5: *Vicia cracca* L. +2, *Peucedanum verticillare* (L.) Koch 2.2, *Spartium junceum* L. +2, *Trifolium medium* L. ssp. *medium*, +2; ril. 6: *Vicia cracca* L. +, *Galium album* Miller +; ril. 8: *Geranium robertianum* L. +, *Asplenium trichomanes* L. ssp. *quadri-valens* D. E. Meyer +2, *Peucedanum cervaria* (L.) Lepeyr. +, *Lamium maculatum* L. +; ril. 9: *Aegopodium podagraria* L. +2; ril. 10: *Polypodium cambricum* L. +, *Lathyrus sylvestris* L. +, *Echinops sicutus* Strobl +, *Orobancha hederæ* Duby +, *Tussilago farfara* L. +, *Pinus nigra* Arnold +, *Digitalis ferruginea* L. +; ril. 11: *Asplenium trichomanes* L. ssp. *quadri-valens* D. E. Meyer +, *Chaerophyllum aureum* L. +, *Geranium molle* L. +; ril. 12: *Rosa subcanina* (H. Christ) R. Keller 1, *Campanula persicifolia* L. +; ril. 13: *Stachys sylvatica* L. 1, *Genista tinctoria* L. +, *Rosa subcanina* (H. Christ) R. Keller 1, *Blackstonia perfoliata* (L.) Hudson +; ril. 14: *Agrimonia eupatoria* L. +, *Rubus hirtus* W. et K., +, *Ranunculus lanuginosus* L. 1, *Lathyrus pratensis* L. +; ril. 15: *Agrimonia eupatoria* L. +, *Rubus hirtus* W. et K., 1, *Echinops sphaerocephalus* L. +; ril. 16: *Peucedanum verticillare* (L.) Koch +, *Aquilegia vulgaris* L. +2; ril. 17: *Stachys sylvatica* L. +, *Teucrium flavum* L. ssp. *flavum* +, *Aegopodium podagraria* L. +, *Aquilegia vulgaris* L. +, *Vitis vinifera* L. +; ril. 19: *Lonicera etrusca* Santi +, *Tanacetum corymbosum* (L.) Sch. Bip. +, *Campanula apennina* Podlech +, *Rosa pendulina* L. +; ril. 20: *Lonicera etrusca* Santi, +2, *Spartium junceum* L. +, *Lathyrus sylvestris* L. +; ril. 21, *Bromus erectus* Hudson +2; ril. 22: *Teucrium flavum* L. ssp. *flavum* 2; ril. 23: *Lonicera etrusca* Santi, +, *Teucrium flavum* L. ssp. *flavum* +, *Tanacetum corymbosum* (L.) Sch. Bip. +; ril. 24: *Geranium robertianum* L. +; ril. 25: *Rubus hirtus* W. et K. +; ril. 26: *Stachys sylvatica* L. +.

Locality and date of the relevés:

rel. 1: Valley of the Vomano river, right side (18.07.2005); rel. 2: along the road Fano Adriano-Intermesoli (20.07.2005); rel. 3: along the road Fano Adriano-Pratoselva (29.09.2006); rel. 4: along the road Pietracamela-Cerqueto (05.09.2005); rel. 5: near Tottea (30.09.2006); rel. 6: beneath Fano Adriano, along the road to Prato Selva. (29.05.2007); rel. 7: beneath Fano Adriano along the road to strada per Prato Selva (29.05.2007); rel. 8: near Intermesoli (26.07.2006); rel. 9: near

Aprati (19.07.2005); rel. 10: along the path from Case Paladini to Tottea (20.09.2006); rel. 11: along the road from Aprati to Cervaro (06.09.2005); rel. 12: Frattoli (05.07.2005); rel. 13: Frattoli (05.07.2005); rel. 14: along the road to Cesacastina, 4 km from Aprati (30.06.2005); rel. 15: Cesacastina, 3 Km after Aprati (30.06.2005); rel. 16: along the road to Prati di Tivo (08.07.2002)

rel. 17: along the road to Prati di Tivo (24.06.2002); rel. 18: along the road to Pietracamela (20.04.2007); rel. 19: along the SS80 Passo Capannelle-Vallone delle Cese (07.07.2006); rel. 20: along the road to Prati di Tivo (08.07.2002); rel. 21: along the road Fano Adriano-Campotosto (21.07.1995); rel. 22: along the road to Prati di Tivo (23.09.1996); rel. 23: along the road to Prati di Tivo (08.07.2002); rel. 24: along the road to Pietracamela (25.05.2004); rel. 25: along the road to Prati di Tivo (24.06.2002); rel. 26: along the SS80 nera the crossroad to Cerqueto (01.10.2006).

Tab. 10

Accidental species

ril. 1: *Silene italica* (L.) Pers. +.1, *Rubus hirtus* W. et K. 1.1, *Asplenium trichomanes* L. ssp. *quadri-valens* D. E. Meyer +.1, *Helleborus bocconei* Ten. +.1, *Sedum cepaea* L. +.1, *Circaea lutetiana* L. 1.1; ril. 3: *Rubus ulmifolius* Schott +.2, *Petasites hybridus* (L.) Gaertn. +.2, *Carex flacca* Schreber 1.2, *Peucedanum verticillare* (L.) Koch 2.2; ril. 4: *Juniperus oxycedrus* L. +, *Tussilago farfara* L. +2; ril. 5: *Rubus caesius* L. 2.1, *Inula conyza* DC. +.1; ril. 6: *Galium album* Miller 1, *Myosotis sylvatica* Hoffm. 1, *Phleum pratense* L. +, *Poa trivialis* L. 1, *Rumex acetosa* L. 1; ril. 7: *Bupleurum falcatum* L. ssp. *cernuum* (Ten.) Arcang. 1, *Campanula glomerata* L. 1, *Cotoneaster integerrimus* Medicus +, *Cytisus sessilifolius* L. 2, *Euonymus verrucosus* Scop. 1, *Pimpinella major* (L.) Hudson 1, *Rubus canescens* DC. 1, *Sanguisorba minor* Scop. +, *Tanacetum corymbosum* (L.) Sch.-Bip. +; ril. 8: *Chaerophyllum hirsutum* L. +, *Galium mollugo* L. +, *Lathyrus pratensis* L. +, *Leucanthemum vulgare* Lam. +, *Prunella laciniata* (L.) L. +, *Prunella vulgaris* L. 1, *Trifolium medium* L. 2, *Veronica chamaedrys* L. +.

Locality and date of the relevés:

rel. 1: along the SS80, after Ponte Rocchetta (13.07.2006); rel. 2: Colle Asino (13.09.2006); rel. 3: along the road to Tottea (30.09.2006); rel. 4: between Fano Adriano and Intermesoli (04.10.2006); rel. 5: 1 km from Intermesoli (11.07.2006); rel. 6: near Campotosto Lake (22.06.2005); rel. 7: along the SS80, near Passo delle Capannelle (28.07.2006); rel. 8: near the Vomano springs (28.07.2006).

Tab. 11

Accidental species

ril. 1: *Juniperus communis* L. +, *Cruciata laevipes* Opiz +,

*Astragalus glycyphyllos* L. +, *Prunella vulgaris* L. 2.2, *Cytisus scoparius* (L.) Link +, *Thalictrum aquilegifolium* L. +, *Brachypodium rupestre* (Host) R. et S. 1.2; ril. 2: *Polypodium interjectum* Shivas 1.2, *Juniperus communis* L. +, *Carex flacca* Schreber 1.2; ril. 3: *Rosa canina* L. sensu Bouleng. +, *Rubus ulmifolius* Schott 1.2, *Coronilla emerus* L. ssp. *emeroides* (Boiss. et Spruner) Hayek (pl.) +, *Pyracantha coccinea* M. J. Roemer +; ril. 4: *Polypodium interjectum* Shivas, +.2, *Orobanche hederæ* Duby, +, *Quercus ilex* L. +; ril. 5: *Urtica dioica* L. 1.2, *Prunus spinosa* L. +, *Chaerophyllum aureum* L. +, *Galium aparine* L. +; ril. 6: *Prunus spinosa* L. +, *Calystegia sepium* (L.) R.Br. +, *Agrostis tenuis* Sibth. +; ril. 7: *Ptilostemon strictus* (Ten.) Greuter +, *Salix alba* L. 1.1, *Clinopodium vulgare* L. +, *Salix caprea* L. 1.1; ril. 8: *Rosa squarrosa* (Rau) Boreau, +; ril. 9: *Cruciata laevipes* Opiz, +.2, *Silene dioica* (L.) Clairv. +, *Carex flacca* Schreber, +.2, *Ptilostemon strictus* (Ten.) Greuter, +.2, *Silene italica* (L.) Pers. +, *Cytisus villosus* Pourret, +, *Peucedanum cervaria* (L.) Lepeyr. +,

*Rosa pendulina* L. +.2; ril. 10: *Urtica dioica* L. +, *Silene dioica* (L.) Clairv. +, *Scrophularia nodosa* L. +, *Equisetum telmateja* Ehrh. +, *Cardamine impatiens* L. 1.1, *Salix purpurea* L. 1.1; ril. 12: *Hypericum androsaemum* L. +; ril. 13: *Melampyrum italicum* (Beauverd) Soo. 3, *Calamintha sylvatica* Bromf. +.

Locality and date of the relevés:

rel. 1: Ponte Rocchetta (20.09.2006); rel. 2: Ponte Rocchetta (20.09.2006); rel. 3: right hydrographic side of Senarica Stream (22.09.2006); rel. 4: Rocchetta Stream, near Ponte Rocchetta (20.09.2006); rel. 5: near Nerito (20.07.2005); rel. 6: near Nerito (20.07.2005); rel. 7: Venacquaro Stream, right hydrographic side (22.09.2006); rel. 8: Venacquaro Stream, right hydrographic side (22.09.2006); rel. 9: along the road from Aprati to Cervaro (06.09.2005); rel. 10: near Crognaleto (13.07.2006); rel. 11: along the SS80, near Rocchetta Stream (29.07.1997); rel. 12: along the SS80, near Torrente Stream (29.07.1997); rel. 13: Intermesoli, Rio Arno (29.07.1997); rel. 14: near the Alvi bridge, Fucino (08.06.1993).