

PLANT SOCIOLOGY

formerly FITOSOCIOLOGIA

Volume 53(2) - December 2016



RIVISTA SEMESTRALE - POSTE ITALIANE S.P.A. - SPED. ABB. POST. - D.L. 353/2003 - (CONV. IN L. 27/02/2004 N. 46) ART. 1, COMMA 2. DCB ANCONA TASSA RISCOSSA-TAXE PERCUE-CMPP AN
EDITO DALLA SOCIETÀ ITALIANA DI SCIENZA DELLA VEGETAZIONE ONLUS - PAVIA - DIRETTORE RESPONSABILE PROF. E. BIONDI - VOLUME 2 - II° SEMESTRE 2016

Journal of the Italian Society for Vegetation Science

***Brachypodium rupestre* (Host) Roem. & Schult. herbaceous communities of heliophilous edge in the *Trifolio medii-Geranietea sanguinei* Müller 1962 class**

M. Allegrezza¹, E. Biondi¹, S. Ballelli², G. Tesei¹, C. Ottaviani¹ & S. Zitti¹

¹Department of Agricultural, Food and Environmental Sciences, Marche Polytechnic University, Via Brecce Bianche, 60131 Ancona, Italy.

²School of Biosciences and Veterinary Medicine, University of Camerino, Via Pontoni 5, 62032 Camerino (MC), Italy.

Abstract

This phytosociological study defines the heliophilous edges dominated by *Brachypodium rupestre* of different areas of central-southern Italy, from a lower Supratemperate thermotype to a lower Mesotemperate thermotype. This has allowed the description of four new syntaxa of the order *Asphodeletalia macrocarpi* that help to extend its biogeographic, bioclimatic and landscaping areal distribution. In particular, for the Supratemperate thermotype of the Apennine limestone areas, two new associations are recognized: *Tanaceto corymbosi-Brachypodietum rupestris* and *Laserpitio siculo-Brachypodietum rupestris*, which are included in the suborder *Senecio scopolii-Brachypodienalia genuensis* and alliance *Luzulo sieberi-Brachypodion genuensis*. For the sub-Mediterranean areas, the new suborder *Dorycnio herbacei-Brachypodienalia rupestris* (order *Asphodeletalia macrocarpi*) is proposed, with the new alliance *Dorycnio herbacei-Brachypodion rupestris* as the typus. The two new associations, *Galio erecti-Brachypodietum rupestris* (ass. typus) and *Bituminario bituminosae-Brachypodietum rupestris* can be referred to this new alliance. The new suborder *Dorycnio herbacei-Brachypodienalia rupestris* groups together the heliophilous, mesophilous and anthropogenic edges, dominated by *Brachypodium rupestre* of the Mesotemperate thermotype of subcoastal, pre-Apennine and infra-Apennine sub-Mediterranean territories of central and southern Italy. The optimum development of this new suborder is on non-calcareous lithologies and deep soils, in dynamic link with the grasslands of *Polygalo mediterraneae-Bromion erecti*, where *Brachypodium rupestre* is a transgressive species. *Dorycnio herbacei-Brachypodienalia rupestris* is vicarious in the sub-Mediterranean areas, with the calcareous Apennine suborders *Senecio scopolii-Brachypodienalia genuensis* and *Asphodelenalia macrocarpi*. This study of the dynamic and chain contacts has made it possible to define the ecological position of the plant communities described here, and to clarify the reference dynamic landscape and complete the main landscape units described for central-southern Italy. On the basis of these analyses it is possible to define for central and southern Italy three suborders of the order *Asphodeletalia macrocarpi*: *Asphodelenalia macrocarpi* (suborder typus) for the heliophilous edges with *Asphodelus macrocarpus* of the Supratemperate thermotype of the Apennine sector; *Senecio scopolii-Brachypodienalia* for the calcareous communities with *Brachypodium genuense/Brachypodium rupestre* dominant for the Supratemperate thermotype; and *Dorycnio herbacei-Brachypodienalia rupestris* for the heliophilous edges with *Brachypodium rupestre* dominant for the sub-Mediterranean subcoastal, pre-Apennine and infra-Apennine territories.

Key words: Apennines, heliophilous edges, phytosociology, plant community dynamics, secondary grasslands, sub-Mediterranean area, syntaxonomy.

Introduction

Secondary grasslands are one of the richest ecosystems in terms of the number of species, especially on limestone substrates (Kull & Zobel, 1991; Peet *et al.*, 1990; Habel *et al.*, 2013). The abandonment of traditional human activities that were applied for the maintenance of the grasslands over previous centuries, such as grazing, cutting and burning (Kohler *et al.*, 2005), has restarted the natural dynamic processes in large areas, especially around the Mediterranean, with the consequent drastic reduction in biodiversity. These negative trends have led to the conservation of secondary grasslands as a priority across Europe, especially for those of the class *Festuco-Brometea* that are particularly rich in species (Dengler & Jandt, 2005, Dengler *et al.*, 2009). Thus, as many of these are destined to disappear in a short time, most of these communities are considered priority habitats under the European Community habitats Directive (92/43/EEC) (European Commission, 2007).

This reduction in the biodiversity of secondary grasslands through underuse is mainly related to their colonisation by a few particularly competitive grass species, which includes some of the genus *Brachypodium*, as has been indicated in many ecological studies (Bobbink & Willems, 1987; Bonanomi & Allegrezza, 2004, Bonanomi *et al.*, 2006, 2009, 2013; Catorci *et al.*, 2011). In particular, these studies have shown that the mode of colonisation dynamics is similar to the secondary grasslands of *Brachypodium pinnatum* for northern Europe, and of *Brachypodium rupestre* and *Brachypodium genuense* for the Apennines, and in general for the Mediterranean basin. Despite the evident participation of these species in the changes to these grasslands following their abandonment, this is similar to that of the typical species of forest edges of the class *Trifolio-Geranietea*, the same was recognized a marginal role (Dengler *et al.*, 2006).

Therefore, at a syntaxonomic level, the ecological role of the species listed above has not been emphasised, and these have been considered only in the

Corresponding author: Marina Allegrezza. Department of Agricultural, Food and Environmental Sciences, Marche Polytechnic University, Via Brecce Bianche, I-60131 Ancona, Italy; e-mail: m.allegrezza@univpm.it

context of the *Festuco-Brometea* class (Guitian *et al.*, 1989; Biondi *et al.*, 1995, 2005; Rivas-Martínez *et al.*, 2002; Dengler *et al.*, 2003, 2012; Illyes *et al.*, 2007). A specific example here is the order *Brachypodietalia pinnati* that was proposed for central Europe (Dengler *et al.*, 2003, 2012), in which the alliance *typus Cirsio-Brachypodion pinnati* is clearly dominated by *Brachypodium pinnatum* and is rich in forest-edge species, therefore already expressing the transition of the grasslands towards the class *Trifolio-Geranietea*.

The issue concerning the extension of the survey to the ecotone position is particularly felt in the southern and eastern margins of the distribution of the class *Trifolio-Geranietea*. In these contexts, while mesophilous alliances of the order *Origanetalia vulgaris* are clearly differentiated by typical forest-edge species, those of the order *Antherico-Geranietalia sanguinei* include plant communities such as *Dictamo-Ferulagion campestris*, which are differentiated by heliophilous species where most are grassland species (Dengler *et al.*, 2006; Carni, 2005). Only recently for the Apennines have the phytosociological survey methods conducted in the ecotonal spaces between the woods and grasslands allowed the distinction between the heliophilous (*Asphodelalia macrocarpi*) and shady (*Origanetalia vulgaris*) forest edges.

Therefore, acknowledging the order *Asphodeletalia macrocarpi* in the class *Trifolio-Geranietea*, this has been applied to what ecological analyses have previously shown (Biondi *et al.*, 2014a; Allegrezza *et al.*, 2015). In particular, for the heliophilous edge communities dominated by *Brachypodium genuense*, the suborder *Senecio scopolii-Brachypodienalia genuensis* has been proposed, which brings together the heliophilous edges of mesophytes and mesoxerophytes that are connected with the shady forest edges of the order *Origanetalia vulgaris* (*Digitalidi-Trifolion medii*), the dynamic invasion of which has led to their colonisation of the grasslands of the orders *Phleo ambigui-Brometalia erecti* (*Phleo ambigui-Bromion erecti*) and *Nardetalia strictae* (*Ranunculo-Nardion strictae*), with their optimum in the upper Supratemperate thermotype (Biondi *et al.*, 2015). However, for the Italian peninsula, there is currently a lack of specific syntaxonomic studies on the communities dominated by *Brachypodium rupestre* that express the same ecological significance of these plant communities, in line with the new methodological and ecological acquisitions. This is the case even though *Brachypodium rupestre* is considered the most widespread invasive species of the secondary post-cultivation grasslands of the Mesotemperate thermotype (e.g., Ubaldi, 1988; Lucchese, 1990; Biondi, 1994; Lucchese *et al.*, 1995; Di Pietro & Blasi, 2002; Di Pietro *et al.*, 2015), and its methods of colonisation (Bonanomi & Allegrezza, 1994; Bonanomi *et al.*, 2006, 2009, 2013) and repro-

duction (Galiè *et al.*, 2013) are well known. Indeed, *Brachypodium rupestre* is almost always present, and sometimes even found at high coverage levels, in associations of post-cultivation grasslands of the alliance *Polygalo mediterraneae-Bromion erecti* (*Brometalia erecti*) that usually develop on marl-sandstone substrates, and in particular in the association *Centaureo bracteatae-Brometum erecti* that is widely diffuse for the peninsular central-southern hilly areas (Biondi *et al.*, 1995, 2005) with many subassociations and variants (e.g., Allegrezza *et al.*, 2010; Foggi *et al.*, 2014). The species *Brachypodium rupestre* has been used as the epithet of the grassland associations, or of variants related to syntaxa of the class *Festuco-Brometea*, in the associations *Galio lucidi-Brachypodietum rupestris*, *Polygalo flavescentis-Brachypodietum rupestris*, *Polygalo mediterraneae-Brachypodietum rupestris*, and *Dorycnio-Brachypodietum*, the last of which was considered as an edge community of *Bromion* (Ubaldi, 2008), not then the differential at a syntaxonomic level.

Studies on the vegetation dynamics following this abandonment are of fundamental importance, especially in the early stages that characterize it, and in the Natura 2000 areas. These are needed not only as the basis for monitoring and for the planning of conservation interventions, and recovery and/or restoration of the habitat, but also in particular for verification of the initial diffusion of *Brachypodium rupestre* in secondary grassland habitats.

This is thus the main reasoning behind the present study, which brings together what occurs in nature, in syntaxonomical terms, through the study of the heliophilous edges dominated by *Brachypodium rupestre* in central and southern Italy.

Study areas

The study areas are in different geographical and biogeographical districts in central and central-southern Italy (Fig. 1), at altitudes between 100 m and 1400 m a.s.l.. These include the Apennines mountains, the pre-Apennine and infra-Apennine hilly areas and the sub-coastal central-eastern areas.

The bioclimatic classification (Rivas-Martinez *et al.*, 2011) indicates a Temperate macroclimate of the sub-Mediterranean variant, an oceanic bioclimate and thermotype ranging from lower Mesotemperate to lower Supratemperate (Pesaresi *et al.*, 2014). The study areas are characterised by different lithological formations, including limestone, calcareous marl, marl and clay, arenaceous-pelitic, pelitic-arenaceous, and alluvial.

Materials and Methods

This study of the vegetation was conducted accor-

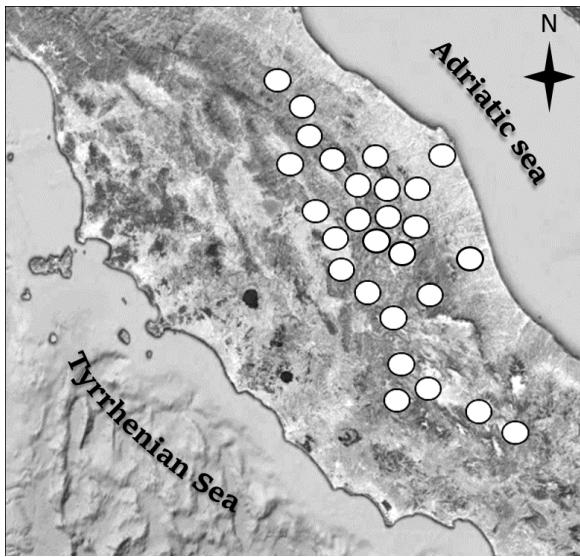


Fig. 1 - Location of the study areas.

ding to the phytosociological methods of the Sigmista school of Zurich-Montpellier and the subsequent additions (e.g., Rivas-Martínez, 2005; Allegrezza *et al.*, 2008; Biondi, 2011; Blasi & Frondoni, 2011).

To define the syntaxonomy, the vegetation dynamics, and the plant landscape, 156 relevés were used, 36 of which were unpublished and were performed in the study area, and 120 of which are published relevés conducted in different areas of the central-southern Apennines (Tomaselli, 1952; Bonin, 1972; Biondi, 1986; Biondi *et al.*, 1986, 2001, 2014a, 2014b; Taffettani, 2000; Allegrezza, 2003; Bonanomi & Allegrezza,

2004; Allegrezza *et al.*, 2014, 2015). The species nomenclature and biological forms follow Aeschimann *et al.* (2004), Conti *et al.* (2005, 2007) and Greuter (2008).

Multivariate analysis was applied to the values of the phytosociological relevés through the use of the VEGAN community ecology package (Oksanen *et al.*, 2015) in the R software (R Development Core Team 2015). The numerical classification obtained by cluster analysis was performed by applying the algorithm of the mean binding and complete binding (Orloci, 1978) to the similarity matrix, calculated by applying the similarity ratio index (Westhoff & Van der Maarel, 1978). Non-metric multidimensional scaling (NMDS) was used to describe the main trends of the floristic variations (Podani, 2007). The results of the cluster analysis were overlaid on the two-dimensional plot of the NMDS.

For the syntaxonomic nomenclature to the alliance, order and class levels, the Prodrome of Italian Vegetation was used (Biondi *et al.*, 2014), with the integrations that followed (Biondi *et al.*, 2015; Allegrezza *et al.*, 2015), and the recently updated interactive web-site of the Italian Botanical Society was consulted (<http://www.prodromovegetazioneitalia.org/>).

Results and discussion

Floristic composition and syntaxonomy

The dendrogram obtained from the classification of the phytosociological relevés considered here (Fig. 2) separates those carried out in the lower Supratemperate

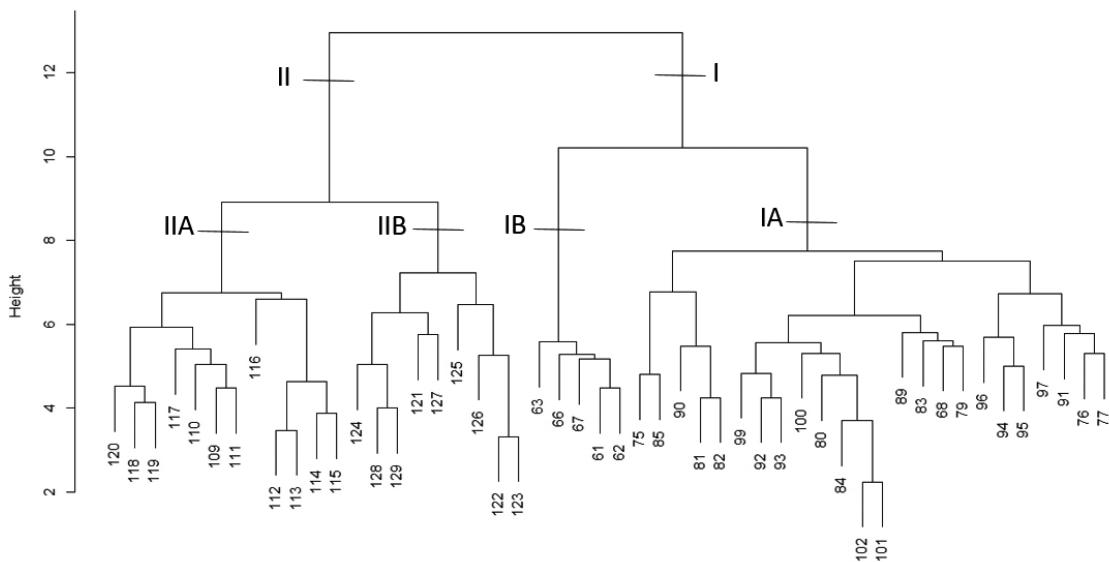


Fig. 2 - Dendrogram from the *Brachypodium rupestre* communities phytosociological relevés: II) in the lower Supratemperate thermotype of central Apennines mountains on limestone substrata [*Tanaceto corymbosi-Brachypodietum rupestris* (IIA) and *Laserpitio siculi-Brachypodietum rupestris* (IIB)]; I) in the Mesotemperate thermotype of subcoastal, pre-Apennine and infra-Apennine sub-mediterranean areas of central and southern Italy [*Galio erecti-Brachypodietum rupestris* (IA) and *Bituminario bituminosae-Brachypodietum rupestris* (IB)].

thermotype on limestone (Cluster II) from those of the Mesotemperate thermotype in the sub-Mediterranean variant (Cluster I). The processing and comparison of the relevés of Table 5 allows the classification of the investigated coenosis into the class *Trifolio-Geranietea* and the order *Asphodeletalia macrocarpi*. In particular, for the Supratemperate thermotype, two new syntaxa are described for the suborder *Senecio scopolii-Brachypodienalia genuensis* of the alliance *Luzulo-Brachypodion genuensis*: *Tanaceto corymbosi-Brachypodietum rupestris*, and *Laserpitio siculi-Brachypodietum rupestris*. For the sub-Mediterranean areas, the new suborder *Dorycnio herbacei-Brachypodienalia rupestris* is proposed, with *Dorycnio herbacei-Brachypodion rupestris* as the alliance *typus*. The two new associations are referred to this: *Galio erecti-Brachypodietum rupestris* (association *typus*), and *Bittuminario bituminosae-Brachypodietum rupestris*.

APENNINES MOUNTAINS ON LIMESTONE SUBSTRATA IN THE LOWER SUPRATEMPERATE THERMOTYPE

TANACETO CORYMBOSI-BRACHYPODIETUM RUPESTRIS ass. nova *hoc loco* (*Holotypus* rel. 5 of Tab. 1)

Tab. 1 - *Tanaceto corymbosi-Brachypodietum rupestris* ass. nova *hoc loco* (*Holotypus* rel. 5); *tanacetosum corymbosi* subass. nova *subass. typus* (rels. 1-5); *helleboretosum bocconeai* subass. nova *hoc loco* (rels. 6-9; *Holotypus* rel. 6); *Galium aparine* variant (rels. 10-12).

Biological form	N. rel.													Presences Class. Press.
		1	2	3	4	5*	6**	7	8	9	10	11	12	
Groups from dendrogram (Fig.2)		IIA	IIA	IIA	IIA	IIA	IIA	IIA	IIA	IIA	IIA	IIA	IIA	
N. rel. from dendrogram (Fig. 2) and NMDS (Figs. 3 and 4)		109	110	111	116	117	112	113	114	115	118	119	120	
Altitude (m a.s.l.) x 10		90	90	91	120	975	124	126	126	125	91	92	95	
Aspect		WSW	SW	W	WNW	NW	E	ESE	SE	SE	WSW	NNW	NW	
Slope (°)		20	20	25	30	20	20	30	20	20	20	10	10	
Coverage (%)		100	100	100	100	100	100	100	100	100	100	100	100	
Area (m²)		30	20	20	20	10	20	30	30	20	20	20	20	
N. species x rel.		19	23	19	27	18	12	16	19	14	16	11	21	
Charact. and diff. species of the ass. .														
H caesp Brachypodium rupestre (Host) Roem. & Schult.		5.5	5.5	5.5	4.4	5.5	4.4	5.5	5.5	5.5	4.5	5.5	5.5	12 V
H scap Tanacetum corymbosum (L.) Sch. Bip. subsp. achilleae (L.) Greuter		2.3	3.4	3.4	2.2	1.1	1.2	2.3	+.2	2.3	.	.	.	9 IV
H scap Rumex acetosa L. subsp. acetosa		+	+.2	+.2	.	+	.	.	.	.	+.2	.	+.2	6 III
H scap Filipendula vulgaris Moench		.	.	+	.	.	1.2	1.1	1.1	1.1	.	.	.	5 II
Diff. species of the <i>helleboretosum bocconeai</i> subass.														
G rhiz Helleborus bocconeii Ten. subsp. bocconeii		2.3	+.2	+.2	+	.	.	.	4 II
H ros Leontodon cichoraceus (Ten.) Sanguin.		+	1.1	.	+.2	+.2	.	.	.	4 II
H scap Campanula micrantha Bertol.		2.3	+.2	.	1.2	.	.	.	3 II
Diff. species of the <i>Galium aparine</i> variant														
T scap Galium aparine L.		+.2	+.2	+.2	3 II
H scap Lamium maculatum L.		+.3	+.2	.	2 I
<i>Luzulo sieberi-Brachypodion genuensis</i> , <i>Senecio scopolii-Brachypodienalia genuensis</i> , <i>Asphodeletalia macrocarpi</i>														
Ch suffr Helianthemum nummularium (L.) Mill. subsp. obscurum (Čelak.) Holub		1.2	+.2	1.1	+.2	.	.	.	+.2	1.1	.	.	1.1	7 III
H scap Crucia glabra (L.) Ehrend. subsp. glabra		.	2.2	1.2	+.2	1.1	.	.	.	.	1.2	1.2	2.3	7 III
H scap Cyanus triumfetti (All.) Dostál ex A. et D. Löve		1.1	1.2	.	.	1.1	.	+.2	+	.	.	.	.	5 II
G rhiz Asphodelus macrocarpus Parl. subsp. macrocarpus		+.2	.	+.2	.	+	.	.	+	.	.	.	.	4 II
H caesp Trifolium ochroleucum Huds.		2.2	.	2.2	.	+.2	.	.	.	.	.	.	.	3 II
H ros Viola alba Besser subsp. dehnhardtii (Ten.) W. Becker		.	+.3	1.1	.	.	.	+.2	.	.	.	.	.	3 II
H scap Knautia purpurea (Vill.) Borbás		+	.	.	.	+	.	.	.	2 I
H caesp Luzula sylvatica (Huds.) Gaudin subsp. sieberi (Tausch) K. Richt.		+.2	.	.	.	.	.	.	.	1 I
H ros Silene italica (L.) Pers. subsp. italica		.	+	1 I
<i>Trifolio-Geranietea</i>														
Ch suffr Teucrium chamaedrys L. subsp. chamaedrys		+.2	+.2	+.2	.	+.2	.	.	+.2	.	+.2	+.2	7 III	
H scap Geranium sanguineum L.		.	1.1	.	.	.	+.2	2.2	1.2	.	2.3	.	.	5 II
H rept Fragaria vesca L. subsp. vesca		.	.	1.2	+.3	.	+.2	1.2	.	.	.	.	.	4 II
H scap Geum urbanum L.		.	.	.	+	+	.	2 I

	Others species																								
H scap	Trifolium pratense L. subsp. pratense	.	1.2	+.2	+	.	.	.	1.1	1.1	1.1	1.2	1.2	8	IV										
H scap	Stachys recta L. (s.l.)	1.1	+.2	.	.	.	.	+.2	.	.	.	.	1.2	4	II		
H caesp	Centaurea scabiosa L. subsp. scabiosa	1.1	.	.	.	.	.	.	+.2	.	+	.	+	4	II				
H scap	Centaurea ambigua Guss. (s.l.)	.	2.3	.	+.2	.	.	+.2	1.1	.	.	.	.	4	II						
H scap	Achillea millefolium L. subsp. millefolium	.	+.2	+.2	.	.	+.2	.	.	.	.	.	1.2	4	II					
H scap	Ranunculus neapolitanus Ten.	+.2	.	1.2	.	.	.	.	.	.	.	+.2	+.2	4	II			
P caesp	Sorbus aria (L.) Crantz subsp. aria (pl.)	.	.	.	+	+	+.2	+.2	.	.	.	.	.	4	II					
	Accidental species													8	8	5	17	7	2	4	7	4	8	3	10

ciation *Tanaceto corymbosi-Brachypodietum rupestris* towards the forest edges of the alliance *Digitalidi microcarthae-Trifolion medii*, with the presence of species of the alliance *Geranion sanguinei*, while the *Galium aparine* variant indicates the nitrophilous aspects (rels. 10-12). At the syntaxonomic level, the new association is referred to the alliance *Luzulo sieberi-Brachypodion*

genuensis and to the suborder *Senecio scopolii-Brachypodienalia genuensis*.

LASERPITIO SICULI-BRACHYPODIETUM RUPESTRIS ass. nova *hoc loco* (Holotypus rel. 4 of Tab. 2)

This is a dense herbaceous community of the current upper limits of the forests on steep slopes of mountains,

Tab. 2 - *Laserpitio siculi-Brachypodietum rupestris* ass. nova *hoc loco* (Holotypus rel. 4).

Biological form	N. rel.	1 2 3 4* 5 6 7 8 9									Presences Class. Press.	
		IIB	IIB	IIB	IIB	IIB	IIB	IIB	IIB	IIB		
Groups from dendrogram (Fig.2)		121	122	123	124	125	126	127	128	129		
N. rel. from dendrogram (Fig. 2) and NMDS (Figs. 3 and 4)		141	132	132	141	131	130	139	142	142		
Altitude (m a.s.l.) x 10		SE	NW	NW	NNW	NW	NW	W	N	N		
Aspect		15	35	35	40	35	30	45	40	40		
Slope (°)		100	100	100	100	100	100	100	100	100		
Coverage (%)		15	15	20	25	25	30	15	15	15		
Area (m ²)		27	19	19	26	30	18	28	15	14		
N. species x rel.												
Charact. and diff. species of the ass. .												
H caesp	Brachypodium rupestre (Host) Roem. & Schult.	5.5	4.5	4.5	4.5	4.4	4.4	4.4	4.4	5.5	9	V
H bienn	Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti et Gubellini	2.2	.	+.2	1.1	.	.	+	1.1	1.1	6	IV
Ch suffr	Genista radiata (L.) Scop.	+.2	1.2	+.2	+	+.2	.	.	.	.	5	III
Ch suffr	Cerastium arvense L. subsp. suffruticosum (L.) Ces.	.	1.2	+.2	.	+	+.3	+	.	.	5	III
H scap	Pimpinella major (L.) Huds.	.	.	+	.2	.	.	+	+	+.2	4	II
H scap	Galium lucidum All. subsp. lucidum	+	1.1	1.1	+	.	.	.	.	.	4	II
G rhiz	Doronicum columnae Ten.	.	.	.	+	+	+.2	.	.	.	3	II
<i>Luzulo sieberi-Brachypodenion genuensis</i> , <i>Brachypodienalia genuensis</i> , <i>Asphodeletalia macrocarpi</i>												
Ch suffr	Helianthemum nummularium (L.) Mill. subsp. obscurum (Čelak.) Holub	1.1	+.2	+.2	+	+.2	+.2	+	.	.	7	IV
H scap	Viola eugeniae Parl. subsp. eugeniae	+	+	+	+	+.2	+.3	+	.	.	6	IV
H scap	Cyanus triumfetti (All.) Dostál ex Ā. et D. Löve	+	1.2	1.1	.	.	+.3	.	.	+	5	III
H caesp	Luzula sylvatica (Huds.) Gaudin subsp. sieberi (Tausch) K. Richt.	.	.	.	+.2	1.1	.	1.2	+.2	+.2	5	III
H scap	Campanula micrantha Bertol.	.	.	.	+	1.1	.	1.1	.	1.1	4	II
H caesp	Carex macrolepis DC.	.	+.2	1.2	.	+.2	.	.	.	.	3	II
H ros	Viola alba Besser subsp. dehnhardtii (Ten.) W. Becker	+	+.2	.	.	.	.	.	.	.	2	I
H scap	Knautia purpurea (Vill.) Borbás	+	.	.	.	.	.	+	.	.	2	I
H scap	Cruciata glabra (L.) Ehrend. subsp. glabra	+	.	.	.	.	.	.	.	.	1	I
<i>Trifolio-Geranietea</i>												
Ch suffr	Teucrium chamaedrys L. subsp. chamaedrys	1.2	1.2	1.2	+.2	.	.	.	.	.	4	II
H scap	Geranium sanguineum L.	.	.	.	.	.	.	+	+	1.2	3	II
H rept	Fragaria vesca L. subsp. vesca	.	+.2	.	.	+.2	2.2	.	.	.	3	II
H scap	Hypericum perforatum L. subsp. perforatum	+	.	.	.	.	.	+.2	.	.	2	I
H scap	Trifolium alpestre L.	+	.	.	.	.	.	+	.	.	2	I
H scap	Lactuca muralis (L.) Gaertn.	+	.	.	.	+	.	.	.	.	2	I
H scap	Bupleurum falcatum L. subsp. cernuum (Ten.) Arcang.	.	+	+	.	.	.	.	.	.	2	I
Other species												
H caesp	Bromopsis erecta (Huds.) Fourr. subsp. erecta	+	+.2	+.2	.	.	.	+.2	+.2	.	5	III
H scap	Campanula glomerata L.			+.2	+.2	+		1.2	1.1		5	III
Ch suffr	Euphorbia amygdaloides L. subsp. amygdaloides	.	.	.	+	+	.	+.2	+	+	5	III
P scap	Fagus sylvatica L. subsp. sylvatica p.l.	+	.	.	+.2	+	+	.	.	.	4	II
H scap	Viola reichenbachiana Jord. ex Boreau	+	.	.	+	1.1	.	.	+.2	.	4	II
H caesp	Festuca circummediterranea Patzke	+	+.2	.	.	.	.	1.2	.	.	3	II
P caesp	Sorbus aria (L.) Crantz subsp. aria (pl.)	+	.	.	+	.	.	.	.	+.2	3	II
H scap	Leucanthemum vulgare Lam. subsp. vulgare	.	.	.	+	.	.	+.2	+	.	3	II
H scap	Lotus corniculatus L. subsp. corniculatus	.	.	.	+	.	.	.	+	+	3	II
Accidental species												
		8	3	5	7	16	10	11	5	4		

often under conditions of high hydrogeological risk, where it is a durable pioneer edge species in contact with the high-shrub pre-forest edaphoxerophilous vegetation of the association *Lathyrо veneti-Fagetum sylvaticae* subass. *sorbetosum ariae* and with the *Genista radiata* chamaephytic vegetation of the association *Cyano triumfetti-Genistetum radiatae*. The characteristic and differential species of the new association (Tab. 2) are: *Brachypodium rupestre*, *Laserpitium siler* subsp. *siculum*, *Genista radiata*, *Cerastium arvense* subsp. *suffruticosum*, *Pimpinella major*, *Galium lucidum* subsp. *lucidum*, and *Doronicum columnae*. At the syntaxonomic level, the new association is referred to the alliance *Luzulo sieberi-Brachypodion genuensis* and the suborder *Senecio scopolii-Brachypodiensia genuensis*.

MESOTEMPERATE THERMOTYPE OF SUBCOASTAL, PRE-APENNINES AND INFRA-APENNINES SUB-MEDITERRANEAN AREAS

DORYCNIO HERBACEI-BRACHYPODIENALIA RUPESTRIS subord. novo *hoc loco* (*Holotypus*: *Dorycnio herbacei-Brachypodion rupestris* all. nova *hoc loco*)

This new suborder brings together the vegetation of the heliophilous edges with a dominance of *Brachypodium rupestre* in the Mesotemperate thermotype in the sub-Mediterranean variant of the Temperate macroclimate. This is for the sublithoral sectors to the Apennine and infra-Apennine central-southern foothills, on marl-sandstone, chalky marl, silty-sandy, clayey and sandy substrates, with the optimum of deep alluvial soils that are rich in silt. Under disturbed conditions, this can replace the forest edges of the orders *Origanetalia vulgaris* and *Antherico-Geranietalia*. This is preferentially a part of the dynamic context and landscape of the oak forests of the alliances *Carpinion orientalis* and *Teucrio-Quercion cerridis*. Through dynamic invasion, this colonises former croplands and grasslands that are no longer used, of the alliance *Polygalo mediterraneae-Bromion erecti*. In the Mesotemperate thermotype, the new syntaxa replaces the purely calcareous Supratemperate Apennine suborders of the order *Asphodeletalia macrocarpi*: *Senecio scopolii-Brachypodiensia genuensis* and *Asphodelenalia macrocarpi*. The characteristic and differential species of suborder *Dorycnio herbacei-Brachypodiensia rupestris* are: *Brachypodium rupestre*, *Dorycnium herbaceum*, *Bituminaria bituminosa*, *Inula viscosa*, *Viola alba* subsp. *dehnhardtii*, *Cruciata glabra* subsp. *glabra*, *Helianthemum nummularium* subsp. *obscurum*, *Galium mollugo* subsp. *erectum*, *Agrimonia eupatoria*, *Calamintha nepeta* (s.l.), *Clinopodium vulgare*, *Dorycnium hirsutum*, *Dactylis glomerata* subsp. *glomerata*, *Lathyrus sylvestris* subsp. *sylvestris*, *Cota tinctoria* (s.l.), *Genista tinctoria* and *Centaurea jacea* subsp. *gaudini*. The constant presence of *Dactylis glomerata*

subsp. *glomerata*, which is inserted as a combination of characteristic species that are specifically the differential species of the suborder, highlights the anthropogenic origins of the edge communities of this syntaxon, as well as their mesophilous nature.

DORYCNIO HERBACEI-BRACHYPODION RUPESTRIS all. nova *hoc loco* (*Holotypus*: *Galio erecti-Brachypodietum rupestris* ass. nova *hoc loco*)

This is a community of heliophilous mesophilic sub-Mediterranean edges with *Brachypodium rupestre*. The optimum is in the hilly pre-Apennine and infra-Apennine areas of central-southern Italy, on non-calcareous substrates, in dynamic link with post-cultivation grasslands of the alliance *Polygalo mediterraneae-Bromion erecti*. These connect with the shady forest edges of the orders *Origanetalia vulgaris* and *Antherico-Geranietalia sanguinei*, and preferentially they are part of the dynamic and landscaping context of the wood alliances *Carpinion orientalis* and *Teucrio-Quercion cerridis*. The characteristics and differential species of the alliance are the same as indicated for the suborder.

GALIO ERECTI-BRACHYPODIETUM RUPESTRIS ass. nova *hoc loco* (*Holotypus* rel. 3 of Tab. 3) *galietosum erecti* subass. nova subass. *typus* (rels. 1-13) *equisetosum telmatejae* subass. nova *hoc loco* (rels. 14-18; *Holotypus* rel. 14) *Viola alba* subsp. *dehnhardtii* and *Buglossoides purpurocaerulea* variant (rels. 19-23)

This is a heliophilous and mesophilous edge community with a dominance of *Brachypodium rupestre* that is widespread in the pre-Apennine and infra-Apennine hilly areas of central Italy. It develops on marl-sandstone substrate, in conjunction with the woods of the alliance *Carpinion orientalis* and with the post-cultivation grasslands of the association *Centaureo bractetae-Brometum erecti* (*Polygalo mediterraneae-Bromion erecti*). The characteristic and differential species are: *Brachypodium rupestre*, *Galium mollugo* subsp. *erectum*, *Dorycnium herbaceum*, *Dactylis glomerata* subsp. *glomerata*, *Hypericum perforatum* subsp. *perforatum* and *Helianthemum nummularium* subsp. *obscurum*. As well as the subassociation *typus galietosum erecti*, Table 3 shows the new subassociation *equisetosum telmatejae* and the variant of *Viola alba* subsp. *dehnhardtii* and *Buglossoides purpurocaerulea*. The subassociation *galietosum erecti* (rels. 1-13) represents the *typus* of the new association, and develops in slope positions, under conditions of dry soils. This connects with the post-cultivation grasslands of the association *Centaureo bractetae-Brometum* and with the shrub layer of the alliances *Cytision sessilifolii*. The new subassociation *equisetosum telmatejae* (rels. 14-18) is differentiated by: *Schedonorus arundinaceus*

Tab. 3 - *Galio erecti-Brachypodium rapistris* ass. nova *hoc loco* (*Holotypus* rel. 3) ; *galioides* *erecti* subass. nova *subass. typus* (rels. 1-13); *equisetum telmateiae* subass. nova *hoc loco* (rels. 14-18); *Holotypus* rel. 14); *Viola alba* subsp. *dehanhardtii* and *Buglossoides purpureocaelea* variant (rels. 19-23).

subsp. *arundinaceus*, *Equisetum telmateja* and *Holcus lanatus* subsp. *lanatus*, which indicates the conditions of high edaphic humidity linked to substrates with a high clay-marl matrix and with a subplain morphology. These mesophilous conditions are also confirmed by the differential species of pre-forest vegetation of the alliance *Pruno-Rubion ulmifolii*. Finally, the *Viola alba* subsp. *dehnhardtii* and *Buglossoides purpureo-caerulea* variant (rels. 19-23), which is differentiated by *Quercus pubescens* (s.l.), *Viola alba* subsp. *dehnhardtii*, *Buglossoides purpureo-caerulea* and *Campanula persicifolia* subsp. *persicifolia*, is present under conditions where the traditional human activities have resulted in the elimination of the forest edge vegetation.

BITUMINARIO BITUMINOSAE-BRACHYPODIE-TUM RUPESTRIS ass. nova *hoc loco* (*Holotypus rel.* 2 of Tab. 4)

Dorycnium hirsutum variant (rels. 5-6)

This new association (Tab. 4) brings together the communities of heliophilous sub-Mediterranean mesoxerophilous edges dominated by *Brachypodium rupestre* of the hilly sub-coastal areas of the central Adriatic side. These are dynamically linked with the sub-Mediterranean forests of the associations *Roso sempervirentis-Quercetum virgiliiana* and *Fraxino orni-Lauretum nobilis*, predominantly on limestone-marl substrate. Due to the natural dynamics, these preferentially invade the post-cultivation grasslands of the association *Convolvulo elegantissimi-Brometum erecti*. The characteristic and differential species are: *Brachypodium rupestre*, *Inula viscosa*, *Bituminaria bituminosa*, *Pallenis spinosa* and *Sixalis atropurpurea* subsp. *grandiflora*. The *Dorycnium hirsutum* variant (rels. 5-6) of the new association, which is differentiated by *Dorycnium hirsutum* and *Carex flacca* subsp. *flacca*, indicates the relatively mesophilous aspect of the association (especially rel. 6) and the connection with the heliophilous edges of the association *Galio erecti-Brachypodietum rupestris*.

Dynamic contacts and plant landscape

To highlight the ecological autonomy and flora of the *Brachypodium rupestre* communities investigated as compared to the main grassland and forest-edge syntaxa of the same altitudes and landscape ranges, classification of the relevés was carried on the similarity matrix for the coverage values. The NMDS (Fig. 3) shows two floristic gradients: the first (NMDS1) is linked to the light factor, which decreases going from grassland coenoses to those of the shady forest edges, through the heliophilous edge. The second (NMDS2) is linked to the altitude, from the lower Supratemperate thermotype on purely limestone substrates to the lower Mesotemperate thermotype in the sub-Mediterranean

Tab. 4 - *Bituminario bituminosae-Brachypodietum rupestris* ass. nova hoc loco (Holotypus rel. 2); *Dorycnium hirsutum* variant (rels. 5-6).

Biological form	N. rel.	1	2*	3	4	5	6	Presences	Class. Press.
		IB	IB	IB	IB	IB	I		
	Groups from dendrogram (Fig.2)	61	62	63	67	66	68		
	N. rel. from dendrogram (Fig. 2) and NMDS (Figs. 3 and 4)	195	190	195	210	215	320		
	Altitude (m a.s.l.) x 10	E	SE	W	S	S	SE		
	Aspect	5	5	5	15	15	10		
	Slope (°)	100	100	100	100	100	100		
	Coverage (%)	40	30	20	20	20	20		
	Area (m ²)	31	25	29	23	24	20		
	N. species x rel.								
	Charact. and diff. species of the ass.								
H caesp	Brachypodium rupestre (Host) Roem. & Schult.	5.5	4.5	5.5	4.5	5.5	5.5	6	V
H scap	Bituminaria bituminosa (L.) C.H. Stirt.	1.1	+	+.2	+.2	+.2	2.2	6	V
H scap	Inula viscosa (L.) Aiton	1.1	+	1.1	.	+.2	(+)	5	V
H bienn	Pallenis spinosa (L.) Cass.	+	+	+.2	+.2	+	.	5	V
H bienn	Sixalis atropurpurea (L.) Greuter et Burnet subsp. grandiflora (Scop.) Soldano et F. Conti	+.2	+	+.2	1.1	.	+	5	V
	<i>Dorycnium hirsutum</i> variant								
Ch suffr	Dorycnium hirsutum (L.) Ser.	.	.	.	.	+.3	1.2	2	II
G rhiz	Carex flacca Schreb. subsp. flacca	.	.	.	.	+	1.1	2	II
	<i>Dorycnio herbacei-Brachypodion rupestris</i> and <i>Dorycnio herbacei-Brachypodienalia rupestris</i>								
H scap	Dactylis glomerata L. subsp. glomerata	+.2	1.2	1.2	.	+	+.2	5	V
H scap	Calamintha nepeta (L.) Savi (s.l.)	+	1.1	.	1.1	.	+	4	IV
H scap	Agrimonia eupatoria L.	+.2	+	.	.	+.2	.	3	III
H scap	Galium mollugo L. subsp. erectum Syme	.	+.2	+.2	.	.	+.3	3	III
H scap	Dorycnium herbaceum Vill.	.	2.2	.	.	.	2.3	2	II
H scand	Lathyrus sylvestris L. subsp. sylvestris	.	.	+.2	.	.	.	1	I
	<i>Asphodeloletalia macrocarpi</i> and <i>Trifolio-Geranietea</i>								
H scap	Hypericum perforatum L. subsp. perforatum	+	+.2	+.2	+	+	.	5	V
H scap	Origanum vulgare L. subsp. vulgare	+.2	+	.	.	.	.	2	II
Ch suffr	Teucrium chamaedrys L. subsp. chamaedrys	.	+.2	.	.	.	.	1	I
	<i>Rhamno-Prunetea</i>								
P lian	Clematis vitalba L.	+.2	+.2	+.2	.	+	.	4	IV
NP	Rubus ulmifolius Schott	+	+.2	.	.	+.2	.	3	III
P caesp	Cornus sanguinea L. (s.l.)					+	+	2	II
	<i>Quercetea ilicis</i>								
NP	Asparagus acutifolius L.	+	+	+.2	+	+	.	5	V
P lian	Rubia peregrina L. subsp. peregrina	1.1	1.1	.	+	1.1	.	4	IV
	Others species								
T scap	Avena fatua L.	+	+	1.1	+	.	.	4	IV
P scap	Quercus pubescens Willd. (s.l.) pl.	+	+	.	+	+	.	4	IV
H caesp	Bromopsis erecta (Huds.) Fourr. subsp. erecta	+.2	.	+.2	.	+.2	+.2	4	IV
H scap	Foeniculum vulgare Mill.	+	.	+.2	+	.	+	4	IV
H caesp	Poa trivialis L.	.	+.2	+.2	+.2	+.2	.	4	IV
T scap	Vicia sativa L. (s.l.)	+.2	.	+	+.2	.	.	3	III
H scap	Lotus corniculatus L. subsp. corniculatus	+	+	.	.	.	+.2	3	III
G rhiz	Elymus repens (L.) Gould. subsp. repens	+.2	+.2	+.2	.	.	.	3	III
H scap	Sulla coronaria (L.) Medik.	+	.	1.2	.	.	(+.)	3	III
	Accidental species	9	3	11	10	7	6		

variant. This thus highlights two distinct landscapes: that of the Supratemperate thermotype in the macro-thermal calcareous beechwood *sigmetum* (*Lathyro veneti-Fagenion sylvaticae*), and that of the sub-Mediterranean landscape of the alliance *Carpinion orientalis* (Blasi, 2010; Blasi *et al.*, 2014).

The NMDS obtained shows clear distinction of the types and the autonomy of the described communities

dominated by *Brachypodium rupestre*. Such floristic autonomy with coverage values for *Brachypodium rupestre* of over 80% and low numbers of species (<25 species; mean number of species: 20 per relevé). This is realized only under conditions of continued absence of human disturbance, and in the deep soils, mainly in heliophilous ecotone positions, in valleys and on grasslands that were abandoned a long time ago.

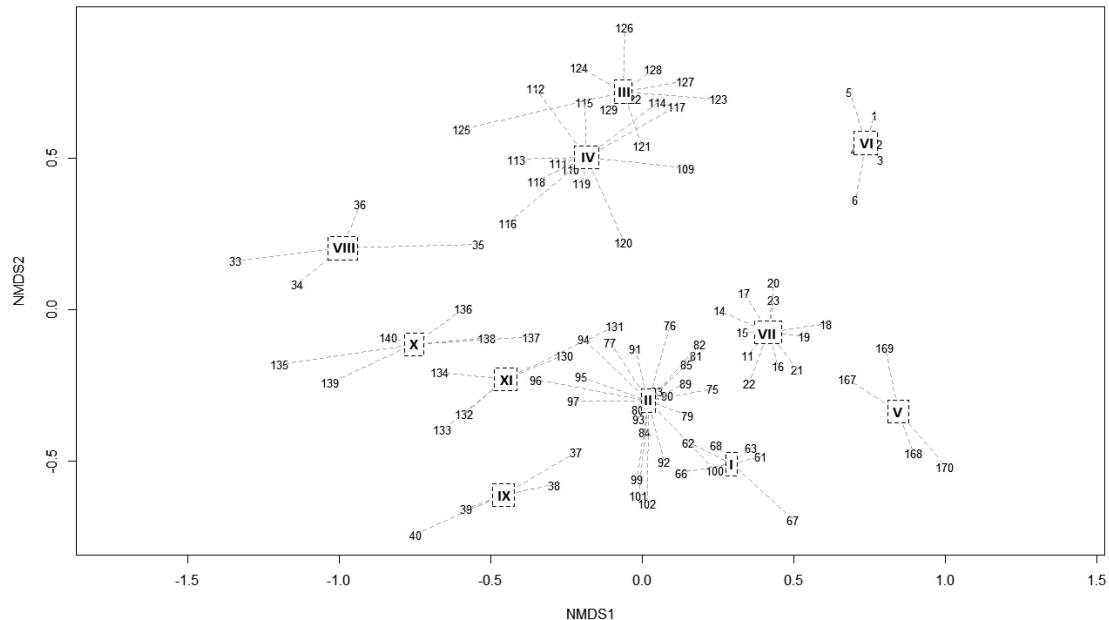


Fig. 3 - NMDS ordination (axes NMDS1 and NMDS2) from the *Brachypodium rupestre* communities phytosociological relevés and published relevées referred to several typical forest edge and grasslands communities described in the areas study: I: *Bituminario bituminosae-Brachypodietum rupestris* (Tab. 4); II: *Galio erecti-Brachypodietum rupestris* (Tab. 3); III: *Laserpitio siculi-Brachypodietum rupestris* (Tab. 2); IV: *Tanaceto corymbosi-Brachypodietum rupestris* (Tab. 1); V: *Convolvulo elegantissimi-Brometum erecti* (rels. 2, 6, 7, 11 of Tab. 16 in Biondi, 1986); VI: *Brizo mediae-Brometum erecti* (rels. 1-6 of Tab. 48 in Allegrezza, 2003); VII: *Centaureo bracteatae-Brometum erecti* (rels. 1-13 of Tab. 1 in Biondi et al., 1986); VIII: *Digitali micranthae-Helleboreum boconeui* subass. *veratretosum nigri* (rels. 21-24 of Tab. 2 in Biondi et al., 2001); IX: *Centaureo neapolitanae-Galietum albi* (rels. 1-4 of Tab. 5 in Taffetani 2000); *Digitali micranthae-Helleboreum boconeui* subass. *typus* (rels. 27, 37, 31, 40, 41, 42 of Tab. 2 in Biondi et al. 2001); XI: *Pilostemo stricti-Melampyretum italicci* (rels. 5, 9, 10, 12, 13 of Tab. 1 in Biondi et al. 2001).

For the conditions of under use or where the abandonment of the traditional human practices was recent, a lower concentration of *Brachypodium rupestre* is seen, with coverage that generally does not exceed 50%. Under these conditions, *Brachypodium rupestre* only marginally affects the composition and floristic richness of the grasslands, such that this can be considered *Brachypodium rupestre* facies or variants, or possibly a subassociation within the syntaxon of the reference grassland. These subassociations or *Brachypodium rupestre* variants indicate only the beginning of colonisation by the heliophilous edges, which if not countered, will inevitably lead to the replacement of the different grassland syntaxa with communities that belong to the class *Trifolio-Geranietea*.

General considerations on the syntaxonomy of the *Brachypodium rupestre* communities in central and southern Italy

The described comparisons of the relevés carried out and the plant communities of the order *Asphodeletalia macrocarpi* (Fig. 4, Tab. 5) show clear differentiation between the sub-Mediterranean communities of the suborder *Dorycnio herbacei-Brachypodienalia rupestris* and the Apennine purely calcicole of su-

borders *Senecio scopolii-Brachypodienalia genuensis* and *Asphodelenalia macrocarpi*, with the entry of the *Brachypodium* communities of the new associations: *Tanaceto corymbosi-Brachypodietum rupestris*, and *Laserpitio siculi-Brachypodietum rupestris*. In particular, in the NMDS diagram of Fig. 4, the gradient of the Mediterranean influence can be followed: from the Apennine coenoses with *Brachypodium genuense* (suborder *Senecio scopolii-Brachypodienalia genuensis*) of the upper Supratemperate, to those with *Brachypodium rupestre* in the lower Supratemperate (suborder *Senecio scopolii-Brachypodienalia genuensis*), up to the sub-Mediterranean *Brachypodium* communities of the Mesotemperate thermotype, for which the new suborder *Dorycnio herbacei-Brachypodienalia rupestris* is proposed. The synoptic Table 5 shows the characteristic and differential species of the different syntaxa of the order *Asphodeletalia macrocarpi* that have been recognized for central and southern Italy, up to the present state of our knowledge.

The communities described for central-southern Italy that are defined by the dominance or the high presence of *Brachypodium rupestre* refer to the grassland plant communities that are mostly post-cultivation, which are related to the different syntaxa of classes *Festu-*

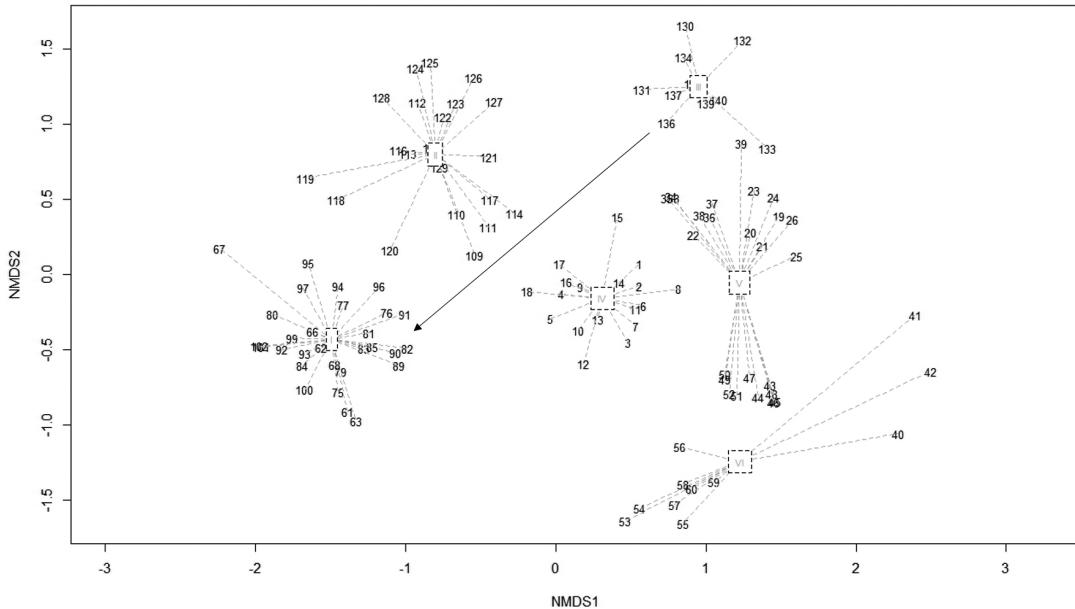


Fig. 4 - NMDS ordination from *Brachypodium rupestre* communities phytosociological relevés and published relevés refered to the *Asphodeloletalia macrocarpi* order (level of alliance and suborder). I) *Galio erecti-Brachypodietum rupestris* (Tab. 3) and *Bituminario bituminosae-Brachypodietum rupestris* (Tab. 4); II) *Tanaceto corymbosi-Brachypodietum rupestris* (Tab. 1) and *Laserpitio siculi-Brachypodietum rupestris* (Tab. 2); III: *Senecio scopolii-Brachypodiinalia genuensis* and *Luzulo sieberi-Brachypodion genuensis* [*Luzulo sieberi-Brachypodietum genuensis* (rels. 1, 2 of Tab. 10 in Allegrezza et al., 2014), *Scillo bifoliae-Brachypodietum genuensis* (rels. 1-4 of Tab. I in Biondi et al., 2015), *Paeonio italicae-Brachypodietum genuensis* (rels. 5-9 of Tab. I in Biondi et al., 2015)]; *Aphodelenalia macrocarpi*: (in Allegrezza et al., 2015) IV) *Thalicstro aquilegiifolii-Asphodelion macrocarpi* [Leontodo cichoracei-*Asphodeloletum macrocarpi* (rels. 1-8 of Tab. 1 in Allegrezza et al., 2015), *Trifolio ochroleuci-Asphodeloletum macrocarpi* (rels. 9-13 of Tab. 1 in Allegrezza et al., 2015) and *Senecio apennini-Asphodeloletum macrocarpi* (rels. 14-18 of Tab. 1 in Allegrezza et al., 2015)]; V) *Cyano triumfettii-Asphodelion macrocarpi* [*Senecio scopolii-Asphodeloletum macrocarpi* (rels. 19-32 of Tab. 1 in Allegrezza et al., 2015) and *Asphodeloletum macrocarpi* (rels. 1-10 of Tab. 4 in Tomaselli, 1952)]; VI) *Hyperico calabricae-Asphodelion macrocarpi* [*Hyperico calabriici-Asphodeloletum macrocarpi* (rels. 1-8 of Tab. 1 in Biondi et al., 2014b) and *Meo athamantici-Asphodeloletum macrocarpi* (rels. 7, 14, 16 of Tab. 1 in Bonin, 1972)].

co-Brometea (*Phleo ambigui-Bromion erecti*, *Polygono mediterraneae-Bromion erecti*) and *Artemisieta vulgaris* (*Inulo-Agropyron repens*). In the different associations described (*Galio lucidi-Brachypodietum rupestris*, *Polygalo flavescentis-Brachypodietum rupestris*, *Centaureo bracteatae-Brometum erecti*, *Centaureo bracteatae-Brometum erecti* subass. *linetosum cathartici*, *Senecio erucifolii-Inuletum viscosae*), the mean number of species for each relevé is relatively high and is still characterised by a strong component of typical grassland species (e.g., *Polygalo flavescentis-Brachypodietum rupestris*), thus justifying the syntaxonomic attribution in different studies.

A preliminary NMDS analysis (data not shown) was performed to evaluate the autonomy of the groups (forest edge/ heliophilous edge/ grassland; see Fig. 3) and therefore for the choice of the relevés with *Brachypodium rupestre* to use for the heliophilous edges. This analysis (especially for the sub-mediterranean plant communities) highlighted the superposition of numerous relevés characterised by high coverage of *Brachypodium rupestre* with those of the grasslands, and

a less than clear differentiation between these groups (*Brachypodium rupestre* heliophilous edge/grassland). These relevés were from the literature for grassland associations and concerned the aspects of these association that are characterised by high coverage of *Brachypodium rupestre*; these relevés were, then, removed from the processing.

Finally, a consideration on the association *Dorycnio-Brachypodietum* that was described by Ubaldi (1988) for Montefeltro (Ubaldi, 1988: Tab. 1, rels. 1-19). Although this combination was considered as an edge community of *Bromion* by Ubaldi (2008), it was not really differentiated at a syntaxonomic level. This represents infra-forest and peri-forest plant communities (mean, 38 species per relevé) with *Brachypodium rupestre*, in which there are many wood species with higher coverage, as well as heliophilous grassland species (e.g., *Bromopsis erecta*, *Dactylis glomerata*). This does not allow their clear interpretation as herbaceous edges that would be in keeping with recent methodological acquisitions (e.g. Biondi et al., 2015a) and was not considered in the processing carried out here.

Tab. 5 - Groups of phytosociological relevés belong to the *Asphodeletalia macrocarpi* recognized in central-southern Italy (the number of groups and the references are the same as Fig. 4).

N. columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Pres.
N. groups from NMDS (Fig. 4)	1	1	II	II	III	III	IV	IV	IV	V	V	VI	VI	VI	
N. rel. x column	6	23	12	9	4	5	2	8	5	5	10	15	3	8	
<i>Bituminario bituminosae-Brachypodietum rupestris</i>															
Sixalis atropurpurea (L.) Greuter et Burnet subsp. <i>grandiflora</i> (Scop.) Soldano et F. Conti															1
Pallenis spinosa (L.) Cass.															1
Bituminaria bituminosa (L.) C.H. Stirt.															1
<i>Galio erecti-Brachypodietum rupestris, Dorycnio herbacei-Brachypodion rupestris and Dorycnio herbacei-Brachypodiella rupestris</i>															
Galium mollugo L. subsp. <i>erectum</i> Syme								I	IV					I	7
Centaurea jacea L. subsp. <i>gaudini</i> (Boiss. & Reut.) Greml.										V	II				5
Clinopodium vulgare L. subsp. <i>vulgare</i>										III	IV	I			5
Lathyrus sylvestris L. subsp. <i>sylvestris</i>								I							3
Dorycnium herbaceum Vill.								II	V						2
Agrimonia eupatoria L.								III	III						2
Calamintha nepeta (s.l.)								IV	II						2
Dorycnium hirsutum (L.) Ser.								II	I						2
Inula viscosa (L.) Aiton								V	I						2
Cota tinctoria (L.) J. Gay (s.l.)								I	I						2
Genista tinctoria L.								. II			I				2
<i>Tanaceteto corymbosi-Brachypodietum rupestris</i>															
Tanacetum corymbosum (L.) Sch. Bip. subsp. <i>achilleae</i> (L.) Greuter									IV		III	2	I	II	5
Centaurea ambigua Guss. (s.l.)									II		I		I		3
<i>Laserpitio siculi-Brachypodietum rupestris</i>															
Galium lucidum All. subsp. <i>lucidum</i>									II		I				2
Pimpinella major (L.) Huds.									II		I				2
Genista radiata (L.) Scop.									III						1
Laserpitium siler L. subsp. <i>siculum</i> (Spreng.) Santangelo, F. Conti et Gubellini									IV				I		2
Doronicum columnae Ten.									II						1
<i>Scillo bifoliae-Brachypodietum genuensis</i>															
Scilla bifolia L.										4			I	1	3
Ranunculus ficaria L. (s.l.)									4						1
<i>Paeonio italicae-Brachypodietum genuensis</i>															
Ranunculus breyninus Crantz										IV					1
Stachys alopecuroides (L.) Benth. subsp. <i>divulsa</i> (Ten.) Grande									III						1
Delphinium fissum Waldst. et Kit. subsp. <i>fissum</i>									II						1
<i>Luzulo sieberi-Brachypodietum genuensis, Luzulo sieberi-Brachypodion genuensis and Senecio scopolii-Brachypodiella genuensis</i>															
Euphorbia cyparissias L.								I	I	I	V	I			8
Sorbus aria (L.) Crantz subsp. <i>aria</i> (pl.)								II	II	1	I	I			7
Luzula sylvatica (Huds.) Gaudin subsp. <i>sieberi</i> (Tausch) K. Richt.								I	III	4	V	2			7
Campanula micrantha Bertol.								II	II	3	IV	2		I	7
Trifolium alpestre L.									I	1	V			IV	6
Carex macrolepis DC.									II	1	IV	1	I		5
Gentiana lutea L. subsp. <i>lutea</i>									4	II	.		II	II	5
Brachypodium genuense (DC.) Roem. et Schult.									4	V	2			V	4
Veratrum nigrum L.									I	IV	2				3
Anemone ranunculoides (L.) Holub									4	V	2				3
<i>Thalictrum aquilegiifolii-Asphodeletum macrocarpi</i>															
Leontodon cichoraceus (Ten.) Sanguin.										II			IV	V	4
Laserpitium latifolium L.										I		1	II		4
Euphorbia amygdaloides L. subsp. <i>amygdaloides</i>										III		I			2
Ferulago campestris (Besser) Grecescu											II				1
Orchis mascula (L.) L. subsp. <i>mascula</i>											II				1
<i>Trifolio ochroleuci-Asphodeletum macrocarpi</i>															
Linum bienne Mill.								I				IV	V	I	4
Prunella vulgaris L. subsp. <i>vulgaris</i>								I				III			2
<i>Senecio apennini-Asphodeletum macrocarpi</i>															
Rumex nebroides Campd.									I	2	V		V	I	5
Centaurea nigrescens Willd. (s.l.)								I				III			2
Festuca stricta ssp. <i>trachyphylla</i> (Hack.) Patzke ex Pils											V				1
Cirsium lobelii Ten.											III		III		1
Senecio apenninus Tausch												III			1
<i>Thalictrum aquilegiifolii-Asphodelion macrocarpi</i>															
Thalictrum aquilegiifolium L. subsp. <i>aquilegiifolium</i>											I	II	IV	II	4
Salvia pratensis L. subsp. <i>pratensis</i>											II	IV	III		3
Campanula rapunculus L.								I				III	V		3
Cirsium morisianum Rchb.											II	II	I		3
Loncomelos pyrenaicus (L.) Hroudka ex J. Holub subsp. <i>sphaerocarpus</i> (A. Kern.) Holub											II	III			2

Cytisophyllum sessilifolium (L.) O. Lang	.	I	I	2
Juniperus communis L. subsp. communis	.	I	.	.	.	.	.	.	.	I	.	.	.	.	2
Crataegus laevigata (Poir.) DC.	.	.	I	.	.	.	I	.	.	.	.	.	.	.	2
<i>Querco-Fagetea</i>																
Fagus sylvatica L. subsp. sylvatica (pl.)	.	.	I	II	.	.	2	I	.	I	.	I	.	I	.	7
Quercus pubescens Willd. (<i>s.l.</i>)	IV	II	I	.	.	.	.	I	.	I	.	.	.	.	5
Hepatica nobilis Schreb.	.	.	I	.	.	2	I	.	.	I	.	.	I	.	4	
Quercus cerris L.	.	I	I	.	.	.	.	.	.	.	.	1	I	3	
Fraxinus ornus L. subsp. ornus	I	I	.	.	.	.	.	.	.	.	.	.	.	.	2
Hedera helix L. subsp. helix	I	I	.	.	.	.	.	.	.	.	.	.	.	.	2
Ostrya carpinifolia Scop.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	2
Buglossoides purpureoerulea (L.) I.M. Johnst.	.	II	I	.	.	.	.	.	.	.	.	.	.	.	2
Solidago virgaurea L. subsp. virgaurea	.	I	I	.	.	.	.	.	.	.	.	.	.	.	2
Campanula trachelium L. subsp. trachelium	.	.	I	I	.	.	.	.	.	.	.	.	.	.	2
Sanicula europaea L.	.	.	.	.	.	1	.	.	.	I	.	.	I	.	2
Veronica officinalis L.	.	.	.	.	.	.	.	.	I	.	I	.	I	.	2
Viola reichenbachiana Jord. ex Boreau	.	.	.	II	.	.	.	I	.	.	.	.	.	.	2
Daphne laureola L.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	2
Myosotis sylvatica Hoffm. subsp. sylvatica	.	.	.	.	.	.	.	.	.	II	.	I	.	I	2
<i>Quercetea ilicis</i>																
Asparagus acutifolius L.	V	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Rosa sempervirens L.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Rubia peregrina L. subsp. peregrina	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Other species																
Lotus corniculatus L. subsp. corniculatus	III	II	I	II	1	II	2	I	III	IV	V	I	.	III	13	
Bromopsis erecta (Huds.) Fourr. subsp. erecta	IV	I	I	III	.	V	1	III	V	III	V	III	.	I	12	
Dactylis glomerata L. subsp. glomerata	V	V	II	I	2	I	1	III	III	V	.	II	.	V	12	
Achillea millefolium L. subsp. millefolium	.	II	II	I	2	V	.	I	V	V	.	III	3	I	11	
Trifolium pratense L. subsp. pratense	.	II	IV	.	2	I	2	I	IV	IV	III	I	.	10		
Galium verum L. subsp. verum	.	II	I	.	2	IV	.	I	I	V	.	IV	.	III	9	
Cruciata laevipes Opiz	.	I	I	I	1	.	.	I	I	II	.	1	III	9		
Rumex acetosa L. subsp. acetosa	.	I	III	I	.	.	.	IV	III	IV	III	II	.	I	9	
Anthoxanthum odoratum L. subsp. odoratum	.	I	I	.	.	.	I	V	IV	V	.	2	III	8		
Bunium bulbocastanum L.	.	I	I	I	.	III	.	I	II	I	.	II	.	.	8	
Trifolium montanum L. subsp. rupestre (Ten.) Nyman	.	.	I	2	V	2	III	III	V	.	II	.	.	8		
Tragopogon pratensis L.	.	I	.	.	2	V	.	I	II	IV	.	II	.	.	7	
Briza media L.	.	I	.	.	1	IV	.	I	III	V	.	II	.	.	7	
Stachys officinalis (L.) Trevis.	.	I	I	.	I	.	I	IV	IV	.	I	.	.	7		
Campanula glomerata L.	.	.	.	III	2	IV	.	I	V	.	I	2	.	7		
Poa trivialis L.	IV	II	.	I	.	.	.	IV	V	.	I	.	II	7		
Eryngium amethystinum L.	.	I	I	.	III	.	.	II	II	V	I	.	.	6		
Sanguisorba minor Scop. subsp. balearica (Bourg. ex Nyman) Muñoz Garm. & C. Navarro	.	I	.	.	I	.	.	II	II	V	I	.	.	6		
Potentilla rigoana Th. Wolf	.	II	I	.	.	.	.	I	IV	I	2	.	.	6	
Festuca circummediterranea Patzke	.	.	II	1	V	.	I	.	II	.	IV	.	.	6		
Galium aparine L.	.	I	II	I	.	.	I	.	I	I	.	I	.	6		
Ranunculus neapolitanus Ten.	.	II	II	.	.	.	II	I	IV	.	I	.	6			
Agrostis capillaris L.	.	.	.	3	II	.	.	IV	IV	.	I	.	.	5		
Carex flacca Schreb. subsp. flacca	II	III	I	.	.	.	.	I	I	.	.	.	.	5	
Poa alpina L. subsp. alpina	.	.	.	4	II	.	.	I	.	II	2	.	5			
Dianthus carthusianorum L. (<i>s.l.</i>)	.	.	I	.	I	.	.	I	I	.	I	.	5			
Gymnadenia conopsea (L.) R. Br.	.	I	.	1	.	.	I	II	I	.	5					
Plantago argentea Chaix subsp. argentea	.	.	.	V	1	.	.	III	I	1	.	5				
Acinos alpinus (L.) Moench subsp. alpinus	.	I	I	I	.	.	I	.	IV	.	.	5				
Luzula campestris (L.) DC.	.	.	I	.	I	.	I	II	.	II	.	III	5			
Dactylorhiza sambucina (L.) Soó	.	.	.	4	.	.	I	I	I	II	.	II	.	5		
Arabis hirsuta (L.) Scop.	.	.	I	.	I	.	I	II	.	I	.	5				
Daucus carota L. (<i>s.l.</i>)	II	III	I	.	.	.	I	II	.	.	.	.	5		
Sporadic species																
33	62	29	34	11	23	5	7	17	62	19	41	16	26			

Conclusions

This phytosociological study of the heliophilous edges dominated by *Brachypodium rupestre* of central and southern Italy, from the lower Supratemperate thermotype to the lower Mesotemperate thermotype, has allowed the description of four new syntaxa of the order *Asphodeletalia macrocarpi*, which has help extend their biogeographic, bioclimatic and landscaping areal distribution. On the basis of the analyses perfor-

med, three suborders for the order *Asphodeletalia macrocarpi* are recognized here for central and southern Italy: *Asphodelenalia macrocarpi* (suborder *typus*) for heliophilous edges with *Asphodelus macrocarpus* subsp. *macrocarpus* of the Supratemperate thermotype in the Apennine sector; *Senecio scopolii-Brachypodetalia* for the Apennine calcareous communities with a dominance of *Brachypodium genuense/Brachypodium rupestre*, of the Supratemperate thermotype; and *Dorycnio herbacei-Brachypodienalia rupestris* for the

heliophilous edges with *Brachypodium rupestre*, of the Submediterranean sub-coastal, pre-Apennine and infra-Apennine territories.

Finally, in terms of the communities with a dominance or high presence of *Brachypodium rupestre* of central and southern Italy, these communities can still be considered as coenosis of grasslands or post-cultivation, due to the high mean numbers of species per relevé, which are still characterised by strong components of species that are typical of grasslands and that justify the syntaxonomic allocation in different

previous studies. However, the plant communities of grasslands that are characterised by high levels of *Brachypodium rupestre* coverage indicate the beginning of the colonisation by the heliophilous edges. If this is not countered, this will lead to the replacement of the different grassland syntaxa that belong to the habitats of Community Interest [and in particular, habitat *6210 “Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchid sites)] with communities that belong to the class *Trifolio-Geranietea*.

Syntaxonomic scheme

TRIFOLIO MEDII-GERANIETEA SANGUINEI Müller 1962

ASPHODELETALIA MACROCARPI Biondi & Allegrezza in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi 2014

ASPHODELENALIA MACROCARPI Allegrezza & Biondi in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Poldini, Sburlino, Vagge & Venanzoni 2015

Cyano triumfetti-Asphodelion macrocarpi Biondi & Allegrezza in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi 2014

Senecio scopolii-Asphodeletum macrocarpi Biondi & Allegrezza in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi 2014

Asphodeletum macrocarpi Tomaselli 1952 corr. Allegrezza, Biondi, Ballelli, Tesei & Ottaviani 2015

Thalictro aquilegiifolii-Asphodelion macrocarpi Allegrezza, Biondi, Ballelli, Tesei & Ottaviani 2015

Leontodo cichoracei-Asphodeletum macrocarpi Allegrezza, Biondi, Ballelli, Tesei & Ottaviani 2015

Trifolio ochroleuci-Asphodeletum macrocarpi Allegrezza, Biondi, Ballelli, Tesei & Ottaviani 2015

Senecio apennini-Asphodeletum macrocarpi Allegrezza, Biondi, Ballelli, Tesei & Ottaviani 2015

Hyperico calabricae-Asphodelion macrocarpi Biondi, Gangale & Uzunov in Biondi, Casavecchia, Pesaresi, Gangale & Uzunov 2014

Hyperico calabricae-Asphodeletum macrocarpi Biondi, Gangale & Uzunov in Biondi, Casavecchia, Pesaresi, Gangale & Uzunov 2014

Meo athamantici-Asphodeletum macrocarpi Bonin 1972 corr. Allegrezza, Biondi, Ballelli, Tesei & Ottaviani 2015

SENECIO SCOPOLII-BRACHYPODIENALIA GENUENSIS Allegrezza & Biondi in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Poldini, Sburlino, Vagge & Venanzoni 2015

Luzulo sieberi-Brachypodion genuensis Allegrezza & Biondi in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Poldini, Sburlino, Vagge & Venanzoni 2015

Luzulo sieberi-Brachypodietum genuensis Allegrezza, Ballelli, Ciucci, Mentoni & Pesaresi 2014

Scillo bifoliae-Brachypodietum genuensis Allegrezza, Biondi, Ballelli, Ciucci & Tesei in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Poldini, Sburlino, Vagge & Venanzoni 2015

Paeonio italicae-Brachypodietum genuensis Allegrezza, Biondi, Ballelli, Ciucci & Tesei in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Poldini, Sburlino, Vagge & Venanzoni 2015

Tanaceto corymbosi-Brachypodietum rupestris ass. nova *hoc loco*

tanacetosum corymbosi subass. nova subass. *typus*

helleboretosum bocconei subass. nova *hoc loco*

Galio aparine variant

Laserpitio siculi-Brachypodietum rupestris ass. nova *hoc loco*

DORYCNIO HERBACEI-BRACHYPODIENALIA RUPESTRIS subord. novo *hoc loco*

Dorycnio herbacei-Brachypodion rupestris all. nova *hoc loco*

Galio erecti-Brachypodietum rupestris ass. nova *hoc loco*

galietosum erecti subass. nova subass. *typus*

equisetosum telmateiae subass. nova *hoc loco*

Viola alba subsp. *dehnhardtii* and **Buglossoides purpurocaerulea** variant

Bituminario bituminosae-Brachypodietum rupestris ass. nova *hoc loco*

Dorycnium hirsutum variant

Other syntaxa quoted in the text, in figures and in tables

Antherico-Geranietalia sanguinei Julve ex Dengler in Dengler, Berg, Eisenberg, Isermann, Jansen, Koska, Löbel, Manthey, Pätzolt, Spangenberg, Timmermann & Wollert 2003; *Artemisietea vulgaris* Lohmeyer, Preising & Tüxen ex Von Rochow 1951; *Brachypodietalia pinnati* Korneck 1974; *Brizo mediae-Brometum erecti* Bruno in Bruno & Covarelli 1968 Biondi & Ballelli 1982; *Bromion* Koch 1926; *Carpinion orientalis* Horvat 1958; *Centaureo bracteatae-Brometum erecti* Biondi, Ballelli, Guitian, Allegrezza & Taffetani 1986; *Centaureo bracteatae-Brometum erecti* Biondi, Ballelli, Guitian, Allegrezza & Taffetani 1986 subass. *linetosum cathartici* Foggi, Lastrucci, Gennai & Viciani 2014; *Centaureo neapolitanae-Galietum albi* Taffetani 2000; *Cirsio-Brachypodion pinnati* Hadac & Klika in Klika & Hadac 1944; *Centaureo triumfetti-Genistetum radiatae* Biondi, Pinzi & Gubellini 2004; *Convolvulo elegantissimi-Brometum erecti* Biondi 1986; *Cytision sessilifolii* Biondi in Biondi, Allegrezza & Guitian 1988; *Dictamno albi-Ferulagion galbaniferae* (Van Gils, Keysers & Launsdach 1975) De Foucault, Rameau & Royer ex Čarni & Dengler in Mucina, Dengler, Bergmeier, Čarni, Dimopoulos, Jahn & Matevski 2009; *Digitalidi micranthae-Helleboretum bocconeii* Biondi, Čarni, Vagge, Taffetani & Ballelli 2001; *Digitalidi micranthae-Trifolion medii* (Čarni 2005) Biondi & Galdenzi in Biondi et al. 2014; *Dorycnio-Brachypodietum Ubaldi* 1988; *Festuco valesiacae-Brometea erecti* Br.-Bl. & Tüxen ex Br.-Bl. 1949; *Fraxino orni-Lauretum nobilis* Allegrezza, Biondi & Felici 2006; *Galio lucidi-Brachypodietum rupestris* Di Pietro & Blasi, 2002; *Geranion sanguinei* Tüxen in Müller 1962; *Inulo-Agropyron repenti* Biondi & Allegrezza 1996; *Lathyro veneti-Fagenion sylvaticae* Zitti, Casavecchia, Pesaresi, Taffetani & Biondi 2014; *Lathyro veneti-Fagetum sylvaticae* Biondi et al. ex Biondi, Casavecchia, Pinzi, Allegrezza & Baldoni in Biondi et al. 2013 subass. *sorbetosum ariae* Allegrezza ex Allegrezza in Biondi et al. 2013; *Nardetalia strictae* Oberdorfer ex Preising 1949; *Origanetalia vulgaris* Müller 1962; *Phleo ambigui-Brometalia erecti* Biondi, Allegrezza, Blasi & Galdenzi in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi 2014; *Phleo ambigui-Bromion erecti* Biondi, Ballelli, Allegrezza & Zuccarello ex Biondi & Galdenzi 2012; *Polygalo flavescentis-Brachypodietum rupestris* Lucchese, Pignatti & Persia 1995; *Polygalo mediterraneae-Brachypodietum rupestris* Di Pietro, Conte & Iamonico 2014; *Polygalo mediterraneae-Bromion erecti* (Biondi, Allegrezza & Zuccarello 2005) Di Pietro in Di Pietro et al. 2015; *Pruno-Rubion ulmifolii* O. Bolòs 1954; *Ptilostemo stricti-Melampyretum italicii* Biondi, Carni, Vagge, Taffetani & Ballelli 2001; *Roso sempervirentis-Quercetum virgiliiana* Biondi 1986 corr. Biondi & Casavecchia in Biondi, Casavecchia & Pesaresi 2010; *Senecio erucifolii-Inuletum viscosae* Biondi & Allegrezza, 1996; *Teucrio siculi-Quercion cerridis* Blasi, Di Pietro & Filesi 2004; *Trifolion medii* Müller 1962.

References

- Aeschimann D., Lauber K., Moser D.M. & Theurillat J.P. 2004. Flora alpina. Voll. 1-3. Zanichelli.
- Allegrezza M., 2003. Vegetazione e paesaggio vegetale della dorsale del Monte San Vicino (Appennino centrale). *Fitosociologia* 40 (1) suppl. 1: 1-118.
- Allegrezza M., Biondi E. & Mentoni M., 2008. Iso-oro-geosigma e iso-orogeoserie nella dorsale calcarea del Monte San Vicino (Appennino centrale). *Fitosociologia* 45 (1): 29-37.
- Allegrezza M., Mentoni M. & Tesi G., 2010. Geomorfologia e paesaggio vegetale: l'esempio della grande frana di Pescacci (Comune di Serra San Quirico - Appennino centrale). *Fitosociologia* 47 (2): 57-97.
- Allegrezza M., Ballelli S., Ciucci V., Mentoni M. & Pesaresi S., 2014. The vegetation and the plant landscape of Monte Sassetto (Sibillini Mountains, Central Apennines). *Plant Sociology* 5 (1): 59-87.
- Allegrezza M., Biondi E., Ballelli S., Tesei G. & Ottaviani C., 2015. The edge communities of *Asphodelus macrocarpus* subsp. *macrocarpus*: the different ecological aspects and a new case study in the central Apennines. *Plant Sociolgy* 52: 19-40.
- Biondi E., 1986. La vegetazione del Monte Conero (con carta della vegetazione alla scala 1:10.000). Regione Marche. Assessorato all'Ambiente, Ancona. pp. 94.
- Biondi E., 1994. The phytosociological approach to landscape study. *Ann. Bot.* 52: 135-141.
- Biondi E., 2011. Phytosociology today: Methodological and conceptual evolution. *Plant Biosystems* 145 (1): 19-29.
- Biondi E., Ballelli S., Allegrezza M., Guitián J. & Taffetani F., 1986. *Centaureo bracteatae-Brometum erecti* ass. nova dei settori marnoso-arenacei dell'Appennino centrale. *Doc. Phytosoc.* 10: 117-126.
- Biondi E., Ballelli S., Allegrezza M. & Zuccarello V., 1995. La vegetazione dell'ordine *Brometalia erecti* Br.-Bl. 1936 nell'Appennino (Italia). *Fitosociologia* 30: 3-45.
- Biondi E., Carni A., Vagge I., Taffetani F. & Ballelli S., 2001. The vegetation of the *Trifolio medii-Geranietea sanguinei* Muller 1962 class in the central part of the Apennines (Italy and San Marino). *Fitosociologia* 38 (1): 55-65.
- Biondi E., Allegrezza M. & Zuccarello V., 2005. Taxonomic revision of the Apennine grasslands belonging to *Brometalia erecti*, and analysis of their relationships with the xerophilous vegetation of *Rosmarinetea officinalis* (Italy). *Phytocoenologia* 35 (1): 129-163.
- Biondi E., Blasi C., Allegrezza M., Anzellotti I., Azzella

- M.M., Carli E., Casavecchia S., Copiz R., Del Vico E., Facioni L., Galdenzi D., Gasparri R., Lasen C., Pesaresi S., Poldini L., Sburlino G., Taffetani F., Vagge I., Zitti S. & Zivkovic L., 2014. Plant communities of Italy: The Vegetation Prodrome. *Plant Biosystems* 148 (4): 728-814.
- Biondi E., Allegrezza M., Casavecchia S., Galdenzi D., Gasparri R., Pesaresi S., Vagge I. & Blasi C., 2014a. New and validated syntaxa for the checklist of Italian vegetation. *Plant Biosystems* 148 (2): 318-332.
- Biondi E., Casavecchia S., Pesaresi S., Gangale C. & Uzonov D., 2014b. New syntaxa for the prodrome of the Italian vegetation. *Plant Biosystems* 148 (4): 723-727.
- Biondi E., Allegrezza, M., Casavecchia S., Galdenzi D., Gasparri R., Pesaresi S., Poldini L., Sburlino G., Vagge I. & Venanzoni R., 2015. New syntaxonomic contribution to the Vegetation Prodrome of Italy. *Plant Biosystems* 149 (3): 603-615.
- Biondi E., Allegrezza, M., Casavecchia S., Galdenzi D., Gasparri R., Pesaresi S., Soriano, Tesei G. & Blasi C., 2015a. New insight on Mediterranean and sub-Mediterranean syntaxa included in the Vegetation Prodrome of Italy. *Flora Mediterranea* 25 (Special Issue): 77-102.
- Blasi C., 2010. La Vegetazione d'Italia. Palombi e Partner S.r.l., Roma.
- Blasi C. & Frondoni R., 2011. Modern perspectives for plant sociology: The case of ecological land classification and the ecoregions of Italy. *Plant Biosystems* 145: 30-37.
- Blasi C., Capotorti G., Copiz R., Guida D., Mollo B., Smiraglia D. & Zavattero L., 2014. Classification and mapping of the ecoregions of Italy. *Plant Biosystems* 148(6): 1255-1345.
- Bobbink R. & Willems J.H., 1987. Increasing dominance of *Brachypodium pinnatum* (L.) Beauv. in chalk grasslands: A threat to a species-rich ecosystem. *Biol. Conserv.* 40: 301-314.
- Bonanomi G. & Allegrezza M., 2004. Effetti della colonizzazione di *Brachypodium rupestre* (Host) Roemer et Schultes sulla diversità di alcune fitocenosi erbacee dell'Appennino centrale. *Fitosociologia* 41: 51-69.
- Bonanomi G., Caporaso S. & Allegrezza M., 2006. Short-term effects of nitrogen enrichment, litter removal and cutting on a Mediterranean grassland. *Acta Oecologica* 30: 419-425.
- Bonanomi, G., Caporaso S. & Allegrezza M., 2009. Effects of nitrogen enrichment, plant litter removal and cutting on a species-rich Mediterranean calcareous grassland. *Plant Biosystems* 143: 443-455.
- Bonanomi G., Incerti G. & Allegrezza M., 2013. Plant diversity in Mediterranean grasslands: the controlling effect of land abandonment, nitrogen enrichment and fairy ring fungi. *Biodivers. Conserv.* 22: 2285-2304.
- Bonin G., 1972. Première contribution à l'étude des pelouses mésophiles et des groupements hygrophytes du Monte Pollino (Calabre). *Phyton*: 14(3-4): 271-280.
- Čarni A., 2005. *Trifolio-Geranietea* vegetations in south and southeast Europe. *Acta Bot. Gallica* 152(4): 483-496.
- Catorci A., Cesaretti S., Gatti R. & Ottaviani G., 2011. Abiotic and biotic changes due to spread of *Brachypodium genuense* (DC.) Roem. et Schult. In sub-mediterranean meadows. *Community Ecology* 12(1): 117-125.
- Conti F., Abbate G., Alessandrini A. & Blasi C., 2005. An Annotated Checklist of the Italian Vascular Flora. Palombi e Partner S.r.l., Roma: 13-420.
- Conti F., Alessandrini A., Bacchetta G., Banfi E., Barberis G., Bartolucci F., Bernardo L., Bonacquisti S., Bouvet D., Bovio M., Brusa G., Del Guacchio E., Foggi B., Frattini S., Galasso G., Gallo L., Gangale C., Gottschlich G., Grunanger P., Gubellini L., Iriti G., Lucarini D., Marchetti D., Moraldo B., Peruzzi L., Poldini L., Prosser F., Raffaelli M., Santangelo A., Scalsellati E., Scortegagna S., Selvi F., Soldano A., Tinti D., Ubaldi D., Uzonov D. & Vidali M., 2007. Integrazioni alla checklist della flora vascolare italiana. *Natura Vicentina* 10: 5-74.
- Dengler J., Berg C., Eisenberg M., Isermann M., Jansen F., Koska I., Löbel S., Manthey M., Pätzolt J., Spannberg A., Timmermann T. & Wollert H., 2003. New descriptions and typifications of syntax within the project 'Plant communities of Mecklenburg-Vorpommern and their vulnerability' - Part I. *Feddes Repert.*, 114: 587-631, Weinheim.
- Dengler J. & Jandt U., 2005. Arbeitsgruppe "Trockenrasen" gegründet –Bericht von der ersten Jahrestagung unter dem Motto "Trockenrasen als Biodiversitätshotspots". *Tuexenia* 25: 375-378.
- Dengler J., Eisenberg M. & Schröder J., 2006. Die grundwasserfernen Saumgesellschaften Nordostniedersachsens im europäischen Kontext -Teil I: Säume magerer Standorte (*Trifolio-Geranietea sanguinei*). *Tuexenia* 26: 51-93.
- Dengler J., Ruprecht E., Szabó A., Turtoreanu D., Beldean M., Ugurlu E., et al. 2009. EDGG cooperation on syntaxonomy and biodiversity of *Festuco-Brometea* communities in Transylvania (Romania): Report and preliminary results. *Bull. Eur. Dry Grassl. Group* 4: 13-19.
- Dengler J., Becker T., Ruprecht E., Szabó A., Becker U., Beldean M., Bita-Nicolae C., Dolnik C., Goia I., Peyrat J., Sutcliffe L.M.E., Turtoreanu P.D. & Ugurlu E., 2012. *Festuco-Brometea* communities of the Transylvanian Plateau (Romania) - a preliminary overview on syntaxonomy, ecology, and biodiversity. *Tuexenia* 32: 319-359.
- Di Pietro R. & Blasi C., 2002. A phytosociological analysis of abandoned olive-grove grasslands of Ascoli mountains (Tyrrhenian district of Central Italy).

- Lazaroa 23: 73-93.
- Di Pietro R., Theurillat J.-P., Capelo J., Fernández-González F., Terzi M., Čarni A. & Mucina L., 2015. Nomenclature and syntaxonomic notes on some high-rank syntaxa of the European grassland vegetation. Lazaroa 36: 79-106.
- European Commission, editor. 2007. Interpretation manual of European Union habitats – EUR27. Brussels: European Commission, DG Environment.
- Foggi B., Lastrucci L., Gennai M. & Viciani D., 2014. The *Festuco-Brometea* grasslands on sandstone and marl-clay-sandstone substrata in Tuscany (Northern-central Italy). Hacquetia 13: 19-56.
- Galié M., Casavecchia S., Galdeani D., Gasparri R., Soriano P., Estrelles E. & Biondi E., 2013. Seed germination behavior of two *Brachypodium* species with a key role in the improvement of marginal areas. Plant Sociology 50 (1): 91-107.
- Greuter W., 2008. Med-Checklist. A critical inventory of vascular plants of the circum-mediterranean countries. Vol. 2. Dicotyledones (*Compositae*). Genève.
- Gutián, J., Izco J. & Amigo J., 1989. El *Mesobromion cantábrico* y su diferenciación occidental. Doc. Phytosoc. 11: 275-281.
- Habel J.C., Dengler J., Janišová M., Török P., Wellstein C. & Wiezik M., 2013. European grassland ecosystems: threatened hotspots of biodiversity. Biodivers. Conserv. 22: 2131-2138.
- Illyés E., Chytrý M., Botta-Dukát Z., Jandt U., Škodová I., Janišová M., Willner W. & Hájek O., 2007. Semidry grasslands along a climatic gradient across Central Europe: Vegetation classification with validation. Journal of Vegetation Science 18 (6): 835-846.
- Köhler B., Gigon A., Edwards P.J., Krüsi B., Langenauer R., Lüscher A., et al. 2005. Changes in the composition and conservation value of limestone grassland in Northern Switzerland after 22 years of contrasting management. Persp. Plant Ecol. Evol. Syst. 7: 51-67.
- Kull K. & Zobel M., 1991. High species richness in an Estonian wooded meadow. Journal of Vegetation Science 2: 711-714.
- Lucchese F., 1990. Ruolo di alcune specie di *Brachypodium* nelle associazioni prative e forestali. Not. Fitosc. 23: 173-188.
- Lucchese F., Persia G. & Pignatti S., 1995. I prati a *Bromus erectus* Hudson dell'Appennino laziale. Fitoscologia 30: 145-180.
- Oksanen J., Blanchet F.G., Kindt R., Legendre P., Minchin P.R., O'Hara R.B., Simpson G.L., Solymos P., Henry M., Stevens H. & Wagner H., 2015. Vegan: Community Ecology Package. R package version 2.3-2. <http://CRAN.R-project.org/package=vegan>.
- Orlóci L., 1978. Multivariate analysis in vegetation research. 2nd ed. Junk, The Hague.
- Peet R.K., van der Maarel E., Rosén E., Willems J.H., Norquist J. & Walker J. 1990. Mechanisms of species coexistence in species-rich grasslands. Bull. Ecol. Soc. Am. 71: 283.
- Pesaresi S., Galdeani D., Biondi E. & Casavecchia S., 2014. Bioclimate of Italy: application of the worldwide bioclimatic classification system. Journal of Maps 10: 538-553.
- Podani J., 2007. Analisi ed esplorazione multivariata dei dati in ecologia e biologia. Liguori Editore, Napoli.
- R Development Core Team, 2015. R: A Language and Environment for Statistical Computing. R Found. Stat. Comput. Vienna, Austria. Retrieved from <http://www.r-project.org/>.
- Rivas-Martínez S., 2005. Notions on dynamic-catenal phytosociology as a basis of landscape science. Plant Biosystems 139(2): 135-144.
- Rivas-Martínez S., Díaz T.E., Fernández-González F., Izco J., Loidi J., Lousá M. & Penas A., 2002. Vascular plant communities of Spain and Portugal. Addenda to the Syntaxonomical checklist of 2001. Itineraria Geobotanica 15 (1-2): 5-922.
- Rivas-Martínez S., Sáenz S.R. & Penas A., 2011. Worldwide bioclimatic classification system. Global Geobotany 1: 1-634.
- Taffetani F., 2000. Serie di vegetazione del complesso geomorfologico del Monte Ascensione (Italia centrale). Fitoscologia 37(1): 93-151.
- Tomaselli R., 1952. Appunti su un Faggeto dell'Alto Vallone del Retino (Terminillo). Arch. Bot. Ital. 28 (3): 179-204.
- Ubaldi D., 1988. Nuove associazioni vegetali del Montefeltro e dell'alta Valle del Foglia. Proposte e Ricerche 20: 38-47.
- Ubaldi D., 2008. La vegetazione erbacea e gli arbusteti italiani. Tipologie fitosociologiche ed ecologia. ARACNE editrice, Roma, pp. 329.
- Westhoff V. & Van der Maarel E., 1978. The Braun-Blanquet approach. In Whittaker R.H., Classification of Plant Communities: 287-399.

Supplementary material associated with this article (Appendix I "Sporadic species" and Appendix II "Relevès dates and localities") is embedded in the pdf of this article. The online version of *Plant Sociology* is hosted at the journal's website www.scienzadellavegetazione.it/sisv/rivista/rivista_elenco.jsp.

Appendix I: Sporadic species

Tab. 1 - Rel. 1: H scap *Lotus corniculatus* L. subsp. *corniculatus* +, H scap *Galium verum* L. subsp. *verum* 1.1, G bulb *Allium sphaerocephalon* L. +, H scap *Eryngium amethystinum* L. +, H caesp *Bromopsis erecta* (Huds.) Fourr. subsp. *erecta* 1.2, H scap *Urospurum dalechampii* (L.) F.W. Schmidt +, G bulb *Allium carinatum* L. subsp. *pulchellum* Bonnier et Layens +, *Lathyrus pratensis* L. subsp. *pratensis* +; Rel. 2: H scap *Stachys officinalis* (L.) Trevis. 1.1, H scap *Galium verum* L. subsp. *verum* +, NP *Rosa canina* L. (s.l.) +, T scap *Chaerophyllum temulum* L. +, T scap *Stellaria media* (L.) Vill. subsp. *media* +, *Potentilla rigoana* Th. Wolf +, H scap *Salvia verbenaca* L. 1.2, Ch suffr *Acinos alpinus* (L.) Moench subsp. *alpinus* +; Rel. 3: H scap *Stachys officinalis* (L.) Trevis. +, H scap *Urospermum dalechampii* (L.) F.W. Schmidt +, P caesp *Crataegus monogyna* Jacq. +, P caesp *Crataegus laevigata* (Poir.) DC. +, H scap *Cruciata laevipes* Opiz +; Rel. 4: H scap *Euphorbia cyparissias* L. +, H scap *Hypericum perforatum* L. subsp. *perforatum* +, H scap *Peucedanum austriacum* (Jacq.) W.D.J. Koch +, H scap *Vicia cfr incana* Gouan +, H scap *Lotus corniculatus* L. subsp. *corniculatus* +, P caesp *Cytisophyllum sessilifolium* (L.) O. Lang +, H scap *Digitalis lutea* L. subsp. *australis* (Ten.) Arcang. +, H scap *Campanula trachelium* L. subsp. *trachelium* +, H scap *Solidago virgaurea* L. subsp. *virgaurea* +, G rhiz *Lathyrus venetus* (Mill.) Wohlf. +, H scap *Melittis melissophyllum* L. +, NP *Emerus majus* Mill. subsp. *emeroides* (Boiss. et Spruner) Soldano et F. Conti +, P caesp *Laburnum anagyroides* Medik. +, H scap *Scabiosa columbaria* L. (s.l.) +, H caesp *Sesleria nitida* Ten. (s.l.) +, H scap *Leucanthemum vulgare* Lam. subsp. *vulgare* +, H scap *Galium mollugo* subsp. *erectum* Syme 1.2; Rel. 5: P scap *Fagus sylvatica* L. subsp. *sylvatica* pl. 1.1, P scap *Acer opalus* Mill. subsp. *obtusatum* (Waldst. et Kit. ex Willd.) Gams 1.1, P scap *Quercus pubescens* Willd. (s.l.) +, G bulb *Bunium bulbocastanum* L. 1.1, H ros *Plantago lanceolata* L. +, G rhiz *Carex flacca* Schreb. subsp. *flacca* 1.2, H scap *Thesium linophyllum* L. +; Rel. 6: H caesp *Silene ciliata* Pourr. subsp. *graefferi* (Guss.) Nyman 1.2, H scap *Centaurea jacea* L. subsp. *gaudini* (Boiss. et Reut.) Greml +, H scap *Asperula purpurea* (L.) Ehrend. +, H scap *Asperula cynanchica* L. subsp. *cynanchica* +, NP *Rubus hirtus* Waldst. et Kit. (group) +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, G bulb *Bunium bulbocastanum* L. +, H scap *Potentilla rigoana* Th. Wolf +, Ch suffr *Asperula purpurea* (L.) Ehrend. +, H scap *Centaurea jacea* L. subsp. *gaudini* (Boiss. et Reut.) Greml +, H scap *Polygala major* Jacq. +; Rel. 2: NP *Rosa canina* L. (s.l.) +, Ch suffr *Satureja montana* L. +, *Thymus serpyllum* L. (s.l.) +; Rel. 3: H scap *Euphorbia cyparissias* L. +, NP *Rosa canina* L. (s.l.) +, H ros *Plantago lanceolata* L. +, T scap *Arenaria serpyllifolia* L. +, *Polygala major* subsp. *apennina* 1.1; Rel. 4: H scap *Dactylis glomerata* L. subsp. *glomerata* +, H scap *Galium mollugo* L. subsp. *erectum* Syme 1.2, H caesp *Hypericum montanum* L. +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, H scap *Rumex acetosa* L. subsp. *acetosa* 1.2, H scap *Heracleum sphondylium* L. subsp. *pyrenaicum* (Lam.) Bonnier et Layens +, H scap *Linaria purpurea* (L.) Mill. +; Rel. 5: H scap *Thalictrum minus* L. subsp. *minus* 2.3, G rhiz *Veratrum nigrum* L. 1.2, H bienn *Arabis turrita* L. 1.1, G rhiz *Polygonatum multiflorum* (L.) All. 1.2, H scap *Hieracium murorum* L. (s.l.) +, G bulb *Lilium bulbiferum* L. subsp. *croceum* (Chaix) Jan +, H scap *Euphorbia cyparissias* L. +, T scap *Galium aparine* L. +, P caesp *Daphne laureola* L. +, P caesp *Rhamnus alpina* L. subsp. *fallax* (Boiss.) Maire et Petitm. +, H scap *Cruciata laevipes* Opiz +, G bulb *Crocus vernus* (L.) Hill +, H scap *Campanula trachelium* L. subsp. *trachelium* +, G rhiz *Hepatica nobilis* Schreb. +, H ros *Senecio doronicum* (L.) L. +, H ros *Carlina acaulis* L. subsp. *caulescens* (Lam.) Schübl. et G. Martens +; Rel. 6: G rhiz *Helleborus boccone* Ten. subsp. *boccone* 1.2, H ros *Primula veris* L. subsp. *suaveolens* (Bertol.) Gutermann et Ehrend. +, H caesp *Luzula campestris* (L.) DC. +, H bienn *Arabis hirsuta* (L.) Scop. +, H caesp *Festuca rubra* L. (s.l.) +, H scap *Galium anisophyllum* Vill. cfr +, H scap *Hesperis laciniata* Pourr. subsp. *graefferi* (Guss.) Nyman +, G rhiz *Paeonia officinalis* L. subsp. *italica* N.G. Passal. et Bernardo +, G bulb *Lilium martagon* L. +; Rel. 10: H scap *Lathyrus pratensis* L. subsp. *pratensis* 1.1, H scap *Vicia sepium* L. +, G rhiz *Mercurialis perennis* L. +, H scap *Dactylis glomerata* L. subsp. *glomerata* +, NP *Rubus ulmifolius* Schott +, T scap *Stellaria media* (L.) Vill. subsp. *media* +, P caesp *Ostrya carpinifolia* Scop. +, H scap *Silene flos-cuculi* (L.) Clairv. +; Rel. 11: T scap *Daucus carota* L. (s.l.) +, P caesp *Daphne laureola* L. +, H scap *Urtica dioica* L. +; Rel. 12: H scap *Eryngium amethystinum* L. +, NP *Rosa canina* L. (s.l.) +, NP *Rubus ulmifolius* Schott +, T scap *Chaerophyllum temulum* L. +, T scap *Daucus carota* L. (s.l.) +, H bienn *Arctium nemorosum* Lej. et Court. +, H ros *Potentilla reptans* L. +, H scap *Dactylis glomerata* L. subsp. *glomerata* +, H ros *Taraxacum officinale* Weber (aggr.) +, Ch suffr *Asperula purpurea* (L.) Ehrend. +. Tab. 2 - Rel. 1: H scap *Asperula cynanchica* L. subsp. *cynanchica* +, NP *Rubus hirtus* Waldst. et Kit. (group) +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, G bulb *Bunium bulbocastanum* L. +, H scap *Potentilla rigoana* Th. Wolf +, Ch suffr *Asperula purpurea* (L.) Ehrend. +, H scap *Centaurea jacea* L. subsp. *gaudini* (Boiss. et Reut.) Greml +, H scap *Polygala major* Jacq. +; Rel. 2: NP *Rosa canina* L. (s.l.) +, Ch suffr *Satureja montana* L. +, *Thymus serpyllum* L. (s.l.) +; Rel. 3: H scap *Euphorbia cyparissias* L. +, NP *Rosa canina* L. (s.l.) +, H ros *Plantago lanceolata* L. +, T scap *Arenaria serpyllifolia* L. +, *Polygala major* subsp. *apennina* 1.1; Rel. 4: H scap *Dactylis glomerata* L. subsp. *glomerata* +, H scap *Galium mollugo* L. subsp. *erectum* Syme 1.2, H caesp *Hypericum montanum* L. +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, H scap *Rumex acetosa* L. subsp. *acetosa* 1.2, H scap *Heracleum sphondylium* L. subsp. *pyrenaicum* (Lam.) Bonnier et Layens +, H scap *Linaria purpurea* (L.) Mill. +; Rel. 5: H scap *Thalictrum minus* L. subsp. *minus* 2.3, G rhiz *Veratrum nigrum* L. 1.2, H bienn *Arabis turrita* L. 1.1, G rhiz *Polygonatum multiflorum* (L.) All. 1.2, H scap *Hieracium murorum* L. (s.l.) +, G bulb *Lilium bulbiferum* L. subsp. *croceum* (Chaix) Jan +, H scap *Euphorbia cyparissias* L. +, T scap *Galium aparine* L. +, P caesp *Daphne laureola* L. +, P caesp *Rhamnus alpina* L. subsp. *fallax* (Boiss.) Maire et Petitm. +, H scap *Cruciata laevipes* Opiz +, G bulb *Crocus vernus* (L.) Hill +, H scap *Campanula trachelium* L. subsp. *trachelium* +, G rhiz *Hepatica nobilis* Schreb. +, H ros *Senecio doronicum* (L.) L. +, H ros *Carlina acaulis* L. subsp. *caulescens* (Lam.) Schübl. et G. Martens +; Rel. 6: G rhiz *Helleborus boccone* Ten. subsp. *boccone* 1.2, H ros *Primula veris* L. subsp. *suaveolens* (Bertol.) Gutermann et Ehrend. +, H caesp *Luzula campestris* (L.) DC. +, H bienn *Arabis hirsuta* (L.) Scop. +, H caesp *Festuca rubra* L. (s.l.) +, H scap *Galium anisophyllum* Vill. cfr +, H scap *Hesperis laciniata* Pourr. subsp. *graefferi* (Guss.) Nyman +, G rhiz *Paeonia officinalis* L. subsp. *italica* N.G. Passal. et Bernardo +, G bulb *Lilium martagon* L. +; Rel. 10: H scap *Lathyrus pratensis* L. subsp. *pratensis* 1.1, H scap *Vicia sepium* L. +, G rhiz *Mercurialis perennis* L. +, H scap *Dactylis glomerata* L. subsp. *glomerata* +, NP *Rubus ulmifolius* Schott +, T scap *Stellaria media* (L.) Vill. subsp. *media* +, P caesp *Ostrya carpinifolia* Scop. +, H scap *Silene flos-cuculi* (L.) Clairv. +; Rel. 11: T scap *Daucus carota* L. (s.l.) +, P caesp *Daphne laureola* L. +, H scap *Urtica dioica* L. +; Rel. 12: H scap *Eryngium amethystinum* L. +, NP *Rosa canina* L. (s.l.) +, NP *Rubus ulmifolius* Schott +, T scap *Chaerophyllum temulum* L. +, T scap *Daucus carota* L. (s.l.) +, H bienn *Arctium nemorosum* Lej. et Court. +, H ros *Potentilla reptans* L. +, H scap *Dactylis glomerata* L. subsp. *glomerata* +, H ros *Taraxacum officinale* Weber (aggr.) +, Ch suffr *Asperula purpurea* (L.) Ehrend. +. Tab. 2 - Rel. 1: H scap *Asperula cynanchica* L. subsp. *cynanchica* +, NP *Rubus hirtus* Waldst. et Kit. (group) +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, G bulb *Bunium bulbocastanum* L. +, H scap *Potentilla rigoana* Th. Wolf +, Ch suffr *Asperula purpurea* (L.) Ehrend. +, H scap *Centaurea jacea* L. subsp. *gaudini* (Boiss. et Reut.) Greml +, H scap *Polygala major* Jacq. +; Rel. 2: NP *Rosa canina* L. (s.l.) +, Ch suffr *Satureja montana* L. +, *Thymus serpyllum* L. (s.l.) +; Rel. 3: H scap *Euphorbia cyparissias* L. +, NP *Rosa canina* L. (s.l.) +, H ros *Plantago lanceolata* L. +, T scap *Arenaria serpyllifolia* L. +, *Polygala major* subsp. *apennina* 1.1; Rel. 4: H scap *Dactylis glomerata* L. subsp. *glomerata* +, H scap *Galium mollugo* L. subsp. *erectum* Syme 1.2, H caesp *Hypericum montanum* L. +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, H scap *Rumex acetosa* L. subsp. *acetosa* 1.2, H scap *Heracleum sphondylium* L. subsp. *pyrenaicum* (Lam.) Bonnier et Layens +, H scap *Linaria purpurea* (L.) Mill. +; Rel. 5: H scap *Thalictrum minus* L. subsp. *minus* 2.3, G rhiz *Veratrum nigrum* L. 1.2, H bienn *Arabis turrita* L. 1.1, G rhiz *Polygonatum multiflorum* (L.) All. 1.2, H scap *Hieracium murorum* L. (s.l.) +, G bulb *Lilium bulbiferum* L. subsp. *croceum* (Chaix) Jan +, H scap *Euphorbia cyparissias* L. +, T scap *Galium aparine* L. +, P caesp *Daphne laureola* L. +, P caesp *Rhamnus alpina* L. subsp. *fallax* (Boiss.) Maire et Petitm. +, H scap *Cruciata laevipes* Opiz +, G bulb *Crocus vernus* (L.) Hill +, H scap *Campanula trachelium* L. subsp. *trachelium* +, G rhiz *Hepatica nobilis* Schreb. +, H ros *Senecio doronicum* (L.) L. +, H ros *Carlina acaulis* L. subsp. *caulescens* (Lam.) Schübl. et G. Martens +; Rel. 6: G rhiz *Helleborus boccone* Ten. subsp. *boccone* 1.2, H ros *Primula veris* L. subsp. *suaveolens* (Bertol.) Gutermann et Ehrend. +, H caesp *Luzula campestris* (L.) DC. +, H bienn *Arabis hirsuta* (L.) Scop. +, H caesp *Festuca rubra* L. (s.l.) +, H scap *Galium anisophyllum* Vill. cfr +, H scap *Hesperis laciniata* Pourr. subsp. *graefferi* (Guss.) Nyman +, G rhiz *Paeonia officinalis* L. subsp. *italica* N.G. Passal. et Bernardo +, G bulb *Lilium martagon* L. +; Rel. 10: H scap *Lathyrus pratensis* L. subsp. *pratensis* 1.1, H scap *Vicia sepium* L. +, G rhiz *Mercurialis perennis* L. +, H scap *Dactylis glomerata* L. subsp. *glomerata* +, NP *Rubus ulmifolius* Schott +, T scap *Stellaria media* (L.) Vill. subsp. *media* +, P caesp *Ostrya carpinifolia* Scop. +, H scap *Silene flos-cuculi* (L.) Clairv. +; Rel. 11: T scap *Daucus carota* L. (s.l.) +, P caesp *Daphne laureola* L. +, H scap *Urtica dioica* L. +; Rel. 12: H scap *Eryngium amethystinum* L. +, NP *Rosa canina* L. (s.l.) +, NP *Rubus ulmifolius* Schott +, T scap *Chaerophyllum temulum* L. +, T scap *Daucus carota* L. (s.l.) +, H bienn *Arctium nemorosum* Lej. et Court. +, H ros *Potentilla reptans* L. +, H scap *Dactylis glomerata* L. subsp. *glomerata* +, H ros *Taraxacum officinale* Weber (aggr.) +, Ch suffr *Asperula purpurea* (L.) Ehrend. +. Tab. 2 - Rel. 1: H scap *Asperula cynanchica* L. subsp. *cynanchica* +, NP *Rubus hirtus* Waldst. et Kit. (group) +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, G bulb *Bunium bulbocastanum* L. +, H scap *Potentilla rigoana* Th. Wolf +, Ch suffr *Asperula purpurea* (L.) Ehrend. +, H scap *Centaurea jacea* L. subsp. *gaudini* (Boiss. et Reut.) Greml +, H scap *Polygala major* Jacq. +; Rel. 2: NP *Rosa canina* L. (s.l.) +, Ch suffr *Satureja montana* L. +, *Thymus serpyllum* L. (s.l.) +; Rel. 3: H scap *Euphorbia cyparissias* L. +, NP *Rosa canina* L. (s.l.) +, H ros *Plantago lanceolata* L. +, T scap *Arenaria serpyllifolia* L. +, *Polygala major* subsp. *apennina* 1.1; Rel. 4: H scap *Dactylis glomerata* L. subsp. *glomerata* +, H scap *Galium mollugo* L. subsp. *erectum* Syme 1.2, H caesp *Hypericum montanum* L. +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, H scap *Rumex acetosa* L. subsp. *acetosa* 1.2, H scap *Heracleum sphondylium* L. subsp. *pyrenaicum* (Lam.) Bonnier et Layens +, H scap *Linaria purpurea* (L.) Mill. +; Rel. 5: H scap *Thalictrum minus* L. subsp. *minus* 2.3, G rhiz *Veratrum nigrum* L. 1.2, H bienn *Arabis turrita* L. 1.1, G rhiz *Polygonatum multiflorum* (L.) All. 1.2, H scap *Hieracium murorum* L. (s.l.) +, G bulb *Lilium bulbiferum* L. subsp. *croceum* (Chaix) Jan +, H scap *Euphorbia cyparissias* L. +, T scap *Galium aparine* L. +, P caesp *Daphne laureola* L. +, P caesp *Rhamnus alpina* L. subsp. *fallax* (Boiss.) Maire et Petitm. +, H scap *Cruciata laevipes* Opiz +, G bulb *Crocus vernus* (L.) Hill +, H scap *Campanula trachelium* L. subsp. *trachelium* +, G rhiz *Hepatica nobilis* Schreb. +, H ros *Senecio doronicum* (L.) L. +, H ros *Carlina acaulis* L. subsp. *caulescens* (Lam.) Schübl. et G. Martens +; Rel. 6: G rhiz *Helleborus boccone* Ten. subsp. *boccone* 1.2, H ros *Primula veris* L. subsp. *suaveolens* (Bertol.) Gutermann et Ehrend. +, H caesp *Luzula campestris* (L.) DC. +, H bienn *Arabis hirsuta* (L.) Scop. +, H caesp *Festuca rubra* L. (s.l.) +, H scap *Galium anisophyllum* Vill. cfr +, H scap *Hesperis laciniata* Pourr. subsp. *graefferi* (Guss.) Nyman +, G rhiz *Paeonia officinalis* L. subsp. *italica* N.G. Passal. et Bernardo +, G bulb *Lilium martagon* L. +; Rel. 10: H scap *Lathyrus pratensis* L. subsp. *pratensis* 1.1, H scap *Vicia sepium* L. +, G rhiz *Mercurialis perennis* L. +, H scap *Dactylis glomerata* L. subsp. *glomerata* +, NP *Rubus ulmifolius* Schott +, T scap *Stellaria media* (L.) Vill. subsp. *media* +, P caesp *Ostrya carpinifolia* Scop. +, H scap *Silene flos-cuculi* (L.) Clairv. +; Rel. 11: T scap *Daucus carota* L. (s.l.) +, P caesp *Daphne laureola* L. +, H scap *Urtica dioica* L. +; Rel. 12: H scap *Eryngium amethystinum* L. +, NP *Rosa canina* L. (s.l.) +, NP *Rubus ulmifolius* Schott +, T scap *Chaerophyllum temulum* L. +, T scap *Daucus carota* L. (s.l.) +, H bienn *Arctium nemorosum* Lej. et Court. +, H ros *Potentilla reptans* L. +, H scap *Dactylis glomerata* L. subsp. *glomerata* +, H ros *Taraxacum officinale* Weber (aggr.) +, Ch suffr *Asperula purpurea* (L.) Ehrend. +. Tab. 2 - Rel. 1: H scap *Asperula cynanchica* L. subsp. *cynanchica* +, NP *Rubus hirtus* Waldst. et Kit. (group) +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, G bulb *Bunium bulbocastanum* L. +, H scap *Potentilla rigoana* Th. Wolf +, Ch suffr *Asperula purpurea* (L.) Ehrend. +, H scap *Centaurea jacea* L. subsp. *gaudini* (Boiss. et Reut.) Greml +, H scap *Polygala major* Jacq. +; Rel. 2: NP *Rosa canina* L. (s.l.) +, Ch suffr *Satureja montana* L. +, *Thymus serpyllum* L. (s.l.) +; Rel. 3: H scap *Euphorbia cyparissias* L. +, NP *Rosa canina* L. (s.l.) +, H ros *Plantago lanceolata* L. +, T scap *Arenaria serpyllifolia* L. +, *Polygala major* subsp. *apennina* 1.1; Rel. 4: H scap *Dactylis glomerata* L. subsp. *glomerata* +, H scap *Galium mollugo* L. subsp. *erectum* Syme 1.2, H caesp *Hypericum montanum* L. +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, H scap *Rumex acetosa* L. subsp. *acetosa* 1.2, H scap *Heracleum sphondylium* L. subsp. *pyrenaicum* (Lam.) Bonnier et Layens +, H scap *Linaria purpurea* (L.) Mill. +; Rel. 5: H scap *Thalictrum minus* L. subsp. *minus* 2.3, G rhiz *Veratrum nigrum* L. 1.2, H bienn *Arabis turrita* L. 1.1, G rhiz *Polygonatum multiflorum* (L.) All. 1.2, H scap *Hieracium murorum* L. (s.l.) +, G bulb *Lilium bulbiferum* L. subsp. *croceum* (Chaix) Jan +, H scap *Euphorbia cyparissias* L. +, T scap *Galium aparine* L. +, P caesp *Daphne laureola* L. +, P caesp *Rhamnus alpina* L. subsp. *fallax* (Boiss.) Maire et Petitm. +, H scap *Cruciata laevipes* Opiz +, G bulb *Crocus vernus* (L.) Hill +, H scap *Campanula trachelium* L. subsp. *trachelium* +, G rhiz *Hepatica nobilis* Schreb. +, H ros *Senecio doronicum* (L.) L. +, H ros *Carlina acaulis* L. subsp. *caulescens* (Lam.) Schübl. et G. Martens +; Rel. 6: G rhiz *Helleborus boccone* Ten. subsp. *boccone* 1.2, H ros *Primula veris* L. subsp. *suaveolens* (Bertol.) Gutermann et Ehrend. +, H caesp *Luzula campestris* (L.) DC. +, H bienn *Arabis hirsuta* (L.) Scop. +, H caesp *Festuca rubra* L. (s.l.) +, H scap *Galium anisophyllum* Vill. cfr +, H scap *Hesperis laciniata* Pourr. subsp. *graefferi* (Guss.) Nyman +, G rhiz *Paeonia officinalis* L. subsp. *italica* N.G. Passal. et Bernardo +, G bulb *Lilium martagon* L. +; Rel. 10: H scap *Lathyrus pratensis* L. subsp. *pratensis* 1.1, H scap *Vicia sepium* L. +, G rhiz *Mercurialis perennis* L. +, H scap *Dactylis glomerata* L. subsp. *glomerata* +, NP *Rubus ulmifolius* Schott +, T scap *Stellaria media* (L.) Vill. subsp. *media* +, P caesp *Ostrya carpinifolia* Scop. +, H scap *Silene flos-cuculi* (L.) Clairv. +; Rel. 11: T scap *Daucus carota* L. (s.l.) +, P caesp *Daphne laureola* L. +, H scap *Urtica dioica* L. +; Rel. 12: H scap *Eryngium amethystinum* L. +, NP *Rosa canina* L. (s.l.) +, NP *Rubus ulmifolius* Schott +, T scap *Chaerophyllum temulum* L. +, T scap *Daucus carota* L. (s.l.) +, H bienn *Arctium nemorosum* Lej. et Court. +, H ros *Potentilla reptans* L. +, H scap *Dactylis glomerata* L. subsp. *glomerata* +, H ros *Taraxacum officinale* Weber (aggr.) +, Ch suffr *Asperula purpurea* (L.) Ehrend. +. Tab. 2 - Rel. 1: H scap *Asperula cynanchica* L. subsp. *cynanchica* +, NP *Rubus hirtus* Waldst. et Kit. (group) +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, G bulb *Bunium bulbocastanum* L. +, H scap *Potentilla rigoana* Th. Wolf +, Ch suffr *Asperula purpurea* (L.) Ehrend. +, H scap *Centaurea jacea* L. subsp. *gaudini* (Boiss. et Reut.) Greml +, H scap *Polygala major* Jacq. +; Rel. 2: NP *Rosa canina* L. (s.l.) +, Ch suffr *Satureja montana* L. +, *Thymus serpyllum* L. (s.l.) +; Rel. 3: H scap *Euphorbia cyparissias* L. +, NP *Rosa canina* L. (s.l.) +, H ros *Plantago lanceolata* L. +, T scap *Arenaria serpyllifolia* L. +, *Polygala major* subsp. *apennina* 1.1; Rel. 4: H scap *Dactylis glomerata* L. subsp. *glomerata* +, H scap *Galium mollugo* L. subsp. *erectum* Syme 1.2, H caesp *Hypericum montanum* L. +, H caesp *Poa nemoralis* L. subsp. *nemoralis* +, H scap *Rumex acetosa* L. subsp. *acetosa* 1.2, H scap *Heracleum sphondylium* L. subsp. *pyrenaicum* (Lam.) Bonnier et Layens +, H scap *Linaria purpurea* (L.) Mill. +; Rel. 5: H scap *Thalictrum minus* L. subsp. *minus* 2.3, G rhiz *Veratrum nigrum* L. 1.2, H bienn *Arabis turrita* L. 1.1, G rhiz *Polygonatum multiflorum* (L.) All. 1.2, H scap *Hieracium murorum* L. (s.l.) +, G bulb *Lilium bulbiferum* L. subsp. *croceum* (Chaix) Jan +, H scap *Euphorbia cyparissias* L. +, T scap *Galium aparine* L. +, P caesp *Daphne laureola* L. +, P caesp *Rhamnus alpina* L. subsp. *fallax* (Boiss.) Maire et Petitm. +, H scap *Cruciata laevipes* Opiz +, G bulb *Crocus vernus* (L.) Hill +, H scap *Campanula trachelium* L. subsp. *trachelium* +, G rhiz *Hepatica nobilis* Schreb. +, H ros *Senecio doronicum* (L.) L. +, H ros *Carlina acaulis* L. subsp. *caulescens* (Lam.) Schübl. et G. Martens +; Rel. 6: G rhiz *Helleborus boccone* Ten. subsp. *boccone* 1.2, H ros *Primula veris* L. subsp. *suaveolens* (Bertol.) Gutermann et Ehrend. +, H caesp *Luzula campestris* (L.)

nata All. +, H scap *Pedicularis comosa* L. +, H scap *Saxifraga bulbifera* L. +, Ch suffr *Acinos alpinus* (L.) Moench subsp. *alpinus* +; Rel. 7: H scap *Peucedanum austriacum* (Jacq.) W.D.J. Koch 2.2, G rhiz *Paeonia officinalis* L. subsp. *italica* N.G. Passal. et Bernardo 2.2, H scap *Dactylis glomerata* L. subsp. *glomerata* +, H scap *Asperula cynanchica* L. subsp. *cynanchica* +, H caesp *Hypericum montanum* L. +, G bulb *Bunium bulbocastanum* L. +, H scap *Achillea millefolium* L. subsp. *millefolium* +, H caesp *Poa trivialis* L. +, H scap *Rumex nebroides* Campd. +, Ch succ *Sedum rupestre* L. subsp. *rupestre* +, H caesp *Hippocratea comosa* L. subsp. *comosa*; Rel. 8: H scap *Campanula persicifolia* L. subsp. *persicifolia* 1.1, G bulb *Lilium martagon* L. +, H scap *Laserpitium latifolium* L. +, Ch pulv *Minuartia verna* (L.) Hiern subsp. *collina* (Neilr.) Halliday +, H caesp *Koeleria splendens* C. Presl (s.l.) +; Rel. 9: H scap *Galium mollugo* subsp. *erectum* Syme +; NP *Rubus hirtus* Waldst. et Kit. (group) +, H scap *Rumex acetosa* L. subsp. *acetosa* +, H scap *Trifolium montanum* L. subsp. *rupestre* (Ten.) Nyman +. Tab. 3 - Rel. 1: H scap *Prunella vulgaris* L. subsp. *vulgaris* +, H bienn *Campanula rapunculus* L. +, H scap *Silene vulgaris* (Moench) Garcke subsp. *vulgaris* +, H scap *Polygala nicaeensis* W.D.J. Koch subsp. *mediterranea* Chodat +, T scap *Medicago lupulina* L. +, H bienn *Pastinaca sativa* L. subsp. *urens* (Req. ex Godr.) Celak. +, H scap *Scabiosa columbaria* L. (s.l.) +, Ch suffr *Dorycnium hirsutum* (L.) Ser. 2.2, T scap *Vicia sativa* L. (s.l.) +, P caesp *Cytisophyllum sessilifolium* (L.) O. Lang +, Ch suffr *Acinos alpinus* (L.) Moench subsp. *alpinus* +, H scap *Polygala flavescens* DC. +; Rel. 2: H scap *Ranunculus neapolitanus* Ten. +, H scap *Silene vulgaris* (Moench) Garcke subsp. *vulgaris* +, H scap *Carlina vulgaris* L. subsp. *vulgaris* +, P caesp *Prunus spinosa* L. subsp. *spinosa* +, H scap *Medicago sativa* L. +, H scap *Inula conyzoides* DC. +, G bulb *Anacamptis pyramidalis* (L.) Rich. +, H scap *Convolvulus cantabrica* L. +, H scap *Eryngium amethystinum* L. +; Rel. 3: P caesp *Prunus spinosa* L. subsp. *spinosa* +, H rept *Ajuga reptans* L. 1.1, H scap *Geum urbanum* L. +, G bulb *Bellevalia romana* (L.) Sweet +, P lian *Hedera helix* L. subsp. *helix* +; H scap *Lamium maculatum* L. +, P lian *Lonicera caprifolium* L. +; Rel 4: H scap *Linum viscosum* L. 1.2, H scap *Silene vulgaris* (Moench) Garcke subsp. *vulgaris* +, T scap *Medicago lupulina* L. +, H caesp *Bromopsis erecta* (Huds.) Fourr. subsp. *erecta* +, H scap *Galega officinalis* L. +.3, G rhiz *Melilotus altissima* Thuill. +, P lian *Lonicera etrusca* Santi +, G bulb *Anacamptis pyramidalis* (L.) Rich. +, H scap *Carlina corymbosa* L. +, H ros *Silene otites* (L.) Wibel subsp. *otitis* +, P caesp *Ostrya carpinifolia* Scop. +; Rel. 5: T scap *Medicago lupulina* L. +, H caesp *Bromopsis erecta* (Huds.) Fourr. subsp. *erecta* +, H scap *Securigera varia* (L.) Lassen +, H scap *Galega officinalis* L. +, T scap *Lathyrus aphaca*

L. +, T scap *Cynosurus echinatus* L. +, T scap *Galium aparine* L. +, P scap *Ficus carica* L. +, H bienn *Linum bienne* Mill. +; Rel. 6: H scap *Linum viscosum* L. +, H scap *Polygala nicaeensis* W.D.J. Koch subsp. *mediterranea* Chodat +, P lian *Hedera helix* L. subsp. *helix* +, P caesp *Pyracantha coccinea* M.J. Roem. +; Rel. 7: H scap *Carlina vulgaris* L. subsp. *vulgaris* +, T scap *Medicago lupulina* L. +, H scap *Vicia corynoides* Gouan +, H bienn *Pastinaca sativa* L. subsp. *urens* (Req. ex Godr.) Celak. +, H scap *Medicago sativa* L. +, T scap *Lathyrus aphaca* L. +, P caesp *Crataegus monogyna* Jacq. +, P caesp *Prunus mahaleb* L. +; H caesp *Briza media* L. +, H caesp *Festuca rubra* L. (s.l.) +; Rel. 8: H caesp *Bromopsis erecta* (Huds.) Fourr. subsp. *erecta* +, H scap *Polygala nicaeensis* W.D.J. Koch subsp. *mediterranea* Chodat +, H scap *Carlina vulgaris* L. subsp. *vulgaris* +, H scap *Vicia corynoides* Gouan +, G bulb *Loncomelos brevistylus* (Wolffn.) Dostál +, H scap *Leucanthemum vulgare* Lam. subsp. *vulgare* 1.1, T scap *Trifolium campestre* Schreb. +, H caesp *Anthoxanthum odoratum* L. subsp. *odoratum* +; Rel. 9: P scap *Acer campestre* L. +, G rhiz *Convolvulus arvensis* L. +, H scap *Senecio erucifolius* L. +, H scap *Sanguisorba minor* Scop. subsp. *balearica* (Bourg. ex Nyman) Muñoz Garm. et C. Navarro +, P caesp *Fraxinus ornus* L. subsp. *ornus* +, H bienn *Cirsium vulgare* (Savi) Ten. +; Rel 10: H scap *Silene vulgaris* (Moench) Garcke subsp. *vulgaris* +, H scap *Scabiosa columbaria* L. (s.l.) +, H scap *Sanguisorba minor* Scop. subsp. *balearica* (Bourg. ex Nyman) Muñoz Garm. et C. Navarro +, H scap *Leucanthemum vulgare* Lam. subsp. *vulgare* +, H scap *Inula conyzoides* DC. +, T scap *Vicia sativa* L. (s.l.) +, H caesp *Centaurea scabiosa* L. subsp. *scabiosa* 1.2, G bulb *Orchis morio* L. +; Rel 11: H scap *Sanguisorba minor* Scop. subsp. *balearica* (Bourg. ex Nyman) Muñoz Garm. et C. Navarro +, P lian *Lonicera etrusca* Santi +; Rel 12: T scap *Inula salicina* L. 1.2, H scap *Prunella vulgaris* L. subsp. *vulgaris* +, G rhiz *Convolvulus arvensis* L. +, G rad *Cirsium arvense* (L.) Scop. +; Rel 13: H scap *Solidago virgaurea* L. subsp. *virgaurea* +, T scap *Inula salicina* L. 2.3, H scap *Carlina vulgaris* L. subsp. *vulgaris* +, H scap *Ranunculus neapolitanus* Ten. 1.1, P scap *Quercus cerris* L. +.2, H scap *Artemisia vulgaris* L. +, H bienn *Sonchus asper* (L.) Hill (s.l.) 1.2, P scap *Sorbus domestica* L. +; Rel. 14: P caesp *Prunus spinosa* L. subsp. *spinosa* +, G rhiz *Convolvulus arvensis* L. 1.2, H scap *Crucia laevipes* Opiz +, H scap *Medicago sativa* L. +, G bulb *Bellevalia romana* (L.) Sweet +, G bulb *Bunium bulbocastanum* L. +, H scap *Rumex acetosa* L. subsp. *acetosa* +, H scap *Tragopogon pratensis* L. +, H caesp *Phleum pratense* L. +; Rel 15: P scap *Acer campestre* L. +.2, T scap *Inula salicina* L. +.3, P caesp *Juniperus communis* L. subsp. *communis* +.2, Ch suffr *Cytisus hirsutus* L. subsp. *polytrichus* (M. Bieb.) Hayek +; Rel 16: H caesp *Bromopsis erecta* (Huds.)

Fourr. subsp. *erecta* +.2, P scap *Acer campestre* L. +, H scap *Senecio erucifolius* L. +, P caesp *Fraxinus ornus* L. subsp. *ornus* +, H scap *Inula viscosa* (L.) Aiton +, P scap *Fraxinus oxycarpa* Bieb. +, G rhiz *Melilotus altissima* Thuill. +, T scap *Odontites luteus* (L.) Clairv. +, P scap *Populus canescens* (Aiton) Sm. +, NP *Rubus caesius* L. 1.1; Rel 17: H scap *Serratula tinctoria* L. subsp. *tinctoria* +; Rel 18: P scap *Fraxinus oxycarpa* Bieb. +.2; Rel 19: H scap *Polygala nicaeensis* W.D.J. Koch subsp. *mediterranea* Chodat +, G rhiz *Epipactis helleborine* (L.) Crantz +, H scap (L.) Trevis. +, G rhiz *Helleborus bocconeii* Ten. subsp. *bocconeii* +, H caesp *Trifolium ochroleucum* Huds. +.2, H scap *Securigera varia* (L.) Lassen +, P caesp *Juniperus communis* L. subsp. *communis* +.2, H scap *Scabiosa columbaria* L. (s.l.) +, H scap *Leucanthemum vulgare* Lam. subsp. *vulgare* +, G bulb *Bellevalia romana* (L.) Sweet +, G rhiz *Tussilago farfara* L. +; Rel. 20: H scap *Ranunculus neapolitanus* Ten. +, H scap *Veronica chamaedrys* L. subsp. *chamaedrys* 1.1, P scap *Acer campestre* L. +, H scap *Cruciata laevipes* Opiz +, P caesp *Cytisophyllum sessilifolium* (L.) O. Lang +.2, G rad *Tamus communis* L. +, G bulb *Gymnadenia conopsea* (L.) R. Br. +, P caesp *Euonymus europaeus* L. +.2; Rel 21: H scap *Silene italica* (L.) Pers. subsp. *italica* 1.1, H scap *Ranunculus neapolitanus* Ten. +, H caesp *Trifolium ochroleucum* Huds. +, H scap +, H scap *Inula conyzoides* DC. +, G bulb *Bunium bulbocastanum* L. +, G bulb *Gymnadenia conopsea* (L.) R. Br. +, P scap *Castanea sativa* Mill. +.2; Rel 22: H scap *Silene italica* (L.) Pers. subsp. *italica* +.2, G rhiz *Pteridium aquilinum* (L.) Kuhn subsp. *aquilinum* +, H scap *Ptilostemon strictus* (Ten.) Greuter +, H bienn *Arabis turrita* L. +, G rhiz *Arum italicum* Mill. +, G rad *Tamus communis* L. +.2, H scap *Salvia glutinosa* L. +, P caesp *Colutea arborea* L. +.2; Rel. 23: T scap *Inula salicina* L. 1.1, H scap *Solidago virgaurea* L. subsp. *virgaurea* 1.1, P caesp *Prunus spinosa* L. subsp. *spinosa* +, P caesp *Juniperus communis* L. subsp. *communis* +, P scap *Quercus cerris* L. +.2, H bienn *Pastinaca sativa* L. subsp. *urens* (Req. ex Godr.) Celak. +, H scap *Serratula tinctoria* L. subsp. *tinctoria* +, Ch suffr *Dorycnium hirsutum* (L.) Ser. 2.3, P caesp *Pyracantha coccinea* M.J. Roem. +.2, H scap *Artemisia vulgaris* L. +, H ros *Primula vulgaris* Huds. subsp. *vulgaris* +.

Tab. 4 - Rel. 1: T scap *Securigera securidaca* (L.) Degen et Dörfel. +, H scap *Linaria vulgaris* Mill. +, T par *Linum corymbulosum* Rchb. +, P caesp *Fraxinus ornus* L. subsp. *ornus* +, T scap *Odontites luteus* (L.) Clairv. +, T scap *Daucus carota* L. (s.l.) +, H scap *Silene vulgaris* (Moench) Garcke subsp. *vulgaris* +, T scap *Scorpiurus muricatus* L. +, H scap *Convolvulus cantabrica* L. +; Rel 2: P caesp *Laurus nobilis* L. +, P caesp *Euonymus europaeus* L. +, T scap *Trifolium angustifolium* L. +; Rel 3: T scap *Securigera securidaca* (L.) Degen et Dörfel. +, T scap *Torilis arvensis* (Huds.) Link +.2, P

caesp *Ulmus minor* Mill. +, C suffr *Cota tinctoria* (L.) J. Gay (s.l.) +, T scap *Odontites luteus* (L.) Clairv. +, T scap *Daucus carota* L. (s.l.) +, H bienn *Centaurium erythraea* Rafn subsp. *erythraea* +, H scap *Centaurea nigrescens* Willd. (s.l.) +, H ros *Plantago lanceolata* L. +, H scap *Urospermum dalechampii* (L.) F.W. Schmidt +, H scap *Lolium multiflorum* Lam. +; Rel 4: T scap *Torilis arvensis* (Huds.) Link +, H scap *Linaria vulgaris* Mill. +, T par *Linum corymbulosum* Rchb. 1.1, NP *Rosa sempervirens* L. +.2, T scap *Lotus ornithopodioides* L. +, T scap *Trifolium campestre* Schreb. +, H scap *Picris hieracioides* L. subsp. *hieracioides* +.2, T scap *Blackstonia perfoliata* (L.) Huds. +, T scap *Scorpiurus muricatus* L. +.2, G rhiz *Convolvulus arvensis* L. +; Rel 5: NP *Rosa sempervirens* L. 1.1, H scap *Picris hieracioides* L. subsp. *hieracioides* +, P lian *Hedera helix* L. subsp. *helix* +, P lian *Lonicera caprifolium* L. +, NP *Osyris alba* L. +.2, NP *Smilax aspera* L. +.2, T par *Orobanche* sp. +; Rel 6: G rhiz *Glycyrrhiza glabra* L. +.2, P caesp *Spartium junceum* L. +, P caesp *Prunus spinosa* L. subsp. *spinosa* +, H scap *Senecio erucifolius* L. +.2, G rhiz *Tussilago farfara* L. +, NP *Rosa canina* L. (s.l.) +.

Tab. 5 - Col. 1: *Origanum vulgare* L. subsp. *vulgare* II, *Blackstonia perfoliata* (L.) Huds. III, *Centaurium erythraea* Rafn subsp. *erythraea* I, *Convolvulus cantabrica* L. I, *Convolvulus arvensis* L. I, *Foeniculum vulgare* Mill. IV, *Glycyrrhiza glabra* L., *Laurus nobilis* L. I, *Linaria vulgaris* Mill. II, *Linum corymbulosum* Rchb. II, *Lolium multiflorum* Lam. I, *Lotus ornithopodioides* L. I, *Odontites luteus* (L.) Clairv. II, *Orobanche caryophyllacea* Sm. I, *Osyris alba* L. I, *Picris hieracioides* L. subsp. *hieracioides* II, *Pilosella officinarum* Vaill., *Scorpiurus muricatus* L. II, *Securigera securidaca* (L.) Degen et Dörfel. II, *Senecio erucifolius* L. I, *Silene vulgaris* (Moench) Garcke subsp. *vulgaris* I, *Smilax aspera* L. I, *Sulla coronaria* (L.) Medik. III, *Torilis arvensis* (Huds.) Link II, *Trifolium angustifolium* L. I, *Trifolium campestre* Schreb. I, *Tussilago farfara* L. I, *Ulmus minor* Mill. I, *Urospermum dalechampii* (L.) F.W. Schmidt I, *Vicia sativa* L. (s.l.) III, *Senecio erucifolius* L. I, *Silene vulgaris* (Moench) Garcke subsp. *vulgaris* I, *Smilax aspera* L. I; Col.. 2: *Blackstonia perfoliata* (L.) Huds. II, *Centaurium erythraea* Rafn subsp. *erythraea* II, *Convolvulus cantabrica* I, *Convolvulus arvensis* L. I, *Odontites luteus* (L.) Clairv. I, *Picris hieracioides* L. subsp. *hieracioides* II, *Trifolium campestre* Schreb. I, *Tussilago farfara* L. I, *Urospermum dalechampii* (L.) F.W. Schmidt I, *Anacamptis pyramidalis* (L.) Rich. I, *Artemisia vulgaris* L. I, *Arum italicum* Mill. subsp. *italicum* I, *Bellevalia romana* (L.) Sweet I, *Carlina corymbosa* L. I, *Carlina vulgaris* L. subsp. *vulgaris* I, *Castanea sativa* Mill. I, *Centaurea scabiosa* L. subsp. *scabiosa* I, *Cirsium arvense* (L.) Scop. I, *Cirsium vulgare* (Savi) Ten. I, *Colutea arborescens* L. I, *Epipactis helleborine* (L.) Crantz I, P caesp *Crataegus*

monogyna Jacq. I, Equisetum telmateja II, Schedonorus arundinaceus (Schreb.) Dumort. subsp. arundinaceus II, Festuca rubra L. (s.l.) I, Ficus carica L. I, Fraxinus oxycarpa Bieb. I, Galega officinalis L. I, Holcus lanatus L. subsp. lanatus I, Inula conyza DC. I, Inula salicina L. I, Lamium maculatum L. I, Lathyrus aphaca L. I, Leucanthemum vulgare Lam. subsp. vulgare I, Ligustrum vulgare II, Cynosurus echinatus L. I, Linum viscosum L. I, Lonicera etrusca Santi I, Medicago lupulina L. I, Medicago sativa L. I, Melilotus altissima Thuill. I, Orchis morio L. I, Pastinaca sativa L. subsp. urens (Req. ex Godr.) Celak. I, Phleum pratense L. I, Polygala flavescens DC. I, Polygala nicaeensis W.D.J. Koch subsp. mediterranea Chodat I, Populus canescens (Aiton) Sm. I, Primula vulgaris Huds. subsp. vulgaris I, Prunella laciniata (L.) I, Prunus mahaleb L. I, Ptilostemon strictus (Ten.) Greuter I, Pulicaria dysenterica (L.) Bernh. II, Pyracantha coccinea M.J. Roem. I, Rubus canescens DC. II, Salvia glutinosa L., Scabiosa columbaria L. (s.l.) I, Securigera varia (L.) Lassen I, Serratula tinctoria L. subsp. tinctoria I, Silene otites (L.) Wibel subsp. otites I, Sonchus asper (L.) Hill (s.l.) I, Sorbus domestica L. I, Tamus communis L. I; Col. 3: Pilosella officinarum Vaill. I, Urospermum dalechampii (L.) F.W. Schmidt I, Centaurea scabiosa L. subsp. scabiosa II, Lamium maculatum L. I, Leucanthemum vulgare Lam. subsp. vulgare I, Scabiosa columbaria L. (s.l.) I, Acer opalus Mill. subsp. obtusatum (Waldst. et Kit. ex Willd.) Gams I, Allium carinatum L. subsp. pulchellum Bonnier et Layens I, Allium sphaerocephalon L. I, Arctium nemorosum Lej. et Court. I, Asperula purpurea (L.) Ehrend. I, Chaerophyllum temulum L. I, Echium vulgare L. I, Emerus majus Mill. subsp. emerooides (Boiss. et Spruner) Soldano et F. Conti I, Laburnum anagyroides Medik. I, Lithospermum officinale L. I, Melittis melissophyllum L. I, Mercurialis perennis L. I, Silene flos-cuculi (L.) Clairv. I, Potentilla reptans L. I, Salvia verbenaca L. I, Seseli viarum Calest. I, Crataegus monogyna Jacq. I, Sesleria nitida Ten. (s.l.) I, Stachys recta L. (s.l.) II, Stellaria media (L.) Vill. subsp. media I, Taraxacum officinale Weber (aggr.) I, Thesium linophyllum L. I, Urtica dioica L. I; Col. 4: Thalictrum minus L. subsp. minus I, Poa nemoralis L. subsp. nemoralis I, Pilosella officinarum Vaill. I, Festuca rubra L. (s.l.) I, Leucanthemum vulgare Lam. subsp. vulgare II, Adenostyles glabra (Mill.) DC. subsp. glabra I, Arenaria serpyllifolia L. I, Arrhenatherum elatius (L.) P. Beauv. ex J. et C. Presl subsp. elatius I, Asperula cynanchica L. I, Bromus diandrus Roth I, Carlina acaulis L. subsp. caulescens (Lam.) Schübl. et G. Martens I, Crocus vernus (L.) Hill I, Epilobium montanum L. I, Galium anisophyllum Vill. I, Geranium robertianum L. I, Helianthemum oelandicum (L.) Dum. Cours. subsp. incanum (Willk.) G. López I, Heracleum sphondylium L. subsp. pyrenaicum (Lam.) Bonnier et Layens I, Hesperis laci-

niata All. I, Hieracium murorum L. (s.l.) I, Hippocratea comosa L. subsp. comosa I, Hypericum montanum L. I, Koeleria splendens C. Presl (s.l.) I, Lactuca muralis (L.) Gaertn. I, Linaria purpurea (L.) Mill. I, Minuartia verna (L.) Hiern subsp. collina (Neilr.) Halliday I, Pedicularis comosa L. subsp. comosa I, Polygala major Jacq. I, Polygala major subsp. apennina I, Polygonatum multiflorum (L.) All. I, Rhamnus alpina L. subsp. fallax (Boiss.) Maire et Petitm. I, Satureja montana L. I, Saxifraga bulbifera L. I, Sedum rupestre L. subsp. rupestre I, Senecio doronicum (L.) L. I, Thymus serpyllum L. (s.l.) I; Col. 5: Anthoxanthum odoratum L. subsp. nipponicum (Honda) Tzvelev IV, Bellardiochloa variegata (Lam.) Kerguélen subsp. variegata I, Carlina acaulis L. subsp. caulescens (Lam.) Schübl. et G. Martens I, Crocus vernus (L.) Hill I, Dianthus monspessulanus L. I, Leucanthemum adustum (W.D.J. Koch) Greml II, Ranunculus apenninus (Chiov.) Pignatti I, Rhinanthus minor L. III, Stachys typhaea Hausskn. I, Taraxacum officinale Weber (aggr.) I, Verbascum longifolium Ten. II; Col. 6: Festuca rubra L. (s.l.) III, Alchemilla sp. II, Anthoxanthum odoratum L. subsp. nipponicum (Honda) Tzvelev V, Asperula cynanchica L. I, Avenula praetutiana (Parl. ex Arcang.) Pignatti I, Biscutella laevigata L. subsp. laevigata III, Carex caryophyllea Latourr. I, Dianthus monspessulanus L. II, Fritillaria montana Hoppe ex Koch I, Galium anisophyllum Vill. I, Galium corrudifolium Vill. IV, Koeleria splendens C. Presl (s.l.) I, Polygala major Jacq. III, Leontodon hispidus L. III, Leucanthemum adustum (W.D.J. Koch) Greml I, Linum alpinum Jacq. III, Narcissus poëticus L. V, Phleum hirsutum Honck. subsp. ambiguum (Ten.) Tzvelev I, Ranunculus illyricus L. I, Ranunculus pollinensis (N. Terracc.) Chiov. II, Rhinanthus alectorolophus (Scop.) Pollich subsp. alectorolophus III, Rhinanthus minor L. I, Thesium linophyllum L. II; Col. 7: Leontodon hispidus L. 2, Leucanthemum adustum (W.D.J. Koch) Greml 1, Poa pratensis L. 1, Silene ciliata Pourr. subsp. graeffei (Guss.) Nyman 1, Oenanthe pimpinelloides L. I; Col. 8: Pilosella officinarum Vaill. I, Cornus mas L. I, Corylus avellana L. I, Crataegus laevigata (Poir.) DC. I, Euphorbia dulcis L. I, Smyrnium perfoliatum L. (s.l.) I, Vicia cracca L. I; Col. 9: Linum catharticum L. (s.l.) I, Ononis spinosa L. subsp. spinosa I, Onobrychis viciifolia Scop. I, Allium carinatum subsp. pulchellum Bonnier et Layens II, Leontodon hispidus L. IV, Holcus lanatus L. subsp. lanatus II, Carex pendula Huds. I, Viola reichenbachiana Jord. ex Boreau I, Leucanthemum vulgare Lam. subsp. vulgare III, Ranunculus repens L. I, Bromus hordeaceus L. I, Stellaria media (L.) Vill. subsp. media I, Capsella rubella Reut. I, Lamium maculatum L. I, Erodium cicutarium (L.) L'Hér. I, Viola arvensis Murray subsp. arvensis II, Vulpia muralis (Kunth) Nees I; Col. 10: Linum catharticum L. (s.l.) I, Ononis spinosa L. subsp. spinosa II, Onobrychis vici-

folia Scop. IV, Allium carinatum subsp. pulchellum Bonnier et Layens II, *Dianthus monspessulanus* L. IV, *Anthyllis vulneraria* L. (s.l.) I, *Deschampsia flexuosa* (L.) Trin. subsp. *flexuosa* II, *Polygala vulgaris* L. subsp. *vulgaris* I, *Ranunculus pollinensis* (N. Terracc.) Chiov. I, *Colchicum lusitanum* Brot. I, *Ranunculus millefoliatus* Vahl I, *Leontodon hispidus* L. III, *Holcus lanatus* L. subsp. *lanatus* III, *Pyrus pyraster* Burgsd. I, *Listera ovata* (L.) R. Br. I, *Schedonorus arundinaceus* (Schreb.) Dumort. subsp. *arundinaceus* I, *Arrhenatherum elatius* (L.) P. Beauv. ex J. et C. Presl subsp. *elatius* II, *Trisetaria flavescens* (L.) Baumg. subsp. *flavescens* II, *Dianthus deltoides* L. subsp. *deltoides* I, *Genista sagittalis* L. II, *Carex caryophyllea* Latourr. I, *Carlina acaulis* subsp. *caulescens* (Lam.) Schübl. et G. Martens I, *Aira elegantissima* Schur I, *Koeleria cristata* (L.) Roem. et Schult. I, *Thesium linophyllum* L. II, *Picris hieracioides* L. subsp. *hieracioides* I, *Crocus vernus* (L.) Hill I, *Draba muralis* L. I, *Myosotis alpestris* F.W. Schmidt I, *Myosotis arvensis* (L.) Hill subsp. *arvensis* III, *Verbascum longifolium* Ten. I, *Veronica arvensis* L. II, *Capsella rubella* Reut. I, *Cynoglottis barrelieri* (All.) Vural et Kit Tan subsp. *barrelieri* I, *Trifolium campestre* Schreb. I, *Stachys tymphaea* Hausskn. I, *Phyteuma orbiculare* L. I, *Plantago media* L. subsp. *media* I, *Stellaria graminea* L. I, *Arabidopsis thaliana* (L.) Heynh. I, *Arenaria serpyllifolia* L. I, *Bistorta officinalis* Delarb're II, *Campanula scheuchzeri* Vill. (s.l.) I, *Carduus nutans* L. (s.l.) I, *Carex pallescens* L. I, *Cerastium holeosteoides* Fr. I, *Chaerophyllum aureum* L. I, *Cirsium arvense* (L.) Scop. I, *Dactylorhiza maculata* (L.) Soó subsp. *fuchsii* (Druce) Hyl. I, *Geranium columbinum* L. I, *Medicago falcata* L. subsp. *falcata* I, *Medicago lupulina* L. I, *Potentilla reptans* L. I, *Ranunculus serpens* Schrank subsp. *polyanthemophyllum* (W. Koch et H.E. Hess) Kerguélen I, *Saxifraga bulbifera* L. I, *Scabiosa columbaria* L. (s.l.) III, *Scorzonera purpurea* L. I, *Sherardia arvensis* L. I, *Thlaspi caerulescens* J. et C. Presl I, *Trifolium micranthum* Viv. I, *Valeriana officinalis* L. I, *Veronica serpyllifolia* L. subsp. *tenella* All. I; Col. 11: *Viola canina* L. subsp. *rupestris* III, *Hippocrepis comosa* L. subsp. *comosa* IV, *Schedonorus gigantus* (L.) Holub V, *Cerastium arvense* Gaud. V, *Helianthemum nummularium* (L.) Mill. subsp. *grandiflorum* (Scop.) Schinz et Thell. III, *Alyssum campestre* (L.) L. (s.l.) III, *Pedicularis comosa* L. subsp. *comosa* III, *Myosotis alpestris* F.W. Schmidt III, *Cynoglottis barrelieri* (All.) Vural et Kit Tan subsp. *barrelieri* III, *Iberis carnosa* Willd. subsp. *carnosa* III, *Polygala major* Jacq. III, *Lapsana communis* L. subsp. *communis* III, *Bellis sylvestris* Cirillo III, *Carex bryzoides* L. subsp. *eu-brizoides* I, *Elymus caninus* (L.) L. subsp. *caninus* I, *Lathyrus nissolia* L. I, *Orchis provincialis* Balb. ex Lam. et DC. III, *Sedum hispanicum* L. III; Col. 12: *Trifolium medium* L. subsp. *medium* I, *Thymus praecox* Opiz subsp. *polytrichus* (Borbás) Ja-

las I, *Dianthus monspessulanus* L. I, *Koeleria splendens* C. Presl (s.l.) I, *Deschampsia flexuosa* (L.) Trin. subsp. *flexuosa* I, *Ranunculus pollinensis* (N. Terracc.) Chiov. I, *Colchicum lusitanum* Brot. I, *Ranunculus millefoliatus* Vahl I, *Fraxinus excelsior* L. subsp. *excelsior* (pl.) I, *Juniperus communis* L. subsp. *communis* I, *Rhamnus alpina* L. subsp. *alpina* I, *Galium mollugo* L. subsp. *mollugo* I, *Taraxacum officinale* Weber (aggr.) I, *Ranunculus apenninus* (Chiov.) Pignatti I, *Alyssum montanum* L. subsp. *montanum* I, *Asperula cynanchica* L. I, *Galium corrudifolium* Vill. I, *Leucanthemum adustum* (W.D.J. Koch) Greml I, *Allium sphaerocephalon* L. I, *Helianthemum oelandicum* (L.) Dum. Cours. subsp. *incanum* (Willk.) G. López I, *Knautia integrifolia* (L.) Bertol. subsp. *integrifolia* I, *Thesium linophyllum* L. I, *Picris hieracioides* L. subsp. *hieracioides* I, *Crocus vernus* (L.) Hill I, *Geranium molle* L. I, *Verbascum longifolium* Ten. I, *Valeriana tuberosa* L. I, *Festuca rubra* L. (s.l.) I, *Globularia bisnagarica* L. I, *Arabis sagittata* (Bertol.) DC. I, *Barbara bracteosa* Guss. I, *Linum alpinum* Jacq. I, *Lithospermum officinale* L. I, *Orchis pauciflora* Ten. I, *Pedicularis acaulis* Scop. I, *Plantago major* L. (s.l.) I, *Saxifraga granulata* L. subsp. *granulata* I, *Sedum sexangulare* L. I, *Sedum rupestre* L. subsp. *rupestre* I, *Trinia glauca* (L.) Dumort. subsp. *carniolica* (A. Kern. ex Janch.) H. Wolff I, *Tulipa australis* Link I; Col. 13: *Thymus praecox* Opiz subsp. *polytrichus* (Borbás) Jallas 2, *Anthyllis vulneraria* L. (s.l.) 1, *Hippocrepis comosa* L. subsp. *comosa* 2, *Helianthemum apenninum* (L.) Mill. subsp. *apenninum* 1, *Polygala vulgaris* L. subsp. *vulgaris* 2, *Potentilla hirta* L. 1, *Phleum alpinum* L. 1, *Alchemilla vulgaris* L. 1, *Crepis aurea* (L.) Cass. subsp. *glabrescens* (Caruel) Arcang. 1, *Leontodon tuberosus* L. 1, *Silene vulgaris* (Moench) Garcke subsp. *vulgaris* 1, *Chenopodium bonus-henricus* L. 1, *Galium rubrum* L. 1, *Veronica serpyllifolia* subsp. *tenella* All. 1, *Genista sericea* Wulf. var. *rigida* Pamp. 1, *Alsine verna* Whub. var. *montana* Fenzl. 2; Col. 14: *Trifolium pratense* L. subsp. *semipurpureum* (Strobl) Pignatti IV, *Phleum pratense* L. I, *Tragopogon dubius* Scop. I, *Helianthemum nummularium* (L.) Mill. (s.l.) I, *Draba muralis* L. I, *Geranium molle* L. I, *Leontodon tuberosus* L. IV, *Stellaria media* (L.) Vill. subsp. *media* I, *Veronica arvensis* L. I, *Cerastium semidecandrum* L. I, *Silene latifolia* Poir. subsp. *latifolia* II, *Hypochaeris radicata* L. I, *Barbarea sicula* C. Presl I, *Cerinthe auri-culata* Ten. I, *Clinopodium alpinum* (L.) Kuntze subsp. *meridionale* (Nyman) Govaerts I, *Cruciata pedemontana* (Bellardi) Ehrend. I, *Geum molle* Vis. et Pančić II, *Milium effusum* L. I, *Oenanthe pimpinelloides* L. I, *Plantago maritima* subsp. *serpentina* (All.) Arcang. I, *Ranunculus polyanthemos* L. subsp. *thomasii* (Ten.) Tutin I, *Romulea bulbocodium* (L.) Sebast. et Mauri I, *Rumex thyrsoides* Desf. I, *Secale strictum* (C. Presl) C. Presl I, *Silene italicica* (L.) Pers. subsp. *sicula* (Ucria)

Jeanm. I, Valeriana wallrothii Kreyer I.

Appendix II: Relevès dates and localities

Tab. 1 - Rels. 1-3: from Tab. 2 (rels. 5-7) in Bonanomi & Allegrezza 2004 (Monte Rogedano, Umbria-Marche Apennines); Rel. 4: 04/07/2000, Acquasanta Valley (Sibillini mountains); Rel. 5: 20/07/2013, Passo Galluccio (Sibillini mountains); Rels. 6-9: from Tab. 2 (rels. 1-4) in Bonanomi & Allegrezza 2004 (Mt. Serra Santa, Umbria-Marche Apennines); Rels. 10-12: from Tab. 2 (rels. 8-10) in Bonanomi & Allegrezza 2004 (Mt. della Sporta, Marche Apennines).

Tab. 2 - Rel. 1: 17/07/ 2015, San Vicino Mountain group (Marche Apennines) 33 T 343095m E 4799210m N; Rels. 2-3: 18/06/2004, Catria-Acuto Mountain group (Umbria-Marche Apennines); Rel. 4: 17/07/ 2015, San Vicino Mountain group (Marche Apennines)) 33 T 342639m E 4799555m N; Rel. 5: 18/06/2004, Catria-Acuto Mountain group (Umbria-Marche Apennines); Rel. 6: 18/05/2015, Catria-Acuto Mountain group (Appennino Umbro-Marchigiano) 33 T 311620m E 4815671m N; Rel. 7: 17/07/2015, San Vicino Mountain group (Marche Apennines) 33 T 342573m E 4799420m N; Rel. 8: 17/07/ 2015, San Vicino Mountain group (Marche Apennines) 33 T 342701m E 4799543m N; Rel. 9: 17/07/ 2015, San Vicino Mountain group (Marche Apennines) 33 T 342681m E 4799528m N.

Tab. 3 - Rel. 1: 12/06/2015, Ferentillo (Umbria Infra-Apennines) 33 T 314363m E 4720104m N; Rels. 2-3: 12/06/2015, Contigliano (Lazio Infra-Apennines) 33 T

316501m E 4696497m N; Rel. 4: 10/07/2015, Carpegna (Marche Pre-Apennines) 33 T 286606m E 4848925m N; Rel. 5: 12/06/2015, Canistro Inferiore (Abruzzo Infra-Apennines) 33 T 368612m E 4644840m N; Rel. 6: 12/06/2015, Scapoli (Molise Pre-Apennines) 33 T 419661m E 4606818m N; Rels. 7-8: 12/06/2015, Pescolanciano (Molise Pre-Apennines) 33 T 445324m E 4613496m N; Rels. 9-11: 10/07/2015, Cantiano (Marche Pre-Apennines) 33 T 307488m E 4817104m N; Rel. 12: from Tab. 3 (rel. 1) in Bonanomi & Allegrezza 2004, Casacastalda Umbria Infra-Apennines); Rel. 13: from Tab. 3 (rel. 2) in Bonanomi & Allegrezza 2004, Branca (Umbria Infra-Apennines); Rel. 14: 10/07/2015, Carpegna (Marche Pre-Apennines) 33 T 285262m E 4849159m N; Rel. 15: from Tab. 3 (rel. 3) in Bonanomi & Allegrezza 2004, Casacastalda Umbria Infra-Apennines); Rels. 16-18: 29/06/2008, Pescacci (Marche Pre-Apennines); Rel. 19: 10/07/2015, Carpegna (Marche Pre-Apennines) 33 T 285563m E 4849295m N; Rels. 20-22: 19/06/2015, Capolapiaggia (Marche Infra-Apennines) 33 T 346156m E 4778836m N; Rel. 23: from Tab. 3 (rel. 4) in Bonanomi & Allegrezza 2004, Branca (Umbria Infra-Apennines).

Tab. 4 - Rel. 1: 02/07/2015, Monte Colombo (AN) 33 T 386816m E 4819678m N; Rel. 2: 02/07/2015, Monte Colombo (AN) 33 T 386632m E 4819732m N; Rel. 3: 06/07/2015, Monte Acuto (AN) 33 T 382555m E 4827348m N; Rels. 4-5: 08/07/2015, Fonte d'Olio (AN) 33 T 386810m E 4820957m N; Rel. 6: 28/05/2016, Atri (PE) 416834m E 4713840m N.