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THE *FESTUCO-BROMETEA* GRASSLANDS ON SANDSTONE AND MARL-CLAY-SANDSTONE SUBSTRATA IN TUSCANY (NORTHERN-CENTRAL ITALY)

Bruno FOGGI[1], Lorenzo LASTRUCCI[1], Matilde GENNAI[1] & Daniele VICIANI[1]

Abstract

The grasslands dominated by *Bromus erectus* and/or *Brachypodium rupestre* cover large areas on sandstone and marl-clay-sandstone substrata (limestone is excluded), of the Apennines and pre-Apennines between Pistoia and Arezzo provinces (Tuscany, Central Italy). Our investigation was focused on to 71 unpublished relevés and 45 literature relevés from Tuscany and surrounding areas, reporting the original relevés of *Astragalo monspessulani-Brometum erecti, Centaureo bracteatae-Brometum erecti* and *Ononido masquillerii-Brometum erecti*. The relevés were submitted to exploratory multivariate analysis, allowing to detect nine distinct groups. Their consistence was verified by mean of NMDS against Ellenberg/Pignatti indicator values, and CCA constrained against chorotypes and growth forms. Diagnostic species of the definitive groups resulting from the analysis were chosen according to species fidelity, based on the φ coefficient of association. The analysis splits the data set in two main subclusters; the first one (A) includes few relevés of low altitude, thermophilous conenoses, interpreted as a transition between the submediterranean aspects of *Festuco-Brometea* class and other Mediterranean herbaceous and shrubby classes; the second subcluster (B) includes most of the data set and can be clearly subdivided in pioneering, mesoxerophilous communities (B1 and B2a groups) and mesophilous communities (B2b group). The relevés of clusters B1 and B2a are referred to *Coronillo minimae-Astragaletum monspessulanii* association and to three other groups: *Plantago argentea-Carex caryophyllea* communities, *Tragopogon samaritani-Bromus erectus* communities, *Festuco trachyphyllae-Brometum erecti* ass. nova. The mesophilous group (B2b) includes the original *Centaureo bracteatae-Brometum erecti* and *Ononido masquillerii-Brometum erecti* relevés, together with a slightly differentiated community; due to the non-relevant differences between these grassland types from floristic, ecological and chorological perspectives, we propose herewith to treat them as three subassociations of *Centaureo bracteatae-Brometum erecti* (*typicum, ononidetosum masquillerii* and *linetosum cathartici*). Post-cultural grasslands in human-disturbed areas were also detected. All these communities can be attributed to *Polygalo mediterraneae-Bromenion erecti* suballiance (*Bromion* alliance), even if a clear subdivision between the mesoxerophilous pioneer aspects and the more mesophilous and evolved ones can be noted.

Keywords: *Bromion erecti,* Ellenberg Indicator Values, grasslands, multivariate analysis, Northern Apennines, phytosociology, syntaxonomy.

Izvleček

Travišča v katerih prevladujeta vrsti *Bromus erectus* in/ali *Brachypodium rupestre* pokrivajo velike površine na podlagi iz peščenjaka in laporasto-glinastega peščenjaka (apnenec je izključen) na Apeninih in območju pred njimi med provincama Pistoia in Arezzo (Toskana, srednja Italija). Naša raziskava je bila osredotočena na 71 neobjavljenih in 45 objavljenih vegetacijskih popisov iz Toskane in sosednjih območij. Originalni popisi opisujejo asociacije *Astragalo monspessulani-Brometum erecti, Centaureo bracteatae-Brometum erecti* in *Ononido masquillerii-Brometum erecti*. Popise smo obdelali z multivariatno analizo s katero smo zaznali 9 skupin. Konsistenstnost skupin smo preverili s povprečjem NMDS proti Ellenberg/Pignatti indikatorskim vrednostim

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in CCA proti horotipom in rastnim oblikam. Diagnostične vrste posameznih skupin smo določili z navezanostjo vrst, ki temelji na φ koeficientu asociacije. Z analizo smo podatkovni niz razdelili na dva klastra; prvi (A) vključuje nekaj popisov termofilne cenoze z nižje nadmorske višine, ki jih opišemo kot prehod med submediteranskim aspektom razreda *Festuco-Brometea* in drugih mediteranskih zeliščnih in grmiščnih razredov; drugi klaster (B) pa vključuje večino podatkovnega niza in ga lahko členimo na pionirske, mezokserofilne (skupini B1 in B2a) in mezofilne združbe (skupina B2b). Popise klastrov B1 in B2a uvrščamo v asociacijo *Coronillo minimae-Astragaletum monspessulanii* in tri druge skupine: združba *Plantago argentea-Carex caryophyllea*, združba *Tragopogon samaritani-Bromus erectus* in *Festuco trachyphyllae-Brometum erecti* ass. nova. Mezofilna skupina (B2b) vključuje popise asociacij *Centaureo bracteatae-Brometum erecti* in *Ononido masquillerii-Brometum erecti,* skupaj z delno spremenjeno združbo. Zaradi majhnih razlik v floristočnem, ekološkem in horološkem pogledu med temi traviščnimi tipi predlagamo, da jih obravnavamo kot tri subasociacije *Centaureo bracteatae-Brometum erecti* (*typicum, ononidetosum masquillerii* in *linetosum cathartici*). Opisali smo tudi nekaj negospodarjenih travišč na motenih rastiščih. Vse združbe lahko uvrstimo v podzvezo *Polygalo mediterraneae-Bromenion erecti* (podzveza *Bromion*), čeprav je opazna delitev med mezokserofilnim pionirskim in mezofilnim in bolj razvitim aspektom.

Ključne besede: *Bromion erecti,* Ellenbergove indikatorske vrednosti, travišča, multivariatna analiza, severni Apenini, fitosociologija, sintaksonomija.

1. INTRODUCTION

European dry grasslands belonging to *Festuco-Brometea* class are considered by the European Community as seminatural habitats of high conservation value, listed in Annex I of the Habitat Directive (92/43 EEC, with Natura2000 codes 6210, 62A0): their presence and conservation are generally related to human management (Biondi 2005). In the last two decades several papers were devoted to the syntaxonomical problems of these communities in Europe (see Royer 1991; Mucina & Kolbek 1993, Dengler et al. 2003, 2006, Dengler 2004, Chytrý et al. 2007, Mucina et al. 2009, Terzi 2011), including Italy, with particular concern on the peninsular regions (Biondi et al. 1995, 2005, Di Pietro 2011, Biondi & Galdenzi 2012). Based on the afore mentioned literature data about Italy, some considerations raised: i) much of the information on this vegetation type consists in local contributions mainly focused on the limestone substrata of central and southern Apennines; ii) very few studies have been carried out in the north-western Apennines (e.g. Castelli 1995, Zanotti et al. 1995, 1998, Castelli et al. 2001, Barcella & Assini 2013).

In past and recent revisions of Apennine *Festuco-Brometea* grasslands, whose references are quoted above, contributions from Tuscany were poorly represented. Indeed published vegetation relevés attributed to this class in the Tuscan region are usually dispersed in extensive vegetation surveys of restricted areas and invariably analyzed apart without comparing all the available data and without the aim to define general floristic-ecological trends. Moreover, most of the available data refer to dry grasslands on calcareous and ultramafic substrata (Arrigoni et al. 1983, 1997, Arrigoni & Bartolini 1997, Casini & De Dominicis 1999, Viciani et al. 2002a, Arrigoni 2003, Angiolini et al. 2003, 2009, Lastrucci et al. 2009, Viciani & Gabellini 2013, etc.), whereas information about sandstone and marl-clay-sandstone substrata is scarce, and addressed to restricted areas in eastern Tuscany (Biondi et al. 1985, 1988, De Dominicis et al. 2002, Viciani et al. 2002b, 2004, Viciani & Gabellini 2006). In two of the above quoted papers, two new associations were described: *Coronillo minimae–Astragaletum monspessulani* (Biondi et al. 1985) and *Ononido masquillerii-Brometum erecti* (Biondi et al. 1988). Recently, several field research promoted by Local Administrations were carried out, mainly in order to improve the knowledge on habitats of conservation concern (e.g. Foggi & Venturi 2009), allowing to collect several new dry grassland vegetation relevés.

In order to implement the phytosociological knowledge on the *Festuco-Brometea* grasslands growing on non-calcareous substrata, we focus on the following questions:

1) is the diversity of Tuscan vegetation types on sandstone and marl-clay-sandstone substrata already known?
2) is the traditional classification of the *Festuco-Brometea* class at the level of orders, alliances and suballiances adequate to describe these vegetation types?

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2. MATERIAL AND METHODS

2.1 Data sources and vegetation sampling

A total of 71 original phytosociological relevés were performed with Braun-Blanquet (1932, 1964) method also in accordance to the pragmatic rules given by Dengler et al. (2005, 2008). The general position of all the relevés used for the analysis has been reported on Figure 1. These relevés are deposited in an Access data-base of the Laboratory of Botany the Department of Biology, University of Florence and are at disposition under request. All data exclusively concern grasslands located on sandstone or marl-clay-sandstone substrata, according to the geological map by Carmignani & Lazzarotto (2004). Original relevés have been performed in 2007–2010 spring and summer periods, in a strictly homogeneity of physiognomy and physiography according to Géhu (1988). We only sampled grasslands where the dominance of grass species (*Poaceae*) and other herbs was clear and where only a little visible effect of succession was observed. The 45 published relevés included the original tables of some associations, described in Tuscany or in the surrounding areas and/or reported in vegetation studies for Tuscan areas. The references of the published relevés we used and a list of the original relevés with their geographical coordinates are reported in Appendix 1. Some literature relevés were excluded because of their high shrub cover values (no relevé with more than 25% shrub cover value was considered).

Vascular plant nomenclature was unified following Conti et al. (2005, 2007) with very few exceptions due to more recent nomenclatural changes.

The attribution to syntaxonomic ranks higher than association level and the selection of diagnostic species were determined by comparison with specific literature (Oberdorfer 1978, Biondi et al. 1995, 2005, Rivas-Martínez et al. 2002, Dengler et al. 2003, Chytrý 2007, Mucina et al. 2009, Biondi & Galdenzi 2012), besides some other sources quoted specifically in the text.

The syntaxonomic nomenclature follows the International Code of Phytosociological Nomenclature (Weber et al. 2000).

2.2 Vegetation classification

All 116 relevés (Table 1) were submitted to classification (cluster analysis) and ordination (PCoA and NMDS) with statistical software (package Syntax V, Podani 2002; PAST, Hammer et al.

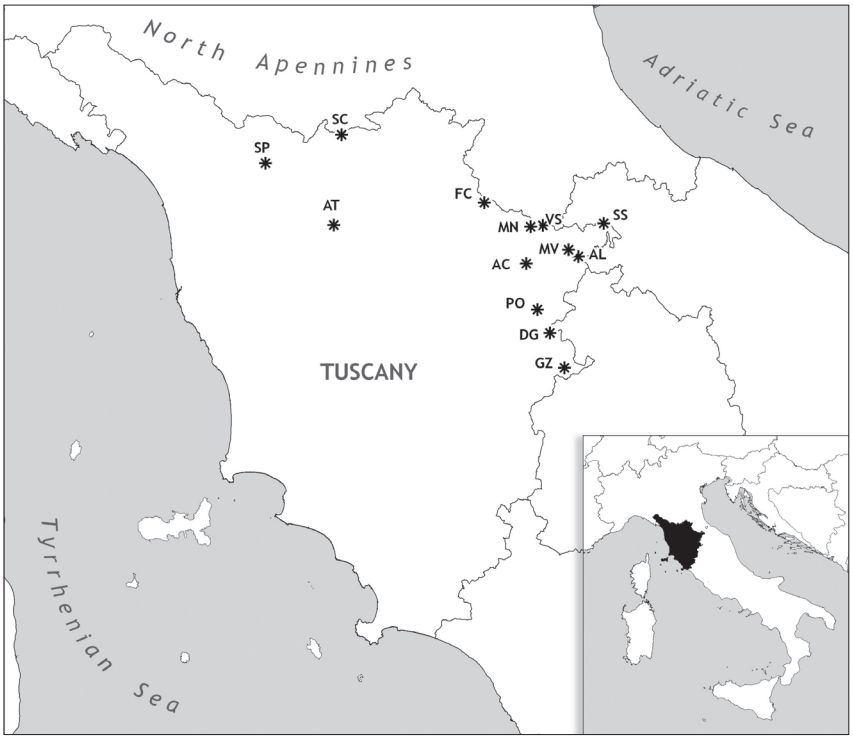

Figure 1: Map of the study area and sites of the relevés. Abbreviations: AT – Artimino; SP – Alta Svizzera Pesciatina; VS – Vallesanta; AL – Alpe della Luna; SC – Scalette; DG – Monte Dogana; GZ – Monte Ginezzo; PO – Alpe di Poti; MV – Monteverde; MN – Monte Nero; SS – Sasso di Simone; AC – Alpe di Catenaia; FC – National Park of Casentino Forests.

Slika 1: Zemljevid proučevanega območja in lokacije popisov. Okrajšave: AT – Artimino; SP – Alta Svizzera Pesciatina; VS – Vallesanta; AL – Alpe della Luna; SC – Scalette; DG – Monte Dogana; GZ – Monte Ginezzo; PO – Alpe di Poti; MV – Monteverde; MN – Monte Nero; SS – Sasso di Simone; AC – Alpe di Catenaia; FC – Nacionalni park Casentino.

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2001). For cluster analysis we used UPGMA algorithm with Bray-Curtis as distance measure; for NMDS we used a Bray-Curtis distance too. Diagnostic species of the main vegetation units, obtained by the numerical classification, were identified using the phi-coefficient of association (Chytrý et al. 2002), performed by software JUICE 7 (Tichý 2002). According to Chytrý (2007), species with phi ≥ 0.50 were considered as highly diagnostic, and species with phi > 0.25 as diagnostic. The species whose concentration according to Fisher's exact test was not significant at p<0.01 were disregarded. Furthermore, for the already described *syntaxa,* we reported the species considered as characteristic/differential by the authors of that *syntaxon* only if they proved to have a relevant phi-coefficient in our relevés. The relevés in Table 1 are arranged according to these procedures. Finally, some relevés were re-arranged according to our personal knowledge of the species and of the ecological situation of the sites.

We calculated un-weighted Ellenberg/Pignatti Ecological Indicator Value mean (EIV) for temperature, nutrients, moisture, soil reaction and continentality (Ellenberg et al. 2001, Pignatti 2005) and chorotypes (Arrigoni 1983, Takhtajan 1986). Furthermore we calculated weighted principal growth forms (Arrigoni 1996).

In addition, constrained ordinations of the hypothesized groups were performed through canonical correspondence analysis (CCA) according to the distribution of species and growth forms. Its effect on the ordination pattern was tested using the Monte Carlo test with 9999 random permutations. The ecological requirements (indirectly calculated by mean of EIV) were plotted against the unconstrained NMDS ordination of the relevés.

3. RESULTS

The cluster analysis performed on the data set of 116 relevés (Figure 2) shows two principal subclusters (A and B). The subcluster A encompasses a small group of relevés made at low altitudes in the central part of the study area. They are floristically well-distinguished for a relevant cover of Mediterranean suffrutices and scrubs (*Dorycnium hirsutum, Cistus monspeliensis, Teucrium capitatum*) that are found in the class *Rosmarinetea* (Rivas-Martinez et al. 1991) and for the presence of thermophilous herbaceous species like *Bothriochloa ischaemum*, *Melica ciliata, Galactites tomentosa*, etc.

The second subcluster (B) can be further divided in two main groups: the smaller one (B1) includes relevés from the Pistoia province characterized by mesoxerophilous species as *Plantago argentea* and *Koeleria lobata*; the second larger group (B2) is further divided in two principal subgroups. B2a encompasses *Coronillo minimae-Astragaletum monspessulani* original relevés (B2a1) and other pioneer floristically differentiated communities related to scarcely evolved soils confined on mountain areas of northern-central (B2a2) and eastern Tuscany (B2a3).

The B2b subcluster can be referred to grasslands on more evolved and mesophilous soils and encompasses several distinguishable subgroups: mesophilous communities located in eastern Apennines (B2b1), *Centaureo bracteatae-Brometum erecti* original relevés and some other Tuscan relevés (B2b2), *Ononido masquillerii-Brometum erecti* association present only on Sasso di Simone and Simoncello Mt. (B2b3), finally a group of similar conenoses more strongly characterized by ruderal and human managed meadow species (B2b4).

The groups distinguished by cluster analysis have been tested against the Ellenberg/Pignatti Ecological Indicator values (EIV), the chorotypes and the growth forms (Figures 3, 4, 5). The EIV NMDS (Figure 3) shows that groups B2b1, B2b2 and B2b3 appears positively related to nutrient (N), water availability (U) and soil reaction (R); others (B1 and B2a3) to temperature (T) and light (L) and negatively related to moisture (U). B2a1 and B2a2 groups appears to be more oligotrophic, while A results clearly separated from all the others groups and seems to be strictly related to T. Group A is well distinguished also in the chorological CCA (Figure 4), because of its floristic composition very rich in Mediterranean species. B1 and B2a3 have a relevant portion of Mediterranean and Euro-Mediterranean elements, while the more mesophilous groups resulted to be characterized by European and Eurasiatic chorotypes. Some discriminating features can be illustrated also by the growth form CCA (Figure 5), as some groups are positively related to the presence of graminoid and non-graminoid annual herbs (B1 and B2a3), others to a relevant portion of suffrutices (B2a1, B2a2), others to non-graminoid perennial herbs (B2b1, B2b2, B2b3).

In the synoptic table (Table 2) the fidelity phi-coefficient (Chytrý et al. 2002, Tichý 2002) of the diagnostic species was also reported.

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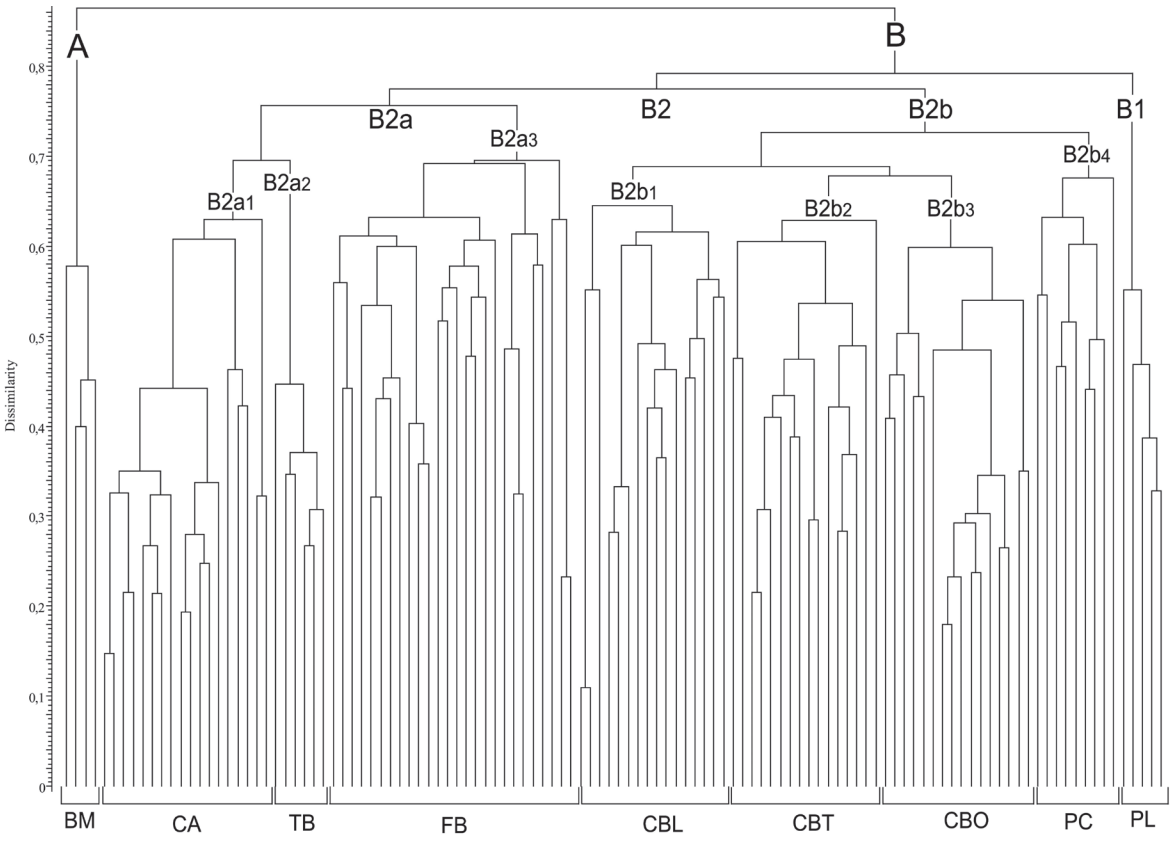

Figure 2: Dendrogram of phytosociological relevés. Group A – *Bothriochloa ischaemum-Melica ciliata* comm.(BM); group B1 – *Plantago argentea-Carex caryophyllea* comm. (PL); group B2a1 – *Coronillo minimae-Astragaletum monspessulani* (CA); group B2a2 – *Tragopogon samaritani-Bromus erectus* comm. (TB); group B2a3 – *Festuco trachyphyllae-Brometum erecti* (FB); group B2b1 – *Centaureo bracteatae-Brometum erecti linetosum cathartici* (CBL); group B2b2 – *Centaureo bracteatae-Brometum erecti typicum* (CBT); group B2b3 – *Centaureo bracteatae-Brometum erecti ononidetosum masquillierii* (CBO); group B2b4 – *Cichorium intybus-Bromus erectus* post-cultural comm. (PC).

Slika 2: Dendrogram fitocenoloških popisov. Skupina A – združba *Bothriochloa ischaemum-Melica ciliata*(BM); skupina B1 – združba *Plantago argentea-Carex caryophyllea* (PL); skupina B2a1 – *Coronillo minimae-Astragaletum monspessulani* (CA); skupina B2a2 – združba *Tragopogon samaritani-Bromus erectus* (TB); group B2a3 – *Festuco trachyphyllae-Brometum erecti* (FB); skupina B2b1 – *Centaureo bracteatae-Brometum erecti linetosum cathartici* (CBL); skupina B2b2 – *Centaureo bracteatae-Brometum erecti typicum* (CBT); skupina B2b3 – *Centaureo bracteatae-Brometum erecti ononidetosum masquillierii* (CBO); skupina B2b4 – združba *Cichorium intybus-Bromus erectus* (PC).

4. DISCUSSION

4.1 Group A – *Bothriochloa ischaemum-Melica ciliata* communities (Table 1, rel. 1–4)

Diagnostic species: *Brachypodium rupestre, Bromus erectus, Bothriochloa ischaemum, Melica ciliata, Avena barbata, Centaurea deusta, Galactites tomentosus, Onobrys caput-galli*.

These communities are termophilous grasslands located at very low-altitudes (70–145 m a.s.l.) near Montalbano hills (Prato Province) on clay-sandstone substrata. Several grass species (above mentioned) are co-dominant and many herbs (*Galactites tomentosa, Crupina vulgaris)* and suffrutices belonging to Mediterranean vegetation are present (*Teucrium capitatum, Micromeria graeca, Dorycnium hirsutum,* etc.). The strong dominance of Mediterranean elements is evidenced by CCA of the chorotypes (Figure 4); the EIV NMDS (Figure 3) highlights the termophilous and xerophilous character of these conenoses. Presence of some species as *Bothriochloa ischaemum, Micromeria graeca, Teucrium capitatum,* etc., once attributed to *Xerobromion* and recently

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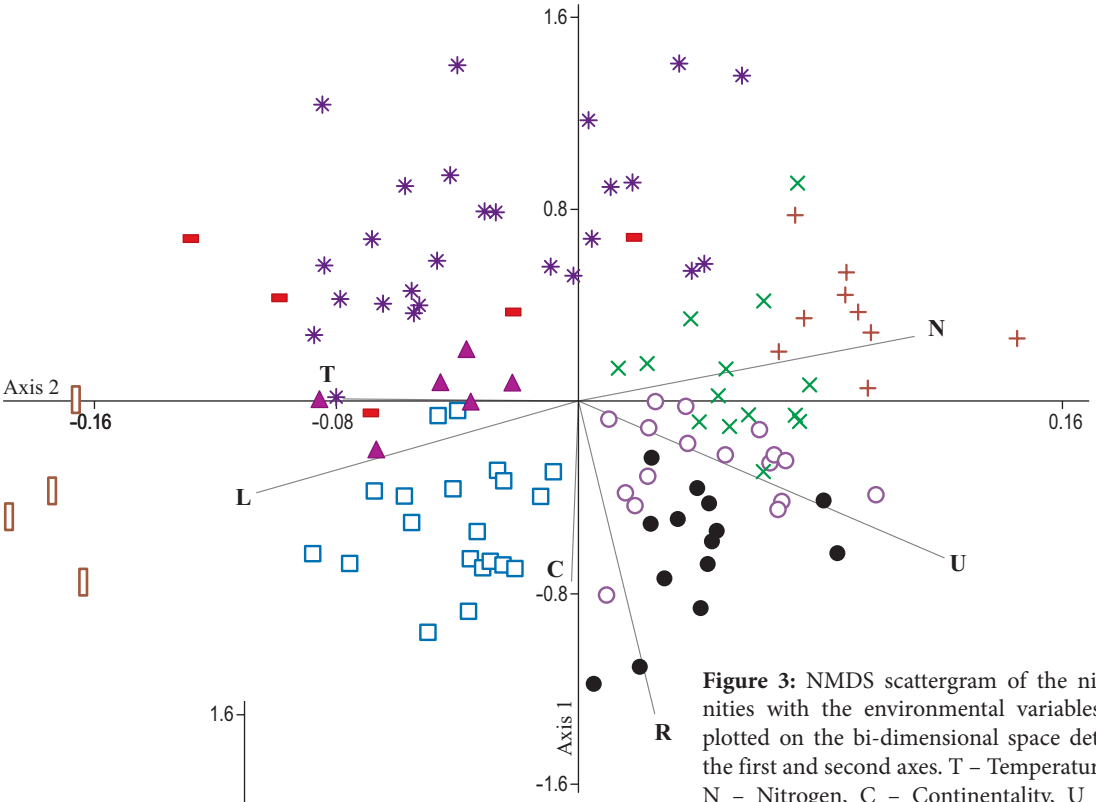

Figure 3: NMDS scattergram of the nine communities with the environmental variables as vectors plotted on the bi-dimensional space determined by the first and second axes. T – Temperature, L – Light, N – Nitrogen, C – Continentality, U – Moisture, R – Soil reaction.

Slika 3: Graf NMDS z devetimi združbami in okoljskimi spremenljivkami kot vektorji prikazanimi v dvodimenzionalnem prostoru določenem s prvo in drugo osjo. T – temperatura, L – svetloba, N – hranila, C – kontinentalnost, U – vlaga, R – reakcija tal.

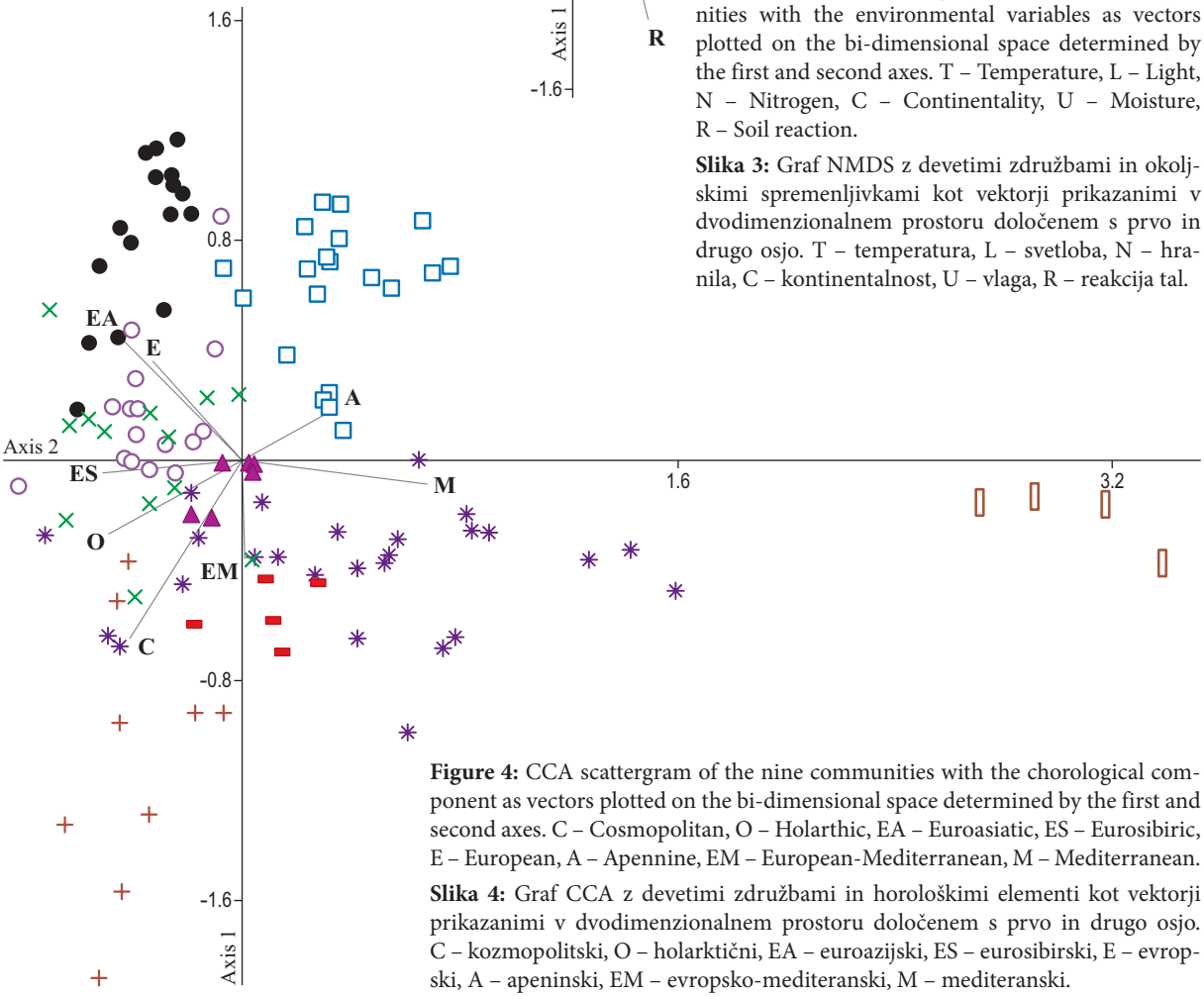

Figure 4: CCA scattergram of the nine communities with the chorological component as vectors plotted on the bi-dimensional space determined by the first and second axes. C – Cosmopolitan, O – Holarthic, EA – Euroasiatic, ES – Eurosibiric, E – European, A – Apennine, EM – European-Mediterranean, M – Mediterranean.

Slika 4: Graf CCA z devetimi združbami in horološkimi elementi kot vektorji prikazanimi v dvodimenzionalnem prostoru določenem s prvo in drugo osjo. C – kozmopolitski, O – holarktični, EA – euroazijski, ES – eurosibirski, E – evropski, A – apeninski, EM – evropsko-mediteranski, M – mediteranski.

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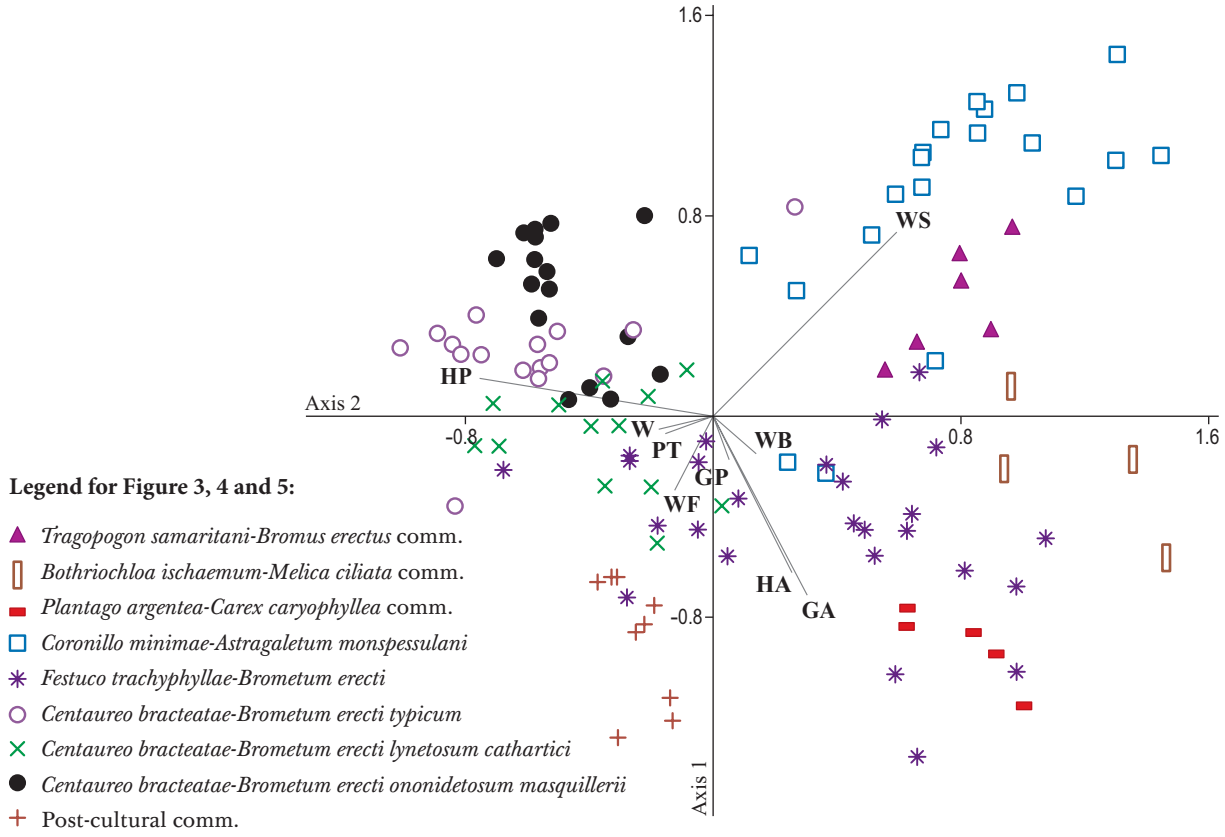

Figure 5: CCA scattergram of the nine communities with the growth forms as vectors plotted on the bi-dimensional space determined by the first and second axes. W – Trees, WB – Scrubs, WS – Suffrutex, WF – Frutex and Lianes, HP – Perennial Herbs, HA – Annual Herbs, GP – Perennial Grasses, GA – Annual Grasses, PT – Pteridophytes.

Slika 5: Graf CCA z devetimi združbami in rastnimi oblikami kot vektorji prikazanimi v dvodimenzionalnem prostoru določenem s prvo in drugo osjo. W – drevesa, WB – grmi, WS – pritlični grmi, WF – grmi in ovijalke, HP – trajna zelišča, HA – enoletna zelišča, GP – trajne trave, GA – enoletne trave, PT – praproti.

re-attributed to *Rosmarinetea* (Biondi et al. 2005), as well as the ecological features, suggest to interpret these communities as a transition between the submediterranean aspects of *Festuco-Brometea* class and other Mediterranean herbaceous and shrubby classes, particularly *Rosmarinetea officinalis*. For these reasons they are not included in the final syntaxonomical scheme.

4.2 Group B1 – *Plantago argentea-Carex caryophyllea* communities (Table 1, rel. 5–9)

Diagnostic species: *Plantago argentea, Koeleria lobata, Aira caryophyllea, Centaurea arrigonii, Poa bulbosa, Hypochaeris radicata, Cerastium pumilum, Medicago minima, Bromus rubens.*

This vegetation type has been recorded exclusively in Pistoia Apennines at altitudes around 1000 m a.s.l., on marly-clay-sandstone substrata. As shown by the NMDS of EIV (Figure 3), heliophilous, oligotrophic and xerophilous species are found to be dominant of these open pioneer grasslands growing on thin soils. The community is dominated by *Bromus erectus* and *Carex caryophyllea*, with other species belonging to more mesoxerophilous syntaxa of the *Festuco-Brometea* (*Plantago argentea, Koeleria lobata, Centaurea arrigonii*, etc.) and differentiated by annual pioneer graminoid and non-graminoid species (*Aira caryophyllea, Poa bulbosa, Cerastium pumilum, Medicago minima*, etc.) as shown by the growth form CCA (GA and HA in Figure 5). The relevant portion of Euro-Mediterranean chorotypes (Figure 4) confirms the slightly thermophilous character of

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the community. From a syndynamic perspective, these grasslands tend to be invaded by *Juniperus communis* stands; the mature forest stage is not clear and is probably linked to mesophilous-subacidophilous *Quercus cerris* woods (Gennai 2011).

4.3 Group B2a1 – *Coronillo minimae-Astragaletum monspessulani* Biondi & Ballelli in Biondi, Ballelli & Principi 1985 (Table 1, rel. 10–30)

Diagnostic species: *Coronilla minima*, *Astragalus monspessulanus, Linum tenuifolium, Leontodon rosani, Fumana procumbens*. (In the original description of the association *Centaurea jacea* subsp. *gaudinii* was considered a characteristic species, but afterwards it was included in the differential species of *Polygalo mediterraneae-Bromenion erecti* suballiance by Biondi et al. 2005; *Fumana procumbens* was added as diagnostic species by Biondi et al. 2005)

This syntaxon was firstly described for eastern Tuscan Apennines (Alpe della Luna, Badia Tedalda) and some other localities at the boundaries with Marche, Umbria and Emilia-Romagna regions (Biondi et al., 1985). The field survey extends the presence of this association also in the Casentino Valley (Valle Santa). The association refers to pioneer vegetation with *Astragalus monspessulanus, Coronilla minima, Centaurea ambigua, Fumana procumbens, Linum tenuifolim* etc.; it grows on scarcely evolved soils, subjected to a certain degree of erosion, on arenaceous or, more often, marl-clay-sandstone substrata. The association was originally assigned to *Xerobromion* alliance due the high presence of xerophilous species (Biondi et al. 1985, 1986) but in the most recent revision of Apennine grasslands belonging to *Brometalia erecti* order (Biondi et al. 2005) the association was attributed to the *Bromion erecti* alliance, representing its pioneer aspect. The EIV NMDS (Figure 3) evidences the xeroheliophilous and oligotrophic character of these communities and the growth form CCA (Figure 5) shows a relevant presence of suffrutices (WS). The community appears to be chorologically characterized by Apennine elements (Figure 4). With the soil evolution, the association tends to evolve towards more mesophilous and nitrophilous grasslands such as *Centaureo bracteatae-Brometum erecti* (Biondi et al., 1986, Viciani et al. 2002b). From a syndynamical perspective, in Tuscan sites the mature forest vegetation consists mainly of mixed subacidophilous *Quercus cerris* wood (*Cephalanthero longifoliae-Querco cerridis sigmetum* and *Melico uniflorae-Querco cerridis sigmetum*, see De Dominicis et al. 2010). In some localities of the study area (Alpe della Luna: rel. 25 and 26) an impoverished aspect of the subassociation *seslerietosum italicae* Zanotti, Ubaldi & Puppi 1995 was found (Viciani et al. 2002b). The subassociation, described for the Emilia-Romagna sector of the Apennines (Zanotti et al. 1995) in lower aridity conditions with respect to the typical association (see Biondi et al. 1985), is differentiated by species such as *Sesleria italica*, *Campanula medium, Festuca robustifolia* (maybe confused with other *Festuca* species) and *Euphorbia cyparissias*.

4.4 Group B2a2 – *Tragopogon samaritani-Bromus erectus* communities (Table 1, rel. 31–36)

Diagnostic species: *Tragopogon samaritani, Teucrium montanum, Arenaria serpyllifolia, Crepis staticifolia, Silene vulgaris, Thymus pulegioides*.

This vegetation type can be found on oligotrophic soils derived from sandstone substrata, in the northern-central part of the study area (Prato Apennines), at altitudes around 1100 m a.s.l. It consists in open, meso-subacidophilous grasslands dominated by *Festuca inops, Bromus erectus,* etc. The soil is shallow and not well developed, rich in debris, as clearly evidenced by the presence of some specialized species (*Anthyllis vulneraria, Sedum sexangulare, Astragalus monspessulanus, Teucrium montanus, Acinos alpinus, Arenaria serpyllifolia*, etc.). These grasslands are similar to *Coronillo minimae-Astragaletum monspessulani*, as they are markedly pioneer and present numerous xerophilous species; they could be interpreted as a vicariant of *Coronillo-Astragaletum* on marl-deficient soils. The ecological affinity between these two communities is also highlighted by either EIV NMDS (Figure 3) and growth form CCA (Figure 5) where they show similar positions and trends. The two vegetation types seem to be chorologically quite different (Figure 4) since in *Tragopogon samaritani-Bromus erectus* communities the Apennine elements are less important and several chorological components (Eurosiberian, Mediterranean and Euro-Mediterranean) are more or less equally represented. Furthermore *Coronillo-Astragaletum* presents a slightly higher suffrutex cover (WS in Figure 5). Syndynamically, these grasslands tend

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to evolve towards acidophilous shrublands of the class *Cytisetea scopario-striati* (Angiolini et al. 2007) as indicated by a relevant presence of *Cytisus scoparius* in the relevés, and subsequently towards meso-acidophilous mixed *Quercus spp*. dominated woods (*Physospermo cornubiensis-Querco petraeae sigmetum*) (cfr. De Dominicis et al. 2010).

4.5 Group B2a3 – *Festuco trachyphyllae-Brometum erecti* ass. nova hoc loco (Table 1, rel. 37–62; typus rel. n. 49)

Diagnostic species: *Festuca stricta* subsp. *trachyphylla*, *Sedum rupestre* subsp. *rupestre*, *Aira elegantissima*.

Grasslands on scarcely evolved arenaceous soils, often with the presence of outcroppings rocks were recognized at altitudes ranging from 700 to 1040 m a.s.l. in the mountain of south-eastern Tuscan Apennines (Poti Alp, Dogana Mt., Ginezzo Mt. and Catenaia Alp). These communities are characterized by the dominance of *Bromus erectus* invariably accompanied by *Festuca stricta* subsp. *trachyphylla* and by numerous xerophilous species of the *Festuco-Brometea* class (e.g. *Festuca inops*, *Galium lucidum* subsp. *lucidum*, *Allium spherocephalon*). This vegetation type appears differentiated by two groups of transgressive species testifying the spatial and dynamical contacts with other vegetation types occurring in the study areas: first group is represented by small succulent suffrutices included in the class *Sedo-Scleranthetea* such as *Sedum rupestre* subsp. *rupestre*, *S. sexangulare*, and perennial herbs like *Rumex acetosella*; second group consists of annual subacidophilous, xerophilous and oligotrophic species of the *Tuberarietea guttatae* class such as *Aira elegantissima*, *Linum tryginum*, *Cerastium brachypetalum*, *Briza maxima* etc. This vegetation type is here described with the proposal of a new association named *Festuco trachyphyllae-Brometum erecti ass. nova hoc loco*. The relatively oligotrophic, thermophilous, heliophilous, xerophilous and subacidophilous character of the association is highlighted by the EIV NMDS (Figure 3). According with the ecology of this vegetation type, the chorotype CCA (Figure 4) shows high relevance of Mediterranean and Euro-Mediterranean elements. The growth form CCA (Figure 5) evidences occurrence of annual species in the association. From the vegetation dynamics perspective, in condition of more-evolved soils, these meadows tend to be invaded by woody species such as *Erica scoparia, E. arborea, Calluna vulgaris*, *Juniperus communis* or *J. oxycedrus,* either forming a mosaic pattern with these shrubs or evolving towards acidophilous vegetation of the class *Cytisetea scopario-striatae* (see Angiolini et al., 2007). The mature forest steps could be referred to the acidophilous Thyrrenian *Q. cerris* series (*Erico arboreae-Querco cerridis sigmetum* and *Cephalanthero longifoliae Querco cerridis sigmetum* (see De Dominicis et al. 2010).

4.6 Mesophilous grasslands of the *Centaureo bracteatae-Brometum erecti* (s.l.) association

The B2b1, B2b2 and B2b3 groups refer to mesophilous grasslands on evolved soils; these groups include mainly published relevés of *Centaureo bracteatae-Brometum erecti* association (B2b2), published and unpublished relevés of *Ononido masquillerii-Brometum erecti* from Sasso di Simone (B2b3), and a slightly separated group of literature and original relevés from several localities of eastern Tuscan Apennines (B2b1). These three groups show several floristic affinities such as the presence of *Centaurea jacea* subsp. *gaudinii* (= *C. bracteata*), *Dorycnium herbaceum* and many other mesophilous species of *Bromion/Brometalia* syntaxa (see Table 1). These communities appear also ecologically and chorologically quite similar: they are positively related with N and U axis (Figure 3), and mostly characterized by Eurasiatic (s.l.) and European chorotypes (Figure 4). Similar trends are also shown by growth form CCA (Figure 5), as they are positively related to a significant presence of perennial herbs. Due to the floristic, ecological and chorological overall affinity, from a syntaxonomic perspective, we prefer to consider all these relevés as belonging to the same association, divided in three distinct subassociations. According to the ICPN (Weber et al. 2000) the priority name to be used is *Centaureo bracteatae-Brometum erecti,* further articulated in three subassociations: *typicum*, *ononidetosum masquillerii* and *linetosum cathartici*.

4.6.1 Group B2b1 – *Centaureo bracteatae-Brometum erecti linetosum cathartici* subass. nova hoc loco (Table 1, rel. 63–77; typus rel. n. 76)

Diagnostic species of subassociation: *Linum catharticum, Leontodon hispidus, Medicago lupulina*.

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This vegetation type refers to mesophilous grasslands mainly located in eastern Tuscan Apennines, from Sasso di Simone to Alpe della Luna Mt., generally on low slopes and evolved soils, at altitudes ranging from 770 to 1150 m a.s.l. The floristic composition is mostly charaterized by mesophilous species of *Festuco-Brometea*, such as *Centaurea jacea* subsp. *gaudinii*, *Leucanthemum vulgare, Briza media*, etc. and by differential species of *Molinio-Arrhenatheretea* (*Cynosurus cristatus, Trisetaria flavescens, Trifolium pratense,* etc.). From an ecological and chorological concern, these communities are very similar to *Centaureo bracteatae-Brometum* typicum and, to lesser extent, to the subass. *ononidetosum masquillerii* (see Figures 3 and 4). They are also similar to other mesophilous *Brometalia* associations, such as *Trifolio incarnati-Brometum erecti* described from Ligurian Apennines (Oberdorfer & Hofmann 1967). Notwithstanding, these grasslands present some peculiar floristic features, making problematic the attribution to the above mentioned syntaxa; moreover some species, mainly *Linum catharticum, Leontodon hispidus, Ononis spinosa, Polygala flavescens, Cirsium tenoreanum,* and *Carlina utzka*, can be considered differential since they are absent or poorly represented in the other two mesophilous communities. Accordingly, based on these plants, the proposal of a new subassociation, named *Centaureo bracteatae-Brometum erecti linetosum cathartici* subass. nova hoc loco, is herewith advanced. It refers to grazed or sometimes mowed meadows on nutrient-rich soils. Significant presence of *Molinio-Arrhenatheretea* species indicates the contact of these grasslands with the human-managed meadows in the neighboring. Abandonment of the traditional activities favors the ingression of shrubs (mesophilous *Rhamno-Prunetea* thickets) and afterwards of mixed oak woods (*Aceri obtusati-Querco cerridis sigmetum, Cephalanthero longifoliae-Querco cerridis sigmetum*, see De Dominicis et al. 2010).

4.6.2 Group B2b2 – *Centaureo bracteatae-Brometum erecti* Biondi, Ballelli, Allegrezza, Guitian & Taffetani 1986 subass. *typicum* (Table 1, rel. 78–91; typus: rel. n. 3, Table 3 in Biondi et al. 1986)

Diagnostic species: *Galium mollugo* subsp. *erectum*, *Centaurea scabiosa* subsp. *scabiosa*.

The association was firstly described on marl-sandstone substrata of Umbria-Marche Apennines, from hilly belt to 900 m a.s.l. (Biondi et al., 1986). In the original description of the association, *Centaurea jacea* subsp. *gaudinii* was considered a characteristic species, but afterwards it was included in the differential species of *Polygalo mediterraneae-Bromenion erecti* suballiance by Biondi et al. (2005). This vegetation type refers to meadows on evolved substrata, rich in mesophilous species of the *Bromion* alliance and also in several transgressive plants from *Molinio-Arrhenatheretea* class.

From the point of view of vegetation dynamics, with the abandonment of grazing these communities undergo the invasion by shrubs (*Juniperus* spp., *Spartium junceum* etc.) and successively evolve towards *Quercus cerris/Ostrya carpinifolia/Fraxinus ornus* woods (Biondi et al. 1986). The cluster analysis and Table 1 show that the association is present in two eastern Tuscan sites, always at altitudes lower than 1000 m a.s.l.: Monte Nero and The National Park of Casentino Forests. The analysis however evidence that this association is probably less widespread in Tuscany than it has been reported in previous studies.

The mesophilous and nitrophilous character of the association is shown by the EIV NMDS (Figure 3); the growth form CCA (Figure 5) and the chorotype CCA (Figure 4) evidence the relevant presence of perennial non-graminoids herbs and the high contribution of Eurasiatic (s.l.) geographic elements, respectively.

4.6.3 Group B2b3 – *Centaureo bracteatae-Brometum erecti ononidetosum masquillerii stat. novo* (=*Ononido masquillierii-Brometum erecti* Biondi, Allegrezza, Guitian & Taffetani 1988 subass. typicum) (Table 1, rel. 92–105; typus rel. n. 5 in Tab. 2 in Biondi et al. 1988)

Diagnostic species of the subassociation: *Ononis masquillieri*, *Plantago maritima*, *Scorzonera cana*. (In the original description of the association *Dorycnium herbaceum* was considered a characteristic species, but afterwards it was included in the differential species of *Polygalo mediterraneae-Bromenion erecti* suballiance by Biondi et al. 2005).

These communities refer to mesophilous meadows with *Bromus erectus* and *Ononis masquillieri* originally described on marl-sandstone clay-rich substrata of the Sasso Simone and Simoncello Mts. (Biondi et al. 1988). These grasslands

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are typically in contact with the pioneer association *Podospermo cani-Plantaginetum maritimae* of the clay badlands, and develop at the head of the badlands, extending also towards areas not directly interested by erosion (Biondi et al. 1988). *Ononido masquillieri-Brometum erecti* association was interpreted by original Authors as a vicariant of *Centaureo bracteatae-Brometum erecti* on marl-clay-sandstone substrata. The NMDS and CCA analyses evidence the same features showed by the two other subassociations of *Centaureo bracteatae-Brometum erecti*: the mesophilic and moderate hygrophilic character of the communities (Figure 3), the relevant portion of perennial herbs among the growth forms (Figure 5) and the important chorological contribution of European and Eurasiatic elements (Figure 4).

4.7 Group B2b4 – *Cichorium intybus-Bromus erectus* post-cultural mesophilous grasslands in human-disturbed areas (Table 1, rel. 106–116)

Diagnostic species: *Brachypodium rupestre, Bromus erectus, Plantago lanceolata, Cichorium intybus, Calamintha nepeta, Cynosurus echinatus, Trifolium repens, Holcus lanatus, Bromus hordeaceus, Dactylis gomerata, Schedonorus arundinaceus*.

In Casentino Valley (eastern Tuscany), from Alpe di Catenaia Mt. to the National Park of Casentino Forests, some grasslands rich in ruderal and human-management related species were detected. The autonomy of this group (B2b4) is highlighted also in the dendrogram derived from cluster analysis (Figure 2). These communities are generally dominated by *Bromus erectus* and/or *Brachypodium rupestre*, and rich in mesophilous species belonging to *Bromion* alliance with a relevant presence of transgressive species from *Molinio-Arrhenatheretea*. These features testify the ecological affinities with the above mentioned mesophilous communities. Notwithstanding, it is worth to note that some differential species are present. Some of these species are related to a recent past human management of the meadows (*Bromus hordeaceus, Schedonorus arundinaceus, Holcus lanatus*, etc.) and others are represented by post-cultural annual or perennial ruderal nitrophilous plants (*Cychorium intybus, Galega officinalis, Lolium temulentum, Trifolium angustifolium,* etc.) linked to traditional agro-pastoral activities. The prevalent nitrophilous and mesophilous character of these communities is also shown by the EIV NMDS (Figure 3), whereas the significant presence of cosmopolitan species (see chorotype CCA in Figure 4) testifies the relation with human-management activities.

The diagnostic species of the nine detected groups, based on phi-coefficient, and on the ecological and syntaxonomic relevance here attributed, are reported in Table 2 for an easy comparison.

4.8 Notes on the attribution to higher syntaxonomical units

Recently several complete or partial revisions of the *Festuco-Brometea* grasslands or papers dealing with these vegetation types, especially in central-southern Apennines, were published and a plethora of syntaxa at every rank was produced. Furthermore, in addition to the syntaxa typically included in the core of the *Festuco-Brometea*, several papers focused on neighboring classes like *Rosmarinetea, Scorzoneretea, Sedo-Scleranthetea*, etc. In this work we do not discuss these contact classes, since this topic should be solved using a wide, all-embracing synthesis at European and Mediterranean level. However some considerations are needed in order to classify the vegetation types herewith described within a larger context.

Due to its high suffrutex cover value and to the relevant presence of thermo-xerophilous species, Group A (communities with *Bothriochloa ischaemum, Avena barbata* and *Melica ciliata*) can be referred to a transition aspect between the submediterranean grasslands of *Festuco-Brometea* class and other Mediterranean herbaceous and shrubby classes, particularly *Rosmarinetea officinalis*.

For the other vegetation types here detected (Group B) it can be inferred that the *Bromion* species, according to Mucina & Kolbek (1993), are present in all the relevés, although their presence, both in number and cover values, is less relevant in the left part of Table 1. According to Biondi et al. (2005) the non-calciphilous grasslands of the mesotemperate bioclimatic belt of the northern-central Apennines can be referred to the suballiance *Polygalo mediterraneae-Bromenion erecti*, which has as type the association *Centaureo bracteatae-Brometum erecti*. Biondi et al.

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(2005) highlighted that this suballiance includes some pioneer grassland types, like *Coronillo-Astragaletum* association, together with more mesophilous communities, like *Centaureo-Brometum* and similar aspects. Our relevés belonging to group B are separated by the cluster analysis in two main subgroups, the B1 and B2 clusters. The latter is further divided in two subgroups: B2a grasslands (*Coronillo-Astragaletum, Festuco trachyphyllae-Brometum*, *Tragopogon samaritanus-Bromus erectus* communities) are more pioneer and grow on shallow and less evolved soils, while B2b communities (*Centaureo bracteatae-Brometum* subass. *typicum*, subass. *ononidetoum masquillerii*, subass. *linetosum cathartici* and *Cichorium intybus-Bromus erectus* post-cultural grasslands) are more mesophilous and typical of deeper and evolved soils. Due to their ecological and floristic features, B2 communities can be attributed to *Polygalo mediterraneae-Bromenion erecti* suballiance, with both its pioneer (B2a) and its mesophilous aspects (B2b). On the contrary, B1 grasslands (*Plantago argentea-Carex caryophyllea* communities) share with B2a some similar ecological aspects (pioneer features, non-evolved soils, etc.) but, from a strictly floristic perspective, they appear impoverished in diagnostic species of higher syntaxa; however, we also refer these communities to *Polygalo mediterraneae-Bromenion erecti* and *Bromion*, but this attribution should be confirmed by further field data and analyses.

Regarding the attribution at the order level, several syntaxonomical disputations have been more or less recently produced by several authors about the ecological requirements and the nomenclatural validity of the order *Brometalia erecti* (e.g. Dengler 2003, 2004, Dengler et al. 2003, Mucina et al. 2009, Terzi 2011, Di Pietro 2011, Biondi & Galdenzi 2012, Becker et al. 2012). In this work we use the name *Brometalia erecti* Koch 1926 according to Biondi & Galdenzi (2012), waiting for a definitive sentence of the ICPN nomenclature Committee (Weber et al. 2000) about its rejection and substitution by *Brachypodietalia pinnati* Korneck 1974, as suggested by Dengler et al. (2003) and Mucina et al. (2009).

Syntaxonomic scheme

Festuco-Brometea Br.-Bl. et R. Tx. ex Klika et Hadač 1944
Brometalia erecti W. Koch 1926
Bromion erecti W. Koch 1926
Polygalo mediterraneae-Bromenion erecti Biondi, Allegrezza et Zuccarello 2005
Coronillo minimae-Astragalaetum monspessulani Biondi et Ballelli in Biondi et al. 1985
seslerietosum italicae Zanotti, Ubaldi & Puppi 1995
Tragopogon samaritani-Bromus erectus comm.
Plantago argentea-Carex caryohyllaea comm.
Festuco trachyphyllae-Brometum erecti ass. nova
Centaureo bracteatae-Brometum erecti Biondi, Ballelli, Allegrezza, Guitian et Taffetani 1986.
subass. *typicum*
subass *ononidetosum masquillierii* (Biondi, Ballelli, Allegrezza, Guitian et Taffetani 1986) stat. novo
subass. *linetosum cathartici* subass. nova
Cichorium intybus-Bromus erectus comm.

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APPENDIX 1

Published relevés of Table 1 – References

Relevés n. 10–23: Biondi et al. (1985); relevés n. 25, 26, 30, 69–72: Viciani et al. (2002b); relevés n. 61, 108: Viciani & Gabellini (2006); relevé n. 77: Viciani et al. (2004); relevés n. 78–90: Biondi et al. (1986); relevés n. 93–100: Biondi et al. (1988).

Unpublished relevés of Table 1 – Geolocalization

For each unpublished relevé the number is followed by the coordinates UTM WGS84 x and y.

1 – 659662, 4852937; 2 – 660345, 4853201;
3 – 660257, 4853168; 4 – 659881, 4852928;
5 – 637368, 4874761; 6 – 637339, 4874841;
7 – 637350, 4874812; 8 – 637694, 4874598;
9 – 637656, 4874594; 27 – 740026, 4848006;
28 – 738856, 4848690; 29 – 738914, 4848706;
37 – 745853, 4809728; 38 – 744996, 4809887;
39 – 744936, 4808833; 40 – 738874, 4818673;
41 – 738663, 4818385; 42 – 739159, 4818317;
43 – 738752, 4818426; 44 – 739901, 4817797;
45 – 746206, 4797400; 46 – 746455, 4797899;
47 – 746466, 4797875; 48 – 745197, 4809930;
49 – 750551, 4795942; 50 – 744982, 4808825;
51 – 751133, 4795180; 52 – 749793, 4796656;
53 – 748924, 4796954; 54 – 744796, 4810487;
55 – 750008, 4796388; 56 – 750287, 4796144;
57 – 750543, 4795946; 58 – 749591, 4796832;
59 – 749733, 4796704; 60 – 744974, 4808775;
63 – 751937, 4841104; 67 – 750129, 4841617;
73 – 752206, 4840983; 74 – 751933, 4841009;
75 – 752196, 4841101; 76 – 752379, 4840926;
91 – 737834, 4845440; 101 – 765038, 4850206;
102 – 763508, 4850767; 103 – 766914, 4848553;
104 – 762576, 4850272; 105 – 762806, 4850414;
106 – 765808, 4849460; 107 – 766555, 4849632;
109 – 724041, 4850393; 110 – 739529, 4848657;
111 – 737784, 4849523; 112 – 721743, 4854598;
113 – 722340, 4852913; 114 – 721682, 4854550;
115 – 722928, 4853141; 116 – 736694, 4848427;

Sporadic species of Table 1

Rel. 1: Aegilops neglecta Req. ex Bertol. 1, Odontites sp., 1, Trachynia distachya (L.) Link.; **Ril. 2**: Dianthus balbisii Ser. subsp. balbisii, +, Spartium junceum L., 2; **Rel. 3**: Linaria vulgaris Mill. subsp. vulgaris, +; **Rel. 5**: Minuartia hybrida (Vill.) Shischk. subsp. hybrida, +; **Rel. 6**: Sedum acre L., 2; **Rel. 9**: Trifolium sp., +; Taraxacum erythrosperma (group), 1; **Rel. 22**: Trifolium dubium Sibth., +, Anagallis arvensis L. s.l., +, Arenaria bertolonii Fiori, +, Chaenorhinum minus (L.) Lange subsp. Minus, +, Festuca centro-apenninica (Markgr.-Dann.) Foggi, F. Conti & Pignatti, +, Cytisus sessilifolius L., +; **Rel. 23**: Orchis purpurea L., +; **Rel. 27**: Polygala major Jacq., +, Genista januensis Viv., +; **Rel. 28**: Polygala major Jacq., +; **Rel. 29**: Sedum acre L., 1; **Rel. 30**: Trifolium dubium Sibth., +, Anagallis arvensis L. s.l., +, Chaenorhinum minus (L.) Lange subsp. minus, +, Arenaria bertolonii Fiori, +, Trachynia distachya (L.) Link, 1, Festuca centro-apenninica (Markgr.-Dann.) Foggi, F. Conti & Pignatti, 1; **Rel. 31**: Deschampsia flexuosa (L.) Trin. s.l., +; **Rel. 33**: Epilobium dodonaei Vill., +, Securigera varia (L.) Lassen, +; **Rel. 34**: Dianthus seguieri Vill. subsp. seguieri, +; **Rel. 37**: Scabiosa holosericea Bertol., +, Crupina crupinastrum (Moris) Vis., +, Cuscuta sp., +; **Rel. 38**: Geranium dissectum L., +, Rubus hirtus Waldst. & Kit., +; **Rel. 40**: Juniperus oxycedrus L. subsp. oxycedrus, 1, Crepis capillaris (L.) Wallr., +, Vicia tetrasperma (L.) Schreb., +; **Rel. 42**: Ophrys bertolonii Moretti, +, Alyssum campestre (L.) L. s.l., +; **Rel. 43**: Spartium junceum L., +, Astragalus hamosus L., +, Catapodium rigidum (L.) C.E. Hubb. s.l., +, Cynoglossum creticum Mill., r, Valerianella muricata (Stev. ex M. Bieb.) J.W. Loudon, +; **Rel. 44**: Ophrys bertolonii Moretti, +, Alyssum campestre (L.) L. s.l.; **Rel.** 45: Vicia peregrina L., +, Cistus creticus L. subsp. eriocephalus (Viv.) Greuter & Burdet, +; **Rel. 46**: Silene gallica L., +, Sonchus oleraceus L., 1; **Rel. 48**: Scabiosa holosericea Bertol., +, Knautia integrifolia (L.) Bertol. subsp. integrifolia, 1; **Rel. 50**: Vicia bithynica (L.) L., +; **Rel. 51**: Filago minima (Sm.) Pers., +, Galium divaricatum Pourr. ex Lam., +; **Rel. 52**: Hypochaeris glabra L., +, Scleranthus annuus L., +; **Rel. 54**: Minuartia hybrida (Vill.) Shischk. subsp. hybrida, +, Erica scoparia L. subsp. scoparia, +, Scleranthus perennis L. s.l., +; **Rel. 55**: Asphodelus macrocarpus Parl. subsp. macrocarpus, 2, Ranunculus millefoliatus Vahl., +, Linaria vulgaris Mill. subsp. vulgaris, +, Narcissus poëticus L. s.l., 2, Campanula trachelium L. subsp. trachelium, 2, Cardamine hirsuta L., +, Festuca trichophylla (Ducros ex Gaudin) K. Richt. subsp. asperifolia (St.-Yves) Al-Bermani, +, Neotinea ustulata (L.)

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R.M. Bateman, Pridgeon & M.W. Chase, +, Oreoselinum nigrum Delarbre, 1, Vicia incana Gouan, 1; **Rel. 56**: Ranunculus millefoliatus Vahl, 1, Veronica arvensis L., +; **Rel. 57**: Geranium dissectum L., +, Veronica arvensis L., +, Taraxacum fulvum Raunk., +; **Rel. 58**: Asphodelus macrocarpus Parl. subsp. macrocarpus, 2, Luzula forsteri (Sm.) DC., r, Anthericum liliago L., +; **Rel. 59**: Hypochaeris glabra L., +, Luzula forsteri (Sm.) DC., r, Silene gallica L., +, Anthemis cotula L., +, Consolida regalis Gray s.l., r, Lupinus albus L. subsp. albus, +, Vulpia bromoides (L.) Gray, +; **Rel. 60**: Rhinanthus alectorolophus (Scop.) Pollich, 2, Dianthus deltoides L. subsp. deltoides, r; **Rel. 61**: Dianthus armeria L. subsp. armeria, +, Galium parisiense L., +; **Rel. 62**: Dianthus armeria L. subsp. armeria, +, Galium parisiense L., +, Odontites sp., +; **Rel. 63**: Trifolium strictum L., +, Vicia peregrina L., +, Saxifraga tridactylites L., +; **Rel. 64**: Helleborus bocconei Ten. s.l., +; **Rel. 66**: Sulla coronaria (L.) Medik., 1; **Rel. 67**: Crepis vesicaria L. s.l., +, Trifolium strictum L., +, Veronica arvensis L., +; **Rel. 68**: Poa annua L., +, Anthemis arvensis L. s.l., +, Cervaria rivinii Gaertn., +, Dactylorhiza sambucina (L.) Soó, +; **Rel. 69**: Colchicum lusitanum Brot., +, Ostrya carpinifolia Scop., +; **Rel. 70**: Acer opalus Mill. subsp. obtusatum (Waldst. & Kit. ex Willd.) Gams, +, Astragalus glycyphyllos L., +, Crataegus monogyna Jacq., +, Homalotrichon pubescens (Huds.) Banfi, Galasso & Bracchi s.l., +, Allium vineale L., +; **Rel. 71**: Dactylorhiza maculata (L.) Soó, +, Homalotrichon pubescens (Huds.) Banfi, Galasso & Bracchi s.l., +, Poa annua L., +; **Rel. 72**: Acer opalus Mill. subsp. obtusatum (Waldst. & Kit. ex Willd.) Gams, +, Astragalus glycyphyllos L., +, Dactylorhiza maculata (L.) Soó, +, Listera ovata (L.) R. Br., +; **Rel. 74**: Dipsacus fullonum L., +, Galeopsis angustifolia Hoffm. subsp. angustifolia, +, Aremonia agrimonoides (L.) DC. subsp. agrimonoides, +, Primula vulgaris Huds. subsp. vulgaris, +; **Rel. 75**: Trifolium sp., r; **Rel. 76**: Galeopsis angustifolia Hoffm. subsp. angustifolia, +; **Rel. 84**: Minuartia hybrida (Vill.) Shischk. subsp. hybrida, +; **Rel. 85**: Himantoglossum adriaticum H. Baumann, +, Ophrys apifera L., 1, Aceras anthropophorum (L.) R. Br., 1; **Rel. 91**: Crataegus monogyna Jacq., +, Marrubium incanum Desr., +, Equisetum arvense L. subsp. arvense, +; **Rel. 92**: Polygala vulgaris L. subsp. vulgaris, +, Daphne oleoides Schreb., r; **Rel. 105**: Gaudinia fragilis (L.) P. Beauv., +; **Rel. 107**: Cruciata glabra (L.) Ehrend., +, Polygala alpestris Rchb., +; **Rel. 108**: Trifolium incarnatum L. subsp. molinerii (Hornem.) Ces., +, Barbarea stricta Andrz., +, Cerastium arvense L. subsp. arvense, +; **Rel. 109**: Crepis neglecta L., +, Galega officinalis L., +, Verbena officinalis L., +, Avena sterilis L. s.l., 1, Dipsacus fullonum L., +, Helminthotheca echioides (L.) Holub, 1, Medicago arabica (L.) Huds., +, Trifolium striatum L., +; **Rel. 110**: Lolium temulentum L. subsp. temulentum, +, Rhinanthus alectorolophus (Scop.) Pollich, +, Marrubium incanum Desr., +, Danthonia decumbens (L.) DC. subsp. decumbens, +, Geranium molle L., +; **Rel. 114**: Crepis neglecta L., +, Cirsium vulgare (Savi) Ten., +, Knautia integrifolia (L.) Bertol. subsp. integrifolia, +, Torilis japonica (Houtt.) DC., +; **Rel. 115**: Filago germanica (L.) Huds., +, Althaea hirsuta L., +; **Rel. 116**: Vulpia ciliata Dumort., r.

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Table 1: Published and unpublished relevés of the grasslands on sandstone and marl-clay-sandstone substrata.

Relevé n.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Altitude (m a.s.l.)	170	140	140	145	978	1017	996	964	965	850	860	850	540	680	750	980	950	1010	960	1000	1000
Aspect	SW	S	S	-	-	W	-	E	S	ENE	SE	ESE	-	WSW	W	SSW	SSW	SSW	WSW	S	SSW
Total cover (%)	80	50	70	80	100	85	100	100	100	90	90	90	90	20	90	90	80	85	30	90	50
Slope (°)	5	20	25	-	-	5	-	3	3	30	10	50	-	70	50	30	30	20	25	30	40
Area (m^2)	10	10	15	15	10	10	10	10	10	15	20	20	15	20	15	20	20	10	15	20	10
Site abbreviation	AT	AT	AT	AT	SP	SP	SP	SP	SP												
Typus (T)																					
Relevés from literature (for references see Appendix 1)										x	x	x	x	x	x	x	x	x	x	x	x
Number of the relevé in the original publication										1	2	6	7	3	8	10	12	14	5	9	13
Number of the table in the original publication										1	1	1	1	1	1	1	1	1	1	1	1
***Botriochloa ischaemum-Melica ciliata* comm.**																					
Avena barbata Pott ex Link	2	1	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melica ciliata L. s.l.	1	1	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galactites tomentosus Moench	1	1	r	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carthamus lanatus L. subsp. *lanatus*	+	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bothriochloa ischaemum (L.) Keng	.	1	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Onobrychis caput-galli (L.) Lam.	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea deusta Ten.	.	3	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Echium vulgare L.	.	1	1	+	.	.	.	.	.	+	.	.	.	+	.	.	+	+	+	+	+
Globularia punctata Lapeyr	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon porrifolius L. s.l.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Transgressive species from *Rosmarinetea* and other Mediterranean classes																					
Asparagus acutifolius	1	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Teucrium capitatum L. subsp. *capitatum*	2	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crupina vulgaris Cass.	.	1	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dorycnium hirsutum	r	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Micromeria graeca (L.) Benth. ex Rchb. s.l.	.	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cistus monspeliensis L.	r	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
***Plantago argentea-Carex caryophyllea* comm.**																					
Plantago argentea Chaix subsp. *argentea*	.	.	.	.	2	1	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria lobata (M. Bieb.) Roem. & Schult.	.	.	.	.	.	2	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.
Bromus rubens L.	.	3	.	.	.	1	2	1	2	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea arrigonii Greuter	.	.	.	.	.	2	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.
Poa bulbosa L.	.	.	.	.	1	.	2	1	2	.	.	.	.	.	.	.	.	.	.	.	.
Aira caryophyllea L. subsp. *caryophyllea*	.	.	.	.	+	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium pumilum	.	.	.	.	+	.	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.
Medicago minima (L.) Bartal.	.	.	.	.	1	1	+	.	1	.	.	.	.	.	.	.	+	+	.	+	.
Hypochaeris radicata L.	.	.	.	.	2	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.
Aphanes arvensis L.	.	.	.	.	+	.	r	.	r	.	.	.	.	.	.	.	.	.	.	.	.
Geranium rotundifolium L.	.	.	.	.	.	+	r	.	r	.	.	.	.	.	.	.	.	.	.	.	.
Gnaphalium sylvaticum L.	.	.	.	.	.	+	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.
Coronillo minimae-Astragaletum monspessulani																					
Astragalus monspessulanus L. subsp. *monspessulanus*	.	.	.	.	.	.	.	.	.	2	2	3	+	2	2	1	+	+	+	+	1
Coronilla minima L.	.	.	.	.	.	.	.	.	.	1	1	1	3	+	+	2	1	2	+	+	1
Linum tenuifolium L.	.	.	.	.	.	.	.	.	.	+	1	+	+	1	1	1	1	1	1	1	+
Fumana procumbens (Dunal) G.et G.	.	.	.	.	.	.	.	.	.	+	+	1	.	1	+	+	+	+	+	.	+
Leontodon rosani (Ten.) DC.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	.	.	.	.	+	.	.
Sesleria italica (Pamp.) Ujhelyi (diff. of subass. *seslerietosum italicae*)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon samaritani-Bromus erectus comm.																					
Thymus pulegioides L. s.l.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arenaria serpyllifolia L. s.l.	.	.	.	.	+	+	r	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Silene vulgaris (Moench) Garcke s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthyllis vulneraria L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Teucrium montanum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon samaritani Heldr. & Sart. ex Boiss.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crepis staticifolia (All.) Galasso, Banfi & Soldano	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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Tabela 1: Objavljeni in neobjavljeni popisi travišč na podlagi iz peščenjaka in laporasto-glinastega peščenjaka.

22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
680	840	900	1030	920	1100	970	970	1040	1090	1160	1140	1110	1110	1090	970	900	850	800	700	770	750	850	770	800	800	950	910	870	910	900	850	870	900	910	910	830	900
WSW	SSW	WSW	SE	SE	S	NW	-	SW	SW	W	W	SW	S	S	N	-	SW	SW	SW	E	SW	SW	SE	SE	SW	-	SE	S	NE	E	SW	SW	-	-	-	-	-
45	85	20	70	75	80	70	80	85	60	70	60	60	35	50	100	95	100	95	95	90	70	90	95	95	100	90	90	95	60	80	80	40	100	95	100	98	95
60	20	70	40	40	3	10	-	25	20	25	45	30	25	40	15	-	2	<5	15	5	<5	<5	25	10	30	-	5	8	<5	25	2	5	-	-	-	-	-
20	25	20	50	50	15	15	15	50	10	15	15	10	10	10	16	15	20	10	10	10	15	10	16	25	16	10	10	10	12	25	16	10	20	20	10	15	10
		AL			VS	VS	VS		SC	SC	SC	SC	SC	SC	DG	DG	DG	PO	PO	PO	PO	PO	GZ	GZ	GZ	DG	GZ	DG	GZ	GZ	GZ	DG	GZ	GZ	GZ	GZ	GZ
																											T									
x	x		x	x				x																													
4	11		14	8				71																													
1	1		3	3				3																													
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Relevé n.	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Altitude (m a.s.l.)	870	1040	1040	1032	1040	1050	850	948	1150	1030	900	1040	1035	965	1035	968	950	770	730	650	520
Aspect	S	W	W	-	NW	E	SE	-	SW	SW	W	SW	W	-	-	-	-	E	SW	NE	WNW
Total cover (%)	95	100	100	100	100	95	90	85	100	100	100	100	100	95	100	100	100	95	100	100	100
Slope (°)	<5	<5	5	-	<5	<5	10	-	25	35	20	<5	5	-	-	-	-	50	30	40	40
Area (m^2)	15	10	10	20	10	10	10	20	30	50	50	50	40	20	20	20	20	50	40	40	80
Site abbreviation	DG		AC	MV	SS	SS	SS	MV	AL					MV	MV	MV	MV				
Typus (T)																	T				
Relevés from literature (for references see Appendix 1)		x								x	x	x	x					x	x	x	x
Number of the relevé in the original publication		52								46	40	45	72					82	1	2	13
Number of the table in the original publication		5								5	5	5	5					4	3	3	3
***Botriochloa ischaemum-Melica ciliata* comm.**																					
Avena barbata Pott ex Link	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melica ciliata L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galactites tomentosus Moench	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carthamus lanatus L. subsp. *lanatus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	″.	+
Bothriochloa ischaemum (L.) Keng	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Onobrychis caput-galli (L.) Lam.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea deusta Ten.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Echium vulgare L.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Globularia punctata Lapeyr	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon porrifolius L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Transgressive species from *Rosmarinetea* and other Mediterranean classes																					
Asparagus acutifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Teucrium capitatum L. subsp. *capitatum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crupina vulgaris Cass.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dorycnium hirsutum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Micromeria graeca (L.) Benth. ex Rchb. s.l.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Cistus monspeliensis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
***Plantago argentea-Carex caryophyllea* comm.**																					
Plantago argentea Chaix subsp. *argentea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria lobata (M. Bieb.) Roem. & Schult.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bromus rubens L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea arrigonii Greuter	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Poa bulbosa L.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.
Aira caryophyllea L. subsp. *caryophyllea*	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Cerastium pumilum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Medicago minima (L.) Bartal.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypochaeris radicata L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aphanes arvensis L.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Geranium rotundifolium L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gnaphalium sylvaticum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Coronillo minimae-Astragaletum monspessulani																					
Astragalus monspessulanus L. subsp. *monspessulanus*	.	.	.	.	+	r	.	2	.	.	.	.	.	.	.	.	.	+	.	.	.
Coronilla minima L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
Linum tenuifolium L.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	.	.	.
Fumana procumbens (Dunal) G.et G.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leontodon rosani (Ten.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sesleria italica (Pamp.) Ujhelyi (diff. of subass. *seslerietosum italicae*)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
***Tragopogon samaritani-Bromus erectus* comm.**																					
Thymus pulegioides L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arenaria serpyllifolia L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene vulgaris (Moench) Garcke s.l.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthyllis vulneraria L. s.l.	.	.	.	.	.	.	.	.	.	.	.	+	.	2	.	.	.	.	.	.	.
Teucrium montanum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon samaritani Heldr. & Sart. ex Boiss.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crepis staticifolia (All.) Galasso, Banfi & Soldano	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	
836	755	685	400	460	565	520	750	730	380	980	1100	950	950	940	1065	950	960	980	980	1120	1070	930	980	1030	1060	1050	650	670	880	760	780	610	780	700	700	
NE	S	W	NNW	WNW	ENE	ENE	NW	N	S	-	SW	W	SW	W	SE	E	SE	SSW	E	SW	S	-	W	S	-	-	NE	E	W	SE	S	SSE	SSW	SW	S	
100	100	100	100	100	100	100	100	100	100	100	40	100	100	100	100	100	100	100	100	70	70	95	100	95	100	100	100	100	100	100	100	100	98	80	90	
10	30	20	8	15	35	18	20	10	25	<5	20	8	5	10	10	20	10	5	20	10	25	5	10	10	-	-	10	10	10	10	5	10	5	10	10	
50	60	50	40	25	20	85	80	50	80	50	15	50	50	40	50	80	40	30	50	10	10	15	10	10	16	16	50	50	50	50	50	50	50	50	16	
										FC	SS									SS	SS	SS	SS	SS	SS	SS		FC	FC	FC	FC	FC	FC	FC	VS	
x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x								x									
4	12	3	5	6	7	8	9	10	11			1	2	4	3	8	5	6	7								24									
3	3	3	3	3	3	3	3	3	3			2	2	2	2	2	2	2	2								5									
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Relevé n.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Festuco trachyphyllae-Brometum erecti																					
Festuca stricta Host subsp. *trachyphylla* (Hack.) Patzke ex Pils	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum rupestre L. subsp. *rupestre*	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aira elegantissima Schur	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
transgressive species from *Tuberarietea guttatae* class																					
Cerastium brachypetalum Desp. ex Pers. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum trigynum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Briza maxima L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vulpia myuros (L.) C.C. Gmel.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tuberaria guttata (L.) Fourr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaureo bracteatae-Brometum erecti																					
subass. *linetosum cathartici*																					
Medicago lupulina L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leontodon hispidus L.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum catharticum L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
subass. *typicum*																					
Galium mollugo L. subsp. *erectum* Syme	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea scabiosa L. subsp. *scabiosa*	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.
other phi-relevant species																					
Cota tinctoria (L.) J. Gay s.l.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pastinaca sativa l. subsp. *urens* (Req.) Celak	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Elytrigia repens (L.) Nevski	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Senecio erucifolius L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Inula conyzae (Griess.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Medicago sativa L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acinos arvensis (Lam.) Dandy	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
subass. *ononidetosum masquillierii*																					
Ononis masquillierii Bertol.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Plantago maritima L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scorzonera cana (C.A. Mey.) O. Hoffm.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
other phi-relevant species																					
Carlina corymbosa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
***Cichorium intybus-Bromus erectus* post-cultural comm.**																					
Cichorium intybus L. subsp. *intybus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum strictum L.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa sylvicola Guss.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cynosurus echinatus L.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium repens L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bromus hordeaceus L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Calamintha nepeta (L.) Savi s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Odontites vernus (Bellardi) Dumort.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygalo mediterraneae-Bromenion erecti																					
Centaurea jacea L. subsp. *gaudinii* (Boiss. & Reut.) Gremli	.	.	.	.	.	.	.	.	.	+	+	.	+	.	+	.	.	.	.	.	.
Dorycnium herbaceum Vill.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	1	.	.	.	.	.
Asperula purpurea (L.) Ehrend. subsp. *purpurea*	.	.	.	.	.	.	.	.	.	1	2	1	+	2	2	1	2	1	2	+	2
Polygala nicaeensis W.D.J. Koch subsp. *mediterranea* Chodat	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carlina utzka Hacq.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	+	+
Bromion erecti																					
Lotus corniculatus L. s.l.	.	.	.	.	+	+	.	1	.	.	.	.	+	.	+	.	+	.	+	.	.
Dactylis glomerata L. s.l.	2	2	.	3	1	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Plantago lanceolata L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.
Leucanthemum vulgare (Vaill.) Lam. subsp. *vulgare*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Briza media L.	.	.	2	2	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.
Ononis spinosa L. s.l.	.	.	.	.	1	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.
Carex caryophyllea Latourr.	.	.	.	.	3	1	3	3	3	+	+	+	+	+	+	+	1	2	+	+	.
Daucus carota L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Plantago media L. subsp. *media*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Onobrychis viciifolia Scop.	.	.	.	.	.	.	.	.	.	+	+	.	1	.	+	.	.	+	.	.	.
Gymnadenia conopsea (L.) R. Br.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum bienne Mill.	.	.	.	.	r	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus bulbosus L.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anacamptis morio (L.) R.M. Bateman, Pridgeon & M.W. Chase	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anacamptis pyramidalis (L.) Rich.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.

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22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
.	.	.	.	.	.	2	3	.	.	.	.	.	.	.	2	3	2	2	1	2	2	2	.	.	.	3	2	2	1	1	1	1	1	1	1	3	3
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Relevé n.	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Festuco trachyphyllae-Brometum erecti																					
Festuca stricta Host subsp. *trachyphylla* (Hack.) Patzke ex Pils	1	.	.	.	.	+	.	1	1	.	.	.	.	+	.	.	.	.	.	.	.
Sedum rupestre L. subsp. *rupestre*	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aira elegantissima Schur	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
transgressive species from *Tuberarietea guttatae* class																					
Cerastium brachypetalum Desp. ex Pers. s.l.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum trigynum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Briza maxima L.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vulpia myuros (L.) C.C. Gmel.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tuberaria guttata (L.) Fourr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaureo bracteatae-Brometum erecti																					
subass. *linetosum cathartici*																					
Medicago lupulina L.	.	.	.	.	+	1	+	2	1	+	1	+	.	.	.	2	1	.	.	.	1
Leontodon hispidus L.	+	.	.	+	.	+	+	.	.	.	+	+	+	1	3	1	1	.	.	.	.
Linum catharticum L. s.l.	.	.	.	+	.	.	.	.	.	+	+	+	+	+	1	1	1	1	.	.	.
subass. *typicum*																					
Galium mollugo L. subsp. *erectum* Syme	.	.	.	.	.	.	.	.	+	.	+	+	+	.	.	.	.	+	1	1	+
Centaurea scabiosa L. subsp. *scabiosa*	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	+	.	+
other phi-relevant species	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cota tinctoria (L.) J. Gay s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.
Pastinaca sativa l. subsp. *urens* (Req.) Celak	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.
Elytrigia repens (L.) Nevski	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Senecio erucifolius L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.
Inula conyzae (Griess.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Medicago sativa L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+
Acinos arvensis (Lam.) Dandy	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.
subass. *ononidetosum masquillierii*																					
Ononis masquillierii Bertol.	.	.	.	.	.	2	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Plantago maritima L. s.l.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scorzonera cana (C.A. Mey.) O. Hoffm.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
other phi-relevant species	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carlina corymbosa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
***Cichorium intybus-Bromus erectus* post-cultural comm.**																					
Cichorium intybus L. subsp. *intybus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum strictum L.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Poa sylvicola Guss.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Cynosurus echinatus L.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium repens L. s.l.	.	.	.	1	1	+	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Bromus hordeaceus L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Calamintha nepeta (L.) Savi s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Odontites vernus (Bellardi) Dumort.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygalo mediterraneae-Bromenion erecti																					
Centaurea jacea L. subsp. *gaudinii* (Boiss. & Reut.) Gremli	.	1	1	1	.	1	.	.	.	.	1	2	+	+	2	+	1	.	+	1	+
Dorycnium herbaceum Vill.	.	.	.	.	.	.	.	.	.	.	3	.	1	.	.	.	.	2	4	3	+
Asperula purpurea (L.) Ehrend. subsp. *purpurea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Polygala nicaeensis W.D.J. Koch subsp. *mediterranea* Chodat	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	.	.	.	.
Carlina utzka Hacq.	.	.	.	+	.	.	.	.	+	.	.	+	+	.	.	.	+	.	.	.	.
Bromion erecti																					
Lotus corniculatus L. s.l.	1	1	1	+	1	1	1	3	1	1	1	1	1	1	1	1	1	.	+	+	2
Dactylis glomerata L. s.l.	+	.	.	.	.	1	2	+	.	.	2	1	1	1	+	.	.	2	2	1	2
Plantago lanceolata L.	1	2	1	+	.	.	+	+	1	.	+	+	+	.	.	.	+	+	.	.	+
Leucanthemum vulgare (Vaill.) Lam. subsp. *vulgare*	.	.	.	2	+	+	+	2	+	.	+	+	.	.	1	2	+	1	1	1	2
Briza media L.	.	.	.	.	1	2	.	1	+	.	1	1	+	.	.	.	+	1	.	+	2
Ononis spinosa L. s.l.	1	+	2	.	.	.	.	1	.	+	3	3	3	2	1	1	2	.	+	+	.
Carex caryophyllea Latourr.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Daucus carota L. s.l.	.	.	.	+	.	r	+	.	.	.	+	r	.	+	.	.	+	.	+	+	.
Plantago media L. subsp. *media*	.	.	.	.	1	+	+	1	.	.	+	1	1	.	1	1	+	.	+	+	.
Onobrychis viciifolia Scop.	.	.	.	.	.	.	.	.	.	.	1	+	+	.	.	.	.	2	.	.	+
Gymnadenia conopsea (L.) R. Br.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.
Linum bienne Mill.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Ranunculus bulbosus L.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Anacamptis morio (L.) R.M. Bateman, Pridgeon & M.W. Chase	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Anacamptis pyramidalis (L.) Rich.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+

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Knautia arvensis (L.) Coult.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carlina acaulis L. subsp. *caulescens* (Lam.) Schübl. & G. Martens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brometalia erecti* and *Festuco-Brometea																					
Bromus erectus Huds. subsp. *erectus*	3	.	.	.	3	2	2	2	2	3	2	2	4	3	4	2	2	+	1	1	1
Sanguisorba minor Scop. s.l.	+	+	+	+	1	+	+	+	1	1	1	+	.	1	+	+	1	+	1	+	+
Brachypodium rupestre (Host) Roem. & Schult.	.	3	3	3	+	2	.	1	.	+	+	.	2	+	+	+	.	.	1	+	.
Thymus longicaulis C. Presl subsp. *longicaulis*	.	.	.	.	.	.	.	+	+	2	2	.	.	+	1	1	2	1	2	2	+
Carex flacca Schreb. s.l.	.	1	.	.	.	.	.	.	.	.	.	+	1	.	+	+	.	.	.	.	.
Festuca inops De Not.	.	.	.	.	.	1	.	.	.	1	3	2	.	2	2	2	3	3	2	3	1
Scabiosa columbaria L. s.l.	.	2	3	.	.	.	.	.	.	+	+	.	+	+	+	+	.	.	+	+	.
Teucrium chamaedrys L. subsp. *chamaedrys*	1	.	+	.	.	+	.	.	.	+	+	+	.	+	+	+	1	+	+	.	+
Hippocrepis comosa L. subsp. *comosa*	.	.	.	.	.	.	.	.	.	+	+	.	+	+	.	+	.	.	.	.	+
Achillea collina s.l.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.
Galium lucidum All. subsp. *lucidum*	2	.	2	.	.	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.
Hieracium pilosella L.	.	.	.	.	.	1	2	3	1	+	+	.	.	+	.	+	.	.	+	+	.
Helianthemum nummularium (L.) Mill. s.l.	.	.	.	.	.	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium verum L. subsp. *verum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Prunella laciniata (L.) L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium campestre Schreb.	.	.	.	.	1	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium ochroleucum Huds.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	+	.	.	.	.	.	.
Linum viscosum L.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Petrorhagia prolifera (L.) P.W. Ball & Heywood	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carlina vulgaris L. s.l.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.
Muscari comosum (L.) Mill.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eryngium campestre L.	1	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eryngium amethystinum L.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.
Allium sphaerocephalon L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dianthus sylvestris Wulfen	.	.	.	.	.	+	.	.	.	+	1	.	.	.	.	.	+	+	.	+	+
Arabis hirsuta (L.) Scop.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Reichardia picroides	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla hirta L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga bulbifera L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea ambigua Guss.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	1	1	1
Cerastium arvense L. subsp. *suffruticosum* (L.) Ces.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Odontites luteus (L.) Clairv.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.
Mentha longifolia (L.) Huds.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Petrorhagia saxifraga (L.) Link subsp. *saxifraga*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arabis collina Ten. subsp. *collina*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erysimum pseudorhaeticum Polatschek	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helianthemum apenninum (L.) Miller	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.
Micropus erectus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.
Muscari neglectum Ten.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene italica (L.) Pers. subsp. *italica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphrasia stricta D. Wolff ex J.F. Lehm.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia cyparissias L.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Convolvulus cantabrica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cyanus triumfetti (All.) Dostál ex Á. & D. Löve	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ononis natrix L.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.
Thesium divaricatum Jan.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Filipendula vulgaris Moench	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aegilops geniculata Roth	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Artemisia alba Turra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helianthemum canum (L.) Baumng.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leontodon cichoriaceus (Ten.) Sanguin.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ononis pusilla L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Stachys recta L. s.l.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arabis sagittata (Bertol.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campanula glomerata L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria macrantha (Ledeb-) Sprengel	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Lathyrus sphaericus Retz.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Molinio-Arrhenatheretea																					
Trifolium pratense L. subsp. *pratense*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthoxanthum odoratum L. s.l.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cynosurus cristatus L.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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Relevé n.	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Knautia arvensis (L.) Coult.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carlina acaulis L. subsp. *caulescens* (Lam.) Schübl. & G. Martens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brometalia erecti* and *Festuco-Brometea																					
Bromus erectus Huds. subsp. *erectus*	4	4	3	4	3	3	4	2	3	3	1	1	1	3	4	3	3	4	4	3	5
Sanguisorba minor Scop. s.l.	1	+	+	2	+	r	+	1	+	.	+	+	+	1	+	1	+	+	+	.	+
Brachypodium rupestre (Host) Roem. & Schult.	.	.	.	2	1	+	.	.	+	3	1	1	4	3	.	2	4	1	3	4	2
Thymus longicaulis C. Presl subsp. *longicaulis*	.	1	1	3	.	1	.	2	2	.	+	+	+	2	2	3	2	.	.	.	3
Carex flacca Schreb. s.l.	+	.	.	.	.	1	+	+	.	.	+	+	+	1	.	1	.	1	2	2	3
Festuca inops De Not.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scabiosa columbaria L. s.l.	.	.	.	.	.	.	r	.	.	.	1	r	r	.	.	.	+	1	+	1	1
Teucrium chamaedrys L. subsp. *chamaedrys*	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	1	+	+	+
Hippocrepis comosa L. subsp. *comosa*	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	+
Achillea collina s.l.	.	1	.	2	+	.	.	+	1	.	+	+	.	.	+	+	.	+	+	.	+
Galium lucidum All. subsp. *lucidum*	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Hieracium pilosella L.	.	.	.	1	+	+	1	2	+	.	.	.	.	+	.	+	+	.	.	.	+
Helianthemum nummularium (L.) Mill. s.l.	.	.	.	.	+	r	.	+	.	.	.	1	1	2	.	.	.	.	.	.	+
Galium verum L. subsp. *verum*	+	.	.	.	1	+	.	.	.	.	+	1	.	.	.	.	.	1	.	+	.
Prunella laciniata (L.) L.	.	.	.	+	+		+	.	+	+	+	+	+	.	.	+	+	.	+	+	1
Trifolium campestre Schreb.	.	.	.	.	2	1	1	.	.	.	+	.	.	.	.	.	.	.	+	.	+
Trifolium ochroleucum Huds.	.	.	.		+	+	.	.	.	.	+	2	1	.	.	.	+	1	.	.	.
Linum viscosum L.	.	.	.	.	.	.	.	.	.	.	.	r	r	.	.	.	.	.	+	1	.
Petrorhagia prolifera (L.) P.W. Ball & Heywood	.	r	2	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Carlina vulgaris L. s.l.	.	.	.	1	.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.
Muscari comosum (L.) Mill.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eryngium campestre L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eryngium amethystinum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+
Allium sphaerocephalon L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dianthus sylvestris Wulfen	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arabis hirsuta (L.) Scop.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Reichardia picroides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla hirta L.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga bulbifera L.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea ambigua Guss.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium arvense L. subsp. *suffruticosum* (L.) Ces.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Odontites luteus (L.) Clairv.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mentha longifolia (L.) Huds.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Petrorhagia saxifraga (L.) Link subsp. *saxifraga*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arabis collina Ten. subsp. *collina*	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erysimum pseudorhaeticum Polatschek	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helianthemum apenninum (L.) Miller	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Micropus erectus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Muscari neglectum Ten.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene italica (L.) Pers. subsp. *italica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphrasia stricta D. Wolff ex J.F. Lehm.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.
Euphorbia cyparissias L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Convolvulus cantabrica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cyanus triumfetti (All.) Dostál ex Á. & D. Löve	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ononis natrix L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thesium divaricatum Jan.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Filipendula vulgaris Moench	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aegilops geniculata Roth	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Artemisia alba Turra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helianthemum canum (L.) Baumng.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leontodon cichoriaceus (Ten.) Sanguin.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ononis pusilla L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stachys recta L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arabis sagittata (Bertol.) DC.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campanula glomerata L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria macrantha (Ledeb-) Sprengel	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lathyrus sphaericus Retz.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Molinio-Arrhenatheretea																					
Trifolium pratense L. subsp. *pratense*	.	.	.	.	1	1	1	1	+	.	1	1	+	.	1	.	1	.	+	+	.
Anthoxanthum odoratum L. s.l.	.	.	.	1	1	.	.	1	1	+	.	+	+	+	.	1	.	.	.	.	.
Cynosurus cristatus L.	.	+	+	.	2	2	1	+	3	.	+	1	.	.	+	.	.	.	.	.	.

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81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	
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+	1	+	1	+	1	+	1	+	+	+	.	.	.	+	.	1	+	.	+	.	.	+	.	.	.	+	+	.	+	1	+	1	+	1	+	94
3	2	3	3	3	2	3	1	4	5	4	.	1	2	2	2	2	1	2	2	1	1	2	2	2	.	1	.	1	+	4	4	2	2	3	4	81
.	+	1	2	.	.	.	+	+	.	.	+	+	1	1	+	+	1	1	1	+	1	+	+	.	1	+	.	.	+	.	.	.	.	.	.	72
2	+	1	3	2	+	1	+	.	.	.	1	2	2	1	1	1	1	1	.	1	+	1	1	+	2	2	.	.	.	+	.	.	.	.	.	46
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+	+	.	.	.	.	.	.	.	.	.	+	.	+	.	1	+	+	+	+	r	.	.	.	.	.	.	.	.	.	+	+	.	.	.	r	.	26
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Relevé n.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Schedonorus arundinaceus (Schreb.) Dumort. s.l.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phleum pratense L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lathyrus pratensis L. subsp. *pratensis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lolium perenne L.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhinanthus minor L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa pratensis L.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Trisetaria flavescens (L.) Baumg. subsp. *flavescens*	.	.	.	.	1	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.
Holcus lanatus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Prunella vulgaris L. subsp. *vulgaris*	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bellis perennis L.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium holosteoides Fr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex acetosa L. subsp. *acetosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Taraxacum officinale (group)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arrhenatherum elatius (L.) P. Beauv. ex J. & C. Presl s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Other species																					
Hypericum perforatum L.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.	.	.
Sedum sexangulare L.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+	+	+	+	+
Acinos alpinus (L.) Moench s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.
Helichrysum italicum (Roth) G. Don subsp. *italicum*	2	.	+	.	.	.	.	.	.	.	+	.	.	.	+	+	.	.	.	.	.
Genista tinctoria L.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.
Blackstonia perfoliata (L.) Huds. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Convolvulus arvensis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurium erythraea Rafn s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cuscuta epithymum (L.) L. subsp. *epithymum*	.	.	.	.	.	.	.	.	.	1	1	+	+	+	+	.	+	.	.	.	.
Agrimonia eupatoria L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hieracium piloselloides Vill.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tussilago farfara L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bupleurum baldense Turra	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	+	+	.	+	.
Polygala flavescens DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campanula rapunculus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium medium L. subsp. *medium*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Clinopodium vulgare L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dianthus carthusianorum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Juniperus communis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cirsium tenoreanum Petr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lathyrus sylvestris L. subsp. *sylvestris*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium angustifolium L. subsp. *angustifolium*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cytisus scoparius (L.) Link subsp. *scoparius*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stachys germanica L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Agrostis stolonifera L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rosa canina L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crepis leontodontoides All.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus nemorosus DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubus canescens DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Luzula campestris (L.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Quercus cerris L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sherardia arvensis L.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Hypochaeris achyrophorus L.	+	+	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex acetosella L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ornithogalum umbellatum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bunium bulbocastanum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cruciata laevipes Opiz	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Inula salicina L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia sativa L. subsp. *nigra* (L.) Ehrh.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Picris hieracioides L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa compressa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Xeranthemum cylindraceum Sm.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea nigrescens Willd. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Geranium columbinum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carduus nutans L. s.l.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ajuga iva (L.) Schreb. subsp. *iva*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melilotus neapolitanus Ten.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium stellatum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Danthonia alpina Vest	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stachys officinalis (L.) Trevis.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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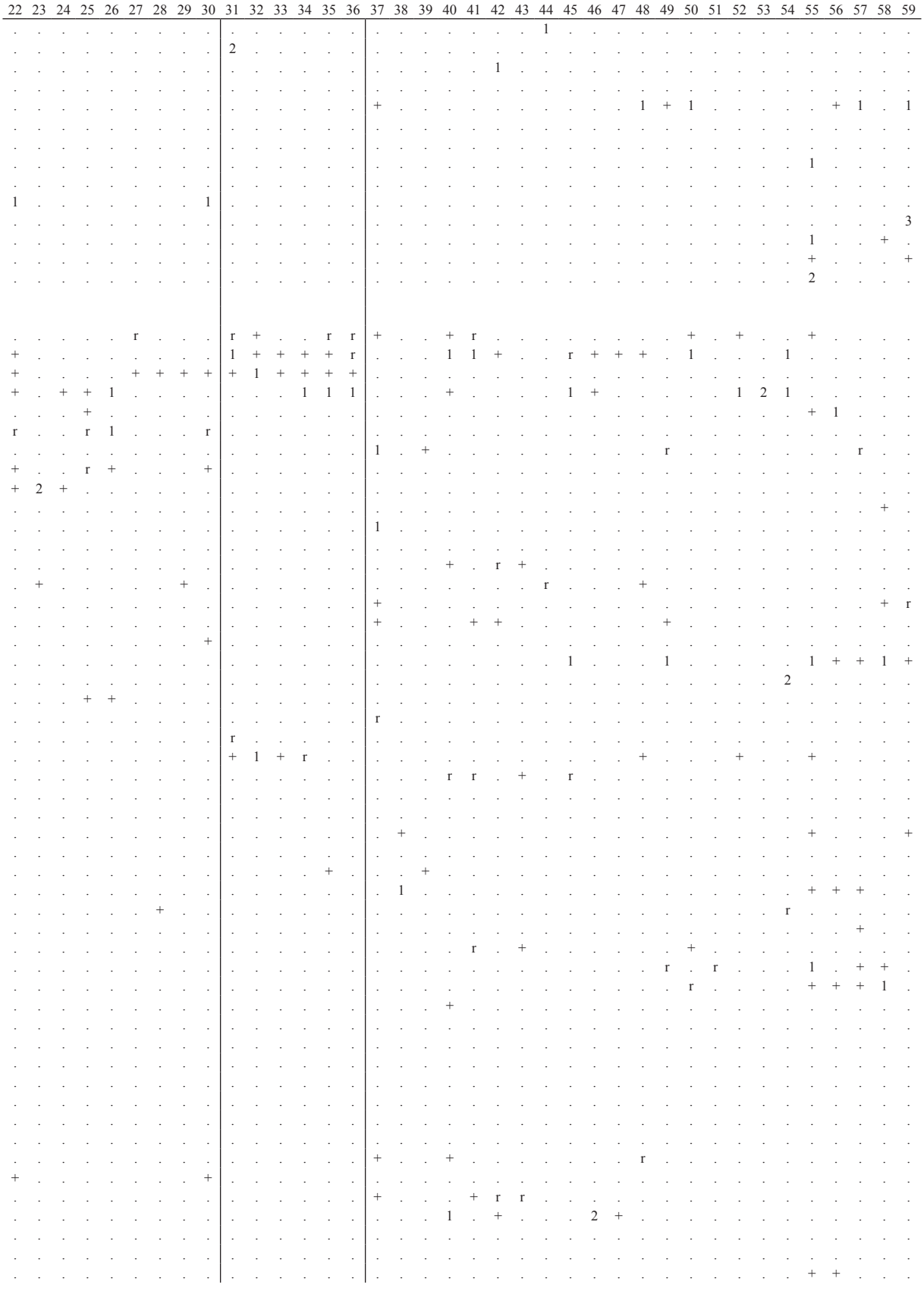

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Relevé n.	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Schedonorus arundinaceus (Schreb.) Dumort. s.l.	.	.	.	.	.	+	+	.	+	.	+	1	+	.	.	.	.	.	.	.	.
Phleum pratense L.	.	2	1	+	+	1	+	.	.	+	+	+	.	.	.	.	.	.	.	.	.
Lathyrus pratensis L. subsp. *pratensis*	+	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	+	.	.
Lolium perenne L.	.	+	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhinanthus minor L.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa pratensis L.	.	1	1	.	.	.	.	.	.	+	.	.	.	.	+	.	+	.	.	+	.
Trisetaria flavescens (L.) Baumg. subsp. *flavescens*	.	.	.	+	1	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.
Holcus lanatus L.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	.	.	.	.
Prunella vulgaris L. subsp. *vulgaris*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+
Bellis perennis L.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.
Cerastium holosteoides Fr.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex acetosa L. subsp. *acetosa*	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.
Taraxacum officinale (group)	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arrhenatherum elatius (L.) P. Beauv. ex J. & C. Presl s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Other species																					
Hypericum perforatum L.	.	+	+	.	.	.	.	.	r	.	+	+	.	.	1	.	+	r	1	+	1
Sedum sexangulare L.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Acinos alpinus (L.) Moench s.l.	.	.	.	.	+	.	.	+	+	+	+	+	.	.	+	+	+	.	.	.	.
Helichrysum italicum (Roth) G. Don subsp. *italicum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Genista tinctoria L.	.	.	.	.	1	.	+	2	.	.	.	.	+	.	.	.	.	.	+	.	.
Blackstonia perfoliata (L.) Huds. s.l.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	+	.	1	+	1
Convolvulus arvensis L.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	+
Centaurium erythraea Rafn s.l.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	1
Cuscuta epithymum (L.) L. subsp. *epithymum*	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	+	.	.	.	.	.
Agrimonia eupatoria L. s.l.	.	r	r	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	+	.	+
Hieracium piloselloides Vill.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tussilago farfara L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Bupleurum baldense Turra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygala flavescens DC.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	1	+	+	.	.	.	.
Campanula rapunculus L.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.
Trifolium medium L. subsp. *medium*	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	1	2	1	.	.	.
Clinopodium vulgare L. s.l.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	1	1	.
Dianthus carthusianorum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Juniperus communis L.	.	.	.	.	.	.	+	.	.	.	1	1	1	1	.	.	.	1	.	.	.
Cirsium tenoreanum Petr.	.	.	.	+	.	.	.	.	r	.	r	+	.	.	+	.	.	.	.	.	.
Lathyrus sylvestris L. subsp. *sylvestris*	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	+
Trifolium angustifolium L. subsp. *angustifolium*	.	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cytisus scoparius (L.) Link subsp. *scoparius*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stachys germanica L. s.l.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	+	.	.	.	.	.	.
Agrostis stolonifera L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Rosa canina L.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.
Crepis leontodontoides All.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus nemorosus DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Rubus canescens DC.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.
Luzula campestris (L.) DC.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.
Quercus cerris L.	.	.	.	.	.	.	.	.	.	.	.	r	+	+	.	.	.	.	.	.	.
Sherardia arvensis L.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Hypochaeris achyrophorus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex acetosella L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ornithogalum umbellatum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bunium bulbocastanum L.	.	.	.	.	.	.	.	.	+	.	+	r	r	.	.	.	.	.	.	.	.
Cruciata laevipes Opiz	.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	.	.	.	.	.	.
Inula salicina L.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Vicia sativa L. subsp. *nigra* (L.) Ehrh.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Picris hieracioides L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Poa compressa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Xeranthemum cylindraceum Sm.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea nigrescens Willd. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.
Geranium columbinum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Carduus nutans L. s.l.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Ajuga iva (L.) Schreb. subsp. *iva*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melilotus neapolitanus Ten.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium stellatum L.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Danthonia alpina Vest	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stachys officinalis (L.) Trevis.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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Potentilla reptans L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca rubra L. subsp. *commutata* (Gaudin) Markgr.-Dann.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Prunus spinosa L. subsp. *spinosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubus ulmifolius Schott	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia cracca L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Clematis vitalba L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica chamaedrys L. subsp. *chamaedrys*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Orobanche rapum-genistae Thuill. subsp. *rapum-genistae*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gladiolus italicus Miller	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Solidago virgaurea L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sonchus asper (L.) Hill	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ophrys fusca Link	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ophrys sphecodes Miller	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca microphylla (St.-Yves ex Coste) Patzke	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Agrostis capillaris L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pteridium aquilinum (L.) Kuhn subsp. *aquilinum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lilium bulbiferum L. subsp. *croceum* (Chaix) Jan	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Melilotus indicus (L.) All.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oenanthe pimpinelloides L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla recta L. subsp. *recta*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pyrus communis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Urospermum dalechampii (L.) F.W. Schmidt	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sporadic species	3	2	1	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0

Relevé n.	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Potentilla reptans L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Festuca rubra L. subsp. *commutata* (Gaudin) Markgr.-Dann.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.
Prunus spinosa L. subsp. *spinosa*	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Rubus ulmifolius Schott	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia cracca L.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Clematis vitalba L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Veronica chamaedrys L. subsp. *chamaedrys*	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.
Orobanche rapum-genistae Thuill. subsp. *rapum-genistae*	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.
Gladiolus italicus Miller	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Solidago virgaurea L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sonchus asper (L.) Hill	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ophrys fusca Link	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Ophrys sphecodes Miller	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca microphylla (St.-Yves ex Coste) Patzke	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Agrostis capillaris L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pteridium aquilinum (L.) Kuhn subsp. *aquilinum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Lilium bulbiferum L. subsp. *croceum* (Chaix) Jan	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Melilotus indicus (L.) All.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Oenanthe pimpinelloides L.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla recta L. subsp. *recta*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pyrus communis L.	.	.	.	.	.	.	.	.	.	.	+	r	.	.	.	.	.	.	.	.	.
Urospermum dalechampii (L.) F.W. Schmidt	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sporadic species	2	2	3	3	1	0	1	3	4	2	5	3	4	0	4	1	1	0	0	0	0

Bothriochloa ischaemum, Melica ciliata comm. (rel. 1–4)
Plantago argentea-Carex caryophyllea communities (rel. 5–9)
Coronillo minimae-Astragaletum monspessulani Biondi & Ballelli in Biondi, Ballelli & Principi 1985 (rel. 10–30)
Tragopogon samaritani-Bromus erectus communities (rel. 31–36)
Festuco trachyphyllae-Brometum erecti ass. nova hoc loco (rel. 37–62; typus rel. n. 49)
Centaureo bracteatae-Brometum erecti linetosum cathartici subass. nova hoc loco (rel. 63–77; typus rel. n. 76)
Centaureo bracteatae-Brometum erecti Biondi, Ballelli, Allegrezza, Guitian & Taffetani 1986 subass. *typicum* (rel. 78–91; typus: rel. n. 3, Table 3 in Biondi et al. 1986)
Centaureo bracteatae-Brometum erecti ononidetosum masquillerii (Biondi, Allegrezza, Guitian & Taffetani 1988) *stat. novo* (rel. 92–105; typus rel. n. 5 in Tab. 2 in Biondi et al. 1988)
Cichorium intybus-Bromus erectus post-cultural grasslands (rel. 106–116)

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22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
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81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	
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0	0	0	1	3	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	3	8	5	1	1	4	4	2	1	

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Table 2: Synoptic table of the nine detected groups with frequency (in bold) and fidelity phi-coefficient. The abbreviations of the groups are the same as in Figure 2.

Table 2: Sinoptična tabela devetih združb s prikazano frekvenco (krepko) in phi-koeficientom navezanosti. Okrajšave skupin so enake kot pri sliki 2.

	%	PHI	%	PHI	%	PHI	%	PHI	%	PHI	%	PHI	%	PHI	%	PHI	%	PHI
	BM		**PL**		**CA**		**TB**		**FB**		**CAL**		**CAT**		**CAO**		**PC**	
***Botriochloa ischaemum-Melica ciliata* comm.**																		
Melica ciliata L. s.l.	100	100	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galactites tomentosus Moench	100	100	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Avena barbata Pott ex Link	100	91	.	.	.	.	.	.	4	.	.	.	.	.	.	.	22	.
Onobrychis caput-galli (L.) Lam.	75	85	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bothriochloa ischaemum (L.) Keng	75	85	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carthamus lanatus L. subsp. *lanatus*	100	81	.	.	.	.	.	.	.	.	.	.	25	.	.	.	33	.
Globularia punctata Lapeyr	50	68	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragopogon porrifolius L. s.l.	50	64	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.
Centaurea deusta Ten.	75	58	.	.	.	.	.	.	38	44	.	.	.	.	.	.	.	.
Echium vulgare L.	75	53	.	.	45	45	.	.	4	.	7	.	.	.	.	.	11	.
Transgressive species from *Rosmarinetea* and other Mediterranean veg. classes																		
Asparagus acutifolius	100	100	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crupina vulgaris Cass.	75	85	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Teucrium capitatum L. subsp. *capitatum*	75	85	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dorycnium hirsutum	75	81	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.
Cistus monspeliensis L.	50	68	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Micromeria graeca (L.) Benth. ex Rchb. s.l.	50	59	.	.	.	.	.	.	4	.	7	.	.	.	.	.	.	.
***Plantago argentea-Carex caryophyllea* comm.**																		
Plantago argentea Chaix subsp. *argentea*	.	.	100	100	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria lobata (M. Bieb.) Roem. & Schult.	.	.	80	88	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bromus rubens L.	25	.	80	84	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aira caryophyllea L. subsp. *caryophyllea*	.	.	80	75	.	.	.	.	8	.	7	.	.	.	.	.	11	.
Cerastium pumilum	.	.	80	75	.	.	50	50	4	.	.	.	.	.	.	.	.	.
Centaurea arrigonii Greuter	.	.	80	72	.	.	17	.	8	.	7	.	6	.	.	.	.	.
Medicago minima (L.) Bartal.	.	.	80	72	20	27	.	.	.	.	.	.	.	.	.	.	.	.
Aphanes arvensis L.	.	.	60	71	.	.	.	.	.	.	7	.	.	.	.	.	.	.
Geranium rotundifolium L.	.	.	60	67	.	.	.	.	.	.	.	.	.	.	.	.	22	.
Gnaphalium sylvaticum L.	.	.	40	61	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypochaeris radicata L.	.	.	60	58	.	.	.	.	19	.	.	.	.	.	.	.	.	.
Poa bulbosa L.	.	.	80	56	5	.	33	.	27	.	14	.	.	.	.	.	11	.
Coronillo minimae-Astragaletum monspessulani																		
Coronilla minima L.	.	.	.	.	80	80	.	.	.	.	.	.	19	.	.	.	.	.
Linum tenuifolium L.	.	.	.	.	70	64	.	.	.	.	7	.	13	.	19	.	.	.
Astragalus monspessulanus L. subsp. *monspessulanus*	.	.	.	.	95	53	100	45	4	.	21	.	13	.	69	25	.	.
Leontodon rosani (Ten.) DC.	.	.	.	.	35	38	.	.	.	.	.	.	6	.	19	.	.	.
Fumana procumbens (Dunal) G.et G.	.	.	.	.	57	72	.	.	.	.	.	.	.	.	.	.	.	.
***Tragopogon samaritani-Bromus erectus* comm.**																		
Thymus pulegioides L. s.l.	.	.	40	.	.	.	100	93	.	.	.	.	.	.	.	.	.	.
Tragopogon samaritani Heldr. & Sart. ex Boiss.	.	.	.	.	.	.	67	80	.	.	.	.	.	.	.	.	.	.
Teucrium montanum L.	.	.	.	.	.	.	67	80	.	.	.	.	.	.	.	.	.	.
Arenaria serpyllifolia L. s.l.	.	.	80	60	.	.	100	76	15	.	.	.	.	.	6	.	.	.
Anthyllis vulneraria L. s.l.	.	.	.	.	5	.	100	71	19	.	14	.	19	.	.	.	11	.
Silene vulgaris (Moench) Garcke s.l.	.	.	.	.	.	.	100	70	8	.	.	.	44	29	.	.	44	.
Crepis staticifolia (All.) Galasso, Banfi & Soldano	.	.	.	.	.	.	33	55	.	.	.	.	.	.	.	.	.	.

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	BM		**PL**		**CA**		**TB**		**FB**		**CAL**		**CAT**		**CAO**		**PC**	
Festuco trachyphyllae-Brometum erecti																		
Sedum rupestre L. subsp. *rupestre*	.	.	20	.	.	.	.	.	73	79	.	.	.	.	.	.	.	.
Festuca stricta subsp. *trachyphylla* (Hack.) Patzke ex Pils	.	.	.	.	15	.	.	.	81	64	29	.	.	.	.	.	.	.
Aira elegantissima Schur	.	.	.	.	.	.	.	.	31	53	.	.	.	.	.	.	.	.
Centaureo bracteatae-Brometum erecti* subass. *linetosum cathartici																		
Leontodon hispidus L.	.	.	20	.	.	.	.	.	4	.	71	62	19	.	6	.	.	.
Linum catharticum L. s.l.	.	.	.	.	5	.	.	.	.	.	64	60	6	.	13	.	.	.
Medicago lupulina L.	.	.	.	.	5	.	.	.	4	.	71	50	25	.	.	.	56	.
subass. *typicum*																		
Galium mollugo L. subsp. *erectum* Syme	.	.	.	.	.	.	.	.	4	.	29	.	94	71	6	.	33	.
Centaurea scabiosa L. subsp. *scabiosa*	.	.	.	.	15	.	.	.	4	.	7	.	63	58	.	.	.	.
Cota tinctoria (L.) J. Gay s.l.	25	.	.	.	.	.	.	.	4	.	.	.	44	53	.	.	.	.
Pastinaca sativa l. subsp. *urens* (Req.) Celak	.	.	.	.	.	.	.	.	.	.	.	.	44	64	.	.	.	.
Elytrigia repens (L.) Nevski	.	.	.	.	.	.	.	.	.	.	.	.	38	59	.	.	.	.
Senecio erucifolius L.	.	.	.	.	5	.	.	.	.	.	.	.	44	58	.	.	.	.
Acinos arvensis (Lam.) Dandy	.	.	20	.	5	.	.	.	4	.	.	.	56	56	.	.	11	.
Inula conyzae (Griess.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	31	53	.	.	.	.
Medicago sativa L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	38	53	.	.	11	.
subass. *ononidetosum masquillierii*																		
Ononis masquillierii Bertol.	.	.	.	.	.	.	.	.	.	.	14	.	.	.	81	81	.	.
Plantago maritima L. s.l.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	75	81	.	.
Scorzonera cana (C.A. Mey.) O. Hoffm.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	25	41	.	.
Carlina corymbosa L.	.	.	.	.	.	.	.	.	8	.	.	.	.	.	50	59	.	.
***Cichorium intybus-Bromus erectus* post-cultural comm.**																		
Cichorium intybus L. subsp. *intybus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67	80
Bromus hordeaceus L. s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	64
Calamintha nepeta (L.) Savi s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44	64
Linum strictum L.	25	.	.	.	.	.	.	.	.	.	21	.	.	.	13	.	67	60
Poa sylvicola Guss.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	44	59
Odontites vernus (Bellardi) Dumort.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33	55
Cynosurus echinatus L.	.	.	20	.	5	.	.	.	23	.	7	.	.	.	.	.	67	53
Trifolium repens L. s.l.	.	.	.	.	.	.	.	.	.	.	29	.	.	.	6	.	56	54
Polygalo mediterraneae-Bromenion erecti																		
Centaurea jacea L. subsp. *gaudinii* (Boiss. & Reut.) Gremli	.	.	.	.	25	.	.	.	23	.	64	.	88	37	81	32	.	.
Dorycnium herbaceum Vill.	.	.	.	.	40	.	17	.	8	.	14	.	63	28	63	28	11	.
Linum viscosum L.	.	.	.	.	5	.	.	.	.	.	14	.	44	27	63	47	.	.
Asperula purpurea (L.) Ehrend. subsp. *purpurea*	.	.	.	.	80	65	.	.	.	.	.	.	19	.	25	.	.	.
Polygala nicaeensis W.D.J. Koch subsp. *mediterranea* Chodat	.	.	.	.	5	.	.	.	.	.	21	.	25	.	75	60	.	.
Carlina utzka Hacq.	.	.	.	.	.	.	.	.	.	.	30	34	.	.	8	.	.	.
Bromion erecti																		
Lotus corniculatus L. s.l.	.	.	60	.	20	.	83	.	50	.	100	29	75	.	88	.	78	.
Dactylis glomerata L. s.l.	75	.	40	.	15	.	67	.	42	.	57	.	94	28	75	.	100	31
Ononis spinosa L. s.l.	.	.	60	.	5	.	33	.	31	.	64	34	19	.	.	.	33	.
Plantago lanceolata L.	.	.	.	.	20	.	.	.	58	.	57	.	69	.	25	.	89	32
Carex caryophyllea Latourr.	.	.	100	59	70	53	17	.	4	.	7	.	13	.	6	.	.	.
Briza media L.	50	.	.	.	5	.	.	.	12	.	57	.	44	.	69	33	11	.
Linum bienne Mill.	.	.	40	.	15	.	.	.	35	28	7	.	.	.	.	.	.	.
Daucus carota L. s.l.	.	.	.	.	.	.	.	.	.	.	50	.	69	45	25	.	33	.
Gymnadenia conopsea (L.) R. Br.	.	.	.	.	.	.	.	.	.	.	7	.	31	.	63	55	.	.
Plantago media L. subsp. *media*	.	.	.	.	.	.	.	.	.	.	71	47	19	.	63	40	.	.

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